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Research & Development Technical Center

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**M/710 DAT Phase II**

**Debris Test Summary**

(10/4/00 - Franz)

(Updated: 10/12/00 - Danner)

**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 only outline the chronology of events dealing with these tests, what tests were run and when followed 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. 9<sup>th</sup>. This gun had Preliminary Measurements taken on the 9<sup>th</sup> followed by magnafluxing of the bolt head on the 11<sup>th</sup>.

**Chronology of Events:**

- Two Test Lab technicians (Jeff Wade and Steve Wade) were assigned to perform the Debris Tests as outlined in the DAT Test Plan referenced above.
- 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 3<sup>rd</sup> 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. Mike Keeney and Dale Danner were notified of the situation. The gun was disassembled and a small particle was observed between the engagement screw and the trigger. Pictures were taken of this situation.

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- Scott Franz interviewed technician (Steve Wade) on 9/19/00 to understand specific steps taken while running the above Dynamic Sand & Dust and Field Debris tests. Learned during this interview that the procedures for both the Dynamic Sand & Dust and Field Debris Tests were not followed exactly as documented in the Test Plan. The two 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.
- Upper management was notified of the situation. It was decided to rerun the tests to establish system performance when the test is correctly run to the previously agreed to test protocol. Scott Franz was asked to observe these tests to ensure that procedures were followed as closely as possible.
- The Field Debris Test was rerun on 9/27/00. Steve and Jeff Wade were again the technicians running the test, only this time Scott Franz was present to observe 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 which resulted in a light indent. 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. A more detailed description of this test is documented in file **M710 Field Debris Test #2**.
- The gun was again torn down, cleaned, lubricated and trigger pull and engagement set.
- 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. No marks were found on any of the five primers that resembled an indent. The test was stopped at this time since the gun would not function.
- A new engagement screw was designed by Mike Keeney 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 Jesse Arnold and Bob Lee were the technicians assigned to run the tests in Jeff and Steve Wades absence. Scott Franz was again the test observer.
- The same gun, B-22, was torn down, cleaned, lubricated and fitted with the new engagement screw. Trigger pull and engagement was reset.

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- 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 2<sup>nd</sup> and 8<sup>th</sup> 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. A very slight mark was detected on both primers. 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 was 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. No marks were found on any of the five primers that resembled an indent. 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 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 was 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 3<sup>rd</sup> round. No evidence of the firing pin falling was detected. Bolt lift was heavy on opening, evidence that the firing pin was in the fully forward or fired position. A slight mark on the primer was present. The 4<sup>th</sup> and 5<sup>th</sup> rounds fired normally. The three remaining malfunctions were Stem lows that occurred on the 7<sup>th</sup>, 12<sup>th</sup>, and 17<sup>th</sup> rounds, or the 2<sup>nd</sup> 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.
- End Franz authorship of summary and begin Danner authorship.
- 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

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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 were thoroughly cleaned, the 60 degree cone shaped engagement screw installed, and the firecontrols 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. Jeff Wade provided the technician support and executed the test while being observed by Dale Danner. Jim Snedeker recorded the results.
- 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
- 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.
- The magazine was loaded with four rounds and inserted into the firearm. It immediately fell out of the gun into the spent round container. Danner carefully examined the gun and operated the latch mechanism 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 Danner 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 by Danner. 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 indicating a probable follow down.

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- The firearm and shooting jack assembly was carefully moved backward several inches to expose the "sight hole" added to the stock.
- Danner illuminated the sight hole 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.
- Snedeker carefully used the custom firing pin tool to pull back on the firing pin head. Danner watched the sear/connector interface 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.
- Danner instructed Snedeker to engage the safety to the safe position while holding back on the firing pin head. Snedeker encountered resistance in attempting to do this so he carefully lowered the firing pin back down to its farthest forward position.
- Danner and Snedeker traded places. Danner pulled back on the firing pin and attempted to engage the safety while Snedeker watched the connector / sear interface through the sight hole.
- Danner was successful in moving the safety from the fire to safe state although it was significantly more difficult than expected.
- Snedeker 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.
- Discussion ensued as to how we might measure the actual amount of engagement between the sear and connector with no ideas proposed deemed safe enough to try. Bear in mind the firearm still has a loaded round chambered. Danner made the decision to fire the round.
- 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.