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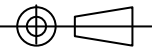
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FORM 09-01	THIRD ANGLE PROJECTION		CUSTODIAN ENGINEERING MANAGEMENT COMMITTEE	REVISION 1
	PROCUREMENT SPECIFICATION NONE		TITLE ROBOT - INDUSTRIAL, CNC, FOR DRILLING, REAMING AND COUNTERSINKING	CLASSIFICATION SPECIFICATION NAS875 SHEET 1 OF 19

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FED SUP CLASS

3413

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1.0 SCOPE:

1.1 Purpose:

This specification provides for the manufacture, performance, reliability, inspection and procurement of an Industrial Robot. This standard lists minimum requirements and is not to limit design advances.

1.2 Classification:

The machine shall be of the following type, size and class.

1.2.1 Type:

1.2.1.1 Linear, swiveling, multi-axis.

1.2.1.2 Rotary jointed arm, multi-axis.

1.3 Size:

Medium

1.4 Class:

Computerized Numerical Control (CNC).

1.5 Intended Use:

The machine described by this specification is intended for use within the aerospace manufacturing industry for presenting tools to accomplish drilling, reaming, and countersinking without the requirement for hard tooling for final positioning.

2.0 APPLICABLE SPECIFICATIONS, CODES AND STANDARDS:

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.

LIST OF CURRENT SHEETS

NO.	REV.	NO.	REV.	NO.	REV.	NO.	REV.	NO.	REV.
1	New	7	New	13	New				
2	New	8	New	14	New				
3	New	9	New	15	New				
4	New	10	New	16	New				
5	New	11	New	17	New				
6	New	12	New	18	New				

CUSTODIAN:

MANUFACTURING COMMITTEE

PROCUREMENT
SPECIFICATION

TITLE

ROBOT - INDUSTRIAL, CNC, FOR DRILLING,
REAMING AND COUNTERSINKING

Specification

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AIA NAS 875
AIA Aerospace Industries Association of America, Inc.

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- 2.1 The Joint Industrial Council (JIC) Electrical Standards for General Purpose Machine Tools. (3.4, 3.6)
- 2.2 The Joint Industrial Council (JIC) Hydraulic and Pneumatic Standards for Industrial Equipment. (3.7)
- 2.3 The Joint Industrial Council (JIC) Electronics Standards for General Purpose Machine Tools. (3.3)
- 2.4 The American Society of Mechanical Engineers' (ASME) Boiler and Pressure Vessel Code, Section VIII. (3.11)
- 2.5 National Electrical Code (NEC). NFPA Electrical Standards No. 70-1971; for Metal Working Machines NFPA 79. (3.4)
- 2.6 Current standards for robot programming. (3.3)
- 2.7 Occupational Safety and Health Standards, Part 1910 of Chapter XVII of Title 29 of the Code of Federal Regulations. Reference: Occupational Safety and Health Act (OSHA) - 1970. (3.9)
- 2.8 State and local Safety and Electrical Codes. (3.6)
- 2.9 National Machine Tool Builders Association (NMTBA) Noise Measurement Techniques. (3.9, 3.12.3)
- 2.10 Electronics Industries Association (EIA) Construction Standards, Numerical Machine Tool Control #RS-281. (3.3)

3.0 REQUIREMENTS:

3.1 Design:

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

- 3.1.1 The design shall incorporate the capability of presenting drilling, reaming and countersinking tooling to a work piece of any angular orientation within $\pm 0.001^\circ$ and positioned within $\pm 0.010''$ while operating at full extension and at full rated load. Deviations from the foregoing with up to an additional 75% of rated load applied in any direction shall not exceed 200% of these values.

3.2 Type, Size, Class:

The robot shall maintain the following minimum accuracies in all planes of motion while manipulating the maximum loads at any point within the normal operating volume.

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3.2.1 Velocity: INACTIVE FOR DESIGN AFTER 31 MAY 2012

Shall be 0.1 to 25 i.p.s. with capability of being manually overridden by a factor of 2 with both division and multiplication and shall be controllable by front panel switch(s) or external control lines. Speed shall be either infinitely variable, or variable in a series of steps.

3.2.2 Accuracy:

Shall be defined in terms of the actual position and orientation of a point 20" out from the faceplate.

3.2.3 Repeatability:

Shall be defined as the ability to repeatedly return to a previously programmed position and orientation.

3.2.4 Resolution:

Shall be defined as the smallest programmable and achievable incremental change in position and orientation.

3.2.5 Load Capacity:

The robot shall maintain the following accuracies as shown in Table I in all planes of motion while manipulating any load up to the rated load of 100 pounds at 20" from the faceplate.

3.2.6 Positioning Accuracy:

The robot shall have the capacity to position at full rated loads and speeds to a given point with the accuracies shown in Table I.

TABLE I

Positioning:	
Accuracy	±0.020" at 20" from faceplate
Repeatability	±0.010" at 20" from faceplate
Orientation:	
Accuracy	±0.02"
Repeatability	±0.01"
Resolution	±0.010", worst case
Angular resolution	±.01°
* Horizontal Sweep	270° min. at faceplate at full arm extension
* Horizontal Reach	96" min. at faceplate at full arm extension
Vertical Reach, floor to ceiling	0-154" min. at faceplate at full arm extension
Velocity, Max.	50 i.p.s.
Velocity, Min.	0.05 i.p.s.
Pitch, Min.	270°
Roll, Min.	360°
Yaw, Min.	270°
* At center of faceplate with faceplate in vertical position.	

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3.3 MACHINE CONTROL DESIGN AFTER 31 MAY 2012

The machine shall be equipped with an AIA Class IV, continuous path, solid state, integrated circuit, closed loop system for controlling all machine movements and functions necessary to meet the requirements of this specification and shall be capable of operation in manual/teach, or automatic modes.

3.3.1 The system shall be capable of accepting teach programs as well as program input data from tape, mass local storage devices or a remote central computer system, and executive programs. Off-line programming capabilities shall be supplied. (Customer option).

3.3.2 The system shall be capable of producing a mirror image program from an existing program about the X & Z axis. (Customer option).

3.3.3 Selectable offsets up to 24" along the roll axis shall be provided for optimum defined tool center location for both positive and negative tool lengths.

3.3.4 The system shall control auxiliary functions as specified by customer.

3.3.5 Loss of synchronization, for any reason, shall stop the system. The loss of synchronization as well as the particular joint involved shall be indicated by appropriate signals, e.g. lights, or by CRT screen display.

3.3.6 The system shall provide the following selectable modes of operation.

3.3.6.1 Automatic Mode: Programs may be run continuously or with a stop at the end of each cycle, or point-by-point in forward or reverse sequence. The program interruption will result in and be capable of restart with automatic acceleration.

3.3.6.2 Manual/Teach Mode: Control by a portable unit shall move and control the orientation of the tool. Provisions shall be made for entering functional input, output, tool offset, path velocity data, and other operating parameters. The unit will be used to replay and edit programmed data in forward or reverse sequence.

3.3.7 The system shall be capable of controlling individual or simultaneous motion of all joints at all speeds and shall provide a controlled path movement (straight line path) of the tool center point. The system shall provide the ability to play-back and edit programs without machine movement.

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3.3.8 Operating Functions:

The following are functions selectable by the operator during programming for usage in the automatic mode.

- 3.3.8.1 Wait: See Glossary. Quantity to be customer option.
- 3.3.8.2 Output: See Glossary.
- 3.3.8.3 Delay: See Glossary.
- 3.3.8.4 Conditional Waits and Branches: Wait may be controlled by a programmable combination of inputs instead of by a single input. The entry into a Branch can be made conditional on a programmable combination of inputs instead of on a single input.
- 3.3.8.5 Branch: See Glossary.
- 3.3.8.6 Offset Branching: Provision allowing the programmer to shift (offset) the X, Y, D, E and R coordinates of all points in a programmed branch by a predetermined amount.
- 3.3.8.9 The system shall be capable of accepting programmed stops. Resumption of the cycle shall not cause any loss of positioning or orientation accuracy.
- 3.3.10 It shall be possible to interrupt the automatic cycle without loss of information. Switching from automatic to teach, or 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.
- 3.3.11 Automatic acceleration and deceleration shall be provided for planned and unplanned stops and all directional changes.
- 3.3.12 The least significant increment of dimensional data shall be as shown in Para. 3.2.6.
- 3.3.13 A full floating zero reference system for all tool center point movements shall be provided to allow location of the start point of the cycle at any location in the work area.
- 3.3.14 Point, branch or program deletion utilizing codes shall be provided.

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