



ACT[®] WORKKEYS[®] NCRC[®]
MAKING Connections:

CONNECTING CREDENTIALS FRAMEWORK

NATIONAL INSTITUTE FOR METALWORKING SKILLS
Measurement, Materials & Safety Credential
Job Planning, Benchwork & Layout Credential

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SYNOPSIS

In 2017, ACT® and the Corporation for a Skilled Workforce (CSW) completed a joint project to develop a crosswalk between WorkKeys and the beta Connecting Credentials Framework¹. It was hypothesized that the crosswalk could be used in conjunction with the Framework to connect the ACT® WorkKeys® National Career Readiness Certificate® (NCRC®) to other credentials that have been profiled using the Framework. The purpose of this project was to test that hypothesis by profiling two industry occupational credentials with both the ACT profiling process and the Connecting Credential Framework². The results would then be compared to evaluate the accuracy of the initial alignment study. The results of this comparison did validate the initial crosswalk and enables both ACT and CSW to say with a high degree of confidence that any program or certification aligned to the Framework can use the WorkKeys NCRC to predict program readiness. An additional outcome of this research indicates that individuals ideally need to be at a Platinum level WorkKeys NCRC level in order to ensure successful passing of the National Institute for Metalworking Skills' (NIMS) Measurement, Materials, & Safety and Job Planning, Benchwork & Layout certification exams. The Platinum Level WorkKeys NCRC is the only level that ensures an individual has the Level 6 Applied Math skills required. This is the highest WorkKeys NCRC credential attainment level an individual can earn and shows that entry level machinists occupations should be considered 'highly skilled.'

ACT WORKKEYS NCRC

The ACT National Career Readiness Certificate™ (NCRC®) is the most widely adopted foundational skills credential with over 4.3 million individuals earning over the past ten years. The NCRC is based on an individual's performance on three WorkKeys® skills assessments: Applied Math, Graphic Literacy, and Workplace Documents. WorkKeys assessments measure the workplace skills that can affect job performance and measure a range of cognitive skills relevant to any occupation, at any level, and in any industry. Successful completion of WorkKeys assessments can lead to earning an ACT WorkKeys NCRC — a credential that verifies foundational workplace skills. To date over 20,000 employers recognize the value of the NCRC, and many recommend the credential to candidates.

A minimum score of three on all three assessments is the threshold for an NCRC issuance. The certificates are awarded at four levels as determined by the minimum of

three WorkKeys assessment scores earned. The criteria for each certificate level is: Bronze (minimum 3 on each WorkKeys assessment), Silver (minimum 4 on each WorkKeys assessment), Gold (minimum 5 on each WorkKeys assessment), or Platinum (minimum 6 on each WorkKeys assessment). The NCRC provides documentation that individuals demonstrate their skill mastery through assessment scores with the specific skills listed on the back of the certificate. When individual skills are aligned to the skills needed for a job, workers tend to learn job-related tasks more quickly, benefit from on-the-job training, and obtain new knowledge and skills. Conferral of this certificate improves career outcomes for everyone, from new entrants to the workforce to longtime employees—and it enhances employers’ hiring, training, and promotion decisions. ACT has conducted research and documented validity evidence for WorkKeys and the NCRC as a measure of cognitive foundational workplace skills and for their use for a variety of purposes some of which involve high stakes testing.³

CONNECTING CREDENTIAL FRAMEWORK

The Credentials Framework uses competencies as common reference points to help understand and compare the levels and categories of knowledge and skills that underlie degrees, certificates, industry certifications, licenses, apprenticeships, badges and other credentials. The Framework is intended to connect the dots among diverse credentials by using a common language to describe what recipients of each credential should know and be able to do.

Use of the Framework is intended to make it easier to compare credentials, and make it possible to translate the learning gained from one credential toward securing another. By connecting credentials on a common platform, the Framework is designed to help create clear and multiple pathways for students and employers. By illustrating the connections between and across multiple credentials, use of the Framework is intended to help make it easier to understand the competencies associated with any credential and help stakeholders compare and align various credentials.

DEFINING PROFILING

The Connecting Credentials Framework and ACT WorkKeys use the word “profile” in different ways. The Framework defines a profile as a delineation of competency levels across knowledge and skill domains within a credential. Profiles are the foundation for all Framework applications. ACT WorkKeys profiling analyzes the tasks and skill

levels for specific occupations, jobs, and curriculum and links them to the skills measured by WorkKeys assessments.

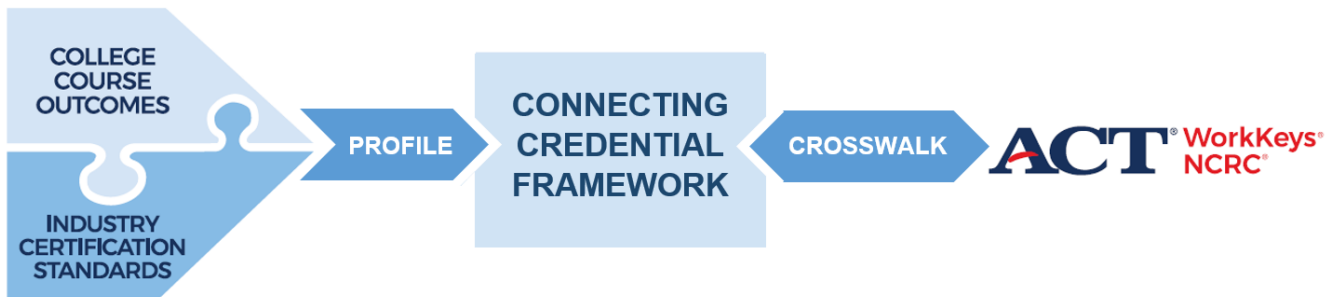
DEVELOPMENT AND FIELD TEST OF CROSSWALK MODEL

In 2017, ACT® and the Corporation for a Skilled Workforce developed a joint project to explore the possibility of a connection between ACT WorkKeys® competencies and the beta Connecting Credentials Framework. A major product of the project was a crosswalk between WorkKeys and the beta Connecting Credentials Framework.



Since this study was completed, the Framework has moved out of beta into its final form for program use without any changes from the beta version used by ACT in conducting the original crosswalk study.

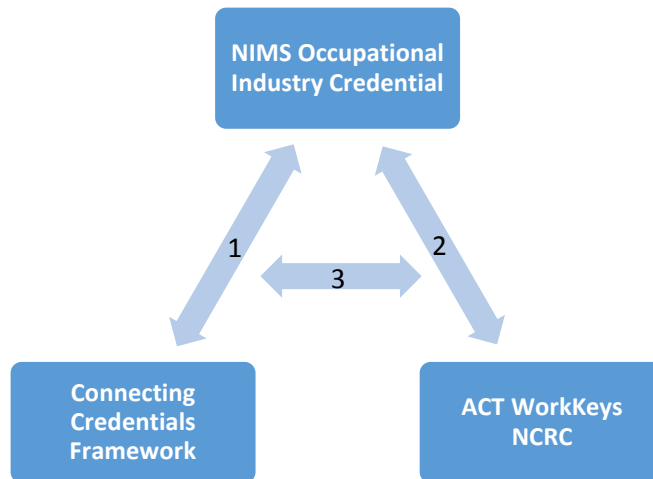
The model was expanded and a field test of the crosswalk was proposed to validate the premise of the Connecting Credentials Framework as a “connector” or “translator” tool between various types of credentials. By creating the crosswalk between the ACT WorkKeys NCRC and Framework, individuals are able to navigate between the two without having to conduct profiles on both.



Field Test of Crosswalk

The team of researchers included Catherine Ross, NIMS Director of Services, Susan Lupo, Corporation for a Skilled Workforce Senior Policy Associate, Cindy Hill, Ph.D., ACT Principal Industrial/Organizational Psychologist. The study consisted of three steps:

1. Creating competency based profiles for two of the NIMS certifications by mapping each certification test blueprint to the Framework.
2. Crosswalk of WorkKeys competencies to NIMS certifications by mapping the WorkKeys competencies to each NIMS certification test blueprint using the ACT WorkKeys profile process.
3. Comparing results of 1 and 2 with respect to validating the Framework/WorkKeys NCRC Crosswalk.



In step three, the results were compared with an initial match of 87% for the Job Planning, Benchwork and Layout credential and 98% for the Measurement, Materials and Safety credential. The surprising finding was that simply going through the process of discussing and comparing the alignment of the two profiles increased the quality of both profiles. After a discussion about the NIMS Job Planning, Benchwork and Layout credential, a 93% match was achieved.

The findings suggest validation of the premise of the Connecting Credentials Framework as a “connector” or “translator” tool between various types of credentials. Individuals can use the crosswalk to navigate between the two without having to conduct profiles on both. This means that any credential listed in the Credential Finder that has been mapped to the Connecting Credentials Framework could also be listed as a connection to WorkKeys.

Proposed Future Study

Now that the WorkKeys NCRC crosswalk to the Connecting Credentials Framework has been verified, the next step is to use the outcomes of this work in a field test. The Right Signals Initiative demonstrated a new credentialing model leveraging the Connecting Credentials Framework that recognized multiple quality credentials to send “the right signals” to employers, students, and colleges about the meaning of these

credentials. Key credentials targeted degrees, certificates, industry certifications, apprenticeships, and badges. CSW and ACT will use the data from the Connecting Credentials Framework alignment studies conducted by three of the Right Signals community colleges and the crosswalk to identify entry WorkKeys scores. It is further proposed that the colleges will then use the WorkKeys NCRC levels determined from the crosswalk as entry into these programs of study. Students' successful completion of the programs will be evaluated by ACT to demonstrate that both the Framework and the NCRC WorkKeys alignment improve program success.

WORKKEYS NCRC ALIGNMENT TO NIMS

A secondary scope of research work conducted by ACT was to align selected NIMS credentials associated with entry level machinists training, because this is one of the critical skill shortage areas cited⁴. ACT and NIMS came together with mutual common goals of conducting a study testing the crosswalk to the four NIMS industry credentials (Measurement, Materials, and Safety; Job Planning, Benchwork and Layout; CNC Milling; and CNC Lathe Operator) associated with the RSN program. However, in beginning the work, the scope of the study was narrowed to two of the four credentials (Measurement, Materials and Safety and Job Planning, Benchwork and Layout) due to the availability of the necessary materials to conduct the crosswalk. ACT was comfortable proceeding in this manner after reviewing NIMS credential attainment data from Wisconsin that showed the Job Planning, Benchwork and Layout had the lowest passing rate and Measurement and Safety had the highest.⁵ The outcomes of the WorkKeys alignments for these two credentials are contained in this paper.

Why NIMS Credentials Selected for Study

Currently there is accelerated advanced manufacturing job growth that include semi-skilled positions in welding, CNC programming, robotics technologies and machinists. The 2015 Skills Gap Report produced by Deloitte and the National Association of Manufacturers states that there will be 3.5 million manufacturing jobs needing to be filled by 2025 of which 2 million will go unfilled due to the skills gap. The report states that 93% of manufacturing executives project that this gap is primarily due to retirements. The gap is further exacerbated by loss of this embedded knowledge due to retirements plus the negative image of manufacturing, lack of necessary STEM skills needed for training success and decline of technical education in traditional education programs. The 2018 significant economic growth in the manufacturing sector has

added 95,000 jobs in the first five months of the year⁶, showing that the rate of manufacturing job expansion is accelerating faster than what has been predicted.

This situation requires solutions that will enable quick training and successful attainment of competencies needed to successfully fill these skilled positions. National portable industry credentials and associated training programs have a proven track record of being able to provide this type of turn-key training provided training candidates are at the necessary foundational skill level to be successful in these short term training programs⁷. ACT WorkKeys NCRC is the most recognized foundational skill credential used by industry and ACT research and validity claims for the NCRC state that;

- (1) WorkKeys assessments that constitute the WorkKeys NCRC measure important job-related cognitive skills that improve an individual's chances of employment, entry into and success in career pathway programs, or attainment of stackable credentials in industry sector credentialing systems and,
- (2) When large numbers of employees possess the skills certified by the WorkKeys NCRC, employers will see more efficient and effective business outcomes such as higher job placement rates, higher productivity, lower turnover rates and lower accident rates.

Findings from WorkKeys Alignment to NIMS

A review of the individual WorkKeys assessment alignment to foundational competencies needed to successfully complete the two NIMS credentials was conducted. The following WorkKeys skills and skill levels are required to perform all the NIMS Job Planning, Benchwork and Layout credential exam tasks:

- Workplace Documents Level 5
- Graphic Literacy Level 6
- Applied Math Level 7

The following WorkKeys skills and skill levels are required to perform all the NIMS Measurement, Materials & Safety credential exam tasks:

- Workplace Documents Level 6
- Graphic Literacy Level 5
- Applied Math Level 7

The following tables provide the number of tasks that require each WorkKeys skill level. However, it is important to note that the only Job Planning, Benchwork and Layout tasks for the theory exam that require Level 7 Applied Math skills are:

- Application of a sine bar for checking angles

- Gage block stacks for creating angles on a given sine plate
- Solid square angularity
- Applying the surface feet per minute formula to find rpm
- Basic trigonometric applications
- Application of diagonals and diameters (largest or smallest square from round stock)
- Materials and cutting speeds (relating to sfm and rpm)

The first two tasks listed above are also required on the Measurement, Materials and Safety exam. A student with Level 6 Applied Math skills could probably learn to perform these seven tasks and successfully complete the exam.

Number of NIMS Job Planning, Benchwork, & Layout Credential Tasks requiring the WorkKeys Skill Level

WorkKeys Skills	Level 3	Level 4	Level 5	Level 6	Level 7	Not Required
Workplace Documents	6	62	13	0	0	1
Graphic Literacy	31	35	3	4	0	9
Applied Math	0	0	16	11	7	48

Number of NIMS Measurement, Materials & Safety Credential Tasks requiring the WorkKeys Skill Level

WorkKeys Skills	Level 3	Level 4	Level 5	Level 6	Level 7	Not Required
Workplace Documents	6	8	33	1	0	0
Graphic Literacy	19	7	6	0	0	16
Applied Math	0	5	9	2	2	30

The outcomes of this research indicates that individuals ideally need to be at a Platinum level WorkKeys NCRC level in order to ensure successful passing of Measurement, Materials, and Safety and Job Planning, Benchwork and Layout assessments. The Platinum Level WorkKeys NCRC is the only level that ensures an individual has the Level 6 Applied Math required. This is the highest WorkKeys NCRC credential attainment level an individual can earn and shows that entry level machinists occupations can be considered 'highly skilled'.

Proposed Future Study

The two NIMS credentials aligned to WorkKeys are part of the credentials earned in the Right Skills Now Program, originally developed by ACT in partnership with the Manufacturing Institute, the education and workforce development arm of the National

Association of Manufacturers (MI/NAM). The intent of the program was to develop a short term training that leveraged the ACT WorkKeys National Career Readiness Certificate for entry into a 16 week computer numerical control (CNC) machining tool training program. Upon completion of the program, students would be prepared to earn National Institute for Metalworking Skills (NIMS) credentials: Measurement, Material and Safety; Job Planning, Benchwork and Layout; CNC Operator – Turning Level 1; and CNC Operator – Milling Level 1. Community colleges in Ohio, Minnesota and Nevada engaged in the RSN initiative when first launched. Further, ACT has completed a success story with General Plug with facilities in Oberlin and Grafton, Ohio. General Plug uses this program in a work-based learning environment to develop its workforce. Also in 2017, MI/NAM turned the RSN program over to NIMS where they sought to reset the program to enable broader use in both credit and non-credit programs and to increase the number of individuals earning NIMS credentials. And a new program, Right Skills Now Plus will be released by NIMS in 2019.

It is proposed that ACT conduct an alignment study to the Right Skills Now program to determine the entry and exit level WorkKeys assessments scores and ensure that the program is incorporating the foundational skills needed to ensure successful program completion and NIMS credential attainment. By understanding the foundational skills required to enter the program, as determined by WorkKeys assessments, and knowing the exit WorkKeys levels needed to successfully attain the four NIMS credentials post program, it is hoped that more students will be better prepared for career success in machinist occupations.

NIMS Job Planning, Benchwork, and Layout Credentialing Exam to Connecting Credentials Framework

NIMS Job Planning, Benchwork, and Layout Theory and Performance Credentialing Exams	Connecting Credentials Framework		ACT WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Theory Exam								
Taper Problems								
Applying taper terminology and trigonometry to set a compound rest to cut a taper on the lathe	3	3	5	4	5	2/3	2	3
Calculating the taper per inch given parameters found in the <i>Machinery's Handbook</i> , page 685, 26 th Edition	3	3	4	4	5	2	2	3
Calculating a taper per foot	2	2	4	4	5	2	2	3
Finding the angle to the centerline when given a taper per foot	3	3	4	4	6	2	2	4
Given a taper per foot, finding the included angle	3	3	4	4	6	2	2	4
Applying a taper per foot formula	3	3	4	4	6	2	2	4
Machinery's Handbook								
Find a tap drill size	2	2	3	4	N/A	1	2	N/A
Keyway and keyseat calculations	3	3	5	4	6	2/3	2	4
Steel identification system (SAE)	2	2	4	4	N/A	2	2	N/A

NIMS Job Planning, Benchwork, and Layout Theory and Performance Credentialing Exams	Connecting Credentials Framework		ACT WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Angle to the centerline of a taper given the taper per foot	2	3	5	4	6	2/3	2	4
Finding thread parameters (minor diameter, pitch diameter, etc.)	2	3	4	5	N/A	2	3	N/A
Speeds and Feeds								
Definition and acronym for surface feet per minute	1	1	5	N/A	N/A	2/3	N/A	N/A
Drilling – how the feed rate is designated	2	2	4	4	6	2	2	4
Applying the surface feet per minute formula to find rpm	3	3	4	4	7	2	2	5
Calculating cutting time	3	3	4	4	6	2	2	4
Calculating the feed rate for a milling operation	3	3	4	4	5	2	2	3
Calculating the rpm for a drilling operation	3	3	4	4	5	2	2	3
Math Applications								
Basic trigonometric applications	3	3	4	4	7	2	2	5
Value of Pi	2	2	4	4	5	2	2	3
Application of diagonals and diameters (largest or smallest square from round stock)	3	3	4	4	7	2	2	5
Metric conversion	3	3	4	4	5	2	2	3

NIMS Job Planning, Benchwork, and Layout Theory and Performance Credentialing Exams	Connecting Credentials Framework		ACT WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Applications of formulas	3	3	4	4	5	2	2	3
Tolerance, Fits, and Allowances								
Converting inch tolerance to the metric equivalent	3	3	4	4	6	2	2	4
Understanding bilateral tolerancing	2	2	4	4	6	2	2	4
Allowance between mating parts for various types of fits	2	2	4	4	5	2	2	3
Assembly with a shrink fit	3	3	4	4	5	2	2	3
Reaming								
Comparing the rpm for reaming and drilling	3	3	5	6	N/A	2/3	4	N/A
Stock allowance for machine reamers	2	2	4	6	N/A	2	4	N/A
Identification of hand reamers	2	2	4	3	N/A	2	1	N/A
Stock allowance for hand reamers	2	2	4	3	N/A	2	1	N/A
Measurement (Semi-precision)								
Scale measurements to 1/100th of an inch	2	2	4	3	N/A	2	1	N/A
Combination set applications	3	3	4	3	N/A	2	1	N/A
Scale measurements to 1/64 th of an inch	2	2	4	3	N/A	2	1	N/A
Application of a plate protractor	3	3	5	4	N/A	2/3	2	N/A

NIMS Job Planning, Benchwork, and Layout Theory and Performance Credentialing Exams	Connecting Credentials Framework		ACT WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Measurement (Precision)								
Divisions around a thimble on a micrometer	2	2	4	4	5	2	2	3
Solid square angularity	2	2	4	4	7	2	2	5
Reading a vernier scale on a caliper	2	2	4	4	N/A	2	2	N/A
Divisions on the spindle of a micrometer	2	2	4	4	N/A	2	2	N/A
Discrimination of a vernier caliper	3	3	5	4	N/A	2/3	2	N/A
Thread Terminology and Tapping								
Tap drill diameter	2	2	N/A	4	N/A	N/A	2	N/A
Basic thread terminology	2	2	4	3	N/A	2	1	N/A
Application of the three wire formula for checking threads	3	3	4	3	5	2	1	3
Types of taps in a tap set	2	2	3	3	N/A	1	1	N/A
Hole preparation for tapping	3	3	4	3	N/A	2	1	N/A
Importance of countersinking the hole to be tapped	3	3	4	3	N/A	2	1	N/A
Tool for removal of a broken tap	2	2	4	3	N/A	2	1	N/A
Basic tapping procedure and tap back-off rationale	3	3	4	4	N/A	2	2	N/A

NIMS Job Planning, Benchwork, and Layout Theory and Performance Credentialing Exams	Connecting Credentials Framework		ACT WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Threads per inch on an inch micrometer	2	2	4	3	N/A	2	1	N/A
Tap used to obtain maximum threads for a blind hole	3	3	4	3	N/A	2	1	N/A
Layout (Semi-precision)								
Layout instrument for layout of circles	2	2	4	3	N/A	2	1	N/A
Layout of angles with a combination set	2	2	4	3	N/A	2	1	N/A
Application of trammel points	3	3	4	3	N/A	2	1	N/A
Purpose and application of layout die	2	2	4	3	N/A	2	1	N/A
Function of a scribe	2	2	4	3	N/A	2	1	N/A
Layout (Precision)								
Precision layout tools used with a surface plate	2	2	4	3	N/A	2	1	N/A
Drilling								
Various drilling operations such as counterboring, countersinking, reaming, etc.	2	2	4	3	N/A	2	1	N/A
Drilling feed rate terms	2	2	4	3	N/A	2	1	N/A

NIMS Job Planning, Benchwork, and Layout Theory and Performance Credentialing Exams	Connecting Credentials Framework		ACT WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Calculating rpm for a drilling operation using the cutting speed formula	3	3	4	3	5	2	1	3
Included angle for countersinking a flat-head screw	2	2	4	3	N/A	2	1	N/A
Milling								
Climb milling and conventional milling characteristics	2	2	4	4	N/A	2	2	N/A
Harder and softer materials and their correlation to cutting speed	2	2	4	N/A	N/A	2	N/A	N/A
Milling a square from round stock	3	3	4	4	6	2	2	4
Milling feed rate calculations	3	3	4	N/A	5	2	N/A	3
Materials								
Materials and cutting speeds (relating to sfm and rpm)	4	4	4	N/A	7	2	N/A	5
SAE steel identification system	2	2	4	N/A	N/A	2	N/A	N/A
Sawing								
Materials that can be cut with an abrasive cutoff saw	2	2	4	N/A	N/A	2	N/A	N/A
Proper hacksawing procedures and strokes per minute	3	3	5	4	5	2/3	2	3

NIMS Job Planning, Benchwork, and Layout Theory and Performance Credentialing Exams	Connecting Credentials Framework		ACT WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Filing								
Proper procedure and tool used to clean a file	2	2	4	3	N/A	2	1	N/A
Filing to a layout line	2	2	4	3	N/A	2	1	N/A
Post processing a surface after filing	2	2	4	N/A	N/A	2		N/A
How to keep a file from loading up	2	2	4	3	N/A	2	1	N/A
Blueprint Reading								
Types of lines used in print reading	2	2	3	3	N/A	1	1	N/A
Functions of each type of line	2	2	3	3	N/A	1	1	N/A
Surface finish symbols and interpretation	2	2	3	3	N/A	1	1	N/A
Machine Theory								
Advantages of carbide-tipped cutters over high-speed steel	2	2	5	3	N/A	2/3	1	N/A
Types of tools that produce holes (drills, saws, etc.)	2	2	4	3	N/A	2	1	N/A
Knurling								
Definition of knurling	2	2	3	N/A	N/A	1	N/A	N/A
Machine used for knurling operations	2	2	4	N/A	N/A	2	N/A	N/A

NIMS Job Planning, Benchwork, and Layout Theory and Performance Credentialing Exams	Connecting Credentials Framework		ACT WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Performance Standard								
Benchwork								
Given a process plan, blueprint, access to hand tools, produce a part with two holes prepared for hand tapping, a hole prepared (reamed) for the press fit of a bushing, and a stud for one of the tapped holes.	4	4	5	6	7	2/3	4	5
Deburr the part, hand drill and hand tap the holes, press in the bushing, and install the stud.	2	2	5	5	6	2/3	3	4
File chamfer.	2	2	5	5	5	2/3	3	3
Layout								
Given a surface plate, surface gage, layout height gage, combination set, scribe, layout ink, prick punch, ball peen hammer, process plan, and part print, layout hole locations, radii, and surfaces matching the specifications.	4	4	5	6	7	2/3	4	5

NIMS Measurement, Materials and Safety Exam to Beta Connecting Credentials Framework

NIMS Measurement, Materials and Safety Credentialing Exam	Connecting Credentials Framework		Act WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Machine Maintenance								
Lubrication of machinery (procedure and checking oil level)	2	2	4	3	N/A	2	1	N/A
Safe method of removing chips from machinery	2	2	4	3	N/A	2	1	N/A
Maintenance procedure when mounting a chuck on the lathe	2	2	4	3	N/A	2	1	N/A
Application of grease guns	2	2	4	3	N/A	2	1	N/A
Researching Maintenance Procedures								
Instructions for general maintenance	3	3	5	5	4	2/3	2/3	2
Finding information for lubrication and maintenance of specific machinery	3	3	5	3	N/A	2/3	1	N/A
Hand Tool Safety and Maintenance								
Hand file safety	2	2	4	3	N/A	2	1	N/A
Characteristics and causes of loading, pinning, scratching, etc.	2	3	5	3	N/A	2/3	1	N/A

NIMS Measurement, Materials and Safety Credentialing Exam	Connecting Credentials Framework		Act WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Tooling Maintenance								
Process plan and tooling maintenance	3	3	5	5	5	2/3	2/3	2/3
Use and application of sulphurized oil	3	3	5	N/A	N/A	2/3	N/A	N/A
Description and cause of finish tears when reaming	3	3	5	N/A	N/A	2/3	N/A	N/A
Gage Blocks								
Calculating gage block stacks	3	3	5	N/A	6	2/3	N/A	3/4
Tools needed to use gage blocks to check heights on a surfaceplate	3	3	5	4	5	2/3	1/2	2/3
Gage block stacks for creating angles on a given sine plate	3	4	5	5	7	2/3	2/3	4/5
Surface Finish								
Surface finish comparison charts	3	3	5	4	5	2/3	1/2	2/3
Interpretation of surface finish symbols	3	3	5	5	N/A	2/3	2/3	N/A
Inspection Plan and Sampling Procedures								
Initial step for developing an inspection plan	3	3	5	4	5	2/3	1/2	2/3

NIMS Measurement, Materials and Safety Credentialing Exam	Connecting Credentials Framework		Act WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Main criteria for determining when a part is rejected	3	3	5	4	5	2/3	1/2	2/3
Definition of a sampling	2	2	4	N/A	N/A	2	N/A	N/A
Rationale for having inspection plans	3	3	5	3	N/A	2/3	1	N/A
Main detail for determining the correct measuring tool to check a dimension	3	3	5	3	N/A	2/3	1	N/A
The contribution of the sampling plan to quality control	3	3	5	N/A	5	2/3	N/A	2/3
Measuring Techniques and Tools								
Application of a sine bar for checking angles	3	4	5	4	7	2/3	1/2	4/5
Feature of a thread checked by a thread micrometer	3	3	5	N/A	N/A	2/3	N/A	N/A
Application of gage pins for checking diameters	3	3	5	N/A	4	2/3	N/A	2
Feature best suited for measuring with a dial bore gage	3	3	5	N/A	N/A	2/3	N/A	N/A
SPC								
Definition of the range applied in SPC	2	2	5	4	4	2/3	1/2	2

NIMS Measurement, Materials and Safety Credentialing Exam	Connecting Credentials Framework		Act WorkKeys NCRC Skills and Levels			CCF Framework Crosswalked to WorkKeys Skills ¹		
	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Chart used to measure variation between parts in a sampling	3	3	5	5	N/A	2/3	2/3	N/A
MSDS Knowledge								
Acronym and definition of the Lower Explosive Limit	3	2	5	4	N/A	2/3	1/2	N/A
MSDS indoctrination and safety meetings	2	2	5	3	N/A	2/3	1	N/A
Acronym and definition of the Threshold Limit Value	2	3	5	N/A	N/A	2/3	N/A	N/A
Basic Shop Safety								
Rationale and proper disposal of rags and wipes	2	2	4	N/A	N/A	2	N/A	N/A
Acronym for government agency which regulates safety and health requirements for industry	2	2	4	N/A	N/A	2	N/A	N/A
First course of action if materials (solids) become lodged in the eye	1	1	3	3	N/A	1	1	N/A
Safety hazards of long hair, loose clothes, and jewelry	1	1	3	3	N/A	1	1	N/A
Proper technique for lifting	1	1	3	3	N/A	1	1	N/A

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Personal Protective Equipment (PPE)								
Equipment used when materials are stored overhead or hoists or cranes are utilized	1	1	3	3	N/A	1	1	N/A
Basic PPE for common machine tools such as lathes, mills, and grinders	1	1	3	3	N/A	1	1	N/A
Machine Safety								
Safety practices for milling machines	2	2	3	N/A	N/A	1	N/A	N/A
Tapping and Threading – Process Adjustment and Improvement								
Causes of tapped holes being too tight or too loose	3	3	5	N/A	N/A	2/3	N/A	N/A
Percentage of thread engagement	3	3	5	N/A	N/A	2/3	N/A	N/A
Grinding – Process Adjustment and Improvement								
Grinding long slender parts and flatness concerns	3	3	5	N/A	4	2/3	N/A	2

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	Knowledge	Specialized Skills	Workplace Documents	Graphic Literacy	Applied Math	Workplace Documents	Graphic Literacy	Applied Math
Milling – Process Adjustment and Improvement								
Machining tough material causing excessive tool wear	3	3	5	3	5	2/3	1	2/3
Procedures for machining slots	3	3	5	3	N/A	2/3	1	N/A
Drilling – Process Adjustment and Improvement								
Drill breakage related to rpm and feed rate	3	3	5	3	5	2/3	1	2/3
Corrective action for oversized reamed holes	3	3	5	N/A	4	2/3	N/A	2
Fits and Allowances								
Allowances for various fits (reference the Machinery's Handbook)	3	3	5	3	5	2/3	1	2/3
Rationale for Process Adjustment and Improvement								
Reason to adjust and improve	4	4	6	5	6	4/5	2/3	3/4

References

1. "ACT WorkKeys NCRC Crosswalk to Beta Connecting Credential Framework", Dr. Cindy L. Hill and Debra Lyons, ACT, 2017: <https://www.act.org/content/dam/act/unsecured/documents/NCRC-Crosswalk-Research-2017-09.pdf>
2. The beta Connecting Credential Framework was validated by field testing and the 'beta' was removed in late 2017.
3. "A Summary of ACT WorkKeys Validation Research", Mary LeFebvre, ACT Research Report Series 2016-4
4. Skill Shortage is a 'Crisis' for Tool and Die workers, OEMs American Machinist: <https://www.americanmachinist.com/cutting-tools/skills-shortage-crisis-tool-and-die-makers-oems>
5. National Metalworking Institute reports that since 2015 through early 2018, approximately 1200 NIMS credentials were issued of which 87% were in Measurement, Materials and Safety; Job Planning, Benchwork and Layout; CNC Mill Operation and CNC Lathe Operation. The attainment results in percent are showing below:
 - 37% Measurement, Materials and Safety
 - 25% CNC Mill Operations
 - 22% CNC Lathe Operations
 - 3% Job Planning, Benchwork and Layout
6. Washington Post, September 2018: https://www.washingtonpost.com/news/wonk/wp/2018/06/01/u-s-economy-continues-its-hiring-spree-and-is-projected-to-add-200000-jobs-in-may/?utm_term=.8514193d81a4
7. "Making a Market for Competency-based Credentials", Nancy LaPrade, Dr. Keith Bird, Larry Good, Jeanine LaPrad, Taryn McFarlane and Chelsea Farley, Corporation for a Skilled Workforce, 2014