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TX-28, 3-2

Case No. 690,00

Ref. Sym: 1611 (353)

Project No. ET-2814-A-1

Completed 2/15/57

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW	
1 st Review Date: <u>7/28/98</u>	Determination (Circle Numbers):
Authority: <u>W.C. LAYNE</u>	1 Classification Changed to: <u>U</u>
Name: <u>W.C. LAYNE</u>	2 Contains No DOE Classified Information: <u>U</u>
2 nd Review Date: <u>7/29/98</u>	3 Coordinates With: <u>U</u>
Authority: <u>ADD</u>	4 Contains UCAT: <u>U</u>
Name: <u>W.C. LAYNE</u>	5 Comments: <u>Velocity</u>

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Re: Low Frequency Vibration of MC-711 Cartridge Assembly of the TX-28

Object of Test

The object of this test was to determine the effect of vibration through the frequency range of 10 to 55 cycles per second on the MC-711 cartridge assembly.

Procedure and Results

Two MC-711 cartridge assemblies, designated Units 1 and 2, were submitted for testing. Unit No. 1 is the fuse section for an external version of the TX-28 which is to be subjected to a number of environmental tests. Unit No. 2 is the fuse section for an internal version of the TX-28 which is to be subjected to a number of environmental tests.

In mounting cartridge assembly No. 1 to the vibration jig in Plane I, as shown in Fig. 1, only one wrench was used on one side of the mounting ring. The ring was tightened as much as possible with the wrench, then a hammer was used on the wrench.

A resonance survey was conducted through the frequency range of 10 to 55 cps with a double displacement of 0.010 inch in accordance with SCS-5, paragraph 2.5. Accelerometers were mounted at 10 locations in the cartridge assembly, as indicated at the bottom of each table. The resonant frequency of the whole cartridge assembly, as indicated by the output of the accelerometers as shown in Table I, was 43.5 cps. The unit was vibrated for 30 minutes at this frequency and then cycled through the frequency range of 10 to 55 cps in 15-minute cycles for a period of 35 minutes. The time spent in resonance survey and cycling totaled one hour in each plane.

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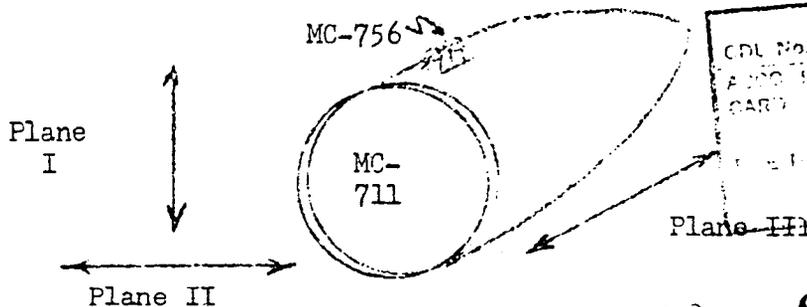


Fig. 1

CDL No.	
APPROVED BY	<u>BYN</u>
DATE	<u>TX-28</u>
	<u>3-2</u>

INVENTOR

66467

AUG 6

2427

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW DOWNGRADING OR DECLASSIFICATION STAMP	
CLASSIFICATION CHANGED TO: <u>U</u>	AUTHORITY: <u>W.C. LAYNE</u>
PERSON CHANGING MARKING & DATE: <u>Emelda Selph 7/30/98</u>	RECORD ID: <u>98SN3195</u>
PERSON VERIFYING MARKING & DATE: <u>W.C. Layne 7/30/98</u>	DATED: <u>7/29/98</u>

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The unit was then rotated 90 degrees (Plane II), and mounted for this test in the same manner as in Plane I. The output of the accelerometers for the resonance survey, as shown in Table II, indicated that the resonant frequency in this plane was 55 cps. Vibration was started at 55 cps, and at the end of 5 minutes the resonant frequency suddenly changed to 52 cps. The unit was then vibrated for 20 minutes at 52 cps, then the resonant frequency changed to 48 cps. After 3 minutes of vibration at 48 cps, the test was stopped because the unit sounded as though something were broken inside. The inspection plates were removed and the components visually inspected; no physical damage was evident. The mounting ring was tightened while the unit was vibrating, then the unit was cycled for 40 minutes through the frequency range of 10 to 55 cps in 15-minute cycles. Following this period of vibration, another resonance survey was conducted in Plane II. From the output of the accelerometers, as shown in Table III, it is evident that the resonant frequency was raised to above 60 cps by tightening the mounting ring.

A resonance survey was then conducted in Plane III, i.e., along the longitudinal axis of the assembly. For this test the unit was mounted in the same manner as in Plane II, and the mounting ring was tightened while the unit was vibrating. The output of the accelerometers in this plane is shown in Table IV, and it is evident from the values shown that the resonant frequency is above 60 cps.

The unit was vibrated for 30 minutes at 55 cps, then cycled for 45 minutes. An accelerometer was mounted on the nose of the unit which indicated acceleration as follows: horizontal - 6 g, vertical - 5 g.

Unit No. 2 was mounted to the vibration jig in Plane I, as shown in Fig. 2, by the use of a spanner wrench and two torque wrenches. A torque of 150 ft/lbs was applied to each side of the spanner wrench; then one wrench was removed and with a torque of 150 ft/lbs applied with one wrench, the spanner wrench was tapped with a 1-lb lead hammer. A resonance survey was conducted through the frequency range of 10 to 55 cps. From the output of the accelerometers, as shown in Table V, it is evident that the resonant frequency of the cartridge assembly is approximately 49 cps. At this frequency an accelerometer mounted on the MC-627-628 bulkhead indicated 11.3 g acceleration along the longitudinal axis of the cartridge. The unit was vibrated at 49 cps for 30 minutes, then cycled through the frequency range of 10 to 55 cps for 45 minutes. At the end of this period, the MC-627 and MC-628 were removed. The range selectors on both units were loose. A connector was loose on the MC-691 and one bolt was stripped out of the MC-628 mounting plate and one bolt broken. Heli-Coils were installed in the MC-627--628 mounting plates and the MC-627 and MC-628 were put back into the unit before vibration was started in Plane II.

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MC-716

Plane II

MC-711

Plane III

Plane I

Fig. 2

The unit was mounted for Plane II vibration in the same manner as in Plane I. It is evident from the output of accelerometers, as shown in Table VI, that the resonant frequency of the cartridge assembly was 48 cps. The unit was vibrated at this frequency for 30 minutes, then cycled through the frequency range of 10 to 55 cps in 15-minute cycles for 45 minutes.

The unit was then mounted in Plane III in the same manner as in the other two planes and a resonance survey conducted. It is evident from the output of the accelerometers, as shown in Table VII, that the resonant frequency in this plane was 58 cycles. Vibration was started at this frequency and during the 30 minutes of vibration the resonant frequency shifted from 58 cycles to 53 cps. During this period P-102 connector on the MC-714 loosened and came out of its socket. The inspection plate was removed and this connector was put back into place. Then the unit was cycled through the frequency range of 10 to 55 cps for a period of 45 minutes. During this cycling period an accelerometer was mounted on the nose of the assembly and indicated accelerations as follows: 9.9 g in the horizontal directions and 3.0 g in the vertical direction. An accelerometer on the MC-627 -628 bulkhead along the longitudinal axis of the assembly indicated an acceleration of 12.5 g.

It is interesting to note that the resonant frequency of Unit 2 when attached to the vibration jig by use of the torque wrenches was about the same as the resonance of Unit 1 when connected to the vibration jig by the use of one wrench. It is also interesting to note that the resonant frequency of the cartridge assembly No. 1 was raised above 60 cps when the mounting ring was tightened while the unit was vibrating.



Test Conducted by C. H. JONES - 1611-1



Approved by R. S. HOOPER - 1611-1

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TABLE I

'Plane I Resonance Survey on MC-711 - Unit I

Freq in cps	Table accel. in g	Pickup Output in g									
		41	42	43	44	45	46	61	62	63	65
10	0.07	*	*	*	*	*	*	*	*	*	*
15	0.10	*	*	0.17	*	0.21	0.15	0.17	*	*	0.15
20	0.26	*	*	0.33	*	0.40	0.30	0.30	*	*	0.28
25	0.41	0.12	*	0.57	0.14	0.70	0.54	0.48	0.10	*	0.51
30	0.60	0.15	0.25	1.35	0.64	1.64	1.33	0.74	0.39	0.33	0.98
35	0.81	1.07	0.78	1.37	1.68	1.65	1.61	0.99	2.95	0.74	1.73
40	1.06	5.21	1.55	2.90	2.61	3.07	3.75	1.30	3.09	1.46	4.44
43.5	**	8.6	**	**	**	**	**	**	**	**	**
45	1.34	6.46	3.63	2.95	3.60	2.82	3.45	1.30	1.73	1.38	2.18
50	1.66	4.17	1.59	2.80	2.40	2.75	3.27	1.53	1.69	1.64	2.22
55	2.01	3.02	1.75	3.00	2.71	3.00	5.47	1.65	2.90	1.38	3.09

* Output of pickup not enough to read on meter with 10 mv full scale.

** No pickup reading obtained.

- 41 Horizontal axis on MC-689)
 42 Longitudinal axis on MC-543) perpendicular to applied force
 43 Vertical axis on MC-543 in direction of applied force
 44 Horizontal axis on MC-543)
 45 Horizontal axis on MC-713) perpendicular to applied force
 46 Vertical axis on MC-689)
 61 Vertical axis on MC-756) in direction of applied force
 62 Horizontal axis on MC-627 perpendicular to applied force
 63 Vertical axis on MC-713)
 65 Vertical axis on MC-628) in direction of applied force

Time: Resonance survey 25 minutes, vibration at resonance (43.5 cps) 30 minutes,
 cycling 35 minutes.

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TABLE II

Plane II Resonance Survey on MC-711 Unit 1

Freq. Table in accel. cps	in g	Pickup output in g									
		41	42	43	44	45	46	61	62	63	65
10	.06	*	*	*	*	*	*	*	*	*	*
15	0.11	0.10	*	*	0.12	*	*	*	0.11	0.09	*
20	0.20	0.19	*	0.10	0.22	*	0.12	*	0.20	0.17	*
25	0.29	0.31	*	0.12	0.35	*	0.19	*	0.34	0.28	*
30	0.41	0.50	*	0.14	0.56	0.16	0.28	*	0.54	0.45	*
35	0.56	0.79	0.15	0.17	0.90	0.20	0.36	0.17	0.86	0.71	0.13
40	0.73	1.27	0.18	0.20	1.44	0.22	0.45	0.16	1.32	1.01	0.22
45	0.93	2.29	0.58	0.53	2.69	0.54	0.53	0.38	2.54	1.74	0.34
50	1.02	8.23	3.87	4.50	9.23	3.94	6.19	2.77	8.18	5.87	4.60
55	1.85	17.71	9.28	8.50	17.79	7.12	11.19	6.88	14.54	10.16	7.93
60		3.18	5.38	2.25	5.09	2.42	3.57	1.43	3.90	1.94	3.41

* Output of pickup not enough to read on meter with 10 mv full scale.

- 41 Horizontal axis on MC-689 in direction of applied force
 42 Longitudinal axis on MC-543)
 43 Vertical axis on MC-543) perpendicular to applied force
 44 Horizontal axis on MC-543)
 45 Horizontal axis on MC-713) in direction of applied force
 46 Vertical axis on MC-689)
 61 Vertical axis on MC-756) perpendicular to applied force
 62 Horizontal axis on MC-627 indirection of applied force
 63 Vertical axis on MC-713)
 65 Vertical axis on MC-628) perpendicular to applied force

Time: Resonance survey 20 minutes, vibration at resonance: 5 minutes at 55 cps, sudden change to 52 cps then after 20 minutes changed to 48 cps, vibration stopped after 28 minutes at resonance. No physical damage noticed so ring was tightened during vibration and unit cycled for 40 minutes.

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TABLE III

Plane II Resonance Survey on MC-711 After Tightening Ring, Unit 1

Freq. Table in accel. cps	in g	Pickup Output in g									
		41	42	43	44	45	46	61	62	63	65
10	*	*	*	*	*	*	*	*	*	*	*
15	*	0.10	*	*	0.12	*	*	*	*	*	*
20	0.18	0.19	*	*	0.22	*	*	*	0.20	0.16	*
25	0.29	0.32	*	*	0.36	*	0.17	*	0.34	0.28	*
30	0.44	0.53	*	0.11	0.61	0.12	0.25	*	0.58	0.44	*
35	0.61	0.83	0.13	0.13	1.00	0.14	0.30	0.14	0.91	0.68	0.14
40	0.73	1.08	0.28	0.36	1.63	0.23	0.50	0.18	1.53	1.09	0.26
45	0.93	2.19	0.81	0.54	2.88	0.55	0.74	0.30	2.64	1.74	0.39
50	1.15	4.38	0.75	0.90	5.19	1.19	1.55	0.96	5.09	3.17	1.13
55	1.24	8.33	3.15	2.70	10.77	3.12	3.33	1.75	10.73	6.59	3.17
60	1.38	14.59	9.52	6.80	23.08	9.50	13.68	6.10	20.91	14.28	10.32

* Output of pickup not enough to read on meter with 10 mv full scale.

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TABLE IV

Plane II Resonance Survey on MC-711, Unit 1

Freq. in cps	Table accel. in g	Pickup Output in g									
		41	42	43	44	45	46	61	62	63	65
10	0.06	*	*	*	*	*	*	*	*	*	*
15	0.13	*	*	*	*	*	*	*	*	*	*
20	0.22	*	0.23	*	*	*	*	0.27	*	*	*
25	0.35	0.15	0.39	*	*	*	*	0.24	*	*	*
30	0.51	0.15	0.56	0.18	*	0.16	0.16	0.74	*	0.09	0.17
35	0.69	0.56	0.92	0.36	0.51	0.90	0.75	1.25	0.36	0.37	0.73
40	0.90	0.59	1.07	0.26	1.03	0.28	0.17	1.49	0.66	0.46	0.48
45	1.14	2.03	1.31	2.20	1.92	2.45	2.68	2.21	2.00	1.27	1.79
50	1.40	1.94	1.90	1.00	0.72	1.50	1.40	3.70	1.62	0.62	0.95
55	1.54	2.60	2.80	1.05	0.84	1.46	1.46	6.10	2.09	0.40	1.07
60	1.64	3.75	4.64	1.90	2.40	2.37	2.50	12.21	4.96	0.48	2.34

* Output of pickup not enough to read on meter with 10 mv full scale.

- 41 Horizontal axis on MC-689 perpendicular to applied force
 42 Longitudinal axis on MC-543 in direction of applied force
 43 Vertical axis on MC-543)
 44 Horizontal axis on MC-543)
 45 Horizontal axis on MC-713) perpendicular to applied force
 46 Vertical axis on MC-689)
 61 Longitudinal axis on MC-627-628 bulkhead in direction of force
 62 Horizontal axis on MC-627)
 63 Vertical axis on MC-713) perpendicular to applied force
 65 Vertical axis on MC-628)

Unit was connected to jig and ring was tightened while unit was vibrating.

Time: Resonance survey 15 minutes, vibration at 55 cps 30 minutes, cycling
10-55-10 cps 45 minutes.

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TABLE V

Plane I Resonance Survey on MC-711, Unit 2

Table double displacement	Freq. (cps)	Accelerometer output in g						
		Table	21	22	23	24	25	11
0.010	10	*	*	*	*	*	*	*
0.010	15	*	*	*	0.12	*	0.11	*
0.010	20	0.19	0.072	*	0.22	*	0.21	*
0.010	25	0.30	0.01	*	0.35	*	0.33	*
0.0095	30	0.45	0.11	0.11	0.56	*	0.52	*
0.010	35	0.59	0.14	0.16	0.83	*	0.80	0.14
0.010	40	0.77	0.16	0.185	1.26	0.15	1.15	0.28
0.010	45	0.98	0.30	0.36	1.90	0.19	1.70	2.12
**	49	**	**	**	**	**	**	11.3
0.010	50	1.18	0.45	2.25	2.30	2.21	2.70	9.90
0.009	55	2.04	2.73	6.22	7.15	7.20	5.40	7.65
0.013	60	2.35	8.21	3.0	19.1	4.34	15.35	7.06

* Output of pickup not enough to read on meter.

** No reading taken.

21 Longitudinal axis on MC-543 perpendicular to applied force

22 Vertical axis on MC-543 " " " "

23 Horizontal axis on MC-543 in direction of applied force

24 Vertical axis on MC-713 perpendicular to applied force

25 Horizontal axis on MC-713 in direction of applied force

11 On MC-627-628 bulkhead in longitudinal axis perpendicular to force

NOTE: The unit was mounted on the jig by the application of 150 ft/lbs on each side of a spanner wrench then holding this pressure on one wrench and tapping with a one-pound lead hammer.

Resonance survey 35 minutes, vibration at 49 cps 30 minutes, cycling 10-55 cps 25 minutes.

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TABLE VI

Plane II Resonance Survey on MC-711, Unit 2

Frec. cps	Table		Pickup output in g									
	Double in displace ment(in)	accel. (g)	11	12	13	14	15	21	22	23	24	25
10	0.011	*	*	*	*	*	*	*	*	*	*	*
15	0.010	*	0.118	*	0.15	*	0.12	*	0.13	0.08	0.12	*
20	0.010	0.195	0.226	*	0.29	*	0.22	*	0.23	0.09	0.25	*
25	0.010	0.30	0.38	0.17	0.42	0.08	0.35	0.11	0.39	0.1	0.43	*
30	0.0095	0.45	0.67	0.17	0.83	0.1	0.51	0.11	0.69	0.13	0.64	*
35	0.010	0.59	1.07	0.20	1.38	0.38	0.76	0.17	1.03	0.21	1.1	*
40	0.0095	0.76	1.93	0.70	2.2	0.38	1.16	0.23	1.9	0.29	1.92	0.18
45	0.008	0.81	8.45	5.50	9.0	1.23	3.4	3.6	7.8	4.12	8.45	1.71
48	**	**	14.3	11.0	20.0	4.2	5.4	6.1	15.5	7.9	14.9	4.7
50	0.012	1.65	4.5	2.06	5.2	3.2	1.1	0.75	4.5	2.1	4.45	1.62
55	0.012	1.84	3.4	1.3	4.2	1.8	0.64	0.52	3.3	1.15	3.1	0.95
60	0.012	2.1	2.85	1.1	3.8	1.3	0.78	1.2	2.7	1.5	2.35	0.5

* Output of pickup not enough to read on meter.

** No pickup reading obtained.

- 11 Vertical axis in direction of applied force on MC-689
- 12 Horizontal axis on MC-689 perpendicular to applied force
- 13 Vertical axis on MC-628 in direction of applied force
- 14 Horizontal axis on MC-627 perpendicular to applied force
- 15 Vertical axis on MC-756 in direction of applied force
- 21 Longitudinal axis on MC-543 perpendicular to applied force
- 22 Vertical axis on MC-543 in direction of applied force
- 23 Horizontal axis on MC-543 perpendicular to applied force
- 24 Vertical axis on MC-713 in direction of applied force
- 25 Horizontal axis on MC-713 perpendicular to applied force

NOTE: Heli-Coils were installed in the MC-627-628 mounting plates and the MC-627-628 were put back into the unit before vibration was started in this plane. The unit was attached to the jig in the same manner as in Plane 1. Resonance survey 20 minutes, vibration 25 48 cps 30 minutes, cycling 10-55 cps 40 minutes.

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TABLE VII

Plane III Resonance Survey on MC-711, Unit 2

Freq cps	Table		Pickup output in g									
	Double in displace- (in)	Accel. (g)	11	12	13	14	15	21	22	23	24	25
10	0.009	*	*	*	*	*	*	*	*	*	*	*
15	0.009	*	*	*	*	*	0.09	0.1	*	*	*	*
20	0.009	0.17	*	*	*	0.098	*	0.17	*	*	*	*
25	0.008	0.29	*	0.16	*	0.11	0.08	0.3	*	0.103	*	0.12
30	0.008	0.42	*	0.07	*	0.15	0.13	0.43	0.10	0.13	*	0.12
35	0.008	0.68	0.39	0.36	0.39	0.09	0.14	0.55	0.41	0.22	0.26	0.27
40	0.0085	0.91	0.34	0.26	0.25	0.16	0.23	0.79	0.30	0.11	0.13	0.15
45	0.008	1.31	1.05	0.99	0.8	1.64	0.37	1.05	0.86	1.2	0.71	1.08
50	0.0095	1.71	0.32	1.15	0.35	0.74	0.44	1.58	0.27	0.52	0.18	0.47
55	0.007	2.64	0.53	3.1	0.78	4.68	0.83	2.52	0.39	1.75	0.32	0.99
60	0.009	2.64	2.96	5.8	4.57	22.1	1.52	3.60	1.98	7.95	1.0	4.60

* Output of pickup not enough to read on meter with 10 millivolts full scale.

** No pickup reading obtained.

- 11 Vertical axis on MC-689)
 12 Horizontal axis on MC-689)
 13 Vertical axis on MC-628) perpendicular to applied force
 14 Horizontal axis on MC-627)
 15 Vertical axis on MC-756)
 21 Longitudinal axis on MC-543 in direction of applied force
 22 Vertical axis on MC-543)
 23 Horizontal axis on MC-543)
 24 Vertical axis on MC-713) perpendicular to applied force
 25 Horizontal axis on MC-713)

Resonance survey 25 minutes, vibration at resonance 30 minutes (during this period the resonant frequency shifted from 58 cps to 53 cps), cycling 10-55 cps 35 min.

Radar bulkhead at resonance 12.56; nose at resonance: 9.96 sideways, 3.06 up and down.

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