IEEE Standard for the Testing of Overhead Transmission and Distribution Line Hardware

Sponsor

Transmission and Distribution Committee
of the
IEEE Power Engineering Society

Approved 16 September 1997

IEEE Standards Board

Abstract: Requirements for mechanically testing load-rated line hardware for use on transmission and distribution facilities are described. Items specifically addressed in this standard include clevis and eye fittings, Y-clevis fittings, socket fittings, ball fittings, chain links, shackles, triangular and rectangular yoke plates, suspension clamps, and strain clamps. This standard is intended to cover routine acceptance testing. It is not intended for initial design tests.
Keywords: acceptance testing, load-rated line hardware

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Introduction

(This introduction is not part of IEEE Std C135.61-1997, IEEE Standard for the Testing of Overhead Transmission and Distribution Line Hardware.)

This standard covers the requirements for the testing and acceptance of transmission and distribution line hardware. The standard covers routine acceptance testing, and is not intended for use for initial design tests.

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IEEE Standard for the Testing of Overhead Transmission and Distribution Line Hardware

1. Overview

1.1 Scope

This standard covers the requirements for mechanically testing load-rated line hardware for use on transmission and distribution facilities. This standard is intended to cover routine acceptance testing. It is not intended for initial design tests. This standard specifically addresses, but is not limited to, clevis and eye fittings, Y-clevis fittings, socket fittings, ball fittings, chain links, shackles, triangular and rectangular yoke plates, suspension clamps, and strain clamps. This standard may be applied to other line hardware as agreed upon by the manufacturer and the end user.

1.2 Purpose

All load-rated line hardware conforming to the requirements of this standard shall, in all respects, meet the acceptance criteria in Clause 5, when tested in accordance with the procedures outlined in Clause 6.

1.3 Application

The routine acceptance tests covered by this standard test the "as-manufactured" condition of the product. It is expected that the user will select suitable safety factors in applying these devices, based on experience and a knowledge of the associated codes and materials involved. Assurance of compliance with this standard is a matter to be agreed upon by the purchaser and the supplier.

2. References

This standard shall be used in conjunction with the following publication. When the following publication is superseded by an approved revision, the revision shall apply.

ANSI/ASQC Z1.4-1993, Sampling Procedures and Tables for Inspection by Attributes.[1]

[1]ANSI publications are available from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

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3. Definitions

3.1 acceptance quality level (aql): The maximum percent defective (maximum number of defects per 100 units) that, for the purpose of a sampling inspection, can be considered satisfactory as a process average.

3.2 average test value ($\overline{X}_n$): $\overline{X_n} = (X_1 + X_2 + X_3 + ... + X_n)/n$

where

X_1, X_2,...,X_n, are individual test values and n is the total number of units tested.

3.3 defect: Any nonconformance with specified requirements of the tested unit of product. For purposes of this standard, a defect is defined as a unit of product that, when tested, falls below its specified rated ultimate strength.

3.4 lot: A quantity of line hardware selected and agreed upon by the manufacturer and customer as being representative of a homogeneous population. Each lot, as far as is practicable, shall consist of units of product of a single type, grade, class, size, and composition that are manufactured at essentially the same time and under essentially the same conditions. Consideration should be given to limit the lot size, where applicable, to each heat-treating and/or annealing process of a group of units. As necessary, the manufacturer shall provide adequate and suitable storage space for each lot and means for proper identification. Any lot shall not exceed 35 000 units.

3.5 major defect: A unit of product that, when tested, falls below 85% of its specified rated ultimate strength.

3.6 sample: One or more units of product drawn from a lot, the units of sample being selected at random without regard to their quality.

3.7 sample size: Based on the lot size. Minimum sample sizes are given in Table 1.

Table 1—Minimum sample size

Lot size	Sample size
1–29	3
30–150	5
151–1200	13
1201–10 000	20
10 001–35 000	32

4. Requirements

The inspection criteria used in this standard correspond to sample size code S-4 with a double sampling plan for normal inspection having an aql of 2.5% (see ANSI/ASQC-1993).

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5. Determination of acceptability

The acceptability of a lot shall be determined by the use of Table 2.

Table 2—Acceptance/rejection criteria

Test sample	Sample size	Cumulative sample size	Accept	Reject
Single	3	—	0	1
Single	5	—	0	1
First Second	13 13	13 26	0 1	2 2
First Second	20 20	20 40	0 3	3 4
First Second	32 32	32 64	1 4	4 5

The lot shall be considered acceptable when the number of defects found in the first (or single) sample is equal to or less than the first acceptance number from Table 2. If this acceptance criterion is met on the first sampling, a second sampling is not needed. If the number of defects found in the first or single sample is equal to or greater than the first rejection number, the lot shall be rejected without a second sampling being allowed. If the number of defects found in the first sample is between the first acceptance and rejection numbers, a second sampling of the size given in Table 1 shall be tested. The number of defects found in the first and second samples shall be accumulated. If the cumulative number of defects is equal to or less than the second acceptance number, the lot shall be considered acceptable. If the cumulative number of defects is equal to or greater than the second rejection number, the lot shall be rejected.

Both the manufacturer and the end user shall reserve the right to reject the entire lot if a tested unit of product is found to have a major defect (i.e., falls below 85% rated ultimate strength).

6. Test procedure and test reports

Pulling hardware used in the application of the load shall be dimensional according to Exhibits A–D (see Figures 1–5). Pins or bolts that are normally furnished with the hardware shall be used during all tests. This standard applies to straight-line loading. Lower ultimate strengths may occur if loaded in a manner other than shown in this standard.

In performing a tensile test, the load shall be started at zero and shall be brought up smoothly in a practically stepless manner. The load may be increased rapidly to approximately 75% of the rated strength of the hardware. Load shall then be smoothly applied at a rate of 25% of rated strength per minute, until the point of failure.

All tests shall be recorded in a permanent and organized manner, and shall be maintained for a minimum of 10 years. Each test write-up shall contain the following:

a) Date of test.
b) Location of test.
c) Catalog part number.
d) Hardware rating.

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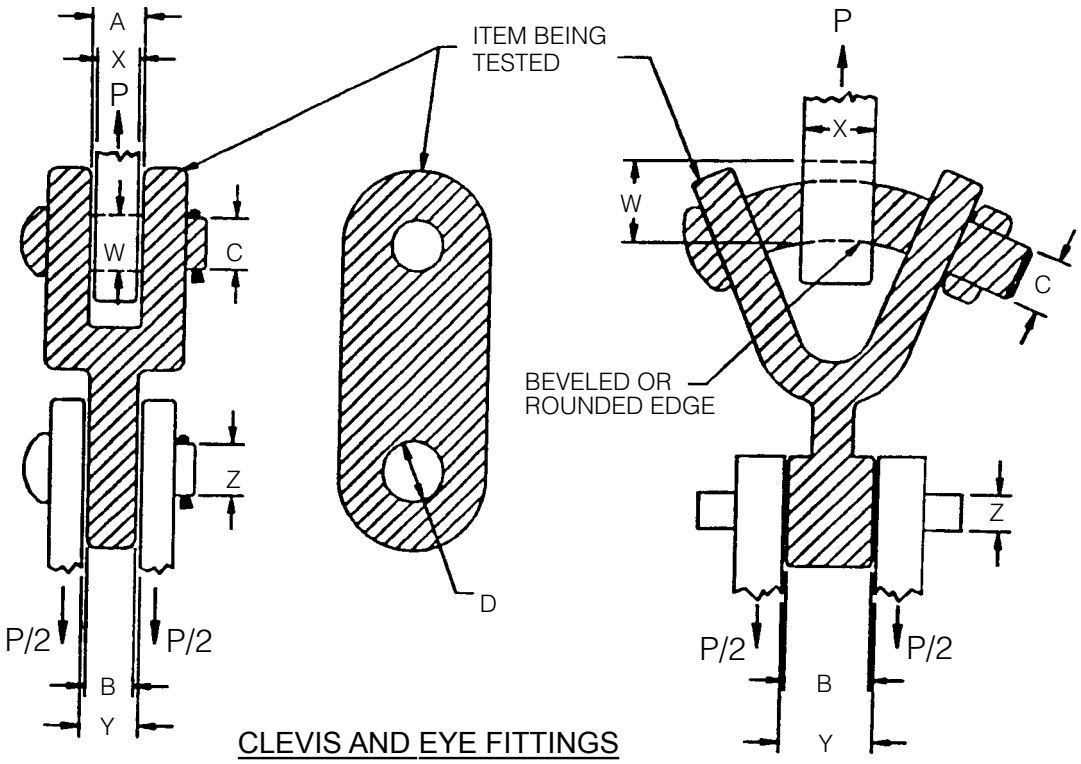
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e) Description of test setup, including serial number of test equipment.
f) Date of last calibration of test equipment.
g) Any pertinent notes.
h) Test values at which failure occurred, and a description of the failure (i.e., broken pin, fracture at clevis, etc.).
i) Name of the inspector performing or witnessing the test. If any electronic data base is utilized, security shall be employed so that only the person witnessing the test may enter or alter the results.

All test reports submitted to customers shall be typed and certified. Each test report shall contain the following:

a) Date of test.
b) Location of test.
c) Supplier catalog part number.
d) Description of the part including hardware rating.
e) Object of test.
f) Test procedure.
g) Description of the test equipment, including test equipment serial number and last date of calibration.
h) Number of units tested (n).
i) Test values at which failure occurred (X_1, X_2,..., X_n), and a description of the failure (broken pin, fracture at clevis, etc.).
j) Average test value ($\bar{X}_n$).
k) A statement that the hardware conforms, or does not conform, to the requirements of this standard.
l) Personnel present at the test.
m) Signature of certification.

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CLEVIS AND EYE FITTINGS

W = C + [2 mm (1/16 in) to 3 mm (1/8 in)]
X = A – [2 mm (1/16 in) to 3 mm (1/8 in)]
Y = B + [2 mm (1/16 in) to 3 mm (1/8 in)]
Z = D – [2 mm (1/16 in)]

Y-CLEVIS FITTINGS

W = C + [3 mm (1/8 in) to 5 mm (3/16 in)]
X = A – [0 mm (0 in) to 6 mm (1/4 in)]
Y = B + [2 mm (1/16 in) to 3 mm (1/8 in)]
Z = D – [2 mm (1/16 in)]

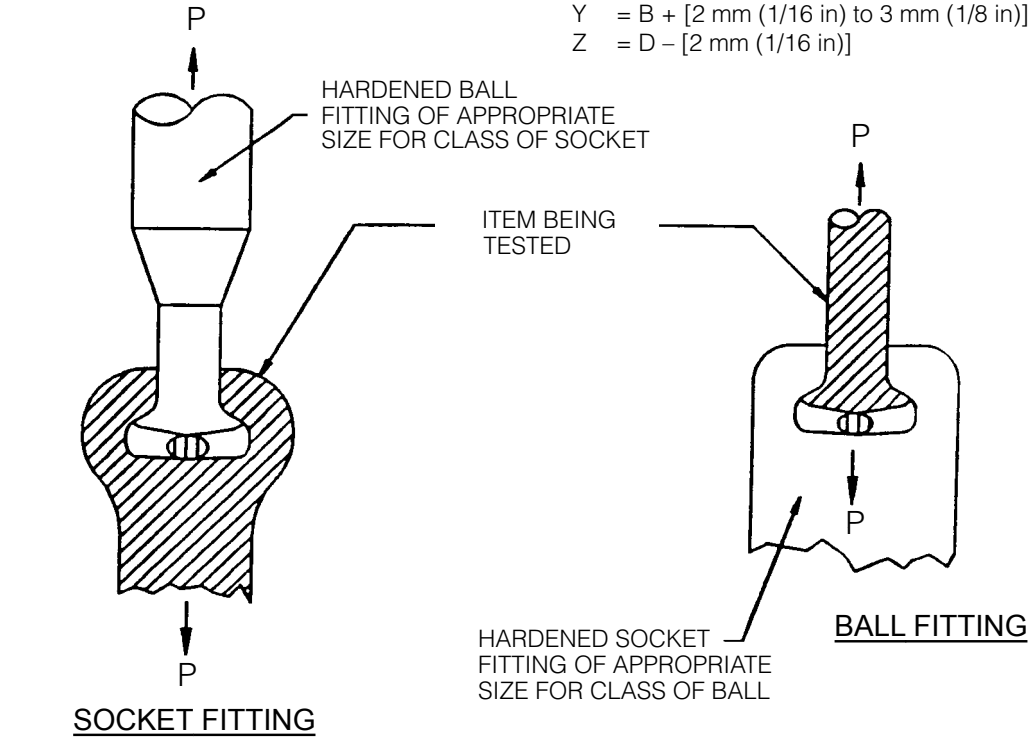


Figure 1—Exhibit "A"

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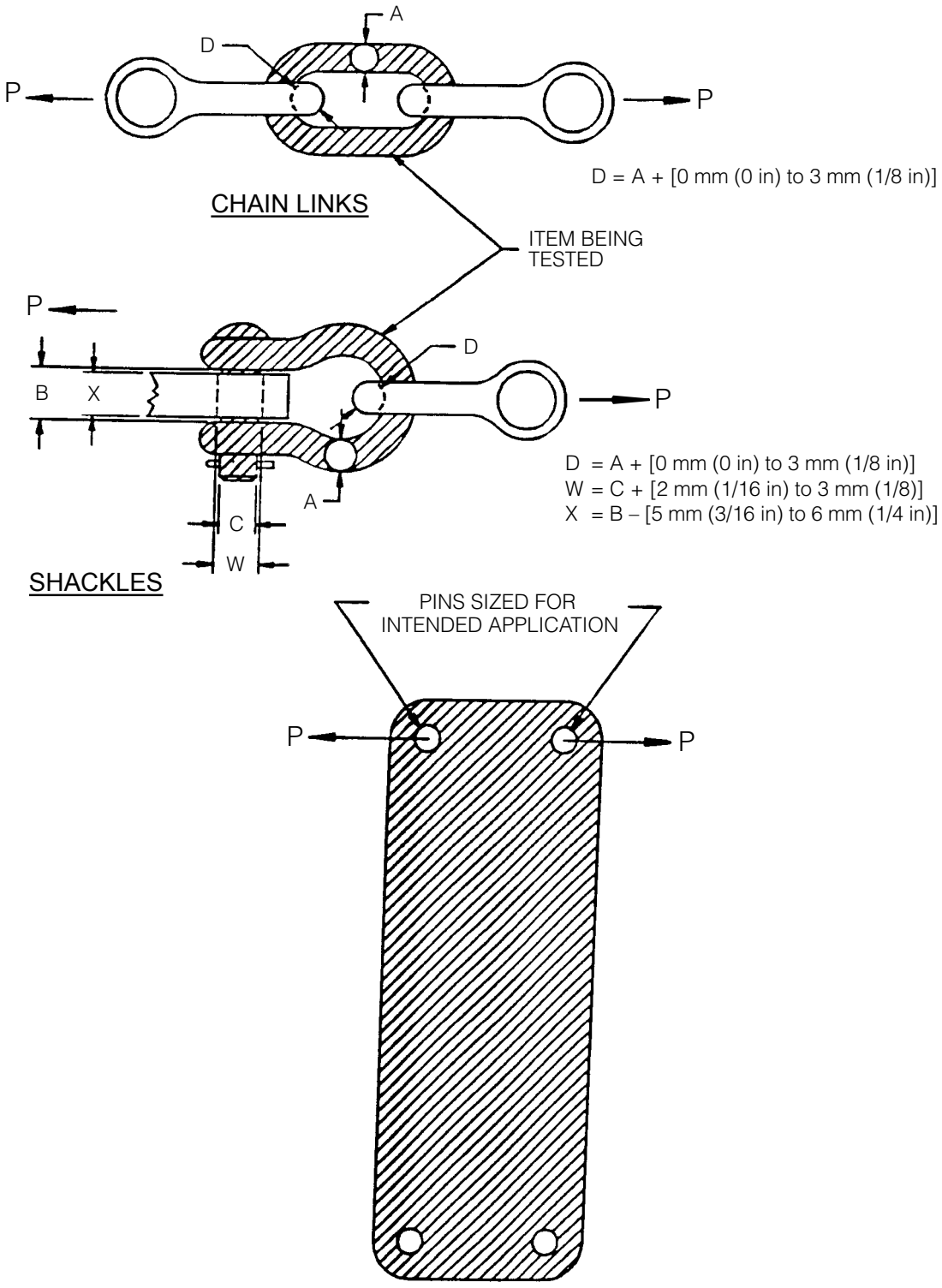
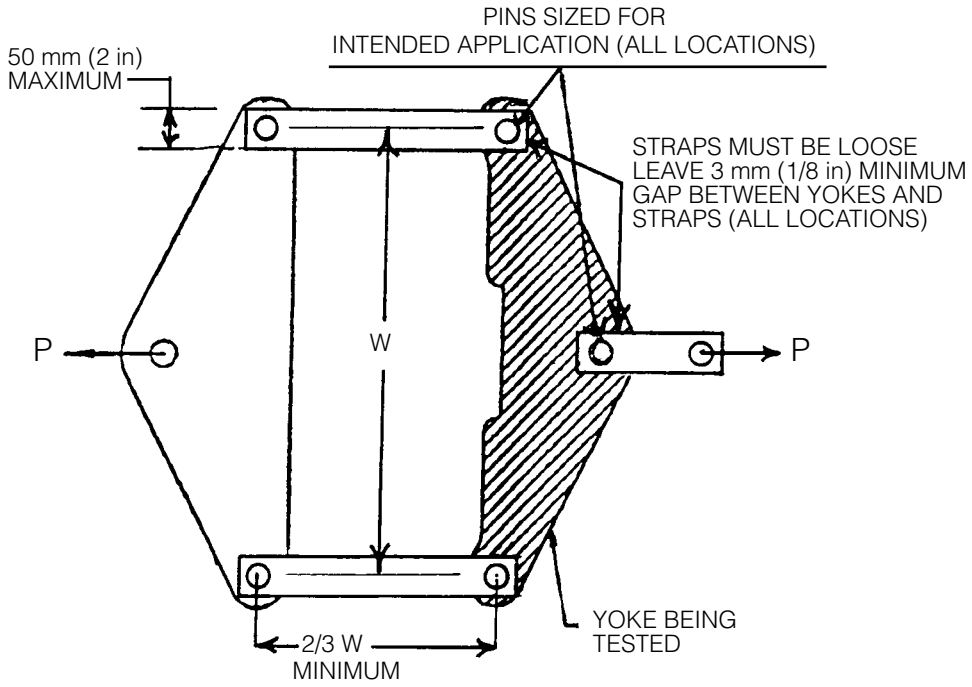
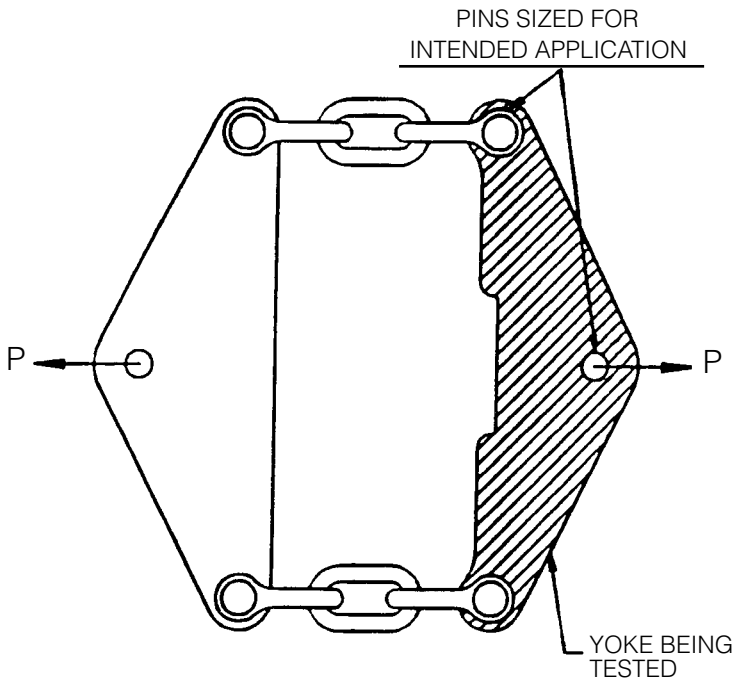


Figure 2—Exhibit "B"

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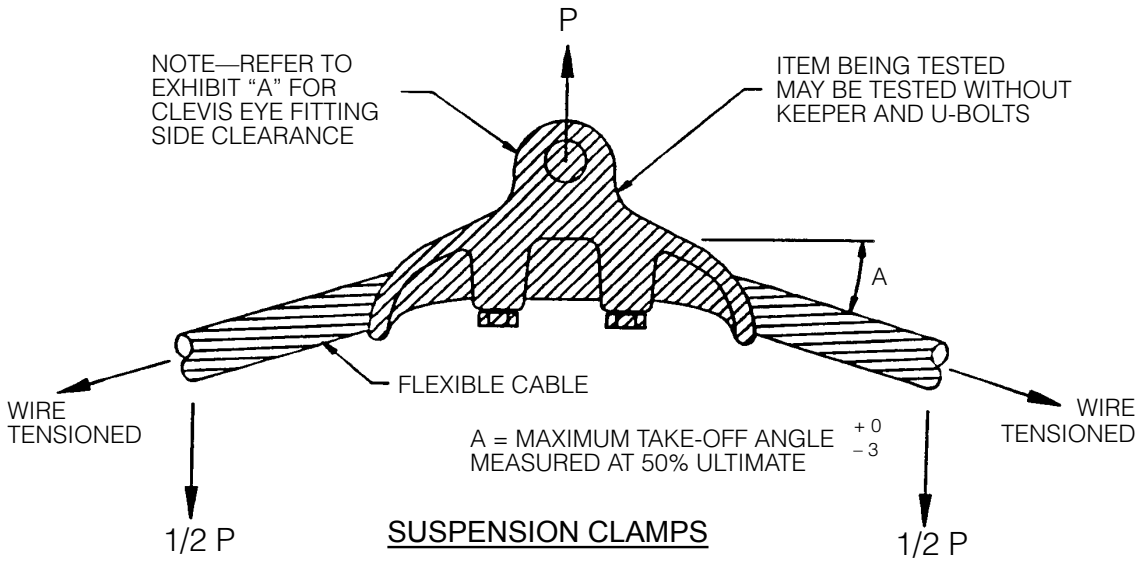


TRIANGULAR YOKES (EITHER METHOD)

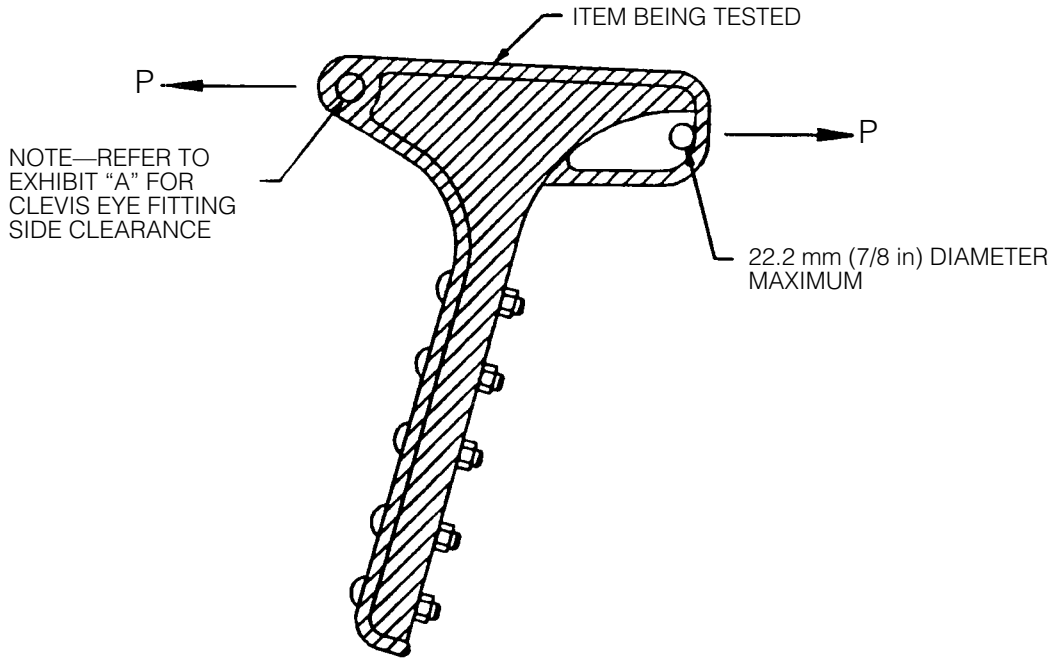
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SUSPENSION CLAMPS



QUADRANT STRAIN CLAMPS

Figure 4—Exhibit "C"

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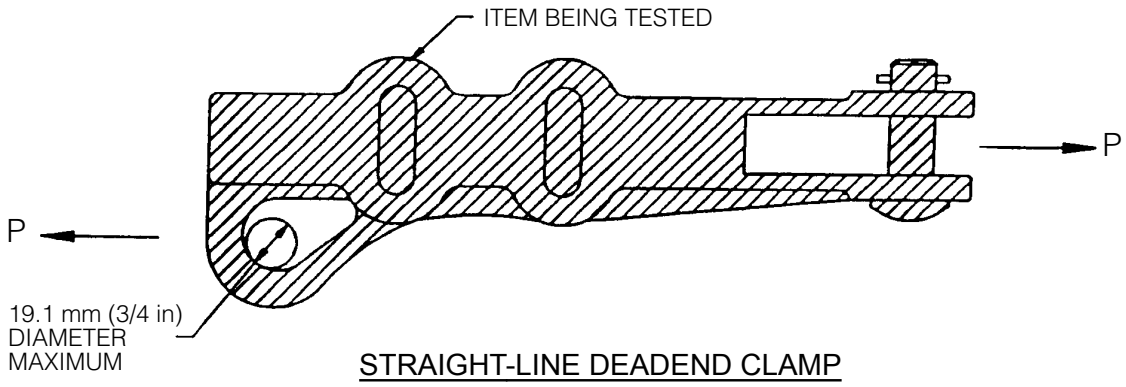


Figure 5—Exhibit "D"

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