Apprenticeship and Industry Training

Water Well Driller

Apprenticeship Course Outline

Alberta

Apprenticeship and
Industry Training

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Water Well Driller

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Apprenticeship and Industry Training System

Apprenticeship is post-secondary education with a difference. It helps ensure Alberta has a steady supply of highly-skilled employees, the foundation of our economy's future health and competitiveness.

Apprentices in more than 50 trades and crafts spend between one and four years learning their trade - 80% of the time on the job under the supervision of a certified journeyman or qualified tradesperson. The balance of the program is technical training in the theory, skills and technologies of their trade.

To become certified journeymen apprentices must learn theory and skills, and they must pass examinations. Requirements for certification—including the content and delivery of technical training—are developed and updated by the Alberta Apprenticeship and Industry Training Board (the Board) and a network of local and provincial industry committees.

The graduate of the Water Well Driller apprenticeship training is a journeyman who:

- through skill and knowledge, is capable of operating the machines used to produce bore holes.
- Is able to complete a bore hole into a finished productive well.
- Is able to complete well records and reports as required by the industry.
- Is able to complete well records and reports as required by Alberta Environment.
- Is able to disinfect and service completed wells and pumping equipment.
- Is familiar with the work in related trades such a mechanics and plumbers.

Apprenticeship and Industry Training Committee Structure

While government supports Alberta's apprenticeship and industry training system, it is driven by industry, a term which includes both employers and employees. The Alberta Apprenticeship and Industry Training Board, with the support of Alberta Advanced Education, oversees the system. But the system relies on a network of industry committees. These committees include local and provincial apprenticeship committees (LACs and PACs) in the designated trades and occupational committees (OCs) in the designated occupations, as well as other committees such as provisional committees established before the designation of a new trade or occupation comes into effect. All these committees are composed of equal numbers of employers and employees. The network of industry committees is the foundation of Alberta's apprenticeship and industry training system.

Local Apprenticeship Committees (LAC)

Wherever there is activity in a trade, the Board can set up a LAC. The Board appoints equal numbers of employees and employers for terms of up to three years. The committee appoints a member as presiding officer. Local Apprenticeship Committees:

- monitor the apprenticeship system, and the progress of apprentices in their trade, at the local level.
- help settle certain kinds of issues between apprentices and their employers.
- recommend improvements in apprenticeship training and certification to their trade's provincial apprenticeship committee.
- make recommendations to the Board regarding the appointment of members to their trade's PAC.

Provincial Apprenticeship Committees (PAC)

The Board establishes a PAC for each trade and, based on PAC recommendations, appoints a presiding officer and equal numbers of employees and employers for terms of up to three years. Most PACs have nine members. Provincial Apprenticeship Committees:

- identify the training needs and content for their trade.
- recommend to the Board the standards for training and certification for their trade.
- monitor the activities of local apprenticeship committees in their trade.
- make recommendations to the Board about the designation of trades and occupations.
- determine whether training of various kinds is equivalent to training provided in an apprenticeship program in the trade.
- may participate in resolving any apprenticeship-related disputes between employers and employees.

Water Well Driller PAC Members

Mr. B. Meyers	De Winton	Presiding Officer
Mr. K. Bland	Calgary	Employer
Mr. G. Synders	Edmonton	Employer
Mr. G. Topilka	Spruce Grove	Employer
Mr. D. Yurkish	Sherwood Park	Employer
Mr. S. Blackwood	De Winton	Employee
Mr. W. Johnson	Calgary	Employee
Mr. D. Lees	Edmonton	Employee
Mr. K. Topilka	Edmonton	Employee

The Alberta Apprenticeship and Industry Training Board (Board)

The mandate of the Alberta Apprenticeship and Industry Training Board relates to the standards and requirements for training and certification in programs under the *Apprenticeship and Industry Training Act*. The Board provides advice to the Minister of Advanced Education on the training and certification of people in designated trades and occupations and on the needs of the Alberta labour market for skilled and trained persons. The Board also makes orders and regulations respecting standards and requirements for apprenticeship programs and the training of apprentices and for training and certification in designated trades and occupations, and the criteria or requirements for granting and recognizing trade and other certificates.

The 13-member Board consists of a chair, eight members representing trades and four members representing other industries. The trades and other industry members are equally represented by employer and employee representatives.

Safety Education

Safe working procedures and conditions, accident 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, employers, employees and the public. Therefore, it is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to or cause an accident or injury.

It is generally recognized that a safe attitude contributes to an accident free environment. Everyone will benefit as a result of a healthy, safe attitude towards prevention of accidents.

A tradesperson is possibly exposed to more hazards than any other person in the work force and, therefore, should be familiar with and apply the Occupational Health and Safety Act and Regulations dealing with personal safety and the special safety rules applying to each task.

Legal and Administrative Aspects of Safety

Accident prevention and the provisions of safe working conditions are the responsibilities of an employer and employee.

Employer's Responsibilities

The employer is responsible for:

- providing and maintaining safety equipment and protective devices.
- ensuring proper safe work clothing is worn.
- enforcing safe working procedures.
- providing safeguards for machinery, equipment and tools.
- observing all accident prevention regulations.
- training employees in the safe use and operation of equipment.

Employee's Responsibilities

The employee is responsible for:

- working in accordance with the safety regulations pertaining to the job environment.
- working in such a way as not to endanger themselves or fellow employees.

Workplace Health and Safety's Responsibilities:

Workplace Health and Safety (Alberta Human Resources and Employment) will conduct periodic inspections of the workplace to ensure that safety regulations for industry are being observed.

Technical Training Establishment

Alberta Advanced Education, Apprenticeship and Industry Training offer your apprenticeship training program. Staff and facilities for delivering the program are supplied by:Red Deer College

Procedures For Recommending
Revisions To The Course Outline

Apprenticeship and Industry Training, Industry Programs and Standards has prepared this course outline in partnership with the Water Well Driller Provincial Apprenticeship Committee.

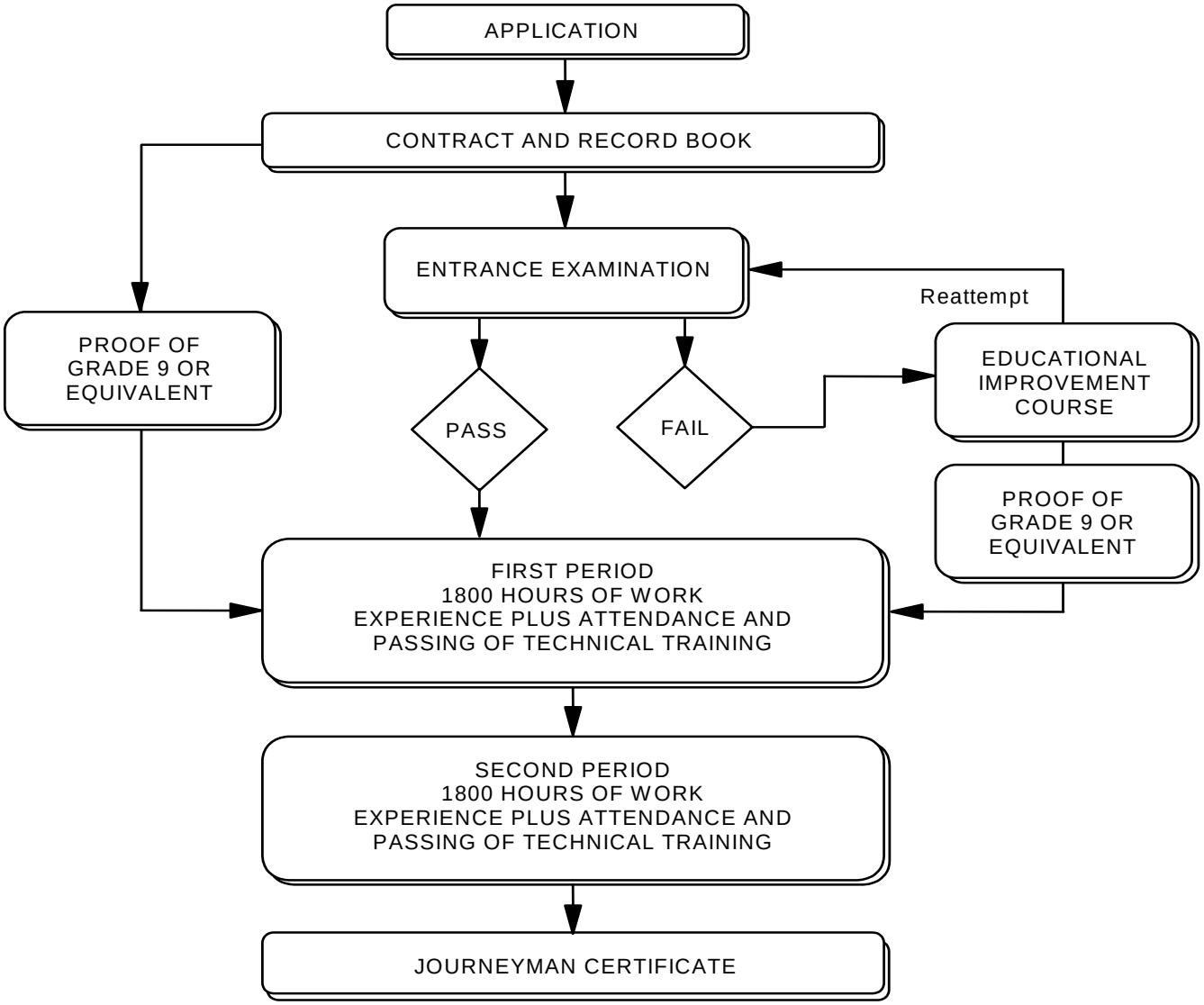
This course outline was approved on June 24, 2004 under the authority of the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. Valuable input is acknowledged from industry and the institutions.

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

Water Well Driller Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
10th floor, Commerce Place
10155 - 102 Street
Edmonton, AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used. Recommendations received will be placed before regular meetings of the Provincial Apprenticeship Committee.

Apprenticeship Route Toward Certification



Water Well Driller Training Profile

FIRST PERIOD

(6 Weeks 30 Hours Per Week – Total of 180 Hours)

SECTION ONE

INDUSTRY OVERVIEW AND REGULATIONS
29 Hours

- **A** — Apprenticeship System — 2 Hours
- **B** — Water Well Industry Roles and Associations — 1 Hour
- **C** — Regulations that affect the Trade — 9 Hours
- **D** — Safety, Fire Hazards and Metrics in Water Well Drilling — 17 Hours

SECTION TWO

BASIC TOOLS AND SKILLS
3 Hours

- **A** — Proper Care and Use of Hand Tools — 2 Hours
- **B** — Proper Care and Use of Power Tools — 1 Hour

SECTION THREE

VEHICLE ENGINES AND SUPPORT SYSTEMS
28 Hours

- **A** — Engines/Powertrains — 2 Hours
- **B** — Cooling Systems — 3 Hours
- **C** — Lubrication Systems — 3 Hours
- **D** — Fuel Supply Systems — 4 Hours
- **E** — Electrical System — 5 Hours
- **F** — Batteries — 3 Hours
- **G** — Brake System — 2 Hours
- **H** — Service Schedules — 2 Hours

SECTION FOUR

HYDRAULICS
18 Hours

- **A** — Hydraulic Systems — 18 Hours

SECTION FIVE

WELDING
30 Hours

- **A** — Metal Heating and Cutting — 12 Hours
- **B** — Arc Welding — 18 Hours

SECTION SIX

STANDARDS AND REGULATIONS
12 Hours

- **A** — Environmental Regulations — 12 Hours

SECTION SEVEN

WELL DRILLING SYSTEMS
60 Hours

- **A** — High Air Volume Systems — 12 Hours
- **B** — Drilling Safety — 3 Hours
- **C** — Drilling Fluids — 6 Hours
- **D** — Cable Tool Drilling — 6 Hours
- **E** — Mud Rotary, Air Rotary, Dual Rotary and Air Hammer Drilling — 14 Hours
- **F** — Drilling Bits — 6 Hours
- **G** — Auger and Boring Drilling — 6 Hours
- **H** — Other Drilling Systems — 7 Hours

SECOND PERIOD

(6 Weeks 30 Hours Per Week – Total of 180 Hours)

SECTION ONE

GROUND WATER
80 Hours

A	B	C
Ground Water Geology 21 Hours	Water Sources 4 Hours	Lithology 1 Hour
D	**E**	**F**
Maps 6 Hour	Ground Water Exploration 21 Hours	Aquifer Characteristics 21 Hours
G		
Ground Water Chemistry 6 Hours		

SECTION TWO

WATER WELLS
67 Hours

A	B	C
Well Construction and Design 21 Hours	Well Development 12 Hours	Well Maintenance 12 Hours
D	**E**	
Water Well/Bore Hole Reclamation 10 Hours	Ground Water Monitoring 12 Hours	

SECTION THREE

WATER WELL PUMPING SYSTEMS
30 Hours

A	B	C
Pump Types, Applications and Installations 12 Hours	Pump Maintenance and Diagnosis 6 Hours	Electrical (AC) 12 Hours

SECTION FOUR

WORKPLACE COACHING SKILLS
3 Hours

A
Workplace Coaching Skills 3 Hours

NOTE: The hours stated are for guidance and should be adhered to as closely as possible. However, adjustments must be made for rate of apprentice learning, statutory holidays, registration and examinations for the training establishment and Apprenticeship and Industry Training

FIRST PERIOD TECHNICAL TRAINING
WATER WELL DRILLER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM (BOTH ON THE JOB AND TECHNICAL TRAINING) THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: .....INDUSTRY OVERVIEW AND REGULATIONS.....29 HOURS

A. Apprenticeship System ..... 2 Hours

Outcome: Explain the role and purpose of the advisory network and Provincial Apprenticeship Committee structure for the Water Well Driller trade.

1. Describe the structure and purpose of provincial and local apprenticeship committees.
2. State the process involving the Contract of Apprenticeship and Record Book.
3. Outline the Training Profile for the Water Well Driller Trade.

B. Water Well Industry roles and Associations..... 1 Hour

Outcome: Explain the role of the industry and identify the associations and whom they represent.

1. Demonstrate knowledge of the scope of this industry as it applies to Alberta.
2. Describe the scope of training education opportunities.
3. Briefly describe trade associations available to water well drillers.

C. Regulations that affect the Trade..... 9 Hours

Outcome: Adhere to the regulations that apply to the water well driller trade.

1. Recognize, explain and comply with Occupational Health and Safety regulations.
2. Recognize, explain and comply with WHMIS regulations.
3. Recognize, explain and comply with fire regulations.
4. Recognize, explain and comply with WCB regulations.
5. Recognize and explain the Apprenticeship Act and Regulations.
6. Recognize and explain the Highway Traffic Act.

D. Safety, Fire Hazards and Metrics in Water Well Drilling ..... 17 Hours

Outcome: Recognize safety hazards present in the worksite and take actions to protect yourself and others from them.

1. Describe the types of personal hazards associated with the work assigned to a water well driller (elec. tools, rotating machinery, comp. air, jacking and hoisting, exhaust gases, etc.).
2. Identify and use safety equipment and procedures when dealing with hazards associated with being a water well driller.
3. Practice safe care and control of hazardous products commonly used by a water well driller.
4. Recognize and describe environmental hazards associated with the trade.

5. State the safety considerations when dealing with gas encounters.
6. Perform measurements and conversions using metric and imperial units.

SECTION TWO: .....BASIC TOOLS AND SKILLS..... 3 HOURS

A. Proper Care and Use of Hand Tools ..... 2 Hours

Outcome: Select and use proper hand tools for a given task.

1. Recognize the safe and serviceable condition of hand tools.
2. Recognize, identify and use proper wrench sizing (Metric and SAE).
3. Recognize and identify special use tools.
4. Apply and use measuring principles and tools:
   a) units of measure
   b) accurate interpretation of measurements
   c) relationship of fractional and decimal measurements
   d) metric rules; scales and gauges to measure volume, temperatures and pressures
   e) micrometers
   f) calipers
   g) torque wrenches
   h) thread gauges.

B. Proper Care and Use of Power Tools ..... 1 Hour

Outcome: Identify and use power tools common to the trade.

1. Identify power tools and their use in the trade.
2. Recognize power tools in an unserviceable condition.
3. Recognize the capacities and limitations of power tools.

SECTION THREE: ..... VEHICLE ENGINES AND SUPPORT SYSTEMS .....28 HOURS

A. Engines/Powertrains ..... 2 Hours

Outcome: Perform basic servicing.

1. Identify the common types (designs) of engines:
   a) two and four cycle design
   b) diesel and gasoline design
   c) air and liquid cooled design
   d) number and arrangement of cylinders.
2. Explain the differences in operating principles between a two and four-stroke engine.
3. Identify types and servicing of transmissions, differentials, gearboxes and drive trains.
4. Identify specialty control devices:
   a) engine shutdowns
   b) safety shutdowns.

B. Cooling Systems ..... 3 Hours

Outcome: Perform maintenance and servicing on a cooling system.

1. Explain the differences in operating principles between air and liquid systems
2. Identify the major components of both types of cooling systems:
   a) radiator
   b) thermostats
   c) radiator caps
   d) pumps
   e) fins and deflectors
   f) shutters
   g) filters (air and coolant)
   h) thermatic fans (reversible)
   i) shutdown devices
   j) oil coolers and heat exchangers (torque converter, engine oil, hydraulics).
3. Describe the recovery of the coolant prior to disassembly of a system:
   a) components and proportion
   b) handling and storage
   c) testing methods and interpretation
   d) inhibitors.
4. Describe the removal and replacement of the components and coolant of a cooling system.
5. Describe routine service methods:
   a) adjustments
   b) servicing an overheated system
   c) correcting leaks (internal and external).

C. Lubrication Systems ..... 3 Hours

Outcome: Perform maintenance and servicing on a lubrication system.

1. Describe the various types of oils and greases:
   a) types and grades
   b) handling and storage
   c) precautions for adding oil.
2. Describe oil filter systems:
   a) types
   b) operational principles of full flow and bypass systems
   c) installation procedures and inspection and cleaning precautions.
3. Analyze engine oil for:
   a) oil condition
   b) presence of moisture
   c) leaks
   d) other foreign substances.
4. Explain the reason for oil coolers and heat exchangers.
5. Explain the reason for and consistency of greasing rig and truck components.

D. Fuel Supply Systems ..... 4 Hours

Outcome: Perform maintenance and service on a fuel supply system.

1. Identify the different fuels used to power motor vehicles and the precautions for working around them (Gasoline, diesel and LPG).

2. Recognize the types and grades of fuel.
3. Identify the major fuel supply system components.
4. Describe the operation of a fuel supply system.
5. Describe the recovery of fuel during a disassembly process.
6. Describe the removal and replacement of the major components of a fuel supply and filtration system.

E. Electrical System ..... 5 Hours

Outcome: Perform basic testing and servicing of vehicle electrical system.

1. Explain basic electrical theory.
2. Recognize electrical terms and symbols.
3. Identify basic electrical circuits and their faults.
4. Use a voltmeter, ammeter, ohmmeter and test light to identify a shorted, open or grounded electrical circuit.
5. Identify those electrical/electronic systems most commonly serviced by water well drillers (lighting circuit, power accessories, interior lighting, rear window defrost).
6. Describe generic troubleshooting steps for electrical systems.
7. Describe the hazards associated with electrostatic discharge (ESD) when working with vehicle electronic systems.
8. Describe removal and replacement procedures of damaged or defective electrical/electronic components.
9. Perform industry-approved simple wire harness and connector repairs (soldering single wires, replacing fusible links, replacing terminal connectors, etc.).

F. Batteries ..... 3 Hours

Outcome: Service, test and diagnose problems related to batteries.

1. Be aware of battery hazards and maintenance.
2. Explain the purpose, construction, operation and ratings of batteries.
3. Test and service batteries.
4. Diagnose problems attributed to batteries.
5. Perform battery charging and boosting operations.

G. Brake System ..... 2 Hours

Outcome: Operate, adjust and service an air brake system.

1. Explain the principles of basic hydraulics/air brake systems.
2. Identify and describe the purpose of the major air brake system components (Compressors, tanks, air dryers, filters, regulators, valves and governors).
3. Describe the inspection process to identify damaged or worn components.
4. Describe the removal and replacement of brake system components.
5. Verify brake system operation.

H. Service Schedules..... 2 Hours

Outcome: Follow a maintenance schedule.

1. Interpret maintenance schedule according to hour meter and drilling conditions.
2. Explain the engine conditions that are apparent due to telltales:
   a) heavy white exhaust
   b) heavy black exhaust
   c) excessive blue exhaust
   d) rough running
   e) bearing noise
   f) overheating.

SECTION FOUR: ..... HYDRAULICS .....18 HOURS

A. Hydraulic Systems ..... 18 Hours

Outcome: Use and maintain the hydraulic system on a drilling rig.

1. Explain the different types of hydraulic systems applicable to water well drills and their principle of operation.
2. Describe the corresponding layout for each hydraulic system.
3. Identify the basic system components and functions of:
   a) lubricating oil
   b) pumps
   c) motors
   d) cylinders
   e) valves
   f) plumbing/fixtures/hoses
   g) reservoirs
   h) filters
   i) heat exchangers
   j) clutches and brakes(hydraulic).
4. Identify component/system failures and their causes.
5. Explain maintenance schedules and required system servicing.

SECTION FIVE: .....WELDING..... 30 HOURS

The instruction under this section shall not be to the level of proficiency of a skilled Welder. The intent is to train the apprentice to a level where he may operate the required equipment in a safe manner, and perform such operations as cutting and tack welding to make temporary attachment of component parts, prior to the finish welding required by a certified journeyman Welder.

A. Metal Heating and Cutting ..... 12 Hours

Outcome: Heat, braze, tack weld and cut metals using oxy-fuel equipment.

1. Describe the characteristics, composition and handling of fuel gases:
   a) oxygen
   b) acetylene
   c) propane.
2. Assemble and operate oxy-fuel welding equipment:
   a) cylinders
   b) regulators and hoses
   c) torch

d) welding, and heating attachments
e) basic technique.

3. Assemble and operate oxy-fuel cutting equipment:
   a) cutting attachments
   b) basic technique and operational procedures.

B. Welding ..... 18 Hours

Outcome: Produce industry acceptable tack welds using arc welding equipment.

1. Wear the proper apparel to be used when arc welding.
2. Describe the types of arc welding machines and their uses (AC transformer, AC to DC rectifier, DC generator and wire feed welders).
   a) advantages and disadvantages
   b) reverse and straight polarity.
3. Describe the operation and uses of accessories required in arc welding:
   a) cable construction and sizes
   b) electrode holders
   c) cable lugs, quick connectors and ground clamps.
4. Describe the types and uses of electrodes:
   a) numerical definitions
   b) manufacturing specification control
   c) function of the coating
   d) function of the slag
   e) alloy additions to the coating
   f) static and dynamic loading.
5. Assemble, adjust and operate arc welding equipment.
6. Perform industry-acceptable lap, butt and plug welds on 16 and 20-gauge steel.
7. Demonstrate the ability to weld in the flat, vertical and horizontal positions.
8. Recognize, identify and correct weld faults:
   a) inclusions (slag, porosity)
   b) lack of penetration
   c) excessive penetration
   d) insufficient build-up
   e) excessive build-up
   f) pipe misalignment
   g) undercutting.
9. Troubleshoot and maintain arc welding equipment.

SECTION SIX: ..... STANDARDS AND REGULATIONS ..... 12 HOURS

A. Environmental Regulations ..... 12 Hours

Outcome: Follow the regulations that govern the drilling and construction of water wells and complete the well site records, well reports, contracts and agreements.

1. List all the regulations that specifically govern the drilling and construction of water wells.
2. Understand what records must be kept in rough logs and day sheets:
   a) drilling information
   b) business information.
3. Understand what constitutes a contract and what should be included in a contract:

a) verbal contract
b) written contract;

4. State the various records and reports necessary for water well construction and to whom they are distributed:
   a) for the customer:
   b) for environment
   c) for the driller or company file.

SECTION SEVEN: ..... WELL DRILLING SYSTEMS ..... 60 HOURS

A. High Air Volume Systems ..... 12 Hours

Outcome: Operate and maintain the compressed air system as it pertains to drilling.

1. Identify the types of compressors.
2. Describe the operational safety requirements of compressed air systems.
3. Describe the maintenance of a compressed air system.

B. Drilling Safety ..... 3 Hours

Outcome: Work safely on the drilling site.

1. Identify safety hazards on the worksite.
2. Follow safety procedures and regulations on the worksite.

C. Drilling Fluids ..... 6 Hours

Outcome: Select, mix and use the appropriate drilling fluids.

1. Describe the different types of drilling fluids and their uses.
2. Select the appropriate drilling fluid for a given application.

D. Cable Tool Drilling ..... 6 Hours

Outcome: Identify the cable tool drilling system.

1. Discuss the terminology.
2. Explain the principles of operation of cable tool drilling.

E. Mud Rotary, Air Rotary, Dual Rotary and Air Hammer Drilling ..... 14 Hours

Outcome: Use one of the listed types (Topics E, G and H) of drilling equipment.

1. Discuss the terminology.
2. Explain the principles of operation of these types of drilling systems.
3. Perform the plumbness and alignment test.

F. Drilling Bits ..... 6 Hours

Outcome: Identify and use different types of rotary drilling bits for different applications.

1. Describe the types and uses of drilling bits.
2. Select the appropriate bit for a particular application.

G. Auger and Boring Drilling ..... 6 Hours

Outcome: Use one of the listed types (Topics E, G and H) of drilling equipment.

1. Discuss the terminology.
2. Explain the principles of operation of these types of drilling systems.

H. Other Drilling Systems ..... 7 Hours

Outcome: Use one of the listed types (Topics E, G and H) of drilling equipment.

1. Describe other type of drilling equipment (HDD, sonic, etc.).
2. Describe future trends in the water well drilling industry.

SECOND PERIOD TECHNICAL TRAINING
WATER WELL DRILLER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM (BOTH ON THE JOB AND TECHNICAL TRAINING) THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: ..... GROUND WATER ..... 80 HOURS

A. Ground Water Geology ..... 21 Hours

Outcome: Identify the geology/hydrogeology that is encountered when drilling and constructing water wells.

1. Identify various rock types and the process that form them:
   a) rock types (igneous, metamorphic, sedimentary)
   b) processes (erosion, volcanic, ice, heat and pressure).
2. Describe the various formations found in Alberta using proper names:
   a) bedrock (paskapoo, edmonton, belly river, bear paw, lea park)
   b) surficial.
3. Use proper terminology to describe geological formations as it applies to the water well industry.
4. Describe the Hydrologic Cycle (Water Cycle), define the terms associated with it and describe how weather and water movement affect it:
   a) importance of precipitation
   b) infiltration
   c) transpiration
   d) evaporation.
5. Describe the various underwater zones using proper terminology and how to locate water tables:
   a) zone of soil moisture
   b) zone of aeration
   c) zone of saturation
   d) effects of gravity and capillary motion
   e) occurrence and movement of ground water.
6. Identify using proper terminology of ground water formation as it pertains to water storage:
   a) aquifer
   b) confining beds
   c) porosity.

B. Water Sources ..... 4 Hours

Outcome: Identify the different sources of water using proper terminology.

1. Define surface water.
2. Describe the effects of surface water on the water table.
3. Define ground water.

C. Lithology ..... 1 Hour

Outcome: Use the appropriate terms to report on lithology.

1. Using proper terminology describe the sequence and format used in reporting.
2. Demonstrate the proper use of abbreviations.

D. Maps ..... 6 Hours

Outcome: Read and interpret maps used in the industry.

1. Read and interpret maps that pertain to geology, hydrogeology and location.

E. Ground Water Exploration ..... 21 Hours

Outcome: Select the proper drilling sites and use appropriate methods of sampling and logging

1. Describe the site selection process.
2. Explain the process of taking samples and logging them.

F. Aquifer Characteristics ..... 21 Hours

Outcome: Recognize aquifer potential and perform aquifer tests.

1. Explain ground water flow as it pertains to various formations.
2. Recognize hydraulic properties of rocks (porosity, permeability, hydraulic properties, types of aquifers, transmissivity, storativity, hydraulic gradient).
3. Describe the different types of aquifer tests and the equipment necessary.
4. Perform the various aquifer tests, record the readings and interpret the results (water withdrawal, water injection and flowing wells).
5. Describe new technology for data acquisition.

G. Ground Water Chemistry ..... 6 Hours

Outcome: Determine type of water characteristics.

1. Perform basic water chemistry tests.
2. Interpret detailed chemistry reports.
3. Describe proper techniques for acquiring water samples.

SECTION TWO: ..... WATER WELLS ..... 67 HOURS

A. Well Construction and Design ..... 21 Hours

Outcome: Design a water well.

1. Explain the history of well design.
2. Identify the basic types of wells.
3. Describe the types of formations.
4. List the design considerations with regard to longevity, environmental concerns and customer expectations.
5. Describe the types and sizing of casing.
6. Describe the methods of sealing, grouting and cementing casings.
7. Describe the methods of setting and sealing screens.
8. Identify the types of screens and filter packs and pressure tanks.

9. Describe the methods of installing filter packs.
10. Design a well.

B. Well Development ..... 12 Hours

Outcome: Use development techniques to maximize well efficiencies.

1. Explain the theory of well development.
2. Describe the methods of well development taking into account equipment requirements.
3. Describe the methods of well and piping disinfection.
4. Perform tests for well efficiency.

C. Well Maintenance ..... 12 Hours

Outcome: Identify existing well conditions and perform appropriate maintenance.

1. Describe the causes of well failures and identify the methods of correction (corrosion, incrustation, and sand pumping).
2. Identify equipment/well failure causes and describe methods of correction and repair.
3. Describe the methods of well screen recovery and reinstallation.
4. Identify common pollution problems and describe methods of correction.
5. Describe well inspection/maintenance procedures.

D. Water Well/Bore Hole Reclamation ..... 10 Hours

Outcome: Perform reclamation of water wells and/or bore holes.

1. Identify the equipment required for decommissioning a water well or bore hole.
2. Describe the regulations and methods to decommission a water well or bore hole.

E. Ground Water Monitoring ..... 12 Hours

Outcome: Drill ground water monitoring wells.

1. Identify ground water contamination sources.
2. Describe containment movement.
3. Describe how to locate monitoring wells.
4. Describe Monitor well construction and design.
5. Describe safety procedures at a monitoring site.

SECTION THREE: ..... WATER WELL PUMPING SYSTEMS ..... 30 HOURS

A. Pump Types, Applications and Installation ..... 12 Hours

Outcome: Design and install a water pumping system at a well site.

1. Identify types of shallow well pumps.
2. Identify types of deep well pumps.
3. Select pump type according to application and sizing.
4. Describe installation processes for the different pump types.
5. Describe licensing and equipment requirements.
6. Outline the process for dealing with gas encounters.

B. Pump Maintenance and Diagnosis ..... 6 Hours

Outcome: Diagnose pumping system problems and perform maintenance on such systems.

1. Perform pumping system tests including troubleshooting.
2. Perform pump maintenance and/or repair.

C. Electrical ..... 12 Hours

Outcome: Install and wire motor controls as they pertain to the water well pumping system.

1. Be informed of the electrical code requirements.
2. Recognize electrical circuits.
3. Explain lockout/tag out procedures.
4. Be aware of personal protection as per OH&S regulations.
5. Use a voltmeter, amp probe and ohmmeter.
6. Describe the method to wire motor controls.
7. Describe the procedure for protecting and burying underground cables.
8. Install a waterproof splice on a submersible pump lead.
9. Connect and disconnect electrical cable at the well head for servicing.
10. Complete a control box installation (accounting for the location and wiring of the controller as well as the junction box before the controller).
11. Complete a motor ground while testing a pump and for permanent installation.
12. Perform all electrical tests as required on pumping systems.

SECTION FOUR: ..... WORKPLACE COACHING SKILLS .....3 HOURS

A. Workplace Coaching Skills ..... 3 Hours

Outcome: Provide mentorship to apprentices on the job.

1. Describe the coaching skills used for training apprentices.

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