

Apprenticeship and Industry Training

Appliance Service Technician Curriculum Guide

023 (2022)

Alberta



Apprenticeship
and Industry
Training

ALBERTA ADVANCED EDUCATION

Appliance Service Technician: apprenticeship education program curriculum guide

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**Appliance Service Technician
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CURRICULUM GUIDE

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Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding a sponsor. Sponsors guide apprentices, and support on-the-job learning through provision of mentorship. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyman or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution (PSI) – usually a college or technical institute.

To receive their post-secondary credential, apprentices must learn theory and skills, and they must pass examinations. Criteria for the program—including the content and delivery of technical training—are developed and updated by the Registrar.

The graduate of the Appliance Service Technician apprenticeship program is an individual who will be able to:

- responsibly do all work tasks expected of a journeyman
- supervise, train and coach apprentices
- perform assigned tasks in accordance with quality and production standards required by industry

Apprenticeship and Industry Training System

Alberta's apprenticeship programs are supported by industry stakeholders that ensures a highly skilled, internationally competitive workforce in the province. The Registrar establishes the educational standards and provides direction to the system supported by industry and the PSI's. The Ministry of Advanced Education provides the legislative framework and administrative support for the apprenticeship and industry training system.

Special thanks are offered to the following industry members who contributed to the development of the standard:

Mr. K. GourlayMedicine Hat
Mr. D. CarewEdmonton
Mr. J. Griep.....Edmonton
Mr. C. FordCalgary
Mr. D. Brewka.....Edmonton
Ms. L. ClarkLeduc
Mr. R. FooCalgary

Alberta Government

Alberta Advanced Education works with industry, sponsor and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to apprentices and sponsors
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, sponsors, employees, apprentices and the public. Therefore, it is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment.

Occupational Health and Safety

Persons engaged in, or supporting an individual in an experiential learning environment are often exposed to more worksite hazards than in other forms of traditional post-secondary education and therefore should be familiar with and apply the Occupational Health and Safety Act, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Occupational Health and Safety-OHS (a division of Alberta Labour and Immigration) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.alberta.ca/occupational-health-safety.aspx

Technical Training

Apprenticeship technical training is delivered by the PSI's throughout Alberta. The PSI's are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All PSI's place a strong emphasis on safety that complements safe workplace practices towards the development of a culture of safety for all professions.

The PSI's work with industry and Alberta Advanced Education to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs across the province. They develop curriculum from the curriculum guides established by the Registrar in consultation with the PSI's and industry and provide the technical training to apprentices.

The following PSI's deliver Appliance Service Technician trade apprenticeship technical training:

Southern Alberta Institute of Technology
(Main Campus)

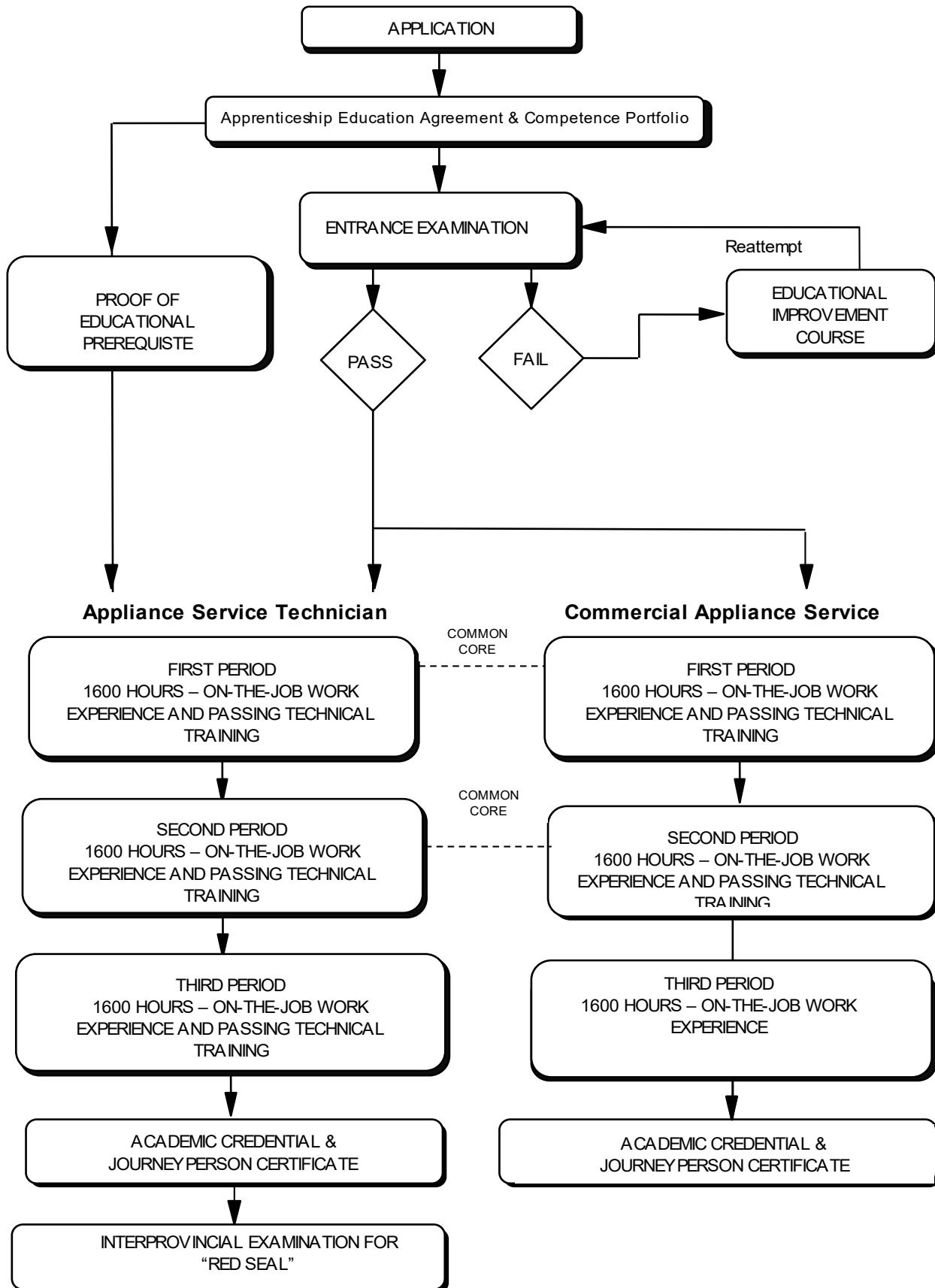
Procedures for Recommending Revisions to the Curriculum Guide

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

Registrar of Apprenticeship Programs
c/o Apprenticeship Delivery and Industry Support Services
Apprenticeship Delivery and Industry Support
Advanced Education
19th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used.

Apprenticeship Route toward Academic Credential



Appliance Service Technician Training Profile

**(Common Training for Appliance Service Technician and Commercial Appliance Service Technician
FIRST PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)**

SECTION ONE

STANDARD WORKPLACE SAFETY, EQUIPMENT AND MATERIALS
10%



A

Safety Legislation, Regulations & Industry Policy in the Trades
17%

B

Climbing, Lifting, Rigging and Hoisting
12%

C

Hazardous Materials & Fire Protection
21%

D

Electrical Safety
33%

E

Customer Relations
17%

SECTION TWO

ELECTRICITY AND ELECTRONICS
33%



A

Principles of Electricity
88%

B

Electronics
12%

SECTION THREE

CONDUCTORS, INSULATORS AND CODES
18%



A

Conductors and Insulators
9%

B

Switches and Contacts
14%

C

Termination
5%

D

Fuses and Circuit Breakers
5%

E

Electrical Code
10%

F

Electrical Measuring Devices
9%

G

Schematics and Wiring Diagrams
48%

SECTION FOUR

MECHANICAL AND GAS
18%



A

Mechanical Components
18%

B

Motors
27%

C

Gas
55%

SECTION FIVE

ALTERNATING CURRENT FUNDAMENTALS
21%



A

Alternating Current
100%

Appliance Service Technician Training Profile

(Common Training for Appliance Service Technician and Commercial Appliance Service Technician)

SECOND PERIOD

(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

ALTERNATING CURRENT APPLICATIONS
10%



A

Transformers
50%

B

Three-Phase Systems
50%

SECTION TWO

APPLIANCE COMPONENTS
27%



A

Appliance Components
100%

SECTION THREE

APPLIANCE OPERATING PRINCIPLES
26%



A

Appliance Operating Principles
100%

SECTION FOUR

TROUBLESHOOTING
37%



A

Diagnostics
48%

B

Testing Systems
49%

C

Workplace Coaching Skills
3%

Appliance Service Technician (Only)
THIRD PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

REFRIGERATION
21%



A

Refrigeration Concepts
60%

B

Refrigeration Cycle
40%

SECTION TWO

REFRIGERATION COMPONENTS
26%



A

Refrigerants and Oils
16%

B

Compressors
16%

C

Evaporator Metering Devices
16%

D

Evaporators and Condensers
6%

E

Air Properties
16%

F

Air Conditioning
9%

G

Defrost Systems
12%

H

Icemaker Systems
6%

I

Refrigeration Cabinet Servicing
3%

SECTION THREE

AIR CONDITIONING APPLIANCES
15%



A

Domestic Air Conditioners
56%

B

Laws, Regulations and Code
11%

C

Refrigerant Recovery, Recycling and Reclaiming
22%

D

Refrigerant Management
6%

E

Interprovincial Standards Red Seal Program
5%

SECTION FOUR

MAINTENANCE, TROUBLESHOOTING AND REPAIR
21%



A

Leak Detection
12%

B

Refrigeration Tools
8%

C

Soldering and Brazing
28%

D

System Evacuation, Dehydrating and Charging
28%

E

Electrical Components
24%

SECTION FIVE

TROUBLESHOOTING AND SYSTEM COMPONENT REPLACEMENT
17%



A

Troubleshooting and System Component Replacement
100%

**FIRST PERIOD TECHNICAL TRAINING
APPLIANCE SERVICE TECHNICIAN TRADE
CURRICULUM GUIDE**

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... STANDARD WORKPLACE SAFETY, EQUIPMENT AND MATERIALS 10%

A. Safety Legislation, Regulations & Industry Policy in the Trades 17%

Outcome: *Apply legislation, regulations and practices ensuring safe work in this trade.*

1. Demonstrate the application of the Occupational Health and Safety Act, Regulation and Code.
2. Describe the sponsor's and employee's role with Occupational Health and Safety (OH&S) regulations, Worksite Hazardous Materials Information Systems (WHMIS), fire regulations, Workers Compensation Board regulations and related advisory bodies and agencies.
3. Describe industry practices for hazard assessment and control procedures.
4. Describe the responsibilities of worker and sponsors to apply emergency procedures.
5. Describe tradesperson attitudes with respect to housekeeping, personal protective equipment and emergency procedures.
6. Describe the roles and responsibilities of sponsors and employees with the selection and use of personal protective equipment (PPE).
7. Maintain required PPE for tasks.
8. Use required PPE for tasks.

B. Climbing, Lifting, Rigging and Hoisting 12%

Outcome: *Use industry standard practices for climbing, lifting, rigging and hoisting in this trade.*

1. Describe manual lifting procedures.
2. Describe rigging hardware and associated safety factors.
3. Select equipment for rigging loads.
4. Describe hoisting and load moving procedures.
5. Maintain personal protective equipment (PPE) for climbing, lifting and load moving equipment.
6. Use PPE for climbing, lifting and load moving equipment.

C. Hazardous Materials & Fire Protection..... 21%

Outcome: *Apply industry standard practices for hazardous materials and fire protection in this trade.*

1. Describe roles, responsibilities, features and practices related to the Workplace Hazardous Materials Information System (WHMIS) program.
2. Describe three key elements of WHMIS.
3. Describe handling, storing and transporting procedures for hazardous material.
4. Describe venting procedures when working with hazardous materials.
5. Describe hazards, classes, procedures and equipment related to fire protection.

D. Electrical Safety 33%**Outcome: Apply safe work practices in the workplace.**

1. Describe the workplace safety programs in Alberta and safety procedures relating to the trade.
2. Describe the use of hand tools and equipment related to the trade.
3. Describe the use of power and specialty tools related to the trade.
4. Describe lockout procedures.
5. Apply safe work practices in the workplace.

E. Customer Relations 17%**Outcome: Apply aspects of customer relations.**

1. Describe customer and co-worker communication techniques.
2. Apply aspects of customer relations.

SECTION TWO:.....ELECTRICITY AND ELECTRONICS 33%**A. Principles of Electricity 88%****Outcome: Apply the principles of electricity.**

1. Explain the relationship between the structure of the atom and the flow of electrons.
2. Describe the relationship between voltage, current and resistance in an electric circuit.
3. Solve problems using Ohm's law.
4. Verify relationship between voltage current resistance for series, parallel, series-parallel and Edison three-wire circuits.
5. Measure electrical values of a circuit.
6. Identify electrical symbols and terms.
7. Apply Kirchhoff's current and voltage laws to circuits.
8. Identify the application of series, parallel, series-parallel and Edison three-wire circuits.
9. Solve problems involving series, parallel, series-parallel and Edison three-wire circuits.
10. Describe the effect of an open or high resistance neutral connection.
11. Define line loss and voltage drop.
12. Define power and energy.
13. Calculate electrical power, voltage, resistance and current.
14. Calculate electrical energy and cost.
15. Describe electromagnetism and its applications.

B. Electronics..... 12%**Outcome: Diagnose electronic components and circuit boards.**

1. Identify schematic symbols.
2. Describe the purpose and application of schematic symbols.
3. Test electronic boards and devices as per wiring diagrams.
4. Describe static electricity problems during the handling or cleaning electronic circuit boards and connection.

5. Diagnose triacs, diodes, varistors and thermistors.
6. Program microprocessors as per manufacturer's specs.

SECTION THREE: CONDUCTORS, INSULATORS AND CODES 18%

A. Conductors and Insulators 9%

Outcome: Describe the characteristics and application of conductors and insulators.

1. Describe the characteristics and application of conductor materials.
2. Interpret an American Wire Gauge (AWG) table.
3. Determine wire size required for an appliance.
4. Describe the relationship between resistance, length, cross sectional area and type of conductor material.
5. Explain the terminology relating to conductors on a diagram.
6. Identify the colour and purpose of a conductor.
7. Describe the characteristics and application of insulator materials.

B. Switches and Contacts 14%

Outcome: Test switches and contacts.

1. Explain the application of switches and contacts.
2. Describe the difference in construction and operation of relays.
3. Describe the purpose and operation of thermally operated contacts, overloads and thermostats.
4. Test switches and contacts in relays.

C. Termination 5%

Outcome: Perform electrical connections and terminations.

1. Describe the importance of electrically and mechanically sound connections.
2. Describe the procedure for splicing dissimilar metals.
3. Describe the types and application of terminals.
4. Describe the methods of completing electrical connections.
5. List the characteristics and applications of solders and fluxes.
6. Describe the hazards relating to the use of lead based solder.
7. Describe the techniques for soldering and de-soldering electrical components.
8. Perform electrical connections and terminations.

D. Fuses and Circuit Breakers 5%

Outcome: Describe the purpose and application of protection devices.

1. Define overload and short circuit.
2. Describe the purpose of protection devices in an electrical distribution system.
3. Describe the application of thermal fuses.

E. Electrical Code 10%**Outcome: Apply electrical codes when working with appliances.**

1. Describe the object and scope of the Canadian Electrical Code as it applies to an Appliance Service Technician.

F. Electrical Measuring Devices 9%**Outcome: Use electrical measuring devices.**

1. Select an electrical measuring device for an application.
2. Select the mode and range for an electrical measuring device.
3. Use an electrical measuring device.
4. Interpret readings on an electrical measuring device.

G. Schematics and Wiring Diagrams 48%**Outcome: Use wiring diagrams and schematics as diagnostic tools.**

1. Identify the standard drawing symbols on schematic and wiring diagrams.
2. Develop schematic diagrams.
3. Connect equipment according to the diagram.
4. Develop a schematic diagram from a wiring diagram.
5. Develop a wiring diagram from a schematic diagram.
6. Explain the sequence of electrical operation using bar charts.
7. Use diagrams to isolate electrical failure.

SECTION FOUR: MECHANICAL AND GAS 18%**A. Mechanical Components 18%****Outcome: Troubleshoot mechanical components.**

1. Describe the types of mechanical fastening devices.
2. Describe lubricants and their application.
3. Describe gear reduction ratio.
4. Describe the application of types of seals, gaskets and boots.
5. Perform the installation and maintenance of bearings.
6. Inspect the condition of mechanical components.
7. Replace drive belts, pulleys and couplings.

B. Motors 27%**Outcome: Troubleshoot electrical motors.**

1. Describe the operating characteristics and applications of single-phase and three-phase motors.
2. Describe the procedures for installing motor starting devices.
3. Describe frequency and poles for speed control.
4. Describe the types of motor overload protection devices.
5. Troubleshoot electrical motors.

C. Gas 55%**Outcome: Troubleshoot gas-fired appliances.**

1. Describe the characteristics and uses of natural and propane gases.
2. Describe safety precautions for handling gases.
3. Identify the fittings used for connecting gas appliances according to the gas code.
4. Explain the gas code installation requirements for ranges, ovens, dryers and barbecues.
5. Describe the characteristics of gas valves used in gas-fired appliances.
6. Describe ignition systems used in gas-fired appliances.
7. Describe safety devices used in gas-fired appliances.
8. Adjust gas and air mixture to pilot and main burner.
9. Test thermocouples and thermopiles.
10. Test electronic ignition systems.
11. Troubleshoot a gas-fired appliance.

SECTION FIVE: ALTERNATING CURRENT FUNDAMENTALS..... 21%**A. Alternating Current..... 100%****Outcome: Apply the principles of alternating current.**

1. Explain the theory of sine wave.
2. Define terms relating to alternating current.
3. Define instantaneous, effective and peak values.
4. Calculate instantaneous, effective and peak values.
5. Define units of measurement.
6. Identify the factors affecting resistance.
7. Define phase relationships between voltage and current.
8. Define inductance.
9. Identify the symbol and unit of measurement for inductance.
10. Describe the factors affecting inductance.
11. Define inductive reactance.
12. Identify the symbol and unit of measurement for inductive reactance.
13. Describe the phase relationship between voltage and current in an inductive circuit.
14. Describe the factors affecting capacitance.
15. Describe the construction and characteristics of an elementary capacitor.
16. Describe testing for open and shorts in circuits.
17. Describe capacitor types and applications.
18. Identify the symbol and unit of measurement for the charge of a capacitor.
19. Identify the symbol and unit of measurement for capacitive reactance.
20. Describe the phase relationship between voltage and current in a capacitive circuit.
21. Describe the methods of connecting capacitors in series and parallel configurations.

22. Define impedance.
23. Describe the symbol and unit of measurement for impedance.
24. Identify the formulas required to calculate impedance.
25. Describe the factors affecting impedance.
26. Solve electrical problems using the impedance triangle.

**SECOND PERIOD TECHNICAL TRAINING
APPLIANCE SERVICE TECHNICIAN TRADE
CURRICULUM GUIDE**

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:.....ALTERNATING CURRENT APPLICATIONS 10%

A. Transformers 50%

Outcome: *Troubleshoot transformer failures.*

1. Identify types of transformers used in appliances and their applications.
2. Define the primary and secondary windings of a transformer.
3. Describe standard terminal and winding identification.
4. Describe how transformers are rated and sized.
5. Solve problems involving transformer voltage, turns and current ratios.
6. Describe troubleshooting techniques and procedures to confirm transformer failures.
7. Troubleshoot transformer failures.

B. Three-Phase Systems 50%

Outcome: *Describe the characteristics of a three-phase electrical system.*

1. Explain the difference between single-phase power and three-phase power.
2. Describe the generation of the phase voltages of a three-phase system.
3. Explain the phase sequence of three-phase sine waves.
4. Describe the advantages of three-phase power over single-phase power.

SECTION TWO:..... APPLIANCE COMPONENTS..... 27%

A. Appliance Components..... 100%

Outcome: *Apply the principles and operation of appliance components.*

1. Describe the operation principles and applications of safety devices and switches.
2. Describe the operation of devices used for filling, draining, and measuring of liquids in appliances.
3. Describe the operation of devices used for overflow prevention.
4. Describe the characteristics and applications of dispensing systems.
5. Describe the characteristics of ranges and the accessories available.
6. Describe the operation of hi-voltage components in a microwave oven.
7. Describe the processes for testing the high voltage components in a microwave oven.
8. Describe the characteristics of appliance cabinets and doors.
9. Verify the requirements for installing and commissioning appliances.
10. Apply principles and operation of appliance components.

SECTION THREE: APPLIANCE OPERATING PRINCIPLES..... 26%

A. Appliance Operating Principles 100%

Outcome: Explain the operation of appliances.

1. Describe the characteristics and uses of clutch assemblies and transmissions.
2. Describe the characteristics and uses of suspension and dampening systems.
3. Describe the characteristics and uses of pumps.
4. Describe the characteristics and uses of heating systems.
5. Describe the characteristics and uses of condensing systems.
6. Interpret manufacturer's specifications, manuals and drawings.
7. Redraw electric schematic diagrams in different forms.
8. Use bar charts and schematic diagrams for describing circuit operation.
9. Describe the sequence of operation of appliances.

SECTION FOUR: TROUBLESHOOTING 37%

A. Diagnostics..... 48%

Outcome: Troubleshoot non-operating appliances.

1. Explain the process of problem solving and analysis.
2. Troubleshoot non-operating appliances.

B. Testing Systems 49%

Outcome: Test systems.

1. Check electrical values using instruments.
2. Identify faulty components.
3. Calibrate controls.
4. Select replacement parts.

C. Workplace Coaching Skills..... 3%

Outcome: Use coaching skills when training an apprentice..

1. Describe the process for coaching an apprentice.

**THIRD PERIOD TECHNICAL TRAINING
APPLIANCE SERVICE TECHNICIAN TRADE
CURRICULUM GUIDE**

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... REFRIGERATION..... 21%

A. Refrigeration Concepts 60%

Outcome: Apply the concepts of refrigeration.

1. Describe the terms relating to the principles of refrigeration.
2. Describe the concepts and methods of heat transfer.
3. Describe the laws of thermal dynamics.
4. Describe the units of measure pertaining to heat transfer.
5. Perform calculations related to heat transfer.
6. Convert temperatures and pressures between various scales.
7. Describe gas laws and how they apply to thermal dynamics.
8. Describe the units of measurement used in refrigeration calculations.
9. Describe formulas used in calculating gas laws and pressure enthalpy.
10. Describe the components of a pressure enthalpy diagram.
11. Plot a basic cycle using a pressure enthalpy diagram.
12. Use formulas for calculating gas laws and pressure enthalpy.

B. Refrigeration Cycle..... 40%

Outcome: Describe refrigeration systems.

1. Identify the components of a vapour compression system.
2. Describe the conditions of the refrigerant as it flows through the vapour compression cycle.
3. Describe the absorption cycle.
4. Describe the evaporative process.
5. Describe the thermal electric process.

SECTION TWO:..... REFRIGERATION COMPONENTS..... 26%

A. Refrigerants and Oils 16%

Outcome: Describe the properties and characteristics of refrigerants and oils.

1. Describe the requirements for disposing and reclaiming refrigerants.
2. List the desirable qualities of a good refrigerant.
3. List hazards associated with the refrigerant used in domestic refrigerating and air conditioning.
4. Describe each refrigerant including its chemical name and formula and cylinder colour code.
5. Describe the products of combustion of refrigerants.
6. Define viscosity, pour point, miscibility, wax content and flash point.

7. Describe the process of adding or removing oil from a refrigeration system.
8. Interpret environmental protection standards relating to the handling of refrigeration oils.

B. Compressors 16%

Outcome: *Describe the operating principles of compressors.*

1. Describe the construction, components and operation of compressors used in refrigeration.
2. Describe the compression process and the flow of gas through the compressor.
3. Describe compressor lubrication.
4. Describe the cooling methods used for compressors.

C. Evaporator Metering Devices 16%

Outcome: *Describe applications and principles of metering devices.*

1. Describe the construction and operating principles of a capillary tube.
2. List the applications of a capillary tube and purpose in a heat exchanger.
3. Describe how to determine evaporator and system superheat.
4. Describe the consequences of an improper charge.
5. Explain the effects of a restricted capillary tube.
6. Describe the construction and operating principles of expansion orifices.
7. Describe the construction and operating principles of expansion valves.

D. Evaporators and Condensers 6%

Outcome: *Describe the purpose, operation and test procedures of evaporators and condensers.*

1. Describe the purpose and operation of evaporators and condensers.
2. Describe the construction of evaporators and condensers.
3. Describe filter dryer construction.
4. Describe the procedures for testing air flow.
5. Describe testing procedures for evaporators and condensers.

E. Air Properties 16%

Outcome: *Describe the characteristics of air.*

1. Describe air properties as it relates to heat transfer.
2. Describe methods of heat transfer as they relate to airflow.
3. Describe units of measurement as it relates to air properties.
4. Describe psychometric charts as it relates to air conditioning systems.
5. Describe tools used for measuring air properties.

F. Air Conditioning..... 9%

Outcome: Describe the processes for conditioning air.

1. Describe how air is conditioned for cooling.
2. Describe how air is conditioned for heating.
3. Describe how air is conditioned for humidifying.
4. Describe how air is conditioned for dehumidifying.
5. Describe how air is conditioned for filtering.

G. Defrost Systems..... 12%

Outcome: Troubleshoot defrost systems.

1. Identify the types of defrost systems.
2. Identify the purpose and applications of the components of a defrost system.
3. Explain the operating characteristics of a defrost system.
4. Troubleshoot the operation of a defrost system.

H. Icemaker Systems..... 6%

Outcome: Troubleshoot icemaker systems.

1. Identify the types of icemaker systems.
2. Identify the purpose and application of the components of an icemaker system.
3. Explain the operating characteristics of an icemaker system.
4. Troubleshoot the operation of an icemaker system.

I. Refrigeration Cabinet Servicing 3%

Outcome: Describe the principles, characteristics and service procedures of refrigeration cabinet components.

1. Explain the construction and operational differences between chest and upright freezers.
2. Explain the construction and principles of chest and upright freezers.
3. Describe the procedure for removing, replacing or adjusting doors and their components.
4. Describe the consequences of improperly levelling refrigerators and freezers.

SECTION THREE: AIR CONDITIONING APPLIANCES 15%

A. Domestic Air Conditioners 56%

Outcome: Service air conditioning systems.

1. List the design and operating principles of window air conditioners.
2. List the design and operating principles of split system air conditioners.
3. List the design and operating principles of portable air conditioners.
4. Troubleshoot air conditioners.
5. Clean air conditioners.
6. Disassemble and reassemble a window air conditioner.
7. List the steps required to test an air conditioning system after installation.

8. Interpret wiring diagrams of air conditioning systems.
9. Draw a wiring diagram for an air conditioning system.
10. Size air conditioning equipment for air conditioning applications.
11. Select air conditioning equipment for air conditioning applications.
12. Describe the general installation procedures for air conditioners.
13. List the servicing requirements of air conditioners.

B. Laws, Regulations and Code..... 11%

Outcome: Apply regulations relating to handling refrigerant.

1. Describe the Government of Canada's regulations and codes affecting refrigeration and the environment.
2. Describe how the *Environmental Protection and Enhancement Act* impacts the servicing of sealed refrigeration systems.
3. Describe the *Ozone-depleting Substances and Halocarbons Regulation* and the results of non-compliance.
4. Describe the Canadian Standards Association (CSA) *B-52 Mechanical Refrigeration Code*.
5. Identify the government guidelines and applicable codes for the transporting, storage and disposal of refrigerants.
6. Explain the penalties of allowing refrigerant to escape into the atmosphere.
7. Apply regulations relating to handling refrigerant.

C. Refrigerant Recovery, Recycling and Reclaiming..... 22%

Outcome: Perform procedures for refrigerant recovery, recycling and reclaiming.

1. Describe the procedures for recovering, recycling and reclaiming refrigerant.
2. Describe the procedures for removing contaminants from refrigeration systems.
3. Explain the differences between recycling and reclaiming refrigerant.
4. Describe the procedures when recycling equipment fails during processing.
5. Describe the warranty concerns of appliance manufacturers.
6. Describe the process to return refrigerants to virgin status.
7. Recover refrigeration oils.
8. Dispose of refrigeration oils.
9. Recover refrigerants.
10. Recycle recovered refrigerant.

D. Refrigerant Management..... 6%

Outcome: Use refrigerant handling techniques.

1. Describe the requirements for transporting refrigerant.
2. Label cylinders containing recycled refrigerants.
3. Use the methods for transferring refrigerant between storage cylinders, charging cylinders and the refrigeration system.

- E. Interprovincial Standards Red Seal Program 5%**
- Outcome: Use Red Seal products to challenge an Interprovincial examination.**
1. Identify Red Seal products used to develop Interprovincial examinations.
 2. Use Red Seal products to prepare for an Interprovincial examination.
- SECTION FOUR: MAINTENANCE, TROUBLESHOOTING AND REPAIR 21%**
- A. Leak Detection 12%**
- Outcome: Perform leak detection.**
1. Detect gas leaks using the bubble method and solutions.
 2. Detect gas leaks using electronic equipment.
 3. Detect gas leaks using dyes.
- B. Refrigeration Tools 8%**
- Outcome: Use refrigeration tools.**
1. Describe the required components of refrigerant recycling equipment.
 2. Describe the use of refrigerant recycling equipment.
 3. Maintain refrigeration tools and equipment.
 4. Select refrigeration tools for bending, cutting and connecting tubing and pipe.
 5. Use refrigeration tools for bending, cutting and connecting tubing and pipe.
- C. Soldering and Brazing 28%**
- Outcome: Perform soldering and brazing.**
1. Describe tools, equipment and material used for pipe work.
 2. Describe tools and equipment used for soldering.
 3. Describe tools and equipment used for brazing.
 4. Describe the safety precautions for the brazing and soldering work area.
 5. Describe the methods of protection for components.
 6. Prepare material for brazing and soldering.
 7. Perform soldering on prepared material.
 8. Perform brazing on prepared material.
 9. Troubleshoot flow control valves.
 10. Replace a compressor.
 11. Replace evaporators and condensing coils.
- D. System Evacuation Dehydrating and Charging 28%**
- Outcome: Perform cleaning, evacuating, dehydrating, and charging of sealed systems.**
1. Describe the evacuation process.
 2. Describe the methods of system evacuation.

3. Connect a vacuum pump and evacuate a refrigeration system.
4. Maintain vacuum pumps.
5. Back flush a sealed system.
6. Sweep charge a sealed system.
7. List the safety precautions to follow when adding refrigerants to systems.
8. Add the correct type and amount of refrigerant to a system.
9. Describe the procedures for testing metering devices.

E. Electrical Components 24%

Outcome: Diagnose electrical components in a refrigeration system.

1. Identify electrical components in refrigeration systems.
2. Use schematic wiring diagrams as an aid in troubleshooting faults.
3. Troubleshoot an electrical circuit within a refrigeration system.

SECTION FIVE: TROUBLESHOOTING AND SYSTEM COMPONENT REPLACEMENT 17%

A. Troubleshooting and System Component Replacement..... 100%

Outcome: Repair a sealed refrigeration system.

1. Explain the methods for accessing a sealed system.
2. Diagnose sealed system without refrigeration tools.
3. Diagnose a sealed system using refrigeration tools.
4. Interpret pressure and temperature readings using charts.
5. Describe the types of compressors and their applications.
6. Identify compressor problems of a mechanical nature.
7. Diagnose systems with variable speed compressors.
8. Describe methods of replacing a heat exchanger in a system.
9. Determine when to replace filter dryers.



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