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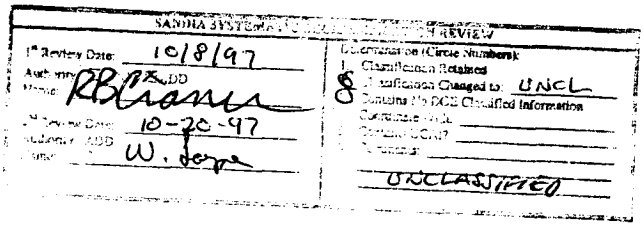

SCDR 57-60

CHARACTERISTICS AND DEVELOPMENT REPORT FOR THE H-779 SLING

[redacted]

D. R. Kvarnstrom, 1284-1

February 1960

Approved by: R. H. Schultz
R. H. Schultz, 1280

ABSTRACT

This report provides a current authoritative record of the design intent, product characteristics, and development history for the H-779 sling.

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CHARACTERISTICS AND DEVELOPMENT REPORT FOR THE H-779 SLING

1. INTRODUCTION

The purpose of this document is to provide a current authoritative record of the design intent, product characteristics, and development history for the H-779. The product definition drawings and specifications, which are the basis for production contracts, are listed on NX 320174.

2. DESCRIPTION

The H-779 sling consists of a nylon strap and two steel brackets; the brackets are permanently attached to the strap. One bracket is provided with a bolt and nut for ground strap attachment. The sling is attached to the warhead case by four No. 10 screws. These screws engage into heli-coil inserts. The overall dimensions are 2-3/4 inches x 1/2 inch x 24-1/2 inches. Package dimensions are 3 inches x 4 inches x 4 inches and the weight is one pound.

3. DESIGN INTENT

The objective of this design was to provide a sling which could economically be furnished on a one for one basis. The sling was to be capable of lifting a 680-pound load, four times the actual load of 170 pounds. The sling will be used to install and remove the XW-44-X1 warhead from the H-651 container. The sling will be subject to the standard warhead environment.

4. PRODUCT CHARACTERISTICS

The product characteristics and capabilities are as outlined in Section 3 above. The H-779 limitation is that it was designed for the above-mentioned specific function and will not be compatible with other uses.

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5. TEST AND QUALITY REQUIREMENTS

Each sling will be required to withstand a 300-pound proof-test load. The quality of the nylon strap and the nylon thread is controlled by MIL-W-5625 and MIL-T-7807, respectively.

6. DEVELOPMENT HISTORY

The original design was a belly-type sling which would adapt to the warhead case without special inserts. This design was reviewed by Mr. V. E. Blake, 1225, and Mr. R. H. Schultz, 1280. It was determined during this evaluation that this type of sling would be uneconomical provided on a one for one basis. The weapon design group was questioned as to the possibility of providing inserts in the warhead case to accommodate a simple nylon strap sling, and a layout was shown to the group at this time. They stated their approval and provided the inserts.

The sling was designed from a psychological standpoint as well as a stress standpoint. From past experience it has been noted that the Military is reluctant to handle items with a sling which may appear flimsy or weak. This is overcome in this case by providing a one inch nylon strap which has a load rating of approximately 3000 pounds. The brackets, which are fastened to the nylon strap are also over-designed. A static pull test was conducted with the sling attached to an XW-44 rear case section. The sling and No. 10 bolts yielded at a load of approximately 4600 pounds. The stress calculations, a drawing of the H-779, a picture of the test setup, and the test report T-16506 are given in the Appendix.

APPENDIX

STRESS CALCULATIONS H-779

Bracket

Safety Factor = 6 (based on ultimate strength)

Loads

Basic load = 170

$\Sigma V = 0 \quad Fy - \frac{170}{2} = 0$

$Fy = 85$ lbs.

$Fh = 85/\sin 54^{\circ} = 104$ lbs.

$Fx = \sqrt{(Fh)^2 - (Fy)^2} = 60$ lbs.

Stresses

All bracket stresses based on nylon strap producing point loading.

Stress produced by Fy

$$S_1 = \frac{M}{Z} \qquad M = \frac{Fy\,(2)}{8} = \frac{85(1.25)}{8} = 13.3 \text{ in lbs.}$$

$$Z = \frac{bh^2}{6} = \frac{.187\,(.38)^2}{6} = .0045$$

$$S_1 = \frac{13.3}{.0045} = 3,325 \text{ psi}$$

Stress produced by Fx

$$S_2 = \frac{M}{Z} \qquad M = \frac{Fx\,(L)}{8} = \frac{60\,(1.25)}{8} = 9.38$$

$$Z = \frac{.38\,(.187)^2}{6} = .0022$$

$$S_2 = \frac{9.38}{.0022} = 4,200 \text{ psi}$$

[redacted]

Maximum tensile stress

$Sm = S_1 + S_2 = 7,525$ psi

Ultimate tensile strength material used (C1015) = 60,000

Safety Factor = $\frac{60,000}{7,525} = 8$

Required S.F. = 6

Strap Strength

Breaking strength (straight pull load) 3,000 pounds as purchased per Mil-W-5625.

Screw Strength

Shearing Stress produced by Fy

$S_3 = \frac{Fy/2}{A}$ $\quad Fy/2 = 85/2 = 43$ lbs.

A(stress) = .0174

$S_3 = \frac{43}{.0174} = 2,470$ psi

Stress tensile produced by Fx

$St = \frac{P}{A}$ $\quad .75P = .625(60)\ P = 50$ lbs.

$St = \frac{50}{.0174} = 2,880$ psi

Maximum Normal Stress

$Sn = \frac{St}{2} + \sqrt{S_3^2 + \frac{St}{2}^2} = 1,440 + \sqrt{10,800,000} = 4,730$ psi

AN - 3 Bolt used with a permissible tensile load of 2210 lbs and a permissible shear load of Z 125 lbs.

It is apparent from the above calculations that an S.F. of well above the required 6 is present; therefore, no further analysis is made.

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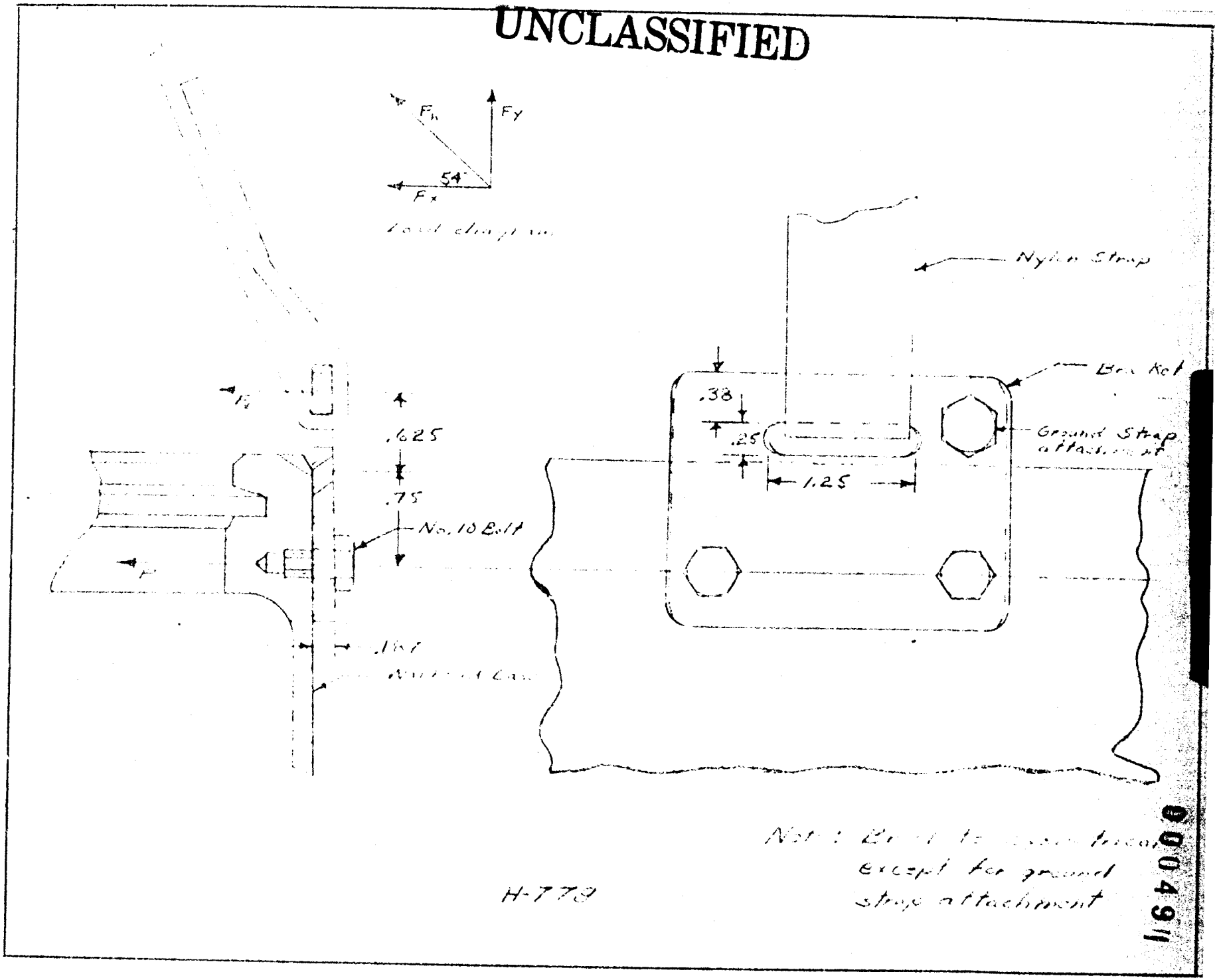
F_h
F_y
54°
F_x
Nylon Strap
Bar Nut
.38
.25
1.25
Ground Strap attachment
.625
.75
No. 10 Bolt
H-779
except for ground strap attachment

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XW-44, 3-2
Project No. T-16506
Case No. 761.01
Completed 8-6-59

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Re: Structural Strength Test of the XW-44 Sling

One XW-44 Sling (DL 10936) was subjected to a static pull test to determine its structural adequacy.

The XW-44 Sling was fastened to the XW-44 rear case section and loaded as shown in Figure 1. A 1-inch diameter loading pin was used to pull on the sling.

At a load of 4600 pounds, the number 10 bolts, holding the sling brackets to the case, yielded and the sling broke at the bracket.

Based on the minimum design requirements that there will be no yielding of either the bracket bolts or the sling at 4 g (680 pounds), the results of this test show that there is a safety factor of 6.78 in this sling.

1613 Project Engineer: R. F. HARLAN - 1613-3

Approved by: R. S. HOOPER - 1613-3

RFH:1613-3:ec

Enc: Figure 1

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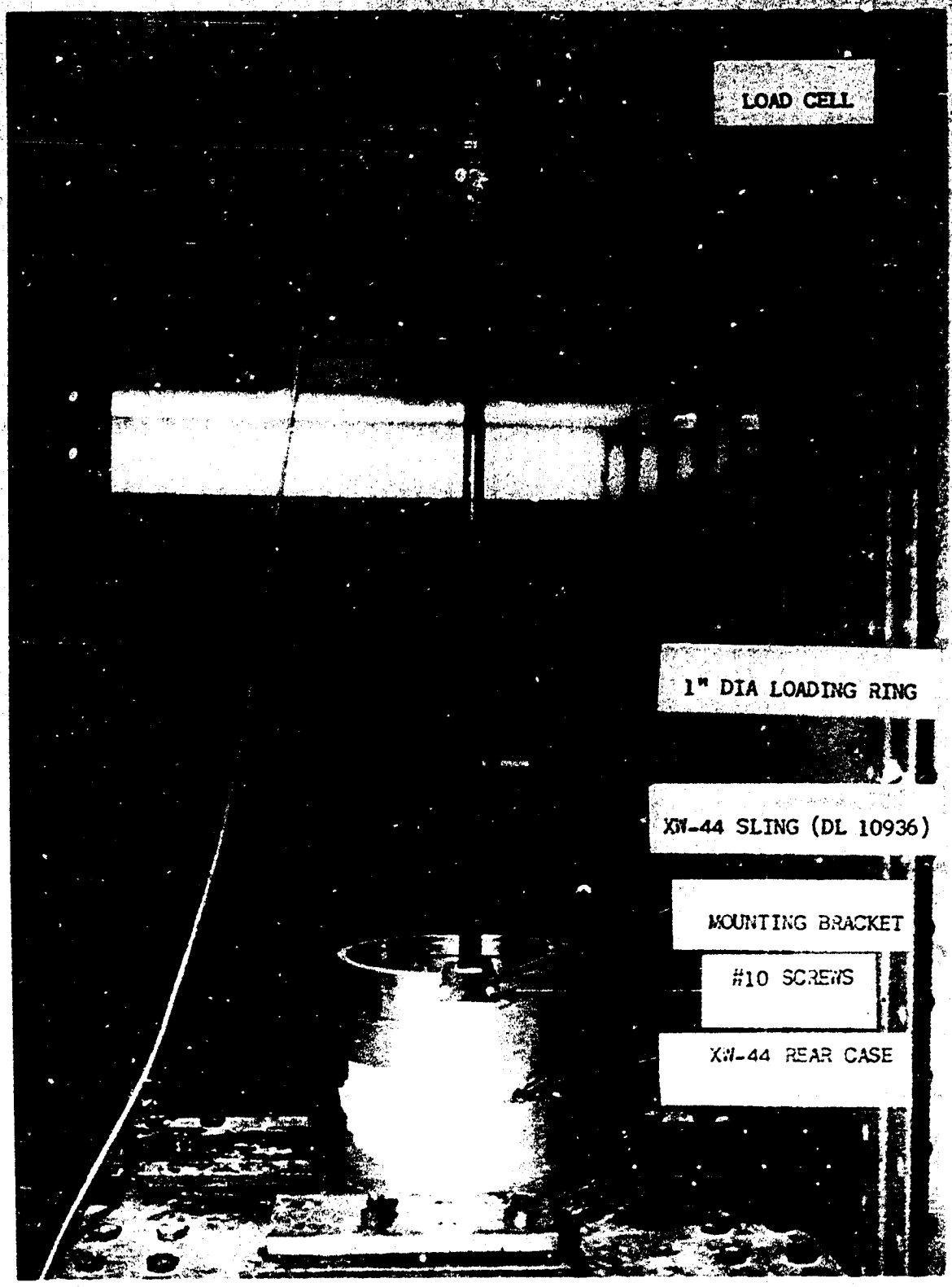

FIGURE 1 - SETUP FOR STRUCTURAL STRENGTH TEST OF THE XW-44 SLING