



DEPARTMENT OF THE NAVY

NAVAL SEA SYSTEMS COMMAND
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IN REPLY REFER TO

9245
Ser 05H/007
5 February 2001

From: Commander, Naval Sea Systems Command
To: DISTRIBUTION

Subj: PROPELLER INSPECTION SAMPLING REQUIREMENTS

Ref: (a) NAVSEA Ltr 9245 OPR3X7, Ser 0347/82 of 6 AUG 1993

Encl: (1) Propeller Inspection Sampling Requirements for Class I and II Propellers dtd 5 February 2001

1. We rely on the on-site certifying official to ensure that the propeller inspection data submitted by manufacturing and repair activities reflects the actual condition of the propeller. We also expect the certifying official to review all inspection data to confirm completeness, to look for suspicious data, and to check against specified requirements.

2. This letter and enclosure (1) supersedes the Propeller Inspection Sampling Requirements of Reference (a).

3. Enclosure (1) provides the minimum level of verification sampling inspection that must be performed by the certifying official for each propeller. The actual amount of verification inspection may be greater than the requirements in enclosure (1) based on the activity's past performance and the certifying official's confidence level in the facilities capabilities. In some cases, 100% inspection verification may be required until the facility has established a performance record that provides the certifying official confidence that a quality product is being produced.

4. The requirements of enclosure (1) are considered mandatory for all Navy Class I and II propellers. Your cooperation and support is appreciated. Questions on this subject should be directed to Mr. Paul R. Moore, SEA 05H2, 703-602-9573 x150 or moorepr@navsea.navy.mil.

A handwritten signature in black ink, appearing to read "C. R. Crockett".

C. R. CROCKETT
By direction

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PROPELLER INSPECTION SAMPLING REQUIREMENTS

CLASS I AND CLASS II PROPELLERS

5 February 2001

- Ref (a): NAVSEA S9245-AR-TSM-010/PROP, "TECHNICAL MANUAL MARINE PROPELLER INSPECTION, REPAIR, AND CERTIFICATION"
(b): NAVSEA S9245-AQ-TSM-010/PROP, "TECHNICAL MANUAL PROPELLER ASSEMBLY AND REPAIR"

1. SCOPE

- 1.1 Propeller inspection must be performed correctly and data acquired accurately to ensure that inspection reports reflect the actual condition of the propeller. It is the responsibility of the certifying official to ensure that the requirements of references (a) and (b) are fulfilled.
- 1.2 The usual procedure is for a certifying official to perform a verification inspection to provide assurance of correct methods and accurate data. The following requirements are provided for the purpose of assisting the certifying official in determining which propeller attributes and how many samples of each must be examined in order to establish confidence that the data is accurate. These requirements should be used in the preparation of inspection reports for Class I and II propellers, as defined in reference (a), being repaired or manufactured. Sampling for pre-repair can be reduced at the discretion of the inspector, but not eliminated.
- 1.3 The requirements contained herein are considered minimum and are not intended to relieve the certifying official of the responsibility to investigate, question and resolve any data or condition which is considered to be suspicious, inaccurate or misleading. To ensure a quality propeller, the certifying official may, at their discretion, require a greater level of verification inspection than imposed by the requirements specified herein. In some cases, it may be prudent to require 100 percent inspection. The certifying official must use these requirements in conjunction with other inspections/reports as deemed necessary.

2. DEFINITIONS

- 2.1 Attribute: A characteristic (e.g., cylindrical gage clearance, pitch, etc.) which can be measured or evaluated.

- 2.2 Certifying official: A government employee who has successfully completed the Propeller Certification training course or government personnel specifically designated by NAVSEA. Certifying officials responsible for oversight of commercial repair facilities must be qualified Level II for the applicable nondestructive testing method.
- 2.3 Accuracy: Conformity of a measurement to a true value or a standard.
- 2.4 Repeatability: The ability to obtain the same value or result each time a measurement or inspection is performed.
- 2.5 Verification Sample Size: The number of data points for a given attribute that are examined by the certifying official to confirm accuracy.

3. SAMPLING PROCEDURE

- 3.1 The certifying official normally performs a review of the propeller inspection report and then witnesses the verification of inspection data. The certifying official shall review the inspection report, witness the verification inspection and in limited cases witness the original data acquisition to assure that the accuracy and repeatability of the inspection data is satisfactory. By using accurate gages and measuring equipment, proper gage application and measurement techniques, the certifying official shall obtain data of sufficient accuracy such that repeatability of the data can be used as an indication of the accuracy of the original measurements.
- 3.2 Attributes are shown in Tables 1 and 2 along with the minimum sample size for that attribute (based upon the number of required measurements). Other attributes, some of which may be classified, must also be monitored for accuracy.
- 3.3 Table 1 provides the minimum amount of verification required for attributes, which do not lend themselves to a statistical sampling approach. The verification of this data typically may be accomplished during its initial acquisition as opposed to repeating the process for verification.

3.4 Table 2 provides the minimum verification sample size required for various attributes of a typical propeller. This table is based on a "typical", blade as defined in note 1 of Table 2. If the propeller has a different number of cylindrical sections, tip or fillet gages, or other variations, Table 3 can be used to determine the verification sample size based on the number of required measurements.

3.5 Verification inspection shall cover the following:

- a. Several blades and random regions of each attribute.
- b. Pressure and suction faces.
- c. Questionable areas observed in the inspection report.

4. ANALYSIS

4.1 If the data obtained during the verification inspection of the attributes differs from the initially acquired data by more than the allowable variation shown in Table 4, these data points shall be rejected.

4.2 If the number of rejected data points in the first sample is less than or equal to the number of rejections allowed for that sample size, as shown in Table 5, then no further sampling is necessary.

4.3 If the number of rejected data points in the first sample exceeds the number of rejections allowed for that sample size as shown in Table 5, then another sample (the same quantity, but different locations) must be inspected at the discretion of the certifying official.

4.3.1 If the total number of rejected data points from both samples is less than or equal to the number of rejections allowed for the total sample size (i.e., double the original sample size), as shown in Table 5, then no further sampling is necessary.

4.3.2 If the total number of rejected data points from both samples exceeds the number of rejections allowed for the total sample size (i.e., double the original sample size) as shown in Table 5, then a 100 percent re-inspection of that attribute shall be performed by the manufacture/repair activity.

TABLE 1

Verification Sample Size for Special Attributes

Attribute ¹	Verification Sample Size
Propeller Setup (level, scribe line location, etc.)	100%
Dye Penetrant	100%
Balance	100%
Hub Pressure Test	100%
Prairie Air Flow Test ²	100%
Tip Installation ²	100%
Stress Relief Setup ²	100%
Visual Technical Inspection	100%
Visual Preservation Inspection	100%
Report Review	100%
Cusp Inspection	100%
Material Certification Review	100%
Fairing Rod	30%
Stress Relief Temp Data ²	30%
Ultrasonic Inspection ²	30%
Void Inspection ²	30%
Plug Gage Inspections	
Depth of Insertion ³	100%
Contact	100%
Keyway Clearance	100%

1. These inspections should typically be witnessed as they occur.
2. When applicable.
3. This verification can be limited to the final inspection with keys installed.

TABLE 2
Verification Attributes and Sample Size¹

Attribute	Single Blade		3 Blade Propeller		4 Blade Propeller	
	No. of Required Measurements	Verification Sample Size	No. of Required Measurements	Verification Sample Size	No. of Required Measurements	Verification Sample Size
Cylindrical Gage Clearance	160	32	480	50	640	80
Cyl. Gage Rate of Change	16	5	48	8	64	13
Half Width	16	5	48	8	64	13
Pitch (S Measured)	8	2	24	5	32	8
Rake	8	2	24	5	32	8
Edge Gage Clearance	128	20	384	50	512	80
Tip Gage Clearance	8	2	24	5	32	8
Thickness	72	13	216	32	288	50
Fillet Gage Clearance ²	110	20	330	50	440	50
Fillet Gage "S" Dimension	10	3	30	8	40	8
Radius (Axis to Tip)	1	1	3	2	4	2
Angular Spacing ³	NA	NA	3	2	4	2
Skew (Beta angle) ³	8	2	24	5	32	8
Attribute	5 Blade Propulsion		6 Blade Propeller		7 Blade Propeller	
	No. of Required Measurements	Verification Sample Size	No. of Required Measurements	Verification Sample Size	No. of Required Measurements	Verification Sample Size
Cylindrical Gage Clearance	800	80	960	80	1120	80
Cyl. Gage Rate of Change	80	13	96	20	112	20
Half Width	80	13	96	20	112	20
Pitch (S Measured)	40	8	48	8	56	13
Rake	40	8	48	8	56	13
Edge Gage Clearance	640	80	768	80	896	80
Tip Gage Clearance	40	8	48	8	56	13
Thickness	360	50	432	50	504	80
Fillet Gage Clearance ²	550	50	660	80	770	80
Fillet Gage "S" Dimension	50	8	60	13	70	13
Radius (Axis to Tip)	5	2	6	2	7	2
Angular Spacing ³	5	2	6	2	7	2
Skew (Beta Angle) ³	40	8	48	8	56	13

1. Based on a blade with 8 cylindrical sections, 10 stations per section, 1 tip gage and 5 fillet gages per side. The verification sample size should be adjusted for other conditions.
2. The number of required fillet gage measurements for repaired propellers is specified in NAVSEA S9245-AR-TSM-010/PROP. Use Table 3 to determine the verification sample size.
3. Verification not required for repaired propellers.

TABLE 3

Verification Sample Size
For Non - Standard Quantities¹

No. of Required Measurements	Sample Size
2 - 8	2
9 - 15	3
16 - 25	5
26 - 50	8
51 - 90	13
91 - 150	20
151 - 280	32
281 - 500	50
501 - 1200	80
1201 - 3200	125

1. This table must be used to determine the recommended sample size when a non-standard number of measurements have been taken.

TABLE 4

Allowable Measurement Variation

Attribute	Allowable Variation
Cylindrical Gage Clearance	0.010
Blade Half Width	0.05
Pitch ¹	0.015
Rake	0.015
Edge/Tip Gage Clearance	0.005
Thickness	0.025
Fillet Gage Clearance	0.010
Fillet Gage ("S" dim)	0.02
Skew	0.05°
Radius (Axis to Tip)	0.05
Angular Spacing	0.05°

¹Variation of S measured value when using gages or for direct measurements when used.

TABLE 5

Acceptance Limits

Verification Sample Size	No. of Allowed Rejects
1 - 3	0
4 - 7	1
8 - 13	2
14 - 20	3
21 - 27	4
28 - 33	5
34 - 40	6
41 - 47	7
48 - 53	8
54 - 60	9
61 - 67	10
68 - 73	11
74 - 80	12
81 - 87	13
88 - 93	14
94 - 100	15

1. For verification sample sizes larger than 100, multiply the verification sample size by 0.15 and round to the nearest whole number to determine the number of allowable rejected data points.