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TECHNICAL NOTE 89: CAUSES, IDENTIFICATION, AND CORRECTION OF MALFUNCTIONS

I. BACKGROUND

Firearm systems are mechanical devices with a human being in the loop. So, sooner or later, EVERY firearm will malfunction. In order to minimize malfunctions, and to diagnose and correct them when they occur, it is essential to understand the entire firearm SYSTEM and its environment.

II. THE FIREARM SYSTEM

It is absolutely critical that you initially view any malfunction as a SYSTEM problem. The entire system consists of the following components:

1. firearm
2. ammunition
3. mount
4. shooter

Any one or combination of these system components can cause or contribute to malfunctions.

And malfunctions can also be induced by:

5. environmental conditions
6. cleaning methods, equipment, and frequency
7. wear of components of the firearm
8. unintended or unauthorized use of the firearm.

Unless you consider all eight of these potential causes, you may not determine the actual cause of the malfunction.

To emphasize the system nature of malfunctions, let us consider a typical malfunction in an AR-style weapon --- "short recoil". Short recoil occurs when, upon firing, the bolt carrier group is not driven rearward far enough to feed a new cartridge.

Let's consider a few of the possible causes of short recoil.

-- Certainly, a number of different problems in the firearm itself could cause short recoil, including an undersize gas port, a front sight base that partially blocks the gas port, and burrs or other nonconformances in the firearm that increase the drag on the bolt carrier.

-- The ammunition can also cause short recoil if the cartridge pressure at the gas port is too low.

-- If the firearm is mounted too softly or held too loosely by the shooter, the firearm, itself, can recoil too much. This reduces the relative movement between the bolt carrier and the firearm causing short recoil.

-- If the shooter supports the firearm by resting it on the magazine, the magazine can drag on the under side of the bolt carrier as it recoils, causing short recoil.

-- Cold weather, particularly in combination with heavy lubricants, can cause short recoil.

-- Improper or inadequate cleaning methods and materials can leave debris in the firearm that causes short recoil.

-- Wear or deformation of some components (for example bolt rings) can cause short recoil.

-- Damage to the firearm or use of unauthorized parts can cause short recoil.

Hopefully this simple example will convince you that every malfunction must be evaluated as a system problem if we want to identify its root cause. In order to thoroughly analyze the cause of any malfunction, you must evaluate ALL of the POTENTIAL causes and eliminate them, one by one, until you have found the actual cause. Once you have identified the actual cause and its root cause, the appropriate corrective action should be obvious.

Remember, the firearm is always the VICTIM of the malfunction ----- BUT it is not always the CAUSE of the malfunction. A wise gunsmith NEVER immediately assumes that the firearm is the CAUSE of any malfunction.

III. FIREARM CYCLE OF OPERATIONS

Every firearm contains eight basic steps in its cycle of operations (except for blowback operated firearms). In order to understand and correct the cause of any malfunction, you must first understand this eight-step cycle. And, you must determine which step in the cycle is malfunctioning. The steps are the same regardless of whether the firearm is a single shot, manually operated, semiautomatic, or full automatic.

The eight steps are:

FIRING: The act of pulling the trigger, causing a firing mechanism to ignite the primer of a cartridge

UNLOCKING: Disengaging the mechanism that supports the rear of the cartridge in the chamber

EXTRACTING: Pulling the cartridge case rearward out of the chamber

EJECTING: Throwing the cartridge case clear of the weapon

COCKING: Resetting the firing mechanism so that it is again ready to ignite a primed cartridge

FEEDING: Moving a loaded cartridge forward from its magazine until the nose of the cartridge enters the chamber

CHAMBERING: Completing the forward motion of the cartridge into the chamber

LOCKING: Engaging the firearm components that retain the cartridge in the chamber

(Note: Blowback operated guns are somewhat simpler because their cycle of functioning doesn't include locking and unlocking.)

IV. FIREARM MALFUNCTION ACRONYMS AND DESCRIPTIONS

Below is a list of commonly-used acronyms and terminology used in the description of malfunctions, particularly those found in AR-style firearms.

The basic malfunctions are FFD, FTC, FTL, etc. Malfunction subsets such as BOB, SR etc will be applied if we can more specifically characterize the malfunction and its cause (e.g., FFD-BOB or FFD-SR). We have divided the malfunctions into two subsets:

1. malfunctions associated with proper cycling of the weapon; and
2. other types of malfunctions/problems.

WEAPON CYCLING MALFUNCTIONS

FFD = Failure to Feed (cartridge not fed forward by bolt feed lug):

BOB - Bolt Over-rides Base of cartridge.

SR - Short Recoil of bolt carrier.

ND - Nose Dive of follower

BSL - Bolt Stop inadvertently Locked bolt to rear

FTC = Failure to Chamber (base of cartridge was presented to bolt feed lug and the nose of the cartridge reached the chamber, but ctg was not fully chambered)

CNS?? - Cartridge Nose is Stubbed at ?? o'clock of chamber

DF - Double Feed

FTL = Failure to Lock (cartridge fully chambered, but bolt not fully locked):

BLE - Bolt Lacked Energy to close

FFR = Failure to FiRe:

FTR - Failure of Trigger to Return forward.

FSO - Failure to Sear Off.

LPI – Light Primer Indent

NPI – Normal Primer Indent

FHC – Failure of the Hammer to remain Cocked

FEX = Failure to EXtract (cartridge not fully extracted from chamber):

FEJ = Failure to eject (cartridge fully extracted from chamber but not ejected from rifle)

SB - Spin Back of cartridge case into ejection port.

OTHER MALFUNCTIONS/PROBLEMS

FRA = Failure of one or more components to Remain in Assembly.

FBR = Failure of Bolt to remain to Rear

FMD = Failure of Magazine to Drop free of the weapon when the magazine release button is depressed

UMD = Unintentional Magazine Drop

DBL = DouBLing (more than one round fired with a single trigger pull)

PML = Parts Missing or Loose

EJC = failure of the EJection port Cover to remain closed

CRS = Cyclic Rate too Slow

CRF = Cyclic Rate too Fast

SAF = SAFety Failure (hammer falls when safety is on, or doesn't fall when safety is off, or inadequate force to move safety lever)

TPW = failure to meet Trigger Pull Weight reqm'ts

ACC = ACCuracy failure

CI – Center of Impact not at point of aim

GS – Group Size too large

CLASSIFICATION OF MALFUNCTIONS:

The military typically classifies malfunctions according to their severity. Below are typical classifications:

CLASS I: Clearable within 10 seconds by the operator.

CLASS II: Clearing takes more than 10 seconds by the operator.

CLASS III: Not clearable by the operator or requires part replacement.

V. COMMON MALFUNCTIONS AND SOME OF THEIR CAUSES

Failure to Feed (FFD) or Failure To Chamber (FTC) first round

Description:

Either of these failures can occur when the bolt is released and it fails to feed or fully chamber the first round from a loaded magazine

Cause:

This malfunction is usually the result of accumulation of dirt or fouling, a defective magazine, an improperly inserted or improperly loaded magazine, or a damaged round. In the case of an improperly loaded magazine the projectile end of the top round in the magazine often becomes inadvertently tipped down. This is often known as a “stuffed” round.

Corrective Action:

The bolt should be retracted and held to the rear while the magazine is removed and the malfunction cleared. The rifle should be field stripped, cleaned, and lubricated. The magazine should be replaced with another if malfunctions recur.

Failure of cartridge to Fire (FFR)

Description:

Failure occurs when the firing pin either strikes the primer with insufficient energy or fails to strike the primer at all.

Cause:

Full forward travel of the firing pin may be obstructed. This may occur when the bolt carrier fails to fully close and the hammer strikes the carrier rather than the firing pin. The hammer striking the carrier may cause the carrier to move fully forward; and, upon subsequent inspection, the cause of the malfunction would not then be apparent.

Corrective Action:

If this malfunction becomes repetitive, the firing pin, bolt, and bolt carrier should be inspected. The firing pin tip should also be inspected for damage.

Cause:

Broken hammer spring. The hammer spring has two coils, with legs protruding from them and over the trigger spring. If one coil or leg of the hammer spring is broken, the spring energy applied to the cocked hammer is insufficient to reliably fire the cartridge. This malfunction will produce intermittent malfunctions.

Corrective Action:

Replace the hammer spring.

Cause:

The problem can be caused by inadequate or inappropriate maintenance, particularly in sandy or cold environments.

Corrective Action:

The firearm should be cleaned in accordance with the owner's manual.

The firing of two rounds (DBL) on a single trigger pull.

Causes:

This is often due to the trigger pin backing out from engagement from one side or the other of the receiver. Loosening of the trigger pin is usually due to a broken or to an incorrectly assembled hammer spring.

Corrective action:

The hammer spring should be inspected for damage or incorrect assembly.

Cause:

The sear surfaces of the trigger or hammer may be worn and prevent full sear action. The disconnecter hook and/or the disconnecter surfaces on the hammer may be worn, allowing doubling. The disconnecter spring may be weak.

Corrective action:

Replace the hammer and trigger if their engagement doesn't provide positive hammer retention. The disconnecter and/or hammer should be inspected for wear that would interfere with safety, and replaced if needed. The disconnecter spring should be replaced.

Failure of Trigger to Return to forward (FFR-FTR) position after trigger release.

Causes:

This is usually due to dirt or an accumulation of fouling in the mechanism, lack of lubricant, or a broken trigger spring.

Corrective action:

This requires disassembly, cleaning and lubrication, or replacement of the trigger spring. In some instances, due to improper engagement surfaces, the hammer and disconnecter may require replacement.

Failure of a fired case to be successfully EXtracted (FEX) from the rifle chamber.

Cause:

Short recoil cycles or fouled or corroded rifle chambers are the most common causes of failures to extract. A damaged extractor or a weak or broken extractor spring can also cause this malfunction.

Corrective action:

Where cleaning and inspection of the mechanism and the chamber reveal no deficiencies in these areas, and failures to extract persist, the extractor and extractor spring should be replaced.

Failure to completely Eject (FEJ) a fired case

Description:

A malfunction occurs when the fired case is not successfully cleared through the ejection port and becomes jammed in the mechanism as the bolt closes. Occasionally the fired case, while initially clearing the gun, may strike an outside surface and bounce back into the path of the bolt. This is referred to as “spin-back”.

Cause:

Ejection failures are often related to a weak or damaged extractor spring and, much less commonly, to a weak or damaged ejector spring. Failures to eject can also be caused by an accumulation of carbon or fouling on the ejector spring, on the extractor, and from short recoil. Short recoil is usually due to an accumulation of fouling in the mechanism. (Short recoil may also be caused by a fouled or obstructed gas tube.) Difficult extraction from a fouled or corroded chamber can also cause ejection failures.

Corrective Action:

If repetitive malfunctions occur and are not corrected by cleaning and lubricating, it is recommended that the ejector spring, the extractor spring, and the extractor be replaced even if damage is not apparent. The ejector itself does not often require replacement. The determining factor in deciding whether a failure-to-eject or a failure-to-extract has occurred is the nature of the clearing action required to overcome the malfunction. If the fired case can be cleared by simply retracting the charging handle, a failure-to-eject has occurred; if difficulty is encountered to the extent that repeated charging handle cycles are required or if tools are required to clear the malfunction then a failure-to-extract has occurred.

Failure of the Bolt to remain in a Rearward (FBR) position, engaged by the bolt catch, after the last round has been fired

Cause:

The malfunction can be caused by short recoil. This failure is also occasionally due to a high cyclic rate of fire where the bolt catch does not have sufficient time to move into position. And, it can be caused by a defective magazine. (This is particularly true with generic or aftermarket magazines.)

Corrective action:

Cleaning, inspection, and lubrication of the mechanism, including the bolt catch assembly, should be accomplished when repetitive failures occur; in the event of continued failure, the bolt catch and spring should be replaced. Replace the magazine.