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Ref. Symbol: 1532 (24)
Project No. TM-58

7/24/98 X W. Sayre 7/23/98 RB Craner U UC/U7

MR. R. A. FREEMAN - 1243

Re: Fin Actuator Test

SUMMARY OF RESULTS

The life test on the TX-7 fin actuators was inconclusive, since the first sample failed after only one-half cycle of operation and the second sample was still operating after more than 500 cycles. There was no excessive heating of the unit, nor any appreciable variation in voltage, current, or operational time of the fin actuator unit in either a vertical or horizontal attitude of the tail assembly. The actuator was operated for 12 cycles in the horizontal attitude.

One of the built-in reversing microswitches in the first sample tested failed to function, resulting in the unit being inoperative. The microswitch could not be adjusted without breaking the seals and opening the actuator unit.

REASON FOR TEST

The life tests on the TX-7 fin actuators was requested by Division 1243, following the failure of several actuators in the field.

OBJECT OF TEST

The test was conducted to determine any malfunctions of the actuator or any important variations in current, voltage, time of raising and lowering the fin, or excessive temperature rise of the electric motor or gear box.

SUMMARY OF PAST TESTS

To the best of our knowledge, no similar tests have been run on the actuator in Department 1530.

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SETUP FOR TEST

The test setup consisted of a sequence timing device to provide four complete operating cycles and five-minute cooling period, a regulated 28-volt d-c power supply, a 0-30 volt d-c voltmeter, a 0-50 ampere d-c ammeter, and a stop watch.

PROCEDURE

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The sequence timer consisted of cam-operated relays which provided power for the actuator for 12 seconds in the fin lowering operating and for 22 seconds

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in the raising operation. Power was applied for these periods, although neither operation required power for the entire period during which power was available. Microswitches cut the motor off at either extremity of actuator gear travel and left the motor circuits in reversing position. Each sequence consisted of four consecutive cycles, followed by a five-minute cooling period during which no power was applied to the motor. Each cycle consisted of one lowering and one raising operation. The cooling period was included in the test since the actuator would not receive any more frequent cycling in actual practice.

The cam-operated relays controlled the supply of 28 volts d-c to the two windings of the actuator motor. The voltmeter and ammeter were installed in this circuit. The tail assembly was mounted in a vertical position for the life test. With the sequence timer in operation, readings of surge, steady current, and voltage were made for each set of operational cycles. The surge values were values as they appeared on the meters. This method of measuring surge values may give a slightly lower reading than actually existed. The time required for lowering and raising the fin was measured with a stop watch for each four cycles. The sequence of four operating cycles and the five-minute cooling period were maintained for the 500-cycle life test.

After the life test, the unit was placed in a position approximately 10 degrees from the horizontal to observe any deviation from the results obtained when the unit was tested in the vertical position. Six cycles were made with the tail section in a horizontal position and the fin moving vertically. The six cycle test was repeated with the tail assembly mounted horizontally, but with the fin moving at a 45 degree angle from the vertical. All tests were made at ambient temperature of approximately 80°F.

RESULTS

The results for the unit which completed the life test are tabulated in Table I. Average current and voltage values, and extreme current and voltage values are listed.

There were no radical deviations from the average values of current and voltage, regardless of the position of the tail assembly. The variation in operating time on the raise portion of each cycle was approximately two seconds slower when the unit was placed in the horizontal position, than the operating time when the unit was mounted in a vertical position. The operating time for the lowering portion of the cycle was essentially the same regardless of the mounting position.

There was extremely heavy pounding of the actuator unit against one of the tail assembly frame members, due to the actuator unit being mounted on ball joints at both extremities and there was no other means of absorbing the excess torque

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developed by the motor at the end of the actuator screw motion. Periodical checks of the unit and frame revealed no serious damage to either the unit or the frame although the pin securing the lower end of the actuator mechanism to the frame at the ball joint, was found to be bowed out of shape, apparently from the pounding action mentioned previously. This condition was not serious, but made replacement of the actuator mechanism very difficult.

The unit was quite noisy on the raise portion of the cycle after approximately three hours of operation (about 70 cycles). There appeared to be some roughness in the action of the actuating screw mechanism, as evidenced by the noise produced and by fluctuations in the current drawn. These current fluctuations were a maximum of 1/2-ampere in magnitude which was not excessive. There was no variation in operational time of the unit in the raise sequence when this roughness occurred.

The actuator gear assembly leaked grease which might present a serious problem under low-temperature operation. Since this test was conducted at ambient temperature, no problem was encountered. The testing organization found no data available on the type of grease used.

CONCLUSION

This test produced positive data on the electrical requirements and the operational times required by the actuator unit. However, no conclusions can be made regarding the reliability of the actuators, since one unit failed immediately and the second unit passed all tests. Additional data should be secured on the unit under environmental test conditions since this test was conducted at approximately 80°F, which is considerably above temperatures encountered in actual operation. The temperature is especially important since the mechanism leaked grease about the actuator screw assembly and the cooling of the grease might cause freezing of the screw mechanism or overloading of the motor.

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NLM:1532:hh

Approved by: Original Signed By P. H. ADAMS
P. H. ADAMS - 1532

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TABLE I

RESULTS OF FIN ACTUATOR TESTS

Life Test - Tail Assembly in Vertical Position (500 cycles)

Line Voltage 28 Volts d-c

		I (down) (amps)	V (down) (volts)	I (up) (amps)	V (up) (volts)	t (down) (sec)	t (up) (sec)
Operating	extremes	4 - 5	28	2 - 2 1/2	28	4.2 - 5.1	11.3 - 12.3
	average	4	28	2	28	4.7	11.7
Initial	surge extremes	6 - 14	26 3/4- 27 3/4	2 1/4- 4	27 1/4- 27 3/4		
	surge averages	12	27 1/2	3	27 1/2		

Tail Assembly in Horizontal Position - Fin Moving Vertically (6 cycles)

average	4		2 1/4	4.2		14.0
surge	13		3			

Tail Assembly in Horizontal Position - Fin Moving 45 degrees From Vertical (6 cycles)

average	4		2	4.4	13.4
surge	12		4		

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