

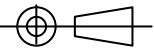
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THIRD ANGLE PROJECTION		CUSTODIAN ENGINEERING MANAGEMENT COMMITTEE	REVISION 4
PROCUREMENT SPECIFICATION NONE		TITLE NUMERICALLY CONTROLLED HORIZONTAL BORING, DRILLING AND MILLING MACHINE	CLASSIFICATION SPECIFICATION DIAS954 SHEET 1 OF 21



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FORM 12-01

REVISION DATE: FEBRUARY 28, 2013

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1. SCOPE

1.1 Purpose

This specification provides a standard for the manufacture, performance, reliability, inspection, and procurement of numerically controlled horizontal boring, drilling, and milling machine(s). This standard lists minimum requirements and is not to limit design advances.

1.2 Classification

The machine(s) shall be of the following types, sizes, and classes.

1.2.1 Type

The machine(s) shall be of the horizontal spindle, table type, numerically controlled, high speed, low speed.

1.2.2 Size

Small; Large

1.2.3 Class

Numerically controlled positioning and straight cut AIA class III, contouring AIA class IV, and contouring/positioning AIA class III/IV.

1.3 Intended Use

The machine(s) described by this specification are intended for boring, drilling, and milling structures and fittings used in aircraft and missile construction. The relationship of horsepower, feeds, and speeds was established for best performance in aluminum and magnesium (high speed machine) and also for titanium and steel alloys (low speed machine).

2. APPLICABLE DOCUMENTS

The latest revision of the following specifications, codes, and standards are included as a portion of this specification. Detail requirements listed in this specification shall override any contradictory portions of the following specifications, codes, and standards.

State and Local Safety and Electrical Codes (3.5, 3.8)

Government Standards

29 CFR 1910 Occupational Safety and Health Standards (OSHA Act 1970) (3.8)

Illinois Institute of Technology Research Institute

Illinois Institute of Technology Research Institute (IITRI) Standard for APT Programming Language

ASME International

ASME B5.1M T-Slots, Their Bolts, Nuts, and Tongues (3.4.1)

ASME B5.18 Spindle Noses and Tool Shanks for Milling Machines (3.3.1.1)

ASME BPVC Boiler and Pressure Vessel Code, Section VIII (3.10)

Copies can be obtained from ASME International, Three Park Ave., New York, NY 10016-5990, www.asme.org.

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TechAmerica

- EIA-RS-244-B Character Code for Numerical Machine Control Perforated Tape
- EIA-RS-281-B Electrical and Construction Standards for Numerical Machine Control
- EIA-358-C American National Standard Code for Information Interchange for Numerical Machine Control
- EIA-408 Interface between Numerical Control Equipment and Data Terminal Equipment Employing Parallel Binary Data Interchange

Copies can be obtained from TechAmerica, 601 Pennsylvania Avenue NW, North Building, Suite 600, Washington DC, 20004, www.techamerica.org.

Telecommunications Industry Association

- TIA-232-F Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange

Copies can be obtained from TIA, 2500 Wilson Boulevard, Suite 300, Arlington, VA 22201, www.tiaonline.org.

Aerospace Industries Association

- NAS938 Machine Axis and Motion Nomenclature
- NAS953 Numerical Control System (Reference Only)
- NAS955 Interchangeable Tape Standards – Variable Block Format, Contouring and Contouring/Positioning Numerically Controlled Equipment (3.3.2.4)
- NAS972 Glossary of Manufacturing Equipment Terms (8.1)
- NAS979 Uniform Cutting Tests - NAS Series Metal Cutting Equipment Specifications (4.3.3.1)
- NAS985 Uniform Alignment Tests NAS900 Series Equipment Specifications (4.3.2.1)
- NAS993 Direct Numerical Control System (DNC) (3.3.2)
- NAS995 Computerized Numerical Control (CNC) System for Numerically Controlled Machine Tools (3.3.2)

Copies can be obtained from AIA, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209, www.aia-aerospace.org.

B11 Standards, Inc.

- ANSI B11.TR5-2006 Sound Level Measurement Guidelines (3.13.3)

Copies can be obtained from B11 Standards, PO Box 690905, Houston, TX, www.b11standards.com.

National Fire Protection Association

- NFPA 70 National Electrical Code (3.5)
- NFPA 79 Electrical Standard for Industrial Machinery (3.5, 3.5.9, 3.3.2.22)

Copies can be obtained from NFPA, 1 Batterymarch Park, Quincy, MA 02169, www.nfpa.org.

International Organization for Standardization

- ISO 4413 Hydraulic fluid power — General Rules and Safety Requirements for Systems and their Components (3.6)
- ISO 4414 Pneumatic fluid power — General Rules and Safety Requirements for Systems and their Components (3.6)

Copies can be obtained from ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56 - CH-1211 Geneva 20, Switzerland, www.iso.org.

Association of American Railroads

- AAR DPA21 Minimum Loading Standards for Machinery in Closed Cars
- AAR Open Top Loading Rules Manual

Copies can be obtained from AAR, 425 Third Street SW, Washington DC, 20024, www.aar.org.

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3. REQUIREMENTS

3.1 Design

The dimensions and capacities of the respective types and sizes shall be as shown in Table I, Section 3.2. The manufacturer has the choice of configuration and the functional operation of the machine, except where specifically stated in this specification.

3.2 Type, Size, Class

TABLE I – NUMERICALLY CONTROLLED HORIZONTAL BORING,
DRILLING AND MILLING MACHINE

ITEM	HIGH SPEED		LOW SPEED		NOTES
	SMALL	LARGE	SMALL	LARGE	
Work Mounting Surface					
Length & Width – Std.	72 x 36	120 x 48	72 x 36	120 x 48	
– Alt.	120 x 36	144 x 48	120 x 36	144 x 48	/a/
T Slots – 5" c/c	13/16	13/16	13/16	13/16	
Spindle Diameter	4/5	4/5	5	5	/e/
Travel					
Spindle	20	20	20	36	
Head – Vertical	48	72	48	72	
Saddle – Cross	24	36	24	36	
Table – Long – Std.	60	108	60	108	
– Alt.	108	132	108	132	/a/
Feed Rate					
Spindle – IPM	1/2-100	1/2-100	1/4-100	1/4-100	/d/
Head & Table IPM	1/2-100	1/2-100	1/4-100	1/4-100	/d/
Rapid Traverse IPM	160 Min	160 Min	160 Min	160 Min	/c/
Spindle					
Horsepower	20	20	30	30	/b/
RPM 20-3600	20-3600	20-3600	10-1800	10-1800	
No. Steps – Min.	24	24	24	24	
ANSI Taper	#40/50	#40/50	#50	#50	/e/

Notes:

- /a/ Alternate cross travel for alternate table size.
- /b/ Low Speed Machine – Torque requirement at spindle need not exceed 1/2 HP per revolution.
- /c/ Install a speed reducing solenoid limit switch a specified distance ahead of end limit switch to eliminate the override, energized only when rapid traverse button on control panel is used.
- /d/ Feed rates to be infinitely variable.
- /e/ On high speed machines, 5" spindle and #50 taper shall be at customers option.

3.3 Machine Sub-Assemblies

3.3.1 Tool Holder Head Assemblies

Spindle head assemblies shall consist of spindle assembly (spindle and bearings), drive motor where applicable, and other necessary devices for providing variations in speed within the stipulated range, integral housing, and such saddle, slide, and tilting mechanisms as necessary to satisfy the requirements of Table I, Section 3.2.

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3.3.1.1 The spindle nose shall be of alloy steel suitable hardened and shall conform to the ASME B5.18 Standards.

3.3.1.2 Spindle rotation shall be reversible.

3.3.1.3 A spindle locking device shall be provided and shall be readily accessible to the operator when cutter or arbor changes are required.

3.3.1.4 The spindle shall be provided with a power operated draw bar to hold the tool in the spindle nose.

3.3.2 Machine Controls

At customer option, the machine control shall be either an AIA Class III or an AIA Class IV system. At customer option, the Class IV system shall be specified as either a Computerized Numerical Control System (CNC), or as a Direct Numerical Control System (DNC).

When specified, the CNC system shall be furnished in accordance with the requirements of NAS995.

When specified, the DNC system shall be furnished in accordance with the customer specified type requirements of NAS993.

The control system furnished shall meet the following requirements.

3.3.2.1 The control system shall be of the latest design technology and shall include all the necessary equipment for controlling the motions and auxiliary operations of the machine as specified and operating at maximum specified feedrates.

3.3.2.2 Switchable inch or metric input capability shall be provided.

3.3.2.3 System axis designation shall conform to NAS938.

3.3.2.4 Control function codes shall be per NAS955.

3.3.2.5 Exceptions to NAS955 shall be documented by the seller.

3.3.2.6 At customer option, a block delete code shall be provided per NAS955.

3.3.2.7 As specified by the customer, the system shall have linear, circular, or parabolic interpolation or any combination.

3.3.2.8 Use of variable block format, free form letter address programming shall be provided; the use of multiple non-conflicting miscellaneous (m) codes contained within the same block shall be permissible where applicable.

3.3.2.9 When input data is from tape, the control system shall accept tape meeting the physical requirements of EIA-RS-244-B (BCD) or EIA-358-C (ASCII) or both as applicable.

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- 3.3.2.10 When specified, the control system shall include an appropriate tape reader and transport equipment complete with all necessary control circuitry properly installed within the control system cabinet. The tape reader and transport equipment shall be capable of reading 300 lines per second, and 1,000 lines per second (minimum) search and rewind. Tape reels shall be Ø8" (minimum).
- 3.3.2.11 When specified, the control system shall be equipped to detect a tape parity error and shall include missing sprocket detection where applicable. The tape reader shall stop on the character containing the error.
- 3.3.2.12 The control system provided shall be capable of having the part programs programmed with a general purpose computer if computation apart from the control system is required.
- 3.3.2.13 The control system shall be capable of controlling the machine movements individually, simultaneously, or in any combination at all feedrates.
- 3.3.2.14 The control system shall provide for the machining of right or left hand parts from the same part program tape (class IV only).
- 3.3.2.15 The control system resolution shall be .0001" (maximum) for all linear movements and .001 degree (maximum) for all angular movements. This requirement includes the system input data and the system servo loops.
- 3.3.2.16 The control system and machine servos shall not hunt more than one pulse.
- 3.3.2.17 The control system shall provide for zero (reference point) offset over the full travel range of any and all axis.
- 3.3.2.18 The control system shall provide for program start position (set point) synchronization of all controlled motions. Control shall be effected at the operator's control pendant.
- 3.3.2.19 The control system shall have the capability of relocating to the original set point automatically after all machine motions are positioned within ±.040" of the original set point.
- 3.3.2.20 The control system shall execute programmed and un-programmed stops as desired for cutter changes, cutter and/or part inspection, part program checks and etc. Resumption of automatic operation shall not cause any loss of accuracy on the work piece.
- 3.3.2.21 It shall be possible to interrupt the automatic cycle without loss of information. Switching from automatic or semi-automatic to manual mode and returning to the original mode of operation without losing the established relationship between the work piece and program shall be possible.
- 3.3.2.22 All control system construction, wiring and electronic equipment shall be in accordance with EIA RS-281-B, TIA-232-F, EIA-408, and NFPA 79.
- 3.3.2.23 The control system circuitry shall be constructed utilizing plug-in units and/or modules for all electronic systems components.
- 3.3.2.24 All control system components sensitive to vibration shall be protected from such conditions.
- 3.3.2.25 The entire system shall be provided with protection from the surrounding environment. Adequate seals and filters shall be provided to prevent the entry of foreign matter.
- 3.3.2.26 Control media installation, removal, and normal operating control functions shall not disrupt or affect continuation of normal environment protection and control.
- 3.3.2.27 Indicator lights shall be employed throughout the system at points of probable failure to expedite location of faulty components.

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