ONTARIO COLLEGE OF TRADES

ORDRE DES MÉTIERS DE L'ONTARIO

Apprenticeship Curriculum Standard

Industrial Mechanic (Millwright)
Trade Code: 433 A

Construction Millwright
Trade Code: 426A

Level 1 Common Core

Date: 2005

Please Note: Apprenticeship Training and Curriculum Standards were developed by the Ministry of Training, Colleges and Universities (MTCU). As of April 8th, 2013, the Ontario College of Trades (College) has become responsible for the development and maintenance of these standards. The College is carrying over existing standards without any changes.

However, because the Apprenticeship Training and Curriculum Standards documents were developed under either the *Trades Qualification and Apprenticeship Act* (TQAA) or the *Apprenticeship and Certification Act, 1998* (ACA), the definitions contained in these documents may no longer be accurate and may not be reflective of the *Ontario College of Trades and Apprenticeship Act, 2009* (OCTAA) as the new trades legislation in the province. The College will update these definitions in the future.

Meanwhile, please refer to the College's website (http://www.collegeoftrades.ca) for the most accurate and up-to-date information about the College. For information on OCTAA and its regulations, please visit: http://www.collegeoftrades.ca/about/legislation-and-regulations

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Introduction

The curriculum has been developed in keeping with the prescribed training standards of Workplace Training Branch, Ministry of Training, Colleges and Universities. The curriculum will allow for easy adaptation to the current reporting structures for the respective program phases and to alternate delivery formats.

For easy reference, a time allocation has been included for each respective unit, along with the Theory/Practical breakdown for the delivery of the performance outcomes.

The continual introduction of innovative techniques and more complex equipment is resulting in increasing demands for tradespeople who are not only skilled in the practical aspects of the trade, but who also have a sound theoretical knowledge of the requirements to inspect, diagnose, repair and service. The curriculum has been developed to provide this theoretical knowledge and to offer some practical applications to complement the on-the-job work experiences of the Industrial Mechanic (Millwright) and Construction Millwright apprentice.

The outcomes of the curriculum, therefore, are to provide a basis for:

a. sound theoretical training to meet the challenges presented by the increasingly more complex designs and testing techniques.

b. the acquisition of fundamental skills of the trade through exposure to practical applications.

c. developing in the apprentices high standards of craftsmanship, problem-solving skills and personal pride in their respective trades.

d. developing desirable work attitudes and a keen sense of responsibility, particularly in regard to public and personal safety.

The curriculum has also been designed to give the instructor every reasonable opportunity for flexibility and innovation without unnecessary deviation from the course requirements (as determined by the Industry Committee and Provincial Advisory Committee, and as prescribed in the regulation for the trades). Since the scope of the prescribed curriculum is quite extensive, the apprentices will be expected to reinforce the acquired knowledge through regular, independent out-of-classroom assignments. In keeping with sound teaching methodologies, the curriculum has been presented in a chronological sequence. However, the actual application of the sequence may differ somewhat between colleges because of scheduling, staffing and utilisation of facilities.

The curriculum includes specific references to the training standards of Workplace Training Branch, Ministry of Training, Colleges and Universities. While the references to various terminal performance outcomes in the Training Standards have been linked to the respective in-school outcomes, employers should not assume complete coverage in all aspects of the outcome. The in-school delivery focuses primarily on the knowledge required to master the respective performance outcomes outlined in the Training Standards. Employers, therefore, are expected to complete the delivery of these respective outcomes by applying the prescribed in-school knowledge to the required practical learning experienced in the work setting.

To ensure that successful students will be able to satisfy the individual outcomes according to the performance criteria, specific times have been allocated in the respective areas to allow for some application enhancement. It is of utmost importance that all application assignments relate to prescribed experiences only. Time constraints will not permit engaging students in irrelevant tasks of limited learning benefits that are unrelated to the curriculum outcomes.

Regular evaluations of the apprentices' learning achievements must be performed in both theory and application throughout the program to assure consistency in learning outcome expectations.

Implementation Date:
September 2004

Summary of Total Program In-School Training Hours

	Reportable Subjects	Total	Theory	Practical
1	Workshop Practice I	48	32	16
2	Workshop Technology I	56	16	40
3	Machine Technology I	32	24	8
4	Rigging & Hoisting	24	20	4
5	Welding & Fabrication I	32	8	24
6	Electrical & Electronic Controls I	16	12	4
7	Drawings & Schematics I	32	32	0
	TOTAL	240	144	96

Number: 1

Title: Workshop Practice I

Duration: 48 Total Hours

Theory: 32 Hours Practical: 16 Hours

Prerequisites:

Co-requisites:

1.1 – Safety

8 Total Hours Theory: 8 Hours Practical: 0 Hours

1.2 – Hand & Power Tools

16 Total Hours Theory: 4 Hours Practical: 12 Hours

1.3 - Precision Measuring Equipment 1

24 Total Hours Theory: 20 Hours Practical: 4 Hours

1.1 – Safety

Cross-Reference to Learning Outcomes:

CM 1301
IMM 4600, 4601

Duration: 8 Total Hours Theory: 8 Hours Practical: 0 Hours

General Learning Outcome:

To develop the apprentice's knowledge of safety legislation, lock-out and isolation procedures, protective clothing and equipment, confined space procedures, housekeeping rules, fire, electrical and chemical hazards.

Learning Outcomes and Content:

Upon successful completion, the apprentice is able to:

1.1.1 Apply all machinery and equipment lock-out and de-energizing procedures (mechanical, electrical, hydraulic and pneumatic) before commencing maintenance and overhaul procedures.

1.1.2 Demonstrate proper use and care of required safety clothing and equipment.

1.1.3 Comply with confined space safety procedures, including the use of the breathing apparatus prior to and while working.

1.1.4 Prevent fires by determining the potential for fire posed by the work performed. Obtain the required fire prevention and fire fighting equipment.

1.1.5 Report all hazards and accidents to co-workers and supervisory personnel, and complete all paper work in compliance with company procedures and government regulations.

1.1.6 Apply correct body mechanics when bending, lifting or moving heavy objects/equipment.

1.2 - Hand & Power Tools

Cross-Reference to Learning Outcomes:

CM 1305
IMM 4603

Duration: 16 Total Hours Theory: 4 Hours Practical: 12 Hours

General Learning Outcome:

To develop the apprentice's knowledge and skill in the selection, safe use and care of the cutting and non-cutting tools used in the trade.

Learning Outcomes and Content:

Upon successful completion, the apprentice is able to:

1.2.1 Correctly select, use and maintain non-cutting hand tools when installing and maintaining machinery to specifications, such as:

- sockets
- drifts
- wrenches
- screwdrivers
- hammers
- power jacks
- plumb bob
- tube and pipe benders
- squares
- torque wrenches
- punches
- pliers
- pry bars
- tapes
- rules

1.2.2 Correctly select, use and maintain hand cutting tools when installing and maintaining machinery, or when manufacturing and shaping components to specifications, such as:

- files
- hacksaws
- chisels
- pliers (cutting)
- twist drills

- reamers
- tapping chucks
- taps and dies
- tin snips
- shears
- powder actuated tools
- nibblers
- broaches
- pipe cutters
- power sanders
- impact tools
- power chippers
- threading machines
- grinders
- magnetic base drills
- power saws

1.3 - Precision Measuring Equipment 1

Cross-Reference to Learning Outcomes:

CM 1307
IMM 4605

Duration: 24 Total Hours Theory: 20 Hours Practical: 4 Hours

General Learning Outcome:

To develop the apprentice's knowledge of units of measurement used in the trade, and skill in the use of measuring devices:

Learning Outcomes and Content:

Upon successful completion, the apprentice is able to:

1.3.1 Interpret imperial and metric linear scales.

1.3.2 Demonstrate the use of and interpret readings from the following devices:

- rules
- calipers
- hole gauges
- levels
- combination sets
- steel squares
- micrometers
- straight edge and feeler gauges
- verniers
- dial indicators
- gauge blocks
- sine bars
- mechanical tachometers

1.3.3 Check accuracy, adjust to standard, maintain and store precision measuring devices.

1.3.4 Identify and select appropriate measuring device, and measure acute, obtuse and compound angles.

Evaluation Structure:

Theory Testing:	67 %
Application Experiences:	33 %
Final Assessment:	100 %

Instructional/Delivery Strategies:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the eight-week term.
- Final exam at end of term.
- Periodic quizzes.

Number: 2

Title: Workshop Technology 1

Duration: 56 Total Hours

Theory: 16 Hours Practical: 40 Hours

Prerequisites:

Co-requisites:

2.1 - Machine Tools 1

56 Total Hours Theory: 16 Hours Practical: 40 Hours

2.1 – Machine Tools 1

Cross-Reference to Learning Outcomes:

CM 1306
IMM 4604

Duration: 56 Total Hours Theory: 16 Hours Practical: 40 Hours

General Learning Outcome:

To develop the apprentice's knowledge of the principles of cutting and the relationship between speeds and feeds during the various machining operations.

Learning Outcomes and Content:

Upon successful completion, the apprentice is able to:

2.1.1 Read and apply chart information to establish feed, speed, thread cutting, drill and tap specifications for a variety of machining operations.

2.1.2 Use different methods to calculate imperial/metric conversion as required.

2.1.3 Apply specific trade calculations and formulae to ensure compliance with engineering drawings and manufacturing specifications when:

- setting up
- laying out
- aligning
- establishing gear ratios
- machining
- fitting

2.1.4 List and describe safety rules and procedures pertaining to lathe operations.

2.1.5 Describe the machining functions normally performed on a lathe.

2.1.6 Identify the component parts, holding devices, and accessories of the lathe and describe the function of each.

2.1.7 Identify the appropriate cutting tool and define the proper rake and clearance angles for specific cutting requirements.

2.1.8 Set up and safely operate a lathe using High Speed Steel (H.S.S.) and carbide cutting tools to perform machining operations within a unit tolerance such as:

- turn
- thread
- form cutting
- bore
- taper
- face
- knurl

2.1.9 List and describe safety rules and procedures pertaining to drilling operations.

2.1.10 Describe the machining functions normally performed on a drilling machine.

2.1.11 Identify the component parts, holding devices, and accessories of the drilling machine and describe the function of each.

2.1.12 Identify the appropriate cutting tool for specific cutting requirements.

2.1.13 Set up and safely operate a drilling machine using tooling such as High Speed Steel (H.S.S.), Carbide and Titanium cutting tools to perform the following machining operations:

- drill
- tap
- ream
- countersink
- bore and counter-bore
- spot face

2.1.14 List and describe safety rules and procedures pertaining to grinding operations.

2.1.15 Describe the machining functions normally performed on a grinder.

2.1.16 Identify the component parts, holding devices, and accessories of the grinding machines and describe the function of each.

2.1.17 Identify the appropriate grinding wheels in terms of abrasive, grade, bonding, material, structure and grinding operation.

2.1.18 Set up and safely operate a surface grinder with correct wheel selection to grind flats, shims, and valves within a unit tolerance.

2.1.19 Safely operate a pedestal grinder to sharpen and grind cutting tools.

2.1.20 Set up and safely operate cut-off and band saws to perform required cutting operations within specifications.

2.1.21 Safely set up and operate an arbor press to perform specific operations.

Evaluation Structure:

Theory Testing:	29 %
Application Experiences:	71 %
Final Assessment:	100 %

Instructional/Delivery Strategies:

-Assignments related to theory and appropriate application skills.
-Minimum of one mid-term test during the eight-week term.
-Final exam at end of term.
-Periodic quizzes.

Number: 3

Title: Machine Technology 1

Duration: 32 Total Hours

Theory: 24 Hours Practical: 8 Hours

Prerequisites:

Co-requisites:

3.1 – Materials & Fasteners

24 Total Hours Theory: 16 Hours Practical: 8 Hours

3.2 – Lubrication

8 Total Hours Theory: 8 Hours Practical: 0 Hours

3.1 - Materials & Fasteners

Cross-Reference to Learning Outcomes:

CM 1309
IMM 4606

Duration: 24 Total Hours Theory: 16 Hours Practical: 8 Hours

General Learning Outcome:

To develop the apprentice's knowledge of ferrous and non-ferrous metals, basic heat treatment procedures, and applications of fasteners.

Learning Outcomes and Content:

Upon successful completion, the apprentice is able to:

3.1.1 Identify and describe the various properties of metals and alloys.

3.1.2 Identify and describe the effects of temperature on metals and alloys.

3.1.3 Define the following properties of metals and alloys:

- tensile strength
- yield point
- malleability
- hardness
- ductility
- elasticity
- strength

3.1.4 Describe the purpose for adding the following to steel:

- carbon
- sulphur
- phosphorus
- silicon
- manganese
- copper

3.1.5 Identify and describe the uses of non-metallic materials such as:

- rubber
- plastic
- nylon

3.1.6 Identify, describe and perform the methods and procedures of heat treating metals and alloys, including:

- annealing
- tempering
- hardening
- normalizing
- stress relieving
- case hardening
- induction hardening

3.1.7 Identify types, applications, and qualities of fasteners including:

- Unified National, Acme, Metric
- pipe thread system

3.1.8 Identify and select bolts, nuts, dowels, snap rings, chemical fasteners, adhesives and powder actuated fasteners for specific applications.

3.1.9 Describe methods of securing machinery and components using bolts, anchors, fasteners, grouting and epoxy resins.

3.2 – Lubrication

Cross-Reference to Learning Outcomes:

CM 1310
IMM 4607

Duration: 8 Total Hours Theory: 8 Hours Practical: 0 Hours

General Learning Outcome:

To develop the apprentice's knowledge concerning different types of lubricants, and their properties and applications.

Learning Outcomes and Content:

Upon successful completion, the apprentice is able to:

3.2.1 Describe the characteristics of friction.

3.2.2 Explain the theory of friction as it applies to moving parts.

3.2.3 Explain lubrication terms, such as:

- viscosity
- flash point
- specific gravity
- viscosity index

3.2.4 List types, applications, and describe the advantages and disadvantages of:

- lubricating oils
- solid lubricants
- greases
- synthetic oils

3.2.5 Read and interpret lubrication charts.

3.2.6 List and describe lubrication devices:

- manual
- automatic
- centralized

3.2.7 List and describe filtration methods:

- full flow
- partial flow
- surface
- depth

3.2.8 Comply with all safety rules, manufacturers' specifications, and environmental legislation when handling and storing lubricants.

Evaluation Structure:

Theory Testing:	75 %
Application Experiences:	25 %
Final Assessment:	100 %

Instructional/Delivery Strategies:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the eight-week term.
- Final exam at end of term.
- Periodic quizzes.

Number: 4

Title: Rigging & Hoisting

Duration: 24 Total Hours

Theory: 20 Hours Practical: 4 Hours

Prerequisites:

Co-requisites:

4.1 – Rigging & Hoisting

24 Total Hours Theory: 20 Hours Practical: 4 Hours

4.1 - Rigging & Hoisting

Cross-Reference to Learning Outcomes:

CM 1312
IMM 4609

Duration: 24 Total Hours Theory: 20 Hours Practical: 4 Hours

General Learning Outcome:

To develop the apprentice's knowledge of correct lifting and hoisting procedures and the safe use of all equipment.

Learning Outcomes and Content:

Upon successful completion, the apprentice is able to:

4.1.1 List, describe, and comply with all safety rules and procedures pertaining to lifting, hoisting and machine moving.

4.1.2 Plan lifts using the following:

- correct sling angles
- load charts
- workload limits (SWL)
- assessment of load characteristics

4.1.3 Select, inspect and maintain hoisting and rigging equipment for specific applications, including:

- ropes (fiber & wire)
- slings
- skates and rollers
- spreader bars
- equalizer beams
- hooks
- EYE-bolts
- jacks
- winches
- chains
- thimbles
- shackles
- blocks

- ladders
- tie knots
- chain falls
- come-alongs
- scaffolding
- turn buckles

4.1.4 Describe the principles and operation of hoists, overhead and mobile cranes.

4.1.5 Demonstrate signals to ensure that correct and safe hoisting operations are performed, using international hand signals, overhead crane signals and radio communications.

4.1.6 Demonstrate methods of moving, rigging and hoisting machinery and equipment safely into position.

4.1.7 Describe methods of installing and aligning machinery to specifications.

Evaluation Structure:

Theory Testing:	83 %
Application Experiences:	17 %
Final Assessment:	100 %

Instructional/Delivery Strategies:

-Assignments related to theory and appropriate application skills.
-Minimum of one mid-term test during the eight-week term.
-Final exam at end of term.
-Periodic quizzes.

Number: 5

Title: Welding & Fabrication 1

Duration: 32 Total Hours

Theory: 8 Hours Practical: 24 Hours

Prerequisites:

Co-requisites:

5.1 – Welding & Fabrication 1

32 Total Hours Theory: 8 Hours Practical: 24 Hours

5.1 - Welding & Fabrication 1

Cross-Reference to Learning Outcomes:

CM 1311
IMM 4614

Duration: 32 Total Hours Theory: 8 Hours Practical: 24 Hours

General Learning Outcome:

To develop the apprentice's knowledge and ability to set-up and operate oxyacetylene and arc welding equipment to weld, braze, solder and cut safely, and to specifications.

Learning Outcomes and Content:

Upon successful completion, the apprentice is able to:

5.1.1 List and describe personal protective equipment for oxy-gas welding, arc welding and cutting.

5.1.2 Describe the construction of oxygen, acetylene and other fuel gas cylinders. Demonstrate withdrawal rates and safe handling procedures.

5.1.3 Safely set-up and disassemble oxyacetylene and other oxy-gas equipment including valves and hoses.

5.1.4 Describe the principles and applications of:

- brazing and soldering
- gas fueled torches

5.1.5 Select the proper equipment and demonstrate:

- fusion welding of steel
- cutting plate and pipe
- heating operations such as bending and stress relieving

5.1.6 Define arc welding terms.

5.1.7 Describe the basic principles of the following:

- shielded metal arc welding process
- alternating current welding machines
- direct current welding machines
- polarity and arc blow

5.1.8 Identify, describe, and apply arc welding electrodes for specific applications.

5.1.9 Demonstrate flame cutting of structural shapes/plates.

5.1.10 Demonstrate safe work practices with fabrication equipment.

5.1.11 Demonstrate SMAW welding in the flat position.

Evaluation Structure:

Theory Testing:	25 %
Application Experiences:	75 %
Final Assessment:	100 %

Instructional/Delivery Strategies:

-Assignments related to theory and appropriate application skills.
-Minimum of one mid-term test during the eight-week term.
-Final exam at end of term.
-Periodic quizzes.

Number: 6

Title: Electrical & Electronic Controls 1

Duration: 16 Total Hours

Theory: 12 Hours Practical: 4 Hours

Prerequisites:

Co-requisites:

6.1 – Electrical & Electronic Controls 1

16 Total Hours Theory: 12 Hours Practical: 4 Hours

6.1 - Electrical & Electronic Controls 1

Cross-Reference to Learning Outcomes:

CM 1301, 1316, 1320, 1321, 1322
IMM 4600.01, 4613.03, 4617.08, 4618.10

Duration: 16 Total Hours Theory: 12 Hours Practical: 4 Hours

General Learning Outcome:

To develop the apprentice's basic knowledge of electrical and electronic theory.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

6.1.1 Describe the purpose and scope of electrical codes and safety precautions and understand electric shock.

6.1.2 Describe the purpose and function of electrical components as they pertain to safety, such as:

- fuses
- circuit beakers
- lock-outs and tagouts
- shut-off procedures

6.1.3 Describe electric and electron principles, and differentiate between AC and DC.

6.1.4 Describe and apply OHM'S law including:

- Units
  a. Voltage in volts (V)
  b. Current in amperes (I)
  c. Resistance in Ohms (R)

- Relationship
  a. V= I x R
  b. I = V/R
  c. R = V/I

6.1.5 Describe on a basic level, series/parallel circuits in relation to:

- design
- characteristics of circuits
- calculations for circuits

6.1.6 Describe electrical power in terms of:

- Watts
- joules

6.1.7 Identify, select, and use electrical instruments safely:

- ohmmeters, continuity testers, ammeters, voltmeters, and multimetres
- meggers
- soldering irons

6.1.8 Describe the principles of grounding and Ground-Fault Interrupter GFI's.

Evaluation Structure:

Theory Testing:	75 %
Application Experiences:	25 %
Final Assessment:	100 %

Instructional/Delivery Strategies:

-Assignments related to theory and appropriate application skills.
-Minimum of one mid-term test during the eight-week term.
-Final exam at end of term.
-Periodic quizzes.

Number: 7

Title: Drawings & Schematics 1

Duration: 32 Total Hours

Theory: 32 Hours Application: 0 Hours

Prerequisites:

Co-requisites:

7.1 – Drawings & Schematics 1

32 Total Hours Theory: 32 Hours Practical: 0 Hours

7.1 - Drawings & Schematics 1

Cross-Reference to Learning Outcomes:

CM 1302
IMM 4602

Duration: 32 Total Hours Theory: 32 Hours Practical: 0 Hours

General Learning Outcome:

To develop the apprentice's ability to draw, sketch, read and interpret engineering drawings and schematics.

Learning Outcomes and Content:

Upon successful completion, the apprentice is able to:

7.1.1 Read and interpret orthographic projections, multi-view projections and auxiliary views of machine components.

7.1.2 Read and interpret assembly and detail drawings of machine components including bill of material, title block and change orders.

7.1.3 Draw and sketch assembly and component parts using orthographic, isometric and sectional views and with the relevant dimensions and notes.

7.1.4 Read and interpret basic principles of geometric tolerance and symbols.

Evaluation Structure:

Theory Testing:	100 %
Application Experiences:	0 %
Final Assessment:	100 %

Instructional/Delivery Strategies:

-Assignments related to theory and appropriate application skills.
-Minimum of one mid-term test during the eight-week term.
-Final exam at end of term.
-Periodic quizzes.

Master Tool List

The Master Tool List has been developed in conjunction with the Industrial Mechanic (Millwright) and Construction Millwright Curriculum Advisory Committee and the Industrial Mechanic (Millwright) Industry Committee and Construction Millwright Provincial Advisory Committee as a requirement for Training Delivery Agents delivering of the program. Actual numbers of tools or equipment required would depend upon method of delivery and number of students in a program.

Level	Description
I	Socket Sets
I	Torque Wrenches
I	Punch Sets
I	Pairs of Pliers
I	Ball Peen Hammers
I	Screwdriver Sets
I	Chisel Sets
I	Pry Bar Sets
I	Scrapers
I	Assorted Files
I	Hacksaws
I	Drill Indexes with Twist Drills
I	Metric Tap & Die Sets
I	Standard Tap & Die Sets
I	Tap Handles
I	Reamer Sets
I	Tin Snips
I	Rivet Guns
I	Grease Guns
I	Funnel
I	Steel Rules
I	Tape Measures
I	Squares
I	Plumb Bobs
I	0 – 1” Micrometers
I	0 – 25mm Micrometers
I	0 – 150mm Metric Depth Micrometers
I	Sets of Standard Depth Micrometers
I	0 – 6’’ Inside Micrometers
I	0 – 150mm Inside Micrometers
I	1 - 2” Micrometers
I	25 – 50mm Micrometers
I	3” Micrometers
I	12” Vernier Height Gauges
I	Sine Bars

Level	Description
I	Precision Measurement Rigs
I	Standard 6” Vernier Calipers
I	Metric Vernier Micrometer
I	Master Level
I	Telescoping Gauge Sets
I	Hole Gauge Sets
I	Radius Gauge Sets
I	Standard Gauge Block Set
I	Metric Gauge Block Set
I	.001” Dial Indicators
I	.0001” Dial Indicators
I	Standard Thread Gauge Sets
I	Metric Thread Gauge Sets
I	3/8” Power Hand Drills
I	3/8” Angle Drills
I	Magnetic Drills
I	4” Angle Grinders
I	Die Grinders
I	Impact Wrenches
I	Powder Actuated Gun
I	Lock Out & Isolation Simulators
I	Safety Harnesses & Fall Arrest Equipment
I	Scott Air Packs*
I	Different Examples of Fire Extinguishers
I	Face Shields
I	Arc Welding Shields
I	Safety Locks
I	Safety Glasses (Student Supplied)
I	Hearing Protectors (Student Supplied)
I	First Aid Kits
I	Welders Gloves (Student Supplied)
I	Welding Glasses
I	Air Tool Compressor (May be a Plant Compressor)
I	Metal Cutting Lathes with Threading Capability
I	Vertical Milling Machines
I	Radial Drill Presses
I	Drill Presses
I	Power Hacksaw
I	Bandsaw
I	Cut Off Saws
I	Hydraulic Press
I	Pedestal Grinders
I	Granite Surface Tables
I	V Blocks
I	Angle Plates

Level	Description
I	Heat Treat Oven*
I	Oil Quench Tank
I	Forge
I	Rockwell or Brinell Hardness Tester*
I	Automatic Lubrication System Trainers*
I	Overhead Crane / Hoist*
I	Pneumatic Hoist
I	Lifting Slings
I	Lifting Chains
I	Assortment of Lifting Hardware
I	Load Skates
I	Hydraulic Jacks
I	Assortment of Blocks
I	Chainfalls
I	Portable Hydraulic Lift
I	Fork Lift*
I	Arc Welding Units
I	Oxy-acetylene Units
I	Brooms
I	Shovels
I	Lathe Brushes
I	Various Lathe High Speed Cutting & Parting Tools
I	Various Lathe Carbide Cutting Tools
I	Pedestal Grinder Wheels
I	Standard Bolt, Nut & Washer Assortment
I	Metric Bolt, Nut & Washer Assortment
I	Dowel Pin Assortment
I	Circlip Assortment
I	Cotter Pin Assortment
I	Loctite Assortment
I	Rivet Assortment
I	Grease Assortment
I	Oil Assortment
I	Drafting & Sketching Kits
I	Tap Drill Charts
I	Cutting Speed Charts
I	Load Charts
I	Tubing Benders
I	Tubing Cutters
I	Pipe Cutters
I	Bearing Pullers
I	Straightedge
I	Induction Bearing Heater
II	Pipe Bender
II	Power Jacks

Level	Description
II	Pipe Threading Machine
II	Power Shear
II	Horizontal Milling Machine
II	Boring Heads
II	Surface Grinders
II	Surface Grinder Magnetic Chunks
II	Dividing Head
II	Laser Alignment Units
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II	12” Precision Levels
II	Block Level
III	Theodolite Rings
III	Vibration Analyzers
III	Dust Collector*
III	Programmable Logic Controllers

Level	Description
III	Computers with PPM Programs
III	Computer Printer
III	Assortment of Anchors
III	Electrical Multi-testers
III	Tachometer*
III	Ultrasonic Gun*
III	Thermographic Unit*
III	Roller Conveyor System Trainer
III	Belt Conveyor System Trainer
III	Example of Vibrator*
III	Example of Screw, Chain, Monorail or Bucket Conveyor
III	Fly Ball Governor
III	Example of AC Motor
III	Example of DC Stepping Motor
III	Example of Internal Combustion Motor*
III	Example of Turbine*
III	Example of Multi-stage Fan*
III	Example of Shaker Bagger*
III	Assortment of Pneumatic Valves
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III	Different Examples of Hydraulic Piston Pumps
III	Different Examples of Hydraulic Vane Pumps
III	Different Examples of Hydraulic Pumps Other Than Piston or Vane
III	Assortment of Filters and Contamination Control Devices
III	Different Examples of Directional Valves
III	Different Examples of Proportional Valves
III	Example of Mechanical Hydraulic Servo Proportioning
III	Different Examples of Linear Hydraulic Actuators
III	Example of Rotary Hydraulic Actuator
III	Example of Electrical Servo Proportioning Valves
III	Example of Fiber Optics*
III	Hydraulic Training Units
III	Hydraulic Pump Test Units
III	Hydraulic Troubleshooting Unit
III	Ironworker
III	Brake
III	Shears
III	Rollers
III	Various Electrical Sensors
III	Electrical Breakers
III	Electrical Fuses

***** These items are considered desirable, but not absolutely necessary.