

MontanaTech

THE UNIVERSITY OF MONTANA

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RE: Testing for corrosion of rifle barrel steel by "Butch's Bore Shine" gun solvent.

Introduction:

Butch's Bore Shine is a red liquid sold for the purpose of cleaning fouling deposits from gun barrels. It will remove carbon and copper deposits. At issue was whether the liquid will do any type of damage to a weapon's bore. The liquid contains a form of ammonia and there were concerns as to what extent if any does that chemical composition in the product attack barrel steel.

This report describes the results of some tests that were conducted to determine whether any damage to steel samples, cut from three different gun barrels, could be detected after a prolonged immersion (a total of over two months) in a dish of the bore cleaner. Another test conducted on a similar set of samples was to examine the effect of a drop of the liquid placed on the steel surface and allowed to remain there, slowly drying over a period of months. The immersion test showed absolutely no reaction at all. The drying drop test showed some tarnish, but certainly no more, and most likely much less than might result from the simple drying of a drop of water.

Test Results:

Several barrel pieces were received from the product's manufacturer for testing. Three were turned pieces of barrel steel about six inches long. Three were short sections marked Krieger and Lilja, and two more were old barrels including the breech ends. For the purpose of the tests described below, and since all barrel steel is basically similar, (whether it be carbon steel or stainless steel) it was decided to conduct the corrosion tests on the Krieger and Lilja pieces. Accordingly, transverse cross sections were cut from each piece. Then each circular (transverse) section was cut to yield two semicircular transverse sections, each of which was mounted in phenolformaldehyde plastic to make a 1.25" diameter metallographic mount. Each mount was ground flat and given a metallographic polish through 3um diamond. This surface was utilized to conduct the corrosion tests.

For the immersion test the plan was to conduct a microscopic examination of a randomly chosen portion of the polished surface before and after exposure to the bore cleaner. To this end microhardness indentations were made on the polished surfaces of three different barrel sections, identified by numbers found on the submitted barrel pieces. They were Krieger BL 8427 (.366/.375), Krieger BS 12532 (.366/.375) and Lilja 6mm /.243. Two were also marked CM, I am assuming for (chromoly) and the third was a stainless steel barrel. The micorhardness indentations were made utilizing a LECO microhardness tester with a load of 500g and produced indentations that were about 0.055mm (0.022in.) across the diagonals. A different pattern of indentations were employed on the three different specimens. Photographs of these indentations were made, at magnifications of 250X and 500X before and after the immersion tests.

Before testing, the metallographic specimens were cleaned in acetone and rinsed with methanol. They were then blown dry with a warm air stream. The actual immersion was conducted by placing the three polished metallographic mounts in a shallow dish so that they were immersed in the bore cleaner to a depth of about 0.375in. A watch-glass cover was placed over the dish to keep out dust and then a large beaker was inverted over the dish. This assembly was then allowed to sit on the laboratory bench from June 8th through August 16th 1999. During this time the specimens were undisturbed (except for intermediate photography) and it was noticed that no discernable evaporation of the liquid in the dish had occurred.

The indentations were photographed before the test and after 23 hrs, 69 hrs, 162 hrs, and after 75 days. The specimens were removed, rinsed and dried for the photos taken at intermediate times. They were placed immediately back in the solution afterwards.

For the " drying drop test" another three metallographic specimens of the different barrels were each wetted with one drop of the bore solvent and then placed under an inverted beaker adjacent to the immersion test specimens. This test was started on June 16th and terminated August 16th, 1999. The samples were not touched during this time and were only given an occasional visual examination. When the test was terminated on August 16th the specimens were rinsed with water and methanol and lightly rubbed with a wet paper towel. It was apparent that some visually faint stain or tarnish was present. The demarcation line between the surface exposed only to the air and the surface covered initially by the liquid solvent was photographed at 62X, 125X, 250X, and 500X.

All photos for both of the tests were taken with Polaroid 55P/N film so that a negative would be available. These photos (prints and negatives) accompany this report. The actual specimens used for the tests are also being returned to you separately.

Results:

As can be seen by inspection of the photographs, the appearance of the indentations is unchanged from before and after the test immersion. All three steels are identical in this respect. Therefore, this test shows that the bore cleaner has not attacked the steels in any way. No corrosion of any kind can be detected after immersion in Butch's Bore Shine.

The drying droplet test shows some tarnish or staining at the interface where the air, the cleaner, and the steel meet. This test is probably a much more severe test than the immersion test. It is well recognized by metallurgists that corrosion attack of metals and alloys partially immersed in an aqueous media always exhibit the most severe attack at the waterline. Essentially, this is due to the enhanced oxygen available for corrosion at the air/water interface. If the droplet had been pure water tarnishing would have also occurred and probably to a greater degree than was found with the bore cleaner. This is because the bore cleaner contains petroleum distillates and has a higher pH than water and therefore actually acts to inhibit corrosion. The tarnishing is attributable to the action of oxygen (from the air) and water rather than from the bore cleaner per se. As can be seen from the photos, the corrosion is essentially superficial. Only at the high magnification of 500X does it appear that some very miniscule rust pits are developing.

Conclusions:

1. Butch's Bore Shine does not attack rifle barrels manufactured in either carbon steel or in stainless steel.
2. Prolonged immersion in Butch's Bore Shine, up to over two months, has absolutely no discernable effect on the polished surfaces exposed, when viewed at a magnification of 500X.
3. If the cleaner is allowed to dry on exposed steel surfaces some tarnishing is likely to result. However, that tarnish is probably less severe than what occurs when a raindrop dries on the hood of a car.
4. Tarnishing that does occur due to the dried bore cleaner is related to air and moisture rather than the bore cleaning liquid itself.