NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

JULY 2023

PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: METROLOGY TECHNICIAN

LEVEL: NTA 6

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ABBREVIATIONS

A	Ampere
CBET	Competency Based Education and Training
CD	Candela
K	Kelvin
Kg	Kilogram
M	Meter
Mol	Mole
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
S	Second
TET	Technical Education and Training
TVET	Technical and Vocational Education and Training

GLOSSARY OF TERMS

Circumstantial Knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues.
Competence:	The ability to use knowledge, understanding, practical, and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based Education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".
Educational/Training Programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks – essentially the same tasks are performed by all employees having the same title. (Example: baker)
Occupational Area:	This is a broad grouping of related jobs. (Example: food service)
Occupational Competence:	The application of knowledge and skills that consistently meet the standards required by the work context.
Occupational Standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as a performance tool of assessment of the prescribed outcomes.
Occupational/Job Analysis:	A process used to identify the tasks that are important to employees in any given occupation**.**
Performance Criteria:	Indicate expected end results or outcomes in the form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a

	composite of three completely interdependent components: cognitive, affective, and psychomotor.
Standards:	A set of statements, which if proved true under working conditions, means that an individual is meeting an expected level and type of performance.
Task Analysis:	The process of analysing each task to determine the steps, circumstantial knowledge, attitudes, performance standards, tools and materials needed, as well as safety concerns required for the employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, and consists of two or more definite steps that leads to a product, service, or decision.
Underpinning Knowledge:	Crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
Verification Process:	The process of having experts review and confirm the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.

1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical and Vocational Education and Training of Tanzania has begun the job of drafting Occupational Standards that will eventually be adopted as National Occupational Standards for TET in order to ensure that it meets the needs of the labour market and the country's economic agenda.

National Occupational Standards (NOS) are performance criteria that are matched with labour market demands. Each National Occupational Standard describes functions, performance standards, and knowledge/understanding for one important function or task. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruiting, supervision, and appraisal, as well as TET standards. They're also helpful for benchmarking and harmonizing qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current and consistent in delivery across all public and private institutions.

However, it must be noted that, Occupational Standards and Training Standards/Qualifications Standards are different. Occupational Standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical circuits, performs fault in electrical wiring, etc.) and they are usually defined by employers following procedures agreed upon by all stakeholders. Education and Training standards are developed from the activities defined in occupational standards, and they include learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him or her to function at an agreed level in an occupation. Education and Training standards are used to define curricula in training institutions. It is however critical that there must be a direct link between the Occupational Standards and the training standards to respond to demands of the labour market.

In TET delivery, Tanzania adopted the Competence Based Education and Training (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the Occupational Standards. Occupational Standards are thus the starting point for developing competency-based training (CBET) programmes. TET institutions will be required to benchmark their curricula with relevant Occupational Standards.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training (TET).

The Metrology Technician Occupation has its own set of occupational standards. The document explains how the Occupational Standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0. OCCUPATIONAL STANDARD DEVELOPMENT PROCESS

The Occupational Standards development process began with an examination of major documents that guide Tanzanian skill development. The *10-year National Skills Development Strategy (2016-2026)* was one of the documents reviewed, and it outlined six (6) economic sectors that should be prioritized when developing skills development programmes.

These sectors include: Transport and Logistics, Tourism and Hospitality, Agribusiness, Construction, Energy and ICT. NACTE labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a workshop comprised of experts and educators with substantial knowledge and experience in the occupation conducted an occupational analysis utilizing the DACUM approach to produce the occupational profile. The analysis resulted in DACUM Charts, which are attached as **Appendix 1** to this document.

The Occupational Standards were then developed. Experts in Occupational Analysis and the Development of Occupational Standards facilitated the workshop. Interviews, online surveys, and a stakeholder forum were used to validate the Occupational Standards. Engineers, supervisory technicians on the job, and experienced Metrology Technicians were key informants in the survey to discover occupational trends. The information was used to gain insight from the workplaces regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation. A total of ... online surveys were completed by experts from the labour market across the country. Apart from the survey aiding in defining the scope for the occupational analysis, they also served to engage a wide cross-section of experts in the occupation. Apart from this, the stakeholders' forum was attended by ... participants from different parts of the country representing various companies.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR METROLOGY TECHNICIANS

The standards cover a broad range of duties and tasks that can be performed by a Metrology Technician. However, the occupational standards are not meant to replace individual job descriptions.

Instead, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Metrology Technician may perform tasks in a number of key areas of the occupational standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

Metrology Technicians are supervised by Metrology Engineers to inspect, use, calibrate, repair, verify, and maintain measuring instruments and systems. In the metrology room, technicians can apply metrological standards and standardization skills to promote quality control and conformity assessment. Generally, the Metrology Technician performs the following responsibilities:

a) Measurement of geometric quantities

b) Measurement of mechanical quantities

c) Measurement of temperature quantities

d) Measurement of electromagnetic quantities

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA 4, 5 and 6.

4.0. VALID PERIOD

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

5.0. OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR METROLOGY TECHNICIAN - NTA 6

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF GEOMETRIC QUANTITIES	**DUTY NO.**	601
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR SURFACE ROUGHNESS MEASUREMENT	**TASK NO.**	6011
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate interference microscopes, light-section microscopes, surface roughness comparison specimens, and stylus surface roughness measuring instruments in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineers. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Spectrophotometer, four-level gauge block, cross-line graticule, and universal tool microscope; 3. Linear scale; 4. Stylus surface roughness measuring instrument (surface roughness comparison specimen standard instrument); 5. Workbench; 6. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty.

5. Use a spectrophotometer to verify the characteristics of the interference filter of the interference microscope; 6. Use a universal tool microscope to verify the indication error of the micrometer eyepiece of the interference microscope; 7. Use a four-level gauge block with a size of no less than 5mm and a cross-line graticule to verify the imaging quality of the optical system of the interference microscope, the relative position of the workbench and the primary optical axis, and the characteristics of the auxiliary imaging device; 8. Use a universal tool microscope to verify the indication error of the micrometer eyepiece of the light-section microscope; 9. Use a linear scale with a graduation value of 0.01mm and a dynamometer to verify the displacement of the object side image caused by a lateral force of 20N on the bracket of the light-section microscope; 10. Use a stylus surface roughness measuring instrument to verify the indication error, repeatability, and residual profile of the surface roughness of the surface roughness comparison specimen; 11. Use specific calibration methods to calibrate the stylus surface roughness measuring instrument, including the circular arc radius and angle of the sensor stylus tip, the straightness of the sensor sliding trajectory, residual profile, indication error, indication repeatability, and indication stability; 12. Record verification/calibration measurement values or conclusions; 13. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 14. Issue verification/calibration reports; 15. Maintain the standard instruments and supporting equipment.	**2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The standard for defining surface profiles; 2.2 The measuring method for surface roughness. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The requirements for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of surface roughness type metrological instruments.

CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF GEOMETRIC QUANTITIES	**DUTY NO.**	601
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR GAUGE MEASUREMENT	**TASK NO.**	6012
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate feeler gauges, conical gauges, and plain limit gauges in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Surface roughness comparison specimen, and length measuring instrument; 3. Taper measuring instrument, and universal tool microscope; 4. Roundness measuring instrument, knife straight edge, and optical meter; 5. Workbench; 6. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Feeler gauge: Use a surface roughness comparison specimen to verify the surface roughness of the working face; use a length measuring instrument to verify thickness deviation and curvature;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The principle of using feeler gauges, conical gauges, and plain limit gauges;

4.2 Conical gauge: Use a taper measuring instrument to verify the taper angle error of the plug gauge; use a universal tool microscope to verify the size of the ring gauge; 4.3 Plain limit gauge: Use a surface roughness comparison specimen to verify the surface roughness of the working face; use tools such as a roundness measuring instrument, knife straight edge, and optical meter to verify the shape and position errors of the gauge; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.2 The methods for distinguishing the three major categories of plain limit gauges. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of gauge type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF GEOMETRIC QUANTITIES	**DUTY NO.**	601
TASK TITLE	VERIFICATION/CALIBRATION OF CONVENTIONAL LENGTH MEASURING INSTRUMENTS	**TASK NO.**	6013
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate optical meters, tool microscopes, length measuring machines, digital altimeters, metallographic microscopes, and spherometers in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Slotted gauge block, dynamometer or weight, and force measuring device; 3. Gauge block, and laser interferometer; 4. Electronic dynamometer, granite surface plate, and micrometer dial; 5. Standard glass linear scale; 6. Standard spherical template, and plane optical flat; 7. Workbench; 8. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Optical meter: Use slotted gauge blocks to verify the adjustability of the workbench, and the verticality of the fixed work surface and the	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles**

measurement axis, etc.; use a dynamometer or weight to verify force measurement; use gauge blocks to verify the work reliability of workbench, etc.; 4.2 Tool microscope: Use specific calibration methods to verify the appearance, flatness, reading device indication error, hysterisis error, etc. of the tool microscope; 4.3 Length measuring machine: Use gauge blocks as auxiliary tools to verify the possibility of workbench adjustment, indication error, etc.; use a laser interferometer to calibrate the indication error; 4.4 Digital altimeter: Use an electronic dynamometer to calibrate the measuring force project; use a granite surface plate and three angle square to verify verticality, indication variability, and indication error; 4.5 Metallographic microscope: Use a standard glass linear scale to calibrate the relative deviation of the left and right field of view center, objective magnification error, indication error, and other items of a binocular microscope; 4.6 Spherometer: Use a standard spherical template to measure the physical parameters of the spherometer; use a plane optical flat to measure the ring radius, and verify the relative error of spherical curvature radius measurement, etc.; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	The person performing this task must be able to explain the following principles: 2.1 The measuring principle of optical meters; 2.2 The methods of measuring the length and angle of parts using tool microscope imaging and axial cutting methods, and measuring the shape of parts using Cartesian or polar coordinate methods; 2.3 The measuring principle of spherometers. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of conventional

	length measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF GEOMETRIC QUANTITIES	**DUTY NO.**	601
TASK TITLE	VERIFICATION/CALIBRATION OF COORDINATE MEASURING INSTRUMENTS	**TASK NO.**	6014
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate coordinate measuring instruments, and image measuring instruments in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Detection ball and two-dimensional target; 3. Circular target, linear scale, or two-dimensional mask plate; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Coordinate measuring instrument: Use detection balls to verify detection errors, multi-probe detection errors, four-axis errors, etc.; use two-dimensional targets to verify images and two-dimensional probe detection errors; 4.2 Image measuring instrument: Use a circular target to verify its detection	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The composition and measuring principle of coordinate measuring machines; 2.2 The composition and measuring principle of image measuring machines.

error; use a linear scale or two-dimensional mask plate to verify dimensional measurement errors, etc.; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of coordinate measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF GEOMETRIC QUANTITIES	**DUTY NO.**	601
TASK TITLE	VERIFICATION/CALIBRATION OF GEAR MEASURING TOOLS	**TASK NO.**	6015
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate micrometers for measuring root tangent lengths of gear teeth, and gear tooth calipers in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Optical flat, gauge block, and optical meter; 3. Tool microscope; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Micrometer for measuring root tangent lengths of gear teeth: Use an optical flat to verify the flatness of the surface; use a gauge block to verify the indication error; use an optical meter to verify the size deviation and size variation of the measuring rod for calibration;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of micrometers for measuring root tangent lengths of gear teeth; 2.2 The measuring principle of gear tooth calipers.

4.2 Gear tooth caliper: Use a tool microscope to calibrate the marking width of the ruler and the difference in marking width; use a gauge block, flat plate, or optical flat to verify the indication variability, zero error, etc.; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of gear type measuring instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF GEOMETRIC QUANTITIES	**DUTY NO.**	601
TASK TITLE	VERIFICATION/CALIBRATION OF THREAD MEASURING TOOLS	**TASK NO.**	6016
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate thread micrometers, and cylindrical thread compasses in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Tool microscope, and professional flat probe and spherical probe; 3. Length measuring instrument, profilometer, and coordinate measuring machine; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Thread micrometer: Use a tool microscope to verify the width of the graduated line, the size of the conical probe, and the angle of the working face of the measuring rod for calibration; use professional flat and spherical probes to verify the indication error of the micrometer head;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of thread micrometers; 2.2 The measuring principle of cylindrical thread compasses.

4.2 Cylindrical thread compass: Use a length measuring instrument to calibrate the simple pitch diameter; use a profilometer to calibrate the screw pitch and thread angle; use a coordinate measuring machine to verify major/minor diameters, virtual pitch diameters, etc.; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of thread type measuring instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

<table>
<tr><td>OCCUPATION</td><td>METROLOGY TECHNICIAN</td><td>OCCUPATION CODE</td><td></td></tr>
<tr><td>DUTY TITLE</td><td>MEASUREMENT OF GEOMETRIC QUANTITIES</td><td>DUTY NO.</td><td>601</td></tr>
<tr><td>TASK TITLE</td><td>VERIFICATION/CALIBRATION OF SURVEYING AND MAPPING INSTRUMENTS</td><td>TASK NO.</td><td>6017</td></tr>
<tr><td>PERFORMANCE CRITERIA</td><td colspan="3">The person performing this task must be able to verify/calibrate theodolites, and level gauges in accordance with technical requirements, and generate verification/calibration reports.</td></tr>
<tr><td>RANGE STATEMENT</td><td colspan="3">The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer.
The tools and equipment to be used include:
1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol;
2. Vertical multi-tooth indexing table, vertical angle standard device, collimator, and alignment instrument or collimation light tube;
3. Level calibrator, precise level gauge, and dedicated variable focus light tube;
4. Workbench;
5. Temperature and humidity indicator.</td></tr>
<tr><td colspan="4">EVIDENCE REQUIREMENT</td></tr>
<tr><td colspan="2">PRACTICAL PERFORMANCE</td><td colspan="2">UNDERPINNING KNOWLEDGE</td></tr>
<tr><td colspan="2">The person performing this task must be able to do the following:
1. Determine the items and contents of verification/calibration;
2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments;
3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments;
4. Complete the verification/calibration of metrological instruments:
4.1 Theodolite: Use a vertical multi-tooth indexing table, vertical angle standard device, collimator, and alignment instrument or collimation light tube to verify various items;</td><td colspan="2">Detailed knowledge about:
1.0 Methods
The person performing this task must be able to explain how to:
1.1 Determine the items and contents of verification/calibration;
1.2 Observe and test;
1.3 Control and monitor the environmental conditions for verification/calibration work;
1.4 Select standard instruments and supporting equipment for verification/calibration;
1.5 Verify/Calibrate indication errors, repeatability, and stability;
1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty.

2.0 Principles
The person performing this task must be able to explain the following principles:
2.1 The measuring principle of theodolites;
2.2 The measuring principle of cylindrical thread compasses.</td></tr>
</table>

4.2 Level gauge: Use a level calibrator, precise level gauge, and dedicated variable focus light tube to verify vertical axis operation errors, collimation line errors, and other items; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of surveying and mapping type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF GEOMETRIC QUANTITIES	**DUTY NO.**	601
TASK TITLE	VERIFICATION/CALIBRATION OF ENGINEERING SPECIFIC INSTRUMENTS	**TASK NO.**	6018
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate test sieves, ultrasonic flaw detection test blocks, and optical instruments and inspection tools in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Image measuring instrument, and universal tool microscope; 3. Coordinate measuring machine: 4. Surface roughness comparison specimen, optical flat/plane, and universal tool microscope; 5. Workbench; 6. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Test sieve: Use image measuring instruments, universal tool microscopes, etc. to measure the mesh size of the test sieve; 4.2 Ultrasonic flaw detection test block: Use coordinate measuring	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of test sieves;

machines, image measuring instruments, etc. to calibrate geometric dimensioning, shape, and position errors; 4.3 Optical instrument and inspection tool: Use tools such as surface roughness comparison specimens, optical flats/planes, and universal tool microscopes to measure the surface roughness, flatness, angular deviation, etc. of the inspected tool; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.2 The measuring principle of ultrasonic flaw detection test blocks, and plug test method; 2.3 The distinguishment of the categories of optical instruments and inspection tools and standard instruments. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills; 4.5 Operating skills of standard instruments for verification/calibration of engineering specific instruments. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of engineering specific instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF MECHANICAL QUANTITIES	**DUTY NO.**	602
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR DENSITY MEASUREMENT	**TASK NO.**	6021
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate working glass hydrometers, and liquid densimeters in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Standard densimeter group; 3. Various calibration liquids; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Working glass hydrometer: Use a standard densimeter group to verify each densimeter; use various calibration liquids to verify various hydrometers; use direct comparative method and static weighing method to calibrate the appearance and indication errors of the verification items;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of working glass hydrometers; 2.2 The measuring principle of liquid densimeters.

4.2 Liquid densimeter: Use various calibration liquids to verify standard instruments; calibrate the appearance, suspension spring diameter, indication error, and repeatability of the verification items in accordance with the specific calibration method; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of density measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF MECHANICAL QUANTITIES	**DUTY NO.**	602
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR TORQUE MEASUREMENT	**TASK NO.**	6022
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate working torquemeters, and torque wrenches in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Torque standard device; 3. Torquemeter and simulator; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Working torquemeter: Use a torque standard device to verify the calibration items such as zero error and repeatability of the torquemeter; 4.2 Torque wrench: Use a torquemeter and simulator to verify the relative error and repeatability of high torque rate and low torque rate indication;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of working torquemeters; 2.2 The measuring principle of torque wrenches. **3.0 Theories**

5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of torque measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF MECHANICAL QUANTITIES	**DUTY NO.**	602
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR VIBRATION MEASUREMENT	**TASK NO.**	6023
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate vibrometers, and vibration benches for testing in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Digital voltmeter, frequency meter, and dynamic signal analyzer; 3. Psychrometer, AC voltmeter, sound level meter, digital frequency meter, vibrometer, distortion analyzer, triaxial accelerometer, stopwatch, and recorder; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Vibrometer: Use digital voltmeter, frequency meter, and dynamic signal analyzer to verify the appearance, frequency error, amplitude frequency response, amplitude linearity, upper and lower cut-off frequencies of the items;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of vibrometers; 2.2 The measuring principle of vibration benches for testing.

4.2 Vibration bench for testing: Use a psychrometer, AC voltmeter, and sound level meter to verify the working environmental conditions; use a digital frequency meter, and vibrometer to verify the frequency indication; use a vibrometer to verify the displacement, acceleration amplitude indication, acceleration waveform distortion, and table displacement amplitude uniformity; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of surface vibration measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF MECHANICAL QUANTITIES	**DUTY NO.**	602
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR IMPULSE MEASUREMENT	**TASK NO.**	6024
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate shock and bump testing tables, and drop weight impact testing machines in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Impact measurement instrument, sound level meter, and stopwatch; 3. Frame level, dial indicator, vernier caliper, and hardness tester; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Shock and bump testing table: Use an impact measurement instrument, sound level meter, and stopwatch to verify the impact table and impact measurement system; 4.2 Drop weight impact testing machine: Use a frame level, dial	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of shock and bump testing tables; 2.2 The measuring principle of drop weight impact testing machines.

indicator, vernier caliper, hardness tester, etc. to calibrate each item; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of impulse measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF MECHANICAL QUANTITIES	**DUTY NO.**	602
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR ROTATIONAL SPEED MEASUREMENT	**TASK NO.**	6025
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate tachometers, speedometers, and taximeters in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Standard tachometric device; 3. Universal counter, rotational speed measurement instrument, and sound level meter; 4. Special micrometer; 5. Workbench; 6. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Tachometer: Use a standard tachometric device to verify general technical requirements, measurement range, indication error, and indication variability;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of tachometers; 2.2 The measuring principle of speedometers;

4.2 Speedometer: Use a universal counter, rotational speed measurement instrument, and sound level meter to verify frequency accuracy, rotational speed range, and other verification items; 4.3 Taximeter: Use a universal counter, rotational speed measurement instrument, special micrometer, and sound level meter to verify the appearance, function, local standard device, and usage error standard device; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.3 The measuring principle of taximeters. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of rotational speed measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF MECHANICAL QUANTITIES	**DUTY NO.**	602
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR INERTIAL MEASUREMENT	**TASK NO.**	6026
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate linear accelerometers, centrifuges, and rotary tables in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Regular polygonal prism, photoelectric autocollimator, electronic level gauge, plane mirror, silicone oil pan, and pentaprism; 3. Precision gauge block, frequency meter, inductance micrometer, and milliohmmeter; 4. Rate measurement system, frequency meter, photoelectric autocollimator, prism, electronic level gauge, and dynamic measurement system; 5. Workbench; 6. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Linear accelerometer: Use a regular polygonal prism and photoelectric autocollimator to verify precision indexing devices; use an electronic	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles:

level gauge and photoelectric autocollimator to verify the installation errors of fixtures in horizontal and vertical directions; use a plane mirror, silicone oil pan, and pentaprism to verify accessories; 4.2 Centrifuge: Use precision gauge blocks, frequency meters, electronic level gauges, and other verification instruments to verify the working radius, angular rate indication error, spindle verticality, conductive slip ring, and misalignment angle; 4.3 Rotary table: Use a rate measurement system, frequency meter, photoelectric autocollimator, prism, electronic level gauge, and dynamic measurement system to calibrate axis rotation error, angular rate error and stability, angular positioning and repeatability, dynamic characteristics of the rotary table, and two-spindle verticality; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.1 The measuring principle of linear accelerometers; 2.2 The measuring principle of centrifuges; 2.3 The measuring principle of rotary tables. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of inertial measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF MECHANICAL QUANTITIES	**DUTY NO.**	602
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR TACHYMETER MEASUREMENT	**TASK NO.**	6027
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate apparatus with radar for measuring rate of motor cars in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Frequency synthesis signal generator, power meter, frequency standard source for verifying crystal oscillators, measuring device for verifying crystal oscillators, universal counter, and frequency divider; 3. Workbench; 4. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Apparatus with radar for measuring rate of motor car: Use a frequency synthesis signal generator, power meter, frequency standard source for verifying crystal oscillators, and measuring device for verifying crystal oscillators to verify microwave frequency counters;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of apparatus with radar for measuring rate of motor cars. **3.0 Theories**

use a universal counter and frequency divider to verify the target speed simulation device; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of tachymeter measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF MECHANICAL QUANTITIES	**DUTY NO.**	602
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR FLOW MEASUREMENT	**TASK NO.**	6028
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate gas flow meters (gas positive displacement flow meters, differential pressure flow meters), liquid flow meters (turbine flow meters, ultrasonic flow meters), and oil flow meters (volume pipes, liquid positive displacement flow meters, water meters, heat meters, gas meters, gas dispensers) in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Auxiliary metrological instruments (thermometer, hygrometer, barometer, differential manometer, pressure gauge); 3. Flow standard device and calibration fluid; 4. Temperature measurement instrument, pressure measurement instrument, standard metal measurement instrument, standard weighing instrument, densimeter, stopwatch, flow sensor, and pairing temperature sensor; 5. Workbench; 6. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments:	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability;

4.1 Gas positive displacement flow meter: Use a standard instrument and auxiliary metrological instrument (thermometer, hygrometer, barometer, differential manometer, and pressure gauge) to verify appearance, sealing, indication error, and repeatability; 4.2 Differential pressure flow meter: Use geometric detection method, coefficient detection method, and indication error detection method to verify random files, identification and appearance, flow meter parameters, relative indication errors, and repeatability; 4.3 Turbine flow meter: Use flow standard devices and calibration fluids to calibrate random files, appearance, indication errors, and repeatability; 4.4 Ultrasonic flow meter: Use calibration fluids to calibrate random files and their appearance, sealing, flow meter parameters, indication errors, repeatability, and correction of flow meter coefficients; 4.5 Volume pipe: Use a temperature measurement instrument, pressure measurement instrument, standard metal measurement instrument, standard weighing instrument, densimeter, and stopwatch to verify the random files and their appearance, sealing, repeatability, and reproducibility; 4.6 Liquid positive displacement flow meter: Use a counter, densimeter, and viscometer to verify random files and their appearance, indication errors, repeatability, and sealing; 4.7 Water meter: Use metrological standard instruments and supporting equipment to verify appearance, markings and seals, electronic device functionality, sealing, and indication errors; 4.8 Heat meter: Use flow sensors, pairing temperature sensors, and calculators to check appearance, operation, sealing, indication error, and repeatability; 4.9 Gas meter: Use micromanometers, thermometers, pressure gauges,	1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of gas flow meters; 2.2 The measuring principle of liquid flow meters; 2.3 The measuring principle of oil flow meters. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.

precision pressure gauges, gas-pressure meters, hygrometers, and stopwatches to verify appearance, sealing, pressure loss, indication error, and additional device functions; 4.10 Gas dispenser: Use the mass method gas flow standard device or standard meter method gas flow standard device to verify the appearance, functional setting, sealing, indication error and repeatability, and payment amount error; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of flow type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF MECHANICAL QUANTITIES	**DUTY NO.**	602
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR VACUUM MEASUREMENT	**TASK NO.**	6029
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate piezoresistance vacuometers in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Secondary standard vacuum device, gas-pressure meter, thermometer, hygrometer, and megger; 3. Workbench; 4. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Piezoresistance vacuometer: Use a secondary standard vacuum device, gas-pressure meter, thermometer, hygrometer, and megger to verify the appearance, insulation resistance, and pressure indication; 5. Record verification/calibration measurement values or conclusions;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of piezoresistance vacuometers. **3.0 Theories**

6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of vacuum measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF TEMPERATURE QUANTITIES	**DUTY NO.**	603
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS FOR RADIATION THERMOMETER MEASUREMENT	**TASK NO.**	6031
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate infrared thermometers, thermal imagers, and working radiation thermometers in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Infrared ear thermometer, infrared body surface thermometer, and infrared body surface temperature rapid screening instrument; 3. Platinum resistance thermometer, thermocouple, and radiation thermometer; 4. Electric measuring instrument, length measurement tool, verification workbench or support, DC power, and change-over switch; 5. Workbench; 6. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Infrared thermometer: Use an infrared ear thermometer, infrared body surface thermometer, and	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles**

infrared body surface temperature rapid screening instrument to check appearance, laboratory errors, and warning temperature measurement errors; 4.2 Thermal imager: Use a platinum resistance thermometer, thermocouple, or radiation thermometer to calibrate appearance, display, and indication errors; 4.3 Working radiation thermometer: Use an electric measuring instrument, length measurement tool, calibration workbench or support, DC power, change-over switch, etc. to calibrate appearance, optical system, insulation resistance, inherent error, and repeatability; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	The person performing this task must be able to explain the following principles: 2.1 The measuring principle of infrared thermometers; 2.2 The measuring principle of thermal imagers; 2.3 The measuring principle of working radiation thermometers. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of surface radiation temperature measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF TEMPERATURE QUANTITIES	**DUTY NO.**	603
TASK TITLE	VERIFICATION/CALIBRATION OF SURFACE THERMOMETER TYPE METROLOGICAL INSTRUMENTS	**TASK NO.**	6032
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate surface platinum thermistors in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Second class standard mercury-thallium alloy low temperature thermometer, second class standard mercury thermometer, and working standard thermometer; 3. Workbench; 4. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Surface platinum thermistor: Use a second class standard mercury-thallium alloy low temperature thermometer, second class standard mercury thermometer, and working standard thermometer to verify the	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of surface platinum thermistors. **3.0 Theories**

appearance, insulation resistance, and maximum permissible errors; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of surface temperature type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF TEMPERATURE QUANTITIES	**DUTY NO.**	603
TASK TITLE	VERIFICATION/CALIBRATION OF TEMPERATURE SECONDARY METER TYPE METROLOGICAL INSTRUMENTS	**TASK NO.**	6033
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate industrial process measurement recorders, and temperature indication controllers in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. DC resistance box, standard resistor, DC current generator, and digital thermometer; 3. Digital voltmeter, three connecting wires, frequency period multi-function test analyzer, and stopwatch; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Industrial process measurement recorder: Use tools such as DC resistance boxes, standard resistors, DC current generators, and digital thermometers to verify	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles:

the basic indicator error, hysterisis error, repeatability, switching, stability, and other verification items; 4.2 Temperature indication controller: Use tools such as digital voltmeters, three connecting wires, frequency period multi-function test analyzers, and stopwatches to verify the basic indicator error, hysterisis error, stepping control instrument, and other verification items; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.1 The measuring principle of industrial process measurement recorders; 2.2 The measuring principle of temperature indication controllers. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of temperature secondary meter type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF TEMPERATURE QUANTITIES	**DUTY NO.**	603
TASK TITLE	VERIFICATION/CALIBRATION OF METROLOGICAL INSTRUMENTS OF TEMPERATURE AND HUMIDITY TEST EQUIPMENT TYPE	**TASK NO.**	6034
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate environmental test devices (temperature and humidity parameters) in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Temperature and humidity sensor; 3. Workbench; 4. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Environmental test device (temperature and humidity parameters): Use temperature and humidity sensors to calibrate temperature deviation, humidity deviation, temperature uniformity, humidity uniformity,	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of environmental test devices. **3.0 Theories**

temperature fluctuation, and humidity fluctuation; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of surface temperature and humidity test equipment type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF ELECTROMAGNETIC QUANTITIES	**DUTY NO.**	604
TASK TITLE	VERIFICATION/CALIBRATION OF AC IMPEDANCE AND INSTRUMENTS	**TASK NO.**	6041
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate AC resistance boxes, alternating current bridges, and high voltage capacitance bridges in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. AC resistance bridge, LCR tester, and AC standard resistor; 3. AC standard resistor, loss factor standard instrument, and frequency meter; 4. Insulation resistance meter, and power frequency withstand voltage test device; 5. Workbench; 6. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 AC resistance box: Use tools such as AC resistance bridges, LCR testers, and AC standard resistors to verify the AC resistance indication, time constant, residual	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The principle of using AC resistance boxes;

resistance, and participating inductance of the instrument; 4.2 Alternating current bridge: Use tools such as AC standard resistors, loss factor standard instruments, and frequency meters to verify the insulation resistance, insulating strength, testing frequency, testing voltage, and other performance of the instrument; 4.3 High voltage capacitance bridge: Use tools such as insulation resistance meters, and power frequency withstand voltage test devices to verify the insulating mat, power frequency withstand voltage, sensitivity of the galvanometer, and fineness test of the shielding branch regulator of the bridge; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.2 The working principle of alternating current bridges; 2.3 The working principle of high voltage capacitance bridges. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of AC impedance and instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF ELECTROMAGNETIC QUANTITIES	**DUTY NO.**	604
TASK TITLE	VERIFICATION/CALIBRATION OF AUDIO VOLTAGE RATIO INSTRUMENTS	**TASK NO.**	6042
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate induction voltage dividers, and transformer-ratio bridge s in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Standard multi-disc induction voltage divider, and reference voltage divider; 3. No-load voltage ratio standard instrument, and three-standard voltage transformer; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Induction voltage divider: Use standard multi-disc induction voltage dividers, reference voltage dividers, and other standard instruments to verify items such as indication,	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The structure and measuring principle of induction voltage dividers;

insulation resistance, and voltage test; 4.2 Transformer-ratio bridge: Use a no-load voltage ratio standard instrument to verify the single error of the bridge; use a three-standard voltage transformer to verify the phase sequence and connection group of the bridge; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.2 The structure and measuring principle of transformer-ratio bridges. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of audio voltage ratio instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF ELECTROMAGNETIC QUANTITIES	**DUTY NO.**	604
TASK TITLE	VERIFICATION/CALIBRATION OF INSTRUMENT TRANSFORMERS AND MEASURING INSTRUMENTS	**TASK NO.**	6043
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate measuring current transformers and voltage transformers in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Standard current transformer, and current proportioning standard instrument; 3. Standard voltage transformer, power frequency voltage ratio standard instrument, and capacitive voltage ratio device; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Measuring current transformer: Use standard current transformers and current proportioning standard instruments to verify the performance of instruments such as power frequency withstand	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of measuring current transformers;

voltage, demagnetization, stability, and basic error; 4.2 Measuring voltage transformer: Use standard voltage transformers, power frequency voltage ratio standard instruments, and capacitive voltage ratio devices to verify the insulation resistance, insulating strength, stability, basic error, and other performance; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.2 The measuring principle of measuring voltage transformers. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF ELECTROMAGNETIC QUANTITIES	**DUTY NO.**	604
TASK TITLE	VERIFICATION/CALIBRATION OF HIGH VOLTAGE MEASURING INSTRUMENTS	**TASK NO.**	6044
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate a high voltage electrostatic voltmeter, impact peak voltmeter, power frequency high-voltage divider, and DC high-voltage divider in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Standard voltmeter, instrument transformer or voltage divider; 3. Standard wave source, and insulation resistance meter; 4. Standard voltage transformer or standard capacitance voltage divider, and induction voltage divider; 5. Standard DC high-voltage divider, zero indicator, offset supply, and differential measuring instrument; 6. Workbench; 7. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 High voltage electrostatic voltmeter: Use standard voltmeters, instrument transformers or voltage dividers	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles:

to verify the basic error, dispersion, zero error, tilt error, etc. of instruments; 4.2 Impact peak voltmeter: Use standard wave sources, insulation resistance meters, etc. to verify the power frequency withstand voltage, basic error, short-term stability, etc. of instruments; 4.3 Power frequency high-voltage divider: Use standard voltage transformers or standard capacitance voltage dividers, induction voltage dividers, etc. to verify the insulating strength, basic error, variation, and other performance of instruments; 4.4 DC high-voltage divider: Use standard DC high-voltage dividers, zero indicators, offset supplies, differential measuring instruments, etc. to verify the overvoltage capacity, short-term stability, variation, and annual stability; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.1 The principle of using high voltage electrostatic voltmeters; 2.2 The working principle of impact peak voltmeters; 2.3 The working principle of power frequency high-voltage dividers; 2.4 The working principle of DC high-voltage dividers. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of high voltage measurement type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF ELECTROMAGNETIC QUANTITIES	**DUTY NO.**	604
TASK TITLE	VERIFICATION/CALIBRATION OF MAGNETIC PARAMETER INSTRUMENTS	**TASK NO.**	6045
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate a weak magnetic field alternating magnetometer, magnetic particle flaw detector, and fluxmeter in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Alternating current source and AC standard resistor; 3. Tesla meter, illuminometer and ultraviolet radiometer; 4. Volt-second generator and constant magnetic field device; 5. Workbench; 6. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Weak magnetic field alternating magnetometer: Use alternating current sources, AC standard resistors, etc. to verify the function test, indication error, and stability of instruments;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of weak magnetic field alternating magnetometers, and electro-magnetic induction effect;

4.2 Magnetic particle flaw detector: Use Tesla meters, illuminometers, and ultraviolet radiometers to verify the safety performance of the instrument, basic error of magnetization current, residual magnetic induction intensity, and other items; 4.3 Fluxmeter: Use volt-second generators, constant magnetic field devices, etc. to verify zero drift and magnetic flux indication error; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.2 The measuring principle of magnetic particle flaw detectors, and magnetization current; 2.3 The measuring principle of fluxmeters, and calibration methods such as volt-second method, mutual inductance method, coil method, etc. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of magnetic parameter instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF ELECTROMAGNETIC QUANTITIES	**DUTY NO.**	604
TASK TITLE	VERIFICATION/CALIBRATION OF ELECTRICAL SAFETY MEASURING INSTRUMENTS	**TASK NO.**	6046
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate an earth resistance meter, insulation resistance meter (tramegger), high insulation resistance measuring instrument (megger), voltage withstanding tester, leakage current tester, and earth-continuity tester in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Standard resistor; 3. Standard high-voltage and high-resistance box,, and rectifier; 4. Power frequency withstand voltage tester; 5. Standard resistor, voltage withstanding tester, and leakage current tester; 6. Workbench; 7. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Earth resistance meter: Use a standard resistor to verify insulation resistance, dielectric strength, indication error, etc.;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles:

4.2 Insulation resistance meter (Tramegger): Use standard high-voltage and high-resistance boxes, rectifiers, etc. to verify insulation resistance measurement and insulating strength inspection; 4.3 High insulation resistance measuring instrument (Megger): Use standard resistors to verify the basic error, repeatability, and terminal voltage ripple content of resistance measurement; 4.4 Voltage withstanding tester: Use a power frequency withstand voltage tester to verify insulation resistance test, power frequency withstand voltage test, and output voltage; 4.5 Leakage current tester: Use standard resistors, stable power supplies, insulation resistance measuring instruments, etc. to verify items such as dielectric strength tests, leakage current tests, and leakage current indication errors; 4.6 Earth-continuity tester: Use standard resistors, voltage withstanding testers, leakage current testers, etc. to verify test current fluctuations, alarm preset errors, test current source no-load current, and other items; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.1 The measuring principle of earth resistance meters; 2.2 The principle of using an insulation resistance meter (tramegger); 2.3 The principle of a high insulation resistance measuring instrument (megger), variable standard resistor and voltage compensation method, and voltage-current method; 2.4 The principle of a voltage withstanding tester; 2.5 The principle of an earth-continuity tester. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of electrical safety measuring instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection;

	2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF WIRELESS QUANTITIES	**DUTY NO.**	605
TASK TITLE	VERIFICATION/CALIBRATION OF ATTENUATION INSTRUMENTS	**TASK NO.**	6051
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate a rotary attenuator, and coaxial resistance attenuator in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Microwave signal source, standard attenuator, and crystal detector; 3. Digital voltmeter, and network analyzer; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Rotary attenuator: Use microwave signal sources, standard attenuators, crystal detectors, etc. to verify attenuation, standing wave ratio, initial attenuation, and other items; 4.2 Coaxial resistance attenuator: Use attenuation standard devices, signal sources, local oscillator sources, digital voltmeters, network analyzers, etc. to verify attenuation,	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of rotary attenuators; 2.2 The measuring principle of coaxial resistance attenuators. **3.0 Theories** The person performing this task must be able to explain the following:

standing wave ratio, initial attenuation, and other items; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of attenuation instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF WIRELESS QUANTITIES	**DUTY NO.**	605
TASK TITLE	VERIFICATION/CALIBRATION OF PHASE AND PHASE SHIFT INSTRUMENT	**TASK NO.**	6052
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate LF phase meters, LF phase shifters, and phase generators in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Standard phase generator, function signal generator, and precision phase meter; 3. Universal counter, digital multimeter, and distortion analyzer; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 LF phase meter: Use standard phase generators, function signal generators, precision phase meters, and other standard instruments to calibrate phase measurements, amplitude and phase errors, and other items;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of LF phase meters, and time interval measurement method; 2.2 The measuring principle of LF phase shifters and phase generators.

4.2 LF phase shifter and phase generator: Use universal counters, digital multimeters, distortion analyzers, and other instruments to calibrate output frequency, output sine wave amplitude, and output sine wave total harmonic distortion; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of phase and phase shift instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF WIRELESS QUANTITIES	**DUTY NO.**	605
TASK TITLE	VERIFICATION/CALIBRATION OF MICROWAVE IMPEDANCE AND NETWORK PARAMETER INSTRUMENTS	**TASK NO.**	6053
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate a RF impedance/material analyzer, and network cable analyzer in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Frequency meter, digital multimeter, and power meter; 3. Impedance converter calibration kit, return loss auxiliary unit, and coaxial step attenuator; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 RF impedance/material analyzer: Use a frequency meter, digital multimeter, power meter, etc. to calibrate items such as frequency indication error and signal level accuracy; 4.2 Network cable analyzer: Use impedance converter calibration kits,	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of RF impedance/material analyzers, and high frequency current-voltage method;

return loss auxiliary units, coaxial step attenuators, and other standard instruments to verify the DC loop resistance, propagation delay, insertion loss, and other items of the instrument; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.2 The measuring principle of network cable analyzers. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of metrological instruments of microwave impedance and network parameter instrument type.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF WIRELESS QUANTITIES	**DUTY NO.**	605
TASK TITLE	VERIFICATION/CALIBRATION OF LUMPED PARAMETER IMPEDANCE INSTRUMENTS	**TASK NO.**	6054
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate HF Q meters in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Capacitance measuring instrument, frequency meter, and Q-value standard measuring tool; 3. Workbench; 4. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 HF Q meter: Use a capacitance measuring instrument, frequency meter, and Q-value standard measuring tool to calibrate the low-frequency indication of the tuning capacitor, signal source frequency indication, Q-value measurement error of the Q meter, and other items;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of HF Q meters. **3.0 Theories** The person performing this task must be able to explain the following:

5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of lumped parameter impedance instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF WIRELESS QUANTITIES	**DUTY NO.**	605
TASK TITLE	VERIFICATION/CALIBRATION OF FIELD STRENGTH AND ELECTROMAGNETIC COMPATIBILITY INSTRUMENTS	**TASK NO.**	6055
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate a near-field electric field measuring instrument, and microwave radiation and leakage measuring instrument in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Synthesis signal generator, cross electromagnetic wave small room, and high-power coaxial attenuator; 3. Signal generator, harmonic filter, and microwave anechoic chamber; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Near-field electric field measuring instrument: Use a synthesis signal generator, cross electromagnetic wave small room, high-power coaxial attenuator, and other standard	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of near-field electric field measuring instruments;

instruments to verify field strength measurement error, and other items; 4.2 Microwave radiation and leakage measuring instrument: Use a signal generator, harmonic filter, microwave anechoic chamber, and other power density standard units to verify power density error of the instrument; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	2.2 The measuring principle of microwave radiation and leakage measuring instruments. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of field strength and electromagnetic compatibility instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF WIRELESS QUANTITIES	**DUTY NO.**	605
TASK TITLE	VERIFICATION/CALIBRATION OF DISTORTION INSTRUMENTS	**TASK NO.**	6056
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate low distortion signal generators in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Low distortion measuring instrument, passive notch filter, and spectrum analyzer; 3. Workbench; 4. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Low distortion signal generator: Use low distortion measuring instruments, passive notch filters, spectrum analyzers, etc. to verify the frequency accuracy, main output harmonic distortion, 1kHz output voltage, and other performance of the equipment; 5. Record verification/calibration measurement values or conclusions;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of low distortion signal generators. **3.0 Theories** The person performing this task must be able to explain the following:

6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of distortion instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF WIRELESS QUANTITIES	**DUTY NO.**	605
TASK TITLE	VERIFICATION/CALIBRATION OF MODULATION INSTRUMENTS	**TASK NO.**	6057
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate modulation measuring instruments in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Modulation analyzer, modulated signal generator, low distortion signal generator, and distortion analyzer; 3. Workbench; 4. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Modulation measuring instrument: Use instruments such as modulation analyzer, modulated signal generator, low distortion signal generator, and distortion analyzer to calibrate items such as frequency modulation deviation measurement, modulation measurement, phase modulation	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of modulation measuring instruments. **3.0 Theories** The person performing this task must be able to explain the following:

and shift measurement, and residual frequency modulation; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of modulation instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF WIRELESS QUANTITIES	**DUTY NO.**	605
TASK TITLE	VERIFICATION/CALIBRATION OF SIGNAL GENERATORS	**TASK NO.**	6058
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate level oscillators, LF signal generators, and function generators in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Standard zero level meter, standard attenuator, level oscillator, and selective level meter; 3. Standard voltmeter, distortion analyzer, and load resistor; 4. Digital oscilloscope, distortion meter, and spectrum analyzer; 5. Workbench; 6. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Level oscillator: Use instruments such as standard zero level meters, standard attenuators, level oscillators, and selective level meters to verify items such as zero level indication error and frequency response error, level indicator indication error, output	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of level oscillators; 2.2 The working principle of LF signal generators; 2.3 The working principle of function generators.

harmonic attenuation or waveform distortion measurement; 4.2 LF signal generator: Use a standard voltmeter, distortion analyzer, load resistor, and other instruments to verify frequency error, frequency stability, output voltage amplitude error, attenuation error, and other items; 4.3 Function generator: Use digital oscilloscopes, distortion meters, spectrum analyzers, and other instruments to verify output waveform amplitude, sine wave amplitude flatness, total sine wave distortion coefficient, and other items; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of signal generator type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF WIRELESS QUANTITIES	**DUTY NO.**	605
TASK TITLE	VERIFICATION/CALIBRATION OF MEASURING RECEIVERS AND SPECTRUM ANALYZERS	**TASK NO.**	6059
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate measuring receivers, and spectrum analyzers in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Standard modulated signal generator, amplitude modulation and frequency modulation test source, and distortion analyzer; 3. Frequency counter, RF synthesis signal source, and matched attenuator; 4. Workbench; 5. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Measuring receiver: Use standard modulated signal generators, amplitude modulation and frequency modulation test sources, distortion analyzers, etc. to complete calibration items such as output reference frequency, frequency measurement, tuning level, frequency modulation, and phase and amplitude modulation;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The module composition and working principle of measuring receivers; 2.2 The measuring principle of spectrum analyzers.

4.2 Spectrum analyzer: Use frequency counters, RF synthesis signal sources, matched attenuators, etc. to complete calibration items such as sweep width, noise sideband, residual frequency modulation, and second harmonic distortion; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of metrological instruments of measuring receiver and spectrum analyzer type.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

OCCUPATION	METROLOGY TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MEASUREMENT OF WIRELESS QUANTITIES	**DUTY NO.**	605
TASK TITLE	VERIFICATION/CALIBRATION OF NAVIGATION MEASUREMENT INSTRUMENTS	**TASK NO.**	60510
PERFORMANCE CRITERIA	The person performing this task must be able to verify/calibrate navigation type satellite receivers in accordance with technical requirements, and generate verification/calibration reports.		
RANGE STATEMENT	The task can be performed in a laboratory or specific environment under the supervision of a Metrology Engineer. The tools and equipment to be used include: 1. Personal protective equipment such as gloves, as well as cleaning tools such as alcohol; 2. Satellite signal simulator, and circumference measurement system; 3. Workbench; 4. Temperature and humidity indicator.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the items and contents of verification/calibration; 2. Observe and check the appearance of the verified/calibrated metrological instruments, and manually test and check the normal operation of each part of the verified/calibrated metrological instruments; 3. Use temperature and humidity indicators and other tools to monitor and control the environmental conditions for verification/calibration of metrological instruments; 4. Complete the verification/calibration of metrological instruments: 4.1 Navigation type satellite receiver: Use a satellite signal simulator, and circumference measurement system to verify positioning error, speed error, acceleration error, and other items; 5. Record verification/calibration measurement values or conclusions; 6. Conduct error analysis and data processing, and provide verification	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the items and contents of verification/calibration; 1.2 Observe and test; 1.3 Control and monitor the environmental conditions for verification/calibration work; 1.4 Select standard instruments and supporting equipment for verification/calibration; 1.5 Verify/Calibrate indication errors, repeatability, and stability; 1.6 Calculate the mean, experimental standard deviation, standard uncertainty, and expanded uncertainty. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The measuring principle of navigation measurement instruments; 2.2 The geodetic standard point method, simulation method, circumference method, etc. involved in the calibration process of navigation measurement instruments.

conclusions and calibration results (mean, experimental standard deviation, standard uncertainty, and expanded uncertainty); 7. Issue verification/calibration reports; 8. Maintain the standard instruments and supporting equipment.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The content of the geometric quantity value transmission system; 3.2 The definition standards for indication repeatability and stability; 3.3 The methods for rounding off numerical values; 3.4 The requirements for error analysis and data processing; 3.5 The assessment requirements for measurement uncertainty. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Data processing skills. **5.0 Math Skills** 5.1 Data processing skills; 5.2 Measurement result calculation skills; 5.3 Error calculation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Verification/Calibration is implemented in accordance with practical operation requirements to form the verification/calibration results of navigation measurement instrument type metrological instruments.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of safety and environmental protection; 2. Knowledge of quality control; 3. Knowledge of relevant laws and regulations.

TABLE 1: DACUM CHARTS FOR METROLOGY TECHNICIAN - NTA 6

DUTIES	TASKS	ENABLERS
1.0 Measurement of geometric quantities	1.1 Verification/calibration of metrological instruments for surface roughness measurement. 1.2 Verification/calibration of metrological instruments for gauge measurement. 1.3 Verification/calibration of conventional length measuring instruments. 1.4 Verification/calibration of coordinate measuring instruments. 1.5 Verification/calibration of gear measuring tools. 1.6 Verification/calibration of thread measuring tools. 1.7 Verification/calibration of surveying and mapping instruments. 1.8 Verification/calibration of engineering specific instruments.	**General skills and knowledge** · Communication skills · Customer service skills · Teamwork skills · Data processing skills · Measurement result calculation skills · Error calculation skills **Tools and equipment** · Personal protective equipment such as gloves, as well as cleaning tools such as alcohol · Surface roughness comparison specimen, length measuring instrument, slotted gauge block, dynamometer or weight, force measuring device, etc. · Taper measuring instrument, universal tool microscope, gauge block, laser interferometer, etc. · Roundness measuring instrument, knife straight edge, optical meter, electronic dynamometer, granite surface plate, micrometer dial, etc. · Standard glass linear scale, etc. · Standard spherical template, plane optical flat, etc. · Workbench · Temperature and humidity indicator **Materials** · Dust-free cloth · Anhydrous ethanol · Anti-rust oil **Requirements for employees** · Collaborative teamwork spirit · Rigorous and meticulous work style · Integrity spirit of keeping promises · Project planning capability in reasonable scheduling
2.0 Measurement of mechanical quantities	2.1 Verification/calibration of metrological instruments for density measurement.	**General skills and knowledge** · Communication skills · Customer service skills

DUTIES	TASKS	ENABLERS
	2.2 Verification/calibration of metrological instruments for torque measurement. 2.3 Verification/calibration of metrological instruments for vibration measurement. 2.4 Verification/calibration of metrological instruments for impulse measurement. 2.5 Verification/calibration of metrological instruments for rotational speed measurement. 2.6 Verification/calibration of metrological instruments for inertial measurement. 2.7 Verification/calibration of metrological instruments for tachymeter measurement. 2.8 Verification/calibration of metrological instruments for flow measurement. 2.9 Verification/calibration of metrological instruments for vacuum measurement.	· Teamwork skills · Data processing skills · Measurement result calculation skills · Error calculation skills **Tools and equipment** · Personal protective equipment such as gloves, as well as cleaning tools such as alcohol · Standard densimeter group, torque standard device, torquemeter and simulator, digital voltmeter, frequency meter, dynamic signal analyzer, psychrometer, AC voltmeter, sound level meter, digital frequency meter, vibrometer, distortion analyzer, triaxial accelerometer, stopwatch, recorder, etc. · Various calibration liquids · Workbench · Temperature and humidity indicator **Materials** · Dust-free cloth · Anhydrous ethanol · Anti-rust oil **Requirements for employees** · Collaborative teamwork spirit · Rigorous and meticulous work style · Integrity spirit of keeping promises · Project planning capability in reasonable scheduling
3.0 Measurement of temperature quantities	3.1 Verification/calibration of metrological instruments for radiation thermometer measurement. 3.2 Verification/calibration of surface thermometer type metrological instruments. 3.3 Verification/calibration of temperature secondary meter type metrological instruments.	**General skills and knowledge** · Communication skills · Customer service skills · Teamwork skills · Data processing skills · Measurement result calculation skills · Error calculation skills **Tools and equipment**

DUTIES	TASKS	ENABLERS
	3.4 Verification/calibration of metrological instruments of temperature and humidity test equipment type.	· Personal protective equipment such as gloves, as well as cleaning tools such as alcohol · Infrared ear thermometer, infrared body surface thermometer, infrared body surface temperature rapid screening instrument, platinum resistance thermometer, thermocouple, radiation thermometer, etc. · Electric measuring instrument, length measurement tool, verification workbench or support, DC power, change-over switch, etc. · Second class standard mercury-thallium alloy low temperature thermometer, second class standard mercury thermometer, working standard thermometer, etc. · DC resistance box, standard resistor, DC current generator, digital thermometer, digital voltmeter, three connecting wires, frequency period multi-function test analyzer, stopwatch, etc. · Workbench · Temperature and humidity indicator **Materials** · Dust-free cloth · Anhydrous ethanol · Anti-rust oil **Requirements for employees** · Collaborative teamwork spirit · Rigorous and meticulous work style · Integrity spirit of keeping promises · Project planning capability in reasonable scheduling
4.0 Measurement of electromagnetic quantities	4.1 Verification/calibration of AC impedance and instruments. 4.2 Verification/calibration of audio voltage ratio instruments.	**General skills and knowledge** · Communication skills · Customer service skills · Teamwork skills · Data processing skills

DUTIES	TASKS	ENABLERS
	4.3 Verification/calibration of instrument transformers and measuring instruments. 4.4 Verification/calibration of high voltage measuring instruments. 4.5 Verification/calibration of magnetic parameter instruments. 4.6 Verification/calibration of electrical safety measuring instruments.	· Measurement result calculation skills · Error calculation skills **Tools and equipment** · Personal protective equipment such as gloves, as well as cleaning tools such as alcohol · AC resistance bridge, LCR tester, AC standard resistor, AC standard resistor, loss factor standard instrument, frequency meter, etc. · Insulation resistance meter, power frequency withstand voltage test device, standard multi-disc induction voltage divider, reference voltage divider, etc. · No-load voltage ratio standard instrument, three-standard voltage transformer, standard current transformer, current proportioning standard instrument, etc. · Standard voltage transformer, power frequency voltage ratio standard instrument, capacitive voltage ratio device, etc. · Workbench · Temperature and humidity indicator **Materials** · Dust-free cloth · Anhydrous ethanol · Anti-rust oil **Requirements for employees** · Collaborative teamwork spirit · Rigorous and meticulous work style · Integrity spirit of keeping promises · Project planning capability in reasonable scheduling
5.0 Measurement of wireless quantities	5.1 Verification/calibration of attenuation instruments. 5.2 Verification/calibration of phase and phase shift instrument. 5.3 Verification/calibration of microwave impedance and	**General skills and knowledge** · Communication skills · Customer service skills · Teamwork skills · Data processing skills · Measurement result calculation skills

DUTIES	TASKS	ENABLERS
	network parameter instruments. 5.4 Verification/calibration of lumped parameter impedance instruments. 5.5 Verification/calibration of field strength and electromagnetic compatibility instruments. 5.6 Verification/calibration of distortion instruments. 5.7 Verification/calibration of modulation instruments. 5.8 Verification/calibration of signal generators. 5.9 Verification/calibration of measuring receivers and spectrum analyzers. 5.10 Verification/calibration of n avigation measurement instr uments.	· Error calculation skills **Tools and equipment** · Personal protective equipment such as gloves, as well as cleaning tools such as alcohol · Microwave signal source, standard attenuator, crystal detector, digital voltmeter, network analyzer, etc. · Standard phase generator, function signal generator, precision phase meter, universal counter, digital multimeter, distortion analyzer, etc. · Frequency meter, digital multimeter, power meter, impedance converter calibration kit, return loss auxiliary unit, coaxial step attenuator, capacitance measuring instrument, frequency meter, Q-value standard measuring tool, etc. · Workbench · Temperature and humidity indicator **Materials** · Dust-free cloth · Anhydrous ethanol · Anti-rust oil **Requirements for employees** · Collaborative teamwork spirit · Rigorous and meticulous work style · Integrity spirit of keeping promises · Project planning capability in reasonable scheduling