

[INCH-POUND]  
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SUPERSEDING  
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## COMMERCIAL ITEM DESCRIPTION

### MACHINING CENTER, VERTICAL, DOUBLE-COLUMN, SINGLE-SPINDLE, COMPUTER NUMERICAL CONTROL (CNC)

The General Services Administration has authorized the use of this commercial item description for all federal agencies.

1. **SCOPE.** This commercial item description (CID) covers computer numerical control (CNC), single-spindle, double-column, vertical machining centers intended for shaping workpieces by linear and surface contouring, continuous-path, material removal processes of drilling, reaming, tapping, milling, and boring. This CID also covers machines of similar single-spindle, double-column design that are referred to by other names such as face mills, five-face milling machines, five-face machining centers, five-face multicenters, bridge mills, bridge vertical machining centers, universal machining centers, double-column machining centers, die mold machines, die sinkers, die sinking machines, and gantry profilers.

2. **CLASSIFICATION.** The machining centers shall be of the following types, classes, styles, and sizes. The type, class, style, and size to be furnished shall be as specified (see 7.2(b)).

Type I - High performance (see table II)

Type II - Standard performance (see table II)

Beneficial comments, recommendations, additions, deletions, clarifications, etc., and any data which may improve this document should be sent to: Defense Supply Center Richmond, ATTN: DSCR-VBD, 8000 Jefferson Davis Highway, Richmond, VA 23297-5610.

AMSC N/A

FSC 3408

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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Class 1 - 25 horsepower

Class 2 - 30 horsepower

Class 3 - 35 horsepower

Class 4 - 40 horsepower

Style A - 3-axis, full contouring

Style B - 4-axis, full contouring

Style C - 5-axis, full contouring

Size – Sizes are shown in table I

TABLE I. Sizes of machining centers.

Size	Class	Minimum machine travel, inches		
		X-axis	Y-axis	Z-axis
01	1	39	28	18
02		59	28	18
03		79	63	16
04		87	87	39
05		118	83	30
06		158	83	30
07		158	126	32
08		197	83	30
09		217	114	39
10	2	87	55	35
11		118	106	32
12		126	67	41
13		126	102	32
14		165	67	41
15		205	98	63
16	3	59	32	20
17		79	32	20
18		83	63	30
19		121	63	30
20		158	63	30
21		197	126	39
22	4	118	106	32
23		158	100	39
24		197	134	35
25		236	134	35
26		288	100	39
27		354	154	35

### 3. SALIENT CHARACTERISTICS

3.1 General requirements. The machining center shall be new and one of the manufacturer's current models capable of operation in accordance with the requirements herein. All parts subject to wear, breakage, or distortion shall be accessible for adjustment, replacement, or repair. The machining center and CNC system shall be compatible in design and integrated into a completely functional unit. The CNC system shall accept workpiece machining operation programs and shall direct all tool changes, accessory changes, spindle head operation, and linear-rotational motion on all axes for continuous-path, full-contouring machining. The term "full contouring" is defined herein as a closed-loop control system having simultaneous control of position, direction, and speed of traverse by linear, parabolic, circular, and helical interpolation. The CNC system shall be capable of machine operator manual control by hand controls and switches, semiautomatic control by manual data input (MDI), and automatic control by workpiece machining operation programs.

3.2 Components. The machining center shall include, as a minimum, the following components:

3.2.1 Base. The base shall support the other elements of the machine and shall incorporate materials, shape, and mass to minimize adverse vibration and deflection. The base shall provide a means for leveling and anchoring the machine.

3.2.2 Worktable. Unless otherwise specified (see 7.2(c)), the worktable length, width, and workpiece weight capacity shall be that considered by the manufacturer as standard for the machine. The number and size of worktable T-slots shall be as specified (see 7.2(d)). The dimensions of the T-slots shall conform to the requirements of American National Standards Institute (ANSI) B5.1. When specified (see 7.2(e)), an optional worktable surface wear plate shall be furnished.

3.2.3 Spindle assembly. Unless otherwise specified (see 7.2(f)), the machining center shall have the spindle head, spindle speed range, and spindle drive motor horsepower considered by the manufacturer as standard for the machine. Unless otherwise specified (see 7.2(g)), the spindle taper, tool shank V-flange, and tool shank retention knob shall be that considered by the manufacturer as standard for the machine. Unless otherwise specified (see 7.2(h)), the spindle taper and tool shank V-flange shall comply with ANSI B5.50. Unless otherwise specified (see 7.2(i)), the spindle head shall be cooled (e.g., air, water, oil, or refrigerant cooling) to control spindle thermal growth.

3.2.4 Machineways. Unless otherwise specified (see 7.2(j)), machineways for the worktable, columns, spindle head, and crossrail (if provided) shall be of the design considered by the manufacturer as standard for the machine. All machineways shall have telescoping protective covers to keep chips, coolant, and other debris from contacting bearing surfaces.

3.2.5 Enclosure panels and splash guards. Unless otherwise specified (see 7.2(k)), the machining center shall be equipped with enclosure panels and splash guards that are considered by the manufacturer as standard for the machine.

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3.2.6 Automatic tool changer and storage magazine. Unless otherwise specified (see 7.2(l)), the machine shall have an automatic tool changer(s) and storage magazine(s) of the type (e.g., carousel, inline row, or chain) and capacity considered by the manufacturer as standard for the machine. The automatic tool changer(s) shall be capable of selecting the next tool from the storage magazine using the bidirectional random shortest path method. The automatic tool changer(s) shall be capable of exchanging tools, returning the previous tool to the storage magazine, and tracking the tool for reuse.

3.2.7 Rigid tapping. Unless otherwise specified (see 7.2(m)), rigid tapping shall be provided.

3.2.8 Automatic accessory changer. If required, the machine shall be equipped with one or more spindle attachment heads, an automatic accessory changer, and an accessory storage device as specified (see 7.2(n)). Regardless of the number of spindle attachment heads specified, a protective spindle ram cover plate shall be provided if the machine spindle ram is designed for attachment heads.

3.2.9 Pressurized air system. The machining center shall have an air supply control system with piping that connects to either a shop pressurized air system or to its own air compressor and tank system as specified (see 7.2(o)). The piping system shall direct pressurized air through the spindle and to tool adapter and accessory tapers to remove debris from the taper surfaces during the tool- and accessory-changing process.

3.2.10 Chip conveyor system. Unless otherwise specified (see 7.2(p)), workpiece chips shall be flushed and removed automatically from the work area, and a conveyor system shall be provided to transfer chips to a collection bin. The chip conveyor chute discharge height shall be as specified (see 7.2(q)).

3.2.11 CNC system. The CNC system shall be based on either a personal computer (PC) open-architecture or other software-programmable microprocessor design. System hardware and control panels shall be industrial grade.

3.2.11.1 Hardware. Unless otherwise specified (see 7.2(r)), the CNC system shall include, as a minimum, the following hardware:

- a. One or more 32-bit microprocessors with math coprocessor.
- b. 250-MB hard disk drive.
- c. 3 1/2-inch floppy disk drive.
- d. Dual Electronic Industries Association (EIA) RS-232 serial ports.
- e. Distributed numerical control (DNC) link.
- f. 9-inch monochrome monitor.
- g. Manual data input (MDI) device: IBM-style keyboard or alpha-numeric keyboard with dedicated keys for specific machine functions.
- h. Pendant for machine remote control from the worktable area.

3.2.11.2 Control panel. Unless otherwise specified (see 7.2(s)), the CNC system shall include, as a minimum, a control panel with the following manual controls and switches:

- a. System keyed lock.
- b. Emergency stop button.
- c. Power on/off switches.
- d. CNC system start/stop switches (cycle start/stop switches).
- e. Spindle start/stop switches; spindle motor power and spindle speed meters.
- f. Spindle speed override rotary switch.
- g. Feed hold.
- h. Feed rate override rotary switches.
- i. Jog and jog direction.
- j. End of tape block stop.

3.2.11.3 Operating modes. Unless otherwise specified (see 7.2(t)), the CNC system shall include, as a minimum, the following operating modes:

- a. Manual operation mode.
- b. Manual data input (MDI) mode.
- c. Setup mode.
- d. Learn mode.
- e. Transmit and receive mode.
- f. Conversational mode.
- g. Automatic mode.
- h. Background editing mode/split screen program preview.
- i. Machine diagnostic/maintenance/monitoring modes.

3.2.11.4 Axis and tool management. Unless otherwise specified (see 7.2(u)), the CNC system shall include, as a minimum, the following axis and tool management features:

- a. Tool length compensation.
- b. Tool life management.
- c. Cutter diameter compensation.
- d. Tool breakage detection.
- e. Scale feedback.
- f. Drive ball screw backlash compensation.
- g. Tool offsets.
- h. Number of tool offsets.

3.2.11.5 Software features. Unless otherwise specified (see 7.2(v)), the CNC system shall include, as a minimum, the following software programming and control features:

- a. Simultaneous control of X-, Y-, Z-, and W-axes and up to two optional rotary axes.
- b. Automatic X-, Y-, and Z-axis conversion for right-angle attachment heads.
- c. Linear, circular, parabolic, and helical interpolation.
- d. Inch/metric switchable programming.

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- e. Decimal point programming.
- f. Workpiece graphic display rotation.
- g. Tool path graphic display.
- h. Reference zero.
- i. Standard G-codes, M-codes, and T-codes.
- j. Standard suite of preprogrammed cycle software.
- k. Dimensional absolute/incremental programming.
- l. Cartesian/polar coordinate programming.
- m. Parametric programming.

3.2.11.6 Variable data block format. The preparatory function G-codes, miscellaneous function M-codes, and tool function T-codes shall be in accordance with EIA RS-274.

3.2.11.7 Battery backup. When specified (see 7.2(w)), the CNC system shall have a volatile memory battery backup or uninterrupted power supply (UPS) with a storage capacity of not less than 72 hours.

3.2.12 Lubrication system. Unless otherwise specified (see 7.2(x)), the machining center shall be equipped with an automatic lubrication system to direct oil flow from the reservoir to all machine components requiring continuous lubrication. Machine parts requiring periodic manual lubrication shall be readily accessible through doors or removable panels.

3.2.13 Coolant system. Unless otherwise specified (see 7.2(y)), cutting tools shall be flood cooled, and the machine shall be equipped with a system to control the rate of coolant flow from the reservoir and to direct coolant flow to nozzles mounted on the spindle head.

3.2.14 Lubrication and coolant systems. Unless otherwise specified (see 7.2(z) and 7.2(aa)), lubricating oil and cutting tool coolant reservoirs, respectively, shall be integral to the machine base or, if free-standing and mobile, stored within the machine footprint and shall include necessary piping, pumps, motors, filters, strainers, heat exchangers, fluid level indicators, and low-level alarms.

3.2.15 Electrical system. Unless otherwise specified (see 7.2(bb)), the electrical system shall conform to the ANSI/National Fire Protection Association (NFPA) 79. The machine shall have dual 230/460-volt, 3-phase, 60-hertz circuit capability and shall be wired for the voltage specified (see 7.2(cc)). Unless otherwise specified (see 7.2(dd)), the CNC system power shall be provided by a separate 120-volt, single-phase, 60-hertz circuit from the machine main power supply.

3.2.16 Electrical motors. The spindle drive motor horsepower shall correspond to a 30-minute duty cycle rating. The motor shall have sealed and permanently lubricated ball or roller bearings, shall be energy efficient, and shall conform to the National Electrical Manufacturers Association (NEMA) MG-1. Unless otherwise specified (see 7.2(ee)), motors shall have open dripproof enclosures. Motion and position control motors and controls shall conform to NEMA ICS 1, NEMA ICS 3, and NEMA MG-7.

3.2.17 Optional accessories. Optional accessories shall be provided as specified (see 7.2(ff)).

3.3 Performance. Unless otherwise specified (see 7.2(gg)), the machining center shall meet the performance requirements shown in table II for either a type I (high performance) or a type II (standard performance) machine when tested in accordance with sections 5.3.1 through 5.3.5.

TABLE II. Performance requirements.

Test	Parameter	Performance category	
		Type I High performance	Type II Standard performance
Linear displacement accuracy <sup>1</sup>	X, Y, Z, and W directions	0.0005 inch/40 inches	0.0015 inch/40 inches
Bidirectional repeatability	X, Y, Z, and W directions	±0.0001 inch	±0.0003 inch
Volumetric performance <sup>1</sup>	Diagonal displacement	0.001 inch/40 inches	0.003 inch/40 inches
Contouring performance (up to 80 percent maximum speed)	X-Y plane, 360° X-Z, X-W plane, 190° Y-Z, Y-W plane, 190°	0.0005 inch	0.0015 inch
Squareness error (CW, CCW)	X-Y, X-Z, Y-Z, X-W, Y-W axes	2 arcseconds	5 arcseconds
Scale mismatch (CW, CCW) (with 10-inch-diameter ball bar)	X-Y axis	0.00025 inch	0.001 inch
Periodic angular positioning accuracy	A-axis B-axis	2 arcseconds	10 arcseconds
Bidirectional angular positioning repeatability	A-axis B-axis	0.5 arcsecond	5 arcseconds
Spindle dynamics	Radial error–average	0.0001 inch	0.0003 inch
	Radial error–asynchronous	0.0002 inch	0.0005 inch
Spindle thermal growth (long term, more than 4 hours)	Without spindle chiller	0.003 inch	0.006 inch
	With spindle chiller	0.0015 inch	(Usually not equipped)

<sup>1</sup>If axis travel is less than 40 inches, the tolerance shall be decreased proportionately.

3.4 Machine axes. The machining center linear and rotary axes shall be identified in accordance with EIA RS-267. Axis feed rate ranges and rapid traverse rates shall be as specified (see 7.2(hh)).

3.5 Machine dimensions and weights. If required, the maximum machine dimensions (length, width, and height) and machine weight shall not exceed the restrictions specified (see 7.2(ii)).

3.6 Safety and health requirements. The machining center shall be designed and manufactured in accordance with ANSI B11.8. The manufacturer shall ensure that the machine and all equipment and accessories used on the machine shall be in compliance with Occupational Safety and Health Administration (OSHA) 29 CFR PART 1910. If a conflict arises between the ANSI and OSHA standards, the OSHA standards shall apply.

3.7 System of units. The U.S. Customary System of Units (US) or the International System of Units (SI) shall be used to graduate measuring and indicating devices. When only one system of units is acceptable, the particular graduation required shall be as specified (see 7.2(jj)). Regardless of the measurement system used, all measuring and indicating devices on the machine shall be graduated in the same system. When specified (see 7.2(kk)), measuring and indicating devices shall be graduated in both the US and SI system of units.

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3.8 Nameplate. A nameplate shall be securely attached to the machine. Unless otherwise specified (see 7.2(II)), the nameplate shall contain the following information:

- a. Nomenclature.
- b. Manufacturer's name.
- c. Serial number.
- d. Machine model designation.
- e. Power input (volts, total amperes, phase, frequency).
- f. Short-circuit/over-current rating.
- g. Contract number or order number.
- h. National stock number.
- i. Date of manufacture.

3.9 Lubrication plate or chart. When specified (see 7.2(mm)), a lubrication plate or chart shall be attached to the machine. The information provided on the plate or chart shall include:

- a. Points of lubricant application.
- b. Servicing interval.
- c. Type of lubricant(s) with SAE number or lubricant identifier.

#### 4. REGULATORY REQUIREMENTS

4.1 Recovered materials. The offeror/contractor is encouraged to use recovered materials to the maximum extent practicable, in accordance with paragraph 23.403 of the Federal Acquisition Regulation (FAR).

4.2 Environmental protection. The item shall meet all applicable Environmental Protection Agency (EPA) restrictions in effect on the date of the contract. These regulations apply to the emission of materials hazardous to the environment or the user's health and shall be adhered to during the manufacturing, service, transportation, storage, and operation/use of the item.

#### 5. QUALITY ASSURANCE PROVISIONS

5.1 Product conformance. The products shall meet the salient characteristics of this commercial item description; conform to the manufacturer's own drawings, specifications, standards, and quality assurance practices; and be the same product offered for sale in the commercial market. The Government reserves the right to require proof of such conformance.

5.2 Inspection. The machining center shall be inspected to determine compliance with all requirements specified in this CID.

5.3 Testing. Unless otherwise specified (see 7.2(nn)), the machining center shall be tested in accordance with sections 5.3.1 through 5.3.5.



5.3.1 Test setup and conditions. Unless otherwise specified (see 7.2(oo)), the manufacturer shall be responsible for supplying all tooling and material(s) and shall conduct all tests required by the Government. The manufacturer shall provide test instruments and equipment with calibration traceable to National Institute of Standards and Technology (NIST) and shall provide certification of calibration as specified (see 7.2(pp)). Unless otherwise specified (see 7.2(qq)), the machining center shall be tested in accordance with environmental conditions specified in American Society of Mechanical Engineers (ASME) B5.54.

5.3.2 Operational test. The machining center and the CNC system shall be operated in accordance with the manufacturer's standard operation procedures. Proper operation of all controls and features shall be verified during the trial period.

5.3.3 Performance tests. Performance tests shall be conducted in accordance with appendix B of ASME B5.54. Test results shall meet the minimum performance requirements shown in table II.

5.3.4 Maximum horsepower cutting test. To demonstrate machine rigidity, performance, and capability, the machining center shall be tested in accordance with ASME B5.54, paragraph 7.5.8, which specifies full-torque test cuts on an SAE 4340 steel (300–350 BHN) workpiece with either a face or end mill. Chatter or stalling during the test or permanent distortion of machine components as a result of the test shall not be permitted. Machine function speed reduction is permitted at the entrance and exit of each cut. The test standard depths and widths of cuts are approximate and may be varied as specified (see 7.2(rr)).

5.3.5 Optional tests. Optional tests shall be conducted as specified (see 7.2(ss)).

5.4 Acceptance. Unless otherwise specified (see 7.2(tt)), the preliminary and final acceptance tests shall be conducted at the manufacturer's site. Failure of the machining center to meet performance requirements shown in table II for the machine type specified shall be cause for rejection.

6. PACKAGING. Preservation, packing, and marking shall be as specified (see 7.2(uu)).

## 7. NOTES

### 7.1 Sources of documents.

7.1.1 Government documents. Copies of Federal documents may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

7.1.2 Industry standards. Copies of industry standards referenced in this CID may be obtained from the following addresses:

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# American National Standards Institute (ANSI)

- ANSI B11.8     Safety Requirements for Construction, Care, and Use of Drilling, Milling, and Boring Machines and Machine Tools
- ANSI B5.50     V-Flange Tool Shanks for Machining Centers with Automatic Tool Changers
- ANSI B5.1     T-Slots, Their Bolts, Nuts, and Tongues

Applications for copies should be sent to the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

# American Society of Mechanical Engineers (ASME)

- ASME B5.54     Methods for Performance Evaluation of Computer Numerically Controlled Machining Centers

Applications for copies should be sent to the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.

# Electronic Industries Association (EIA)

- RS-232     Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Exchange
- RS-267     Axis and Motion Nomenclature for Numerically Controlled Machines
- RS-274     Interchangeable Variable Block Data Format for Positioning and Contouring/Positioning Numerically Controlled Machines

Applications for copies should be sent to the Electronic Industries Association, 2500 Wilson Boulevard, Arlington, VA 22201-3834.

# National Electrical Manufacturer's Association (NEMA)

- NEMA MG-1     Motors and Generators
- NEMA MG-7     Motion/Position Control Motors and Controls
- NEMA ICS-1     Industrial Control and Systems General Requirements
- NEMA ICS-3     Industrial Systems

Applications for copies should be sent to the National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209.

## National Fire Protection Association (NFPA)

ANSI/NFPA 79      Electrical Standard for Industrial Machinery

Applications for copies should be sent to the National Fire Protection Association, One Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

## Occupational Safety and Health Administration (OSHA)

OSHA 1910      General Industry, Safety and Health Standards (29 CFR 1910)

Applications for copies should be sent to the U.S. Department of Labor, 200 Constitution Avenue NW, Room 423, Washington, DC 20210.

7.2 Ordering data. Acquisition documents must specify the following:

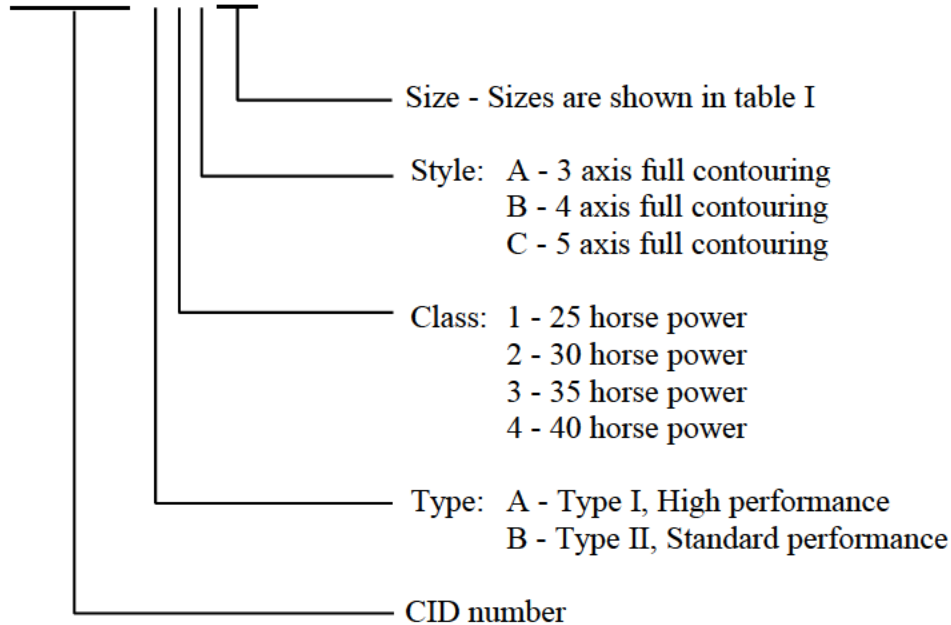
- a. Title, number, and date of this document.
- b. Type, class, style, and size of machining center required (see 2).
- c. Worktable length, width, and workpiece weight capacity, if different (see 3.2.2).
- d. Number and size of T-slots, as specified (see 3.2.2).
- e. Worktable surface wear plate, if required (see 3.2.2).
- f. Spindle head, spindle speed range, and spindle drive motor, if different (see 3.2.3).
- g. Spindle taper, tool shank V-flange, and tool retention knob, if different (see 3.2.3).
- h. Spindle taper and tool shank V-flange standard, if different (see 3.2.3).
- i. Spindle head cooling system, if different (see 3.2.3).
- j. Machineways, if different (see 3.2.4).
- k. Enclosures and splash guards, if different (see 3.2.5).
- l. Automatic tool changer(s) and storage magazine(s) type and capacity, if different (see 3.2.6).
- m. Rigid tapping, if different (see 3.2.7).
- n. Automatic accessory changer and storage device, as specified (see 3.2.8).
- o. Pressurized air system, as specified (see 3.2.9).
- p. Chip conveyor system, if different (see 3.2.10).
- q. Chip conveyor chute discharge height, as specified (see 3.2.10).
- r. CNC system hardware, if different (see 3.2.11.1).
- s. CNC system control panel, if different (see 3.2.11.2).
- t. CNC system operating modes, if different (see 3.2.11.3).
- u. CNC system axis and tool management, if different (see 3.2.11.4).
- v. CNC system software, if different (see 3.2.11.5).
- w. Battery backup system or UPS, if required (see 3.2.11.7).
- x. Lubrication system, if different (see 3.2.12).
- y. Coolant system, if different (see 3.2.13).
- z. Lubrication system reservoir location, if different (see 3.2.14).
- aa. Coolant system reservoir location, if different (see 3.2.14).
- bb. Electrical system industrial standard, if different (see 3.2.15).
- cc. Electrical system voltage, as specified (see 3.2.15).
- dd. Control system voltage, if different (see 3.2.15).

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- ee. Motor enclosures, if different (see 3.2.16).
- ff. Optional accessories, as specified (see 3.2.17).
- gg. Performance, if different (see 3.3).
- hh. Feed rate ranges and rapid traverse rates, as specified (see 3.4).
- ii. Machine dimensions and weight, as specified (see 3.5).
- jj. System of units required (see 3.7).
- kk. Dual system of units, if required (see 3.7).
- ll. Nameplate, if different (see 3.8).
- mm. Lubrication plate or chart, if required (see 3.9).
- nn. Testing, if different (see 5.3).
- oo. Test responsibility, if different (see 5.3.1).
- pp. Certification of calibration, as specified (see 5.3.1).
- qq. Test environmental conditions, if different (see 5.3.1).
- rr. Maximum horsepower cutting test, as specified (see 5.3.4).
- ss. Optional tests, as specified (see 5.3.5).
- tt. Acceptance, if different (see 5.4).
- uu. Packaging requirements, as specified (see 6).

7.3 Part identification number (PIN). The following part identification numbering procedure is for Government purposes and does not constitute a requirement for the manufacturer:

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MILITARY INTERESTS:

Custodians

Army - AL

Air Force - 99

Navy - SH

Reviewer

Air Force - 84

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PREPARING ACTIVITY

DLA - GS

(Project No. 3408-0042)