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COMMERCIAL ITEM DESCRIPTION

MACHINING CENTER, HORIZONTAL, 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

1.1 Scope. This commercial item description (CID) covers computer numerical control (CNC), single-spindle, horizontal machining centers.

1.2 Intended use. The machines covered by this CID are intended for use on light to heavy-duty production machining center operations where milling, drilling, reaming, boring, tapping, and full 3-, 4-, or 5-axis contour milling operations are required.

2. CLASSIFICATION

2.1 Classification. The machining center shall be a horizontal single-spindle type having computer numerical control (CNC) of three linear axes (X, Y, and Z) and with one or two rotary axes (A and B). The machining centers shall be of the following types, styles, and classes. The type, style, and class to be furnished shall be as specified (see 7.2 (b)).

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

Type I - High performance (see table I).
Type II- Standard performance (see table I).

Style A - 3 axes, full contouring.
Style B - 4 axes, full contouring.
Style C - 5 axes, full contouring.

Class 1 - Light duty, 7.5 horsepower.
Class 2 - Medium duty, 15 horsepower.
Class 3 - Heavy duty, 25 horsepower.

3. SALIENT CHARACTERISTICS

3.1 General requirements. The machining centers shall be designed and manufactured in accordance with the American National Standard Institute (ANSI) B11.8. The machine 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, and repair. The machine configuration shall be consistent with the current industry standards for a computer numerically controlled three, four, or five axes, horizontal single-spindle machine capable of accomplishing drilling, tapping, milling, and boring operations. The control system shall be a continuous path, closed-looped system providing full contouring capabilities on the machine's 3, 4, or 5 controlled axes as determined by the style of machine specified. The term "full contouring", used herein, shall be defined as a closed-loop control system having simultaneous control of position, direction, and rate of movement of the machine's controlled axes in linear, parabolic, circular, and helical interpolation. For style B and style C machining centers, the fourth axis (B axis) shall be the clockwise and counterclockwise direction of the rotary table. For style C machining centers, the fifth axis (A-axis) shall be either a vertical rotary milling table, tilting rotary table, or a tilting spindle, as specified (see 7.2 (c)). The minimum work zone (X-, Y-, and Z-axis travels) shall be as specified (see 7.2 (d)). The machine shall be provided with a means for overload protection and shall automatically stop spindle rotation and motion of all axes upon an overload condition or spindle stall. The machine shall have a means to permit leveling and mounting to the floor or foundation. The axes of the machining centers shall be identified in accordance with Electronics Industries Association (EIA) 267.

3.2 System of units. The US 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 graduation is used, the particular system required shall be as specified (see 7.2 (e)). 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 (f)), measuring and indicating devices shall be graduated in both the US and SI system of measurements.

3.3 Worktable. The worktable size and weight holding capacity shall be not less than specified (see 7.2 (g)). The number and size of T-slots shall be as specified (see 7.2 (h)). The

configuration of the T-slots shall conform to the requirements of ANSI B5.1. Edge block locators shall be provided on two adjacent sides of the table. The rotary table for style B and style C machines shall be capable of indexing 360,000 positions with a 0.001-degree resolution.

3.4 Spindle. The spindle shall be driven by a variable-speed electric motor having a spindle speed range as specified (see 7.2 (i)). Unless otherwise specified (see 7.2 (j)), the type I machining center shall incorporate a spindle chiller system for controlling spindle thermal growth in accordance with the requirements shown in table I. The spindle nose taper shall accept either size 40-, 45-, or 50-flange tool shanks as specified (see 7.2 (k)). The tool shanks shall meet the requirements of ANSI B5.50.

3.5 Automatic tool changer. The machine shall be equipped with an automatic tool changer and storage magazine. The tool changer shall consist of a power-activated arm with either a matrix or carousel arrangement for storing an immediate queue of tools. Unless otherwise specified (see 7.2 (l)), the storage capacity of the magazine shall provide a minimum of 24 tools. Automatic tool selection shall be random access and bi-directional with the capability of reusing the tool after it has been returned to the storage magazine. The tool-to-tool change time shall be accomplished within time frame specified (see 7.2 (m)).

3.6 Pallet system. When specified (see 7.2 (n)), the machining center shall have a pallet shuttle system arranged for the mechanized removal and precise reattachment of worktable tops. Unless otherwise specified (see 7.2 (o)), the system shall consist of two duplicate pallets with automatic pallet transfer on and off the Z-axis. The system shall be operated by the CNC unit to accomplish the automatic pallet change, inhibit, and manual cycles. The pallet system shall be capable of completing the pallet transfer to within the time frame specified (see 7.2 (p)).

3.7 Coolant system. Unless otherwise specified (see 7.2 (q)), a flood-type coolant system directed through the spindle shall be provided. The coolant system shall be consistent with industry standards and include a sump reservoir, a power-driven pump, and all necessary piping. The sump or reservoir shall have sufficient capacity to permit full flow of coolant.

3.8 Lubrication. Mechanisms requiring periodic manual lubrication shall be readily accessible for servicing. All oil holes, grease fittings, and filler caps shall be accessible. When provided, the recirculating lubrication system shall have a replaceable in-line filter capable of removing 10-micron particles. The means for determining lubricant level in the reservoir shall be by sight gauge, warning light, or a similar device.

3.9 Chip conveyor system. The chip conveyor system shall be water-tight, reversible, and shall automatically remove ferrous and nonferrous chips from the work area without manual aid. The chip conveyer system shall automatically drain excess coolant back to the sump before discharging chips. Unless otherwise specified (see 7.2 (r)), the height of chip conveyer discharge chute when measured from the floor or foundation shall be not less than 49 inches.

3.10 Computer numerical control. The CNC system shall be “industrial hardened” in accordance with accepted industry practices and shall meet specific government requirements as specified (see 7.2 (s)). The CNC system shall operate as a continuous-path, closed-loop system providing full contouring capabilities with simultaneous control of position, direction, and rate of movement of the

machining center's 3-, 4-, or 5-axes as required for the style of machine specified. The CNC system shall provide on-line diagnostics for detecting programming errors and problems with the control system. The CNC shall be in accordance with all safety guidelines and procedures as specified herein.

3.10.1 Hardware features. Unless otherwise specified (see 7.2 (t)), the CNC unit shall have, as a minimum, the following hardware features:

a. 32-bit main processor with math coprocessor.
b. 250 MB hard drive.
c. Operator control panel.
d. Display resolution (1024 x 768 pixels) 14-inch color display.
e. EIA RS-232C serial port.
f. 3.5 inch floppy drive.

3.10.1.1 Operator control panel. Unless otherwise specified (see 7.2 (u)), the operator control panel shall have, as a minimum, the following control features:

a. Full-travel alphanumeric keyboard.
b. CRT-defined soft keys.
c. Emergency stop.
d. Over-travel.
e. Dry run.
f. Single block.
g. Optional skip block.
h. Mode select axis jog (continuous and intermittent).
i. Feed rate override.
j. Spindle speed override.
k. Cycle start.
l. Feed hold.

3.10.1.2 Data display unit. Unless otherwise specified (see 7.2 (v)), the data display unit shall display, as a minimum, the following information:

a. Block sequence number.
b. Active block of stored data.
c. Actual position of each axis.
d. Feed-rate and override condition.
e. Control/system error messages.
f. Spindle speed.
g. Active event and subsequent events display.

3.10.2 Operating modes. Unless otherwise specified (see 7.2 (w)), the machining center shall contain the following modes as part of the CNC operation:

a. Auto mode.
b. Single event mode.

c. Manual data input (MDI) mode.
d. Setup mode.

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

a. Tool length compensations.
b. Cutter diameter compensation.
c. Fixture offsets.
d. Reversal error compensation.
e. Lead error compensation.
f. Random tool tables.
g. Tool offset memory.
h. Number of tool offsets.

3.10.4 Program and control features. Unless otherwise specified (see 7.2 (y)), the CNC system shall have, as a minimum, the following program and control features:

a. Cartesian/polar coordinate programming.
b. Part rotation.
c. Scale factor.
d. Absolute/incremental programming for dimensions.
e. Fixed cycles - G80 series.
f. Interpolation - positioning, circular and linear.
g. Decimal point programming.
h. Inch/metric switchable data input.
i. Reference zero.
j. Spindle rotation and on/off.
k. Dwell.

3.10.5 Optional CNC hardware and software features. Optional CNC hardware and software features shall be provided as specified (see 7.2 (z)).

3.10.6 Variable data block format. The preparatory function “G codes”, miscellaneous function “M codes," and tool function “T codes” shall be accordance with EIA 274.

3.10.7 Battery backup. If required, the CNC system shall have a battery backup with a memory storage capacity as specified (see 7.2 (aa)).

3.11 Performance. Unless otherwise specified (see 7.2 (bb)), the machining center shall meet the performance requirements specified in table I when tested in accordance with sections 5.3 through 5.3.4.

TABLE I. Performance requirements.

Test name	Parameter	Type I High performance	Type II Standard performance
Linear displacement accuracy[1]	X, Y, and Z directions	0.0005 in/40 in	0.0015 in/40 in
Bi-directional repeatability	X, Y, and Z directions	±0.0001 in	±0.0003 in
Volumetric performance[1]	Diagonal displacement	0.001 in/40 in	0.003 in/40 in
Contouring performance (up to 80% of max. speed)	X-Y plane, 360° X-Z plane, 190° Y-Z plane, 190°	0.0005 in	0.0015 in
Squareness error (CW, CCW)	X-Y, X-Z, and Y-Z axes	2 arc-sec	5 arc-sec
Scale mismatch (CW, CCW) (with 10-in.-dia. ball bar)	X-Y axis	0.00025 in	0.001 in
Periodic angular positioning accuracy	A-axis B-axis	2 arc-sec	10 arc-sec
Bi-directional angular positioning repeatability	A-axis B-axis	0.5 arc-sec	5 arc-sec
Spindle dynamics	Radial error–average	0.0001 in	0.0003 in
	Radial error–asynchronous	0.0002 in	0.0005 in
Spindle thermal growth (long term—more than 4 hr)	Without spindle chiller	0.003 in	0.006 in
	With spindle chiller	0.0015 in	(Usually not equipped)

[1]Machine performance results shall not be greater than specified for each performance category. If axis travel is less than 40 inches, tolerance shall be decreased proportionately.

3.12 Electrical requirements. The machine's electrical system shall conform to ANSI/National Fire Protection Association (NFPA) 79 or International Electrotechnical Commission (IEC) 204-1. The machine shall operate on 230/460-volt, 3-phase, 60-hertz input power. Unless otherwise specified (see 7.2 (cc)), the machine shall be initially wired for 230-volt operation. The CNC system shall operate on a 120-volt, single-phase, 60-hertz circuit.

3.12.1 Motors. Unless otherwise specified (see 7.2 (dd)), motors shall be rated for continuous duty, shall have ball or roller bearings that are sealed and permanently lubricated, shall be energy efficient, and shall conform to National Electrical Manufacturers Association (NEMA) MG-1.

3.13 Optional equipment. Optional equipment shall be furnished as specified (see 7.2 (ee)).

3.14 Safety and health requirements. The manufacturer shall ensure the machine and all associated equipment and accessories used on the machine shall be in compliance with ANSI B11.8, Occupational Safety and Health Association (OSHA) 1910.212, and OSHA 1910.219. If a conflict arises between the ANSI and OSHA standards, the OSHA standards shall apply.

3.15 Nameplate. A nameplate shall be securely attached to the machine in accordance with ANSI/NFPA 79 section 4.7. Unless otherwise specified (see 7.2 (ff)), the nameplate shall contain the following information:

a. Nomenclature.

b. Manufacturer's name.
c. Manufacturer's model designation.
d. Manufacturer's serial number.
e. Power input (volts, total amps, phase, frequency).
f. Amp rating of largest motor.
g. Short/circuit/over-current protection rating.
h. Contract number or order number.
i. National stock number.
j. Date of manufacture.

3.16 Lubrication plate. When specified (see 7.2 (gg)), a lubrication plate shall be attached to each machine. The plate shall include the following information:

a. Points of lubrication.
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 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 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 machine shall be inspected for compliance with all requirements specified in this CID.

5.3 Testing. Unless otherwise specified (see 7.2(hh)), the machine shall be tested in accordance with sections 5.3.1 through 5.3.4.

5.3.1 Test setup and conditions. Unless otherwise specified (see 7.2 (ii)), the manufacturer shall be responsible for supplying all tooling and material(s) and shall conduct all of the tests required by the government. The test equipment shall be calibrated by an independent testing laboratory

and shall have a calibration date not exceeding 60 days prior to testing. Certification of the calibration shall be made available upon request. The machine shall be tested in accordance with environmental conditions specified in American Society of Mechanical Engineers (ASME) B5.54.

5.3.2 Operational test. The machine and the CNC system shall be operated in accordance with the manufacturer's standard operating procedures for warm-up and run-off checks. Proper operation of all controls and features shall be verified during this trial period.

5.3.3 Performance tests. Performance tests shall be conducted in accordance with section 5.6.6, section 5.7, and appendix B of ASME B5.54. The test results shall meet the performance requirements shown in table I.

5.3.4 Maximum horsepower cutting test. To demonstrate machine rigidity, performance, and capability, the machine shall be tested in accordance with ASME B5.54, paragraph 7.5.8, which specifies full-torque test cuts on a 4340 steel (300–350 BHN) workpiece with either a face or end mill. No evidence of chatter, stalling, or permanent distortion of machine components shall be permitted during or subsequent to the test.

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

5.4 Acceptance. Unless otherwise specified (see 7.2(kk)), the preliminary and final acceptance tests shall be conducted at the manufacturer's site. Failure of the machine to meet the performance requirements shown in table I or any of the tests called out in section 5.3 shall be cause for rejection.

6. PACKAGING

6.1 Packaging requirements. Preservation, packing, and marking shall be as specified (see 7.2 (ll)).

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:

American National Standards Institute (ANSI)

ANSI B11.8 Machine Tools - Drilling, Milling, and Boring Machines - Safety Requirements for Construction, Care and Use

ANSI B5.1 T-Slots, Their Bolts, Nuts, and Tongues

ANSI B5.50 V-Flange Tool Shanks for Machining Centers with Automatic Tool Changers

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

American Society of Mechanical Engineers (ASME)

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

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

National Fire Protection Association (NFPA)

ANSI/NFPA 79 Electrical Standard for Industrial Machinery

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

National Electrical Manufacturers Association (NEMA)

NEMA MG 1 Motors and Generators

Applications for copies should be sent to: National Electrical Manufacturer's Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209.

Occupational Safety and Health Association (OSHA)

OSHA 1910.212 Occupational Safety and Health Standards for General Industry (29 CFR 1910)

OSHA 1910.219 Occupational Safety and Health Standards for General Industry (29 CFR 1910)

Applications for copies should be sent to: U.S. Department of Labor, 200 Constitution Avenue NW, Room 423, Washington, DC 20210.
International Electrotechnical Commission (IEC)

IEC 204-1 Electrical Equipment of Industrial Machines - Part 1: General Requirements Third Edition

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

Electronic Industries Association (EIA)

EIA 274 Interchangeable Variable Block Data Format for Positioning, Contouring, and Contouring/Positioning Numerically Controlled Machines

EIA 267 Axis and Motion Nomenclature for Numerically Controlled Machines

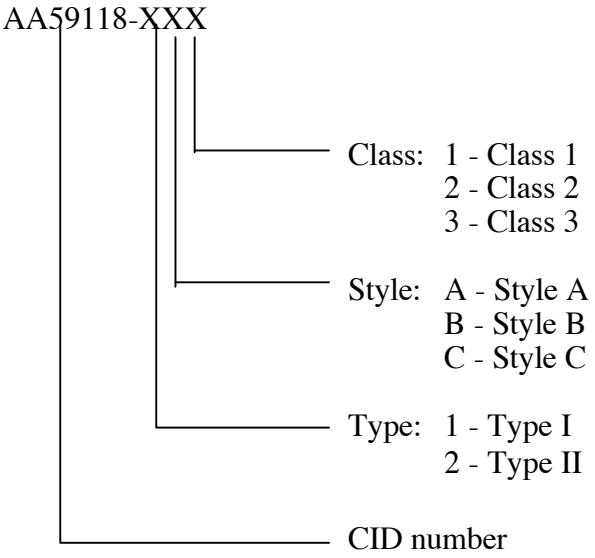
Applications for copies should be sent to: Electronic Industries Association (EIA), 2500 Wilson Boulevard, Arlington, VA 22201-3834.

7.2 Ordering data. Acquisition documents must specify the following:

a. Title, number, and date of this document.
b. Class, size, and grade of machine required (see 2.1).
c. A axis - tilting rotary table, tilting spindle, or vertical table, if required (see 3.1).
d. Minimum work zone (x-, y-, and z-axis travels), specify (see 3.1).
e. System of units, specify (see 3.2).
f. Dual measurement of indicating devices, if required (see 3.2).
g. Worktable size and weight holding capacity, specify (see 3.3).
h. Number and size of T-slots, specify (see 3.3).
i. Spindle speed range, specify (see 3.4).
j. Spindle chiller system, if required (see 3.4).
k. Spindle taper, specify (see 3.4).
l. Tool storage capacity of the automatic tool changer, if different (see 3.5).
m. Tool-to-tool change time, if different (see 3.5).
n. Pallet shuttle system, if required (see 3.6).
o. Number of pallets, if different (see 3.6).
p. Pallet transfer time, specify (see 3.6).
q. Coolant system, if different (see 3.7).
r. Height of chip conveyor discharge chute, if different (see 3.9).
s. CNC industrial hardening requirements, specify (see 3.10).
t. Hardware features, if different (see 3.10.1).
u. Operator control panel, if different (see 3.10.1.1).
v. Data display unit, if different (see 3.10.1.2).
w. Operating modes, if different (see 3.10.2).
x. Axis and tool management features, if different (see 3.10.3).
y. Program and control features, if different (see 3.10.4).
z. Optional hardware and software features, specify (see 3.10.5).
aa. Battery backup and storage capacity, if required (see 3.10.7).
bb. Performance requirements, if different (see 3.11).
cc. Electrical requirements, if different (see 3.12).
dd. Type of motors, if different (see 3.12.1).
ee. Optional equipment, if different (see 3.14).
ff. Nameplate, if different (see 3.16).
gg. Lubrication plate, if required (see 3.17).
hh. Performance testing, if different (see 5.3).

ii. Test setup - tooling and material responsibility, if different (see 5.3.1).
jj. Optional tests, specify (see 5.3.5).
kk. Acceptance criteria, if different (see 5.4).
ll. Packaging requirements, if different (see 6.1).

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



MILITARY INTERESTS:

Custodians
Air Force - 99
Army - AL

Reviewer
Air Force - 84

PREPARING ACTIVITY:
DLA-GS

(Project 3408-0041)