Apprenticeship and Industry Training

Sawfiler

Apprenticeship Course Outline

4406.2 (2006)

Alberta

Apprenticeship and Industry Training

ALBERTA ADVANCED EDUCATION AND TECHNOLOGY CATALOGUING IN PUBLICATION DATA

Alberta. Alberta Advanced Education and Technology. Apprenticeship and Industry Training.
Sawfiler : apprenticeship course outline : 4406 (2006)

ISBN 0-7785-4755-8

1. Saw filing - Study and teaching - Alberta. 2. Apprentices - Alberta. 3. Occupational training - Alberta.
I. Apprenticeship and Industry Training (Series). II. Title.

HD4885.C2.S271.A333 2006 373.27

Sawfiler
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Course Outline

Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding an employer. Employers hire apprentices, pay their wages and provide on-the-job training and work experience. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyperson or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution – usually a college or technical institute.

To become certified journeypersons, 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 on the recommendation of Sawfiler Provincial Apprenticeship Committee.

The graduate of the Sawfiler apprenticeship program is a certified journeyperson who will be able to:

- responsibly do all work tasks expected of a journeyperson
- supervise, train and coach apprentices
- have a thorough knowledge of trade terminology
- use with safety and competence the hand and power tools commonly used in the trade
- perform assigned tasks in accordance with quality and production standards required by industry

Apprenticeship and Industry Training System

Industry-Driven

Alberta's apprenticeship and industry training system is an industry-driven system that ensures a highly skilled, internationally competitive workforce in more than 50 designated trades and occupations. This workforce supports the economic progress of Alberta and its competitive role in the global market. Industry (employers and employees) establishes training and certification standards and provides direction to the system through an industry committee network and the Alberta Apprenticeship and Industry Training Board. The Alberta government provides the legislative framework and administrative support for the apprenticeship and industry training system.

Alberta Apprenticeship and Industry Training Board

The Alberta Apprenticeship and Industry Training Board provides a leadership role in developing Alberta's highly skilled and trained workforce. The board's primary responsibility is to establish the standards and requirements for training and certification in programs under the Apprenticeship and Industry Training Act. The board also provides advice to the Minister of Advanced Education and Technology on the needs of Alberta's labour market for skilled and trained workers, and the designation of trades and occupations.

The thirteen-member board consists of a chair, eight members representing trades and four members representing other industries. There are equal numbers of employer and employee representatives.

Industry Committee Network

Alberta's apprenticeship and industry training system relies on a network of industry committees, including local and provincial apprenticeship committees in the designated trades, and occupational committees in the designated occupations. The network also includes other committees such as provisional committees that are established before the designation of a new trade or occupation comes into effect. All trade committees are composed of equal numbers of employer and employee representatives. The industry committee network 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 local apprenticeship committee. The board appoints equal numbers of employee and employer representatives for terms of up to three years. The committee appoints a member as presiding officer. Local apprenticeship committees:

- monitor apprenticeship programs and the progress of apprentices in their trade, at the local level
- make recommendations to their trade's provincial apprenticeship committee (PAC) about apprenticeship and certification in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- make recommendations to the board about the appointment of members to their trade's PAC
- help settle certain kinds of disagreements between apprentices and their employers
- carry out functions assigned by their trade's PAC or the board

Provincial Apprenticeship Committees (PAC)

The board establishes a provincial apprenticeship committee for each trade. It appoints an equal number of employer and employee representatives, and, on the PAC's recommendation, a presiding officer - each for a maximum of two terms of up to three years. Most PACs have nine members but can have as many as twenty-one. Provincial apprenticeship committees:

- Make recommendations to the board about:
    - standards and requirements for training and certification in their trade
    - courses and examinations in their trade
    - apprenticeship and certification
    - designation of trades and occupations
    - regulations and orders under the Apprenticeship and Industry Training Act
- monitor the activities of local apprenticeship committees in their trade
- determine whether training of various kinds is equivalent to training provided in an apprenticeship program in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- consult with other committees under the Apprenticeship and Industry Training Act about apprenticeship programs, training and certification and facilitate cooperation between different trades and occupations
- consult with organizations, associations and people who have an interest in their trade and with employers and employees in their trade
- may participate in resolving certain disagreements between employers and employees
- carry out functions assigned by the board

Sawfiler PAC Members at the Time of Publication

Mr. D. Adams .....Atmore.....Employer
Mr. G. Grant .....Grovedale.....Employee

Alberta Government

Alberta Advanced Education and Technology works with industry, employer 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 employers
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Technical Institutes and Colleges

The technical institutes and colleges are key participants in Alberta's apprenticeship and industry training system. They work with the board, industry committees and Alberta Advanced Education and Technology to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs. They develop lesson plans from the course outlines established by industry and provide technical training to apprentices.

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, employers, 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.

Alberta Apprenticeship and Industry Training Board Safety Policy

The Alberta Apprenticeship and Industry Training Board fully supports safe learning and working environments and encourages the teaching of proper safety procedures both within trade specific training and in the workplace.

Trade specific safety training is an integral component of technical training, while ongoing or general non-trade specific safety training remains the responsibility of the employer and the employee as required under workplace health and safety legislation.

Workplace Responsibilities

The employer is responsible for:

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

The employee and apprentice are responsible for:

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

Workplace Health and Safety

A tradesperson is often 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, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Workplace Health and Safety (Alberta Employment, Immigration and Industry) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.worksafely.org

Technical Training

Apprenticeship technical training is delivered by the technical institutes and many colleges in the public post-secondary system throughout Alberta. The colleges and institutes are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All training providers place great emphasis on safe technical practices that complement safe workplace practices and help to develop a skilled, safe workforce.

The following institutions deliver Sawfiler apprenticeship technical training:

BCIT (British Columbia Institute of Technology – Burnaby, British Columbia.

Procedures for Recommending Revisions to the Course Outline

Advanced Education and Technology has prepared this course outline in partnership with the Sawfiler Provincial Apprenticeship Committee.

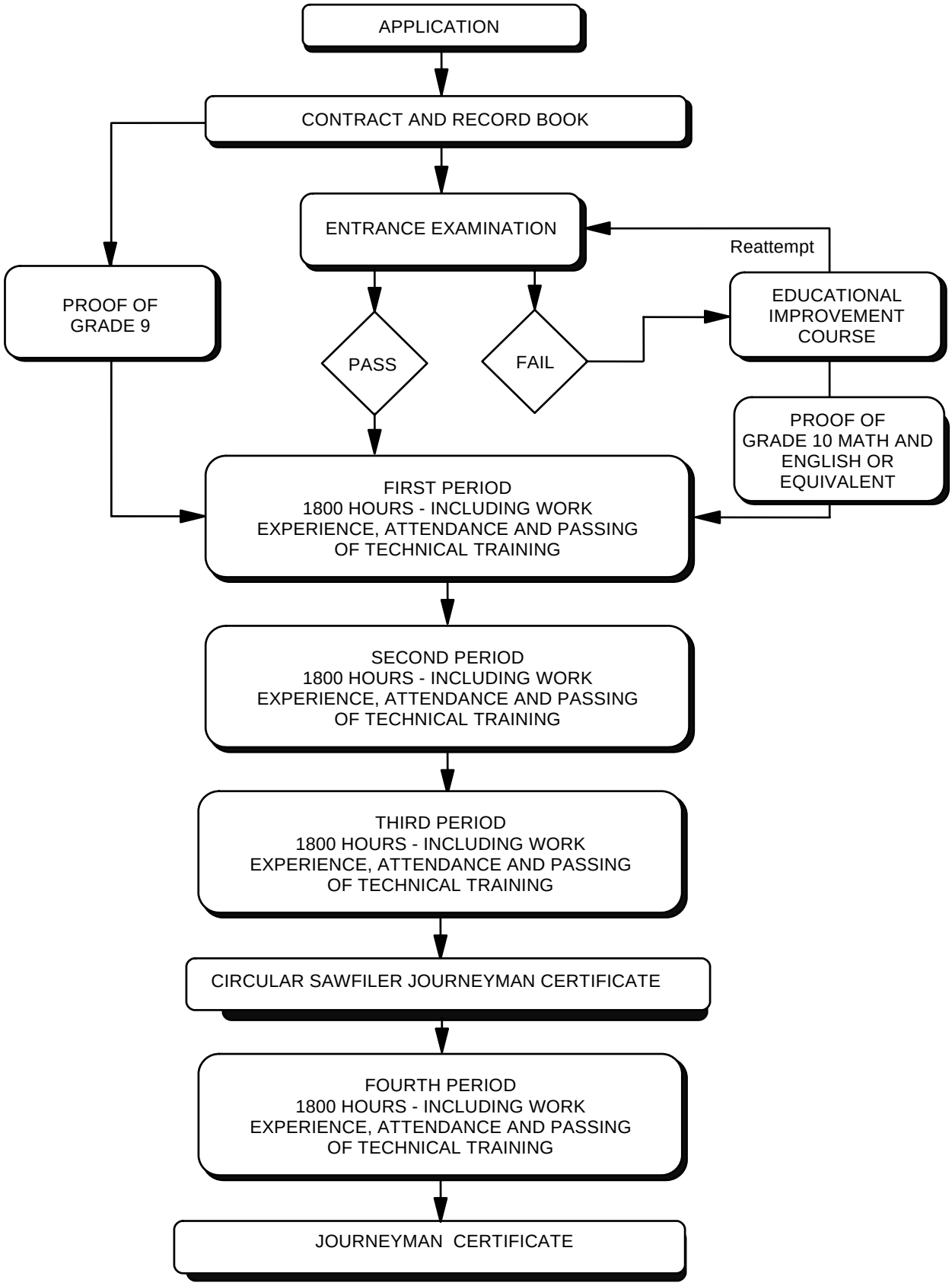
This course outline was approved on June 12, 2006 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

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

Sawfiler Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
Advanced Education and Technology
10th 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. Recommendations for change will be placed on the agenda for regular meetings of the Sawfiler Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification



Sawfiler Training Profile
FIRST PERIOD
(4 Weeks 30 Hours per Week – Total of 120 Hours)

SECTION ONE	**A**	**B**	**C**	
SCOPE OF TRADE **4 HOURS**	Introduction to the Sawfiler Trade 2 Hours	Saw Trades Shop Orientation 1 Hour	Shop Project 1 Hour	
SECTION TWO	**A**			
SAFE WORKING PRACTICES **6 HOURS**	Safe Working Practices 6 Hours			
SECTION THREE	**A**			
MATHEMATICS AND MEASURING TOOLS **7 HOURS**	Trade Mathematics and Measuring Tools 7 Hours			
SECTION FOUR	**A**	**B**	**C**	
TRADE KNOWLEDGE **25 HOURS**	Introduction 3 Hours	Band Saw 4 Hours	Circular Saw 4 Hours	
	D	**E**	**F**	
	Other Cutting Systems 4 Hours	Band Saw and Circular Saw Tooth Profiles 3 Hours	Steel Saws and Alloys 3 Hours	
	G			
	Maintenance of Saw Filing Equipment 4 Hours			
SECTION FIVE	**A**	**B**	**C**	
FITTING BAND SAWS AND CIRCULAR SAWS **51 HOURS**	Handling Saw Blades 3 Hours	Inspecting Saw Blades 6 Hours	Swaging 12 Hours	
	D	**E**		
	Shaping 12 Hours	Troubleshooting Swaging and Shaping 18 Hours		
SECTION SIX	**A**	**B**		
SPECIAL PURPOSE TOOLS **6 HOURS**	Files for Sawfiling 3 Hours	Benching Tools and Equipment 3 Hours		
SECTION SEVEN	**A**	**B**		
GRINDING WHEELS **6 HOURS**	Saw Grinder – Troubleshooting and Maintenance 3 Hours	Grinding Wheels 3 Hours		
SECTION EIGHT	**A**	**B**	**C**	
CHIPPER KNIVES **6 HOURS**	Introduction to Chipper Knives 2 Hours	Grinding Chipper Knives 2 Hours	Babbiting Chipper Knives 2 Hours	
SECTION NINE	**A**	**B**		
WELDING **9 HOURS**	Set-up and Safety 4 Hours	Welding Practice 5 Hours		

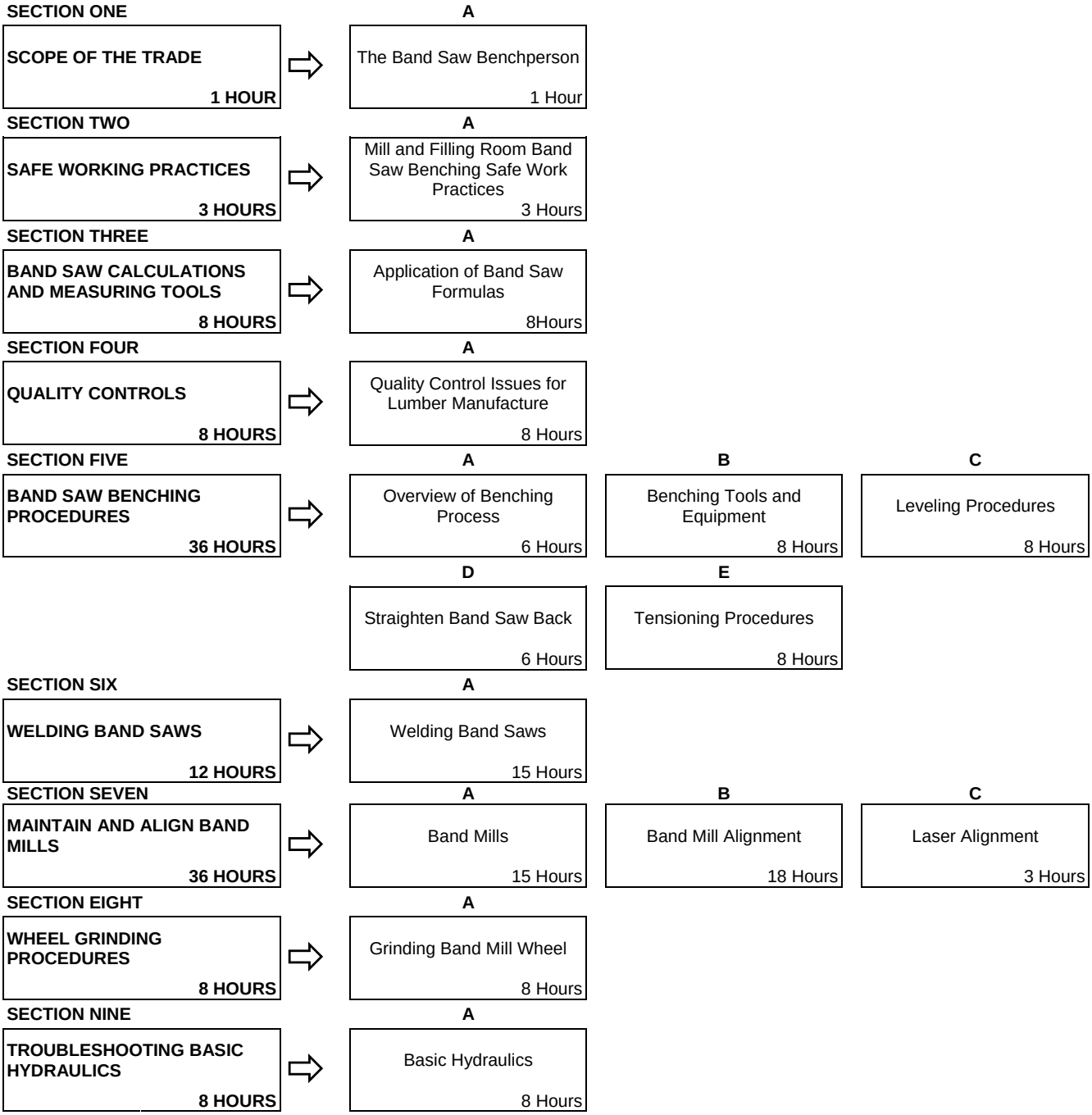
SECOND PERIOD
(4 Weeks 30 Hours per Week – Total of 120 Hours)

SECTION ONE	**A**	**B**	**C**	
SAFE WORKING PRACTICES **3 HOURS**	Legal and Regulatory Requirements 1 Hour	Locking Out 1 Hour	Mill Hazards 1 Hour	
SECTION TWO	**A**	**B**	**C**	
MATHEMATICS AND MEASURING TOOLS **7 HOURS**	General and Bank Saw Calculations 2 Hours	Circular Saw Calculations 3 Hours	Measuring Tools 2 Hours	
SECTION THREE	**A**	**B**		
CARBIDE CIRCULAR SAWS **7 HOURS**	Fitting Carbide Saws 6 Hour	Fitting Strob Saws 1 Hour		
SECTION FOUR	**A**			
FIT STELLITE BAND AND CIRCULAR SAWS **6 HOURS**	Stellite Saws 6 Hours			
SECTION FIVE	**A**	**B**		
SAWFILING BENCHING TOOLS **7 HOURS**	Benching Tools 3 Hours	Manufacture Gauges 4 Hours		
SECTION SIX	**A**	**B**		
GRINDING WHEELS **4 HOURS**	Safe Handling and Storage of Grinding Wheels 1 Hour	Diamond and CBN Wheels 3 Hours		
SECTION SEVEN	**A**	**B**	**C**	
SAW EQUIPMENT MAINTENANCE **6 HOURS**	Mill Machine Maintenance 2 Hours	Lubricants and Coolants 2 Hours	Circular Edger and Band Mill Lubrication and Cooling 2 Hours	
SECTION EIGHT	**A**	**B**	**C**	
MAINTAIN SAW GUIDES **6 HOURS**	Band Mill Guides 2 Hours	Circular Saw Guides 1 Hour	Circular Edger Saw Guides 2 Hours	
	D			
	Babbitt Saw Guides 1 Hour			
SECTION NINE	**A**			
INTRODUCTION TO CIRCULAR SAW BENCING PROCEDURES **35 HOURS**	Benching Circular Saws 35 Hours			
SECTION TEN	**A**			
INTRODUCTION TO BAND SAW BENCHING PROCEDURES **35 HOURS**	Benching Band Saws 35 Hours			
SECTION ELEVEN	**A**			
MAINTAIN CHAIN SAWS **4 HOURS**	Chain Saw Chain Maintenance 4 Hours			

THIRD PERIOD
(4 Weeks 30 Hours per Week – Total of 120 Hours)

SECTION ONE	**A**			
SCOPE OF THE TRADE **2 HOURS**	The Circular Sawfiler 2 Hours			
SECTION TWO	**A**	**B**	**C**	
HAZARD AVOIDANCE **4 HOURS**	Saw Maintenance and Hazard Protection 2 Hours	Rigging and Lifting 1 Hour	Circular Saw Noise 1 Hour	
SECTION THREE	**A**	**B**		
CIRCULAR SAW MATHEMATICS AND MEASURING TOOLS **7 HOURS**	Productivity, Quality Analysis and Calculation 5 Hours	Precision Measuring Tools 2 Hours		
SECTION FOUR	**A**			
QUALITY CONTROL **6 HOURS**	Quality Control and Quality Systems 6 Hours			
SECTION FIVE	**A**	**B**	**C**	
CIRCULAR SAW BENCING AND PROCEDURES **33 HOURS**	Advanced Circular Saw Benching 15 Hours	Strob Saws 3 Hours	Step Saw 3 Hours	
	D	**E**	**F**	
	Circular Head Saw 3 Hours	Circular Trim Saws 3 Hours	Thin Kerf Circular Saw Benching 6 Hours	
SECTION SIX	**A**			
BAND SAW BENCING PROCEDURES **20 HOURS**	Benching Band Saws 20 Hours			
SECTION SEVEN	**A**	**B**	**C**	
MAINTAIN CIRCULAR SAW FILING MACHINES **8 HOURS**	Circular Saw Stretcher Roll Maintenance 1 Hour	Circular Saw Grinder Maintenance 1 Hour	Guide Pad Re-surfacer Maintenance and Operation 6 Hours	
SECTION EIGHT	**A**	**B**	**C**	
MIG WELD CIRCULAR SAW CRACKS **14 HOURS**	Welding Hazards 2 Hours	MIG Welding Equipment and Set-up 2 Hours	MIG Welding Circular Saws 10 Hours	
SECTION NINE	**A**	**B**	**C**	
ALIGN AND MAINTAIN CIRCULAR SAW MACHINES **26 HOURS**	Circular Saw Alignment 9 Hours	Head Rig Alignment 2 Hours	Edger Maintenance and Alignment 8 Hours	
	D	**E**		
	Trimmer Maintenance and Alignment 3 Hours	Troubleshoot Circular Saw and Machine Cutters 4 Hours		

FOURTH PERIOD
(4 Weeks 30 Hours per Week – Total of 120 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
SAWFILER TRADE
COURSE OUTLINE

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

SECTION ONE: ..... TRAINING REQUIREMENTS AND SCOPE OF TRADE ..... 4 HOURS

A. Introduction to the Sawfiler-Sawfitter Trade ..... 2 Hours

Outcome Describe the sawfiling trade and the sawfiler apprenticeship program.

1. Describe the scope of the sawfiler trade.
2. Describe the apprenticeship training program.
3. Describe the responsibilities of the sawfitter.
4. List common sawfiler trade terminology.

B. Saw Trades Shop Orientation ..... 1 Hour

Outcome Identify common shop tools and saw tooth profiles for the sawfiler trade.

1. List and describe the common hand tools and bench tools used in the sawfiling shop.
2. Describe the following saw and tooth characteristics:
   a) circular saw set/kerf
   b) band saw set/kerf
   c) circular saw tooth profile
   d) band saw tooth profile
   e) side clearance
   f) hook angle
   g) included angle
   h) back clearance angle
   i) tangential angle
   j) radial angle
   k) gullet area

C. Shop Project ..... 1 Hour

1. Produce a tooth profile rubbing from a gang saw.
2. Measure and describe the tooth geometry from the profile.

SECTION TWO: ..... SAFE WORKING PRACTICES ..... 6 HOURS

A. Safe Working Practices ..... 6 Hours

Outcome: Describe safe work practices in work site and safety regulations

1. Describe how the Workers Compensation Act applies to the worksite.
2. Describe required footwear, eye protection and personal protective equipment for working in the saw shop.
3. Describe the Workplace Hazardous Materials Information System (WHMIS) as it applies to the worksite.

4. Describe the requirements intended to protect workers from the hazards of airborne metals resulting from grinding.
5. Describe the requirements intended to protect workers and equipment from hazards of improper solvent use, storage and handling.
6. Demonstrate basic body mechanics for lifting or moving equipment.
7. Demonstrate the safe handling of band and circular saw blades.
8. Demonstrate safe handling of chipper knives.
9. Demonstrate lock out procedures.
10. Describe the equipment hazards related to sawfitting.

SECTION THREE: ..... TRADE MATHEMATICS AND MEASURING TOOLS ..... 7 HOURS

A. Trade Mathematics and Measuring Tools .....7 Hours

Outcome Use saw filing measuring tools, perform sawfiling calculations.

1. Convert imperial measure to metric and metric measure to imperial.
2. Calculate surface feet per minute for saws and grinding wheels.
3. Calculate I/C resulting from gear ratios and pulley dimensions.
4. Calculate feed and speed for band saws and circular saws.
5. Calculate feed and speed for grinders.
6. Determine and adjust the speed of:
   a) drill press
   b) bench grinder
   c) feed finger speed of gang grinder
7. Demonstrate the use of measuring tools, rulers, protractors, thickness gauges, calipers and squares.
8. Use combination squares, a straightedge, scribers, marking tools, and layout die to lay out a tooth profile.
9. Read metric or imperial micrometer sleeves, and vernier calipers.
10. Demonstrate the use of a tachometer to determine rpm.
11. Describe care, maintenance and handling of precision measuring and layout tools.

SECTION FOUR: ..... TRADE KNOWLEDGE ..... 25 HOURS

A. Introduction .....3 Hours

Outcome: Differentiate rip sawing and crosscutting tooth characteristics.

1. Describe rip sawing vs. crosscutting.
2. Describe the considerations for saw blade and tooth design and construction for rip sawing vs. crosscut sawing.

B. Band Saw .....4 Hours

Outcome: ***Describe the band mill.***

1. Describe typical band mill design.
2. Describe the considerations necessary for selecting a band saw blade for a particular machine and the intended cutting task.
3. Describe the recommended practice for matching band saw blade thickness and width to the wheels.
4. Describe band saw blade types:
   a) single cut
   b) double cut
   c) sliver teeth
5. Describe the function and purpose for an offset rig.
6. Determine left hand or right hand cut.
7. Describe bandmill types:
   a) headrig
   b) chipper headrig
   c) twin
   d) quad
8. Describe the purpose of conventional carriage system, design and use considerations:
   a) conventional carriage systems
   b) lug chain systems
   c) foundation
   d) tracks and drives
9. Describe band mill resaws:
   a) center cut
   b) linebar
   c) twin
   d) tandem
   e) horizontal

C. Circular Saw .....4 Hours

Outcome: ***Describe circular saws, equipment and applications in the mill.***

1. Describe circular saw ripsawing:
   a) circular headrig
   b) scragg saw
   c) edgers
   d) gang edgers
   e) board edgers
   f) conventional vs. bottom rotation vs. climb cutting
   g) solid plate
   h) strob plate
2. Describe circular saw crosscutting.
3. Describe inserted tooth vs. solid tooth blades.
4. Describe the purpose of hollow ground blades, tooth offset, carbide or stellite tipping.

5. Describe trimmers:
    a) two saw trimmer
    b) multiple trimmer
    c) mountain or canadian trimmer
    d) multiple drop saw trimmer
    e) single or double specialty trimmer
    f) trim optimizer
6. Describe the following requirements for smooth end trimming:
    a) tooth angle
    b) hook angle
    c) face bevel angle
    d) tooth sharpness
    e) saw stability
    f) board control
    g) tooth bite

D. Other Cutting Systems .....4 Hours

Outcome: Describe other cutting machinery found in mills.

1. Describe the operation and advantages of a linear processing machine.
2. Describe the sash gang saw.

E. Band Saw and Circular Saw Tooth Profiles .....3 Hours

Outcome: Describe tooth profiles and their characteristics.

1. Describe how to select tooth profiles for the following:
    a) type of wood
    b) direction of cut relative to grain
    c) speed of blade
    d) rate of feed
    e) thickness of blade
    f) depth of cut
2. Describe the following tooth profile characteristics:
    a) back
    b) face
    c) gullet
    d) hook angle
    e) radial and tangential clearance angles
    f) back clearance angle
    g) sharpness angle
    h) tooth pitch

3. Describe how the following tooth characteristics are measured:
   a) back
   b) face
   c) gullet
   d) hook angle
   e) back clearance angle
   f) sharpness angle
   g) tooth pitch
4. Describe how the correct radial and tangential clearance angles are derived.
5. Describe how tooth profile can affect cutting accuracy, lumber quality, and saw power consumption.
6. Describe band saw tooth profiles and the application or advantage of each type:
   a) Standard
   b) Q style
   c) Frost
7. Describe circular saw tooth profiles for crosscutting and ripping and the application and or advantages of each type:
   a) crosscut inserted tooth, cut off saw
   b) crosscut solid tooth, cut off saw
   c) crosscut trim saw
   d) ripping – standard
   e) ripping – alternatively beveled

F. Saw Steels and Alloys .....3 Hours

Outcome: Describe the metals and alloys used for saws.

1. Define the following characteristics of metals:
   a) alloy
   b) ferrous
   c) non ferrous
2. Describe steel, defining the following:
   a) carbon steel vs. alloy steel
   b) low, medium and high carbon steel
   c) temper
   d) ductility
   e) strain vs. tension
3. Describe the required qualities of saw steel:
   a) withstand stress
   b) ductility
   c) resistance to heat and wear
   d) elasticity
   e) hardness

G. Maintenance of Saw Fitting Equipment.....4 Hours

Outcome: Give an overview of mill maintenance processes and procedures.

1. Describe the importance of a maintenance schedule.
2. List the information required for ordering a part.
3. Use a maintenance inspection form and do an inspection.

SECTION FIVE:..... FITTING BAND SAWS AND CIRCULAR SAWS .....51 HOURS

A. Handling Saw Blades.....3 Hours

Outcome: Unpack, pack, store, handle transport saw blades in the mill.

1. Describe uncrating a bandsaw, including:
   a) when saw should be uncrated
   b) safe handling procedure
2. Demonstrate how to change the 'handedness' of bandsaw blades.
3. Describe methods of storing bandsaw blades.
4. Demonstrate the methods for placing bandsaw blades on a grinder.
5. Describe uncrating circular saws, including:
   a) shipping methods
   b) handling large saw blades
6. Demonstrate methods for storing circular saw blades, including transporting saw blades within the shop.

B. Inspecting Saw Blades.....6 Hours

Outcome: Inspect saw, recommend appropriate action and document.

1. Describe when saw blades should be inspected.
2. Demonstrate equipment for inspecting circular saws, including:
   a) suitable bench
   b) inspection hook
   c) run out check arbor
3. Demonstrate procedures for cleaning saw blades.
4. Perform an inspection, checking for:
   a) cleanliness
   b) kerf
   c) point up swaging or retipping
   d) cracks
   e) lumps or ridges
   f) dishing
   g) twist
   h) dullness
   i) tooth damage - alignment
5. Measure and calculate to determine if the blade has sufficient kerf for sharpening.

6. Describe how the following defects may be corrected:
    a) repair cracks
    b) lumps or ridges
    c) repair dishing
    d) repairing twist
    e) restore tooth profile
    f) replacing missing or damaged teeth or tips
    g) re-align bent teeth
7. Describe the documentation of the final inspection (after grinding) and the importance of record keeping.

C. Swaging .....12 Hours

Outcome: Swage saw teeth.

1. Describe swaging and its purpose.
2. Describe each of the types of swage:
    a) hand swage
    b) air swage
    c) fully automatic swage and equalizer
    d) circular saw swage
3. Describe the function of the parts of the swage:
    a) clamp screws
    b) anvil (and anvil settings)
    c) eccentric die (and eccentric die settings)
    d) swage saw teeth
4. Choose or adjust to correct size:
    a) lubricate tooth face
    b) position and clamp to blade
    c) swage tooth
    d) release
    e) advance to next tooth
5. Describe the effects of improper swaging and how to correct them.
6. Describe swage maintenance, including:
    a) clamp screw maintenance
    b) anvil maintenance
    c) eccentric die maintenance
    d) hand swage maintenance
    e) air swage maintenance

D. Shaping .....12 Hours

Outcome Shape saw teeth.

1. Describe why the tooth needs to be shaped.
2. Demonstrate how a tooth is prepared for shaping after swaging, including:
    a) clipping
    b) correcting for center or side split

3. Describe the parts of the shaper head:
   a) side dies
   b) tooth stops
4. Describe the shaping procedure.
5. Describe commonly used shapers:
   a) 6900
   b) 5700
   c) 5500
   d) (Old style) Styles #1,#2,#3
   e) (Old style) Styles #4,#5
6. Perform a shaping operation, maintain and adjust the shaper, and check for alignment.

E. Troubleshooting Swaging and Shaping .....18 Hours

Outcome: Identify and correct problems that occur with shaping and swaging.

1. Provide possible solutions for the following swaging and shaper problems:
   a) tooth bending or uneven swaging
   b) tooth crumble or splitting
   c) insufficient kerf

SECTION SIX: ..... SPECIAL PURPOSE TOOLS ..... 6 HOURS

A. Files for Sawfiling .....3 Hours

Outcome: Be able to identify and choose the appropriate file for a specific saw filing task.

1. Describe typical size and shapes of files used for sawfiling and how to select:
   a) flat
   b) round
   c) three square
2. Describe common types of cut and the preferred use for each:
   a) single
   b) double
   c) rasp
   d) curved
3. Describe the terms used to designate grades of coarseness and their preferred application:
   a) coarse cut
   b) bastard cut
   c) second cut
   d) smooth cut
4. Describe the importance of fitting a file with the proper handle.

5. Demonstrate the correct way to use a file, including:
    a) securing the work piece
    b) preparing the file
    c) proper holding
    d) direction of cut
    e) speed and pressure
    f) cleaning the work piece and the file
    g) stance
6. Demonstrate draw filing.
7. Clean files store them properly when not in use.

B. Benching Tools and Equipment.....3 Hours

Outcome: Be able to identify and choose the appropriate file for a specific saw filing task.

1. Describe the handsaw vise and proper clamping procedure.
2. Use the following saw gauges and describe their use:
    a) straight edge
    b) tension gauge
    c) band saw back gauge
3. Select and use hammers for appropriate saw filing task:
    a) cross face
    b) twist face
    c) dog head
    d) ball peen
4. Describe how hammers are sized by weight, the commonly used weight ranges for sawfiling, and how a size is selected.
5. Use prick punch, center punch:
    a) sharpen
    b) grind to correct angle for application
    c) correct mushroomed heads
6. Describe honing stones:
    a) types
    b) function
7. Demonstrate honing a chipper knife.
8. Shape and sharpen saw teeth using files.

SECTION SEVEN: .....GRINDING WHEELS.....6 HOURS

A. Saw Grinder Troubleshooting and Maintenance.....3 Hours

Outcome: Be able to perform grinder maintenance.

1. Describe the need for grinder maintenance and adjustment.
2. Describe why the best source of information for maintaining a specific brand and model of grinder is the manufacturer.

3. Describe the function of the system components of band saw grinders:
    a) head lift system
    b) feed system
    c) saw support system
    d) grinding head system
4. Describe the function of the system components of circular saw grinders:
    a) feed finger assembly
    b) cam set up
    c) gate assembly
    d) oscillation assembly
    e) stroke adjustment
    f) centering cones and devices
5. Perform the correct lockout procedure for the machine and the location of the machine.
6. Perform or describe daily, weekly, monthly, and semi-annual grinder maintenance tasks.
7. Perform or describe weekly grinder maintenance tasks.
8. Perform or describe monthly grinder maintenance tasks.
9. Perform or describe semi-annual (6 monthly) grinder maintenance tasks.
10. Explain why compressed air should never be used to clean a saw sharpener.
11. Describe why dry lubricants should be used on grinders.
12. Describe how to isolate a problem to a system and troubleshoot that system.
13. Describe the preferred order in which to check systems.
14. Perform or describe the inspection procedure for each of the following systems:
    a) head lift system
    b) feed system
    c) saw support system
    d) grinding head system

B. Grinding Wheels .....3 Hours

Outcome: ***Be able to select and set up, and use the correct grinding wheel for a sawfiling task.***

1. Describe the basic structure and composition of the grinding wheel.
2. Describe the materials used for abrasives and how abrasives are sized.
3. List factors other than abrasives that can affect finish.
4. Describe how bonding material grade is matched to the material being ground.
5. Interpret the standard wheel marking system for grinding wheel, identifying:
    a) abrasive type
    b) abrasive size
    c) grade
    d) structure
    e) bond
    f) maximum operating speed in rpm

6. Demonstrate the safe use of grinding wheels, including:
   a) personal protection equipment
   b) handling grinding wheels carefully
   c) check wheels for damage, cracks
   d) using wheel for purpose it was designed
   e) proper mounting
   f) condition of machine
   g) fit on spindle
7. Describe the differences and similarities between diamond wheels and Cubic Boron Nitride (CBN) wheels.
8. Describe diamond and CBN wheel specifications:
   a) diamond type/cbn type
   b) abrasive size
   c) abrasive concentration
   d) bond type
   e) abrasive depth
   f) wheel diameter
   g) wheel lubrication
   h) wheel speed
9. Match wheel specifications to the appropriate grinding task.
10. Dress diamond and CBN wheels.
11. Demonstrate the correct procedure for mounting a diamond or CBN wheel for running true.
12. Describe the grinding applications for diamond and CBN wheels.
13. Demonstrate how to use diamond and CBN wheels efficiently and cost effectively:
   a) avoid excess heat generation
   b) avoid high infeeds when dry grinding
   c) select suitable traverse feed for dry grinding
   d) select lower wheel speed when dry grinding
   e) select appropriate lubricant for wet grinding
   f) select appropriate traverse feed for wet grinding
   g) select higher wheel speeds when wet grinding
   h) direct coolant flood to point of grinding where possible
14. Describe how grinding wheels should be stored when they are not being used.
15. Describe the importance of balance to precision grinding.
16. Demonstrate wheel truing, describe when and how it should be done.
17. Describe the relationship between rpm and cutting speed.
18. Determine cutting speed given rpm and wheel diameter.
19. Find i/c required to obtain a desired cutting speed given wheel diameter.
20. Describe why the manufacturers recommended speed should never be exceeded.
21. Describe the effects of increasing of decreasing speed on the grinding operation.
22. Demonstrate the proper procedure for mounting a grinding wheel.
23. Describe the purpose of dressing.

24. Demonstrate or describe the characteristics and application for each dressing tool:
    a) abrasive brick
    b) Metcalf dresser
    c) diamond dresser
    d) mechanical dresser
    e) Desmond dresser
25. Identify solutions for the following problems:
    a) wheel loading
    b) glazed grinding wheel
    c) wheel does not cut
    d) rapid wheel wear
    e) rough work
26. Describe each of the following problems caused by grinding wheels and how to correct them:
    a) gullet cracks
    b) microgrooves
    c) case hardened plate

SECTION EIGHT: ..... CHIPPER KNIVES ..... 6 HOURS

A. Introduction to Chipper Knives ..... 2 Hours

Outcome: ***Be able to identify chipper knives, application, and condition.***

1. Describe the function of chipper knives and on which machines they are normally found.
2. Describe the safe handling of chipper knives.
3. Describe the differences between thick chipper knives and thin chipper knives and how they are mounted.
4. Identify the common styles of chipper knives including the, characteristics and function of each type:
    a) Chipper canter knife
    b) Slabbing headrig knife
    c) Lily pad knife
    d) Veneer chipper knife
    e) Hog knife
    f) Thin planer knife
    g) Key knife
5. List some of the less common styles of chipper knife:
    a) Flaker knife
    b) Waferizer knife
    c) Lathe knife
    d) Spur knife
    e) Pole peeling knife
    f) Brush chipper blade
    g) Ice scraper blade
6. Describe the function of the counter knife.
7. Describe the function of the chipper anvil.

B. Grinding Chipper Knives.....2 Hours

Outcome: Sharpen chipper knives to industry standards.

1. Describe the need for keeping chipper knives sharp.
2. List the causes for chipper knife dulling.
3. List the consequences of using dull chipper knives.
4. Inspect knives for defects; discard and replace if necessary.
5. Describe the normal angle for grinding chipper knives and reasons for using other angles.
6. Check the angle of chipper knives, confirm angle is correct.
7. Describe the two different types of chipper knife grinding machine:
   a) fixed head, traveling bed
   b) fixed bed, traveling head
8. Describe the proper function of chipper knife grinding machine components:
   a) frame and guards
   b) support system
   c) spindle motor
   d) drive gear and motor
   e) scale
   f) knife clamping bar
   g) coolant system and coolant pump
   h) ventilation system
   i) grinding wheels
   j) wheel dressing equipment
   k) grinding fixtures
9. Demonstrate the selection and installation of grinding wheels for chipper knife grinding.
10. Describe the need for balancing chipper knife assemblies.
11. Describe how individual knives have to be balanced as a set.
12. Demonstrate balancing chipper knives.
13. Demonstrate the correct grinding procedure including:
    a) keeping the wheel clean
    b) methods of clamping, clamping considerations
    c) setting the desired angle for grinding
    d) selecting and setting the rpm and feed speed
    e) setting the feed per pass
    f) setting up for the pass
    g) adjusting wheel speeds and feed speeds to achieve desired ‘hardness’ or ‘softness’
14. Describe why honing is required after grinding.
15. Hone a chipper knife.

16. Describe the cause of and methods for correcting common grinding problems:
    a) burning
    b) overheating
    c) irregular edge
    d) bowed knife
    e) cracks from burning
    f) edge cracks
    g) chips
    h) wire edges

C. Babbiting Chipper Knives ..... 2 Hours

Outcome: Be able to Babbitt chipper knives to industry standards.

1. Describe the purpose of babbiting knives.
2. Describe the equipment used for babbiting and how it is used to Babbitt a knife.
    a) babbitt
    b) melting pot and ladle
    c) babbiting jigs
    d) babbitt file
    e) required personal protective equipment for babbitting
    f) ventilation requirements for working with molten Babbitt
3. Describe the importance of keeping water away from molten Babbitt.
4. Describe the reasons for not overfilling the knife jig.
5. Perform babbiting operation.
6. Machine Babbitt to correct width.

SECTION NINE: ..... WELDING ..... 9 HOURS

A. Set up and Safety ..... 4 Hours

Outcome: Assemble, set up and shut down an oxyacetylene welding outfit.

1. Describe oxy-acetylene welding equipment and gases:
    a) oxygen and oxygen tanks and valves
    b) acetylene and acetylene tanks and valves
    c) gauges and regulators
    d) hoses and connectors
    e) welding torches and tips
    f) cutting torches and tips
    g) personal protective equipment and suitable clothing for welding
2. Describe the safe handling pressure for acetylene and the hazards associated with acetylene gas.
3. Describe the safe handling, storage and transport requirements for high pressure tanks.
4. Describe the cause and the correction for flashback.
5. Describe the cause and corrections for backfires.
6. Describe the use of anti flashback devices.
7. Demonstrate assembly and disassembly of a welding set using tanks, regulators, hoses, torch and tip.

8. Describe the considerations for assembling oxy-acetylene equipment such as:
    a) checking for leaks
    b) preventing oil from coming in contact with oxygen or oxygen fittings
    c) identifying the hoses and threaded fittings for each type of gas
9. Demonstrate lighting up, regulator and flame adjustment, and shut down of an oxy-acetylene welding setup.

B. Welding Practice .....5 Hours

Outcome: Weld and anneal saw blades and teeth with oxyacetylene.

1. Describe what is meant by and how to identify:
    a) neutral flame
    b) oxidizing flame
    c) carburizing flame
2. Describe how tips are selected for the welding operation to be carried out.
3. Select the correct filler rod for the material being welded or for the welding process.
4. Repair cracks and broken teeth using:
    a) oxy-acetylene outfit
    b) filler rods
    c) forging hammer
    d) upset tool
    e) clamps and anvil
    f) files and grinders
5. Repair broken teeth by:
    a) welding in replacement blanks
    b) build up damaged teeth using filler rod
    c) anneal completed welds using the color change method and by using a temple stick

SECOND PERIOD TECHNICAL TRAINING
SAWFILER TRADE
COURSE OUTLINE

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

SECTION ONE: ..... SAFE WORKING PRACTICES ..... 3 HOURS

A. Legal and Regulatory Requirements ..... 1 Hour

Outcome: ***Describe safe work practices in work site and safety regulations.***

1. Describe Canadian Electrical code requirements for working on electrically powered equipment.
2. Describe Worker's compensation Board (WCB) requirements for lockouts on equipment when maintenance or work is performed, including:
   a) when lockout is required
   b) who is responsible for locking and removal of lockouts
   c) key box system
   d) central control system procedures
   e) motor disconnect procedure
   f) assuring equipment is de-energized
   g) who authorizes re-energizing
   h) meaning of 'zero mechanical state'
3. Describe WHMIS requirements as applicable to the sawmill industry.
4. List WHMIS categories for hazardous substances.
5. Describe WHMIS labelling, including importance and responsibility for labelling all containers of applicable materials.
6. Describe the hazards associated with airborne hard particles that may be found in a sawfiler environment including:
   a) cobalt and chromium dust
   b) lead fumes or cadmium fumes
   c) prevention through adequate ventilation and exhaust systems

B. Locking Out ..... 1 Hour

Outcome: ***Applies lockout procedure at all times when required.***

1. Describe a typical mill lockout procedure policy and procedures.
2. Describe lockouts for:
   a) electrically powered equipment
   b) valves
   c) steam systems
   d) air systems
   e) hydraulic systems
   f) liquid, solid, or gas feed lines
3. Describe the use of tag out systems for equipment without safety locks.

C. Mill Hazards.....1 Hour

Outcome: ***Be able to identify all mill hazards and uses appropriate precautions or protection.***

1. Describe protection from mill hazards, including:
   a) flying debris
   b) kickback/kickout
   c) pressure rolls
   d) crossing green chains – transfer decks
   e) rollcase access
   f) mechanical handlers
   g) veneer clippers
   h) kiln doors
   i) personnel hoists
   j) hidden hazards
   k) unattended machinery
   l) sharp edged tools
   m) operation of saws
2. Describe saw guards, barrier and splitter requirements.
3. Describe saw blade safety inspection requirements for:
   a) dull or badly set
   b) cracks
   c) worn shanks, inserts
   d) heat damage
4. State the maximum size limit of cracks that can be repaired by welding.
5. Calculate whether a crack exceeds the limit given size of crack and size of saw blade (diameter or band saw blade width).
6. Describe band saw wheel inspection requirements.
7. Describe worker safety protection requirements for:
   a) head rigs
   b) chippers, hogs and planers
   c) shake and shingle mill equipment

SECTION TWO: .....TRADE MATHEMATICS AND MEASURING TOOLS..... 7 HOURS

A. General and Band Saw Calculations .....2 Hours

Outcome: ***Be able to perform calculations for feed and speed using industry formulas and constants.***

1. Describe the relationship between feed and speed when sawing lumber.
2. Describe how the factors that affect waste, accuracy, surface quality, tooth wear and power requirements are affected by:
   a) diameter and plate thickness of saw blade
   b) rpm
   c) depth of cut
   d) tooth spacing
   e) feed speed
   f) gullet area

3. Calculate pulley rpm from pulley diameters.
4. Calculate surface speed per minute.
5. Calculate band saw tooth bite for saw blades:
   a) equal to 10”
   b) under 10”
   c) 10” (200 mm) wide
6. Define the purpose of ‘key numbers’ and calculate key number for band saw blades given saw length and surface speed.
7. Describe how to calculate band saw feed speeds using key numbers.
8. Calculate band saw teeth per minute given tooth pitch and surface speed.
9. Calculate band saw feed speeds given teeth per minute.
10. Calculate gullet area using graph paper method.
11. Calculate gullet area using tooth pitch tooth depth and a constant value.
12. Describe the need for calculating gullet feed index and perform the calculation given tooth bite, cutting depth and gullet area.
13. Calculate band saw plate thickness given wheel diameter and a constant value.
14. Calculate kerf given plate thickness, plate width, and a standard clearance value.
15. Calculate minimum horsepower requirements given gullet area and tooth bite.

B. Circular Saw Calculations ..... 3 Hours

Outcome: ***Be able to perform circular saw calculations using industry formulas and constants.***

1. Calculate circular tooth bite given feed speed, rpm and number of teeth.
2. Calculate the ‘key number’ for circular saws.
3. Calculate feed speeds using the key number method.
4. Calculate feed speed using the tooth bite method given the number of teeth, rpm and a constant value.
5. Calculate horsepower requirements for circular saws given depth of cut, feed sped, kerf, density of wood and a constant value.
6. Describe the role of computer programs in calculating critical cutting factors; and maintaining records of cutting operations.

C. Measuring Tools ..... 2 Hours

Outcome: ***Be able to use gauges, precision measuring tools or optics for inspecting saw blades, and saw teeth.***

1. Describe the application of saw gauges for inspecting and checking saw blades:
   a) straight edges
   b) rpm tension gauges
   c) band saw tension gauges
2. Determine the correct gauge length for an application.
3. Describe the gauge number systems used for rpm and bandsaw tensioning.
4. Measure and inspect saw teeth using clearance gauges and micrometers.
5. Measure saw tooth angles using visual inspection devices.

6. Describe video camera inspection systems.
7. Discuss the advantages and limitations of video inspection systems.
8. Describe the operation of a computer aided video camera tooth inspection and alignment system.

SECTION THREE: ..... FIT CARBIDE CIRCULAR SAWS ..... 7 HOURS

A. Fitting Carbide Saws ..... 6 Hours

Outcome: ***Be able to prepare, tip and grind carbide teeth.***

1. Describe what is meant by 'carbide' including:
   a) composition
   b) properties
   c) grades
   d) advantages
2. Describe the process of joining dissimilar metals by soldering or brazing.
3. Describe the role of fluxes in the brazing process.
4. Describe the hazards associated with cadmium fumes and how they can be avoided.
5. Describe how to determine the temperature required for brazing with silver solder.
6. Describe the purpose of annealing a welded area.
7. Describe the allowable limits for repairing cracks for carbide tipped circular saw blades.
8. Prepare saw for tipping:
   a) clean saw
   b) repair cracks if required
   c) plumb level and tension saw
   d) remove old tips
   e) prepare notch for new tips
   f) tin new tips
   g) replace carbide tips using silver solder, brazing table and oxyacetylene welding torch
   h) anneal the welded area
   i) inspect the new tips for quality of braze
   j) inspect saw for level and tension
9. Describe the grinding process including:
   a) wheel selection
   b) face grinding set up
   c) side grinding set up
   d) top grinding set up
10. Perform each grinding operation; inspect each completed operation before proceeding to the next step.
11. Describe the final inspection procedure.
12. Troubleshoot tip outs or tip loss, list reasons for tip failure or loss due to fitting and how to correct.

B. Fitting Strob Saws ..... 1 Hour

Outcome: ***Be able to braze and sharpen strob saw cutter bars.***

1. Describe the differences between a strob saw and a conventional circular saw.
2. Describe the purpose of cutter bars.
3. Braze long or short HSS or carbide cutter bars.
4. Sharpen cutter bars with appropriate grinder set up and grinding wheel.

SECTION FOUR: .....FIT STELLITE BAND AND CIRCULAR SAWS..... 6 HOURS

A. Stellite Saws..... 6 Hours

Outcome: ***Be able to prepare, apply, shape and sharpen stellite tips to saw teeth.***

1. Describe the characteristics of stellite including:
   a) composition/alloys
   b) use of stellite in sawmills
   c) advantages of stellite
   d) describe the reasons/need for re-tipping stellite saws
   e) describe preparation of the saw plate
   f) cleaning
   g) inspection/repair
   h) level and tension
2. Grind in new tooth profile or remove old stellite by grinding.
3. Describe the methods used to apply stellite including choosing the appropriate method for the situation:
   a) brazing
   b) resistance welding
   c) tig welding
   d) mig welding
4. Perform the following stellite tip welding/brazing operations:
   a) braze prefabricated tips
   b) build up tip using stellite rod with oxyacetylene welding torch
   c) tipping machine and resistance welding
   d) TIG weld preformed stellite pellets
   e) MIG, TIG or use plasma arc with stellite wire
5. Shape the tip as required.
6. Describe the importance of shaping tip at the correct temperature.
7. Anneal tips as required.
8. Select appropriate wheel, set up grinder, grind teeth in correct sequence.
9. Perform final inspection of the finished saw blade.

10. Trouble shoot stellite tip failure, list causes for failure and their prevention:

    a) stellite manufacturers defect
    b) application defects
    c) incorrect welding temperatures
    d) incorrect deposit size
    e) stellite deposit too cold when shaping performed
    f) chill lines/faulty annealing

SECTION FIVE: .....SAW FILING BENCHING TOOLS ..... 7 HOURS

A. Benching Tools.....3 Hours

Outcome: Be able to set and use benching tools and area.

1. Describe the function and selection and set up where applicable of the following tools and equipment used for tensioning and levelling:

    a) hammers, size and type
    b) anvils, anvil characteristics, pads
    c) circular saw hammer bench
    d) precision run out check arbor
    e) circular saw stretcher rolls
    f) anti dishing device
    g) band saw hammer bench
    h) stretcher roll
    i) back gauge

B. Manufacture Gauges.....4 Hours

Outcome: Be able to make accurate gauges and straight edges.

1. Select the correct material and fabricate gauges and straight edges to size and shape required for the application including:

    a) shearing
    b) tensioning
    c) leveling
    d) grinding to shape

SECTION SIX:.....GRINDING WHEELS ..... 4 HOURS

A. Safe Handling and Storage of Grinding Wheels.....1 Hour

Outcome: Select, use and store grinding wheels safely.

1. Describe the hazards associated with grinding wheels.
2. Describe the reasons grinding may break (explode).
3. Describe the ring test, when and how it should be done.
4. Describe the purpose of blotters.
5. Describe the correct choice and use of coolants.
6. Describe the need for proper storage and racking of grinding wheels, including temporary storage of multiple grinding wheels required for a task.
7. Describe the importance of a properly fitting spindle.

8. Describe the importance of a balanced wheel to the grinding operation.
9. Describe how balance can be corrected.
10. Describe the truing operation.

B. Diamond and CBN Wheels ..... 3 Hours

Outcome: Identify, maintain and use diamond and CBN grinding wheels correctly.

1. Explain diamond and CBN wheel marking systems.
2. Describe how to select the best wheel diameter for the job and grinder.
3. Describe the purpose of dressing a diamond or CBN wheel.
4. Mount a diamond or CBN wheel on the grinder with a dial indicator ensure run out does not exceed .001".
5. If run-out exceeds specifications identify the cause and correct the problem.
6. Explain why diamond wheels or CBN requiring truing must be returned to the manufacturer.
7. Explain why it is necessary to avoid overheating.
8. Describe how excessive heat can be limited for:
   a) dry grinding
   b) wet grinding
9. Describe the effect of vibration on job quality and wheel life.
10. List actions for reducing or eliminating vibration including:
    a) rigid machine mounting
    b) appropriate flange selection
    c) appropriate work piece clamping

SECTION SEVEN: ..... SAW EQUIPMENT MAINTENANCE ..... 6 HOURS

A. Mill Machine Maintenance ..... 2 Hours

Outcome: Describe saw mill equipment maintenance requirements for sawfilers.

1. Describe the purpose and timing of a typical saw mill shift maintenance schedule.
2. Describe how equipment inspection and maintenance tasks and schedules are developed:
   a) role of the equipment manufacturer
   b) role of the mill
   c) specific equipment requirements
3. Describe the purpose of the band saw shearboard.
4. Describe the construction, material and dimensions of the shearboard relative to the type of saw on which it is mounted.
5. Describe shearboard adjustment.
6. Describe the damage that results from worn or damaged shearboards.
7. Describe when the shearboard should be inspected.
8. Describe how worn or damaged shearboards are repaired.
9. Describe the location and function of band saw scrapers.
10. Describe inspection requirements for scrapers, including adjustments and when replacement is indicated.

B. Lubricants and Coolants ..... 2 Hours

Outcome: ***Describe saw lubrication and cooling.***

1. Explain the purpose of lubrication for machinery, including:
   a) role of lubricant in reducing or eliminating friction
   b) lubricants as coolant
2. Explain the difference between rolling friction and sliding friction, including the different lubrication requirements for each.
3. Describe the properties of oil for lubrication, including:
   a) adhesion
   b) cohesion
   c) viscosity – viscosity selection for an application
4. Describe what is meant by oil wedge lubrication and boundary lubrication.
5. Describe a total loss or 'once through' oiling system using examples found in mill equipment.
6. Describe a typical enclosed oiling system using examples of how oil is enclosed and distributed.
7. Describe a recirculation system employing pumps, valves, lines, recovery, cooling and filtering systems.
8. Describe oil misting systems.
9. Describe the requirements of saw lubes including:
   a) testing and grading
   b) operational requirements
   c) toxicity, environmental or workplace hazard
   d) effect on finished product
   e) effect on equipment wear and oil consumption
10. Describe the properties of greases, including:
    a) make up and additives
    b) classes of grease and purpose of each
    c) standards for determining penetration dropping point and directional fluidity
11. Describe the appropriate grease is chosen for an application.
12. Describe the correct way to apply grease including:
    a) hand packing
    b) grease guns
    c) avoid over packing
    d) do not mix grades or extra additives in a bearing
    e) use different guns for different grades
    f) inspect bearings etc. for integrity of grease retention
    g) ensuring the nipple matches the connection
    h) avoiding overfilling with the grease gun
13. Describe the application of coolants used in saw mills, including:
    a) water
    b) water and soluble oil
    c) hydraulic and other misting oil
14. Describe cooling retention and lubrication properties for each class of coolant.
15. Describe application system requirements for each class of coolant.

16. Describe the effect on environment and or finished product quality for each class of coolant.

C. Circular Edger and Band Mill Lubrication and Cooling.....2 Hours

Outcome: Describe the lubrication and cooling requirements for circular edgers.

1. Describe how circular edger cutting efficiency and wear is affected by coolant and lubrication systems.
2. Describe the components of the circular edger cooling and lubrication system and their function:
   a) reservoir
   b) pressure control system
   c) manifold
   d) guide assembly
3. Describe the lubrication and cooling requirements for band mills.
4. Describe effect of coolant and lubrication on equipment wear and or alignment problems due to overheating.
5. Describe local considerations for selecting a class of coolant for a band mill.
6. Describe the typical mist generating systems and its components:
   a) oil and water reservoirs
   b) pressure control system with mixing chamber
   c) supply lines
   d) spray nozzles and application heads
7. Describe the possible effects of insufficient and over supply of coolant-lubricant on equipment.
8. Describe the workplace hazards associated with oil mists and how to control these hazards.
9. Describe the inspection requirements for circular edger and band mill lubrication and coolant distribution systems.

SECTION EIGHT: ..... MAINTAIN SAW GUIDES..... 6 HOURS

A. Band Mill Guides.....2 Hours

Outcome: Service and recondition bandsaw guides.

1. Describe the purpose of the band mill guides.
2. Describe the locations of the upper and lower guide and upper guide adjustment methods.
3. Describe the function of following guide systems and components:
   a) guide cartridges
   b) conventional guide systems
   c) pressure guide systems
4. Describe the requirements for guide material and the characteristics of commonly used for guide materials.
5. Describe the effect of worn guides on:
   a) saw stability
   b) sawing deviations
   c) saw condition (gullet cracks)
6. List the common causes of (excessive) guide wear.
7. Explain the importance of maintaining exact tolerances in guide set up and machining.
8. Describe dressing guides with a milling machine or router guide dressing set up.

9. Adjust dressed guide to specified tolerance (.001”) with a quality control jig.
10. Describe the function of the back band mill guide.

B. Circular Saw Guides.....1 Hour

Outcome: Service and recondition circular head saw guides.

1. Describe the purpose of circular head saw guides.
2. Describe the usual location of head saw guides relative to the saw blade.
3. Describe the characteristics of commonly used guide materials:
   a) phenolic composites
   b) babbitt
   c) other (lignum vitae)
4. Describe guide alignment and adjustment, including:
   a) check head saw machine center for plumb level and square
   b) set clearance to correct value
   c) align guides to proper position in relation to saw gullets
5. Describe the consequences of incorrect or out of specification adjustment or alignment circular saw guides.
6. Describe circular saw guide maintenance and inspection requirements.

C. Circular Edger Saw Guides .....2 Hours

Outcome: Describe circular edger guide operation and adjustment.

1. Describe the purpose of edger saw guides.
2. Describe the gang edger saw guide system.
3. Describe the shifting board edger saw guide system.
4. Describe the importance of maintaining edger saw guides.
5. Describe the need for maintaining precise tolerances for edger saw guides.
6. Describe the relationship between saw blade condition and guide settings.
7. List some of the materials in common use for edger saw guides.
8. Troubleshoot circular saw and edger saw guide related problems.

D. Babbitt Saw Guides.....1 Hour

Outcome: Pour and machine babbitt guides.

1. Describe the characteristics and composition of babbitt compounds in common use:
   a) nickel Babbitt
   b) lead based Babbitt
2. Explain why nickel babbitt is generally preferred for edger saw and or circular saw guides.

3. Describe the safe handling of molten babbitt:
    a) ventilation
    b) personal protective equipment
    c) presence of water
    d) hygiene
    e) pour babbitt guides
    f) maintain correct temperature
    g) preheat molds and tools
    h) pour the mold
    i) remove pad – trim flash
    j) machine pad
    k) inspect for casting defects
4. Check saw guides using precision measuring tools:
    a) granite surface plate
    b) dial indicator
    c) micrometer

SECTION NINE:..... INTRODUCTION TO CIRCULAR SAW BENCHING PROCEDURES..... 35 HOURS

A. Benching Circular Saws .....35 Hours

Outcome: ***Describe circular saws benching procedure and equipment.***

1. Describe the relationship of the stages of benching circular saws:
    a) inspection
    b) plumbing
    c) leveling
    d) tensioning
2. List the defects for which a saw should be discarded following inspection.
3. Describe the tools and equipment required for benching, including:
    a) inspection bench
    b) hammers of appropriate weight for application
    c) anvils of appropriate size and hardness
    d) leather pads
    e) appropriate straight edge(s) for application
    f) appropriate tension gauge(s) for application
    g) inspection hook
    h) run out arbor
    i) circular saw stretcher rolls with anti dishing device
    j) chalk or suitable marking stick
4. Inspect circular saws and determine whether saw can be re-used.
5. Check saw for plumb and devise leveling strategy.
6. Check for leveling using straight edge and appropriate lighting.
7. Level circular saw blades using various methods:
    a) appropriate hammers and anvils
    b) stretcher rolls
8. Describe how automatic, computerized circular saw leveling machines work.

9. Describe the purpose of tensioning saw blades.
10. Describe the effects of improper tension on saw performance.
11. Describe how to determine the appropriate amount of tension for a given saw blade.
12. Perform an inspection for tensioning defects using the appropriate straight or tensioning gauge and directed light source.
13. Describe how to recognize and what is meant by a:
    a) tight condition
    b) open condition
14. Describe how to correct common tensioning faults using the appropriate hammers and anvils:
    a) tight spot
    b) tight areas
    c) open spot
    d) open area
15. Describe the major components of stretcher rolls.
16. Describe the inspection procedure required before the stretcher rolls are used.
17. Describe when it is appropriate to use stretcher rolls for tensioning rather than the hammer method.
18. Describe the rolling process, including:
    a) need for clean and smooth saw plate
    b) check for plumb and level prior to tensioning
    c) recommended procedure for setting roll pressure
19. Demonstrate tensioning of a circular saw blade using appropriate tools and techniques to tension saw blade to industry standards.

SECTION TEN: .....INTRODUCTION TO BAND SAW BENCHING PROCEDURES..... 35 HOURS

A. Benching Band Saws .....35 Hours

Outcome: ***Describe band saw benching and equipment.***

1. Describe why band saws are benched, including the need for:
    a) leveling
    b) straightening
    c) tensioning
2. Describe band saw benching tools and equipment:
    a) band saw bench
    b) hammers
    c) leveling slabs
    d) anvils
    e) stretcher rolls
    f) straight edges
    g) back gauges
    h) tension gauges
3. Inspect band saw for level.

4. Describe how to correct level defects using:
   a) hammer
   b) stretcher rolls
5. Inspect band saw for twists.
6. Describe how twists are corrected.
7. Inspect band saw for crate kinks.
8. Describe how crate kinks are corrected.
9. Inspect band saw for straightness.
10. Explain what is meant by ‘short back’ and ‘long back’.
11. Explain why tension is required for band saw blades.
12. Provide examples of differing tension requirements for operating conditions or equipment.
13. Describe ‘tight’ and ‘open’ conditions of tension.
14. Measure tension with light gap and straight edge.
15. Measure tension with light gap and tensioning gauges.
16. Correct or adjust tension using stretcher rolls.

SECTION ELEVEN: ..... MAINTAIN CHAIN SAW CHAINS ..... 4 HOURS

A. Chain Saw Chain Maintenance.....4 Hours

Outcome: ***Perform chain saw maintenance and chain sharpening.***

1. Describe the importance of proper chain saw maintenance and sharpness to safety.
2. Describe chain saw hazards including:
   a) exhaust and ventilation
   b) chain brakes
   c) handling fuel and lubrication
   d) kickbacks
3. Describe the components of chain saw chain:
   a) drive links
   b) cutters
   c) tie straps
4. Determine pitch and gauge for a given chain.
5. Describe the cutting action of the chain saw.
6. Describe how cutting angles affect chain saw efficiency, provide typical values for:
   a) top plate filing angle
   b) side plate filing angle
   c) top plate cutting angle
7. Select the appropriate cutting angles based on the application for which the saw is used and manufacturers recommendations.
8. Inspect saw chain for damage, mark damage and determine whether damage can be repaired.
9. Replace damaged components as using chain breakers, punches etc. to remove and replace rivets.
10. Describe how to identify bar and sprocket wear or damage.

11. Set up chain saw grinder for desired grinding operation.
12. Install chain in filing vise and determine start point for sharpening, sharpen chain.
13. File chain to industry standards avoiding altering heat treatment, etc.
14. Check depth gauges, correct if required.
15. Describe how chain saws are sharpened with a filing vise, filing guide and file holder.
16. Describe how to determine the correct size of file for a specific chain.

THIRD PERIOD TECHNICAL TRAINING
SAWFILER TRADE
COURSE OUTLINE

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

SECTION ONE:..... SCOPE OF THE TRADE ..... 2 HOURS

A. The Circular Sawfiler.....2 Hours

Outcome: ***Explain the role of circular saws and circular sawfilers in the lumber industry.***

1. Explain the increased importance in the use of circular saws to increase output of quality lumber and decrease waste.
2. Describe how thin kerf technology provides new challenges for the sawfiler.
3. Explain the following terms and how they affect product quality and value:
   a) kerf
   b) shrinkage
   c) planing
   d) finished size
   e) target size
   f) total sawing allowance
4. Describe the role of thin kerf technology in better utilization of scarce resources and increasing mill profitability.
5. Compare the value of finished lumber to chips to sawdust and explain how thin kerf technology will increase the amount of higher value product from a given log.
6. Describe the trade off between the use of thinner saws and:
   a) increased sawing variation
   b) increased saw wear or damage
   c) increased demand for maintenance and set up of saws, machine centers and guide systems
7. Describe the role of metallurgy in advancing saw technology and thin kerf technology.
8. Describe the properties of stainless steel as used in the circular saw.

SECTION TWO: ..... HAZARD AVOIDANCE..... 4 HOURS

A. Saw Maintenance Hazard Protection.....2 Hours

Outcome: ***Use safe work practices at all times.***

1. Describe typical lockout procedures for mill equipment:
   a) de-energize
   b) attach lockout clip – lock
   c) ensure clip and lock identify the person performing the lockout
   d) check start control to ensure equipment is de-energized
   e) when work is complete ensure the area is clear before removing lock out
   f) perform all necessary tests to ensure the equipment is safe for operation
2. Describe the responsibility of the worker and the employer for safety.

3. Describe the need to review employer or site based safety policy before starting work at a different site.
4. Describe mill fall hazards.
5. Describe fall protection equipment and when it should be used:
   a) guard rails
   b) belts
6. Inspect equipment before using it replace or repair if required.
7. Ensure guard rails are in place and properly secured where applicable.
8. Wear and safety belt, anchor properly.

B. Rigging and Lifting ..... 1 Hour

Outcome: Be able to lift and hoist heavy objects in the sawmill.

1. Describe the use of hoists and slings for circular saws and saw boxes.
2. Compare the suitability for lifting of the following:
   a) wire rope
   b) synthetic fiber rope
   c) natural fiber rope
   d) chain
3. Describe the proper care and storage requirements for each type of rope and chains.
4. Describe each of the following attachments or end connections:
   a) shackles
   b) hooks
   c) sling
5. Explain what is meant by single basket hitch and double basket hitch and how each is used for lifting.
6. Describe the operation of blocks and chain hoists.
7. Describe the need for signals when heavy loads are lifted or transported.

C. Circular Saw Noise ..... 1 Hour

Outcome: Describe noise hazards in the sawmill and how to avoid them.

1. Describe how circular saws contribute to excessive noise levels in the sawmill.
2. Describe methods of circular saw construction and design that can reduce saw noise.
3. Describe strategies for reducing saw noise at source.
4. Describe the importance of personal hearing protection devices.

SECTION THREE: .....CIRCULAR SAW MATHEMATICS AND MEASURING TOOLS..... 7 HOURS

A. Productivity and Quality Analysis and Calculation ..... 5 Hours

Outcome: Use cutting factors formulas to calculate optimum cutting speed.

1. Describe the relationship between saw design and operation to outcomes such as recovery, accuracy, finish, saw wear, power requirements and productivity.
2. Describe the importance of the optimum surface speed to cutting performance.

3. Define variable factors that affect optimum surface speed:
    a) wood density
    b) moisture content – is wood frozen?
    c) desired finish
    d) cutting edge material
    e) saw stability
    f) machine
    g) safety
4. Describe saw vibration and effect of vibration on cutting.
5. Explain what is meant by a saw's critical speed.
6. Define Load Index (LI).
7. Given the necessary data, a cutting task and the requirements or standards for the product, use calculations tables and formulas to choose the appropriate saw for the task.

B. Precision Measuring Tools ..... 2 Hours

Outcome: ***Be able to use precision measuring tools required to determine saw and tooth condition.***

1. Use the following tools to inspect and align equipment:
    a) micrometers
    b) calipers
    c) vernier calipers
    d) dial indicator
    e) surface plate
    f) sine bar
    g) machinist levels
    h) optical and laser alignment equipment
    i) jigs, etc.

SECTION FOUR: ..... QUALITY CONTROL ..... 6 HOURS

A. Quality Control and Quality Systems ..... 6 Hours

Outcome: ***Describe systematic industry quality control practices related to sawing and finishing lumber.***

1. Explain how daily measurement reports and statistical analysis is used to monitor product quality.
2. Explain the concept of a bell curve and 'standard deviation', distinguishing between a wide and a narrow range of deviation.
3. Explain what is meant by sawing variations, describe common defects, suggest possible causes for each deviation:
    a) between board variation
    b) taper
    c) snake
    d) snipe
    e) flare
    f) bevel

4. Describe what is meant by a continuous improvement program; discuss the strategies in implementing a program:
   a) preventive maintenance plan and procedures
   b) experiment with new equipment designed to reduce waste and improve quality
   c) maintain accurate records and observations to be used for comparison, evaluation

SECTION FIVE.....CIRCULAR SAW BENCHING PROCEDURES..... 33 HOURS

A. Advanced Circular Saw Benching .....15 Hours

Outcome: Describe benching procedure for circular saws.

1. Describe the benching process as a series of interrelated steps.
2. Describe how the basic benching procedure is adapted to different types or classes of saw.
3. Describe two classes of edger's.
4. Describe the various edger saw configurations for rotation and direction of feed.

B. Strob Saws .....3 Hours

Outcome: Be able to bench strob saws.

1. Describe the difference between a conventional saw blade and a strob saw.
2. Describe the purpose of strobs.
3. Explain why use of strob saws is declining in the industry.
4. Describe notched levelling slabs and notched straight edges required for strob saw levelling.
5. Describe the modified benching procedure required for strob saws.

C. Step Saw.....3 Hours

Outcome: Be able to bench step saws.

1. Describe the difference between a step saw and a conventional saw.
2. List the advantages of step saws over conventional saws.
3. Describe how step saws are plumbed.
4. Describe the levelling slab required for levelling step saws.
5. Describe the differences between tensioning step saws and conventional saws.

D. Circular Head Saw .....3 Hours

Outcome: Be able to bench circular head saws.

1. Describe the characteristics of the circular head saw.
2. Describe common configurations for circular head saws.
3. Describe how to distinguish between a left hand saw and a right hand saw.
4. Describe the scragg saw and how it is used.
5. Compare the advantages and disadvantages of circular head rigs and bandsaws.

6. Describe how large diameter saws are benched:
    a) equipment required for hoisting or supporting large diameter saws
    b) Long gauges
    c) Plumb - allow for tapered side
    d) Leveling - tools for large diameter saw
    e) Tensioning - considerations for handling large diameter saws

E. Circular Trim Saws ..... 3 Hours

Outcome: ***Be able to bench trim saws.***

1. Describe the typical trimmer and its uses.
2. Describe types of trimmer.
3. Describe solid tooth circular trim saws:
    a) Size range
    b) Set
    c) Benching procedure
4. Describe the hollow ground trim saw:
    a) Construction
    b) Teeth
    c) Numbering system
5. Describe benching hollow ground saws.
6. Inspect run out with dial indicator.
7. Correct run out defects using anvil, pad and hammer.

F. Thin Kerf Circular Saw Benching ..... 6 Hours

Outcome: ***Be able to bench thin kerf saws.***

1. Produce tooth rubbing of thin kerf circular saw with all required information.
2. Bench thin kerf circular saw to industry standards:
    a) clean and inspect
    b) plumb
    c) level
    d) tension
    e) final inspection

SECTION SIX: ..... BAND SAW BENCHING PROCEDURES ..... 20 HOURS

A. Benching Band Saws ..... 20 Hours

Outcome: ***Be able to bench band saw blades with hammers and stretcher rolls.***

1. Inspect band saw.
2. Describe how to correct level defects using:
    a) hammer
    b) stretcher rolls
3. Inspect band saw for straightness.
4. Explain why tension is required for band saw blades.

5. Provide examples of differing tension requirements for operating conditions or equipment.
6. Measure tension with light gap and straight edge.
7. Measure tension with light gap and tensioning gauges.
8. Correct or adjust tension using stretcher rolls.

SECTION SEVEN: ..... MAINTAIN CIRCULAR SAW FILING MACHINES ..... 8 HOURS

A. Circular Saw Stretcher Roll Maintenance ..... 1 Hour

Outcome: ***Maintain and set up stretcher rolls for leveling and tensioning circular saws.***

1. Describe how thin kerf technology affects the use of stretcher rolls.
2. Describe the parts of the stretcher rolls and how they must be set up, adjusted or maintained:
   a) frame
   b) saw support
   c) motor and reduction unit
   d) pressure handle
   e) two roll stretcher rolls
   f) three roll stretcher rolls
   g) set up attachments for leveling
   h) set up for tensioning

B. Circular Saw Grinder Maintenance ..... 1 Hour

Outcome: ***Maintain and set up circular saw grinders.***

1. Describe how maintenance of the circular saw grinder affects sharpness, tooth profiles and condition of the saw.
2. Describe the components that make up the typical saw grinder:
   a) control panel
   b) head lift system
   c) saw support system
   d) grinding head system
3. Perform the following grinder maintenance procedures:
   a) cleaning
   b) daily maintenance
   c) weekly maintenance
   d) monthly maintenance
   e) six months
4. Perform routine hourly based maintenance operations for the following components:
   a) grease wheel spindles
   b) grease indexing clutch
   c) grease spherical rod ends
   d) maintain motors (inspect and replace brushes etc.)

C. Guide Pad Re-Surfacer Maintenance and Operation ..... 6 Hours

Outcome: ***Maintain and set up guide pad resurfacers.***

1. Describe the role of guide equipment for accurate thin kerf sawing.
2. Describe the operation of the guide pad resurfacer required for accurate guide pad refinishing.
3. Perform the following guide pad resurfacer maintenance operations:
   a) cleaning
   b) cutter shaft lubrication
   c) maintain hydraulic fluid levels
4. Inspect saw guides and saw guide water ports, and make all necessary corrections.
5. Inspect and lap with a honing stone (if required) saw guides and saw guide mounts.
6. Describe saw to guide clearances and the effect clearances have on operation, accuracy, set up and maintenance.
7. Using a micrometer, measure, calculate and select spacers, guides, pads, etc., to set desired saw guide to saw clearance.
8. Using a granite surface plate and dial indicator determine if guide pads are centered
9. Use guide pad resurfacer to refinish guide pads, or to make centering corrections if required.

SECTION EIGHT: ..... MIG WELD CIRCULAR SAW CRACKS ..... 14 HOURS

A. Welding Hazards ..... 2 Hours

Outcome: ***Use welding equipment safely.***

1. Describe hazard protection for the operator of MIG welding equipment (and those in the vicinity) including:
   a) UV radiation and arc flash
   b) ventilation requirements
   c) fire hazards
   d) electrical hazards

B. MIG Welding Equipment and Setup ..... 2 Hours

Outcome: ***Set up and use MIG welder.***

1. Describe the MIG welding process as it applies to the sawfiler trade.
2. Describe MIG welding equipment, including set up and adjustment:
   a) welding unit, settings
   b) welding hose, gun and ground cable
   c) shielding gases, make up and flow rates
   d) electrode wire, selection, feeding
3. Describe common MIG welding defects and their correction.

C. MIG Welding Circular Saws ..... 10 Hours

Outcome: ***Repair and recondition circular saws using MIG welding.***

1. Describe WCB regulations for permissible circular saw crack repair.
2. Describe circular saw cracks and the probable cause:
   a) eye cracks
   b) body cracks
   c) rim or gullet cracks
3. Describe the importance of identifying and correcting operating conditions that cause saws to crack.
4. Describe the cause of tooth or shoulder damage.
5. Describe weld preparation and why it is important:
   a) clean saw
   b) use of chill bars
   c) preheat-post heat – annealing
   d) determine temperatures for pre-heat, etc.
6. Repair circular saw cracks using MIG welding, finish (grind) welds to industry standards.
7. Replace a tooth or a shoulder on a circular saw by MIG welding, finish to industry standards.

SECTION NINE: ..... ALIGN AND MAINTAIN CIRCULAR SAW MACHINES ..... 26 HOURS

A. Circular Saw Alignment ..... 9 Hours

Outcome: ***Align circular saws.***

1. Describe the benefits of proper circular saw alignment:
   a) accuracy of cut lumber
   b) reduced downtime
   c) reduced maintenance costs
   d) reduced unscheduled saw changes
   e) improved troubleshooting
2. Describe the following causes of saw downtime:
   a) log or cant quality
   b) saw failure
   c) operator error
   d) feed control
   e) machine alignment

3. Describe what is meant by the following alignment terms:

   a) concentric
   b) datum
   c) horizontal
   d) level
   e) parallel
   f) perpendicular
   g) plumb
   h) square
   i) straight
   j) vertical
   k) optical alignment
   l) mechanical (wire) alignment
   m) laser alignment

B. Head Rig Alignment ..... 2 Hours

Outcome: ***Align circular saw head rigs.***

1. Describe the function and importance of the following head rig components:

   a) foundation
   b) tracks or rails
   c) husk frame
   d) arbor assembly (including saw and collars
   e) guide assembly
   f) carriage system
   g) spreader

2. Perform the following alignment procedures to industry standards:

   a) align and level tracks-rails
   b) level arbor
   c) hang the saw
   d) select and set the lead
   e) set and inspect collars for fit and collar defects
   f) set saw to guide clearance
   g) carriage alignment
   h) head and knee alignment
   i) carriage trucks and wheels
   j) set spreader

C. Edger Maintenance and Alignment.....8 Hours

Outcome: ***Align edgers.***

1. Describe edgers, edger design and configurations:
   a) single arbor vertical
   b) single arbor horizontal
   c) double arbor vertical
   d) double arbor horizontal
   e) splined arbor (types) and guides
   f) keyed arbors (types) and collars
   g) transportation systems
   h) rolls (types)
2. Describe the problem of maintaining a stable thermal environment for the edger.
3. Describe the factors that affect power requirements for a given edger.
4. Describe the observations/communication that should be made or taken prior to performing maintenance or repair work.
5. Perform preparations for maintenance/repair:
   a) lockout
   b) cleaning
   c) removal of guards, etc.
6. Inspect saw and collars (if applicable) for saw-collar fit.
7. Describe the importance of a level foundation.
8. Inspect foundation and level if required.
9. Inspect arbors for wear and damage.
10. Describe the causes of arbor wear or damage.
11. Check arbor alignment.
12. Describe how arbor alignment relates to all other edger components.
13. Inspect arbor for level and correct if required.
14. Inspect double arbors for parallel and level and correct if required.
15. Establish reference datum for the other edger components.
16. Align line bars.
17. Ensure that guide arm support system is aligned to arbor, correct misalignments.
18. Inspect guides for condition, uneven wear, ports are free, etc.
19. Inspect guides for parallel using a surface block and dial indicator.
20. Refinish guides using a guide dresser.

D. Trimmer Maintenance and Alignment ..... 3 Hours

Outcome: Align trimmers.

1. Describe the difference between sawmill trimming and smooth trimming.
2. Describe the main points of trimmer maintenance:
    a) frames condition
    b) pivot point inspection
    c) arbor installation
    d) collar maintenance
    e) alignment procedure

E. Troubleshoot Circular Saw Machine Centers ..... 4 Hours

Outcome: Troubleshoot problems with circular saw equipment and cutting defects.

1. Describe the importance of a systematic, step by step, approach to troubleshooting.
2. Describe the role of a preventative maintenance program in troubleshooting.
3. Describe lumber manufacturing faults that are signs of circular saw machine center problems.
4. Describe possible causes for the following circular head saw problems:
    a) saw leading in or out of log
    b) saw heating
5. Describe possible causes for the following edger problems:
    a) poor saw line
    b) board quality
    c) board size
    d) crooked material feed

FOURTH PERIOD TECHNICAL TRAINING
SAWFILER TRADE
COURSE OUTLINE

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

SECTION ONE:..... SCOPE OF THE TRADE .....1 HOUR

A. The Band Saw Benchperson .....1 Hour

Outcome: Provide an overview of band sawing in the lumber industry.

1. Describe the role of the bench person in relation to the sawmill, filers and fitters.
2. Describe the impact of thin kerf technology on benching.
3. Describe variable pitch band saws, including defining:
   a) modules
   b) teeth per module
   c) pitches per module
4. Describe the factors that determine tooth and module design.
5. Describe the advantages of variable pitch band saws.
6. Describe cryogenic treatment of steel and its effect on saw wear.

SECTION TWO: ..... SAFE WORKING PRACTICES ..... 3 HOURS

A. Mill and Filing Room Band Saw Benching Safe Work Practices .....3 Hours

Outcome: Use safe work practice at all times.

1. Describe filing room and mill lockout procedure, including the equipment to which lockout procedures apply.
2. Describe the need for fall protection procedure and equipment when working with band saws.
3. Describe what is meant by:
   a) work positioning fall restraint
   b) travel restriction fall restraint
4. Describe checking procedure for safety belts, including when equipment should be checked.
5. Describe the requirements for selecting anchors for restraint equipment.
6. Describe safe handling of band saw blades, including proper attire and personal protective equipment.
7. Describe the safe procedure for uncrating band saw blades.
8. Describe the safe procedure for changing band saw handedness.
9. Describe the safe procedure for starting up a band mill after the blade has been installed, including making all necessary adjustments for strain and tracking.
10. Describe the basic principles of band saw operation.

SECTION THREE: ..... BAND SAW CALCULATIONS AND MEASURING TOOLS ..... 8 HOURS

A. Application of Band Saw Formulas ..... 8 Hours

1. Use formulas and cutting factors to calculate optimum cutting speeds and feeds and strain settings.
2. Describe and calculate the relationship between pulley speed and pulley diameter.
3. Define and calculate sfpm (surface feet per minute).
4. Calculate sfpm from rpm and rpm from sfpm.
5. Calculate tooth bite for band saw blades wider than, less than and equal to 10”.
6. Calculate key numbers.
7. Determine feed speed using key number and by saw teeth per minute.
8. Calculate gullet area using graph paper and by formula.
9. Calculate Gullet feed index.
10. Calculate kerf.
11. Determine required saw plate thickness using wheel diameter.
12. Determine strain requirements for a given plate thickness and width.
13. Calculate the weight required for a given strain requirement for conventional and compound strain systems.
14. Use industry standard charts and tables for determining band saw variables.

SECTION FOUR: ..... QUALITY CONTROL ..... 8 HOURS

A. Quality Control Issues for Lumber Manufacture ..... 8 Hours

Outcome: ***Describe quality control issues related to band sawing lumber.***

1. Describe the manufacture of lumber in terms of maintaining a consistent machined product:
   a) target size
   b) kerf allowance
   c) variation allowance
   d) shrinkage allowance
   e) planing allowance
   f) finished size standards requirements
2. Describe the following saw quality defects and ways to correct or minimize them:
   a) bevel
   b) bruises, dog holes, edge breakage
   c) flare
   d) tooth marking
   e) washboarding
   f) improper lead
   g) snake
   h) snipe

3. Describe controlling the following factors that can affect saw quality:
    a) vibration
    b) feed speed
    c) filing
    d) guide settings, condition, operation
    e) alignment of band mill equipment
    f) improper log handling
    g) saw (blade) lubrication
    h) operation (operators) of head rig equipment
    i) saw (blade-tooth) condition
    j) setworks
    k) strain settings
    l) equipment wear
    m) characteristics of the wood being sawn

SECTION FIVE: ..... BAND SAW BENCHING PROCEDURES ..... 37 HOURS

A. Overview of Benching Process ..... 6 Hours

Outcome: Describe the band saw benching process.

1. Describe how the benching process contributes to the performance of the band saw.
2. Describe the function of the tire lines.
3. Use a tension gage to detect the tire lines.
4. Determine whether the tire lines and tire line area is within specification.
5. Describe the consequences of:
    a) uneven tire lines
    b) incorrect tire line position
6. Describe basic benching principles:
    a) maintain records of saws
    b) maintain level plate and straight and uniform back
    c) maintain minimum required tension
    d) maintain tools, gauges in good condition
    e) avoid excessive roll pressure
    f) vary tension by width and thickness of saw

B. Benching Tools and Equipment ..... 8 Hours

Outcome: Select use and maintain the appropriate band saw benching tools and equipment.

1. Describe the function of the components of the band saw bench:
    a) wheels (fixed and moveable)
    b) strain mechanism
    c) inspection lift assembly
    d) stretcher rolls
    e) light systems
    f) top and bottom leveling slabs

2. Describe each type of back gauge:
    a) dial indicator
    b) three point gauge
    c) solid steel back gauge
3. Describe how tension gauges are sized.
4. Describe the function and set up of the two common types of stretcher rolls:
    a) Williams and White
    b) Armstrong
5. Describe automatic levellers and how automatic levellers improve the levelling process.
6. Describe the three types of automatic levelling systems in use.
7. Describe how automatic saw tensioners contribute to the use of thin kerf technology.
8. Describe the set up and operation of the automatic tensioner.

C. Leveling Procedures ..... 8 Hours

Outcome: Level band saws.

1. Describe levelling defects.
2. Describe preparation of the blade prior to starting the levelling process.
3. Describe the key points of proper levelling:
    a) effect of bumps on saw operation
    b) importance of properly maintained measuring equipment to locate bumps
    c) level the bump only
    d) proper hammer technique
    e) level inside and outside
    f) inspect the saw and determine the appropriate leveling strategy
    g) level bumps using a hammer
    h) level bumps with the stretcher rolls
4. Correct twists and crate kinks:
    a) hammer method
    b) stretcher roll cap screw method
    c) stretcher roll idlers

D. Straighten Band Saw Back ..... 7 Hours

Outcome: Straighten band saw back.

1. Describe how band saw back length must relate to the front length for single and double cut saws.
2. Describe the consequences of operating saws with:
    a) short back
    b) long back
3. Using the levelling rolls adjust a band saw back to a stated specification.

E. Tensioning Procedures.....8 Hours

Outcome: Tension band saws.

1. Describe the need for correct tension in a band saw.
2. Describe what is meant by a tight condition and an open condition when checking band saw tension.
3. Describe the factors the bench person must consider when determining the correct tension for a given blade.
4. Describe the relationship between levelling, straightening the back and tensioning.
5. Cut and grind a tension gauge to a stated size.
6. Inspect band saw tension using light gap straight edges or gauges.
7. Make tension corrections using the stretcher rolls.
8. Describe equipment set up, flame adjustment and required temperature range for heat tensioning with a heat crawler.
9. Make tension corrections using a heat crawler.
10. Re-check level, and straightness after tensioning, make required corrections if applicable until saw is to operational standards.

SECTION SIX:..... WELDING BAND SAWS ..... 12 HOURS

A. Welding Band Saws .....12 Hours

Outcome: Weld, braze, heat treat band saws with MIG and oxyacetylene equipment.

1. Describe WCB requirements, regulations for band saw repair.
2. Setup MIG welder for welding saw steel.
3. Set up clamps, clamp band saw blade.
4. Pre heat clamps, saw blade.
5. Butt weld band saw blade with MIG welder.
6. Butt weld band saw blade with oxyacetylene equipment.
7. Butt braze small band saw blades.
8. Repair cracks in band saw blade with MIG welder.
9. Repair cracks in band saw blade with oxyacetylene equipment.
10. Dress, anneal and retension band saw blades to operational standards.

SECTION SEVEN: ..... MAINTAIN AND ALIGN BAND MILLS..... 35 HOURS

A. Band Mills.....15 Hours

Outcome: Describe band mill maintenance requirements.

1. Describe the four main types of band mill:
   a) headrig
   b) chipper headrig
   c) twins
   d) quads

2. Describe the operation of transport systems:
   a) carriage feed
   b) sharp chain
   c) end dog
3. Describe band mill resaw configurations:
   a) centre cut
   b) line bar
   c) twin
   d) tandem
   e) horizontal
   f) quad
4. Describe the components of the band mill:
   a) husk, stationary and shifting
   b) columns, single and double
   c) wheels
   d) wheel lift and tilt systems
5. Describe wheel maintenance requirements:
   a) inspect face
   b) checking and correcting static and dynamic balance
6. Describe roller or ball bearings used for band mill wheels including:
   a) loading
   b) bearing life
   c) lubrication
   d) bearing inspection methods
   e) bearing replacement procedures
7. Describe the role of the bench person vs. the millwright for band mill maintenance.
8. Describe the band saw guide systems in use:
   a) pressure guide system
   b) conventional guide system
9. Set guide offset to manufacturers specifications.
10. Dress (resurface) guides.
11. Describe the maintenance requirements for the following:
    a) wheel scraper
    b) shearboard
    c) tension shears
12. Describe a typical maintenance inspection schedule for a band mill.
13. Describe the function of the strain system in relation to saw wear and product quality.
14. Describe the operation, advantages and disadvantages the following strain systems:
    a) mechanical
    b) pneumatic
    c) hydraulic
    d) rubber block
    e) steel spring

B. Band Mill Alignment ..... 18 Hours

Outcome: Align band mills.

1. Describe the importance of proper band mill alignment.
2. Describe the principles of alignment.
3. Describe common methods for performing band mill alignment:
   a) optical / laser
   b) wire
4. Describe the precision measuring tools used for alignment:
   a) steel rules, scribers, squares protractors
   b) feeler gauges, spring calipers
   c) micrometers dial indicators and vernier calipers
   d) machinist levels
   e) sine bar
   f) cross alignment jigs
5. Describe pre-alignment procedure:
   a) schedule
   b) check cutting performance
   c) prepare tools, area
   d) perform visual inspection
   e) lockouts
   f) remove saw, guides, shearboard, scrapers, etc.
6. Check and align and level tracks, establish datum.
7. Align band mill wheels, guides, carriage etc to datum point.
8. Describe alignment procedure for the following:
   a) vertical band mill resaw
   b) horizontal band mill resaw
   c) twin and quad band mills
   d) chipper canters

C. Laser Alignment ..... 3 Hours

Outcome: Use laser and optical equipment for checking alignment.

1. Describe laser alignment procedure including:
   a) laser safety
   b) laser types
   c) laser placing and leveling
   d) planning reference points, prisms, etc.

SECTION EIGHT: .....BAND MILL WHEEL GRINDING PROCEDURES..... 8 HOURS

A. Grinding Band Mill Wheel ..... 8 Hours

Outcome: Grind band saw wheels.

1. Inspect and measure band mill and determine condition of the wheel.
2. For wheels that will be ground, determine the wheel surface and grinder settings using pi tape.

3. Inspect the grinder, repair or replace components if required.
4. Mount grinder on the husk and align grinder to wheel to be ground.
5. Grind band mill wheel to industry standards.
6. Grind relief chamfers as required.
7. Describe how crowns are ground, including determining the amount and location of the crown if applicable.
8. Describe grinding flat wheels and grooved wheels.

SECTION NINE:..... TROUBLESHOOTING BASIC HYDRAULICS..... 8 HOURS

A. Basic Hydraulics.....8 Hours

Outcome: Describe hydraulic equipment found on band mills.

1. Describe the basic principles of using hydraulic forces to transfer power.
2. Describe the function of the components of a basic hydraulic system:
   a) reservoir
   b) pumps (types)
   c) directional control valves
   d) cylinders
   e) motors
   f) pressure relief valves
   g) hydraulic fluids
   h) pipe, hoses, seals
3. Identify basic hydraulic and pneumatic symbol and schematics:
   a) reservoir
   b) pumps (types)
   c) directional control valves
   d) cylinders
   e) motors
   f) flow
   g) lines
   h) pressure relief valves
4. Describe a hydraulic strain system, listing its components and their functions.
5. Describe safety considerations for the bench person working on or around hydraulic systems.
6. Identify possible causes for the following symptoms of problems in a hydraulic system:
   a) excessive noise
   b) excessive heat
   c) flow problems
   d) pressure problems
   e) actuator problems

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