

MIL-T-46398(MU)
9 JANUARY 1964

SUPERSEDING
FED-1427 REV. 2>
28 MARCH 1961

MILITARY SPECIFICATION

TOOLS FOR THE PRODUCTION OF FIRE
CONTROL MATERIEL:
GENERAL SPECIFICATION FOR

1 . S C O P E .

1.1 SCOPE. This specification covers general military requirements for the design and fabrication of tools required for the manufacture of fire control materiel.

1.2 Classification. Tools covered by this specification shall be of the following types and grades as specified.

Type I	-Cutting Tools.
Type II	-Punches and dies.
Type III	—Forging dies.
Type IV	-Die casting dies.
Type v	-Molding dies
Type VI	Drill jigs
Type VII	-Fixtures.
Type VXII	-Patterns
Type IX	-Manufacturing gages
Grade A	-Large Production runs- multiple Operations
Grade B	-Medium prOdUction runs multiple or single Operation
Grade C	-Small production runs- single operation.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

S P E C I F I C A T I O N S

MIL-I-45208	-Inspection Requirements, General Specification for.
MIL-D-70327	-Drawings, Engineering and Associated Lists.

STANDARDS

MILITARY "

MIL-STD-129	-Marking for shipment and storage.
MIL-STD-130	-Identification -- ing of U.S. Military Property.
MIL-STD-1243	-Engineering Drawings.
MIL-STD-1244	-Lists Associated with Engineering Drawings.

(Copies of specifications, standards, publications by suppliers in connection with specific procurement functions should be obtained from the procuring activity Or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 General

3.1.1. Material. The materials used in the fabrication of these tools shall be selected on the basis of those best suited to meet the detail requirements.

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3.1.2 Design. Grade A and B tools shall be designed in accordance with their class requirements, and shall include such design characteristics as rigidity of parts, resistance to fatigue, and ease of maintenance. Safety of the operator shall be a prime consideration.

3.1.3 Performance.

3.1.3.1 Grade A tools. Tools in this grade shall perform the largest number of operations and produce the greatest number of pieces. Where special machines are required with the tools, the machine together with the tools becomes Grade A. Standard machines of a particular model or equipped with special attachments shall not be considered special machines. The productive capacity requirements for Grade A tools shall be specified in the contract.

3.1.3.2 Grade B tools. Tools in this grade shall perform single or multiple operations over medium production runs. All Grade B tools shall be adaptable to standard machines.

3.1.3.3 Grade C tools. Tools in this grade are only required to produce small quantities of parts such as R and D work. Low cost, data simple design, single operation shall be the chief characteristics of this class. Grade C tools are usually scrapped at the completion of the contract.

3.1.4 Drawings. Drawings shall be prepared in accordance with specification MIL-D-70327, Standard MIL-STD-1243, and as specified herein for all Grade A and Grade B tools. Drawings are not required for Grade

C tools or commercial tools such as tape dies and reamers.

3.1.4.1 Class and type. Drawings shall be class 1, Grade 2 detail assembly drawings with necessary views of assembled tools and shall be sufficiently definitive to permit manufacture by a second source. Each part shall be fully dimensioned and assigned a part number. Parts which cannot be fully dimensioned on the assembly views shall be detailed and dimensioned separately.

3.1.4.2 Title block. The title block on the drawings shall contain the following identifying information:

- (a) Tool nomenclature. Example Turning Fixture.
- (b) Government tool number consisting of:

1. Tool category letter: "G" for production gages, "M" for Molds, "P" for patterns, "T" special assembly equipment and all other tools.

2. Sequence of operation number; 1, 2, 3 etc.

3. Assigned Government No.

4. Grade of Tool: Letter A or B

- (c) Name, type, model number and capacity of machine, when tool is used on a power machine. Example: Lathe, turret, electrocycle NO. 1, warner & Swazey, M2620, 5 / 8 " dia.

(d) End item nomenclature

number. Example: Range finder M17.

3.1.4.3 Engineering lists. Parts lists and data lists shall be prepared separate from the drawing and shall comply with Standard MIL-STD-1244.

3.1.4. Revisions. The contractor's production tool engineering activity shall review all pertinent product engineering changes made throughout the life of the contract and make the necessary revisions to the pertinent tool drawings.

3.1.4.5 Disposition of drawings. On completion of the contract, all Original tool drawings procured under this specification shall be packaged in accordance with section 5 of Specification MIL-D-70327 and delivered to the Government as directed by the procuring agency (see 6.2).

3.1.5 Standard parts. Wherever possible standard parts such as guide pins, bushings, etc. shall be used in Grade A and B tools, Provided they possess suitable properties and

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the replacement parts are interchangeable. The standard part numbers shall be referenced on the tool drawings.

3.1.6 Accuracy. All tools, regardless of grade, shall produce parts within the tolerance specified on the component drawing; and in addition Grade A and B tools shall meet the tolerances specified on the tool drawings and shall maintain accuracy while in use.

3.1.7 Workmanship. Workmanship shall be in accordance with best toolmaking practice ~~consistent~~ with the grade of tools specified in the contract.

3.1.8 Identification. Grade A and B tools shall be engraved, stamped or etched with the following identification:

- (a) Army and munitions command
- (b) Tool nomenclature.
Tool nomenclature.
- (c) Tool number.
- (d) Component nomenclature.
- (e) Instrument nomenclature.

3.1.8.1 Tool number. The tool number shall consist of four parts; Contractor identification symbol; Tool category sequence of operation symbol; Component item drawing number; and the component drawing revision symbol, if any. The tool number shall be assigned by the contractor.

Example: C-t2-A7432561-B

3.2 Detail requirements.

3.2.1 Type I cutting tools.

3.2.1.1 Material.

3.2.1.1.1 Grade A. The material used in this grade of cutting tool shall be composed of or carbide patches, and inserts, or electroplated high speed tool steel.

3.2.1.1.2 Grade B. The material used in this grade of cutting tool shall be composed of high speed tool steel. In cases where hardening would cause burn away or distortion of thin sections, high carbon tool steel shall be used.

3.2.1.2 Design. Grade A and B. Unless otherwise specified these cutting tools shall be backed off without changing the shape or size of the form. Where backing off cannot be held true to form a template or profile gage shall be supplied with the form tool in order to facilitate regrinding or sharpening.

3.2.1.3 Heat treatment and final finish. Grade A & B tools shall be heat treated and finish ground. To overcome surface decarburization, all cutting edges shall have a surplus of material of $\frac{1}{32}$ of an inch for finish grind. Where grinding allowance is not practicable, the use of atmospheric controlled furnaces, heating of baths, liquid molten metal or salt shall be resorted to. The tool shall then be cleaned with a cleaning agent or by abrasive blasting. All wearing surfaces, cutting edges, bearing surfaces, gaging points shall be finish ground. The heat treatment and finish shall produce a tool which shall maintain a sharp cutting edge and give sufficient toughness to the body to prevent breakage while under working pressure.

3.2.1.4 Number of set. Three sets of Grade A or B cutting tools shall be required.

3.2.2 Type II punches and dies.

3.2.2.1 Material. The steel selected shall be a type which after heat treatment shall possess sufficient hardness and maximum toughness qualities.

3.2.2.2 Design. The following design characteristics shall be incorporated into Grade A and B punches and dies:

3.2.2.2.1 Inserts. Inserts may be used provided they have sufficient reinforcement and are locked in place to prevent recoil, rotation, or any movement detrimental

3.2.2.2.2 Sections. To facilitate maintenance accuracy and machinability, sectional punches and dies may be used provided they are properly installed and are not weakened by excessive use of screws and dowel pins. Sections lacking adequate support, backing, or conditions that would weaken the die beyond safe working limits shall not be used.

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3.2.2.3 Side wall. Where a blank is ejected through the bottom of the press, the straight side wall portion of the die shall be kept to a maximum length. This length shall be determined by the material under process, the thickness of the blank and the class of tool. This requirement applies to piercing or shaving dies and those requiring bottom clearance. When the blank is ejected through the top of the die by a mechanical ejector, the straight side wall length shall be equal to the

3.2.2.4 Clearance. To insure clean blanks, the clearance between the punch and the die shall be kept to a minimum. The required clearance is determined by the material and its thickness.

3.2.2.5 Relief. The relief clearance of the die shall be large enough to permit free passage of the blank or slug, but not enough to permit the blank to tumble and hang up.

3.2.2.6 Stripper. When a stripper is required it shall be made of hardened tool steel or peck hardened machine steel actuated by springs or rubber. When short action is required, the stripper shall be made of cork or similar composition. The stripper shall complete its function with every cycle of operation. Manually operated strippers shall not be permitted.

3.2.2.7 Ejector. The ejector shall be a knockout or air blast type. An ejector composed of cork or composition is acceptable, provided it completes its function with every cycle of operation. Manually operated ejectors shall not be permitted.

3.2.2.8 Alignment. The alignment of the punch and die shall be maintained to prevent hang up, shearing, pushover or undue strain while under working pressure.

3.2.2.9 Heat treatment. All wearing surfaces of Grade A and B punches and dies shall be heat treated to obtain maximum hardness and still retain sufficient toughness to resist chipping, cracking, or crumbling under working pressure. Thin cutting

sections shall be treated to obtain maximum toughness and sufficient hardness to prevent galling and spalling. When heat treating methods do not produce the desired results inserts may be used.

3.2.2.4 Finish. To insure accuracy, and to eliminate soft skin due to decarburization in hardening, all working or wearing surfaces shall be finish ground or polished. Where grinding is not practical, the tool steel used shall be of a type which shall not change

allowable limits. Decarburization shall be avoided and all working or wearing surfaces shall be stoned or polished.

3.2.2.5 Performance. Grade A punches and dies shall perform multiple operations in one cycle or in stages, as in the case of progressive dies. Grade B punch and dies shall perform one or more operations in one cycle and may consist of a family of punches and dies to complete the required operations.

3.2.2.6 Die sets. The use of commercial die sets shall be permitted provided the proper grade and material are selected. Used die sets are not permitted.

3.2.2.7 Guide pins and bushings. The use of commercially hardened and ground steel guide pins and bushings is permitted.

3.2.3 Type III forging dies Grade A and B.

3.2.3.1 Material. The steel selected for these forging dies shall be of a type which after heat treatment shall possess sufficient red

3.2.3.2 Design. Grade A dies shall be of multiple cavity design; Grade B dies shall be of single cavity design.

3.2.3.2.1 Inserts. Inserts may be used provided they are locked in place to prevent any movement. They can also be used to overcome complicated heat treating conditions. They should not be used where their application would be detrimental

3.2.3.2.2 Sections. To facilitate maintenance, accuracy, and machinability, sections may be used provided they are properly in-

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stalled and are not weakened by excessive which shall use of screws and dowel pins. Sections lacking adequate support backing or condition that would weaken the die should be avoided.

3.2.1 Type IV die casting dies - Grade A and B.

3.2.1.1 Material. The steel selected for these dies should be of a type which after heat treatment has sufficient hardness and strength to resist heat checking.

3.2.1.2 Design. Grade A dies shall be of multiple cavity design. Grade B dies shall be of single cavity design.

3.2.1.2.1 Inserts. To facilitate maintenance, inserts may be used provided they have sufficient reinforcement and are locked in place to prevent any movement detrimental to the die. Inserts may also be used to overcome complicated heat treating conditions. They should not be used where their application would be detrimental to the die.

3.2.4.2.2 Sections. To facilitate maintenance, accuracy, and machineability, sections may be used provided they are properly installed, and are not weakened by excessive use of screws and dowel pins. Sections lacking adequate support, backing, or Conditions that would weaken the die should be avoided.

3.2.4.2.3 Vents. Vent size shall be sufficient to allow proper venting but shall not be excessive to the extent that heavy flashes would result in excessive deburring operations.

3.2.1.2.4 Ejector. The ejector shall be the mechanical type. The activation of the ejector shall be optional, either air, hydraulic, or mechanical.

3.2.4.2.5 Alignment. The alignment of the die shall be maintained to prevent shift or pushover while under working pressure.

3.2.4.2.6 Finish. To insure accuracy and to eliminate soft skin due to decarburization in hardening, all cavities and guides shall have a No. 16 RMS or better. Where grinding is not practical the steel used shall be of a type

not change during the hardening process, beyond the allowable limits. Decarburization shall be avoided and all working or wearing surfaces shall be stoned or polished.

3.2.5 Type V molding dies (for plastic and rubber parts.)

3.2.5.1 Hobbing method of die sinking. Where powdered metal molding dies are used the hob produced shall be made of suitable tool steel, which after heat treatment shall possess high compression and transfer strength to resist splitting. The hob shall

3.2.5.1 Machined molding dies. Where molding dies are produced by the machining process, the steel selected shall retain its accuracy after heat treatment and be able to take the required finish.

3.2.5.2 Design. Grade A dies shall be of the multiple cavity design. Grade B dies shall be of the single cavity design.

3.2.5.2.1 Inserts. To facilitate maintenance, inserts may be used in the machined molded die provided they have sufficient reinforcement and are locked in place to prevent any movement detrimental to the die. They may also be used to overcome complicated heat treating conditions. They should not be used where their application would be detrimental to the die.

3.2.5.2.2 Sections. To facilitate maintenance, accuracy, and machineability, sections may be used in the machined molding die provided they are properly installed and are not weakened by excessive use of screws and dowel pins. Sections lacking adequate support, backing, or conditions that would weaken the die should be avoided.

3.2.5.2.3 Vents. Vent size shall be sufficient to allow proper venting but shall not be excessive to the extent that heavy flashes would result in an excessive deburring operation.

3.2.5.2.4 Ejector. The ejector shall be the mechanical type. The activation of the ejector shall be optional; air, hydraulic or mechanical.

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3.2.5.2.5 Alignment. The alignment of the die shall be maintained to prevent shift or pushover while under working pressure.

3.2.5.2.6 Finish. To insure accuracy and to eliminate soft skin to decarborization in hardening, all cavities and guides of the machined molding dies and the hob shall have a No. 16 RMS finish or better. Where grinding is not practical, the steel used shall be of the type which shall not change during the hardening process, beyond the allowable limits. Decarburization shall be avoided and all working or wearing surfaces shall be stoned or polished.

3.2.6 Type VI drill jigs Grade A and B

3.2.6.1 Material. Drill jigs shall be made of hard iron castings which shall be of uniform quality and condition free from all defects such as cracks porosity, hard spots, gasholes or foreign in matter. The scale shall not be broken or disturbed where machine surfaces are not required.

3.2.6.2 Design. Grade A drill jigs shall be designed in the piece on one cycle of operation. Grade B drill jigs will not be required to drill all holes in one cycle of operation will require more than one set up or jig to drill all the required holes.

3.2.6.3 Construction. Informing four sides, two of four separate plates. Joining sections shall be flat machined or ground surfaces attached with socket head screws and located with hardened dowel pins. The dowel pins shall be a force fit in the through holes and a slide fit in the blind holes. The slide fit of the dowel pins shall not be less than one diameter or more than two diameters in length. Holes shall be slightly countersunk to prevent false bearing on joining surfaces. Supports shall machining where necessary. Care shall be exercised to prevent the supports from influencing the jig by setting up undue strain.

3.2.6.4 Alignment. The alignment of the jig shall be maintained to prevent shift during the drilling operation.

3.2.6.5 Combination of cast iron and steel. Drill constructed of a combination of cast iron and steel are permitted provided they produce acceptable work.

3.2.6.6 Bushings. Bushings used in these drill jigs shall be made of hardened tool steel and have a lapped finish.

3.2.7 Type VII fixtures Grade A and B

3.2.7.1 Material. Fixtures shall be constructed of suitable machine or iron castings. Where machine steel is used all or wearing or bearing surfaces shall be hardened. Where castings are used they shall be made of iron of uniform quality and condition, free from defects such as cracks porosity, hard spots, gasholes or foreign matter. The scale shall not be broken or disturbed where machine surfaces are not required.

3.2.7.2 Design. Fixtures shall be designed to hold, locate and position the piece for the necessary machining, operations.

3.2.7.2.1 Grade A. These fixtures shall be designed to permit machining from multiple settings by horizontal and/or vertical indexing. The fixture may also be designed as a multiple fixture permitting the same machining operations on several pieces simultaneously. Class A fixtures shall be automatically operated.

3.2.7.2.2 Grade B. These fixtures shall be designed to permit machining from one or more settings. Grade B fixtures shall be manually operated.

3.2.8 Type VIII patterns Grade A and B

3.2.8.1 Material. Grade A patterns shall be made of metal. Aluminum, bronze, cast iron or brass may be used, Grade B patterns shall be made of seasoned mahogany.

3.2.8.2 Design. Grade A and B patterns shall be designed to produce more than one casting in one complete cycle of operation. Due consideration shall be given to allowances for machining, shrinkage factors, and proper location of bosses and cereal holes.

3.2.9 Type IX manufacturing pages Grade A and B

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3.2.9.1 Material. The material used in Grade A gages shall be a suitable machine steel. Bearing surfaces, wear plates and wear points shall be made of either carbonyl, chromium, tungsten, or diamond. Grade B gages shall be made of suitable machine steel. Bearing surfaces, wear plates, and wear points shall be made of high carbon steel.

3.2.9.2 Design. Grade A manufacturing gages shall be designed to measure more than ^{one dimension} ~~one dimension~~ at one time, with go ~~and not go~~ limitations. Grade B manufacturing gages shall be designed to measure a minimum of one dimension at one time with go and not go limitations.

3.2.9.3 Accuracy. The tolerance of Grade A and B gages shall be equal to 10% of the tolerance specified by the part drawing. To insure compatibility, the gages shall meet the dimensions specified on the gage drawings.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the* supplier is responsible for the performance of all inspection measurements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspection set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 General requirements. Inspection requirements and procedures shall be in accordance with Specification MIL-I-45208.

4.3 Material. Material used in the manufacture of the tool shall be properly certified by the contractor to insure compliance with requirements according to the type and classification of the tool specified in 3.1.1.

4.4 Drawigs. Drawings shall be visually and dimensionally inspected for compliance with 3.1.1. Examination shall be based upon the quality assurance of Specification MIL

D-70327, applicable to Grade 1 drawings. The following inspection requirements and procedures shall also be performed to determine acceptance of completed drawings:

Characteristic	Req. par.	Method of Inspection
Format and size	3.1.4.1	(SME)—Standard Measuring Equipment
Title block	3.1.4.2	Visual
Engineering lists	3.1.4.3	Visual
Revisions	3.1.4.4	Visual
Disposition	3.1.4.5	Visual

4.5 Final acceptance. Final acceptance of tool drawings shall be withheld by the Government Inspector until they have satisfactorily passed the applicable requirements of this following

- (a) All tools shall be inspected 100 percent before acceptance. Defective parts shall be replaced.
- (b) Approved drawings shall be initialed in the approved block of the drawing by the Government inspector prior to final acceptance.

4.6 Design requirements. Tool design shall meet the requirements of Section 3 for the type and grade of tools specified in the contract. The contractor shall provide a complete set of drawings for visual inspection of design by the Government inspector at the place of Operation. This inspection shall be performed after the major problems of production have been recieved and not later than 30 days after reaching maximum production.

4.7 Acceptance inspection.

4.7.1 Tools. Each tool shall be inspected at the place of operation in accordance with the requirements specified in par. 3.1.3 and 3.2 for the classification and type specified. The tool shall be acceptable when the Government inspector has witnessed the tool in operation and is satisfied that:

- (a) The tool is producing acceptable work to the dimensions specified and within the working tolerances and other applicable requirements, such as notes shown on the component part drawing.
- (b) The tool is capable of producing at least the minimum quantity of

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production required by the contract for the particular grade of tool specified.

- (c) The tool has been subjected to inspection and accepted for compliance with the requirements of this specification.

~~4.7.3 Tool drawings. Tool drawings and associated lists shall be inspected for compliance with par. 3.1.4 and 4.4 and the Government inspector shall ascertain that the tool produced from these drawings shall be capable of performing in the manner intended and meet the requirements of par. 4.7.1 and the following control factors:~~

- (a) That the dimensions and tolerances and other pertinent information and specifications indicated on the tool drawings are compatible with the tool.
- (b) That the drawings are true representations of the actual tools in use.
- (c) That the drawings have been inspected for completeness and technical accuracy, legibility, reproducibility and clarity of design to manufacture the tool.
- (d) That the drawings have the proper identification information in accordance with the requirements specified in par. 3.1.4.

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4.8 **Workmanship.** A visual examination of each tool shall be made to determine compliance with the 3.1.1, 3.1.2, and 8.1.7.

~~4.9 Identification markings. The identification marking of the tool shall be visually inspected for compliance with 3.1.8 and conformance with the tool drawings as specified in 4.7.2.~~

5. PREPARATION FOR DELIVERY

~~5.1 Preservation and packaging. Preservation and packaging shall be as specified by the contract (see 6.2).~~

6. NOTES

6.1 **Intended use.** This specification is intended for the procurement of tools required for the manufacture of fire control items.

6.2 **Ordering data.** Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Quantity of tools required.
- (c) Quantity and type of drawing sets required.
- (d) Grade of tools required, A, B, or C.
- (e) Levels of packaging and packing required.
- (f) Disposition of tool drawings.
- (g) Applicable packaging instruction.

Preparing activity:
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Project No. 1286-A146Y

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SPECIFICATION ANALYSIS SHEET		Form Approved Budget Process No. 119-R004
INSTRUCTIONS		
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments on the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).		
SPECIFICATION		
ORGANIZATION (of submitter)		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEM PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?		
A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE?		
<input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity)		DATE