UNCLASSIFIED [redacted] OCT 31 1955

TX28-3-2
Case No. 690.00
Ref. Sym: 1611 (310)
Project No. ET-2814-A-2
Completed 10/3/55

INVENTORIED
DATE 10 31 55

RECEIVED
NOV 4 1955
R & D FILES

TO: DISTRIBUTION

Re: Preliminary Vibration Test of Threaded Ring and Coupling (TX-28)

Object of Test

The object of this test was to determine if the threaded ring - SK(1326)4881 - threaded coupling - SK(1326)48812 - and flanged ring which simulated the coupling of sections of the TX-28 would tolerate vibrational acceleration.

INVENTORIED
SEP 14 '6

Authorization for Test

This test was requested by Division 1326 in a Work Order Authorization dated July 21, 1955. Mr. L. M. Spivey was the consultant.

3428-3

CDL No.	
CARD	dgd
FILE No.	TX
	3-2

Procedure and Results

A mass load which simulated the weight and center of gravity of the tail and/or nose section of the TX-28 in relation to the coupling was designed and fabricated. This simulated load was assembled, with its jig, on a Sonntag shake table so that the direction of vibration would be along a diameter of the assembly.

Since the stress placed on the threaded ring was of prime importance, strain gages were mounted on this portion of the assembly. Four Baldwin-Southwark SR-4 gages were used, each constituting an active arm of a bridge. A Brush Universal Strain Analyzer, Model BL-320 was used in conjunction with a Brush Magnetic Direct Inking Oscillograph, Model BL-902, and the system calibrated to record the deformation of the threaded ring resulting from vibrational forces.

INVENTORIED
MAR 3 1959
BY ORG.

The gages were physically paired, the pairs being placed diametrically opposite along the axis of vibration at the points where it seemed the greatest strain would occur.

Vibration was begun with a constant displacement of 0.027 inch, which would give an acceleration of 5 g at 60 cps. Vibration was begun at 10 cps, with the vibrational frequency increasing. At 45 cps the threaded ring began to loosen, so the table was stopped. The highest strain gage reading was recorded at 40 cps, where a stress of 1800 psi was recorded.

INVENTORI
AUG 6 19

The ring was tightened, an additional 7/16 inch of arc being gained, as measured on the outside circumference of the threaded ring. To preclude further loosening the following precautions were taken: A hole was drilled in the threaded ring (in the thread relief) and this hole tapped for a 10-32 machine screw. An Allen 3/8-16 bolt was drilled through the socket, and used to replace a hexagonal-head

3427-1

[redacted]

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
DOWNGRADING OR DECLASSIFICATION STAMP
CLASSIFICATION CHANGED TO: U
AUTHORITY: W.C. Layne
Emelda Selph 7/30/98
PERSON CHANGING MARKING & DATE
RECORD ID: 98SN3196
WC Layne 7/30/98
PERSON VERIFYING MARKING & DATE
DATED: 7/29/98

[redacted]

53447
UNCLASSIFIED

bolt in the jig. Safing wire was run from the machine screw through the Allen bolt head so that the tension on the wire opposed the loosening of the ring.

Vibration was resumed, the frequency being cycled 10-60-10 cps in five minutes with a constant displacement of 0.027 inch. At approximately 46 cps the ring began to tighten, aided by the rotation of the pedestal-shaped mass constituting the simulated load. While it is not known how far the pedestal rotated, the threaded ring tightened through an additional 17/32 inch of arc, measured as before. The greatest stress recorded was 5250 psi at approximately 60 cps or 5 g acceleration.

The shake table was shut down after one cycle 10-60-10 cps, and the specimen examined for incurred damage. No damage was apparent, so the safing wire was renewed and tightened.

Because of the tightening of the ring, a skewness of approximately 5.6° existed between the present and original position of the strain gages in relation to the axis of vibration. However, since replacement of the gages required a drying period of some 50 hours, it was decided to continue vibration.

A third cycle over the same frequency range with the same displacement was made resulting in a further tightening of 1/8 inch (or some 0.72° of arc) of the threaded ring. A high of 7500 psi stress was recorded at approximately 55 cps, both as the frequency increased to and decreased from 60 cps.

The displacement of the table was increased to 0.054 inch to give an acceleration of 10 g at 60 cps, and a cycle made over the range 10-60-10 cps. The strain, and consequently the stress, was somewhat lower during this run than that in the previous, lower acceleration cycles, probably because the ring snubbed down firmly during this and previous vibration cycles. The greatest stress occurred between 30 and 52 cps, when a modulating beat frequency of about 4 cps resulted in peak readings of approximately 3000 psi stress. One pulse, which occurred as a single disturbance of approximately 0.06 seconds duration at 32 cps as the frequency was being reduced, showed stress of 6000 psi.

During this cycle the threaded ring tightened an additional 5/32 inch. This skewed the gages approximately 7.16° from their original position in relation to the axis of vibration.

Three additional runs were made, 10-60-10 cps with 0.054 inch displacement, with no additional tightening of the threaded ring. During the seventh and final run, pulses at the low frequency beat indicated stresses of some 8600 psi.

Some difficulty was experienced in loosening the threaded ring after the test. The combined efforts of four men were necessary to remove the ring using the spanner wrench provided. These efforts might not have succeeded if the specimen had not been vibrated while a strong torque was maintained on the ring.

Conclusions and Recommendations

This marks the first attempt by Division 1611 to use strain gages during vibration. Although the technique was not well developed at the time of this test, it is felt that valuable information was gained. In future tests, better placement of the gages at different points where strain may occur could result in more accurate analysis of the various stresses encountered. No attempt was made to compensate, mathematically, for the rotation of the gages from their original position. This stand is considered justifiable inasmuch as this was a preliminary test of the first order. Machining of the specimens was rough, and tolerances undoubtedly generous.

The observed beat frequency is believed to be a sliding of the mating flanges of the coupling within the threaded ring or swaying of the pedestal. These are admittedly conjectural, but seem logical explanations of this phenomenon.

This test, while proving that the threaded ring is sufficiently strong structurally, also points out some inadequacies.

A dependable locking device which would prevent rotation of the threaded ring in either direction is a prime need. A key or lock to prevent rotation of the body sections in relation to each other is also a necessity. A wrench more adequate than the hurriedly fabricated spanner would be of great value in first tightening and later removing the threaded ring from its mating components.

It is hoped that further tests on more carefully made assemblies would disclose less relative motion between parts than was evident in this test.

R. G. Hamilton
Test Conducted by R. G. HAMILTON - 1611-2

M. A. Richter
Approved by M. A. RICHTER - 1611-2

RGH:1611-2:dr

Distribution:
1/8A - S. A. Moore, 1326
2/8A - T. B. Morse, 1610
3/8A - G. C. McDonald, 1630
4/8A - Don Williams, Jr., 1611
5/8A - R. E. Fisher, 1621
6/8A - C. L. Gomel, 5523
7/8A - R. K. Smeltzer, 1922-2
8/8A - F. C. Hale, 1922-3
Attn: Tech. Ref. File

"B" Distribution
1, 2/2B Brig. Gen. G. D. Starlind
DMA, USAEC,
Washington, D.C.