

Issued: May 2, 2019

Program: Machinist

To: ITA Training Providers
Articulation Chair
System Liaison Person
Youth Train in Trades School Districts

Subject: Machinist

OPSN No.: OPSN 2019 006

Effective Date: April 1, 2020

Summary of Change: Please be advised that a new Program Outline has been posted to the Industry Training Authority (ITA) [website](#). For details of changes to the Program Outline, please see ***Machinist Program Outline Review Details*** (attached).

Please note the following changes have been made to the Machinist program.

- Increase of Technical Training Hours – from 780 hours total to 870 hours
 - Level 1: from 180 hours to 210 hours
 - Level 2: from 180 hours to 240 hours
 - Level 3: from 210 hours to 240 hours
 - Level 4 from 210 hours to 180 hours (a decrease)
- Decrease of Work-based Training Hours – from 6,600 to 6,330
- Decrease of hours required to challenge the trade – from 9,900 to 9,495

See attached document, *Machinist Harmonized Training Hours*, for details.

Please note that the increase to technical training applies only to the Harmonized levels. The Harmonized Levels will be implemented starting in April 2020 per the Transition Plan.

Rationale: The Machinist National Occupational Analysis (NOA 2013) was reviewed and updated as part of the **Harmonization Initiative** (see *General Information below for more details*). After a series of consultations, workshops and pan-Canadian webinars, a new Red Seal Occupational Standard (RSOS) was developed to replace the NOA,

including the following finalized priorities for Machinist:

What's changing for MACHINIST	Changing in BC?	What will it be?
TRADE NAME	NO	MACHINIST
NUMBER OF TRAINING LEVELS	NO	4
TOTAL HOURS	YES	7200 HOURS decreased by 180
TRAINING SEQUENCE	YES	SOME CHANGES

The revised RSOS and the finalized harmonization recommendations triggered a full program review in BC. As part of this program review and because of the change to the content mandated by the RSOS, a training duration analysis was also conducted, followed by industry consultation.

Details:

A review of the BC Machinist Program to align it to the (draft) RSOS was conducted in March 2018. During the Program Outline review, a need for more technical training was identified. A training duration analysis was conducted and resulted in a proposal to increase the hours as detailed in the attached document, *Machinist Harmonized Training Hours*.

Subsequently, ITA consulted more broadly with industry and this consultation validated the need for more technical training time. **The increase has been approved for Harmonized Levels and will be in effect beginning on April 1, 2020 per the Transition Plan.**

ITA will be working with the training providers to identify strategies for transitioning to the harmonized program. ITA is also working on a communication plan to inform apprentices and employers of the changes to the program.

GENERAL INFORMATION: The Harmonization Initiative

At the request of industry, the Canadian Council of Directors of Apprenticeship (CCDA)'s Harmonization Initiative was launched in Fall 2013 and endorsed by the Forum of Labour Market Ministers (FLMM) in 2014. The goal of Harmonization is to *substantively align* apprenticeship systems across Canada by making apprenticeship training requirements more consistent in Red Seal trades.

In consultation with stakeholders, the CCDA identified four harmonization priorities:

1. Use of Red Seal **trade name**
2. Consistent **total training hours** (in-school and on-the-job)

3. Same number of **training levels**
4. Consistent **sequencing** of training content, including use of most recent National Occupational Analysis.

For more information on the Harmonization Initiative, please visit our website at <http://www.itabc.ca/our-trades-training-system/pan-canadian-harmonization-initiative>

Attachments:

Machinist Program Outline Review Details – This attachment provides details of the revisions made to the Machinist Program Outline during the review process.

Machinist Harmonized Training Hours – This attachment provides details of the current and harmonized program training hours.

For more

information contact:

ITA Program Standards
email: programstandards@itabc.ca

cc:

All Staff

MACHINIST HARMONIZED TRAINING HOURS DETAILS

The following changes to training time for Machinist will come into effect for the Harmonized levels as they are implemented beginning on **April 1, 2020 per the Transition Plan**:

- Increased technical training hours in order to accommodate content added to the Red Seal Occupational Standard (RSOS)
- Decreased work-based training (WBT) hours in order to align with the harmonized standard of 7,200 hours of total training

Apprenticeship Pathway

Current Program	Hours
Technical Training	780
Level 1 = 180 hours	
Level 2 = 180 hours	
Level 3 = 210 hours	
Level 4 = 210 hours	
Work-based Training Hours	6,600
Current Total Training Hours	7,380

Harmonized Program	Hours
Technical Training	870
Level 1 = 210 hours	
Level 2 = 240 hours	
Level 3 = 240 hours	
Level 4 = 180 hours	
Work-based Training Hours	6,330
Harmonized Total Training Hours	7,200

Challenge Pathway and Sign-off Authority

Current Program	Hours
Work-based Training Hours	6,600
ITA Formula for Calculating Challenge WBT	x 1.5
Current Challenge WBT Hours	9,900

Harmonized Program	Hours
Harmonized Work-based Training Hours	6,330
ITA Formula for Calculating Challenge WBT	x 1.5
Harmonized Challenge WBT Hours	9,495

Machinist – Program Outline Competency Migration

Key

Blue Text = Content moved to lower level = HL←CL (creates an gap)
 Purple Text = Content moved to higher level = CL→HL (creates an overlap)
 Green Text = New content added
 Red Text = Removed from Program Outline
 Black Text = No change to level
 CL = Current Level
 HL = Harmonized level

Summary - Competency Migration

This chart shows the finalized competency distribution for the Harmonized Machinist program. It summarizes the major changes to the competencies, specifically the level they are taught in and any competencies that were added or removed.

MACHINIST HARMONIZED LEVEL 1		MACHINIST HARMONIZED LEVEL 2		MACHINIST HARMONIZED LEVEL 3		MACHINIST HARMONIZED LEVEL 4	
Line A	PERFORM SAFETY-RELATED TASKS	Line A	PERFORM SAFETY-RELATED TASKS	Line A	PERFORM SAFETY-RELATED TASKS	Line A	PERFORM SAFETY-RELATED TASKS
	A1 Describe Occupational Health & Safety Regulations						
	A2 Describe WHMIS and Hazardous Materials Safety (HAZMAT)						
CL1→HL1/HL4	A3 Apply safety practices for shop areas					CL1→HL1/HL4	A3 Apply safety practices for shop areas
	A4 Use lifting equipment						
Line B	PERFORM HAND PROCESSES	Line B	PERFORM HAND PROCESSES	Line B	PERFORM HAND PROCESSES	Line B	PERFORM HAND PROCESSES
	B1 Use and maintain hand tools						
	B2 Use layout tools						
	B3 Use and maintain handheld power tools						
	B4 Mark material and workpiece for identification						
Line C	USE APPLIED MATHEMATICS	Line C	USE APPLIED MATHEMATICS	Line C	USE APPLIED MATHEMATICS	Line C	USE APPLIED MATHEMATICS
	C1 Solve problems involving formulas		C1 Solve problems involving formulas		C1 Solve problems involving formulas		
	C2 Perform metric/Imperial conversions						

Machinist – Program Outline Competency Migration

MACHINIST HARMONIZED LEVEL 1		MACHINIST HARMONIZED LEVEL 2		MACHINIST HARMONIZED LEVEL 3		MACHINIST HARMONIZED LEVEL 4	
C1→HL1/HL2	C3 Solve problems involving geometry	C1→HL1/HL2	C3 Solve problems involving geometry				
	C4 Solve problems involving mass, area and volume						
	C5 Solve problems involving trigonometry		C5 Solve problems involving trigonometry		C5 Solve problems involving trigonometry		
Line D	USE MEASURING TOOLS						
	D1 Use linear and Vernier scales						
	D2 Use micrometers						
	D3 Use calipers and gauges		D3 Use calipers and gauges		D3 Use calipers and gauges		
	D4 Use dial indicators and digital readouts		D4 Use dial indicators and digital readouts		D4 Use dial indicators and digital readouts		
HL1/HL2 ←CL4	D5 Use optical measuring equipment	HL1/HL2 ←CL4	D5 Use optical measuring equipment				
Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS	Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS	Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS	Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS
	E1 Interpret information found on drawings						
HL1←CL1/CL2/CL3/CL4	E2 Determine project requirements						
	E3 Sketch machined parts						
	E4 Use Machinery's Handbook and other reference materials		E4 Use Machinery's Handbook and other reference materials		E4 Use Machinery's Handbook and other reference materials		E4 Use Machinery's Handbook and other reference materials
	E5 Describe fits and tolerances		E5 Describe fits and tolerances				
Line F	SELECT MATERIALS						
HL1←CL2/CL4	F1 Describe principles of metallurgy						
HL1←CL2/CL3/CL4	F2 Describe characteristics of ferrous metals						

Machinist – Program Outline Competency Migration

MACHINIST HARMONIZED LEVEL 1		MACHINIST HARMONIZED LEVEL 2		MACHINIST HARMONIZED LEVEL 3		MACHINIST HARMONIZED LEVEL 4	
		HL2←CL2/CL3/CL4	F3 Describe characteristics of non-ferrous metals				
		HL2←CL2/CL3/CL4	F4 Describe characteristics of non-metals				
		HL2/HL3←CL3/CL4	F5 Perform heat treating	HL2/HL3←CL3/CL4	F5 Perform heat treating		
				HL3←CL3/CL4	F6 Perform materials testing		
HL1←CL2	F7 Describe the use and maintenance of fuel gas equipment						
Line G	REFURBISH COMPONENTS	Line G	REFURBISH COMPONENTS	Line G	REFURBISH COMPONENTS	Line G	REFURBISH COMPONENTS
	G1 Identify fasteners						
	G2 Identify lubricants and sealants						
					G3 Describe bearings, seals and bearing materials		
Line H	USE DRILLING MACHINES	Line H	USE DRILLING MACHINES	Line H	USE DRILLING MACHINES	Line H	USE DRILLING MACHINES
	H1 Describe drilling machines						
	H2 Select and maintain cutting tools						
	H3 Operate and maintain drilling machines						
Line I	USE POWER SAWS	Line I	USE POWER SAWS	Line I	USE POWER SAWS	Line I	USE POWER SAWS
	I1 Describe power saws						
	I2 Select and maintain band saw blades						
	I3 Operate and maintain band saws						
	I4 Operate and maintain other saws						
Line J	USE LATHES	Line J	USE LATHES	Line J	USE LATHES	Line J	USE LATHES

Machinist – Program Outline Competency Migration

MACHINIST HARMONIZED LEVEL 1		MACHINIST HARMONIZED LEVEL 2		MACHINIST HARMONIZED LEVEL 3		MACHINIST HARMONIZED LEVEL 4	
	J1 Describe lathes						
	J2 Describe cutting tools and holders		J2 Describe cutting tools and holders				
	J3 Operate and maintain lathes						
	J4 Cut tapers						
			J5 Cut threads		J5 Cut threads		
					J6 Describe vertical lathes		
Line K	USE MILLING MACHINES	Line K	USE MILLING MACHINES	Line K	USE MILLING MACHINES	Line K	USE MILLING MACHINES
HL1/HL2←CL2	K1 Describe milling machines	HL1/HL2←CL2	K1 Describe milling machines				
HL1/HL2←CL2	K2 Describe cutting tools and holders	HL1/HL2←CL2	K2 Describe cutting tools and holders				
			K3 Use dividing heads and rotary tables		K3 Use dividing heads and rotary tables		
			K4 Operate and maintain milling machines		K4 Operate and maintain milling machines		
					K5 Describe boring mills		
Line L	USE SUPPORT MACHINES	Line L	USE SUPPORT MACHINES	Line L	USE SUPPORT MACHINES	Line L	USE SUPPORT MACHINES
	L1 Operate and maintain pedestal grinder						
	L2 Operate and maintain arbour and hydraulic presses						
HL1/HL2←CL3	L3 Operate and maintain hones and lapping machines	HL1/HL2←CL3	L3 Operate and maintain hones and lapping machines				

Machinist – Program Outline Competency Migration

MACHINIST HARMONIZED LEVEL 1		MACHINIST HARMONIZED LEVEL 2		MACHINIST HARMONIZED LEVEL 3		MACHINIST HARMONIZED LEVEL 4	
							L4 Operate and maintain gear cutting machines
							L5 Operate and maintain EDM
Line M	USE PRECISION GRINDERS	Line M	USE PRECISION GRINDERS	Line M	USE PRECISION GRINDERS	Line M	USE PRECISION GRINDERS
		CL1/CL3→HL2/HL3	M1 Describe types of precision grinders	CL1/CL3→HL2/HL3	M1 Describe types of precision grinders		
		CL1/CL2→HL2 HL2←CL3	M2 Select abrasives				
		CL1/CL3→HL2/HL3	M3 Operate and maintain grinders	CL1/CL3→HL2/HL3	M3 Operate and maintain grinders		
Line N	USE CNC MACHINES	Line N	USE CNC MACHINES	Line N	USE CNC MACHINES	Line N	USE CNC MACHINES
		HL2←CL4	N1 Describe CNC turning centres				
		HL2←CL4	N2 Establish co-ordinate systems and apply programming codes for turning centres				
		HL2←CL4	N3 Operate and maintain CNC turning centres				
				HL3←CL4	N4 Describe CNC machining centres		
				HL3←CL4	N5 Establish co-ordinate systems and apply programming codes for machining centres		
				HL3←CL4	N6 Operate and maintain CNC machining centres		
				NEW	N7 Create 2D and 3D models	NEW	N7 Create 2D and 3D models
				NEW	N8 Program using CAM	NEW	N8 Program using CAM

Key

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 Purple Text = Content moved to higher level = CL→HL (creates an overlap)
 Green Text = New content added
 Red Text = Removed from Program Outline
 Black Text = No change to level
 CL = Current Level
 HL = Harmonized level

Details of Changes

The following chart provides a side by side comparison with notes of major changes.

	Current Level 1		Harmonized Level 1	Description of Changes
Line A	USE SAFE WORK PRACTICES	Line A	PERFORM SAFETY RELATED TASKS	
A1	Describe Occupational Health and Safety Regulations	A1	Describe Occupational Health and Safety Regulations	
A2	Describe WHMIS and Hazardous Materials Safety (HAZMAT)	A2	Describe WHMIS and Hazardous Materials Safety (HAZMAT)	
A3	Apply safety practices for shop areas	A3	Apply safety practices for shop areas	Content from CL1 was split into HL1 and HL4 (CL1→HL1/HL4)
A4	Use lifting equipment	A4	Use lifting equipment	
Line B	USE HAND TOOLS	Line B	PERFORM HAND PROCESSES	
B1	Use and maintain hand tools	B1	Use and maintain hand tools	
B2	Use layout tools	B2	Use layout tools	
B3	Use and maintain handheld power tools	B3	Use and maintain handheld power tools	
B4	Mark workpieces for identification	B4	Mark material and workpiece for identification	
Line C	USE APPLIED MATHEMATICS	Line C	USE APPLIED MATHEMATICS	
C1	Solve problems involving formulas	C1	Solve problems involving formulas	
C2	Solve problems involving ratios	C1	Solve problems involving formulas	
C3	Perform metric/Imperial conversions	C2	Perform metric/Imperial conversions	
C4	Solve problems involving geometry	C3	Solve problems involving geometry	Content from CL1 was split between HL1 and HL2 (C1→HL1/HL2)
C5	Solve problems involving algebra	C1	Solve problems involving formulas	
C6	Solve problems involving mass, area and volume	C4	Solve problems involving mass, area and volume	
C7	Solve problems involving trigonometry	C5	Solve problems involving trigonometry	
Line D	USE MEASURING TOOLS	Line D	USE MEASURING TOOLS	

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	Current Level 1		Harmonized Level 1	Description of Changes
D1	Use linear and Vernier scales	D1	Use linear and Vernier scales	
D2	Use micrometers	D2	Use micrometers	
D3	Use calipers and gauges	D3	Use calipers and gauges	
D4	Use dial indicators and digital readouts	D4	Use dial indicators and digital readouts	
		D5	Use optical measuring equipment	Content from CL4 was moved and split between HL1 & 2 (HL1/HL2 ←CL4) HL1 = Describe optical measuring equipment HL2 = Use optical measuring equipment
Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS	Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS	
E1	Interpret information found on drawings	E1	Interpret information found on drawings	
E2	Sketch machined parts	E3	Sketch machined parts	
E3	Use Machinery’s Handbook and other reference materials	E4	Use Machinery’s Handbook and other reference materials	
E4	Describe fits and tolerances	E5	Describe fits and tolerances	
Line F	SELECT MATERIALS	Line F	SELECT MATERIALS	
		F1	Describe principles of metallurgy	Content from CL2 and CL4 was combined and moved to HL1 (HL1←CL2/CL4)
		F2	Describe characteristics of ferrous metals	Content from CL2, CL3 and CL4 was combined and moved to HL1 (HL1←CL2/CL3/CL4)
		F7	Describe the use and maintenance of fuel gas equipment	Moved from CL2 to HL1 (HL1←CL2)
Line G	PLAN SEQUENCE OF OPERATION			
G1	Determine project requirements	E2	Determine project requirements	Content from all four levels was combined and moved to HL1 (HL1←CL1/CL2/CL3/CL4)
G2	Describe work holding devices	J2	Describe cutting tools and holders	
G3	Perform roughing and finishing			Moved into LTs in M3 Operate and maintain grinders in HL2 & HL3 (CL1→HL2/HL3) HL2 = within context of “operate and maintain surface grinders” HL3 = within context of “operate and maintain cylindrical grinders”
Line H	DESCRIBE FABRICATION AND ASSEMBLY	Line G	REFURBISH COMPONENTS	
H1	Identify fasteners	G1	Identify fasteners	
H2	Identify lubricants and sealants	G2	Identify lubricants and sealants	

	Current Level 1		Harmonized Level 1	Description of Changes
Line I	USE DRILLING MACHINES	Line H	USE DRILLING MACHINES	
I1	Describe drilling machines	H1	Describe drilling machines	
I2	Select and maintain cutting tools	H2	Select and maintain cutting tools	
I3	Operate and maintain drilling machines	H3	Operate and maintain drilling machines	
Line J	USE POWER SAWS	Line I	USE POWER SAWS	
J1	Describe power saws	I1	Describe power saws	
J2	Select and maintain band saw blades	I2	Select and maintain band saw blades	
J3	Operate and maintain band saws	I3	Operate and maintain band saws	
J4	Operate and maintain other saws	I4	Operate and maintain other saws	
Line K	USE LATHES	Line J	USE LATHES	
K1	Describe lathes	J1	Describe lathes	
K2	Operate and maintain lathes	J3	Operate and maintain lathes	
K3	Cut tapers	J4	Cut tapers	
Line L	USE MILLING MACHINES	Line K	USE MILLING MACHINES	
		K1	Describe milling machines	Content from CL2 was split between HL1 and HL2 (HL1/HL2←CL2) HL1 = Describe milling machines and their accessories HL2 = Describe milling machine accessories, work holding devices and applications
		K2	Describe cutting tools and holders	Content from CL2 was split between HL1 and HL2 (HL1/HL2←CL2) HL1 = Describe cutting tools and holders HL2 = Describe cutting tools and holders and their applications
Line M	USE SUPPORT MACHINES	Line L	USE SUPPORT MACHINES	
M1	Operate and maintain hydraulic and arbour presses	L2	Operate and maintain arbour and hydraulic presses	
		L3	Operate and maintain hones and lapping machines	Content from CL3 was split between HL1 and HL2 (HL1/HL2←CL3) HL1 = Describe hones and lapping machines HL2 = Operate and maintain hones; Describe lapping
Line N	USE GRINDERS AND ABRASIVES			
N1	Describe types of grinders			Moved from CL1 and CL3 to HL2 and HL3 (CL1/CL3→HL2/HL3)

Machinist – Program Outline Competency Migration

	Current Level 1		Harmonized Level 1	Description of Changes
				HL2 = Describe types of precision surface grinders and their applications; Describe tool and cutter grinders HL3 = Describe precision grinders and their applications
N2	Select abrasives			Moved from CL1, CL2 and CL3 into HL2 CL1→HL2 = Describe abrasives and their applications HL2←CL3 = Select abrasives for applications
N3	Operate and maintain grinders	L1	Operate and maintain pedestal grinders	
N4	Operate and maintain sanders and polishers			Removed

	Current Level 2		Harmonized Level 2	Description of Changes
Line C	USE APPLIED MATHEMATICS	Line C	USE APPLIED MATHEMATICS	
C1	Solve problems involving formulas	C1	Solve problems involving formulas	
		C3	Solve problems involving geometry	Content from CL1 was split between HL1 and HL2 (C1→HL1/HL2)
C7	Solve problems involving trigonometry	C5	Solve problems involving trigonometry	
Line D	USE MEASURING TOOLS	Line D	USE MEASURING TOOLS	
D3	Use calipers and gauges	D3	Use calipers and gauges	
D4	Use dial indicators and digital readouts	D4	Use dial indicators and digital readouts	
		D5	Use optical measuring equipment	Content from CL4 was moved and split between HL1 & HL2 (HL1/HL2 ←CL4) HL1 = Describe optical measuring equipment HL2 = Use optical measuring equipment
Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS	Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS	
E3	Use Machinery's Handbook and other reference materials	E4	Use Machinery's Handbook and other reference materials	
E4	Describe fits and tolerances	E5	Describe fits and tolerances	
Line F	SELECT MATERIALS	Line F	SELECT MATERIALS	
F1	Describe principles of metallurgy			Content from CL2 and CL4 was combined and moved to HL1 (HL1←CL2/CL4)
F2	Describe characteristics of ferrous metals			Content from CL2, CL3 and CL4 was combined and moved to HL1 (HL1←CL2/CL3/CL4)

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	Current Level 2		Harmonized Level 2	Description of Changes
F3	Describe characteristics of non-ferrous metals	F3	Describe characteristics of non-ferrous metals	Content from CL2, CL3 and CL4 was combined and moved to HL2 (HL2←CL2/CL3/CL4)
F4	Describe characteristics of non-metals	F4	Describe characteristics of non-metals	Content from CL2, CL3 and CL4 was combined and moved to HL2 (HL2←CL2/CL3/CL4)
		F5	Perform heat treating	Moved from CL3 and CL4 to HL2 and HL3 (HL2/HL3←CL3/CL4)
F8	Describe the use and maintenance of fuel gas equipment			Moved from CL2 into HL1 (HL1←CL2)
Line G	PLAN SEQUENCE OF OPERATION			
G1	Determine project requirements			Moved from all four levels into only HL1 (HL1←CL1/CL2/CL3/CL4)
Line K	USE LATHES	Line J	USE LATHES	
K4	Cut threads	J5	Cut threads	
K5	Describe the use of advanced cutting tools	J2	Describe cutting tools and holders	
Line L	USE MILLING MACHINES	Line K	USE MILLING MACHINES	
L1	Describe milling machines	K1	Describe milling machines	Content from CL2 was split between HL1 and HL2 (HL1/HL2←CL2)
L2	Describe cutting tools and holders	K2	Describe cutting tools and holders	Content from CL2 was split between HL1 and HL2 (HL1/HL2←CL2)
L3	Use dividing heads and rotary tables	K3	Use dividing heads and rotary tables	
L4	Operate and maintain milling machines	K4	Operate and maintain milling machines	
		Line L	USE SUPPORT MACHINES	
		L3	Operate and maintain hones and lapping machines	Content from CL3 was split between HL1 and HL2 (HL1/HL2←CL3) HL1 = Describe hones and lapping machines HL2 = Operate and maintain hones; Describe lapping
Line N	USE GRINDERS AND ABRASIVES	Line M	USE PRECISION GRINDERS	
		M1	Describe types of precision grinders	Moved from CL1 and CL3 to HL2 and HL3 (CL1/CL3→HL2/HL3)
N2	Select abrasives	M2	Select abrasives	Moved from CL1, CL2 and CL3 into HL2 CL1→HL2 = Describe abrasives and their

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Current Level 2	Harmonized Level 2	Description of Changes
		applications HL2←CL3 = Select abrasives for applications
	M3 Operate and maintain grinders	Moved from CL1 and CL3 to HL2 and HL3 (CL1/CL3→HL2/HL3)
	Line N USE CNC MACHINES	
	N1 Describe CNC turning centres	Moved from CL4 to HL2 (HL2←CL4)
	N2 Establish co-ordinate systems and apply programming codes for turning centres	Moved from CL4 to HL2 (HL2←CL4)
	N3 Operate and maintain CNC turning centres	Moved from CL4 to HL2 (HL2←CL4)

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	Current Level 3		Harmonized Level 3	Description of Changes
Line C	USE APPLIED MATHEMATICS	Line C	USE APPLIED MATHEMATICS	
C2	Solve problems involving ratios	C1	Solve problems involving formulas	
C7	Solve problems involving trigonometry	C5	Solve problems involving trigonometry	
Line D	USE MEASURING TOOLS	Line D	USE MEASURING TOOLS	
D3	Use calipers and gauges	D3	Use calipers and gauges	
D4	Use dial indicators and digital readouts	D4	Use dial indicators and digital readouts	
Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS	Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS	
E3	Use Machinery’s Handbook and other reference materials	E4	Use Machinery’s Handbook and other reference materials	
Line F	SELECT MATERIALS	Line F	SELECT MATERIALS	
F2	Describe characteristics of ferrous metals			Content from CL2, CL3 and CL4 was combined and moved to HL1 (HL1←CL2/CL3/CL4)
F3	Describe characteristics of non-ferrous metals			Content from CL2, CL3 and CL4 was combined and moved to HL2 (HL2←CL2/CL3/CL4)
F4	Describe characteristics of non-metals			Content from CL2, CL3 and CL4 was combined and moved to HL2 (HL2←CL2/CL3/CL4)
F5	Select materials for applications			Moved into context of other tasks
F6	Describe and perform heat treating	F5	Perform heat treating	Moved from CL3 and CL4 to HL2 and HL3 (HL2/HL3←CL3/CL4)
F7	Describe materials testing	F6	Perform materials testing	Content from CL3 and CL4 was combined and moved to HL3 (HL3←CL3/CL4)
Line G	PLAN SEQUENCE OF OPERATION			
G1	Determine project requirements			Moved from all four levels into only HL1 (HL1←CL2/CL3/CL4)
Line H	DESCRIBE FABRICATION AND ASSEMBLY	Line G	REFURBISH COMPONENTS	
H3	Describe bearings, seals and bearing materials	G3	Describe bearings, seals and bearing materials	
H4	Disassemble and assemble components	G3	Describe bearings, seals and bearing materials	
Line K	USE LATHES	Line J	USE LATHES	
K4	Cut threads	J5	Cut threads	
Line L	USE MILLING MACHINES	Line K	USE MILLING MACHINES	
L3	Use dividing heads and rotary tables	K3	Use dividing heads and rotary tables	
L4	Operate and maintain milling machines	K4	Operate and maintain milling machines	
Line M	USE SUPPORT MACHINES			
M2	Operate and maintain hones and lapping machines			Content from CL3 was split between HL1 and HL2 (HL1/HL2←CL3) HL1 = Describe hones and lapping machines HL2 = Operate and maintain hones; Describe lapping
Line N	USE GRINDERS AND ABRASIVES	Line M	USE PRECISION GRINDERS	

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	Current Level 3		Harmonized Level 3	Description of Changes
N1	Describe types of grinders	M1	Describe types of precision grinders	
N2	Select abrasives			Moved from CL1, CL2 and CL3 into HL2 CL1→HL2 = Describe abrasives and their applications HL2←CL3 = Select abrasives for applications
N3	Operate and maintain grinders	M3	Operate and maintain grinders	Content from CL1 and CL3 was moved to HL2 and HL3 CL1/CL3→HL2/HL3
		Line N	USE CNC MACHINES	
		N4	Describe CNC machining centres	Moved from CL4 to HL3 (HL3←CL4)
		N5	Establish co-ordinate systems and apply programming codes for machining centres	Moved from CL4 to HL3 (HL3←CL4)
		N6	Operate and maintain CNC machining centres	Moved from CL4 to HL3 (HL3←CL4)
		N7	Create 2D and 3D models	New
		N8	Program using CAM	New
Line O	USE BORING MACHINES			
O1	Describe boring machines	K5	Describe boring mills	
O2	Operate and maintain vertical boring mills	J6	Describe vertical lathes	Incorporated into lathes and CNC machines

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Current Level 4		Harmonized Level 4		Description of Changes
		Line A	PERFORM SAFETY RELATED TASKS	
		A3	Apply safety practices for shop areas	Was in only CL1; split into HL1 and HL4 (CL1→HL1/HL4)
Line D	USE MEASURING TOOLS			
D5	Describe optical measuring equipment			Content from CL4 was split and moved to HL1 and HL2 (HL1/HL2←CL4)
Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS	Line E	INTERPRET DRAWINGS AND REFERENCE MATERIALS	
E3	Use Machinery’s Handbook and other reference materials	E4	Use Machinery’s Handbook and other reference materials	
Line F	SELECT MATERIALS	Line F	SELECT MATERIALS	
F1	Describe principles of metallurgy			Content from CL2 and CL4 was combined and moved to HL1 (HL1←CL2/CL4)
F2	Describe characteristics of ferrous metals			Content from CL2, CL3 and CL4 was combined and moved to HL1 (HL1←CL2/CL3/CL4)
F3	Describe characteristics of non-ferrous metals			Content from CL2, CL3 and CL4 was combined and moved to HL2 (HL2← CL2/CL3/CL4)
F4	Describe characteristics of non-metals			Content from CL2, CL3 and CL4 was combined and moved to HL2 (HL2← CL2/CL3/CL4)
F6	Describe and perform heat treating			Moved from CL3 and CL4 to HL2 and HL3 (HL2/HL3←CL3/CL4)
F7	Describe materials testing			Content from CL3 and CL4 was combined and moved to HL3 (HL3←CL3/CL4)
Line G	PLAN SEQUENCE OF OPERATION			
G1	Determine project requirements			Moved from all levels into HL1 (HL1←CL1/CL2/CL3/CL4)
G3	Perform roughing and finishing			Moved into LTs in M3 Operate and maintain grinders in HL2 & HL3 (HL2/HL3←CL4) HL2 = within context of “operate and maintain surface grinders” HL3 = within context of “operate and maintain cylindrical grinders”
Line M	USE SUPPORT MACHINES	Line L	USE SUPPORT MACHINES	
M3	Operate and maintain gear cutting and electrical discharge machines	L4 L5	Operate and maintain gear cutting machines Operate and maintain electrical discharge machines	
Line O	USE BORING MACHINES			
O1	Describe boring mills			Moved from CL3 and CL4 to HL3 (HL3←CL3/CL4)
O3	Operate and maintain horizontal boring mills			Moved from CL3 and CL4 to HL3 (HL3←CL3/CL4)
Line P	USE CNC MACHINES	Line N	USE CNC MACHINES	

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	Current Level 4		Harmonized Level 4	Description of Changes
P1	Describe CNC machines			Moved from CL4 into HL2/HL3 (HL2/HL3←CL4)
P2	Describe co-ordinate systems and programming codes			Moved from CL4 into H2/HL3 (HL2/HL3←CL4)
P3	Operate and maintain CNC machines			Moved from CL4 into H2/HL3 (HL2/HL3←CL4)
		N7	Create 2D and 3D models	New
		N8	Program using CAD	New