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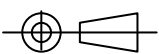
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THIRD
ANGLE
PROJECTION



CUSTODIAN
ENGINEERING MANAGEMENT COMMITTEE

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PROCUREMENT
SPECIFICATION

NONE

TITLE
**TUBE BENDER, NUMERICAL CONTROL,
PRECISION AIRCRAFT TYPE FOR THIN WALL,
FERROUS AND NON-FERROUS ALLOYS**

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CLASSIFICATION
SPECIFICATION

DAS956
SHEET 1 OF 15



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AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
1000 WILSON BLVD.
ARLINGTON, VA 22209

THIS DRAWING SUPERSEDES ALL ANTECEDENT STANDARD DRAWINGS FOR THE SAME
PRODUCT AND SHALL BECOME EFFECTIVE NO LATER THAN SIX MONTHS FROM THE LAST
REVISION DATE:

FORM 12-01

REVISION DATE: APRIL 30, 2013

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1. SCOPE

1.1 Purpose

The purpose of this specification is to provide a standard for a numerically controlled, thin wall tube bender of adequate power, rigidity and accuracy to draw form tight radius, thin wall bends, in non-ferrous and annealed ferrous tubing associated with the manufacture of aircraft, missile, and space vehicles.

1.2 Classification

The equipment specified herein shall be designated as, "Tube Bender, Numerically Controlled, Precision Aircraft Type for Thin Wall, Ferrous and Non-Ferrous Alloys".

1.2.1 Type

1.2.1.1 Type I

Precision tube bender equipped with direct pressure for pressure and clamp die (Draw Bend).

1.2.1.2 Type II

Precision tube bender equipped with direct pressure for pressure die and indirect hydraulic pressure for clamp (Comp. Bend).

1.2.2 Class

1.2.2.1 Class I

Precision Bender (left hand), Counter Clockwise Bending Motion. Numerical Control system AIA Class III positioning.

1.2.2.2 Class II

Precision Bender (right hand), Clockwise Bending Motion. Numerical Control System AIA Class III positioning.

1.2.3 Bender Capacity

Size 2 Bender capacity shall cover a range of tube diameters from 3/16" OD to 2" OD.

1.3 Intended Use

The machine described by this specification is intended for use by the Aerospace Manufacturing Industry and shall be used to form single, multiple, or tangent bends in ferrous and non-ferrous tubing within the sizes and capacities specified herein.

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2. APPLICABLE DOCUMENTS

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

State and Local Safety and Electrical Codes

ASME International

ASME BPVC Boiler and Pressure Vessel Code, Section VIII

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

TechAmerica

EIA Electrical and Construction Standards

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

Aerospace Industries Association

NAS938 Machine Axis and Motion Nomenclature

NAS943 Interchangeable Perforated Tape Standards – Variable Block Format for Positioning and Straight Cut Numerically Controlled Equipment

NAS953 Numerical Control System

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

SAE International

AS33611 Tube Bend Radii

Copies can be obtained from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001. www.sae.org

National Fire Protection Association

NFPA 79 Electrical Standard for Industrial Machinery

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

ISO 4414 Pneumatic fluid power — General rules and safety requirements for systems and their components

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

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3. REQUIREMENTS

3.1 Responsibilities

An overall responsibility shall be accepted by the prime contractor for the design and manufacture, performance, reliability, and packaging of the control system and the controlled equipment as defined in the specification. This responsibility shall provide for technical direction during installation and maintenance during the warranty period.

3.1.1 The prime contractor will, in turn, hold subcontractors responsible for the performance of the control sub-systems and components.

3.1.2 The prime contractor will be responsible for the inspection, acceptance, and warranty of the control system, controlled equipment and all sub-systems. The warranty period shall be for one (1) year from final machine acceptance during which time the prime contractor is responsible for replacement of all defective materials, workmanship, and engineering and in turn will assure compliance of his supplies and subcontractors to the warranty. Exceptions may be made on low-cost perishable components for which preventive maintenance procedures may provide more frequent replacements than one (1) year.

3.1.3 (Optional) The prime contractor will be responsible for instructions and indoctrination of the user's personnel. The period and extent of training may vary according to the complexity of the system, and the prior training of the user's employees. Basic and advanced training in system trouble shooting and diagnostic procedures is to be available by the prime contractor prior to and/or during the installation and checkout of the equipment.

3.2 Design

The machine tool builder shall be responsible for design and construction of the equipment in conformance with the following capacities and operational and inspection requirements.

3.3 Type, Size, Class

3.3.1 Type – Purchaser's Option

Type I – Precision tube bender equipped with direct pressure for pressure and clamp die. This type shall be able to exert direct controlled pressure against the tube during the entire bending cycle. It shall have adjustment with scales and dials that permit repetitive identical set-ups.

Type II – Precision tube bender equipped with direct pressure for the pressure die and indirect pressure for the clamp die. It shall have adjustments with scales and dials that permit repetitive identical set-ups.

3.3.2 Size 2

Tube Diameter (inches) – All types and classes
Minimum 3/16 OD
Maximum.....2 OD

Wall Thickness (inches) – All types and classes
..... .016 to .125

Tube Length (inches) – All types and classes
Minimum 12
Maximum..... 144 (over mandrel)

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Mandrel Stroke, Double Action (inches) – All types and classes
Adjustable to 15

Degree of Bend (Degrees) – All types and classes
0° to 195° Tolerance plus or minus 15 minutes

Speed of Bending Arm Rotation – All types and classes
Forward 0-10.0 rpm
Reverse 10.0 rpm

The following data shall apply to the movement along "Y" axis:
Maximum positioning speed 240 in/min.
Maximum traverse speed 240 in/min.
Smallest increment of positioning information 01 inches
Smallest increment of position information ("C" Motion) 1°

The following data applies to the "B" motion:
Maximum rotation 360.0°
Maximum positioning speed 40 rpm
Smallest increment of position information 1°

3.3.3 Class – Purchaser's Option

Class I – Precision tube bender with left hand (counter-clockwise) bending movement

Class II – Precision tube bender with right hand (clockwise) bending movement

3.4 Construction

3.4.1 Machine shall be constructed to comply with the requirements of Section 3 and the Inspection and Acceptance Tests of Section 4. Choice of configuration and actual moving elements shall be the prerogative of the manufacturer.

3.4.2 Swinging and stationary arms shall be fitted with replaceable and adjustable wear strips to compensate for wear.

3.4.3 Tie-Down and Leveling Devices

Provisions for suitable devices for tie-down and leveling shall be incorporated in and supplied with machine. Anchor bolts need not be furnished by machine tool builder unless special.

3.5 Machine Configuration

The machine shall be controlled by an electronic numerical control system, conforming to NAS938, directing: "Y" movement (to locate position of bend); "B" motion (around Y axis) to locate plane of bend; and "C" motion (around Z axis) to determine angle of bend. Both constant and proportional spring back compensation shall be provided for "C" motion.

3.5.1 A tube clamp and feed device shall be provided to position the tubing for distances between bends. This device shall be designated the "Y" axis controlled motion.

3.5.2 A rotary drive shall be provided to rotate the tube and set the angle between bends. This motion shall be designated the "B" motion around "Y".

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