

# Federal Wage System Job Grading Standard for Electronics Mechanic, 2604

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## WORK COVERED

This standard is for grading nonsupervisory jobs involved in fabricating, overhauling, modifying, installing, troubleshooting, repairing, and maintaining ground, airborne, and marine electronic equipment, such as: radio; radar; sonar; cryptographic; satellite; microwave; micro computers and peripherals; laser; infrared; industrial x-ray; marine, aeronautical, and space navigation aid; TV receiver; surveillance; and similar devices. The work requires knowledge of electronic principles; the ability to recognize improper operation, locate the cause, and determine the best method to correct the defect; and the skill to disassemble, assemble, and adjust electronic equipment. The work includes using both manual and automated test equipment. The work may require the use of a personal computer and numerous software packages to program or realign various components or systems, download information, and detect equipment deficiencies.

This standard cancels and supersedes the Job Grading Standard for Electronics Mechanic, 2604, issued February 1981.

## WORK NOT COVERED

This standard does not cover work that primarily involves:

- Work involved in maintaining, repairing, calibrating, and certifying electronic test, measurement, and reference equipment used for precise measurement of electrical and electronic values. (See [Job Grading Standard for Electronic Measurement Equipment Mechanic Series, 2602.](#))
- Work involved in maintaining, repairing, installing, and aligning electronic integrated systems. (See [Job Grading Standard for Electronic Integrated Systems Mechanic Series, 2610.](#)) (Note: The [Introduction to the 2600 family](#) contains a detailed discussion of the difference between electronics mechanics and electronic integrated systems mechanics. Work performed only on portions of integrated systems that do not require integration of all operable subsystems into a functional system are not covered by the 2610 series.)
- Work involved in installing, troubleshooting, repairing, overhauling, and aligning electronic control, indicating, and recording systems used on industrial machinery or engines, in automated materials storage and handling systems, in aircraft engine and similar test facilities, or in energy monitoring and control systems. (See [Job Grading Standard for Electronic Industrial Controls Mechanic Series, 2606.](#))
- Work involved in installing, maintaining, and repairing electronic digital main frame computers and associated peripheral equipment. (See [Electronic Digital Computer Mechanic Series, 2608.](#))
- Work involved in installing and maintaining electronic equipment when this is an oversight function and is secondary to the major roles of engineering testing, analysis, alignment, and performance evaluation of complex electronic systems, or when the employee is primarily

responsible for solving engineering problems of site selection, systems integration, and modification of the equipment to adapt to novel site characteristics. (See [Electronics Technician Series, GS-856](#).) (Note: The [Introduction to the 2600 family](#) contains a detailed discussion of the differences between electronics mechanic and electronics technician work.)

- Work involved in installing, modifying, troubleshooting, repairing, and maintaining voice and nonvoice communication systems including central office, private branch automatic exchanges, local area network systems, telephone sets, wire carrier equipment, communication cable, alarm systems, intercom and public address systems, and teletype equipment. (See [Job Grading Standard for Telecommunications Mechanic Series, 2502](#).)
- Work involved in installing, modifying, and repairing electrical systems in aircraft, watercraft, buildings, and mobile or transportable vans and vehicles which provide power to, or carry signals between electronics equipment, where the primary knowledge and skill is of electrical circuitry and electrical principles and formulae. (See the [Electrical Installation and Maintenance Family, 2800](#).)
- Work involved in installing, aligning, modifying, troubleshooting, repairing, overhauling, testing, and calibrating a variety of instruments containing electric, mechanical, pneumatic, hydraulic, and/or electronic components, assemblies, and controls. (See [Job Grading Standard for Instrument Mechanic Series, 3359](#).)

## TITLES

Jobs covered by this standard at grade 10 and above are titled *Electronics Mechanic*.

Jobs graded by this standard below grade 10 (other than helper and intermediate jobs) are titled *Electronics Worker*.

## GRADE LEVELS

This standard does not describe all possible grades at which jobs might be classified. If jobs differ substantially from the skills, knowledge, or other work requirements described in this standard, they may be graded either above or below the grade levels described based on sound job grading methods.

## HELPER AND INTERMEDIATE JOBS

Helper jobs are graded by the Office of Personnel Management [Job Grading Standard for Trades Helper Jobs](#).

The grade 8 level described in this standard **DOES NOT** apply to jobs that are part of a planned program of training and development of skills for advancement to a higher grade. Such trainee jobs are covered by the Office of Personnel Management [Job Grading Standard for Intermediate](#)

[Jobs](#). Grade 11 in this standard is to be used as the "full performance" or journey level in applying the Intermediate Job Grading Table.

## NOTES TO USERS

The [Introduction to the Electronic Equipment Installation and Maintenance Family, 2600](#) discusses such factors as equipment complexity versus complexity of work assigned, guides for deciding if work is general schedule or wage grade, and a detailed discussion of the difference between electronics mechanic and electronic integrated systems mechanic. The evolution of solid state technology to analog and digital technology has had a significant impact upon the skills and knowledge of the electronic mechanic. The mechanic must now work with dense and complex circuitry such as microminiaturized integrated circuits on multi-layer printed circuit boards (PCB); be able to micro solder surface mounted parts; be knowledgeable of system software and computer operations; and be able to operate and, in some cases, repair more versatile automatic test equipment.

*Automatic Test Equipment:* There are three different work situations involving the operation and repair of automatic test stations, each of which may warrant a different classification depending on the work performed.

*Situation # 1--* The electronics mechanic operates software controlled automated test stations to maintain and repair a variety of line replaceable units (LRUs); i.e., troubleshoots to the lowest replaceable unit and repairs and/or replaces unit. The mechanic also troubleshoots, maintains, and repairs the test stations and their associated peripherals. Work performed in this situation is classified to the 2604 series.

*Situation #2--* The electronic measurement equipment mechanic troubleshoots, *calibrates*, maintains, and may repair complete software controlled automated test stations. In this situation, the mechanic does not operate automated test stations to test and/or repair LRU's. Work performed in this situation is classified to the [2602 series](#).

*Situation #3--* The electronic integrated systems mechanic operates software controlled automated test stations to repair and maintain integrated electronic systems such as: fire control, flight/landing control, flight simulators, bombing-navigation, and electronic warfare. (Note: testing individual components of an integrated system is classified to the 2604 series.)

*Definitions:* Certain general terms may have different meanings to different users of this standard. For the purpose of this standard, the following terms are defined as:

*Part.* The lowest subunit of electronics devices, the basic detachable segments or pieces from which contiguous subassemblies are constructed. That unit which usually must be soldered, connected, wired, attached to a single and/or multi-layer printed circuit card or similar receptacle. Representative examples include: transistor, diode, resistor, capacitor, rectifier, switch, IC chip, etc.

*Subassembly.* A structural unit of interconnected parts comprising a circuit to perform a singular phase of an electronics function. Representative examples include: power supply regulator circuit, audio or video amplifier circuit, intermediate amplifier strip, transmitter modulator, etc.

*Assembly.* A grouping of circuits and/or subassemblies normally interconnected to a chassis or a single and/or multi-layer printed circuit card forming a complete unit capable of performing an electronics function. An assembly cannot normally be removed as an intact end-item from the chassis or printed circuit card. Representative examples include: regulated power supply module, audio board of a modular TV set, intermediate frequency board, transmitter final output module, broadcast phase of a walkie-talkie radio, etc.

*Component.* A grouping of assemblies and/or circuit modules which performs a full electronics function and is normally regarded as an end-item or detachable operational module. Each unit is normally capable of performing a complete linear or operational electronics function as a secondary or supporting constituent element of a complex electronics system. Representative examples include: multiplexer, amplifier of a public address system, receiver set or transmitter set of a complex transceiver, audio or video portion of a color television set, cathode ray tube display console and controls of a radar, etc.

*System.* A grouping of advanced electronics assemblies, and major components which frequently performs two or more substantially unrelated electronics functions where each is dependent on the interaction of one segment to another in the performance of an orderly working totality. Components often involve the presence of numerous and complex integrated circuitry and overall systems operability is affected by the interface of components and their collective reliability. Malfunction diagnosis and repair require a full-systems approach since functional problems in one portion of the system can often emanate from a seemingly unrelated source within the overall system. Representative examples include: cryptographic encoding and decoding devices, closed circuit color TV studio, tactical air navigation (TACAN) transponder beacon, microwave link terminals and repeaters, sonar, precision ground control approach radar, ATC search radar, etc.

*Prototype.* An original model on which something is patterned. Prototype as used at the grade 12 level in this standard is defined as a complex system entailing new approaches to and/or major changes to existing technology.

## **ELECTRONICS WORKER, GRADE 8**

*General:* Grade 8 electronics workers work independently on routine and repetitive work. They may also work as team members or individually under the direction of a higher grade employee in the fabrication, installation, modification, overhaul, maintenance, troubleshooting, and repair of electronic equipment ranging from equipment of limited complexity such as subassemblies, printed circuit cards, and chassis to complete electronics systems. They independently operate automatic test equipment which has been programmed to a type of chassis or printed circuit board to locate and repair defective parts. Following detailed schematics, layout diagrams, and work instructions, they construct individual chassis and components of electronic

equipment, they locate and repair malfunctions in defective circuit cards or chassis, such a audio frequency (AF) or radio frequency (RF) amplifiers, power supplies, oscillators, or other assemblies which are of limited design and functional complexity. They use standard hand tools and a variety of test equipment such as voltmeters, ohmmeters, signal/pulse generators, oscilloscopes, frequency counters, power supplies and a variety of test sets to locate and diagnose defective parts. They assist higher grade workers in the more complex fabrication, overhaul, modification, installation, troubleshooting, repair, and maintenance of complete systems, subsystems, and components as well as performing the more simple tasks such as removing and replacing defective parts and assemblies identified by higher grade workers.

*Skill and Knowledge:* Grade 8 electronics workers have a practical knowledge of electrical and electronic theory. They know how to locate and repair malfunctions and test completed work. They apply knowledge of construction practices of electronic equipment in order to recognize types and sizes of resistors, capacitors, wiring, and transistors; and follow signal paths through simple printed circuit and wired circuitry, recognizing actual circuit configurations which are shown in schematics and diagrams. They apply knowledge of standard test procedures, schematics, test/computer program instructions, technical manuals and technical change directives to complete assignments. They are skilled in the operation and applications of computerized automatic test equipment; oscilloscopes, signal/pulse generators, frequency counters, and voltmeters to follow specified check-out procedures and compare readings with specified values. They have skill in the use of hand tools such as drills, chassis punches, wrenches, soldering irons and micro soldering units to remove and replace circuit parts where accurate positioning, appearance, mechanical strength and electrical integrity are important.

*Responsibility:* Grade 8 electronics workers receive work assignments from their supervisor or higher grade worker. Detailed instructions and specific maintenance and repair procedures are provided for all items serviced. They work independently on routine and repetitive work assignments. Decisions and judgments are controlled through established work procedures and detailed instructions. Routine work assignments are typically carried out with little or no review in progress. They receive detailed instructions from their supervisor or a higher grade worker on new assignments or when assisting on assignments involving complete systems, subsystems, or components. All work is subject to review in progress and upon completion for conformance to standards and job specifications.

*Physical Effort:* Grade 8 electronics workers frequently lift and carry, unassisted, items weighing up to 18 kilograms (40 pounds). They are sometimes required to lift and carry items weighing more than 23 kilograms (50 pounds) with the help of weight handling equipment or with assistance from other workers. The work requires frequent standing, walking, bending, crouching, reaching, and stooping. Climbing and working in high places may be required. Some work may require the aid of magnifying lenses, eye loops, and microscopes to accomplish repairs on miniature components.

*Working Conditions:* Grade 8 electronics workers typically work in well lighted, heated, and ventilated areas. Work is sometimes in aircraft or ships, in high and restricted places, under conditions of heat and cold and outside in inclement weather. They are exposed to the

possibility of electric shock; burns from electrical or RF energy or hot solder; and cuts and bruises.

## **ELECTRONICS MECHANIC, GRADE 10**

*General:* In comparison with grade 8 workers who work independently on subassemblies, printed circuit cards, and chassis of limited complexity or with close supervision on more complex electronic equipment and systems, grade 10 electronics mechanics independently install, modify, overhaul, maintain, troubleshoot, and repair electronics equipment of moderate complexity or a system of limited complexity. Electronic equipment serviced at this level is usually self-contained and functionally independent such as color radar receivers and transmitters, video recorders, color video cameras/recorders, audio recorders, two-way radios, multichannel very high frequency (VHF) or ultra high frequency (UHF) transmitters or receivers, power supplies, and multilayered printed circuit boards. Representative of systems of limited complexity are public address, nurse call, security monitoring and access systems, closed circuit TV monitor systems, and personal computer systems. Working from manufacturers' specifications, schematics, block diagrams, and technical orders, they determine the operation of the circuits, locate the points from which to take readings, analyze the schematic layout and make preliminary visual inspections and operational tests to determine components causing malfunctions or invalid readings. They make the required repairs by replacing damaged, missing, burnt or faulty items such as printed circuit cards; and transistors, diodes, resistors, etc., using the latest techniques in microsoldering. They use a variety of test equipment such as oscilloscopes, pulse and signal generators, distortion and waveform analyzers, digital data generators, digital volt meters, frequency and pulse counters, and special test panels.

Grade 10 electronics mechanics set up and operate computer controlled automatic test equipment (ATE) to test and troubleshoot various components and assemblies of electronic equipment such as radio/radar receivers and transmitters; modulators; electronic analog and digital computer components; modules which contain integrated circuits; and printed circuit boards and assemblies. They select and load the test program for the unit under test, select appropriate interface device, connect required stimulation and measurement blocks, hook up the unit under test and use an electronic keyboard to run the test procedure. May be required to use oscilloscopes, multi meters, etc. to isolate component defects that the ATE cannot detect. They evaluate fault reports to determine if an item should be returned to repair section or if repair or adjustment can be made so testing can continue. Required to retest all items after repairs are completed to ensure that they can pass the diagnostic test without error.

*Skill and Knowledge:* Grade 10 electronics mechanics apply a thorough knowledge of operating electronic principles such as microminiaturized digital and solid state integrated circuits, transistors, diodes, tube circuits, antennas, signal transmission, oscillation, and amplification. They apply this knowledge to troubleshoot and repair malfunctions where circuit theory must be used to understand the operation, not only of individual circuits but also the interaction of other circuits to create a malfunction. They evaluate and perform functional tests on items to determine the extent of repair required, make repairs, and replace defective components and parts.

Electronics mechanics at this level have skill in interpreting and applying a variety of technical information such as technical orders, manufacturers' handbooks and repair manuals, schematics, block diagrams, mathematical expressions, and similar documents while testing and repairing functionally independent electronic equipment. They have skill in the use of electronic test equipment such as oscilloscopes, pulse and signal generators, distortion and waveform analyzers, digital data generators, digital voltmeters, frequency and pulse generators, and special test panels. They have skill in the use of a variety of hand tools such as screwdrivers, drills, wrenches, and soldering irons and in the use of microsoldering techniques.

Grade 10 electronics mechanics have skill in the set-up and operation of computer controlled automatic test equipment to test and troubleshoot various components and assemblies of electronic equipment or printed circuit boards. Electronics mechanics at this level must be able to assist engineering personnel in developing, debugging, or modifying diagnostic programs by recommending changes where necessary and identifying and investigating apparent contradictions between test specifications or test requirement documents and test programs.

*Responsibility:* Grade 10 electronics mechanics receive work assignments from a supervisor or higher grade mechanic in the form of work orders or oral instructions. They work independently on functionally independent equipment or as a member of a group of electronics mechanics working on a system. They prioritize their work; determine the work sequence for executing projects; select test equipment; locate the malfunction; and complete the repairs. They follow or refer to manufacturers' specifications, schematics, block diagrams, and technical orders as needed.

The supervisor or higher grade mechanic provides technical assistance on unusual or difficult problems. Completed work is either self-certified or inspected by the supervisor or quality control personnel. Grade 10 electronics mechanics also are responsible for providing technical assistance to lower grade workers, and may be required to certify the work products of lower grade workers.

*Physical Effort:* Physical effort is the same as that described at the [grade 8 level](#).

*Working Conditions:* Working conditions are the same as those described at the [grade 8 level](#).

## **ELECTRONICS MECHANIC, GRADE 11**

*General:* In comparison with grade 10 mechanics who service functionally independent components of moderate complexity or a system of limited complexity, grade 11 electronics mechanics install, modify, overhaul, maintain, troubleshoot, and repair complex electronics equipment and a complete operational system (s) consisting of numerous complex integral components which require knowledge of a wide range of electronics principles and practices. Examples of systems at this degree of complexity are: closed circuit color TV studio, communications security (COMSEC) systems; computerized avionics/airborne navigation systems; fire control systems for guns, missiles, and other weapons; air traffic control search



radar systems; and electronic countermeasures systems. They maintain, test, and repair directional finding systems consisting of an integrated airborne relay facility, integrated processing facilities mounted in surface vans, and portable tactical commander terminals. They maintain, test, and repair satellite communications systems consisting of carrier level control and monitor equipment, RF monitor and test group equipment, high power amplifier units, frequency generation equipment, intermediate frequency link amplifier (IFLA) and low noise equipment, and tracking equipment such as demodulators, receiver controls and status panels, down converters, signal data translators, RF translators, antenna control panels, servo power supplies, and antenna position and status panels. They maintain, test, and repair complete navigational aids such as TACAN units, air traffic control long range search radar. They install, maintain, and repair discrete avionics systems in aircraft. They evaluate pilot trouble reports, test, and repair a variety of equipment such as weather radar, target identification (IFF) transponders, autopilots, TACAN, radar altimeters, and other avionics equipment. They maintain, repair, install, and make operational checks on a variety of complex equipment and complete systems ranging from low and medium power search radar to sonar scanning equipment, cryptographic encoders and decoders, and electronic counter measures equipment.

*Skill and Knowledge:* Grade 11 electronics mechanics apply a comprehensive knowledge of operating electronic principles such as circuit elements, digital logic, microprocessors, core memory, interface circuits, digital data transmission, microwave, antennas, signal behavior, amplification, and display. They apply this knowledge to troubleshoot, install, repair and maintain malfunctions in complex electronic systems where circuit theory must be used to understand the operation of individual circuits, and the possible interaction of other circuits which create a malfunction. For example, they have skill to diagnose problems and determine corrective action for complex electronic cryptographic encoder/decoder units and complete systems. They are able to understand the interaction of a number of complex, interrelated circuits such as timing circuits, pulse forming networks, etc., to determine the cause of a malfunction and the interaction of factors such as ambient temperature and the power and duration of the signal input, which together cause it to fail.

Electronics mechanics at this level may apply an extensive knowledge of electromechanical servo systems, pneumatics, hydraulics, and mechanical and electric motor systems for antenna control. In some work situations, they apply a thorough working knowledge of satellite power, frequency and bandwidth utilization, and the power sharing properties of a satellite transponder. They may have extensive knowledge of cryptographic equipment and security COMSEC procedures.

Electronics mechanics at this level have skill in interpreting complex drawings, specifications, and schematics of complete systems to recognize the function and interconnections of the various assemblies and troubleshoot the system from the schematic, following signal paths through a complex path of interconnections of components, assemblies, subassemblies, and connecting cable harnesses. They have skill to modify systems by adding, altering, or removing components in order to standardize or alter the purpose of the equipment or to incorporate new features developed since the equipment was manufactured.

*Responsibility:* Grade 11 electronics mechanics receive work assignments from the supervisor in the form of work orders and inspection reports or oral instructions. While guidelines such as drawings, technical orders, manufacturers' specifications, schematics, and block diagrams are usually available, they are often vague or incomplete, and the mechanics may be required to identify and calculate the missing information.

As compared to the work performed at the grade 10 level, grade 11 electronics mechanics make more independent judgments and decisions regarding methods and procedures for completing assignments that may involve extending the use of conventional test equipment, and improvising fault analysis, repair, and calibration techniques. They are responsible for understanding the effect that particular repairs will have on the related integral components of the equipment serviced. They are also responsible for making further tests and alignments to insure that the completed equipment is aligned and functioning properly.

The supervisor spot checks work for compliance with acceptable trade practices and specifications. The supervisor or higher level worker provides technical advice and assistance on unusual or very difficult problems. Grade 11 electronics mechanics must keep abreast of technological changes in the occupation, and may provide technical guidance and assistance to lower grade employees.

*Physical Effort:* Physical effort is the same as that described at the [grade 8 level](#).

*Working Conditions:* Working conditions are the same as those described at the [grade 8 level](#).

## **ELECTRONICS MECHANIC, GRADE 12**

*General:* As compared to the complete standard operational systems typical of work at the grade 11 level, electronics mechanics, at the grade 12 level, work on systems of greater complexity that are characterized by application of advanced electronic theory. They maintain ongoing prototype systems; implement maintenance and repair procedures on major modifications of systems previously assigned to the activity; maintain unusually complex systems that have frequent engineering changes such as in design, construction, operating and servicing procedures; and may operate and maintain complex computerized automated test equipment in the troubleshooting and repair of LRUs that are comparable to the level of complexity described above. Specifications and procedures for work performed at this level are often vague and incomplete. Some work may require electronics mechanics to perform temporary duty at field units, commercial contractor facilities, and in other diverse locations, some of which may be overseas. In these situations, grade 12 electronics mechanics may serve as senior electronics mechanics and provide technical assistance to lower level electronics mechanics.

**(NOTE:** the phrase senior electronics mechanic is meant to denote a work level concept rather than a new titling practice. Electronics mechanics that function in this capacity are considered

the shop technical authority on one or more of the newest and most technologically complex electronic systems.)

*Skill and Knowledge:* Grade 12 electronics mechanics apply an expert knowledge of operation, capabilities and limitations of electronic equipment and systems. They have skill in applying this knowledge to understand new systems or complex systems that have frequent engineering changes to improvise alignment, repair, and operating procedures which will be efficient, complete, and compatible with available resources. They use ingenuity in the application of shop and trade practices to solve operating and repair problems, for example, to improvise alignment procedures for a redesigned radar system in which a number of subsystems have been modified with the introduction of integrated circuits. Mechanics at this level have a practical knowledge of electronic theory and design. They are able to use theoretical concepts to devise solutions for operating or repair problems on systems in which novel engineering approaches have created unforeseen problems. They have skill to interpret electronics drawings, specifications, and schematics of complex operational systems such as a new data transmission system with analog-to-digital converters, pulse generators, multiplexers, timing circuits, microwave transmitters and receivers, and similar involved subunits which create and use many interlocking signals. They have skill in troubleshooting complex electronic systems that lack documentation and to assist engineers in the development of technical orders using reverse engineering procedures. In some work situations, they may be required to interact with engineers, manufacturer's representatives, engineering personnel and field unit personnel in troubleshooting and developing modifications, substitutions or, corrections to equipment to reduce breakdowns and/or simplify repairs, servicing or operation.

They apply a full knowledge of complex automated test equipment (ATE), the unit under test (UUT), and the related computer programs in order to recognize deficiencies in the ATE, programming, or UUT. If malfunction is determined to be in the ATE assemblies or UUT, they isolate same to a specific part and perform the necessary repairs and retest. If malfunction is in the test program, they serve as subject matter experts in providing technical assistance to engineering personnel in resolving the problem.

Additionally, they are often requested to conduct formal training regarding the proper use of a component or system, and continually provide advice and assistance to users.

*Responsibility:* In comparison to the grade 11 electronics mechanics who receive general assignments for work on well proven and well documented equipment, grade 12 electronics mechanics exercise significantly more judgment and independence in determining the methods and techniques required to solve unusually complex maintenance and repair problems. They frequently coordinate the work assignments and provide technical assistance to one or more lower graded employees. They often coordinate with technical and professional personnel on matters affecting the operation specifications or modifications to equipment or systems. The supervisor seldom reviews work in progress and relies on grade 12 electronics mechanics to take independent action in solving unusual maintenance and repair problems. Grade 12 electronics mechanics are expected to not only maintain knowledge of state of the art technologies but also to stay abreast of new and emerging state of the market technologies.

*Physical Effort:* Physical effort is the same as that described at the [grade 8 level](#).

*Working Conditions:* Working conditions are the same as those described at the [grade 8 level](#).