

# Job Grading Standard for Electronic Measurement Equipment Mechanic, 2602

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## WORK COVERED

This standard covers nonsupervisory work involved in maintenance, repair, calibration, and certification of electronic test, measurement, and reference equipment used for precise measurement of a variety of electrical and electronic values, quantities, and relationships such as voltage, resistance, capacitance, frequency, and inductance. This equipment is also used to maintain and assure the functional accuracy and operational precision of industrial, experimental, airborne, marine, and ground electronic systems and equipment. This work requires a working knowledge and practical application of electronic principles and the ability to perform precise measurement of electrical and electronic values, quantities, and relationships. The work also requires skill in performing such processes as troubleshooting, repairing, modifying, overhauling, testing, installing, and calibrating a variety of measurement equipment, instruments, and consoles.

## WORK NOT COVERED

This standard does not cover the following work:

- Operating such test equipment as tube testers, oscilloscopes, ohmmeters, voltmeters, signal generators and oscillators; and performing electrical tests on radio, telephone, and radar equipment (see [Electronics Mechanic Series, 2604](#));
- Troubleshooting, repairing, and maintaining automatic or semiautomatic card or tape programmed checkout equipment or integrated electronic systems such as fire control, flight/landing control, bombing-navigation, and electronic warfare or other multiple integrated electronic systems (see [Electronic Integrated Systems Mechanic Series, 2610](#));
- Planning and fabricating complex research and prototype instruments that are made from a variety of materials and used to detect, measure, record, and regulate heat, pressure, speed, vibration and other areas of interest to scientific, engineering, or medical personnel (see [Instrument Making Series, 3314](#));
- Troubleshooting, repairing, calibrating, and installing mechanical, electrical, and/or pneumatic instruments, test equipment, and functionally related assemblies, data processing equipment, and controls (see [Instrument Mechanic Series, 3359](#));
- Examining services, materials, and products that are processed, manufactured, or repaired by workers performing trade or craft work to determine that the physical and operating characteristics are within acceptable standards, specifications, or contractual requirements (see U.S. Office of Personnel Management [Job Grading Standard for Inspectors](#));
- Installing and maintaining electronic equipment when this is an integral part of the engineering testing, analysis, alignment and performance evaluation of complex electronic systems or solving engineering problems of site election, systems integration and modification of the equipment to adapt to novel site characteristics (see [Electronics Technician, GS-0856](#)).

## TITLES

Jobs graded by this standard at the grade 10 level and above are to be titled Electronic Measurement Equipment Mechanic. Jobs graded below the grade 10 level are to be titled in accordance with the instructions contained in the [2604, Electronics Mechanic Job Grading Standard](#).

## GRADE LEVELS

This standard incorporates by reference the grade 8 level of work described in the [Electronics Mechanic, 2604](#) job grading standard and describes work at the grade 10, 11, and 12 levels. It does not describe all possible grade levels or in any way limit the authority of agencies to assign work or particular duties to positions. If the jobs differ substantially from the skill, knowledge, responsibility and other work requirements described in the standard, they may be graded at levels other than those described, based on the application of sound job grading methods.

## HELPER AND INTERMEDIATE JOBS

Helper and Intermediate electronic measurement equipment mechanic jobs are graded by the U.S. Office of Personnel Management [Job Grading Standards for Trades Helper and Intermediate Jobs](#). (Grade 11 in this standard is to be used as the full performance journey level grade in applying the Intermediate Job Grading Table.)

## ELECTRONIC MEASUREMENT EQUIPMENTMECHANIC, GRADE-10

*General:* As compared to the routine repair and maintenance of chassis, assemblies, and other items of electronic equipment mentioned at the grade 8 level, of the -2614, Electronics Mechanic standard, the grade 10 mechanics troubleshoot, repair, overhaul, modify, test, and calibrate a variety of portable or installed electronic test equipment such as voltohmmeters, frequency meters, attenuators, tube testers, oscilloscopes, impedance bridges, low frequency signal generators, and other devices of similar complexity. The units serviced at this level are usually self contained and functionally independent, and can be serviced while separated from test stations and consoles.

At this level the mechanics work independently on routine assignments or as a member of a team on more difficult tasks. They apply a working knowledge of electronic principles and a knowledge of how the circuits and assemblies function together. For example, the items serviced at this level usually contain circuits that are designed to generate, receive, modify, amplify, measure, or display an electronic signal and transform it into measurable units, as compared to the limited functions performed by devices serviced at the lower grade levels. The mechanics at this level perform functional tests in accordance with cyclic inspection requirements and repair of disclosed operating deficiencies and defective parts.

The grade 10 mechanics make repairs, adjust or replace parts, and apply modifications to the various circuits or wiring in accordance with technical directives and instructions. The mechanics must be skilled in tracing defects that are difficult to locate because of the large number of circuits within the limited space of the units serviced. They determine the repairs needed and perform the work with little or no advice.

The mechanics at this level use a variety of precision measurement standards and instruments such as generators, oscilloscopes, and analyzers to perform functional test and calibration of electronic test equipment serviced. They work with published technical directives and equipment specifications which outline specific alignment and calibration procedures. They use drawings, prints, schematics, and wiring diagrams to locate defective components and perform repairs. The mechanics at this level work under general supervision, and complete assignments in accordance with established techniques and procedures.

*Skill and Knowledge:* The mechanics must have a working knowledge of electronic principles involved in the generation and measurement, of such elements as voltage, current, impedance, capacitance, frequency, and inductance.

They must be familiar with the make-up, operation, and use of a variety of portable or self contained test equipment which is usually commercially manufactured with standard design circuits that contain such components as resistors, capacitors, transistors, diodes, vacuum tubes, relays, and transformers. The mechanics must be able to troubleshoot the equipment to localize defects. They must have ability to follow voltage, current, and resistance paths, and trace signals through a variety of processing and amplification stages. They must be skilled in isolating and checking intermediate components for correct value, and performing precise measurement of such parameters as timing, duration, frequency, amplitude, and phasing at various test points. The mechanics must be skilled in making adjustments to potentiometers, capacitors, and coils related to such characteristics as gain, distortion, linearity, and sensitivity.

The grade 10 mechanics must have the ability to read and interpret a variety of technical information contained in schematics, manufacturers specifications, and clearly defined fault isolation aids, and calibration procedures. They must have a knowledge and understanding of schematic symbols and color codes to identify the value, tolerance, and location of components. They must have the ability to install modifications to circuits and assemblies in accordance with detailed instructions, and the ability to securely mount components, and arrange wiring to prevent electrical interference or other malfunctions under extreme operating conditions. The mechanics must have skill in the use of such trade tools as wire strippers, screwdrivers, hand drills, files, and soldering irons to repair, align, and assemble equipment. The mechanics must be skilled in the use of various precision measurement instruments and standards such as pulse generators, frequency counters, vacuum tube voltmeters and oscilloscopes, and must have the ability to set up and operate such standards to align and calibrate the units serviced in accordance with established calibration procedures.

*Responsibility:* At this level the mechanics work independently or as a member of a team. They receive work assignments from the supervisor or higher graded worker in the form of written or oral instructions which specify the equipment to be serviced. The grade 10 mechanics determine the nature of the trouble and the extent of repairs required. They make repairs and

perform alignment, test, and calibration of equipment with little or no check during their progress or upon completion.

The grade 10 mechanics work with a variety of specifications, procedures, and instructions to achieve peak performance of equipment within the frame-work of the manufacturer's design. The supervisor or higher graded worker is usually available to provide technical advice and assistance on unusual or very difficult problems relating to deviation from standard work practices or equipment reliability considerations. Completed work is subject to review by the supervisor to insure that overall work meets accepted trade practices and to periodic audit by quality assurance to insure conformance with prescribed accuracy and sensitivity requirements.

*Physical Effort:* The work assignments require light to moderate physical effort. The mechanics frequently lift, carry, or other wise handle items weighing from 5 to 18 kilograms (10 to 40 pounds) and occasionally in excess of 18 kilograms. They work in a sitting position for extended periods of time, and frequent standing, walking, bending, reaching, and stooping is required.

*Working Conditions:* The mechanics normally work in well lighted, heated, and ventilated areas. They may be required to work at remote user locations under variable conditions or within clean room environments where special garments including head coverings, shoe coverings, and gloves are required. The mechanics are subject to injuries such as cuts, bruises, and burns caused by electrical shock, RF energy, and soldering irons.

## **ELECTRONIC MEASUREMENT EQUIPMENT MECHANIC, GRADE-11**

*General:* As compared to the self contained and functionally independent units described at the grade 10 level, the grade 11 mechanics service a variety of equipment which is usually combined and interrelated with other electronic equipment or composed of collectively assembled satellite components and assemblies to operate as a complete information gathering unit. The grade 11 mechanics perform repair, maintenance, and calibration of items such as microwave equipment, radar and missile test consoles, high frequency sampling and storage oscilloscopes, distortion analyzers, recording oscillographs, and digital delay generators. Work assignments at this level may also involve the servicing of such equipment as engine analyzer and trust measuring equipment, gas leak detectors, spectrographs, mass spectrometers and digital counters.

The grade 11 mechanics troubleshoot, repair, overhaul, modify, install, and calibrate a variety of standard and nonstandard equipment with a minimum of guidance or procedures. The items serviced are more difficult to repair and maintain at this level because in addition to generating, measuring, and displaying elements as described at the grade 10 level, they contain circuits and assemblies which perform multiple functions such as reception and simulation, amplification and integration, digital and analog conversion, or a variety of other summation, multiplication, and division functions required to evaluate parameters of interest in major electronic, electrical, or electromechanical systems used in industrial, ground, airborne, marine, or experimental applications. The mechanics, apply more comprehensive trade knowledge of electronic

principles than described at the grade 10 level to set up and operate equipment under actual or simulated operating conditions and to troubleshoot and isolate malfunctions to major blocks of circuitry without reference to detailed procedures or instructions.

They perform repairs which are often complicated by critical tolerances or accuracies and common circuit elements that perform multiple functions, which require fabrication of replacement parts such as coils, cables, and probes, and adjustment and alignment of related circuits to insure the equipment is functioning properly.

At this level the mechanics make modifications and perform test and calibration in accordance with instructions and procedures which are often vague and incomplete. As a result, the mechanics must often develop and implement techniques for use on specific equipment. They must also use sound judgment in achieving specified assurances, sensitivities, and precise tolerances. The mechanics use a variety of technical electronic data contained in manufacturer specifications, schematics, and maintenance procedures. They make independent judgments in determining the work sequence, selection and use of trade tools, and testing and measuring instruments. They work under general supervision and may be required to provide technical assistance and guidance to lower graded workers.

*Skill and Knowledge:* As compared to the general knowledge of electronic principles related to functionally independent generation and measurement equipment described at the grade 10 level, the grade 11 mechanics must apply a more comprehensive knowledge of operating electronic principles related to equipment which is combined and interrelated with other devices and complicated by a variety of multicomponent assemblies and devices with intricate functional relationships. For example, the work at this level requires the practical application of such operating principles as the production and utilization of oscillations over a broad range of frequencies; signal and waveform behavior, distortion, and amplification; pulse, trigger, and synchronization techniques; digital/analog processing and data conversion techniques; and a variety of display and indication methods. In addition, the mechanics must be familiar with the methods of signal modulation and electromagnetic radiation.

They must apply a thorough knowledge of the methods and techniques of precise measurement of electrical and electronic quantities and relationships such as standing wave ratio, power, impedance, reactance, and attenuation.

The mechanics at this level must be skilled in performing more difficult troubleshooting techniques than described at the grade 10 level. For example, in addition to tracing signals and voltage paths they are skilled in the analysis of waveform characteristics such as timing, duration, frequency, and phasing. They originate test set-ups to isolate malfunctions and check performance characteristics of special or unique test panels or mockups. At this level the mechanics must be familiar with the functional relationships of the circuits, assemblies, and equipment serviced. In addition to replacing or reworking defective parts and components, they must judge the impact of repairs on related integral devices, and perform further adjustments and alignments. For example, after locating and replacing a defective component in the input circuitry of an oscilloscope, the mechanics verify the proper sweep rates, and perform additional adjustments to intensity, focus, sensitivity, and the range of controls by adjusting potentiometers

and adding or removing resistance to balance the circuitry, and insure the proper operation of equipment throughout the entire range.

The grade 11 mechanics must be able to interpret and apply a variety of technical electronic information such as schematic symbols, mathematical expressions and formulas, calibration procedures, and other reference materials. They apply established techniques and methods of repair, testing, alignment, and calibration of equipment which serves as test equipment or precision measurement standards and utilize electronic circuits to measure electronic or electrical quantities to determine the performance characteristics and accuracy of other instruments and equipment.

The mechanics must be familiar with the operation, capabilities, and limitations of such precision measurement instruments as spectrum and distortion analyzers, digital and differential meters, multichannel oscilloscopes, waveguide equipment, oscillators, and a variety of precision frequency and time measurement standards. At this level the mechanics must have the ability to install major modifications to instruments and equipment in accordance with instruction and procedures. For example, they fabricate cables or install circuits, and components to change or extend the range and improve the stability of equipment serviced. They use a variety of hand and powered tools of the trade and work within the framework of acceptable trade practices.

*Responsibility:* Grade 11 mechanics receive work assignments from the supervisor in the form of work orders and oral discussions. They work in accordance with available drawings, specifications, or technical orders, and must often develop diagrams and sketches for equipment where specifications are vague and incomplete. At this level the mechanics analyze malfunctions and determine the extent of repairs required on equipment which is more complicated than described at the grade 10 level, by a variety of multipurpose components and intricate relationships among its integral devices. They must judge the impact of repairs on the total unit and independently select, use, or, prescribe the methods, materials, and equipment required to complete the assigned project.

The grade 11 mechanics may be responsible for providing technical guidance and assistance to lower graded workers and determining the requirements for equipment maintenance and calibration at remote user locations. Completed work is subject to spot check by the supervisor for compliance with accepted trade practices and to periodic audit by quality assurance for compliance with prescribed accuracy and sensitivity requirements.

*Physical Effort:* The physical effort required at this level is the same as that described at the [grade 10 level](#).

*Working Conditions:* The working conditions at this level are the same as those described at the [grade 10 level](#).

## **ELECTRONIC MEASUREMENT EQUIPMENT MECHANIC, GRADE-12**

*General:* At this level the work involves the maintenance and calibration of unusually complex precision measurement equipment, instruments, and instrumentation systems with a minimum of accompanying instructions. The servicing of equipment at this level is complicated by frequent engineering changes such as in design, construction, operating specifications, and special servicing procedures. The items serviced at this level are more difficult to repair and maintain than those described at the grade 11 level because they are usually custom built, unconventional or one-of-a-kind devices used in support of research, experimental, or testing activities. The grade 12 mechanics analyze and isolate component malfunctions in such items as high and low voltage laser power supplies, amplifiers, and associated units; solid state pressure indicators and oscilloscopes, transistor curve tracers and digital voltohmmeters; and solid state function generators, computing counters, and other devices of similar complexity. In addition, the grade 12 mechanics perform design changes and major modifications to standard and unconventional precision measurement equipment to improve the range or provide new capabilities to identify phenomena or parameters of interest in industrial, marine, airborne, ground support, or research and development equipment test applications.

The grade 12 mechanics select, modify, set-up, calibrate, install, and operate a variety of precision measurement equipment including special test consoles and mockups in support of laboratory tests or prototype and first-article acceptance and calibration tests. They work with specifications and procedures which are often vague and incomplete as a result of the unique equipment applications at this level, and must improvise trade techniques to perform maintenance and repair which require advanced trade knowledge. The items serviced at this level are more complex than those described at the grade 11 level because in addition to simulating, measuring, and processing electronic quantities and values, they are designed or modified to measure such additional elements as infrared radiation, temperature, gas, vacuum, and other parameters of interest in laboratory test applications. The grade 12 mechanics apply significantly greater judgment and higher level skills and knowledge than the grade 11 mechanic. For example, while working from a broad outline of a test objective, they determine or recommend the proper methods to electronically record the performance characteristics of the device, and select and modify the required precision measurement instruments. Typical of the scope of modifications performed at this level are the addition of new circuits, controls, wiring, or units with very critical tolerances or operating characteristics. The mechanics assist in the developmental testing of such equipment as radio, radar, communication, countermeasures, traffic control, guidance, and other systems and devices. They monitor or operate the precision measurement instruments, analyze malfunctions which occur during the tests, and perform necessary corrective actions.

The mechanics coordinate their efforts with technical or professional personnel on matters affecting equipment performance and test objectives.



*Skill and Knowledge:* The grade 12 mechanics apply trade skills and knowledges that are more advanced than those at the grade 11 level. For example, in addition to a comprehensive knowledge of operating electronic principles, the mechanics at this level must apply a thorough knowledge and understanding of the design, construction, function, and end-use application of a variety of highly complex, unconventional, custom built precision measurement equipment used in connection with research, experimental, or testing activities. They must be familiar with such innovations of the trade as programmed, logic, integrated, and interface circuits, assemblies, and components, and apply such knowledge to the major modification of general purpose or common commercially manufactured test equipment.

In addition to the troubleshooting skills employed at the grade 11 level, the grade 12 mechanics must have the ability to analyze circuits and prepare detailed diagrams and schematics to facilitate repair and maintenance of the equipment serviced. They apply comprehensive knowledge of electronic theory to calculate pulses and waveforms, and trace relationships in the signal flow. At this level the isolation of defects is further complicated by a variety of critical absolute or percentage tolerance values and relationships of such factors as bandwidth, frequency response, gain, sensitivity, attenuation, noise level, time delay, power, linearity, modulation, and other values which in combination present substantially more difficult maintenance problems than mentioned at the grade 11 level. In addition to the precision measurement standards described at the grade 11 level, the grade 12 mechanics use the full complement of precision electronic reference standards and complex special test panels. They apply broad trade experience and knowledge to devise test and calibration procedures for testing devices on these precision measurement instruments and standards.

The grade 12 mechanics perform operational checkout, malfunction analysis, and preventative maintenance to insure that instruments and equipment serviced at this level are in first class condition to assure accuracy and reliability of finished test results. They must often improvise in the use of precision measurement equipment and the application of trade techniques to solve unusual problems related to such factors as the testing environment, interference from other frequency generating equipment, location and density of circuitry, and other troubleshooting difficulties.

*Responsibility:* The grade 12 mechanics exercise significantly more judgment and independence in determining the methods and techniques required to solve unusually complex maintenance and repair problems. They independently judge the impact that modifications and use of special test devices may have on tracing malfunctions, achieving test objectives, and assuring proper alignment of integral devices contained in the highly complex equipment serviced at this level. They determine the work sequence, special or nonstandard trade techniques required, and prescribe methods, materials, and procedures to be performed by lower graded workers. For example, they develop detailed schematics, drawings, and calibration procedures for use by lower graded workers in the repair and maintenance of equipment which has been modified to detect, measure, record, or generate one-time test parameters.

The grade 12 mechanics are responsible for applying significantly greater judgments and decisions than described at the grade 11 level which contribute toward more precise accuracies and efficient repair and maintenance operations. They must keep abreast of technological

changes in the occupation and provide technical guidance and assistance to lower graded workers. The grade 12 mechanics coordinate their efforts relating to project objectives with technical and professional personnel and completed projects are often accepted as prototype, experimental devices, or for manufacture as a standard item.

*Physical Effort:* The physical effort required at this level is the same as that described at the [grade 10 level](#).

*Working Conditions:* The working conditions at this level are the same as those described at the [grade 10 level](#).