



United States  
Office of Personnel Management

**FWS Job Grading Standard  
for  
Production Machinery Mechanic**

**5350**

**TS-40, 11/80**

**Workforce Compensation and Performance Service  
Classification Programs Division  
June 1998, HRCD-5**

## COVERAGE OF STANDARD

This standard covers nonsupervisory work involving the dismantling, repairing, relocating, modifying, maintaining, aligning, and installing of fixed and semi-fixed production machinery, equipment, and systems such as various standard and numerically controlled (N/C) machine tools, woodworking and metalworking machines used in the production of goods. They are located in such places as industrial plants and machine tool repair shops.

The work requires a practical knowledge of the mechanical, hydraulic, and pneumatic systems and components of diverse industrial production machinery and their attachments. This includes detailed knowledge of the operating characteristics of the involved machinery, equipment, and systems, their functional relationships, and the applicable installation and repair procedures, methods, and trade practices.

## WORK NOT COVERED

This standard does not cover work that primarily involves:

- Installation, maintenance, and repair of marine machinery and equipment such as propulsion machinery, propellers, rudders, and anchor handling gear (see [Job Grading Standard for Marine Machinery Mechanic, 5334](#));
- Installation, maintenance, and repair of general nonproduction industrial plant machinery and equipment such as bridge cranes, conveyor systems, compressors, pumps, and aircraft test block equipment (see [Job Grading Standard for Industrial Equipment Mechanic, 5352](#));
- Installation, maintenance, and repair of various fixed, semi-fixed, ground, airborne, and marine electronic equipment such as radar, radio, sonar, navigational aids and related devices (see [Job Grading Standard for Electronics Mechanic, 2614](#));
- Installation, maintenance, and repair of electrical wiring systems, fixtures, controls; and equipment such as generators, electric motors, and transformers requiring an indepth knowledge of circuitry, theories, and their practical application (see [Job Grading Standard for Electrician, 2805](#) or [Electrical Equipment Repairer, 2854](#));
- Manufacture and repair of parts and items of equipment using various types of standard and special machine tools, and their attachments, to machine metals, metal alloys, and other materials (see [Job Grading Standard for Machinist, 3414](#) or [Machine Tool Operator, 3431](#));
- Welding metals and alloys when such trade skills are paramount and constitute the primary purpose of the position (see [Job Grading Standard for Welder, 3703](#));

- Installation, maintenance, and repair of water, air, steam, gas, oil, and sewer pipelines and systems (see [Job Grading Standard for Pipefitter, 4204](#) or [Plumber, 4206](#));
- Repair and modification of a variety of refrigeration and air conditioning equipment and systems that achieve regulated climatic conditions (see [Job Grading Standard for Air Conditioning Equipment Mechanic, 5306](#));
- Maintenance and repair of all types of sewing machines (see [Sewing Machine Repairing Series, 5312](#));
- Modification, maintenance, and repair of hydraulic and/or pneumatic systems and components that actuate mechanisms or produce, control, and regulate fluid flow (see [Job Grading Standard for Pneumatic Systems Mechanic, 8255](#)).

## TITLES

Jobs covered by this standard at the grade 10 level and above are to be titled *Production Machinery Mechanic*. Jobs covered by this standard below the grade 10 level (other than Helper and Intermediate jobs) are to be titled *Production Machinery Repairer*.

## GRADE LEVELS

This standard does not describe all possible levels at which jobs may be established. If jobs differ substantially from the skill, knowledge, or other work requirements of the grade levels described in this standard, they may warrant grading either above or below these grades based on the application of 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 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 10 in this standard is to be used as the "journey level" in applying the Intermediate Job Grading Table.)

## NOTES TO USERS

*Coverage*--Production machinery mechanics, covered by this standard, typically perform work on a variety of fixed and semifixed production machinery and equipment. However, some jobs may specialize in work on only one type of machinery and equipment, for example, woodworking machines. Such jobs are covered by this standard unless the specialized work is specifically

recognized in Part 3, Definitions of Trades and Labor Jobs Families and Occupations as a separate occupation. Thus, jobs concerned only with the repair, installation, and maintenance of shoe machines, sewing machines, coffee plant equipment, printing equipment, or powerhouse equipment are graded to the particular occupations concerned.

Troubleshooting, repair, and maintenance of pneumatic and hydraulic control systems on industrial production machinery are an integral part of many jobs performed by production machinery mechanics. However, jobs in which this work is the primary function are excluded from coverage by this standard.

*Incidental Work*--In working on the mechanical, hydraulic, and pneumatic mechanisms and components of industrial production machinery, equipment, and systems, production machinery mechanics typically must have sufficient knowledge of the electrical/electronic mechanisms and devices involved to be able to distinguish mechanical, hydraulic, or pneumatic failures from those which are electrical or electronic. (Defects requiring in depth knowledge of electricity or electronic principles are referred to other personnel, e.g., electricians and electronic industrial controls mechanics.)

In addition, production machinery mechanics may perform other incidental work operations such as machining parts using portable and fixed machine tools, checking and replacing electrical wiring and connections, and welding. Therefore, such work operations are mentioned at different grade levels in this standard. However, this standard is not directly applicable to such incidental work. If such incidental work operations are the primary function of a position, it should be graded by the appropriate specialized standard or by cross-series comparison using sound job grading methods. Similarly, the presence or absence of such incidental duties in a job covered by this standard does not affect the grade level of the production machinery mechanic work performed.

**5350-8      PRODUCTION MACHINERY REPAIRER, GRADE 8      5350-8**

*General:* Grade 8 production machinery repairers apply specific maintenance and repair procedures to install, maintain, and repair fixed and semifixed production machinery and equipment such as band saws, spot welders, punch presses, and other equipment of similar complexity. They also install and repair foundations for industrial production machinery, using impact drills and building materials such as wood, cement, and steel; bolt down parts and accessories to foundations; and connect steam lines, lubricating systems, and any other power source prior to operation. Grade 8 production machinery repairers may assist higher grade machinery mechanics on assignments involving machinery of greater complexity by disassembling and assembling the simpler components and assemblies, locating and repairing or replacing defective parts and components.

*Skill and Knowledge:* Grade 8 production machinery repairers are skilled in the use of test equipment and measuring devices such as levels, feeler gauges, dial indicators, micrometers, tachometers, and calipers to repair, adjust, and test machinery and equipment such as small lathes and drill presses, vulcanizing equipment, portable grinders and sanders, and pneumatic wrenches and drills. They are also skilled in the use of various portable machine and hand tools, for example, flange facing machines, drills, grinders, punch presses, and cutting machines to make routine cuts, shapes, bores, and grinds in the installation and repair of these and other equipment and machinery of similar complexity. Repair operations involve the removal of old or damaged parts and rematching, boring, realigning, and refitting. The work requires the ability to interpret blueprints, diagrams, and other drawings, and the use of arithmetic and standard handbook formulas in performing dimensional measurements and maintaining required tolerances.

Grade 8 production machinery repairers are knowledgeable of the mechanical, pneumatic, and hydraulic operating characteristics of a variety of equipment and machinery and are familiar with the various metals needed for a given repair job as specified in the job order or bill of materials. Incidental to their work, repairers also may machine small parts using portable or fixed machine tools such as small lathes or milling machines, check and replace electrical wiring and connections, and spot weld.

*Responsibility:* Grade 8 production machinery repairers receive assignments from their immediate supervisor, either orally or in writing. They work from simple plans, sketches, and detailed specifications and are held responsible for completion of routine tasks and adherence to instructions and accepted trade practices. On routine work, they determine the proper standardized methods, techniques, and procedures required; tools to use; and complete assignments that are subject to review in progress and upon completion. On new or unusual assignments, the supervisor explains in detail the steps to follow and checks frequently for

**5350-8****5350-8**

adherence to instructions. In contrast to grade 10 production machinery mechanics who have responsibility for independently troubleshooting, diagnosing, planning, and completing projects or work orders involving more complex machinery and equipment in their entirety, grade 8 production machinery repairers are subject to close supervision on such assignments or are usually responsible for only specified segments of such machinery and equipment.

*Physical Effort:* Grade 8 production machinery repairers frequently handle objects weighing up to 20 kilograms (45 pounds) and occasionally carry objects weighing 20 kilograms (45 pounds) and over for considerable distances. They are required to push, pull, reach, walk, stand, crawl, kneel, bend, and work in cramped positions over and under machinery, of all types for sustained periods of time.

*Working Conditions:* Grade 8 production machinery repairers usually perform work inside areas that are adequately lighted, ventilated, and heated. Floor and deck surfaces are sometimes uneven, oily, and slippery. They are frequently exposed to moving objects and sharp edges with the possibility of cuts and bruises, and to noise and vibration from machines. Occasionally work is performed from ladders and stagings exposing the repairers to the possibility of serious injury from slipping and falling, dirt, grease, and dampness are frequently encountered. Various protective devices such as hard hats, gloves, safety shoes, and glasses are used.

**5350-10 PRODUCTION MACHINERY MECHANIC, GRADE 10 5350-10**

*General:* Grade 10 production machinery mechanics apply a variety of methods, procedures, and techniques to lay out, install, align, repair, overhaul, and maintain numerous types of fixed and semifixed production machinery and equipment that are technically more complex than types described at the grade 8 level, i.e., the equipment and machinery have complex interrelationships among components and diagnosis of trouble is more difficult due to various possible causes and combination of factors that may be the source of trouble.

Grade 10 production machinery mechanics disassemble and repair standard and numerically<sup>1</sup> controlled machinery and equipment such as that used for metal forming, pipe, forge and foundry work; machining, welding and burning, and woodworking operations. They determine the nature and extent of repairs necessary and make needed repairs by replacing, reworking, or refinishing worn or damaged parts and components. The mechanics reassemble and install the equipment, connect the power sources, perform operational and functional tests, and make required adjustments in order to ensure proper operation of the machine and its attachments. They also install, replace, adjust, and set various regulating or safety devices such as meters, gages, governors, and automatic alarms.

*Skill and Knowledge:* In comparison with grade 8 production machinery repairers, grade 10 production machinery mechanics apply a greater knowledge of installation and repair of more complex equipment and machinery (including their lubricating and control systems, and power drives) such as automatic screw machines, routers, precision grinders, hydraulic pipe benders, and multistation cartridge loading machines and other equipment of similar complexity used in ammunition maintenance operations.

Depending on the specific nature of the equipment and machinery, grade 10 production machinery mechanics examine and troubleshoot to determine the extent of repairs required, materials or parts needed, and to estimate the time required to complete repairs. They disassemble, repair, and rebuild component parts of production machinery and equipment such as turret lathes, boring mills, planers, radial drill presses, and multiple burning units. The work requires the ability to

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<sup>1</sup> Numerically controlled machinery serviced at this level falls into the category that consists of point-to-point or positioning control units. They are usually single or dual axis and have limited functional capability such as drilling, turning, boring, milling, or grinding. Each function is performed separately and manually with the operator changing the tools and making other adjustments prior to the next function. The mechanical, hydraulic, pneumatic, electrical, and electronic devices interact independently to the degree that a defect in one does not immediately affect any of the others.

**5350-10****5350-10**

interpret and apply the requirements contained in technical manuals, shop directives, multiview blueprints, and other documents in determining critical dimensions and key reference points. They perform precision handwork such as scraping, lapping, and honing to attain the proper finishes and alignment of machined parts to tolerances as close as .0002 of an inch.

Production machinery mechanics at this level independently dismantle, move, and relocate various types of machine tools and their attachments or install new machinery. They anchor machinery to foundations, assemble, and connect accessory or auxiliary component including steel ladders, platforms, and guard rails; make precision alignment and fine adjustments for balance and for achieving proper operating characteristics; and conduct operational tests of the machinery and its auxiliary equipment for proper operation throughout the entire range.

Grade 10 production machinery mechanics are more skilled than grade 8 production machinery repairers in the use and application of standard formulas, shop mathematics, trade theories, and industry practices in calculating needed materials and problem solving; and in the use of various test equipment and measuring devices such as alignment scopes, verniers, micrometers, precision levels, transits, strobe tachometers, bearing bridge gauges, flowmeters, hydrostatic testers, and vibration analyzers. They make the necessary templates, jigs, and other fixtures required for repair or installation utilizing a knowledge of materials and their versatility.

Incidental to their work, mechanics at this level may be skilled in setting up and operating machine tools such as small lathes, milling machines, drill presses, and precision grinders to manufacture component parts or remachine existing parts such as bushings, bearings, seals, couplings, and pistons. They are also skilled in the independent use of machine tools for onsite milling, grinding, boring, facing, and drilling, and the use of various portable machine tools to accomplish repairs.

*Responsibility:* Grade 10 production machinery mechanics work alone or as part of a team under general supervision of the immediate supervisor, who makes assignments orally or in writing. They trouble-shoot equipment to determine the area of difficulty; what parts or materials are required; and the methods, techniques, and procedures to use in completing repairs. They plan and lay out their work using blueprints, sketches, work orders, and other specifications. The supervisor reviews work for adherence to specifications and accepted trade practices. Grade 10 production machinery mechanics have the responsibility for independently diagnosing, planning, and completing projects or work orders involving major machine tools in their entirety such as turret lathes, whereas grade 8 production machinery Repairers are subject to closer supervision on such projects or are responsible for only specified segments of such machinery, for example, the gears or the tailstock of a lathe.

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

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

**5350-11 PRODUCTION MACHINERY MECHANIC, GRADE 11 5350-11**

*General:* Grade 11 production machinery mechanics perform a variety of installation, repair, overhaul, maintenance, and related activities on a range of complex multi-axis, multi-function fixed and semifixed production machinery and equipment such as numerically controlled machine tools \* and other similar complex and sophisticated equipment. The numerically controlled machinery is capable of performing a broad range of programmed machining functions such as multi-plane boring, drilling, milling, tapping, facing, planing, and other related operations.

*Skill and Knowledge:* At this level the work requires skill in installing, troubleshooting, repairing, overhauling, aligning, testing, and maintaining unusually complex equipment and machinery such as a numerically controlled machining center. An example of this kind of machining center is one that is electronically controlled with five hydraulically driven machining axes and incremental closed loop positioning\*\*, has multi-plane contouring capability, an automatic tools indexer and changer, a hydraulic counterbalance, pneumatic oil mist lubrication, and is capable of being operated in a manual, semi-or fully automatic mode. The work requires a knowledge of equipment such as taped program readers, closed loop servo assemblies\*\*\*, position detection and velocity measurement devices, and machine control codes in sufficient depth to trace symptoms of equipment malfunction and distinguish mechanical, pneumatic, and hydraulic failures from those which are electrical or electronic. Defects in the electrical system or an electronic device, requiring in depth knowledge of electricity or electronic principles, are referred to other personnel, e.g., electricians and electronic industrial controls mechanics.

Grade 11 production machinery mechanics have the ability to make precise adjustments for alignment, parallelism, and concentricity due to the continuing effects of malfunctions throughout the entire machine or equipment. For example, they make accurate and precise repair and alignment such as are required to set displacement outputs for electromechanical position and velocity detectors; or to rework gear train assemblies, antibacklash devices, and axis drives. In performing precise alignment and adjustments, they are skilled in the use of a variety of complex optical and laser light measuring devices where performance specifications are met only by simultaneous adjustments, e.g., mechanical and electronic; or mechanical, hydraulic, and electronic balancing of the machine. Although work at this level is performed independently, under circumstances such as these, the mechanic works as a member of a team usually consisting of other production machinery mechanics and an electronic industrial controls mechanic. Also characteristic of skills required at this level is the ability to perform precise measurements of air and fluid pressure and flow, and knowledge of the mechanisms used to convert such readings into measurable units.

Production machinery mechanics at this level are required to have the ability to interpret complex multiview drawings, sketches, wiring diagrams, manufacturers' specifications, and other technical material to isolate malfunctions in such devices as hydraulic pumps and motors, mechanical clamping devices, and electric or hydraulic axis drive and positioning systems. They also have a

**5350-11****5350-11**

knowledge of construction and assembly techniques and the ability to manufacture replacement parts with complex configurations or assemble unique devices with unusual angular relationships. Sometimes repairs or modifications are performed when blueprints and manufacturers' specifications are unavailable or incomplete. They use geometry, shop mathematics, and handbook formulas to provide for surfaces with interrelated dimensions and to calculate angles, clearances, fits, pressure, flow, and other parameters of interest.

*Responsibility:* Work at this level is performed with a minimum of guidance or established procedures. Compared to work performed at the grade 10 level, grade 11 production machinery mechanics independently determine the nature of the trouble and extent of repairs required on equipment that is usually complicated by more variables. They are expected to recognize the evidence of electrical or electronic malfunctions from indications in the mechanical, hydraulic, or pneumatic portions of the equipment, requiring knowledge of the functional relationships among the different portions of the equipment and an understanding of the progressive effects of electrical or electronic malfunctions on the total system. In addition to locating the trouble and judging the impact of the repairs, they independently plan the work sequence, complete the project, and make further tests, adjustments, and alignments to insure that the equipment and all its integral devices are functioning properly. The supervisor spot checks work for compliance with acceptable trade practices, directives, and operating specifications and provides technical advice on unusual or very difficult problems.

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

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

\* Numerically controlled machinery at this level falls in the category that consists of a continuous path or contouring control units that operate with the coordinated, simultaneous motion of two or more axes. They are usually larger and more accurate, and are more complex than point-to-point or positioning control units that have limited functions and no path control during the transition from one end point to the next, as those serviced by grade 10 production machinery mechanics.

By comparison, the controlled motion in a continuous path control system must govern the motion of a tool, or its path, at all times; not just the start and end point, but subsidiary points as well. The equipment is usually composed of a variety of data sensing units, translating devices, activating mechanisms, measurement and response assemblies, displays indicators, and related control boxes with features to perform a number of simultaneous or sequential functions under

**5350-11****5350-11**

Manual, semiautomatic, and automatic control. These mechanical, hydraulic, pneumatic, electrical, and electronic devices are combined and integrated into a complete processing unit. Because of the high degree of complex interaction among the various devices and subsystems comprising the machine tools, particular indications or symptoms of defects in one device or subsystem may result from any of a multiplicity of possible malfunctions in other devices or subsystems, or from the cumulative effect of a number of discrepancies in other areas. Thus, the difficulty in isolating and correcting defects in contouring control units is much greater than it is in positioning control units such as those described at the grade 10 level.

\*\* All instructions on the tape that is fed into the N/C machine are given from the zero reference point. The control relates all dimensions to the original zero point at all times. N/C units allowing for incremental positioning accept dimensions from a point other than the original zero reference. Thus, these units can use a previous point in a sequence of operations as the reference point for the next operation.

\*\*\* A servomechanism is an electromechanical system that receives a variable signal which is proportional to the difference between the actual position of the load and the desired position, detects the error, amplifies the weak error signal, and converts it into a form which will reduce the error to zero. In the closed loop servomechanism, the input controller receives feedback signals produced by a transducer on the load and senses the load's instantaneous position. In the open loop system, the input controller receives no feedback.