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M/710 DAT Phase IIDebris Test Summary

(10/4/00 - Franz)

(Updated: 10/12/00 - Danner)

(Updated: 10/30/00 - Franz)

Introduction:

As part of the original M/710 Design Acceptance Test Plan a series of Abusive Tests were scheduled to be run. This document only summarizes those tests performed during Phase II DAT dealing with Debris. More specifically this document will outline the chronology of events dealing with these tests, what tests were run and when followed by a brief description of test results. You must refer to the specific test in question for more detailed information. As originally planned a single test gun (B-22, Ser. No. 71001278) was identified that would be used for the three different Debris Tests. These tests are listed below.

<u>Test Title</u>	<u>Test Lab Work Request No.</u>
1. Dynamic Sand & Dust	TLW0010AL
2. Static Sand & Dust	TLW0010AM
3. Field Debris	TLW0010AN

The specific procedures for each of these three tests are documented in the M/710 Design Acceptance Test (DAT#1) Test Plan, Model 710, New Centerfire Rifle, Revision #2 dated 3/31/00. Gun B-22 was one of ten guns received on Sept. 9th. This gun had Preliminary Measurements taken on the 9th followed by magnafluxing of the bolt head on the 11th.

Chronology of Events:

- A Dynamic Sand & Dust Test was run on 9/16/00. Nothing unusual reported by the technicians.
- A Field Debris Test was run on 9/16/00. During this test the first two rounds were fired without incident. On the 3rd round the technicians reported that the gun fired while pushing the Safety from the "On" to the "Off" position. The test was stopped at this time. The gun was disassembled and a small particle was observed between the engagement screw and the trigger.
- It was noted that the procedures for both the Dynamic Sand & Dust and Field Debris Tests were not followed exactly as documented in the Test Plan. The three main procedural differences noted were:
 1. The Safety was cycled from "On" to "Off" after every shot was fired. The Test Plan specifically calls out cycling the Safety every 5 shots.
 2. The 10 lb. test procedure was not run in either case as spelled out in the plan.
 3. Only 5 rounds were fired in either test, however the test Plan calls for 20.

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- The Field Debris Test was rerun on 9/27/00 per procedure defined in the test plan. The same two technicians were asked to run the test. An attempt was made to fire 20 rounds of ammunition. Seventeen of the 20 rounds were actually fired during the test. A total of four malfunctions occurred. The first malfunction was a Fail-to-Fire that was either a Follow-Down or an obstructed firing pin/firing pin head/Sear. The second through fourth malfunctions were feeding related (1 Fail-to-Feed from Magazine and 2 Stem-Lows). At no time during this test did an inadvertent discharge occur. The gun was again torn down, cleaned, lubricated with trigger pull and engagement reset.
- The Static Sand & Dust was run on 9/29/00. After application of the sand & dust debris the firearm would not fire. Five attempts were made to pull the trigger. At no time did the gun fire. In addition the firing pin did not fall. A new round was fed before the trigger was pulled for each of the five attempts. On the first attempt the trigger did not move. The bolt lift was easy when opening the bolt to cycle the second round, further evidence that the firing pin did not fall. On the second attempt the trigger moved slightly. On each of the three remaining attempts the bolt lift was easy when opened after the trigger was pulled. Trigger movement increased on each successive attempt but not enough to fire the gun. The test was stopped at this time since the gun would not function.
- A new engagement screw was designed by the design team and fabricated for further testing. This screw instead of having a conical tip had a 60 degree cone shaped tip (see Dwg. B-300448, Alt. D). The full series of Debris tests were rerun to establish performance with this new engagement screw design.
- All three tests were rerun on 10/3/00. This time two different technicians were assigned to run the tests.
- The same gun, B-22, was torn down, cleaned, lubricated and fitted with the new engagement screw. Trigger pull and engagement were reset.
- During the Field Debris retest with the 60 degree cone shaped engagement screw 2 occurrences of a Fail-to-Fire were encountered. This happened on the 2nd and 8th rounds. During the first Fail-to-Fire trigger movement was detected when the trigger was pulled. No evidence of the firing pin falling was observed. When the bolt was opened it had a heavy bolt lift, indicating the firing pin was being cocked by the rotation, therefore it was in the fully forward position. On the second Fail-to-Fire no perceivable movement of the trigger was felt when pulled. Again, no movement of the firing pin was detected on this attempt. Bolt lift was again heavy during opening. 18 of the 20 rounds were fired successfully and all steps as outlined in the test procedure were followed. At no time did an inadvertent discharge occur during this test.
- The same gun, B-22, was torn down, cleaned and lubricated. Trigger pull and engagement were reset.
- The Static Sand & Dust Test with the 60 degree cone shaped engagement screw was run next. After application of the sand & dust debris the firearm would not fire. Five attempts were made to pull the trigger. At no time did the gun fire. In addition no evidence of the firing pin falling was detected. This time trigger movement was detected on all five attempts. The bolt opened easily each time the bolt was rotated up, further evidence that the firing pin was in the cocked position. As in the first

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Static Sand & Dust Test further testing was stopped since the gun would not function. At no time did an inadvertent discharge occur during this test.

- The same gun, B-22, was torn down, cleaned and lubricated. Trigger pull and engagement were reset.
- The Dynamic Sand & Dust Test with the 60 degree cone shaped engagement screw was run last. A total of five malfunctions occurred during this test. The first was a Fail-to-Feed up from the magazine on the second round. The magazine box was removed and the rounds were removed and then reloaded into the box. The round fed ok and fired normally. The next malfunction was a Fail-to-Fire when the trigger was pulled. This occurred on the 3rd round. No evidence of the firing pin failing was detected. Bolt lift was heavy on opening, evidence that the firing pin was in the fully forward or fired position. The 4th and 5th rounds fired normally. The three remaining malfunctions were Stem-Lows that occurred on the 7th, 12th, and 17th rounds, or the 2nd round out of the box in all three cases. In each case the stem was corrected and the round fed and fired. In all a total of 19 of the 20 rounds were fired. At no time did an inadvertent discharge occur during this test.
- Two guns were modified on 10/10/00 to allow for detailed examination of the connector/sear interface. This was accomplished by drilling a "sight hole" through the stock in a location permitting examination of the engagement adjustment hole in the firecontrol. In addition, the rear plastic portion of the bolt head was removed to expose the rear of the firing pin head. This interface was modified slightly to allow a custom tool to be threaded into the firing pin head so it could be manipulated manually/separately from the gun and bolt cam.
- Both guns B-4 and B-7 were thoroughly cleaned, the 60 degree cone shaped engagement screw installed, and the fire controls adjusted to nominal engagement and pull criteria.
- Two of the three tests were rerun on 10/11/00. Specifically, these included the Field Debris Test and the Dynamic Sand and Dust Test.
- Gun B-7 (modified as noted above) was selected for the Field Debris Test.
- The firearm was subjected to debris and the test was executed per standard procedure.
- All rounds fired normally with the exception of round #2 which Failed-to-Feed properly from the magazine box.
- At the end of each five round sequence per standard procedure the safety was cycled with the intervening 10 lbs. pull on the trigger. No discharges occurred.
- This completed the Field Debris Test. At no time did an inadvertent discharge occur.
- Gun B-4 (modified as noted above) was selected for the Dynamic Sand and Dust Test.
- The firearm was subjected to the blowing debris in the test box per standard procedure.
- The firearm was removed from the box and relocated to the endurance facility.
- The "primed case" portion of the test successfully passed as indicated by the primed case successfully firing.

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- The magazine was loaded with four rounds and inserted into the firearm. It immediately fell out of the gun into the spent round container. The gun was carefully examined and the latch mechanism operated by hand to "free it up". The magazine was shaken in an attempt to remove as much debris as possible from the assembly (At this point the observer considered the magazine status irrelevant to the test). The magazine was reinserted into the firearm.
- The bolt was pushed forward and closed chambering the first round. The magazine was removed and the top round was replaced to bring the magazine content back up to four rounds. The magazine was reinserted into the firearm.
- The safety was moved to the fire state and the trigger pulled. Round fired.
- The bolt was opened and pulled back ejecting the first spent case.
- The bolt was pushed forward in an attempt to chamber the second round. The second round Failed-to-Feed correctly from the magazine box (Stem-Low). The magazine was removed from the firearm along with the second round.
- All rounds were removed from the magazine and then it was disassembled. The components of the magazine were blown clear of debris and then the box was reassembled. All four rounds were reinserted into the magazine.
- The magazine was reinstalled into the firearm and the bolt pushed forward and down to chamber a round. The round was chambered successfully.
- The trigger was pulled – Round did not fire. No motion of the firing pin was detected.
- The firearm and shooting jack assembly was carefully moved backward several inches to expose the "sight hole" added to the stock.
- The sight hole was illuminated via the fiber optic light source obtained from the microscope lab.
- It was clearly evident that the connector was forward and the sear was down. It should be further noted that no light could be seen between the sear and connector and that the connector appeared to be resting on the sear.
- The custom firing pin tool was used to pull back on the firing pin head. The sear/connector interface was watched as the head was pulled back.
- After significant movement backward of the pin the sear began to move up but stopped notably short of allowing the connector to return under the sear. Pulling the head all the way back still did not allow the connector to return under the sear.
- An attempt was made to engage the safety to the safe position while holding back on the firing pin head. Resistance was encountered in attempting to do this so the firing pin was carefully lowered back down to its farthest forward position.
- Another attempt to engage the safety to the safe position while holding back on the firing pin head was made. The connector / sear interface was watched through the sight hole during this process.
- The safety was successfully moved from the fire to safe state although it was significantly more difficult than expected.
- It was observed that the sear was driven forcibly upward by the safety arm.
- Immediately after the sear had risen past the point where the connector could move back under the sear it did so.

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- The safety was moved from the safe to the fire position. The trigger was pulled and the round went off as expected. The bolt was opened and pulled back extracting the round.
- The sear / connector interface state was again examined. It was noted that the sear was up and that the connector was under the sear.
- The magazine box was removed (containing the remaining live rounds) and further testing was discontinued.

Jim,
This is the Debris Test
Summary (for all tests)
run during SAT. The file
is in the 710 directory on the
server under Phase 2 directory ^{in three}
filename = "M710 Debris Test Summary"