

US Bureau of Labor Statistics Officially Recognizes Calibration Occupations

AN ODYSSEY SPANNING TWO DECADES

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ON JULY 22, 2016, the US Bureau of Labor Statistics (BLS) published their second federal register denoting proposed changes and additions for the upcoming 2018 Standard Occupational Classification (SOC) system. The SOC is the official listing of occupations recognized by the US Government. The SOC is the basis for categorizing citizen occupations for the US census as well as determining which occupations are contained in the BLS's Occupational Outlook Handbook (OOH). The following is from the second federal register:

'Significant updates were made to the management, business, finance, information technology, engineering, social science, education, media, healthcare, personal care, extraction, and transportation occupations. Among the occupations new to the proposed structure are "Project Management Specialists" (13-1082), "Sustainability Analysts" (13-1191), "Financial Risk Specialists" (13-2054), "Data Scientists" (15-2051), "Calibration Technologists and Technicians" (17-3028), ...'

The proposed 2018 SOC addition of Calibration Technologists and Technicians is the first time the BLS officially recognized calibration professionals. This milestone for the profession was made possible through the efforts of hundreds of volunteers. Readers may remember an initiative spearheaded by American Society for Quality (ASQ), Measurement Quality Division (MQD), NCSL International (NCSLI), and Measurement Science Conference (MSC) to get Metrologist, Calibration Engineer and Calibration Technician occupations included in the 2010 SOC. This initiative involved volunteers participating in job analysis surveys, submitting job descriptions, helping draft and review the proposal, etc. These efforts yielded a +30-page proposal that was submitted to the SOC. Unfortunately, the SOC made the recommendation to reject this proposal citing the following¹:

'Response to Comments on 2010 SOC: Multiple Dockets on Metrology-Related Workers:

Multiple dockets requested new detailed occupations, or modifications to existing SOC definitions, in order to improve classification of metrology-related workers. Proposed new occupations included: Calibration Engineers, Calibration Technicians, Instrument Engineers, Instrument Technicians, Metrologists, Metrologists and Calibration Engineers, Metrology Engineers, Metrology Specialists, and Quality Engineers.

The SOCP did not accept the recommendations for new detailed occupations based on Classification Principle 1 which states that occupations are assigned to only one occupational category and Classification Principle 9 on collectability. Metrology and calibration functions or tasks may be performed by workers in several occupations, such as Electrical Engineers, Industrial Engineers, Mechanical Engineers, Aerospace Engineering and Operations Technicians, Electrical and Electronic Engineering Technicians, Electro-Mechanical Technicians, Industrial Engineering Technicians, and Mechanical Engineering Technicians. The number of workers performing metrology and calibration tasks as their primary activity is not substantial enough to support new detailed occupations.

The SOCP reviewed and modified definitions for engineers, engineering technicians, and production workers, to clarify coverage of metrology and calibration tasks. Also, the SOCP recommended removing "Calibrators" from the title of 51-2093 "Timing Device Assemblers and Adjusters".' ¹ www.bls.gov/soc/2010_responses/response_multiple_docket_4.htm

So how did the new 2018 SOC proposal overcome this 2010 SOC mindset?

In early 2015 I received an email from Craig Gulka, NCSL International's Executive Director, asking if it was too late to submit a proposal to add Metrologists, Calibration Engineers and Calibration Technicians to the upcoming 2018 SOC (the deadline for submission had passed three months prior). I contacted the chair of SOC engineering occupations and was able to negotiate approval to submit a proposal provided it was received within the next three weeks. Three weeks! It had taken nearly three months and scores of volunteers to draft and review the 2010 SOC proposal. If there was to be a fighting chance to meet this deadline a new proposal would need to be created ASAP. This new proposal would need to address the following reasons for prior rejection;

1. Workers performing metrology and calibration tasks as their primary activity is not substantial (unique) enough to support new detailed occupations, and that metrology occupations are dispersed across many industries i.e. uniqueness of tasks
2. The number of workers (population) performing metrology and calibration tasks as their primary activity is not substantial enough to support new detailed occupations i.e. population of metrology works

TO CUT TO THE CHASE, the new proposal would need to build the case for uniqueness and adequate population. I began researching the other occupations SOC administrators referenced in their ‘Response to Comments on 2010 SOC’. After much contemplation, I determined it was the convoluted use of the term calibration which was giving the perception of non-uniqueness. The job descriptions for some of these other occupations included the term calibration denoting an adjustment task, not a metrological task. Primed with this insight I started drafting the 2018 SOC proposal using the VIM (International Vocabulary of Metrology) as the foundation for the contention of uniqueness. The following are some of the VIM excerpts used in the proposal:

Calibration: Operation that, under specified conditions, establishes a relation between the quantity values with measurement uncertainties provided by measurement standards ...

NOTE 1: A calibration may be expressed by a statement, calibration function, calibration diagram, calibration curve, or calibration table ...

NOTE 2: Calibration should not be confused with adjustment of a measuring system ...

Adjustment of a Measuring System: Adjustment is a set of operations carried out on a measuring system so that it provides prescribed indications corresponding to given values of a quantity to be measured

NOTE 1 Types of adjustment of a measuring system include zero adjustment of a measuring system, offset adjustment, and span adjustment (sometimes called gain adjustment). Page 4

NOTE 2 Adjustment of a measuring system should not be confused with calibration, which is a prerequisite for adjustment

As a result of the proposal’s logical contention for the metrological use of the term calibration SOC administrators proposed the following 2018 SOC changes (blue square outlines) for other occupations;

detailed	17-3021	Aerospace Engineering and Operations <u>Technologists and Technicians</u>	Operate, install, <u>calibrateadjust</u> , and maintain integrated computer/communications systems, consoles, simulators, and other data acquisition, test, and measurement instruments and equipment, which are used to launch, track, position, and evaluate air and space vehicles. May record and interpret test data.
detailed	17-3023	Electrical and Electronics Electronic Engineering <u>Technologists and Technicians</u>	Apply electrical and electronic theory and related knowledge, usually under the direction of engineering staff, to design, build, repair, <u>calibrateadjust</u> , and modify electrical components, circuitry, controls, and machinery for subsequent evaluation and use by engineering staff in making engineering design decisions. Excludes “Broadcast Technicians” (27-4012).
detailed	17-3024	Electro-Mechanical <u>and Mechatronics Technologists and Technicians</u>	Operate, test, maintain, or <u>calibrateadjust</u> unmanned, automated, servo-mechanical, or electromechanical equipment. -May operate unmanned submarines, aircraft, or other equipment <u>at worksites to observe or record visual information at sites</u> such as oil rigs, <u>crop fields, buildings, or for similar infrastructure</u> , deep ocean exploration, or hazardous waste removal. -May assist engineers in testing and designing robotics equipment.
detailed	17-3027	Mechanical Engineering <u>Technologists and Technicians</u>	Apply theory and principles of mechanical engineering to modify, develop, test, or <u>calibrateadjust</u> machinery and equipment under direction of engineering staff or physical scientists.

Fig. 1.0 Preliminary 2018 SOC definitions with changes tracked

After establishing the metrological definition of the term ‘calibration’ the next uniqueness proposal step was to identify tasks performed only by metrology and calibration workers. The following denotes some of these tasks:

- Create definitions for measurement units in terms of naturally occurring physical phenomena i.e. volt, second, etc., or artifacts of international consensus i.e. kilogram
- Create physical devices (measurement standards) which implement (realize) measurement unit definitions
- Create and execute procedures (techniques) for insuring measurement standards fulfillment (realization) of measurement unit definitions
- Develop and execute methodologies for determining the performance of primary measurement standards as compared to the performance of working measurement standards (e.g. calibration procedures for standards)
- Develop and execute methodologies for determining the performance of working measurement standards as compared to the performance of measurement devices (e.g. calibration procedures for measurement devices)
- Authenticate calibration traceability of measurement standards (needed to comply with international mutual recognition agreements to insure universal expectance of measurement results)
- Conduct uncertainty analysis of measurement (calibration) processes
- Evaluate primary measurement standards to determine their adequacy/suitability in determining the performance of working measurement standards i.e. determine if primary measurement standards have the necessary attributes such as precision, repeatability, reproducibility, etc. needed to calibrate working measurement standards
- Evaluate working measurement standards to determine their adequacy/suitability in determining the performance of measurement devices i.e. determine if working measurement standards have the necessary attributes such as precision, repeatability, reproducibility, etc. needed to calibrate measurement devices

The aforementioned tasks were helpful in creating short job descriptions necessary for proposal submittal. The following are the proposal’s job descriptions:

METROLOGIST AND CALIBRATION ENGINEER

Apply measurement science, mathematics, physics, and engineering principles in defining and implementing definitions of measurement units by means of measurement standards. Create and execute procedures and techniques for calibrating and maintaining measurements standards. Authenticate calibration traceability of measurement standards and perform uncertainty analysis of measurement processes.

May develop and/or design and support measurement systems, processes, and procedures based on analysis of measurement problems, accuracy and precision requirements. Use statistics to analyze measurement standards and processes. Monitor compliance with calibration laboratory and/or departmental quality systems. Develop software to assist in calibration laboratory and/or departmental processes. May perform laboratory and/or departmental administration and management.

CALIBRATION TECHNICIAN

Apply knowledge of measurement science, mathematics, physics, and electronics in creating and executing procedures and techniques for calibrating measurement devices. Authenticate calibration traceability of measurement devices. Determine measurement standard suitability for calibrating measurement devices.

May perform corrective actions to address identified calibration problems. Adapt equipment, measurement standards, and procedures to accomplish unique measurements. Maintain and calibrate measurement standards. Perform laboratory and/or departmental housekeeping.

Note: Metrologists and Calibration Engineers may be tasked in managing the activities of less senior Metrologists and calibration engineers as well as calibration technicians.

Having completed the ‘uniqueness’ portion of the proposal, the ‘population’ portion of the proposal needed to be created. The 2010 SOC proposal had addressed metrology and calibration worker population using numbers inferred from professional association membership, conference attendance, student enrollment in Metrology based programs, etc. One must remember that unless an occupation is recognized by the SOC, government compiled population demographics for an occupation is non-existent making it extremely difficult to obtain these numbers. Given that the 2010 SOC population contention was rejected by SOC administrators, a new source for determining metrology and calibration worker population was needed. After much pondering I hit on a solution, social media! LinkedIn, being a business-related social network, contains thousands of individual profiles with their occupational titles. The following table show the results of a LinkedIn search for Calibration Technicians, Calibration Engineers and Metrologists as well as other similar occupations that are recognized by the SOC.

Occupation	Pop.	Occupation	Pop.	Occupation	Pop.
Calibration Technicians	10,268	Calibration Engineers	12,105	Metrologists	4,622
Electronics Engineering Technicians	10,941	Computer Hardware Engineers	15,057	Hydrologist	7,912
Electro Mechanical Technicians	6,085	Agricultural Engineers	8,505	Geographer	4,339
Environmental Engineering Technicians	4,511	Marine Engineers & Naval Architects	2,542	Prosthodontics	3,106

To further substantiate these LinkedIn numbers a comparison was presented contrasting these numbers to published OOH 2012 populations.

Occupation	LinkedIn Pop.	OOH Pop. 2012
Environmental Engineering Technician	4,511	19,000
Electro Mechanical Technician	6,085	17,300
Computer Hardware Engineer	15,057	83,300

Comparing these numbers one may infer OOH occupation numbers are likely to be greater than LinkedIn occupation numbers. Following this train of thought, occupation numbers for metrology and calibration workers are likely understated as reported by LinkedIn.

The aforementioned 'uniqueness' and 'populations' aspects of the proposal were combined with other SOC proposal requisites which were not contested in the 2010 SOC proposal (updated to reflect the current state of affairs such as available Metrology based academic programs) to complete the 2018 SOC proposal draft. This draft was shared with interested parties from ASQ, NCSL International, MSC, etc. in order to obtain feedback and incorporate recommended changes. The final draft was submitted to the SOC on April 3, 2015 two days before the three-week deadline (and yes, it took over a year for SOC administrators to published their recommendations). The following is the official SOC response to the 2018 SOC proposal;

Docket Number 1-1311 -- Metrologists and Calibration Engineers; Calibration Technicians (17-2000, 17-3000) Docket 1-1311 requested new detailed occupations for (1) Metrologists and Calibration Engineers and (2) Calibration Technicians. The SOCPC did not accept the recommendation to add Metrologists and Calibration Engineers based on Classification Principle 9 on collectability. However, the SOCPC did accept the recommendation to add Calibration Technicians and proposes establishing a new code for this occupation, 17-3028 Calibration Technologists and Technicians, and removing mention of calibration duties from the appropriate 2010 SOC occupations.

The SOC Classification Principle 9 reads as follows;

The U.S. Bureau of Labor Statistics and the U.S. Census Bureau are charged with collecting and reporting data on total U.S. employment across the full spectrum of SOC major groups. Thus, for a detailed occupation to be included in the SOC, either the Bureau of Labor Statistics or the Census Bureau must be able to collect and report data on that occupation.

The following is the SOC's proposed job description for Calibration Technologists and Technicians;

Create and execute procedures and techniques for calibrating measurement devices, by applying knowledge of measurement science, mathematics, physics, and electronics, sometimes under the direction of engineering staff. Authenticate calibration traceability of measurement devices. Determine measurement standard suitability for calibrating measurement devices. Adapt equipment, measurement standards, and procedures to accomplish unique measurements. May perform corrective actions to address identified calibration problems.

The SOC will be accepting comments on their 2018 SOC recommendations through 2016 with their final recommendations due for completion late 2016. MQD leadership is posed to launch an initiative to solicit from metrology and calibration workers, Metrology associations and other interested parties their comments / recommendations regarding the exclusion of Metrologists and Calibration Engineers from 2018 SOC consideration as well as the SOC's proposed job description for Calibration Technologists and Technicians ... stay tuned.

So what is the big deal about the US Government officially recognizing the calibration occupation?

The following are some of the benefits:

- Population demographics for understanding trends i.e. people entering/ exiting the occupation
- Population demographics for making better informed decisions such as:
- Location / re-location for businesses dependent on local metrological support
- Location for conferences, seminars, training, education programs, etc.
- Resource allocation for public relations and marketing
- Standardized categorization of workers i.e. metrology and calibration workers not lumped with other occupations and their associated skill sets, education requirements, pay scales, etc.
- Standardize job descriptions across industry and a company's business units

I believe by far the biggest benefit to the calibration profession is inclusion of the occupation in BLS's OOH. The OOH is the premier resource used by counselors and job placement professionals to inform students and prospective job candidates about an occupation's education requirements, required skill sets, prospective job growth, salary ranges, etc. The following is the OOH's website for electrical and electronics engineering technicians:

Search Handbook

OCCUPATIONAL OUTLOOK HANDBOOK

Architecture and Engineering >
EN ESPAÑOL

Electrical and Electronics Engineering Technicians

Summary | What They Do | Work Environment | How to Become One | Pay | Job Outlook | State & Area Data | Similar Occupations | More Info

Summary

Quick Facts: Electrical and Electronics Engineering Technicians	
2015 Median Pay	\$61,130 per year \$29.39 per hour
Typical Entry-Level Education	Associate's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2014	139,400
Job Outlook, 2014-24	-2% (Decline)
Employment Change, 2014-24	-2,800

What Electrical and Electronics Engineering Technicians Do
 Electrical and electronics engineering technicians help engineers design and develop computers, communications equipment, medical monitoring devices, navigational equipment, and other electrical and electronic equipment. They often work in product evaluation and testing, using measuring and diagnostic devices to adjust, test, and repair equipment. They are also involved in the manufacture and deployment of equipment for automation.



Electrical and electronics engineering technicians use diagnostic devices to adjust, test, and repair equipment.

This type of public domain information will help spread the word about the calibration profession to folks making education / employment career decisions. So you see, getting the US Government to officially recognize the calibration occupation is kind of a big deal.