



## **FAILZERO Dry Lubricant Treatment Testing and Evaluation Report**

### **PURPOSE**

The purpose of the testing was to evaluate and identify benefits, if any, of utilizing the FAILZERO (FZ) dry lubricant on selected parts of M16 type firearms.

### **PRODUCT BACKGROUND INFORMATION**

The dry lubricant is currently in use in automotive, aerospace and firearms industries as an alternative to lubricants that must be applied and re-applied. The surface treatment nucleates on the surface atoms of metals, creating a permanently dry-lubricated surface and making the surface harder than the substrate itself. The manufacturer claims this surface treatment offers a quantum leap in performance, reliability, lifecycle and maintenance of moving metal parts of firearms.

### **SCOPE**

A bolt carrier group (BCG) which had been surfaced with a metal coating (EXO™) and provided by UCT Coatings was installed into an M4 style rifle, serial number 8029672, which is permanently modified for blank fire. It is important to note, the BCG provided to Unwin by UCT Coatings was used and had already been in some kind of service prior to Unwin's testing. The extent of use is unknown. This rifle will be referred to as the "test rifle".

Two "control" blank fire M4s were used; one that was properly lubricated and one that was over lubricated. The properly lubricated rifle, serial number 6235968, will simulate users that fail to clean or lubricate their firearms for extended periods of time, and the over lubricated rifle, serial number 6235632, will simulate users who, in lieu of proper cleaning time, equipment or facilities, opt to continue to re-lube the firearm in order to keep it functioning.

Prior to the beginning of each test, all rifles received a detailed cleaning so as to start each test in as near perfect a condition as possible.

As another control, the same magazines were used in each rifle for every test.

All tests were either conducted or observed by one of Unwin's Engagement Simulation Systems (ESS) Technicians, who are also armorers certified through the Department of Energy's (DOE) National Training Center (NTC).



## TEST RESULTS

### TEST 1 – Endurance Test (Up to 1000 rounds per rifle)

1. Utilizing 30 round magazines loaded with 25 rounds of blank ammunition, each M4 was fired in full-auto mode until a stoppage occurred that could not be cleared through normal clearing procedures or until there were multiple consecutive failures. Rate of fire was: Expend one magazine, hand-load the same magazine and then expend that magazine, repeat.
  - a. The properly lubricated rifle did not receive additional lubrication after the start of the test.
  - b. The over lubricated rifle was re-oiled after every 100 rounds.
  - c. The test rifle did not have any lubrication applied to the BCG or upper receiver.
2. After an initial 500 rounds, the rifles were allowed to completely cool down for a minimum of two hours, simulating a break in training or activities.
3. After the cool down period, the test resumed by attempting to expend the remaining 500 rounds per rifle.
4. All stoppages were evaluated for cause and recorded.

Rifle Used	# of Stoppages Recorded	Completed Test?
Test Rifle (FZ)	1	Yes
Properly Lubed Rifle	5	No – Test stopped at 628 rounds
Over Lubed Rifle	4	No – Test stopped at 976 rounds

After the completion of the Endurance Test, each rifle was cleaned. The ease or difficulty of cleaning was noted to include those areas with high carbon build up.

On a scale of 1 to 5, a rating was given to difficulty of cleaning (1 = Not difficult, 3 = Moderately Difficult, 5 = Extremely Difficult) and also for the amount of carbon build up in identified areas. (1 = light buildup/fouling, 3 = heavy, 5 = extreme buildup/fouling)



### Carbon Buildup/Fouling Tables

Test Rifle (FZ)		
Area of buildup/Fouling	Amount of Buildup/Fouling	Ease/Difficulty of Clean
Bolt Face and Lugs	2	1
Rear of Bolt Body	2-3	3
Barrel Extension	2-3	2
Carrier	1	1

Properly Lubed Rifle		
Area of buildup/Fouling	Amount of Buildup/Fouling	Ease/Difficulty of Clean
Bolt Face and Lugs	4	2
Rear of Bolt Body	5	4
Barrel Extension	3	3
Carrier	2	2

Over Lubed Rifle		
Area of buildup/Fouling	Amount of Buildup/Fouling	Ease/Difficulty of Clean
Bolt Face and Lugs	4	2
Rear of Bolt Body	4	2
Barrel Extension	5	5
Carrier	4	2



**TEST 2 – Water/Rain** (Up to 200 rounds per rifle)

1. Utilizing 30 round magazines loaded with 25 rounds of blank ammunition, each M4 was fired in full-auto mode until a stoppage occurred that could not be cleared through normal procedures, or until there were multiple, consecutive failures. Rate of fire was: expend one magazine, hand-load the same magazine and then expend that magazine, repeat.
  - a. The properly lubricated rifle did not receive additional lubrication after the start of the test.
  - b. The over lubricated rifle was re-oiled after every 100 rounds.
  - c. The test rifle did not have any lubrication applied to the BCG or upper receiver once the test started.
2. Utilizing a spray bottle, water was sprayed into the ejection port of each rifle before and during firing.
  - a. One spray bottle was used for all tests, with the nozzle adjusted for a medium to light stream.
  - b. Once the nozzle was adjusted, no more adjustments were made after testing had begun.
3. Prior to firing, all rifles received one spray from the water bottle into the ejection port with the bolt locked to the rear and an additional spray of the bottle with the bolt forward.
4. During firing, all rifles received one spray into the ejection port for every magazine.
5. All stoppages were evaluated for the cause of the stoppage and recorded.

Rifle Used	# of Stoppages Recorded	Completed Test?
Test Rifle (FZ)	0	Yes
Properly Lubed Rifle	0	Yes
Over Lubed Rifle	4	Yes



**TEST 3 – Last Man Standing** (200 rounds per rifle)

1. Utilizing eight - 30 round magazines each loaded with 25 rounds of blank ammunition, each M4 was fired in full-auto mode until a stoppage occurred that could not be cleared through normal clearing procedures or until there were multiple consecutive failures. Rate of fire was: expend all eight magazines as quickly as the shooter could load, fire, and reload.
2. All stoppages were evaluated for the cause of the stoppage and recorded.

Rifle Used	# of Stoppages Recorded	Completed Test?
Test Rifle (FZ)	1	Yes
Properly Lubed Rifle	6	No – Test stopped at 156 rounds
Over Lubed Rifle	4	No – Test stopped at 176 rounds

**TEST 4 – Dust/Sand** (Up to 100 rounds)

1. With the rifle in a fully loaded condition and lying with the open ejection port up, one teaspoon of fine sand/dirt was poured over the bolt. The shooter picked up the rifle and attempted to shake off as much of the sand/dirt as possible and then began to fire.
2. Utilizing four 30 round magazines loaded with 25 rounds of blank ammunition, each M4 was fired in full-auto mode, utilizing 3 – 5 round bursts until a stoppage occurred that could not be cleared through normal clearing procedures or until there were multiple consecutive failures.
3. Steps one and two of this test was repeated for each of the four magazines.
4. All stoppages was evaluated for the cause of the stoppage and recorded.

Rifle Used	# of Stoppages Recorded	Completed Test?
Test Rifle (FZ)	0	Yes *
Properly Lubed Rifle	4	No – Test stopped at 52 rounds
Over Lubed Rifle	4	No – Test stopped at 63 rounds



\* Because the test rifle performed so well during the dust/sand test, we attempted to fire an additional 100 rounds, following the above guideline. At 154 rounds the test rifle did malfunction due to a failure to extract. This was primarily due to sand getting into the chamber and acting like sandpaper between the cartridge and chamber preventing extraction though the normal cycle of operation. The test was concluded at this point.

## CONCLUSION

While the above tests are considered to be extreme, they are similar to some of the very conditions we have observed during past Composite Adversary Team (CAT) training cycles, when training time is so precious that it overrides proper firearms cleaning and maintenance.

As shown in the above test results, the Test Rifle was the only rifle to complete all tests while producing few or no stoppages. Conversely, when a test was stopped involving one of the control rifles, the rifle could no longer be cleared though normal clearing procedures, but occasionally required armorer level skills to dismantle the firearm to clear the malfunction and return it to an operational condition. The testing also showed that in the absence of wet lubrication, carbon buildup and fouling is reduced and gives nothing for debris to cling to, allowing for easier and quicker cleaning.

It is the opinion of Unwin's ESS Technicians, based upon the above testing, incorporating the FAILZERO product into the HS-61 ESS firearms will result in a reduction of malfunctions and provide the added benefit of reduced cleaning time and lubrication costs.