Department of Labor & Industries
Apprenticeship Section
PO Box 44530
Olympia WA 98504-4530

REQUEST FOR REVISION OF STANDARDS

L&I apprenticeship coordinator

TO: Washington State Apprenticeship & Training Council

From: IAM/Boeing Joint Apprenticeship Committee (#154)

(NAME OF PROGRAM STANDARDS)

See attached:

RECEIVED BY L&I AC: 8-27-15 TS

E-MAIL RECEIVED BY CENTRAL OFFICE: 9-10-15 KR

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Chair Gary Lundquist Gary Lundquist	Approved by: Washington State Apprenticeship & Training Council
Secretary Laurie Sample Laurens Sample Wood	Secretary of WSATC:
Date: 8/26/2015	Date:

attach additional sheets if necessary

Attachment to Request for Revision of Standards, October 2015

TO: Washington State Apprenticeship & Training Council

From: IAM/Boeing Joint Apprenticeship Committee (#154)

Please note, added language is underlined; deleted language is ~~struck through~~:

COVER PAGE:

NC Skin Mill Operator	51-4011.00	7360 hours
NC Spar Mill Operator	51-4011.0~~1~~0	7360 hours

II. MINIMUM QUALIFICATIONS:

Education: ~~G.E.D. or~~ High School Graduate or the equivalent~~,~~ ~~p~~. Proof of successful completion is required.

Section III. CONDUCT OF PROGRAM UNDER WASHINGTON EQUAL EMPLOYMENT OPPORTUNITY PLAN:

A. Selection Procedures:

To determine employment eligibility with the Boeing Company, prior to the submission of an application for an IAM/Boeing Apprenticeship Program, interested persons can go to the Boeing web site:

For non-Boeing interested persons http://www.boeing.com/careers/

Candidates applying for placement in an IAM/Boeing apprenticeship program who meet the Minimum Qualification and are eligible for hire with the Boeing Company will be placed in the eligibility pool for the program applied for. The following procedures and requirements apply to all candidates meeting the minimum qualifications.

Section IV. TERM OF APPRENTICESHIP:

The term of apprenticeship will be 7,360 hours of reasonably continuous employment and experience in the principal operations of the trade for the following occupations:

Model Maker
NC Skin Mill Operator
NC Spar Mill Operator

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Section V. INITIAL PROBATIONARY PERIOD:

For the 7,360 hours apprenticeship programs, the 20% probationary period is 1,472 hours. These programs are:

Model Maker
NC Skin Mill Operator
NC Spar Mill Operator

Section VII. APPRENTICE WAGES AND WAGE PROGRESSION:

For Manufacturing Machinist; Machine; Tool Maintenance Mechanic; Maintenance Machinist; ~~and~~ Model Maker; and NC Skin Mill Operator programs.

VIII. WORK PROCESSES:

A. Blue Streak Mechanic:

		Code	Hours	
1.	Forming~~,~~: Joggle/Roll/Hydro/Stretch/Brake	A	~~560~~	750
2.	Drilling/Countersinking	B	~~200~~	130
3.	Machining/NC/CNC/Conventional	C	~~240~~	500
4.	Non Metallic	D	~~240~~	280
5.	Waterjet	E	~~100~~	120
6.	Assembly	F	~~2060~~	1600
7.	Adhesive	G	~~150~~	120
9.	Layout/Lofting	I	~~1000~~	800
10.	Deburr/Polish/Burnish	J	~~80~~	120
11.	Trim	K	~~250~~	500
13.	Metallurgy/Heat Treat	M	~~260~~	160
14.	Composite	N	~~400~~	500
16.	~~Control Surface~~ Rework/Repair	P	~~1000~~	750
18.	~~Polish/Burnish~~ Inspection	R	~~40~~	250

E. Machine Tool Maintenance Mechanic:

		Code	Hours	
1.	Oil Crib & Routes	A		
3.	~~Belts & Pulley~~ Facilities and Structural Equipment	C	~~80~~	200
4.	Alignments	D	~~540~~	600
6.	Preventative Maintenance	F	~~840~~	820
7.	~~Boring Mills~~ Precision Process Equipment	G	~~40~~	200
11.	Coordinate Measuring Machines	K	~~120~~	40
12.	~~Hydraulics~~ Fluid Power	L	~~320~~	440

13.	~~Riveters~~ Precision Assembly Tools	M	~~500~~	900
14.	~~Automatic Spar Assembly Tool~~ Orientation	N	~~450~~	40
16.	~~Waterjets~~ Skin and Spar	P	~~160~~	500
17.	Shot Peen	Q	~~230~~	160
18.	~~Wire Coding~~ Robotics	R		
20.	~~Ballbars~~ Heat Treat Ovens/Furnace	T		
21.	~~Balancing~~ Composite Production Equipment	U	~~80~~	240
22.	Spindle Shop	V	~~320~~	160
23.	~~Laser Interferometry~~ Shop Specific Training	W	~~160~~	580
~~25.~~	~~Orientation~~	~~Y~~	~~40~~	
~~26.~~	~~Skin and Spar~~	~~Z~~	~~600~~	
~~27.~~	~~Heat Treat Ovens/Furnace~~	~~A1~~	~~80~~	
~~28.~~	~~Composite Production Equipment~~	~~A2~~	~~240~~	
~~29.~~	~~Hanger Doors~~	~~A3~~	~~80~~	

I. Metal Structures Technician:

		Code	Hours	
4.	Finishing	D	~~920~~	680
7.	Robotic Welding and Preparation	G	~~1500~~	1420
10.	Rework	J		240
11.	Enovia	K		80

K. NC Skin Mill Operator:

		Code	Hours	
1.	Material Store	A		40
2.	NC/CNC Spar Mill	B		600
3.	High Speed Plate Mills	C		980
4.	NC/CNC Milling	D		400
5.	Hand Sand: Skins	E		120
6.	Skin Sanding Machine	F		200
7.	Chip Form	G		160
8.	Layout/SPC	H		400
9.	Conventional Milling	I		420
10.	Heat Treat	J		200
11.	Tool & Cutter Grinder	K		320
12.	Skin Mills	L		1260
13.	Crane Operation	M		160
14.	Shot Peen/Forming	N		400
15.	Checking Fixture	O		180

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16.	Hand Work	P	200
17.	Anodize Tank Line	Q	160
18.	Assembly and Prep	R	120
19.	Spar/Skin Kitting	S	80
20.	Cutting Tool Development	T	80
21.	Cutter Set-up	U	80
22.	Tooling	V	300
23.	Tool Set-up	W	80
24.	NC/CNC Double Plus Chord Mills	X	420
	TOTAL HOURS:		7360

Please renumber and adjust remaining sections as:

~~K~~ L. NC Spar Mill Operator
~~L~~ M. Tool & Cutter Grinder
~~M~~ N. Tool & Die Maker
~~N~~ O. Tooling Inspector

Section IX. RELATED/SUPPLEMENTAL INSTUCTION:

(X) State Community/Technical college: South Seattle ~~Community~~ College

Additional Information:

Apprentices will be provided with a minimum of 144 hours of RSI per year, up to a total of 640 over the course of their apprenticeship, unless otherwise directed by the committee, in the following occupations:

Model Maker
NC Skin Mill Operator
NC Spar Mill Operator

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Apprenticeship Related/Supplemental Instruction (RSI) Plan Review

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Program Sponsor: IAM/Boeing #0154	
Skilled Occupational Objective: NC Skin Mill Operator	
Term/OJT Hours: 7360	Total RSI Hours: 640
Training Provider: IAM/Boeing #0154	

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- By the signature placed below, the **program sponsor** agrees to provide the prescribed RSI for each registered apprentice and assures that:
  1. The RSI content and delivery method is and remains reasonably consistent with the latest occupational practices, improvements, and technical advances.
  2. The RSI is coordinated with the on-the-job work experience.
  3. The RSI is provided in safe and healthful work practices in compliance with WISHA and applicable federal and state regulations.

Signature of Program Sponsor	Print Name
Laurens Wood	Laurens Wood

- By the signature placed below, the **training provider** assures that:
  1. The RSI will be conducted by instructors who meet the qualifications of "competent instructor" as described in WAC 296-05-003.
     a. Has demonstrated a satisfactory employment performance in his/her occupation for a minimum of three years beyond the customary learning period for that occupation; and
     b. Meets the State Board for Community and Technical Colleges requirements for a professional-technical instructor (see WAC 131-16-080 through -094), or be a subject matter expert, which is an individual, such as a journey worker, who is recognized within the industry as having expertise in a specific occupation; and
     c. Has training in teaching techniques and adult learning styles, which may occur before or within one year after the apprenticeship instructor has started to provide the related technical instruction.
  2. If using alternative forms of instruction, such as correspondence, electronic media, or other self-study, such instruction is clearly defined.

Signature of Training Provider	Print Name
Holly Moore	Holly Moore
Title	**Organization**
Executive Dean	South Seattle College, Georgetown

(If additional training providers, please provide information and signatures on next page.)

SBCTC Program Administrator has reviewed RSI plan and recommendations of the Trade Committee.

Signature of SBCTC Program Administrator	Print Name	Date

☐ SBCTC recommends approval ☐ SBCTC recommends return to sponsor

F100-519-000 RSI - Apprenticeship Related Supplemental Instruction (RSI) Plan Review Glossary of term

F100-521-000 Apprenticeship Related Supplemental Instruction (RSI) Plan Review Criteria

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Additional training provider (if necessary)

Signature of Training Provider	Print Name
Title	Organization

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Signature of Training Provider	Print Name
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Program Sponsor: IAM/Boeing #0154
Skilled Occupational Objective: NC Skin Mill Operator

NOTE: The description of each element must be in sufficient detail to provide adequate information for review by the SBCTC and review committee.

Describe minimum hours of study per year in terms of (check one):

- ☐ 12-month period from date of registration
- ☒ Defined 12-month school year
- ☐ 2,000 hours of on-the-job training

Element/course: **Engineering Drawings**	Planned Hours: 50
Mode of Instruction (please check all that apply): ☒ Classroom ☒ Lab ☐ On-line ☐ Self-study Provided by: South Seattle College/AJAC	
Description of element/course: **Blueprint Reading** This course is an introduction to the skills that are required for interpreting technical drawings and transforming those drawings into manufactured products. After this class students will be able to read and fabricate to Blue Prints specifications, with ADCNs, and DCNs. They will have the ability to read and correctly decode blueprints, sketches, parts lists, layout, and assembly drawings. There will be an emphasis on Flat pattern layout, Inserts, and Rapid prototyping. Theory and application of engineering drawing will be taught, including drawing zones, sketching and block lettering, geometric construction and the relationship of detail, standard, section and auxiliary views. Functions and application of normal, inclined oblique, linear dimensioning, tolerancing, lines and symbols, with emphasis on 3rd angle projection. Students will learn conversions between metric and inch/pound measurements. They will delve into scales, datums, and orthographic projection, examine parts lists and how to navigate and utilize process specifications. Instruction interpreting mechanical/manufacturing blueprints per ASME Y14.5 Standards. Emphasis on practical applications of this standard as applied to reading, interpreting, updating, and troubleshooting engineering production drawings.	

Element/course: **Shop Math**	Planned Hours: 50
Mode of Instruction (please check all that apply): ☒ Classroom ☒ Lab ☐ On-line ☐ Self-study Provided by: South Seattle College /AJAC	
Description of element/course: **Basic Algebra** Perform standard shop computations relating to the dimensions of the work. Relevant mathematical concepts are taken from Algebra, Geometry, and Trigonometry, to help students understand formulas, ratios, and measuring techniques. Basic skills will be reviewed (such as adding, subtracting, multiplying, and dividing). This course includes the evaluation of algebraic expressions, simplifying algebraic expressions, properties of real numbers, solving linear equations and inequalities, simplifying monomial fractions, solving fractional equations, and inequalities. Students will also learn ratio, proportion, percentage, and linear measurements. Students will practice the fundamentals of algebra with regard to application of formulas for cutting speed, RPMs, cutting time, and spur gears.	

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Element/course: **Shop Math**	Planned Hours: 50

Mode of Instruction (please check all that apply):
☒ Classroom ☒ Lab ☐ On-line ☐ Self-study
Provided by: South Seattle College/AJAC

Description of element/course:
Applied Geometry and Trigonometry
This course focuses on the fundamental and applications of geometry and trigonometry. Topics include perimeters, areas, volume, trigonometric ratios and function, right angles, non-right angles and geometric function of circles. Students will discuss relationships of lines, planes. Angles, congruent and similar triangles, polygons and circles while performing geometric and trigonometric functions as they relate to manufacturing and aerospace. Other topics include special triangles and the Pythagorean Theorem.

Students will also start on how lines, circles, tangents point arcs and angle relate.

Element/course: **Advanced Shop Math**	Planned Hours: 40

Mode of Instruction (please check all that apply):
☒ Classroom ☒ Lab ☐ On-line ☐ Self-study
Provided by: South Seattle College

Description of element/course:
Geometry/Pre-trigonometry
This course develops mathematical competencies as applied to machine tool technology. Emphasis is placed on the use of machining formulas by incorporating algebraic and geometric formulas. Topics include machining algebra and geometry.
The apprentice will be able to do the following when this course is complete. Manipulate equations using practical machining formulas. Find machine feeds, speeds, length of belts, and length of band saw blades using algebraic equations. Identify geometric figures as they apply to machine tool technology. Compute angles to the nearest second. Describe how points can be located using arcs and angles in machine tool applications. Relate the use of Pythagorean relations to machine tool operations in layout and location of points. Define the terms that apply to using the circle to find points in layout to include arcs, sections, chords, radii, and circumferences in machining applications. Use geometric figures in inscribed in the circle to locate multiple equally spaced points on the circumference of a circle. Use geometric construction to find center points, divide angles, construct right angles for layout, and to find the center of a circle or arc for machining purposes.

Element/course: **Advanced Shop Math**	Planned Hours: 50

Mode of Instruction (please check all that apply):
☒ Classroom ☒ Lab ☐ On-line ☐ Self-study
Provided by: South Seattle College

Description of element/course:
Trigonometry and Shop Problems
This course develops mathematical competencies with an emphasis on the use of formulas using trigonometric functions, and applied trigonometry.
The apprentice will be able to do the following when this course is complete. Explain how to construct a triangle when the value of one side is known. Define the six trigonometric functions found in machining applications. Explain the use of trigonometric tables. List uses of trigonometric functions in machining. Explain the Cartesian system, how it applies to machine operations, and how to determine the "Z" axis on a machine. Calculate the angle to a given function. Find the function to a given angle. Compute the third angle when one angle and one side of a triangle is given. Determine a point when an arc and an angle are given from a reference point. Solve machining work piece details using trigonometric functions.

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Element/course: **Descriptive Geometry**	Planned Hours: 40

Mode of Instruction (please check all that apply):
☒ Classroom ☒ Lab ☐ On-line ☐ Self-study
Provided by: South Seattle College

Description of element/course:
Descriptive Geometry
This will cover fundamental principles in developing graphical solutions to engineering problems. Topics covered in this course include true length, points on a plane, line intersections, true shapes, revolutions, and developments using successive auxiliary views.
The apprentice will use drafting tools to accomplish the development of auxiliary views using both point projection and folding line methods. Be able to project the following: oblique angled surfaces successive auxiliary views, curves. Identify exact points of intersection and develop various transitional pieces.

Element/course: **Geometric Dimensioning and Tolerancing**	Planned Hours: 50

Mode of Instruction (please check all that apply):
☒ Classroom ☒ Lab ☐ On-line ☐ Self-study
Provided by: South Seattle College/AJAC

Description of element/course:
GD&T
Apprentices will study the theory and application of the use of standard tolerances and GD&T concentrating on geometric dimensioning and its relation to engineering drawings. They will understand the feature control frame and center on basic dimension, form (straightness, flatness, cylindricity, circularity), profile of a line and surface, orientation (angularity, perpendicularity, parallelism), location (position, concentricity, symmetry), and total run out. The apprentice will appraise the maximum material condition and least material condition regardless of feature size. Calculation of true position, bonus tolerance, datums and datum targets, fixed fastener and floating fastener formulas will be examined. Apprentices will learn Rules #1 and #2 as well as the as the use of mylars and PCM.

Element/course: **Machine Shop Theory**	Planned Hours: 40

Mode of Instruction (please check all that apply):
☒ Classroom ☒ Lab ☐ On-line ☐ Self-study
Provided by: South Seattle College

Description of element/course:
Shop Theory
Apprentice will gain an understanding of the concepts of gear cutting, dividing heads, turntables. They will be able to describe various kinds of indexing tasks, the machine accessories that perform them, and which is the best method. Define and calculate lead angels, helix angles for threads and gears. They will identify the shape and purpose of an involute curve and define four major types of gears by shape and purpose, (spur, helical, bevel and worm). Apprentices will calculate gear ratios and RPMs. Be able to define gear terms, (addendum, dedendum, spline, involute spline), common materials gears are made from.
Apprentices will also get an introduction to the processes EDM, laser/water jets and shot and roto peening.

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Element/course: **Machinery's Handbook**	Planned Hours: 45

Mode of Instruction (please check all that apply):
☒ Classroom ☒ Lab ☐ On-line ☐ Self-study
Provided by: South Seattle College

Description of element/course:
Machinery's Handbook
At the completion of this course an apprentice will be able to use the Machinery's handbook to find mathematical formulas to solve algebraic, geometric and trigonometric problems, perform metric conversions. Find specific information on bushings drill jigs and how to select the proper precision gage block for their application. They will be able to locate specific information regarding to bolts, screws, nuts, washers, various types of screw threads and screw thread systems, taps, mechanical properties of materials, lubricants, and the effects of friction on materials.
Apprentices will be able to define terms related to allowances and tolerances. Calculate hole size, shrinkage allowances for specific fits, and the tension for particular fasteners to provide adequate join strength. They will be able to find and select proper precision gage blocks, extract information on drive shafts, major types of bearing for machine elements. Understand the standard machine tapers and where they are used.

Element/course: **Physics**	Planned Hours: 50

Mode of Instruction (please check all that apply):
☒ Classroom ☒ Lab ☐ On-line ☐ Self-study
Provided by: South Seattle College

Description of element/course:
Physics
At the completion of this course an apprentice will be able to define technical measurement terms, terms used to discuss motion, the measurement units used to express mass and weight, concepts of work, energy, and power, *impulse* and *momentum*, terms used in describing rotational motion, terms relating to the properties of solid materials, terms used to describe heat and heat transfer, terms used in describing the characteristics of gases and in thermodynamics, terms used in the field of electrostatics, terms relating to the phenomenon of magnetism, terms relating to induced and alternating currents and terms used in explaining wave motion and sound.
Calculate areas, volumes, static, kinetic and rolling friction forces, moment arm length, resultant torque around and axis, objects center of gravity, unknown quantities involved in rotational motion using known quantities, effects of stress on certain solids, mechanical advantage of a hydraulic press, rate of flow in moving fluids, the linear, areal, and volumetric expansion of various materials in response to temperature changes, the specific gravity of a substance, heat loss or gain as a result of temperature changes, expected efficiency of an engine.

Element/course: **Critical Thinking**	Planned Hours: 10

Mode of Instruction (please check all that apply):
☒ Classroom ☒ Lab ☐ On-line ☐ Self-study
Provided by: South Seattle College

Description of element/course:
Critical Thinking
The apprentice uses critical thinking to write 3 papers. They will research new technologies from internal and external sources, they will then communicate that giving the benefit for flow, cost, safety and applicability to their home shop. They will also write two papers giving feedback to the program, one on the OJT and the other regarding RSI. They have to state what worked for them what did not work for them and state the reasons why then they need to make suggestions on how to improve in those areas.

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Element/course: **Cutters**	Planned Hours: 40
Mode of Instruction (please check all that apply): ☒ Classroom ☒ Lab ☐ On-line ☐ Self-study Provided by: South Seattle College	
Description of element/course: Tool and Cutter Grind The apprentice will get the proper safety information and training regarding the operation of grinding wheels. They will learn how to properly dress and prepare grinding wheels, to choose the correct wheel and recognize when a wheel is not cutting correctly and the use, operation and mounting work on internal grinding machines. They will be able to identify the different types of components used in grinding wheels, high speed steel used in tool and cutter grinding, the different types of cutter coatings and their purpose and the different types of forming tools. They will be able to define the parts of cutters, terms used in tool and cutter grinding and the use of trigonometry to solve cutter geometry problems.	

Element/course: **Metallurgy**	Planned Hours: 45
Mode of Instruction (please check all that apply): ☒ Classroom ☒ Lab ☐ On-line ☐ Self-study Provided by: South Seattle College	
Description of element/course: Metallurgy This apprentice will understand the fundamental knowledge of physical and chemical concepts of metallurgy. This includes discussion of ferrous and non-ferrous metallurgy and metals processing, analysis of destructive and non-destructive testing methods. They will focus on metallurgical issues faced in metals manufacturing. They will be able to use formulas to express the relationship of the expansion of material and how that pertains to the metal. The apprentice will see how the metal changes at a microscopic level and learn how that will influence their choice of cutters and feeds.	

Element/course: **Advanced Math**	Planned Hours: 50
Mode of Instruction (please check all that apply): ☒ Classroom ☒ Lab ☐ On-line ☐ Self-study Provided by: South Seattle College	
Description of element/course: Compound Angles The apprentice will be able to identify different types compound angles. They will be able to compute angles of rotation and angles of tilt of holes axes in rectangular solids. They will sketch, draw, dimension, and label compound angular components within rectangular solids and compute angles of rotation and tilt. Learn to use the unity method for solving these problems. They will learn how to use shop equipment to set up their work to machine the work.	

Element/course: **Programming**	Planned Hours: 30
Mode of Instruction (please check all that apply): ☒ Classroom ☒ Lab ☐ On-line ☐ Self-study Provided by: South Seattle College	
Description of element/course: MasterCam The apprentice learn computer-assisted manufacturing, using Mastercam software. Appretnices will learn three-dimensional computerized drafting techniques to create complex surfaces and solid models, tool path programming for advanced multi-axis machine tools, and applications for CAM systems in manufacturing. They will create Mastercam programs, incorporating wireframe, surface, and solid models for multiaxis machining. They will plan machining operations, select tooling, set parameters, and process Mastercam-generated parts, utilizing computers and CNC machine tools.	

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Apprenticeship Section
PO Box 44530
Olympia WA 98504-4530

Journey Level Wage Rate

From which apprentices' wages rates are computed

TO: Washington State Apprenticeship & Training Council

From IAM/Boeing Joint Apprenticeship Committee
(NAME OF STANDARDS)

Occupations	County(s)	Journey Level Wage Rate	Effective Date:
NC Skin Mill Operator	Pierce/King/Snohomish	$43.00	9/11/2015

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