



March 15, 2002 Rev 1

## **TECHNICAL NOTE 50: THE CYCLE OF OPERATION AS A GUIDE TO TROUBLESHOOTING**

Firearms come in a variety of designs. Whether single-shot or repeater, manually operated, self-powered, or externally powered, all share the same operating steps. These steps are referred to as the Cycle of Operation. Even a muzzle-loading firearm shares the same steps. The only difference is how each step is performed.

Each step in the cycle of operations is subject to a number of characteristic malfunctions. A thorough understanding of the cycle makes diagnosis of these malfunctions relatively simple and eases the challenge of repair. Diagnosis of malfunctions requires an understanding of what role each part plays in each step of the cycle of operation.

This document is a combination of information based on ArmaLite® and Department of Defense publications, and will sometimes seem redundant. It includes descriptions of each step of the Cycle of Operations of the AR-10 or M-16 family of rifles, descriptions and causes of common malfunctions, and the standardized codes used by the government to identify the malfunction on government test reports.

## STARTING CONDITION:

At the beginning of the cycle of operations, the rifle is ready, with the magazine inserted and containing at least one cartridge.

### Step 1: Feeding

The compressed buffer spring drives the carrier group forward. The lower teeth of the bolt strike the rear of the top cartridge in the magazine and drive it forward. The bullet tip strikes the feed ramp of the barrel extension and is deflected upward toward the chamber. The base of the cartridge clears the feed lip of the magazine and the cartridge is free to enter the chamber. The remaining cartridges in the magazine are forced upward until the new top round is halted by the bottom of the carrier.

Parts involved with feeding and that could be involved with a malfunction include:

#### Buffer Spring

- Deformed
- Corroded (non-stainless springs can)

#### Buffer

- Pin backed out
- Buna bumper backed out
- Corroded
- Obsolete or inferior design used

#### Lower Receiver Extension ("Buffer tube")

- Bent or dented
- Corroded
- Fouled

#### Carrier

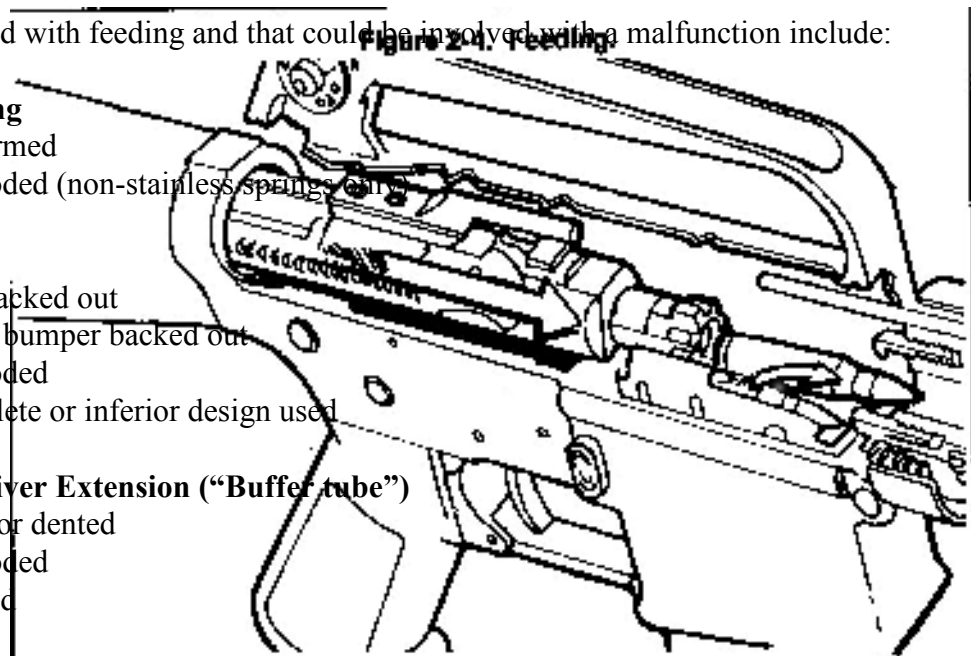
- Fouled in upper receiver with powder residue or foreign matter.

#### Cartridge.

- Bent or otherwise damaged.
- Corroded.

#### Magazine

- Deformed lips.
- Excessive or insufficient spring pressure.
- Jammed with extra cartridge.
- Dented or crushed sides.



### Failure to feed the first round

Failure designation and detailed discussion:

Failure to feed the first round should be viewed as two distinct subsets of Failure to Feed. Unlike the later rounds that are fed under the influence of the gas powered operating system, the first round is fed rather slowly when the bolt is held to the rear by the bolt catch or the shooters hand, and then manually released.

Designation: FF1 – Failure to feed and chamber the first round from the magazine.

Description: This failure occurs when the bolt is manually released by depressing the bolt catch and the bolt and bolt carrier fail to move fully forward to feed and chamber the first round from a fully loaded magazine.

Probable Cause: This malfunction is usually the result of an accumulation of dirt or fouling in and around the bolt and bolt carrier., although it can occur as a result of a defective magazine, an improperly inserted or improperly loaded magazine, or a damaged (dented or bulged) round. In the case of an improperly loaded magazine, the projectile end of the top round in the magazine become inadvertently tipped down and the cartridge cannot clear the front of the magazine; this is often referred to as a “stubbed” round when describing the resultant malfunction.

A round may also stub if the top cartridge is jammed because the magazine spring is too strong or because too many rounds are loaded into the magazine.

The movement of the cartridge from the magazine and up the feed ramp is a more complex action than it seems. The cartridge case pivots on the front of the magazine’s feed lips as the bullet tip rises up the feed ramp of the barrel extension. As the tip rises the rear of the cartridge must lower slightly. Too much resistance at the rear of the cartridge thus prevents the tip of the cartridge from rising.

Corrective Action: Use of the bolt-assist device will often overcome the malfunction by completing closure of the bolt. However, the carrier should not be forced home; if resistance is encountered, as may occur with a “stubbed” round, the bolt should be retracted and held to the rear while the magazine is removed and the malfunction cleared.

While repetitive occurrences of this malfunction may be temporarily overcome by lubricating the bolt carrier without disassembly, the weapons should be field-stripped, cleaned, and lubricated at the earliest opportunity.

Magazine problems can be resolved by reducing the number of rounds in the magazine or by shortening the magazine spring (normally required only with shortened magazines).

Malfunction Subtypes: The malfunction subtypes depend upon the severity of the malfunction and are identified by the degree to which the carrier has failed to close:

- Cartridge fully visible
- Cartridge partially visible
- Carrier not fully closed

## **Failure to feed (subsequent rounds)**

Designation: FF – Failure of a live round to be successfully stripped from the magazine and fully chambered.

Description: This malfunction occurs during a firing sequence, as opposed to the previously discussed FF1 which occurs only after manual bolt release following insertion of a loaded magazine. Feeding failures can be divided into five basic types.

Probable Cause: The majority of feeding failures are due to one of two causes: short recoil or a defective magazine. In short recoil, the bolt lacks sufficient energy to move fully rearward to engage the cartridge base or, with the base engaged, lacks sufficient energy to complete the feeding operation. As previously discussed, short recoil is usually due to an accumulation of fouling or dirt in the mechanism. The problem of defective magazines is discussed in the paragraph dealing with miscellaneous malfunctions.

Corrective Action: Immediate action should be carefully taken to avoid the risk of further jamming the rifle. Where only one round is involved and the bolt is behind the base of the round to be fed, the bolt assist may be used to complete the feeding action. If resistance is encountered, however, the bolt should be retracted and held to the rear while the magazine is removed and the malfunction is cleared.

In instances where the bolt has overridden the base of the next round to be fed, or where the bolt has closed on an empty chamber, the bolt should first be retracted with the charging handle. Inspection of the position of the round will then indicate if the bolt can be released in an attempt to complete feeding using the energy of the action spring or whether the magazine must be removed to clear the malfunction. Magazine removal is usually required to clear a double feed.

Malfunction Subtypes: Various feeding failure subtypes are shown in figures I-10 and I-12. Because of the relative frequency of feeding failures, the subtypes are often identified by the following abbreviations:

- BB – Bolt behind the cartridge base.
- BOB – Bolt override of the cartridge base.
- COEC – Bolt closes on an empty chamber.
- DF – double feed of two cartridges

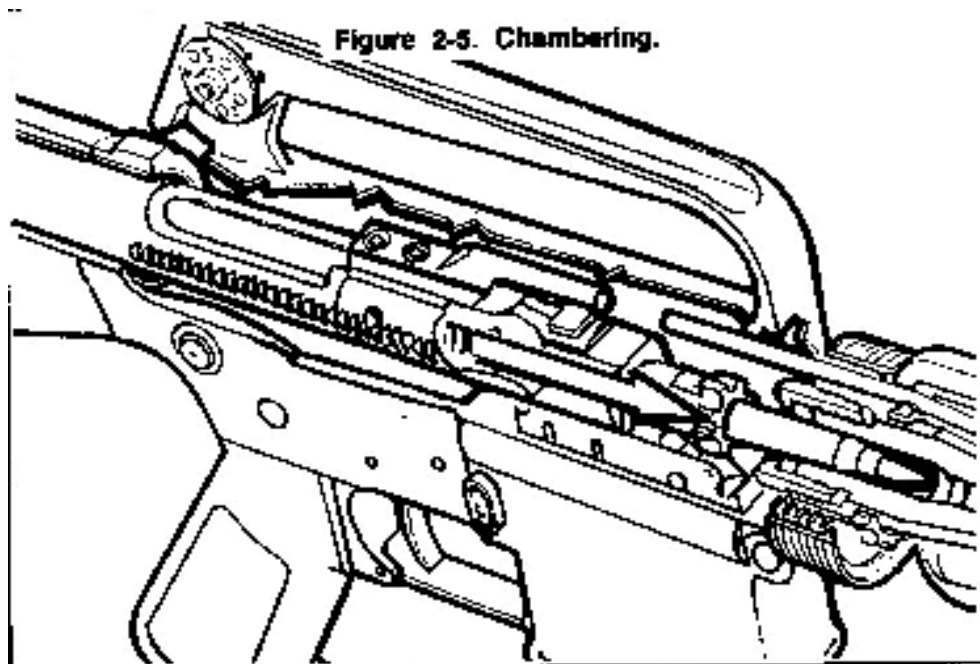
Double feed of two live rounds is normally impossible unless the magazine is defective (spread feed lips). If the magazine loses control of the top cartridge while the fired round is being ejected, that top cartridge may pop up into the upper receiver. The following live cartridge in the magazine then moves upward into the feeding position. As the bolt moves forward and strips that next live round from the magazine it tends to force the previous round into the top of the receiver, where it serves to block further bolt movement.

Double feed of two live rounds is more commonly caused by an error in handling; a chambered round can be slowly withdrawn from the chamber, allowing the extractor to

lose control of the round and allowing it to drop onto the top round in the magazine.  
Releasing the bolt from the full rearward position will produce an apparent double feed.

## Step 2: Chambering

The carrier group continues moving forward, and the bolt forces the cartridge fully into the chamber



Parts involved with chambering and that could be involved with a malfunction include:

### **Barrel**

Blocked or fouled chamber or barrel extension.

### **Cartridge.**

Bent or otherwise damaged.

Corroded.

### **Bolt**

Bolt face fouled, unable to accept cartridge base.

### **Buffer Spring**

Weak, bent, or broken.

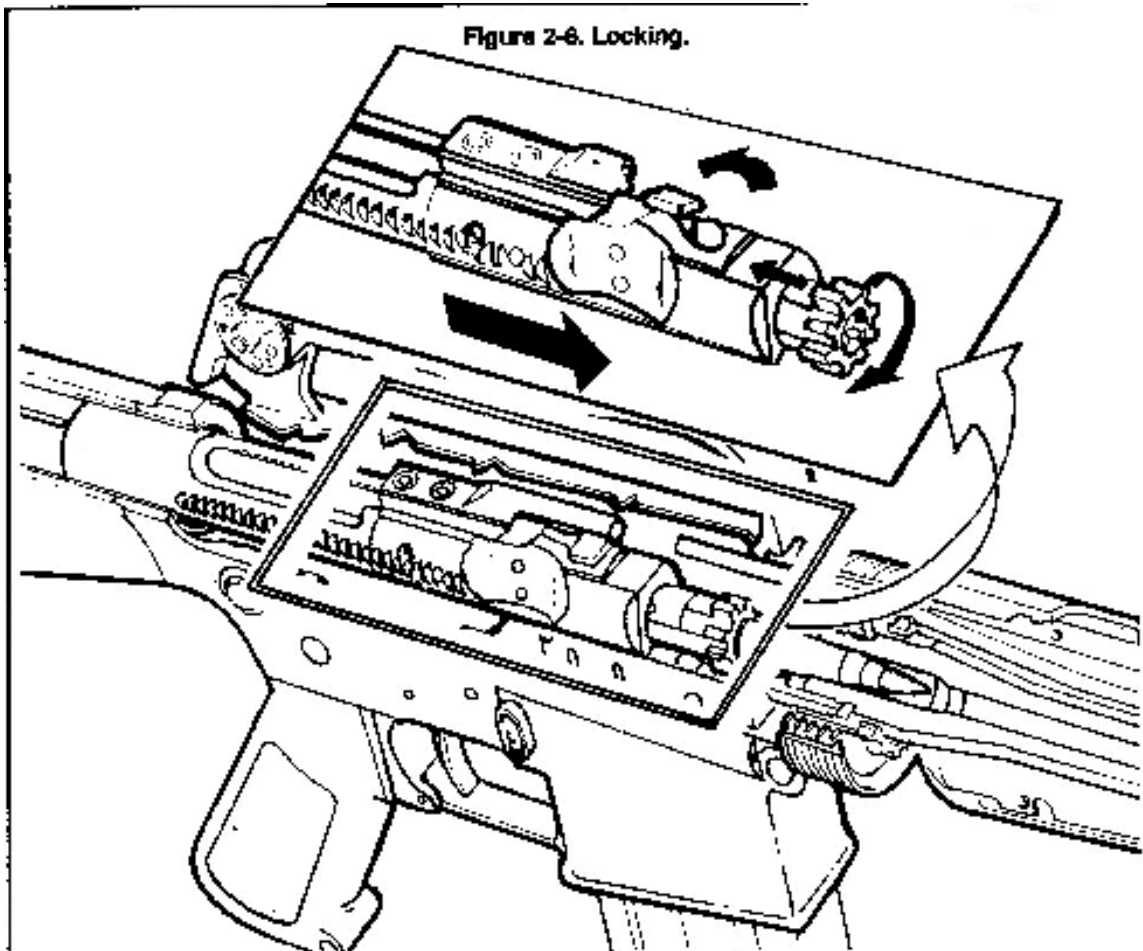
Corroded.

### Step 3: Locking

The bolt is halted by the rear of the barrel, and the cam pin through the bolt halts with it. The carrier continues forward, and the camming surface strikes the cam pin and forces it to rotate. This action forces the bolt to rotate, and its lugs lock behind the lugs of the barrel extension. The final forward movement of the carrier frees the firing pin to allow it to strike the primer when the rifle is next fired.

The entire cycle of operation takes place faster than the shooter can release the trigger. Upon locking the trigger is thus still held to the rear by the trigger finger.

Releasing the trigger forces the trigger to pivot upon its pin. After the primary searing surface moves into position behind the sear surface of the hammer the disconnecter releases the hammer, and it shifts forward and is captured by the sear surface of the trigger. The rifle is now fully cocked and ready for the trigger to be pulled again to fire the rifle.



Parts involved with locking and that could be involved with a malfunction include:

**Barrel**

Fouled or rusted, unchromed chamber  
Chamber features incorrect for bullet.  
Coarse machine marks in chamber.

**Cartridge**

Excessively long. Normally a problem seen with handloads.  
Corroded.  
Bent or damaged.

**Bolt**

Not matched to barrel; insufficient headspace.

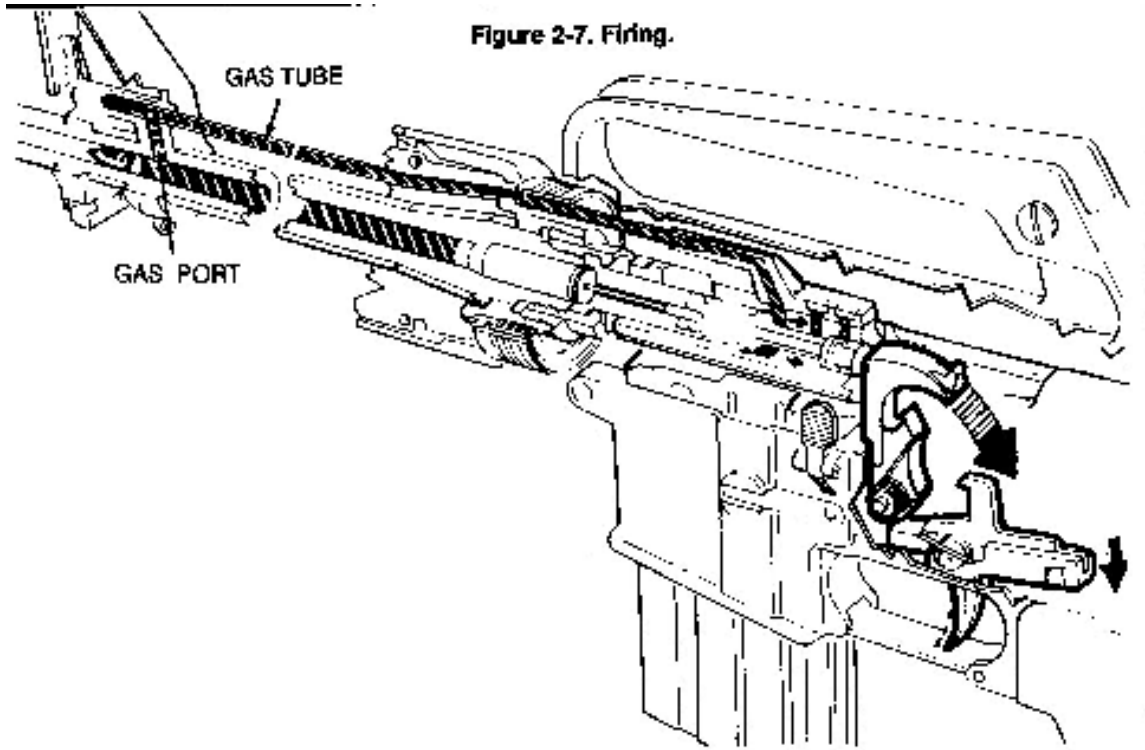
**Extractor**

Fouled, jammed, or otherwise unable to snap around cartridge rim.

## Step 4: Firing

When the trigger is pulled to the rear, the sear surface moves downward, releasing the hammer. The hammer pivots on its pin, and the face of the hammer strikes the rear of the firing pin. The firing pin is driven forward to strike the primer. The force of the strike detonates the primer, which ignites the propellant.

The action of the cartridge case is an important part of firing. The cartridge case expands into contact with the chamber wall under the influence of the high-pressure gasses and seals the chamber. The propellant drives the bullet down the barrel. After the bullet exits the bore the cartridge case contracts from the chamber wall.



Parts involved with firing and that could be involved with a malfunction include:

### **Safety.**

Jammed by rust or debris, preventing trigger from being pulled.

### **Trigger.**

Jammed by debris such as a loose primer, preventing the front from lowering to release hammer.

### **Hammer.**

J-shaped spring in hammer broken, allowing hammer pin to walk out to one side of receiver (below).

### **Hammer pin.**

Shifted to one side so that one end is not supported by the receiver, allowing the hammer to bind against receiver.

**Hammer spring.**

Broken or bent, providing weak strike of primer.  
Legs under trigger spring instead of above, resulting in reduced tension and primer strike.

**Firing pin.**

Broken, worn, or eroded tip fails to initiate primer.  
Jammed or slowed due to fouling or bend.

**Cartridge.**

Defective primer fails to detonate when struck by firing pin.

**Carrier Group.**

Not fully forward due to fouling, especially of the cam area. (Hammer energy is partially absorbed in closing the carrier group.)

**Failure to fire**

Failure designation and detailed discussion:

Designation: FFR – Failure of a cartridge to fire despite the fact that a round has been chambered and the trigger or the automatic sear (automatic versions only) has released the trigger.

Description: This failure occurs when the firing pin either strikes the primer with insufficient energy or fails to strike the primer at all. Superficial visual inspection usually does not indicate the nature of the malfunction and the weapon appears normal with the bolt carrier closed.

Probable Cause: Carbon or fouling accumulation on the firing pin, as shown in Figure I-3, is often the cause, and the full forward travel of the firing pin is restricted. This malfunction also occurs when the bolt carrier fails to fully close and the hammer strikes the carrier rather than the firing pin. However, the hammer striking the carrier may cause the carrier to move fully forward and, on inspection, the cause of the malfunction is not then apparent.

Corrective Action: Immediate corrective action can be taken by fully retracting the bolt, permitting the chambered round to be ejected, and releasing the bolt to chamber a fresh round. If this malfunction becomes repetitive, the firing pin, bolt, and bolt carrier should be inspected and any carbon or fouling removed. The firing-pin tip, although extremely durable in normal service, should also be inspected for damage.

Note that this malfunction is often erroneously attributed to faulty ammunition. If this cause is suspected, and corrective action fails to eliminate the malfunction, rounds which fail to fire and exhibit a normal firing-pin indent should be identified and returned to the ammunition manufacturer.

Malfunction Subtypes: Four subtypes of this malfunction exist, with three of the subtypes distinguished by the degree of firing pin indent. These subtypes are illustrated

in Figure I-4. The fourth subtype, carrier not fully closed, on initial visual inspection will appear to be the same as shown in Figure I-2:

- Carrier not fully closed
- No primer indent
- Light primer indent
- Normal primer indent

It should also be noted that the primer of a cartridge which has been loaded and then unloaded without firing normally show a very light firing-pin imprint. This imprint is caused by a forward movement of the relatively free-floating firing pin; this normal signature effect may be quite indistinct with some rifles.

### **Explosion of Rifle or Cartridge**

Catastrophic failure of the rifle or cartridge is a rare but important malfunction occurring during firing. It is not actually a failure to fire in the usual sense, but is a component failure that takes place during the firing step of the cycle of operations. It is well worth considerable discussion.

Excessive Pressures:

When a normal cartridge is fired, pressures inside the cartridge case rise to 55,000 pounds per square inch or more. Defective cartridges or bore obstructions will cause pressures to rise dramatically.

Upon propellant ignition, the interior of the cartridge case is pressurized pretty evenly. The case walls expand and seize the sides of the chamber as pressures rise. The case stretches rearward until the base of the cartridge contacts the bolt face which supports it, putting pressure on the bolt.

A cartridge case failure allows this high pressure gas to escape into the barrel extension, where it flows into contact with the bolt and bolt carrier. As it expands, the gas has a larger working surface to work on than it does inside the cartridge case. This places tremendous stresses on the bolt and carrier.

The high pressure gas bends the front end of the extractor outward, locking it behind the locking lugs of the barrel extension. In rare cases the barrel extension may be split.

The gas strikes the face of the bolt. The energy deposited in the bolt can cause the bolt to split along a line running between the extractor slot and the firing pin hole, shear the lugs from the bolt, break the bolt at the cam pin hole, and/or break the tail off the bolt. Not all of this damage is normally seen on a single bolt.

The gas passes around the bolt body and enters the bolt carrier. It may split the bolt carrier in the middle of the flat surface at the top front of the carrier and blow the flat bottom of the front half of the bolt carrier down into the magazine. The high pressure gas would then pass out the carrier at both the top and the bottom.

The gas passing down the magazine compresses the cartridge stack and blows it, the follower, and the baseplate out the bottom of the magazine and blows open the portion of the magazine outside the magazine well. In some cases the magazine well of the lower receiver is deformed outward in a distinct bulge.

The gas passing through the fracture at the top of the carrier, and other gas still passing around the bolt body, fill the upper receiver and force the sides outward until they split at the top of the receiver. Sometimes, but rarely, a panel of the receiver may blow out. The ejection port is deformed.

In rare cases, the threads at the front of the upper receiver may break off the receiver.

Upon disassembly, we normally note that the cartridge case shows a blowout at the ejection port, swelling to fill the bolt face, and/or complete circumferential separation of the cartridge head from the cartridge body. Powder residue bearing copper vapors coat the parts.

All of these indicators point to cartridge case failure resulting in high pressure gas leakage into the mechanism, and subsequent damage.

**Bolt Failure:**

Sometimes a fatigued or defective bolt fails. It's sometimes hard to differentiate between a failed bolt and a failed cartridge case without in-depth metallurgical analysis.

Bolt lugs tend to fail in a consistent way, with the lugs nearest the extractor cracking due to fatigue and then breaking off. Then the other lugs will crack and break off toward the opposite side of the bolt, in sequence. Typically several thousands of rounds will be fired between the occurrence of the first visible crack and ultimate bolt failure. In addition, bolts have been safely fired with more than one lug completely missing. These two factors mean that any observant user should have adequate warning of a potential bolt failure.

If the failure is caused by the bolt, high pressure gasses still exit the case as the unsupported case fails, but the cartridge head typically isn't deformed as badly as in the case of an overpressure cartridge.

Bolts are highly, cyclically loaded mechanical components. Thus they should be expected to have a limited life. Firearm designers take great pains to assure that bolt life exceeds anticipated usage and that any failure will occur in a manner which will not injure the shooter or any bystanders.

Parts involved with firing and that could be involved with a "blowup" malfunction include:

**Barrel**

- Incorrect chamber dimensions

- Bore too tight

- Bore constriction (i.e. from chrome buildup in throat, fine sand in neck or throat)

- Blocked by jacket material from previous round, or other obstruction

**Bolt**

Fatigued, or “worn out”. This is normal; all bolts will fail after enough rounds have been fired. Fatigue failures are preceded by various cracks that are detectable during normal cleaning.

Broken lugs. This is a characteristic fatigue mode. The weakest lugs (neighboring the extractor) break off, followed in sequence by the remaining lugs.

Improper material. Rare

Improper heat treatment. Rare

**Cartridge.** Almost all cartridge failures occur with reloaded ammunition.

Damaged, fatigued, or defective cartridge case.

Soft.

Defective Primer.

High pressures due to:

wrong powder

excessively heavy bullet, combined with wrong or excessive powder

Catastrophic failure of M16 or AR-10 rifles is rare. It is ordinarily caused by defective ammunition or a fatigued part. M16 rifles, and all similar models, suffer damage in a characteristic sequence. Fortunately, the design of these rifles provides considerable shielding that contains the pressure and residue, and prevents injury of the shooter. Army and ArmaLite records reveal no significant injury in any incident, a truly outstanding record.

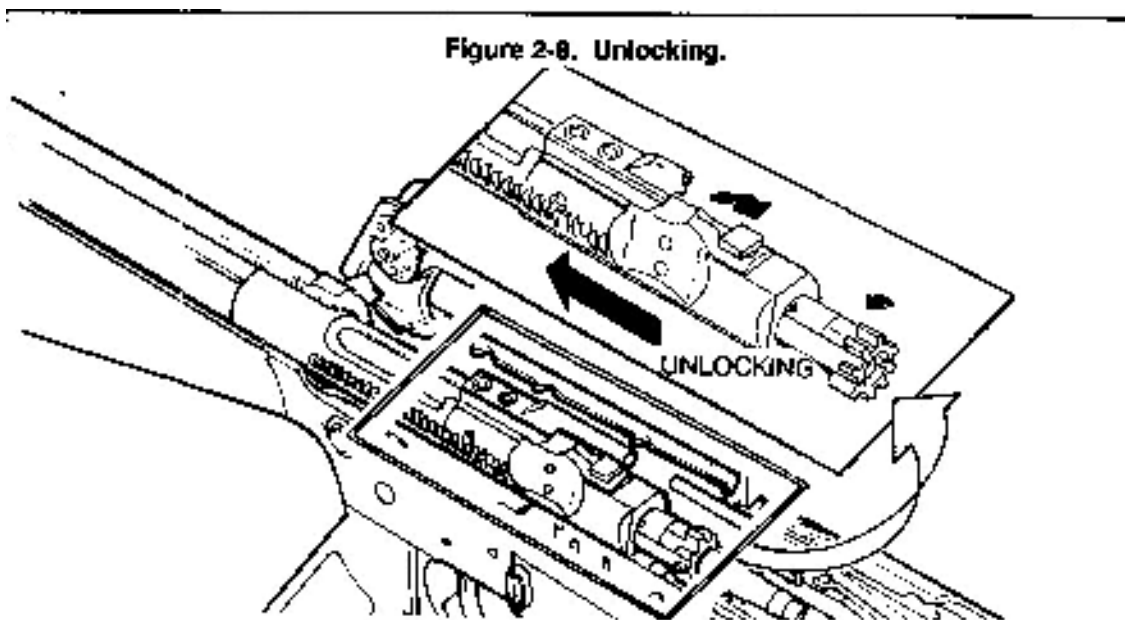
## Step 5: Unlocking

As the bullet passes the gas port a portion of the propellant gas enters the gas port and travels down the gas tube and into the carrier key. It then travels down the carrier key into the expansion chamber inside the bolt carrier. The high-pressure gas tends to expand. The locked bolt cannot move forward, so the expanding gas drives the carrier forcefully to the rear.

The first rearward movement of the carrier retracts the firing pin into the bolt.

The carrier and bolt are linked by the bolt cam pin, which passes through a shaped hole in the carrier (the cam), and through the bolt. The camming surface of the rearward moving carrier strikes the cam pin and forces it counter-clockwise. The cam pin forces the bolt to rotate to a position that frees the bolt lugs from engagement with the barrel extension. As the carrier continues to move to the rear it draws the bolt from the barrel extension and carries it to the rear.

The fundamental rule of fault-finding is that *any fault that interferes with the transfer of energy from the propellant gasses to the moving parts, or interferes with the subsequent free movement of the parts, may cause the cycle of operations to grind to a halt.*



Parts involved with unlocking and that could be involved with a malfunction include:

### Cartridge

Low pressure (energy) due to insufficient or fouled powder.

### Gas Port

Small.

Blocked.

Incorrectly located

**Gas Tube**

Blocked by cleaning materials or powder fouling.  
Worn, allowing gas to leak instead of being forced down carrier key.

**Carrier Key**

Blocked by cleaning materials or powder fouling.  
Worn, allowing gas to leak past gas tube.  
Loose.

**Carrier**

Worn bolt hole at base of expansion chamber allowing leakage between bolt stem and carrier.  
Eroded, uneven, or corroded carrier key surface.  
Cam track fouled, preventing cam pin movement.

**Bolt**

Worn stem, providing poor seal at base of expansion chamber.

**Bolt Rings**

Loose or broken, allowing gas leakage.

**Cam Pin**

Broken, jamming carrier movement.  
Rotated into cam pin relief cut opposite ejection port.

**Firing Pin**

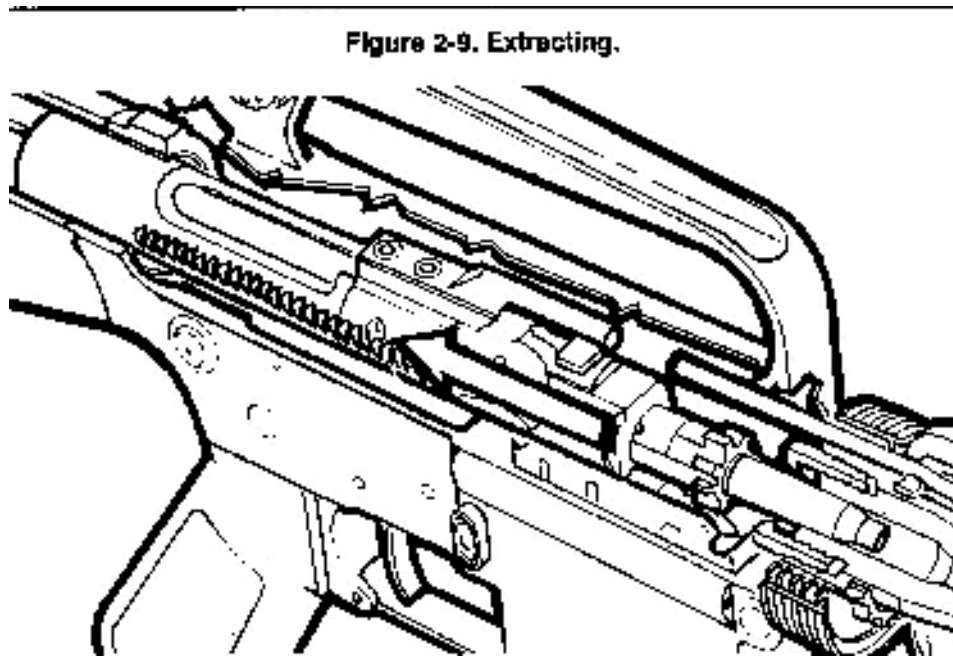
Broken, allowing cam pin to rotate.  
Incorrectly assembled.

**Firing Pin Retainer**

Out of position, jamming between carrier and receiver.

## Step 6: Extracting

The extractor draws the fired cartridge case to the rear, out of the chamber.



Parts involved with extracting and that could be involved with a malfunction include:

### **Operating Energy**

Insufficient energy or energy drained from the system due to items listed in Unlocking step above. Prevents continued rearward movement of carrier group.

### **Barrel**

Dirty, rough, or corroded chamber grips cartridge case.

Overheated, increasing resistance to extraction by preventing case contraction.

### **Cartridge Case**

Corroded, grips chamber and resists movement to the rear.

### **Extractor**

Broken or worn claw fails to grip case rim.

Bent.

### **Extractor spring**

Weak, broken.

Missing buna plug

### **Extractor pin**

Broken.

### **Buffer Spring**

Deformed

Corroded (non-stainless springs only)

## **Buffer**

- Pin backed out
- Buna bumper backed out
- Corroded

## **Lower Receiver Extension (“Buffer tube”)**

- Bent or dented
- Corroded
- Fouled

## **Failure to extract**

Failure designation and detailed discussion:

Designation: FX – Failure of a fired case to be successfully extracted from the rifle chamber.

Description: A failure to extract results when the fired case remains in the rifle chamber. While the bolt and bolt carrier may move rearward only a very short distance, more commonly the bolt and carrier recoil fully to the rear, leaving the fired case in the chamber. A live round is then forced into the base of the fired case as the bolt returns in counter recoil. This malfunction is considered to be one of the most difficult to clear.

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

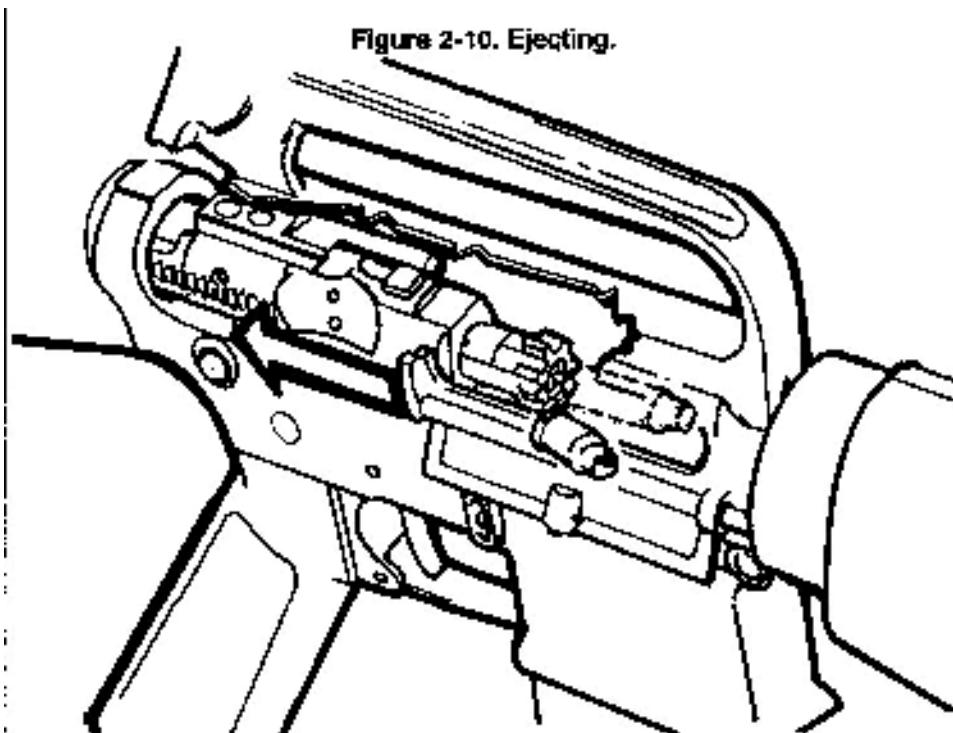
Corrective Action: The severity of a failure to extract determines the corrective action procedures which will be successful. If the bolt has moved rearward sufficiently to engage a live round, the magazine and all live rounds must be removed prior to attempting to extract the fired case. A cleaning rod must then be inserted in the bore in order to remove the fired case.

Malfunction Subtypes: Various degrees of cartridge-case rim damage are shown in Figure I-7 and illustrate, together with Figures I-9 and I-10, the five subtypes of failure to extract:

- Light or no extractor mark
- Hard extractor mark
- Partial rim shear
- Full rim shear
- Live round also jammed

## Step 7: Ejecting

The compressed ejector spring forces the ejector forward. The ejector drives the base of the cartridge case forward, and the cartridge case pivots about the extractor and flips out of the ejection port.



Parts involved with ejection and that could be involved with a malfunction include:

### **Extractor**

- Broken or worn claw fails to grip case rim.
- Bent.

### **Extractor spring**

- Weak, broken.
- Missing buna plug.

### **Ejector**

- Broken.
- Jammed by brass or other fouling.
- Bent.

### **Ejector spring**

- Weakened or broken.
- Deformed.
- Rusted.

### **Ejector Pin**

- Broken

## Failure to eject

Failure designation and detailed discussion:

Designation: FJ – Failure of a fired case to be completely ejected from the rifle.

Description: Ejection of a fired case is a function of automatic gun action regardless of the mode of fire. 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. On some occasions the fired case, while initially clearing the gun, may strike an outside surface and bounce back into the path of the bolt. This is usually referred to as spin-back.

Probable Cause: Ejection failures are difficult to diagnose, but 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 (including the gas tube) which may result in any of a number of failures including a failure to eject. Difficult extraction from a fouled or corroded chamber can also cause ejection failures.

Corrective Action: Immediate action should be carefully taken to avoid the risk of further jamming the rifle. While retraction of the charging handle will usually free the fired case and permit its removal, the charging handle must not be released until the position of the next live round is determined. If a live round has been sufficiently stripped from the magazine, or in some cases completely stripped from the magazine, then the magazine and all live rounds may also require removal before the charging handle should be released.

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. Note that the extractor spring cannot be easily removed from the extractor without damaging the spring, although a new extractor spring can be properly installed if care is exercised.

Malfunction Subtypes: Four main subtypes and a rare fifth subtype of failure to eject exist:

- Base exposed outside the ejection port
- Mouth exposed outside the ejection port
- No portion exposed outside the ejection port
- Live round also jammed under the exposed cartridge case
- Fired round re-chambered (rare)

The fifth subtype is uncommon: the fired cases, which has not been successfully ejected, is found to be completely rechambered and the bolt is fully closed and locked. This should not be confused with a failure-to-extract (FX).

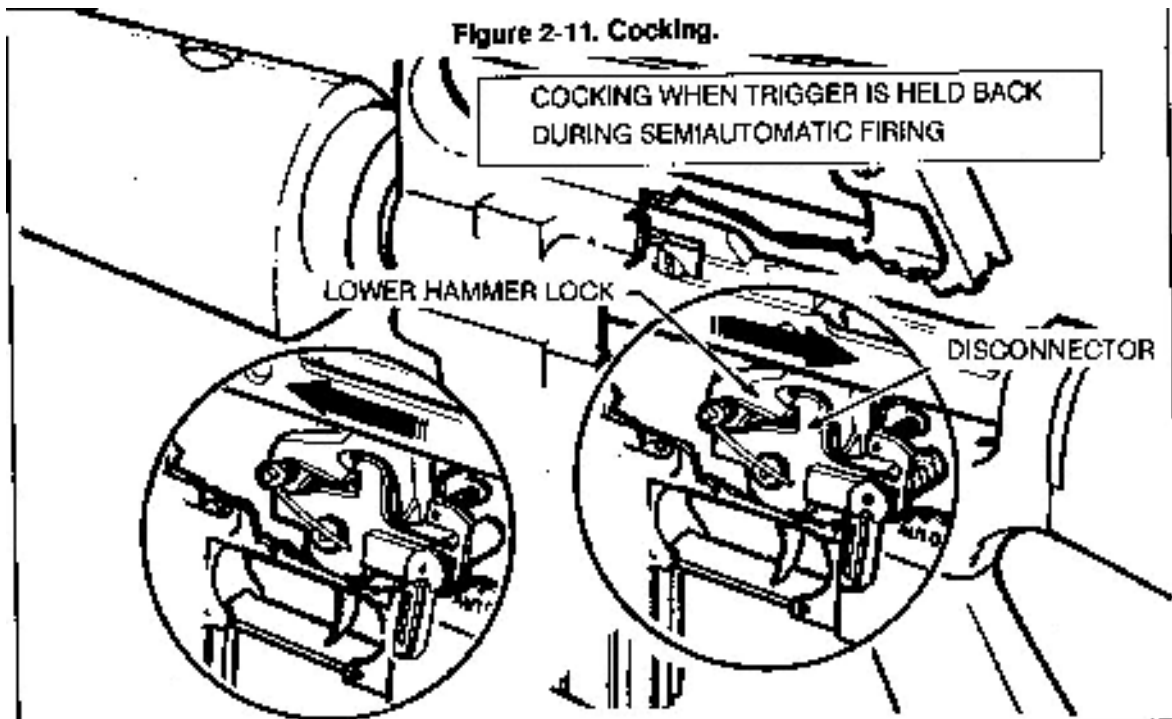
The determining factor in deciding whether a *failure-to-eject* or a *failure-to-extract* has occurred is the nature of the clearing action required to overcome the malfunction. If the fired case can be cleared by simply retracting the charging handle, a failure to eject has occurred; if difficulty is encountered to the extent that repeated charging handle cycles are required or if tools (cleaning rod, bayonet, or another tool) are required to clear the malfunction then a failure-to-extract has occurred.

## Step 8: Cocking

The rearward movement of the bolt carrier forces the hammer down into the receiver and compresses the hammer spring. The carrier continues to the rear driving the buffer behind it to the rear and compressing the buffer spring. The buffer strikes the rear of the buffer tube and stops, which halts the rearward movement of the carrier group. The carrier is then driven forward by the buffer spring. The trigger is still pivoted to the rear by the trigger finger, so the primary sear surface at the lower front of the trigger is too low to catch the hammer when the carrier moves forward and frees it.

The action of the rifle is much faster than human reaction, so the firer cannot release the trigger fast enough to catch the hammer and prevent multiple firing. A spring-loaded disconnecter is therefore mounted on the trigger to automatically catch the hammer and prevent it from swinging forward to strike the firing pin again.

Cocking is complete when the automatic sear catches the hammer (in automatic or burst mode) or when the shooter releases the trigger (in semiautomatic mode or the final shot of automatic or burst mode). When the shooter releases the trigger, it pivots on the trigger pin so that the sear surface at the front of the trigger rises into position to catch the hammer. When the sear surface is high enough to safely catch the lower sear surface of the hammer, the hammer is released by the disconnecter. The shooter may then pull the trigger again to fire the next shot and start the cycle of operations over.

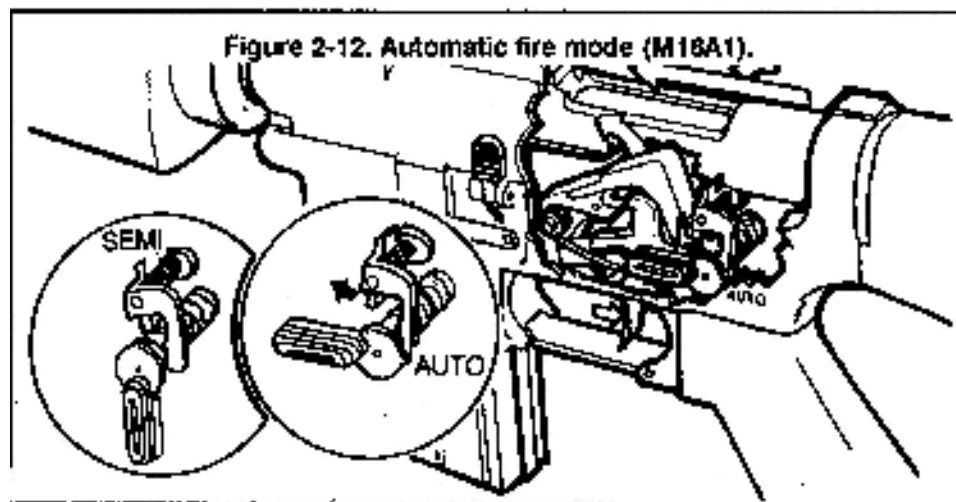


## AUTOMATIC FIRE MODE (M16A1 AND M16A3)

When the selector lever (Figure 2-12) is set on the AUTO position, the rifle continues to fire as long as the trigger is held back and ammunition is in the magazine. The functioning of certain parts of the rifle changes when firing automatically.

Once the trigger is squeezed and the round is fired, the bolt carrier group moves to the rear and the hammer is cocked. The center cam of the selector depresses the rear of the disconnecter and prevents the nose of the disconnecter from engaging the lower hammer hook. The bottom part of the automatic sear catches the upper hammer hook and holds it until the bolt carrier group moves forward. The bottom part strikes the top of the sear and releases the hammer, causing the rifle to fire automatically.

If the trigger is released, the hammer moves forward and is caught by the nose of the trigger. This ends the automatic cycle of fire until the trigger is squeezed again.



## BURST FIRE MODE (M16A2)

When the selector lever is set on the BURST position (the same position as the AUTO markings of the M16A1 and M16A3), the rifle fires a three-round burst if the trigger is held to the rear during the complete cycle. The weapon continues to fire three-round bursts with each separate trigger pull as long as ammunition is in the magazine. Releasing the trigger or exhausting ammunition at any point in the three-round cycle interrupts fire, producing one or two shots. Pulling the trigger again only completes the interrupted 3 shot cycle – allowing only the one or two shots remaining in the burst to fire.

This is not a malfunction. The M16A2 disconnecter has a three-cam mechanism that continuously rotates with each firing cycle. Based on the position of the disconnecter cam, the first trigger pull (after initial selection of the BURST position) can produce one, two, or three firing cycles before the trigger can be pulled again. The burst cam rotates until it reaches the stop notch.

Parts involved with cocking and that could be involved with a malfunction include:

**Hammer**

Disconnecter hook worn or broken.

**Disconnecter**

Broken or worn hammer catch

**Disconnecter spring**

Broken



## FINAL EXAM

1. You assembled a carbine, and it works fine when you shoot it. Your best friend loves to fire the carbine on full auto, but it can't empty his five magazines without a failure. It fails to eject and your buddy thinks you're a likable incompetent but is concerned that he might need the carbine to work some day. A fired and a live cartridge are jammed in the upper receiver. What could be wrong?
2. You are installing a new carrier key on the carrier. How tight do you tighten it?
3. You have a bucket of used magazines. Your best friend wants a magazine that he can stake his life on. How will you decide which one will you issue to your best friend?
4. Your best friend's rifle fails to fire about every fifth shot. He's starting to doubt your skills. What's wrong?
5. Now that you've fixed the rifle again, your friend can shoot it. It shoots to left, even when he's got the rear sight fully to the right. What are you going to do now?
6. Now that the carbine is sighted, it starts to fire two shots (to double) when your friend shoots it on semiautomatic. You need to get the rifle working until new parts can arrive. What are you going to do?
7. The rifle is short-stroking. What could be wrong? (name four possibilities)

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8. Your best friend has given up on you and decided to stick with a shotgun. Which one would you recommend?

