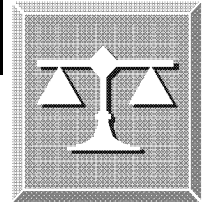


**TS-46 March 1982**

**Federal Wage System  
Job Grading Standards**



WCPS-2 August 2002

**FEDERAL WAGE SYSTEM  
JOB GRADING  
STANDARD  
FOR  
METAL FORGING,  
3802**



**Workforce Compensation  
and Performance Service**



# METAL FORGING, 3802

## TABLE OF CONTENTS

WORK COVERED .....	3
WORK NOT COVERED .....	3
TITLES .....	4
GRADE LEVELS .....	4
HELPER AND INTERMEDIATE JOBS .....	4
NOTES TO USERS .....	4
METAL FORGING WORKER, GRADE 8 .....	5
METAL FORGER, GRADE 10 .....	6
METAL FORGER, GRADE 11 .....	8

## WORK COVERED

This standard covers nonsupervisory work involving the fabrication and repair of various types of ferrous, ferrous-alloy, and nonferrous metal tools, parts, equipment, and structural plates by forging and other methods such as hardening, tempering, stress relieving, and annealing. Forging methods include forging, drop forging, upset forging, and the shaping of metal parts utilizing heat and the force of power or hand hammers to produce required dimensions and contours.

## WORK NOT COVERED

This standard does not cover work that primarily involves:

- Heat treating metals in a furnace or preheated chemical bath to alter the physical and chemical properties of the metal by an established process of controlled heating and cooling. (See [Heat Treating Series, 3712.](#));
- Setting automatic controls to operate oil or gas fired furnaces at the proper temperature to heat metal parts, bars, and billets prior to forging. (See [Furnace Operating Series, 3741.](#));
- Fabricating, installing, and repairing steel framework and other metal parts of buildings, bridges, and other structures and equipment, fitting together and installing iron grills, gratings, stairways, enclosures, and other ornamental ironwork; and/or assembling prefabricated metal parts such as slotted angle iron and panels into items such as work stands, scaffolds, dollies, and positioning devices. (See [Structural/Ornamental Iron Working Series, 3807.](#));
- Setting up, adjusting, and operating metal forming machines such as sheet metal rolls, brakes, shears, hydraulic and mechanical presses, band saws, blanking presses, punch presses, combination beading machines, metal stitching machines, drop hammers, and rivet making machines which cut, punch, stamp, draw, shape, and roll metal sheets, strips, or wire into desired shapes or contours, e.g., skin and frame of aircraft; coin production jobs involving the production of proof and finished coins. (See [Metal Forming Machine Operating Series, 3869.](#)); and
- Making bench, floor, or sweep molds for producing foundry castings. (See [Molding Series, 4373.](#))

## TITLES

Jobs covered by this standard at the grade 10 level and above are to be titled *Metal Forger*.

Jobs covered by this standard below the grade 10 level (other than Helper and Intermediate jobs) are to be titled *Metal Forging Worker*.

## 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 U.S. 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 U.S. 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

Heat treating metals in a furnace including the setting of automatic controls, setting up and aligning dies in forging machines such as drop hammers, and operating annealing equipment are an integral part of some jobs performed by metal forgers. However, jobs in which this work is the primary function are excluded from coverage by this standard.

**3802-8****METAL FORGING WORKER, GRADE 8****3802-8**

*General:* Grade 8 metal forging workers fabricate and repair simple tools and jigs such as chisels, tongs, swages, and other ferrous, ferrous-alloy, and nonferrous metal parts of similar complexity in accordance with specific repair and production forging methods and techniques. They may assist higher grade metal forgers on assignments involving the shaping of metal parts that are more complicated because of their size, weight, and unusual shape.

*Skill and Knowledge:* Grade 8 metal forging workers are skilled in the use of forging processes to manufacture and repair ferrous and nonferrous metal parts such as tongs, hooks, wedges, swages, drift pins, punches, and other small tools and items that have predominately straight edges and regular curves. They are also skilled in the use of tongs, power brakes, calipers, rulers, and other power and hand tools in forging, maneuvering, and shaping metal on anvils and under hammers. The work requires the ability to interpret blueprints, sketches, and other less complicated drawings. A knowledge of arithmetic and standard handbook formulas is used in performing dimensional measurements and in determining the material necessary for given forgings with proper allowance for finishing and to calculate and scribe patterns, using shop principles of parallel-line or radial-line development.

*Responsibility:* Grade 8 metal forging workers receive assignments from their immediate supervisor, either orally or in writing. They work from simple plans, uncomplicated diagrams, and clear-cut work orders and specifications; use predetermined methods, materials, and power tools; and are held responsible for completion of routine tasks and adherence to instructions and accepted trade practices. On routine work, they are responsible for the proper standardized methods, techniques, and procedures required; tools to use and complete assignments that may be spot checked during progress. The supervisor or other higher grade employee is available for advice on new or unusual assignments and to check the completed work to see that it meets requirements.

*Physical Effort:* Grade 8 metal forging workers frequently handle objects weighing up to 20 kilograms (45 pounds) and occasionally carry objects in excess of 20 kilograms (45 pounds). They are required to push, pull, reach, walk, stand, bend, and work in awkward positions for sustained periods of time. Heavy physical exertion is sometimes required to manipulate hot metal under power hammer or press.

*Working Conditions:* Grade 8 metal forging workers usually perform work inside areas that are adequately lighted, ventilated and heated. They are frequently exposed to noise caused by pounding and hammering metals, moving objects and sharp edges with the possibility of cuts and bruises, and excessive heat from furnaces and heated materials with the possibility of burns. Unpleasant conditions from dirt, dust, smoke fumes, and gasses frequently exist. Floor surfaces are sometimes uneven and wet. Various protective devices such as hard hats, gloves, ear plugs, safety shoes, and glasses are used.

**3802-10****METAL FORGER, GRADE 10****3802-10**

*General:* Grade 10 metal forgers plan, lay out, manufacture, and repair various types of ferrous, ferrous-alloy, and nonferrous metal parts, accessories, and tools by forging, forge-welding, tempering, and annealing, using power hammers and presses or hand hammer and anvil methods. They manufacture and repair such metal items as shackles, crankshafts, flask plugs, cleat horns, channel beams, valve shafts, parts to gun mounts, and other items that are more complex and difficult to produce than those mentioned at the grade 8 level because of the more complicated contours or curves, and the closer tolerances that must be maintained. The metal items manufactured or repaired usually do not exceed 45 kilograms (100 pounds) in weight and are completed within a tolerance of 1/16 of an inch; however, when working on or assisting higher grade metal forgers in propeller repair, they must maintain a tolerance of 1/32 of an inch.

To devise and calculate a pattern in the layout of metal objects such as propellers, grade 10 mechanics apply principles of radial-line development combined with parallel-line development. Grade 8 workers do not use both on the same item because the less complex patterns for items such as those at the grade 8 level can usually be developed by one method or the other.

*Skill and Knowledge:* In comparison with grade 8 metal forging workers, grade 10 Metal Forgers utilize various repair and production forging methods and techniques including forge-welding, brazing, riveting, fullering, and other methods such as annealing, stress relieving and tempering to produce metal parts such as crowbars, beams, manhole covers, coil springs, chain links, axles, high speed tools, ordnance items such as collars and gear blanks, and parts for weapons systems such as clevises, rods, trunnions, cradle heads, piston heads, cave breech brackets, telescope blocks, and other items for gun mounts.

Metal forging mechanics at this level have a working knowledge of more kinds of metals than grade 8 workers including high and low carbon steels, reinforcing and chrome steels, chrome-molybdenum, stainless steels, angle iron, brass, copper, high speed tool steels, aluminum, aluminum alloys, and other metals and alloys enabling them to select the appropriate stock. They skillfully perform such forging operations as drawing, upsetting, bending, twisting, scoring, hacking, rolling, beveling, and punching bars, billets, and ingots of metal stock. These forging operations require the ability to heat and manipulate the work piece with tongs on dies while striking with hand or power hammer or presses.

Grade 10 metal forgers are more skilled than grade 8 metal forging workers in the use and application of trade theories and industry practices, geometry and shop mathematics in determining the amount of material necessary including allowance for metal shrinkage and contour formations, and in computing angles and other dimensions. They are also more skilled in pyrometers, hammers, anvils, and tongs. The work requires the ability to interpret and apply the requirements contained in technical manuals, shop directives, multiview blueprints, weight charts, the use of various tools and equipment such as weight calculator slide rules, calipers, dividers, and other documents in determining critical dimensions

**3802-10****3802-10**

and key reference points. They are more skilled than grade 8 workers in setting up and operating machine tools such as induction heating machines, drill presses, power brakes and saws, gas and oil fired furnaces, pipe steam forging hammers [up to 3600 kilograms (8000 pounds)], power rollers, and hardness testers to heat, bend, and shape metals is required.

They improvise and manufacture templates, special tools, fixtures, and jigs to hold parts to close tolerance and prevent distortion and malformation during heat treatment.

*Responsibility:* Grade 10 metal forgers work under the general supervision of the immediate supervisor, who makes assignments orally or in writing. They independently plan and lay out their work using blueprints, sketches, work orders, and other specifications; make templates where necessary; and select, use, or prescribe methods, tools, materials, and machines most appropriate to complete the assignment. The completed work is spot checked by the supervisor for quality and accuracy. In comparison, grade 8 workers, except on routine work, are restricted to predetermined methods, tools, and materials, and are subject to closer supervision.

*Physical Effort:* Physical effort at this level is the same as that described at the [grade 8 level](#), except that grade 10 metal forgers frequently handle metal objects in excess of 34 kilograms (75 pounds).

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

**3802-11****METAL FORGER, GRADE 11****3802-11**

*General:* Grade 11 metal forgers perform a variety of forging operations such as drawing, upsetting, bending, twisting, scoring, hacking, rolling, beveling, and punching on bars and ingots of metal stock. Metal objects at this level are more complex and difficult to manufacture and repair than those described at the grade 10 level because they are usually unconventional, oblique, and greater in size and weight. For example, a ship's propeller ranges in weight from 1350 kilograms (3000 pounds) to 29700 kilograms (66000 pounds) and an anchor shackle from 225 kilograms (500 pounds) to 360 kilograms (800 pounds) whereas, at the grade 10 level, metal objects seldom exceed 45 kilograms (100 pounds) in weight, are smaller in size, and have more conventional lines and contours. The greater size and weight of the tools and work piece increases the difficulty in manipulating the metal objects and controlling the force and frequency of blows from power or hand hammers to produce the desired shape and dimension.

*Skill and Knowledge:* Planning, layout, and construction skills are used to devise complex templates and patterns and to shape, construct, fabricate, and repair various types of ferrous, ferrous-alloy, and nonferrous metal forgings. Grade 11 metal forgers have a thorough knowledge of forging practices and procedures and utilize their knowledge of shop mathematics and geometry to calculate weights and balances, compute angles and other dimensions. In addition to the parallel-line and radial-line development that is typical at the grade 10 level, grade 11 mechanics use principles of triangulation required in the layout of metal objects with unusual contour formations, pitch and varying angles such as a propeller blade that must be straightened to the correct pitch with a tolerance of no more than 1/32 of an inch.

Because of the extreme size and weight of some metal objects, metal forgers at this level are required to have the ability to direct the activities of an assisting crew. This crew usually consists of several helpers, a crane operator, a press operator, and a tumbler who assist in maneuvering and manipulating the work piece into position for forging operations, and other metal shaping and conditioning operations such as annealing, hardening, and tempering. Compared to grade 10 metal forgers who usually work on small easy-to-manipulate metal objects, the work performed by grade 11 metal forgers is complicated by the odd shapes and increased size and weight of the metal objects.

In addition to the knowledge of various kinds of metals typical of grade 10 mechanics, Grade 11 metal forgers have a working knowledge of the physical properties and the malleability of various types of ferrous, ferrous-alloy, and nonferrous metals such as copper, nickel, chromium, brass, bronze, aluminum, wrought iron, stainless steel, titanium, cobalt tool steel, and molybdenum, and their heating temperatures necessary to properly complete the forging process. They are required to have the ability to interpret complex drawings, sketches, manufacturers' specifications, and other technical material to manufacture and repair metal objects such as hawse pendants, anchor shackles and pins, elevator pathways, pipe flanges, anchor shanks, elbows, and crane hooks. They are skilled in selecting the correct type and amount of metal stock; in operating and controlling the heating and cooling rate in furnaces and other heating machines; in utilizing acetylene burning and electric welding techniques and such tools and



**3802-11****3802-11**

measuring devices as the optical pyrometer, weight calculator slide rules, hand hammers, power presses of up to 900 kilograms (2000 ton) capacity, anvils, tongs weighing as much as 45 kilograms (100 pounds), vises, punches, and chisels; and in developing, improvising, and manufacturing the necessary templates, fixtures, jigs, and special tools.

*Responsibility:* Grade 11 metal forgers receive assignments with a minimum of guidance. They independently plan and lay out their work using blueprints, sketches, work orders, and other specifications; determine what materials are required and tools to be used; and select the forging methods, techniques, and operational sequences necessary to complete the project.

The supervisor spot checks work for compliance with acceptable trade practices and directives, and specifications; and provides technical advice on unusual or very difficult problems.

*Physical Effort:* Physical effort at this level is substantially the same as that described at the [grade 10 level](#). However, grade 11 metal forgers occasionally handle objects weighing up to 29,700 kilograms (66,000 pounds) using cranes and other mechanical devices.

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