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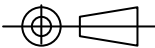
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ISSUE DATE: OCTOBER 1972 REVISION DATE: MAY 31, 2013

FORM 09-01

THIRD ANGLE PROJECTION		CUSTODIAN ENGINEERING MANAGEMENT COMMITTEE	REVISION 1
PROCUREMENT SPECIFICATION NONE	TITLE UNIFORM ALIGNMENT TESTS – NAS 900 SERIES EQUIPMENT SPECIFICATIONS	CLASSIFICATION SPECIFICATION NAS985	SHEET 1 OF 37

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Full document details: AIA NAS985 2013



Documents
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1.0 SCOPE1.1 Purpose

This specification provides a standard for the alignment tests required to evaluate the accuracy and determine acceptance of NAS 900 Series equipment noted in paragraph 1.2, and to provide a standard format for recording and reporting actual alignment results. This standard lists minimum requirements.

1.2 Classification

This specification is applicable to the machines in the following categories.

- 1.2.1 Milling Machines general purpose - knee and bed type - horizontal and vertical.
- 1.2.2 Numerically Controlled milling machines - knee and bed type horizontal and vertical.
- 1.2.3 Horizontal boring, drilling and milling machines.
- 1.2.4 Numerically Controlled horizontal boring, drilling and milling machines.
- 1.2.5 Numerically Controlled combination drilling, boring, milling and tapping machines.
- 1.2.6 Milling Machines tracer controlled - profiling and contouring.

LIST OF CURRENT SHEETS

NO.	REV.	NO.	REV.	NO.	REV.	NO.	REV.	NO.	REV.	NO.	REV.
1	NEW	7	NEW	13	NEW	19	NEW	25	NEW	31	NEW
2	NEW	8	NEW	14	NEW	20	NEW	26	NEW	32	NEW
3	NEW	9	NEW	15	NEW	21	NEW	27	NEW	33	NEW
4	NEW	10	NEW	16	NEW	22	NEW	28	NEW	34	NEW
5	NEW	11	NEW	17	NEW	23	NEW	29	NEW	35	NEW
6	NEW	12	NEW	18	NEW	24	NEW	30	NEW	36	NEW

CUSTODIAN: Manufacturing Committee

PROCUREMENT
SPECIFICATION

TITLE
UNIFORM ALIGNMENT TESTS - NAS 900
SERIES EQUIPMENT SPECIFICATIONS

CLASSIFICATION
Specification

NAS Documents
SHEET 1 of 36

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1.2.7 Milling Machines - numerically controlled profiling and contouring.

1.2.8 Milling Machine - numerically controlled skin/profile.

1.2.9 Spar Mill - numerically controlled.

1.2.10 Any other machines to which the tests contained herein may be applicable.

1.3 Intended Use

The alignment tests described by this specification are intended for use in evaluating machines procured for the aerospace manufacturing industry. At time of bid request, the customer shall select and specify applicable tests and any options under this specification.

2.0 APPLICABLE SPECIFICATIONS

The detailed requirements selected from this specification shall be as defined in Table II of NAS specifications applicable to the machines referred to in Section 1.2.

3.0 REQUIREMENTS

3.1 The manufacturer shall be contractually obligated to perform and comply with the alignment tests specified by the customer per details and descriptive drawings.

3.2 All records of tests listing the alignment results and certified by authorized personnel of the manufacturer shall be presented to the customer.

3.2.1 Data on the record of test shall be written in the same form as presented in the test detail section 4.3, or in a mutually agreeable form.

4.0 INSPECTION AND ACCEPTANCE

4.1 Classification of Tests

Each machine shall be subjected to the alignment tests selected by the customer in order to establish compliance with this specification. Deviations must have customer approval prior to acceptance testing.

4.2 Test Conditions

Each machine shall be tested under the following conditions unless approved deviation is obtained from the customer.

4.2.1 At manufacturer's plant by the manufacturer with verified and certified test results furnished to customer.

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- 4.2.2 At manufacturer's plant, accomplished by the manufacturer and witnessed by the customer. (Customer option)
- 4.2.3 At customer's plant, or designated point of installation, as specified by customer.
- 4.2.4 Complete verification required on alignment test at the completion of construction or by progressive inspection during construction shall be at the option of the customer.
- 4.2.5 The specific measuring instruments and methods specified on the various alignment test specifications do not preclude the use of other acceptable means of measuring such as optical, electronic, or air gaging, etc. The manufacturer will furnish checkout equipment for all tests conducted at their plant, and furnish a list of recommended test equipment to be available at the final installation site, and be responsible for providing test equipment which is not available from the customer.
- 4.2.5.1 The manufacturer's measuring instruments must have evidence of calibration traceable to the National Bureau of Standards.
- 4.3 Test Details
- 4.3.1 Straightness, flatness and parallelism of bedways.
- 4.3.2 Flatness - work mounting surfaces to itself.
- 4.3.3 Rise and fall of work mounting surface.
- 4.3.4 T-slots parallel with longitudinal axis.
- 4.3.5 Transverse movement square with center t-slots.
- 4.3.6 Center t-slot square with spindle.
- 4.3.7 Head movement square with work mounting surface.
- 4.3.8 Work mounting surface square with spindle.
- 4.3.9 Transverse movement square with longitudinal movement.
- 4.3.10 Spindle runout.
- 4.3.11 Spindle in-line check.
- 4.3.12 Spindles - center line distance with respect to each other.
- 4.3.13 Alignment of spindle with arbor support.
- 4.3.14 Spindle parallel with overarm.

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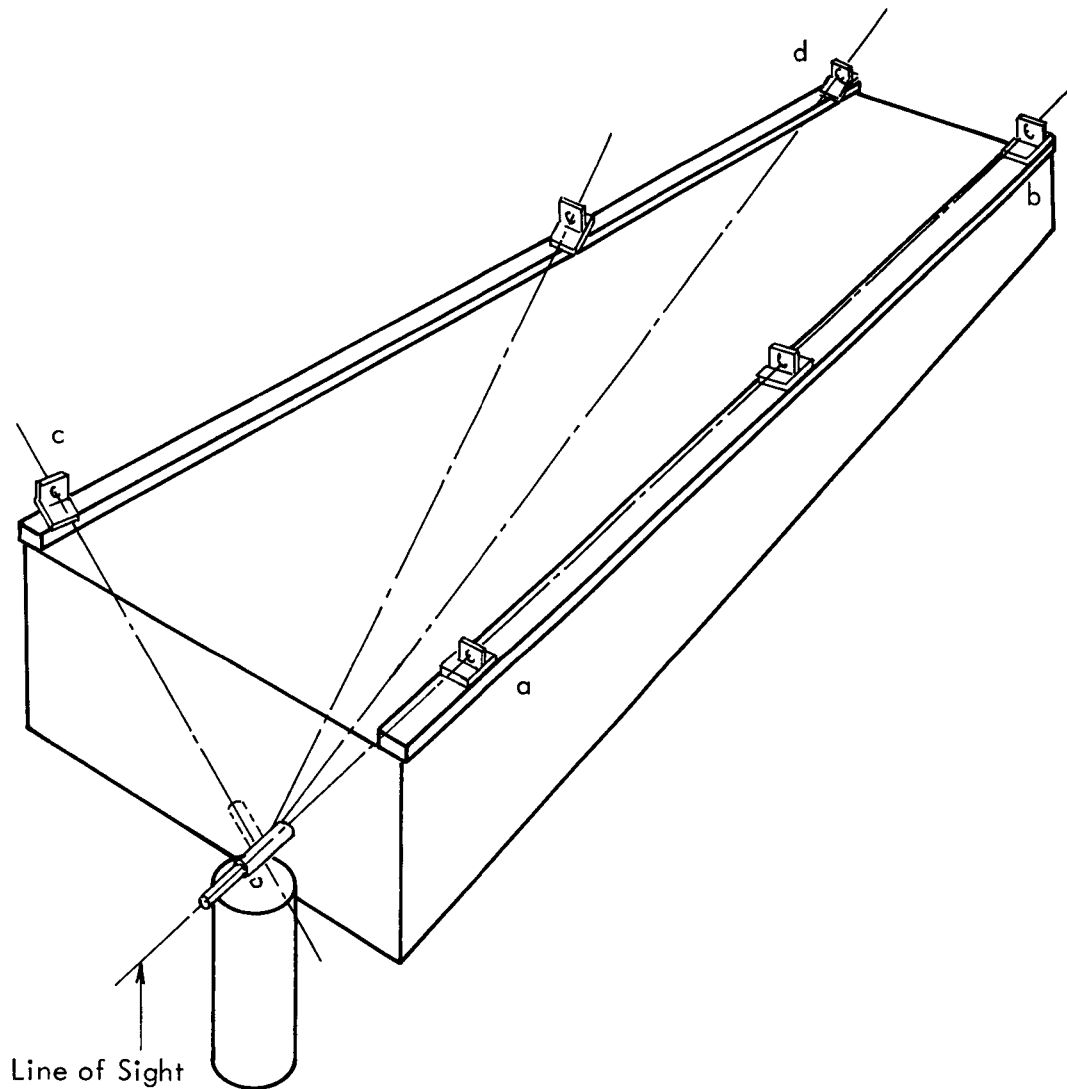
- 4.3.15 Saddle transverse movement parallel with spindle.
- 4.3.16 Quill movement parallel to table
- 4.3.17 Spindle parallel with work mounting surfaces.
- 4.3.18 Work mounting surface square with vertical knee movement.
- 4.3.19 Rotation of heads about pivot point.
- 4.3.20 Alignment of pivot points on front and rear heads.
- 4.3.21 Deflection of table under load.
- 4.3.22 Slide displacement due to clamping.
- 4.3.23 Rotational axis square to work mounting surface.
- 4.3.24 Column square to table.
- 4.3.25 Lost motion - angular axis.
- 4.3.26 Lost motion - manual-tracer machines linear axis.
- 4.3.27 Lost motion - N/C machines linear axis.
- 4.3.28 Gantry skew.
- 4.3.29 Longitudinal straightness

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4.3.1.1

Straightness, Flatness and Parallelism of Bedways
Skin, Spar and All Large Bed-Type Machines



Longitudinal and Transverse

Maximum deviation in any 12" - .0008

Maximum overall accumulated error not to exceed .0008

plus .00015 per foot for the total bed length (or width) up to .003 TIR

NOTE: Straightness refers to side of bedways and can be checked by locating targets against side of bedway.

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4.3.1.1 (continued)

Record of Test

Bed Type Mills

	Location Identity	Max. Over-all Accum. Error	Incremental Readings @ 12"					
			1	2	3	4	5	6
Horizontal Plane	a to b							
	c to d							
	a to c							
	b to d							
Vertical Plane	a to b							
	c to d							
	Parallelism							

Certified by:

Manufacturer _____

Customer _____

Certified Date _____

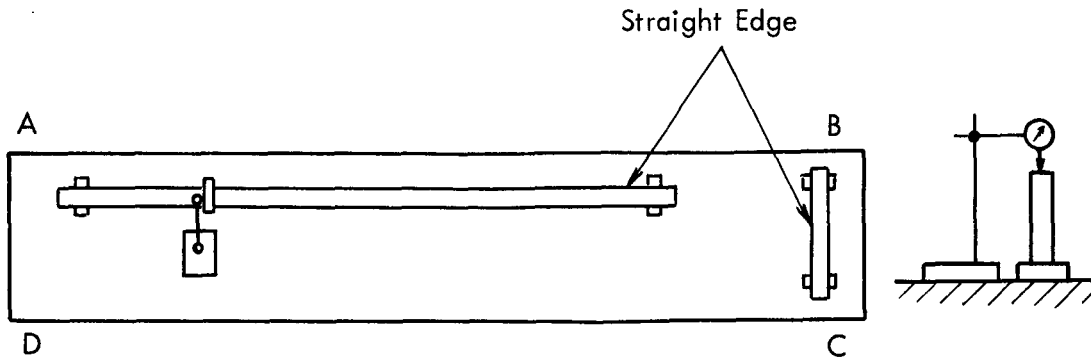
NOTE: Incremental readings column may be expanded to suit specific bed lengths or widths.

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4.3.2.1

Flatness - Work Mounting Surface-Horizontal & Vertical
Knee Type & Small, Bed-Type Mills



Work Mounting Surface

Center the Table Position for Knee Type Mills

Standard Maximum deviation in any 12 inches - .0008
Maximum overall accumulated error shall not exceed .0008
plus .00015 per 12 inches of length or width.
Measurements to be taken every 12 inches.

Record of Test

Location	Max. Accum. Error	Incremental Readings					
		1	2	3	4	5	6
Longitudinal							
a - b							
c - d							
Transverse							
a - d							
b - c							
Diagonal							
a - c							
d - b							

Certified by

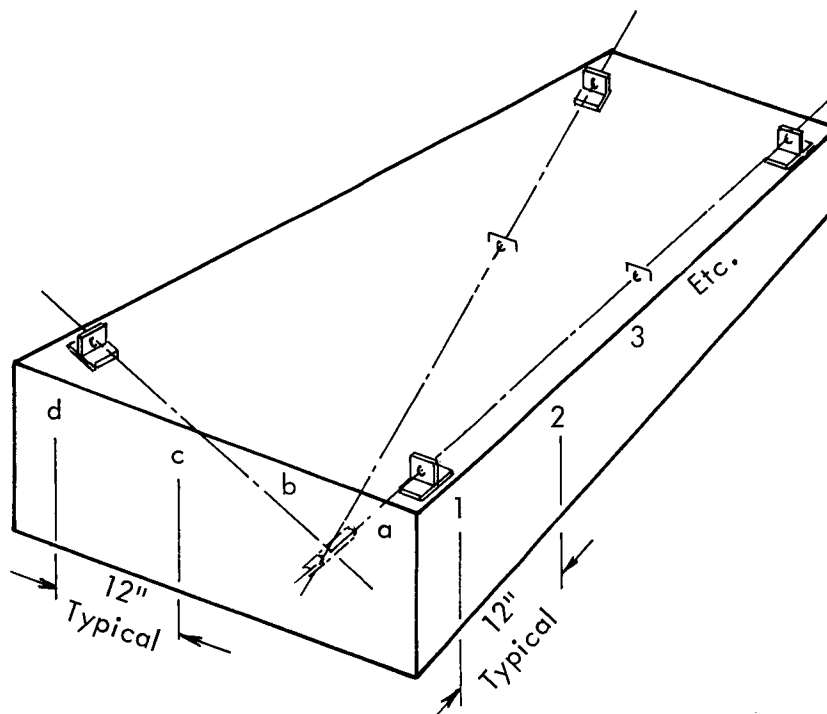
Manufacturer

Customer

Certified Date

4.3.2.2

Flatness - Work Mounting Surface
Horizontal & Vertical Bed Type Mills



Longitudinal & Transverse:

Maximum deviations any 12 inches - .0008.

Maximum overall accumulated error shall not exceed .0008 plus .00015 per foot for either Length or Width. Accumulated error for total machine length not to exceed .005 inches.

Measurements to be taken every 12 inches.

4.3.2.3

Flatness - Work Mounting Surface
Skin & Spar Mills

<u>Length</u>	Spar & Skin Mill	
	.001	TIR/12 in.
	.003	TIR/bed section
	.005	TIR full bed length
	.0005	Max. allowable mismatch between bed sections
<u>Width</u>	Spar	Skin
	.001	.001 Max. deviation TIR/12 in.
	.002	.005 Max. accumulated error TIR

Note: Work mounting surface shall be within .002 TIR of bedway plane established in test section 4.3.1.1

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4.3.2.2 or
4.3.2.3

Record of Test
Specify Type Machine

Max. Overall Accu. Error	12" Increments Both Directions								
		1	2	3	4	5	6	7	8
	a								
	b								
	c								
	d								
	e								

Certified by:

Manufacturer _____

Customer _____

Certified Date _____

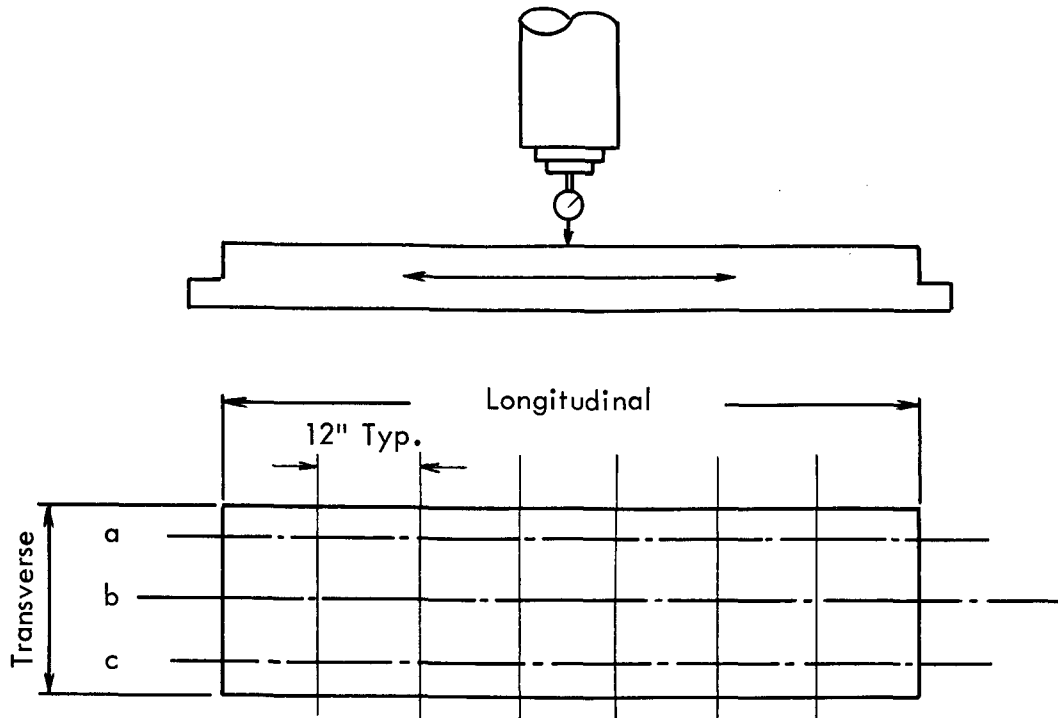
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4.3.3.1

Rise & Fall of Work Mounting Surface
Horizontal & Vertical Mills



Longitudinal and Transverse:

Maximum deviation any 12 inches - .0008.

Maximum overall accumulated error not to exceed .0008 inch plus .00015 per foot for either length or width.

Extensible Length Machine

Max. accumulated error not to exceed .003 TIR/bed section, .005 TIR for total length. Mismatch between bed lengths not to exceed .0005.

Measurements to be taken every 12 inches (24" grid pattern on large machine)

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4.3.3.1 (Continued)

Record of Test

	Incremental Readings						Max. Var. Per Ft.
	1	2	3	4	5	6	
a							
b							
c							
Max. Var. Per Ft.							Long. Transv.

Note: Expand table of tabulation to suit specific machine.

Certified by:

Manufacturer _____

Customer _____

Certified Date _____

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