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Timing

Probably the hardest job when gunsmithing a 1911 is determining if the barrel, link, frame, and slide are adjusted so that upon firing, the timing of their relative motions allows the gun to function reliably and to last for many tens of thousands of rounds.

These instructions, combined with the associated spring and pieces of shim stock, (supplied in the test kit) can be used to determine if a 1911 is properly timed.

This procedure does not require the services of a gunsmith to perform and any gunowner can perform the tests and determine if their 1911 has been properly built.

Before a 1911 is fired, the slide is forward and the barrel is locked to the slide via the meshing of the upper lugs on the barrel into the matching grooves in the slide. The barrel is hooked to the frame via a link, the bottom end of which is connected to the slide stop pin. The link is vertical when the slide and barrel are forward. When the gun is fired, the slide and barrel begin moving rearward together. As the barrel moves rearward, the link rotates about the slide stop pin and starts pulling the barrel down, thereby beginning the unlocking of the barrel from the slide. After the link pulls the barrel downward sufficiently, the barrel becomes completely unlocked from the slide. Then the back of the lower lugs on the barrel will hit the impact surface in the frame, which will stop the barrel's rearward motion, and combined with the link, the barrel's downward motion. The slide freely continues rearward to complete the ejection of the fired case and then moves forward to load the next round into the barrel.

If the gun is not timed properly, the above description of functioning is modified in one of two ways.

Possible problem number one ***is created if the impact surface in the frame, that the barrel's lower lugs hit, is too far forward. This changes the above description in the following way.***

As the slide and barrel move rearward, the link rotates about the slide stop pin and starts pulling the barrel down, thereby beginning to unlock the barrel from the slide. But, just before the barrel is completely unlocked from the slide, the lugs on the bottom of the barrel prematurely hit the impact surface in the frame. The barrel is now partially locked to the moving slide and simultaneously hitting the impact surface in the frame. The resulting crash damages both the barrel's upper and lower lugs. The crash shears metal off the upper lug's corners, finally allowing the slide to get free of the barrel and continue to the rear to eject the case and load the next round. The slide loses some velocity because of the crash and reliability usually suffers.

This crash will be repeated every time the 1911 is fired.

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The result is a characteristic polishing and reshaping of the upper lug corners which, especially under a binocular microscope or on a micro-photograph, clearly shows evidence of the problem.

When subjected to this form of abuse the barrel's upper or lower lugs will typically shear off within about 5,000 rounds.

Possible problem number two is created if the impact surface in the frame, that the barrel's lower lugs hit, is too far rearward. This changes the above description in the following way.

As the slide and barrel move rearward, the link rotates about the slide stop pin and starts pulling the barrel down, thereby unlocking the barrel from the slide. After the barrel is completely unlocked from the slide, the barrel continues moving downward and rearward, and has its vertical motion stopped when the bottom of the barrel hits the top of the frame. The link then stops the barrel's rearward motion before the barrel's lower lugs can contact the impact surface because the impact surface is too far rearward in the frame. The link is not designed to stop the rearward motion of the barrel, and the extra stress will eventually break the link. Either when the link breaks, or certainly when a subsequent shot is fired, the above description changes in the following way. As the barrel moves rearward, the broken link cannot pull the barrel down. The barrel's upper lugs stay fully meshed, locking the barrel to the slide, and in this condition the barrel's lower lugs hit the impact surface in the frame. The resulting crash seriously damages both the barrel's upper lugs and lower lugs. The slide is unable to get free from the barrel and the 1911 jams.

Because of the severe damage caused to the barrel's lugs by this one crash, either the upper or lower lugs, but usually the lower lugs, will typically shear off within the next 1,000 to 2,000 rounds.

Unfortunately, with either problem, the 1911 will hand cycle as though nothing is wrong, independent of whether the impact surface in the frame that the barrel's lower lugs hit is too far forward or too far rearward. Except for possible "unreliable functioning" or reshaping and polishing of the barrel's upper lug corners, as mentioned above, there will be no symptom of a problem until the barrel lugs fail.

The Following Tests Work on Officer, Commander, Government, and Six Inch 1911s.

Before beginning these tests, verify that the 1911 is unloaded.

Test 1: to determine if the impact surface in the frame, that the barrel's lower lugs hit, is too far forward.

Disassemble the 1911. Set aside the recoil spring, spring guide rod, spring plug, and slide stop. Reassemble the 1911 slide, barrel, and frame (no slide stop).

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With the slide approximately 0.25 inch aft of the in-battery position determine that there is a minimum of 0.020 inch clearance between the top of the barrel and the inside of the slide at the front of the ejection port, using a combination of the 0.015 inch and the 0.005 inch strips of shim stock. If the clearance is insufficient, remove metal from the frame bridge and/or interior of the slide until the 0.020 inch clearance is obtained.

Then, insert the slide stop and insert the test spring into the dust cover hole in the front of the 1911 with the S shaped end of the spring entering the dust cover hole first, the tip of the S being upward and the long flat portion of the spring at the bottom of the dust cover hole. Push the spring rearward into the 1911 until the tip of the S contacts the barrel's lower lugs.

Then put the muzzle against the edge of a table with the forward end of the spring extending under the table. While gripping the frame, move the barrel rearward by pressing the muzzle against the table. Simultaneously move the muzzle end of the 1911 upward until the test spring is pushed downward to the bottom of the dust cover hole. Continue to push the muzzle firmly against the table while keeping the test spring at the bottom of the dust cover hole.

What we have done is:

(1) pushed the barrel up with the spring, thereby assuring that all the slack is taken out of the link and

(2) pushed the barrel rearward by pressing the muzzle against the table until the barrel is simultaneously as fully rearward and upward as possible.

This is the condition the barrel is in when the barrel hits the impact surface in the frame during normal firing. To achieve the best reliability and longest barrel lug life, we want a minimum of 0.015 inch clearance (a loose slip fit for the shim stock) between the top of the barrel and the inside of the slide in the above condition.

To review, push the barrel rearward using the table, with the spring simultaneously pushing the barrel upward, and with the slide about 0.2 inches rearward from the battery position insert the supplied piece of 0.015 shim stock between the top of the barrel and the inside of the slide at the front of the ejection port. The shim stock should slide freely between the top of the barrel and inside of the slide. If the 0.015 inch shim goes into the gap between the top of the barrel and inside of the slide, but not freely, the gun does not pass the test because likely the shim stock is forcing the barrel downward against the test spring giving an erroneous indication of clearance. If the 0.015 inch shim does slip freely into the gap, the 1911 passes test 1 and the impact surface in the frame, that the lower lugs hit, is not too far forward. If it does not pass test 1 the impact surface in the frame will have to be moved rearward by removing metal from the frame impact surface.

The additional distance the barrel will move downward when performing test 1 will be approximately 0.7 times the thickness removed from the impact surface in the frame.

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Continue repeating the test one procedure until a minimum of 0.015 inches of clearance is obtained.

Test 2: to determine if the impact surface in the frame, that the barrel's lower lugs hit, is too far rearward.

Disassemble the 1911 and thoroughly clean the area of the frame around where the barrel's lower lugs will be located and the area of the barrel around the barrel's lower lugs. Coat the rear surfaces of the barrel's lower lugs with a black marking pen.

Reassemble the 1911 (without the recoil spring parts but with the slide stop installed).

Hold the 1911 with the muzzle vertically upward, the rear of the frame on your leg, and move the slide to a position about 0.5 inches rearward of the battery position. With the slide in this position, take a plastic mallet and hit the muzzle several times. Then disassemble the 1911 and inspect the black coating on the back of the barrel's lower lugs. If the coating has been removed, the barrel's lower lugs are hitting the impact surface in the frame. This proves that the surface in the frame is not too far rearward and the barrel's motion is being stopped by the barrel's lower lugs, not by the link.

If coating removal only occurs over a somewhat limited area, the 1911 passes test 2 but the lifetime of the barrel will be shortened due to uneven contact between the rear of the barrel's lower lugs and the frame.

Either if a gunsmith uses a standard "flat end mill" (which are not flat on the end) to cut the Wilson/Nowlin impact surface, or if the gunsmith uses one of the standard commercial Wilson/Nowlin ramp cutters which are not ground flat on the end of the cutter, the impact surface is left with a bulge in the middle. This non-flat impact surface bulge will eventually cause a failure of the barrel's lower lugs.

If the black marking on the rear of the barrel's lower standing lugs is not removed the lower lugs are not contacting the impact surface and the barrel's rearward motion is being stopped by the link. This will eventually produce link failure which will irreparably damage the barrel.

If the impact surface is too far rearward, all the surfaces adjacent to the lower standing lugs on the barrel will have to be painted with the black marking pen and test 2 redone to determine where the barrel is prematurely hitting the top of the frame or the interior of the slide. The offending frame or slide surface(s) will have to be removed until the barrel's lower standing lugs are properly contacting the impact surface in the frame. The offending surfaces will have to be removed a minimum of 0.005 inch more than the minimum amount needed to just allow the rear of the barrel's lower standing lugs to hit the impact surface. The reason for the additional metal removal will become clear when performing test 3.

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Test 3: to determine if the upper surface of the frame and the inner surface of the slide are clear of the barrel when the barrel is fully linked down.

Assemble the 1911 without the recoil spring parts, without the test kit spring, and with the slide stop installed.

Move the slide aft of the in battery position approximately 0.25 inch. Using combinations of the supplied shim stock strips determine how much clearance there is between the top of the barrel and the inside of the slide at the forward end of the ejection port. Then remove the slide stop pin and with the slide and barrel in the same positions again measure the clearance between the top of the barrel and the inside of the slide. The measurement with the slide stop pin removed should be at least 0.005 inch greater than the measurement obtained with the slide stop pin installed. If the gun passes this test there is a minimum of 0.005 inch between the bottom of the barrel, in its fully linked down position, and the top of the frame and the inside of the slide.

If the gun does not pass this test then remove the barrel from the gun, paint the bottom of the barrel with a black marking pen, reinsert the barrel into the gun (without the slide stop installed), position the slide and barrel as above, and use a plastic mallet to hit the top of the barrel in the ejection port several times. Remove the barrel from the gun and determine where the barrel is contacting the frame or slide by observing where the black marking has been removed. Remove metal from the frame or slide where indicated and redo test 3.

Continue this process until the gun passes the test. This ensures that when the barrel links down it will neither hit the moving slide, which would cause the gun to be unreliable, nor hit the top of the frame, which would increase the impact loads experienced by the barrel and frame when the barrel comes to rest. The rearward motion of the barrel will have been stopped by the barrel's lower lugs hitting the frame impact surface and the downward motion of the barrel will have been stopped by the link in compression.

Testing of Slide and Barrel Radial (vertical) Lug Spacing

There are three upper lug surfaces on the top of the barrel just forward of the chamber, which are called the radial, and sometimes vertical, lugs. These mate with three lug surfaces in the upper interior of the slide just in front of the ejection port. These three sets of lugs carry the force which flows from the bolt face through the slide and then through these radial lugs into the barrel when the gun is fired. Ideally, and especially if our 1911 is being "overworked"; Cal.355 major IPSC (heavy) comp guns or Cal.400 IPSC major limited guns using heavy bullets and fast powder, all three sets of lugs should be in contact because then the force is shared by the three lugs and the stress on the lugs remains somewhat reasonable.

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Unfortunately, because slide and barrel manufacturers have not standardized the spacing of these radial lugs in the past it is common for only one radial lug to be carrying the entire load. When this is the case there is a substantial probability that the load bearing lug on the barrel side will fail prematurely, because the barrel radial lug is less well supported.

Fortunately, Jerry Kuhnhausen, in his latest book about gunsmithing the 1911, ***"The U.S. M1911/M1911A1 Pistols , A Shop Manual",*** has published a standardized radial lug spacing for match grade slides and barrels. Our barrels use this spacing. It is to be hoped that all slide manufacturers, and the other barrel manufacturers, will also standardize on these radial lug spacing dimensions.

The following tests and adjustments must be made prior to cutting the hood of the barrel to fit the slide.

Since all but one of currently manufactured slides do not meet the Kuhnhausen standard, your slide should be checked to ensure that the radial lug spacing of the slide matches the radial lug spacing of the barrel. As of March '98, to our knowledge, only the Strayer-Voigt slide is being manufactured to these radial lug dimensions.

The following tests can be used to ensure that all three radial lugs, both in the slide and on the barrel, are properly spaced so that the gun will provide maximum reliability and life.

Unfortunately, adjusting the lug spacing of the slide, after it has been manufactured, is nearly impossible. Therefore we have to measure the radial lug spacing in the slide and adjust the lug spacing on the barrel to match the slide.

Checking the radial lug spacing in the slide.

On page 95 of the Kuhnhausen book Jerry describes a technique for using Cerrosafe (obtainable from Brownells) to measure the radial lug bearing surface spacing.

Another, and more direct way, to measure the slide radial lug bearing surface spacing is to use a height gauge. Place the slide muzzle end down on the measuring table. Insert the gauge into the interior of the slide, going in between the slide rails, and determine the height of the first radial lug bearing surface (just at the front of the ejection port). Then move the indicator down and measure the height of the second and third radial lug bearing surfaces. The important dimensions are

(1) the difference between the heights of the first and second lugs and

(2) the difference in height between the first and third lugs.

These should be 0.324 inch and 0.649 inch respectively.

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If they are not, the spacing of the barrel radial lug bearing surfaces must be cut to match the measured slide radial lug bearing surface spacing. This process is described in the Kuhnhausen book on page 124.

Note that Kuhnhausen intersperses ordnance, national match, and "optimum performance" slide and barrel radial lug bearing surface dimensions throughout his book. This can lead to some confusion, and the wide dimensional tolerances in the official 1911 drawings gives slide and barrel manufacturers an opportunity to state that their products conform to the 1911 specifications even though their products are not dimensioned to the "optimum performance" dimensions required because we are pushing our guns well beyond the design limits originally envisioned for the 1911. The following specifications are for "optimum performance" slides and barrels. You should encourage your slide and barrel suppliers to ensure their products conform to these dimensions. Your guns will last longer and cost less if you can convince them to do so.

Miscellaneous comments:

(1) Because gun timing can be affected by many factors including; link length, barrel lockup, distance between slide rails and slide bore, distance between frame rails and slide stop pin hole, distance between the impact surface and the slide stop hole, etc., small variations in each of these measurements can add up to significant variations from gun to gun. While our barrel dimensions are controlled to be reproducible well within 0.001 inch, the frame and slide manufacturers are not able to maintain such close tolerances. For this reason, the proper location of the frame impact surface relative to the slide stop hole will vary up to 0.030 inch from gun to gun. Optimum reliability can only be achieved by performing these tests as the gun is being built, and modifying the frame accordingly.

Under no circumstances should any metal be removed from the barrel's lower lugs, rather than from the frame, to correct any discovered problems. Removing metal from the rear of the barrel's lugs will weaken the lugs and void the barrel warranty.

(2) Compensators significantly increase the total weight of the barrel and compensator assembly. One consequence of the weight increase is that the barrel's upper and lower lugs must carry a proportionately higher load. A typical compensator/barrel assembly will weigh approximately three times the weight of a bushing type 1911 barrel. This increased weight increases the stresses in the upper and lower lugs by the same factor of approximately three. This is an enormous increase in lug stress. Such increased stresses can be responsible for premature upper or lower lug failure, especially if the gun's timing is not perfectly adjusted.

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Compensators also reduce reliability because the weight distribution between the slide and barrel is adversely affected. The momentum imparted to the slide and barrel/comp assembly is shared between the two in accordance with the slide's and barrel/comp assembly's respective percentages of the total slide/barrel/compensator weight. The momentum absorbed by the barrel/comp assembly contributes nothing to the operation of the gun and is dissipated when the barrel/comp assembly hits the frame impact surface. The momentum absorbed by the slide is responsible for the operation of the gun. Since the barrel/comp weight is approximately three times more than a standard barrel, the percentage of the total momentum absorbed by the barrel/comp assembly is increased. Therefore the momentum absorbed by the slide is decreased. This slide momentum decrease reduces the ability of the slide to operate the gun, which necessitates use of a weaker recoil spring, which increases the chance of a failure to feed. Any slide weight reduction, in an attempt to reduce slide cycle time for instance, further reduces the momentum absorbed by the slide, forcing the use of an even weaker recoil spring. The somewhat lighter slide combined with the lighter recoil spring needed for the gun to run, can increase slide cycle time, which is the opposite of the desired effect.

(3) Occasionally it may be necessary to restore the curvature of the spring's middle bend, to maintain sufficient upward force of the spring on the barrel while testing.

Probably the hardest job when gunsmithing a 1911 is determining if the barrel, link, frame, and slide are adjusted so that upon firing, the timing of their relative motions allows the gun to function reliably and to last for many tens of thousands of rounds.

A new fad is circulating through the IPSC shooting community. The fad consists of a simple test, which is reputed to check whether the timing of a 1911 is correct or not. Unfortunately, the test does not check several important timing adjustments needed to ensure a reliable and long lived gun and, in addition, the test can reject a perfectly constructed gun which is correctly timed.

In the latter case the perfectly constructed and timed gun will likely be subjected to unnecessary modifications because of a misunderstanding of how the 1911 works. This could cost hundreds of dollars on unnecessary rework and result in a gun that is less reliable than it was before.

The test consists of: (1) pulling the slide back some; (2) pushing the muzzle of the gun against a surface to push the barrel aft into the 1911; and (3) checking that the slide stop pin is free to rotate when (1) and (2) are satisfied. If the slide stop pin is free to rotate when conditions (1) and (2) are satisfied the gun supposedly is correctly timed.

Assuming you have read and understood the 1911 Test Kit section of this web site you will be able to figure out that the above test, in fact, does check if the frame impact surface is too far aft.

However, the above test: (1) does not check if the vertical impact surface is too far forward; (2) does not check if there is sufficient clearance between the top of the barrel and upper inner surface of the slide main bore when the barrel is unlocked; and (3) does not check if there is sufficient clearance between the bottom of the barrel and lower surface of the slide main bore.

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In particular, if the gun perfectly timed; i.e. the gun is adjusted so that simultaneously: (1) the aft surface of the lower standing lugs hits the frame impact surface, and (2) the bottom of the barrel hits the top of the frame; and (3) at the moment when (1) and (2) happen the link is just snug, then this perfect gun will fail the simple test outlined above.

If any individual (gunsmith) recommends the above simple test to you I suggest you recommend that the individual either obtain a 1911 Test Kit from KKM Precision or go to the 1911 Test Kit section of this Web Site and study the subject of the correct timing.

If your gun is a production gun and you are still concerned I would suggest you contact the manufacturer of your gun to obtain their input. This is important because accepting the individual's judgement that your new gun "needs" to be fixed will result in invalidating your warranty. Especially, if you have an Infinity gun I would talk to them about it. They fully understand the details of timing 1911s, far better than any other manufacturer I know of, and they consistently produce guns with the "perfect" timing discussed above. Because of this I would expect most Infinity guns to fail the invalid timing test we have been discussing.