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**AR-15/M16**

**ARMORER COURSE**

## AR-15/M-16

This course is designed for law enforcement personnel who are charged with maintaining AR/M-16 type firearms. There are several different manufacturers and variations that you may be called upon to service.

I strongly urge you to wear glasses at all times when working on any firearm. Parts may be launched into the ceiling may cause embarrassment, a part launched into your face may be tragic and end your career. When working on any rifle you must ascertain that it is unloaded, every time you handle it. Control the direction of the muzzle at all times.

The use of a chamber flag is highly recommended. To use it, remove the magazine, lock the bolt open, visually inspect to verify the chamber is empty and insert the chamber flag. You can now ease the bolt forward. Anyone can now handle the firearm knowing that it is not loaded.

Armalite and specifically Eugene Stoner developed the M-16 rifle in the late 1950s. The M-16 sprang from the design of the AR-10 which competed with the M-14 for adoption in the mid 1950s. After limited success in 1959 the design was sold to Colt. In 1963 the M-16 became the standard issue of U.S. military troops.

The M-16 family of weapons is a select fire, gas operated, air cooled, magazine fed, shoulder fired weapon. It was the first of its kind to utilize the direct gas impingement system and to fire a small caliber high velocity cartridge.

### **Principles of Operation**

The AR platform uses the direct impingement gas system to function and cycle the action. A small amount of propellant gas is bled off through the gas manifold, that gas travels through a tube into the action, it then travels through a gas key located on the bolt carrier. Here the gas passes through the key and strikes the bolt stem and gas rings, this forces the bolt rearward, unlocking the bolt from the barrel by the cam pin that rotates the bolt head. The bolt travels rearward, pulling the spent cartridge from the chamber and ejecting it. At the end of the bolts rearward travel, it picks up another cartridge from the magazine and the buffer spring/buffer force the bolt forward into lock up chambering another cartridge.

## **Operational Check/Function Check**

An operational check is done, and inspection is done without the firearm being fired. To check the mechanical function, first be sure the firearm is unloaded. Lock the bolt to the rear, engage the safety, drop the bolt to the battery position. Try to fire the weapon, the hammer should not drop while the safety is engaged. Disengage the safety and dry fire the weapon, the hammer should drop and strike the firing pin. Hold the trigger to the rear and cycle the bolt, continue to hold the trigger to the rear. After the bolt is closed, release the trigger. You should hear a "click" and that is the disconnecter releasing the hammer. The hammer should not go fully forward and strike the firing pin. With the safety disengaged a pull of the trigger should release the hammer.

## **My AR Notes**

A2 receivers have a reinforcing ridge added to the receiver extension, A1s do not

Receiver material was originally 7075 and changed to 6061, now we are back to 7075

Barrel twist rates-early prototypes were 1-14", it was changed very quickly to 1-12", these twist rates are good for lighter projectiles. The 1-8" twist rate is good for the heavier projectiles and will still shoot the lighter bullets without loss of accuracy

I like to polish a few parts, break the corners of the magazine release bar, and polish the leading surface of the extractor (so it slides over the case head) and polish the ejector face so it slides over the case as the bolt rotates

A good magnet on your bench keeps those small parts from getting lost or scattered

Receivers-a lower receiver does not do much work, that's why a lower can be made from plastic (I did not say it was a good idea, just that it's possible) and I do not like loose fitting uppers and lowers, What really matters in a lower are that all the holes and machining has been done correctly and the receiver properly finished, I like billet receivers but really no better in function, accuracy, or reliability 7075 T6 aluminum is stronger and harder than 6061

Parts is Parts- until it fails or does not, parts like pins, springs, detents, buffer retainer, all almost always work, fit, and function I want good hammer and trigger pins, no wobble in these Parts prone to failure like bolt stops and extractors should not be scrimped on, buy the best

Barrels-the barrel is the heart of any firearm I like accuracy, but for a duty gun we do not need MOA accuracy at 300 yards nobody needs a bad barrel Its important to always hit the target accuracy si always better but the end result is hit your target buy a good barrel MATCH GRADE- that's crap, anyone can produce a barrel and make a claim, there are no industry standards which is better cut rifling or button? Well depends on who you ask, button is smoother, cut barrels have less stress Hammer forged barrels are stress relieved and have smooth rifling Stainless or chrome moly? Either will work Chrome lining? It extends barrel life and resists corrosion, it's a plating process and improperly applied will adversely effect accuracy

Get the best barrel you can afford

Feed Ramps-know the difference between M4 ramps and rifle ramps You can not use an M4 ramp upper with a rifle ramp barrel extension, M4 is better

Chambers-NATO chambers (5.56) have long leade not the best for accuracy but designed to handle higher pressures NATO ammo is about 7,000 PSI (62,000 PSI) higher than commercial SAMMI specs Bill Wylde chambers work with both NATO and commercial and good for accuracy too

Gas manifolds-I like the clamp on style, the do not leak I like steel, gas cuts metal and aluminum cuts faster than steel

BCG-true military spec is fine, I like plated, lower friction and cleans up easy Ther are hard chrome, boron nitride, titanium sulfide, NP-3, and nickel boron to name a few bolts should be made from 8620 tool steel I like M16 style carriers, never use a bolt with an oversize firing pin hole, never, the hole should measure .058 and no bigger than .062, oversized hole will cause pierced primers, get the correct firing pin, there are large collar and small collar pins, large collar M16, small collar AR15 configuration, you can run a small collar pin in either carrier, but you may not run a large collar pin in an AR configuration, firing pin retainers, a lot of junk out there, if using a cotter pin style make sure the arms are not bent, are of equal length, and the ends come together, I like the Armalite pin

Extractors- get the best you can afford, polish it, and run it No need for "O" rings, inserts or gadgets for proper extraction the real cure is gas system timing and a smooth chamber

Buffer and springs-different weights for different applications

H1 3.8 oz

H2 4.6oz

H3 5.4oz

Increased weight buffers will help carbine cycling, springs are about 13 inches long and 41-43 coils on a rifle and about 10.5 inches long with 37-39 coils in carbine, same wire diameter for both

Gas tube-make sure its not touching the upper receiver, make sure it is aligned with the gas key, a gas tube alignment tool is great for setting up the tube

Triggers-I like the 2-stage triggers, I do not like adjustable triggers on a duty gun, there are a lot of good triggers on the market, I like Geissele and Rock River, a good trigger needs good pins too, not loose fitting ones

Grip screws-I like hex (allen head) head screws, easy to install, on a new receiver run the screw in and out once to clean up the threads, you do not want to cross thread a grip screw, the thread size is ¼ X 28, good idea to have a tap in you inventory to chase threads or fix any that were started cross threaded

Receiver extension tubes- there are 2 sizes, mil spec is 1.148 diameter and commercial is 1.168, the threads are the same

## **Tools**

Set of good pin punches

Set of good screwdrivers

Bench vise

Punch to set carrier key

Punch to set collar on carbine stock

Special punch to install magazine release

Good brass/plastic hammer

Sight tool for both A1 and A2 sights

Lower receiver vise block

Upper receiver vise block

M4 stock wrench

Smith Enterprise armorer wrench

Handguard removal tool

Bench block

If you are taking barrels off and on you will need these too:

Set of barrel vise jaws

Barrel nut alignment gauge

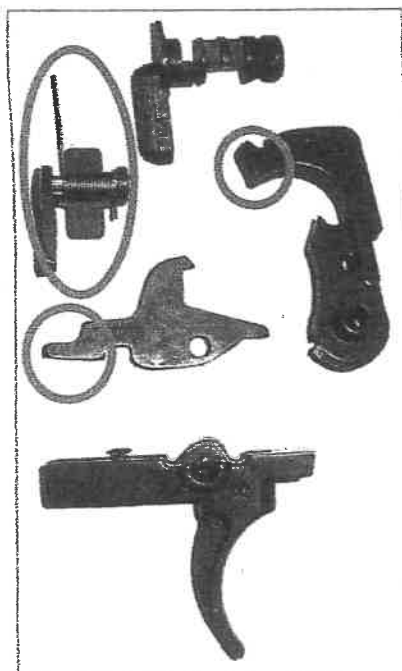
No-Go headspace gauge

If you are taking off/on floating handguard tubes you will need a strap wrench

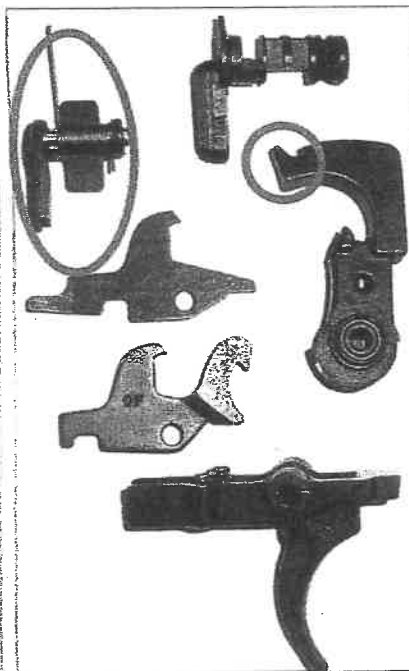
Not necessary but I like a bolt vise when disassembling and re-assembling bolt

Hammer block drop

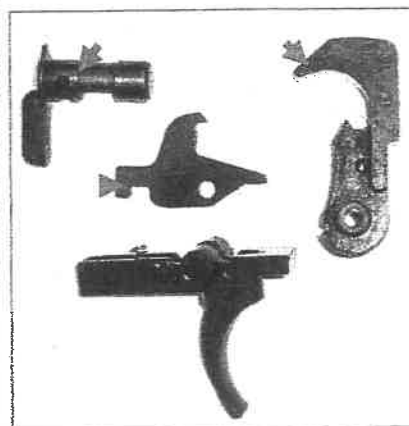
**FIRE CONTROL GROUP VARIATIONS**



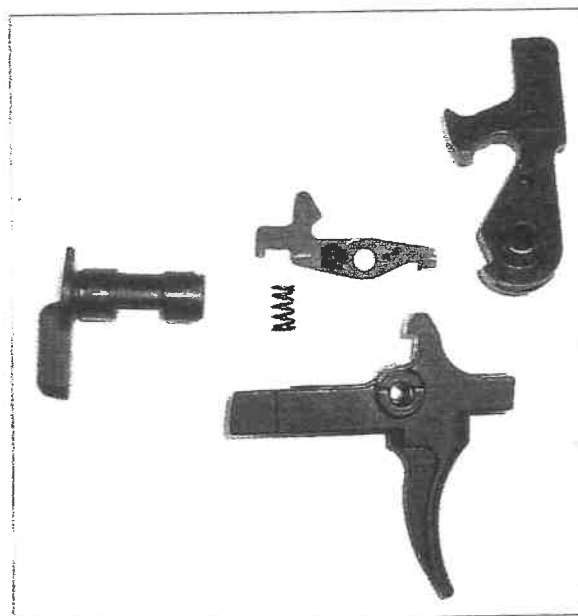
**Semi/Automatic**



**Semi/3-Round Burst**



**Semi Auto Only**

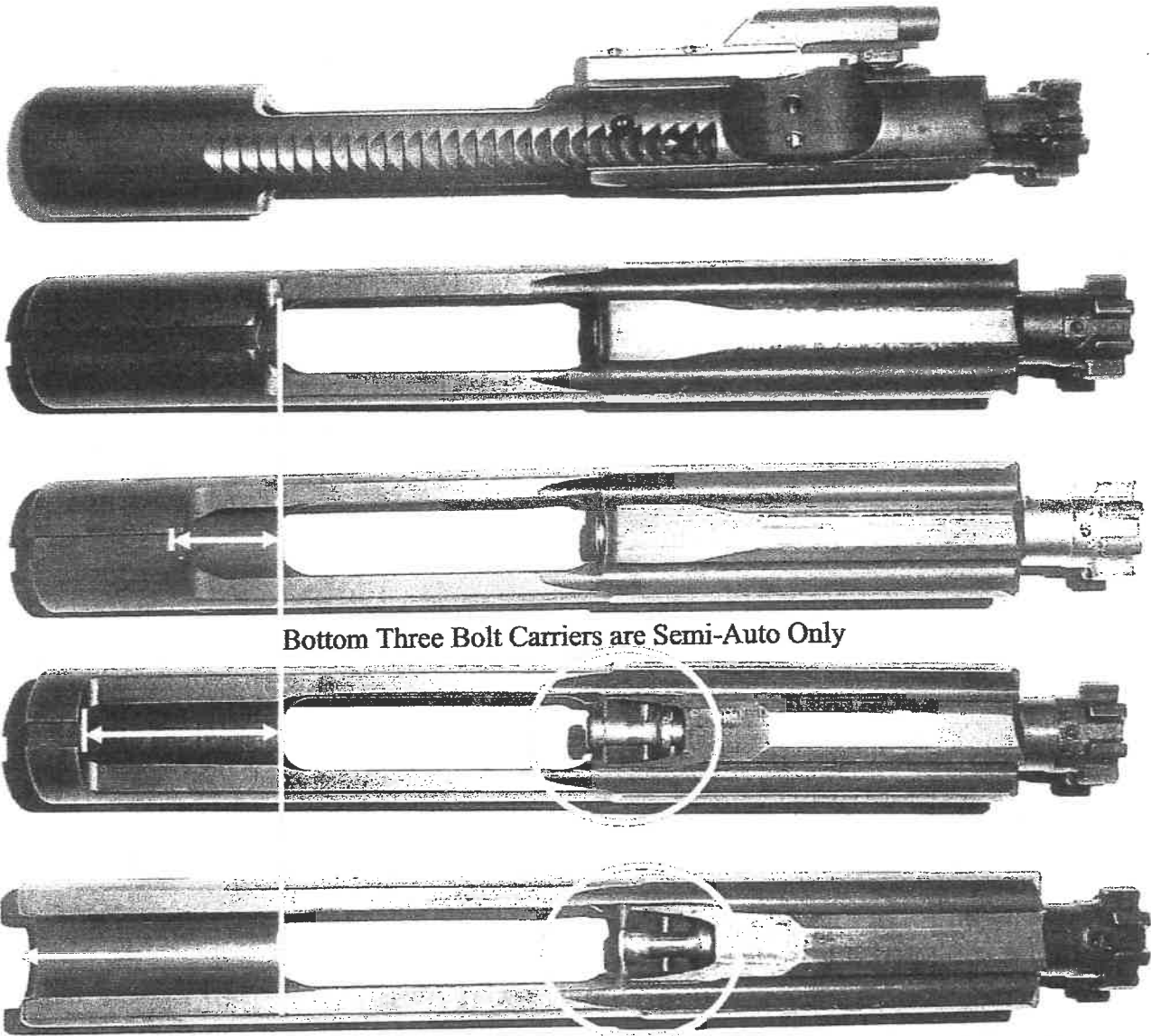


**2 Stage Semi-Auto Only**

# Disassembly

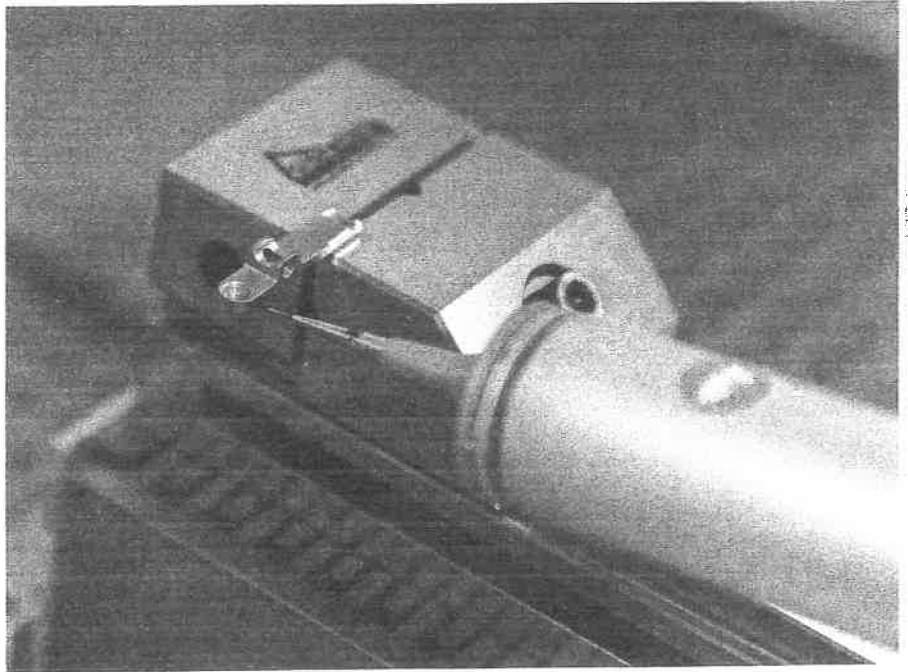
## The Bolt Carrier Group

### The Bolt Carrier

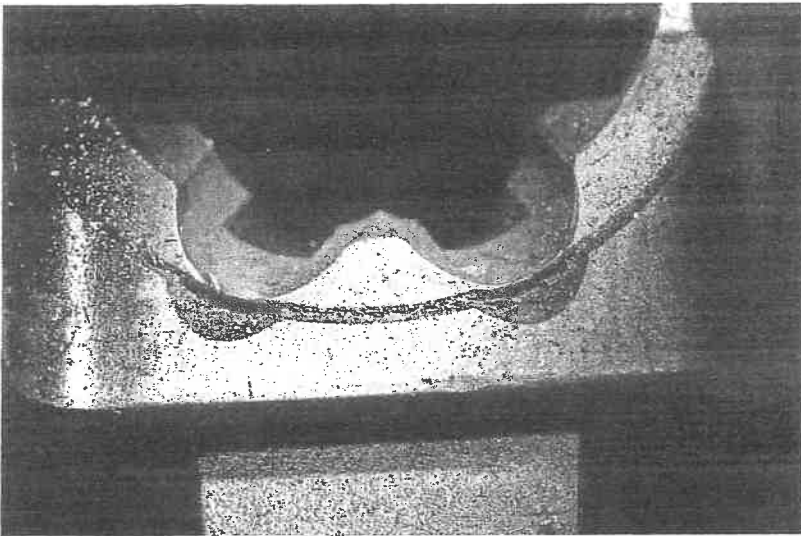


Depending of the manufacturer and the model you may have different bolt carrier groups. Many rifles come with selective fire bolt carriers. Others may have the sear trip area cut back or removed to prevent use with a auto sear (anti-conversion). Some may be set up with a anti slam fire devise where the rear of the firing pin is exposed. With the notch cut on the semi-auto hammer, the notch will get caught on the head of the firing pin to prevent slam fire. This will mostly be seen with post 1993/pre 2006 Colt rifles.

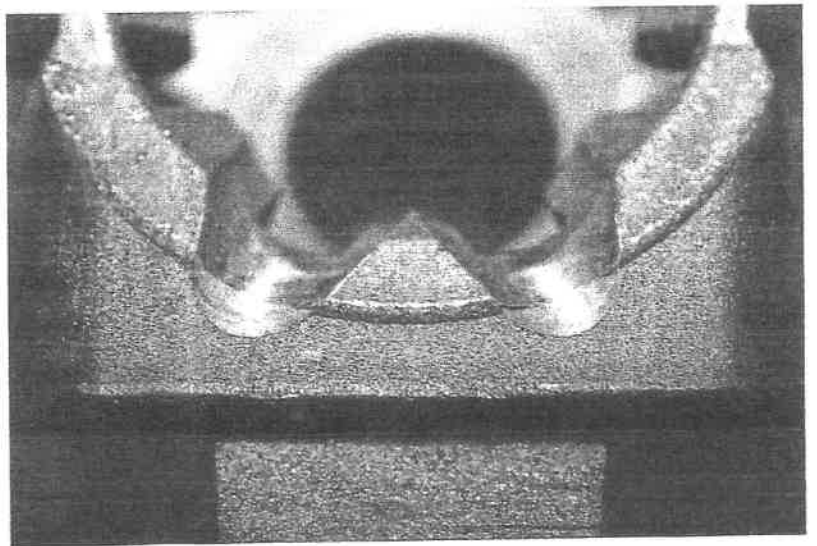




*Modern manufacturing holds all parts to amazing tolerances.*



*This is a mis-match of feed ramps that will cause you headaches.*



## **Understanding 5.56 and .223 Chambers**

First there are no critical differences in .223 and 5.56 NATO cartridge dimensions. Chamber headspace gauges are different, not because of cartridge differences but because of chamber specifications.

SAMMI (sporting arms and ammunition manufactures institute) provides information that defines modern center-fire cartridge specifications. Most all manufactures tend to follow SAMMI for specifications and pressures.

NATO has standard ammunition that is used by member nations, including the USA. NATO has its own set of dimensions and standards for chamber pressure and size.

The 5.56 NATO round and the .223 Remington round came from vastly different circumstances. The .223 round was developed from the .222 Remington round. When Armalite started their small caliber-high velocity experiments it was clear early on that the commercial round could meet the velocity and penetration requirements. Remington created the 5.56 X 45mm and it was officially adopted in 1963. This round became commercially available as the .223 Remington. It was considered a varmint round. The application of a small light bullet of 50-55 grain was the norm, chamber leade was short to accommodate the light bullets. The leade of the NATO 5.56 was much longer. Leade is the amount of free bore (space) between the end of the cartridge case and first point forward where the bullet meets the rifling in the bore. This is the funnel that guides the bullet into the bore. This is also where the pressure is the highest during firing. The NATO leade being much longer, therefore room for more volume for expanding gases, which reduce pressure. There can be a difference of 10,000 PSI difference firing the same ammo in SAMMI and NATO chambers.

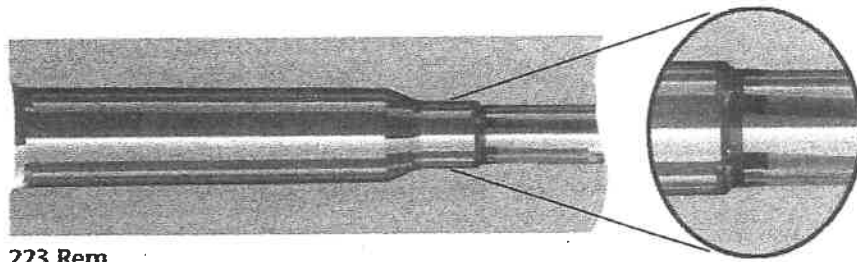
### **NEVER FIRE NATO SPEC ROUNDS IN A .223 REMINGTON CHAMBER**

It is ok to fire a .223 Remington in a NATO chamber.

One more thing, the Wylde Chamber. Bill Wylde was from Greenup Illinois and built highly accurate AR rifles for the Olympics and NRA high power rifle competition. In competition, heavy bullets have become popular. This extends the accuracy distance of the .223/5.56 NATO cartridge. He employed a shorter leade (and a gentle leade-in angle) than the NATO chamber and a bit longer than the .223 Remington chamber. It is a compromise. By doing this he has less bullet jump and less bullet deformation when firing a round in the Wylde chamber. We can shoot 5.56 NATO in a Wylde chamber.

Now we just need to identify those .223 Remington, 5.56 NATO, and Wylde chambers so we will know what ammunition is safe to use.

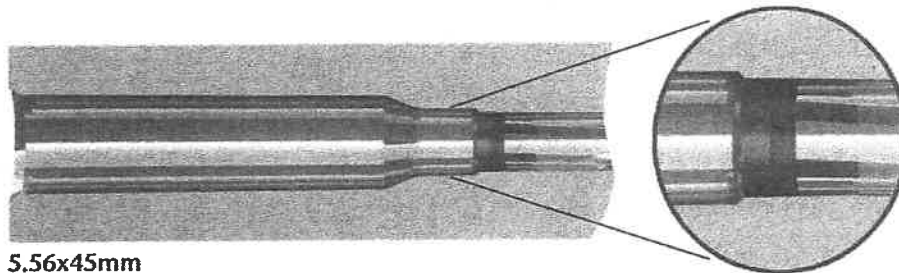
## 5.56X45MM VERSUS 223 REM.



223 Rem.

Freebore .224 Dia.  
Freebore Length  
.025 Inches

Throat Angle  
3 Degrees 10 Minutes  
36 Seconds

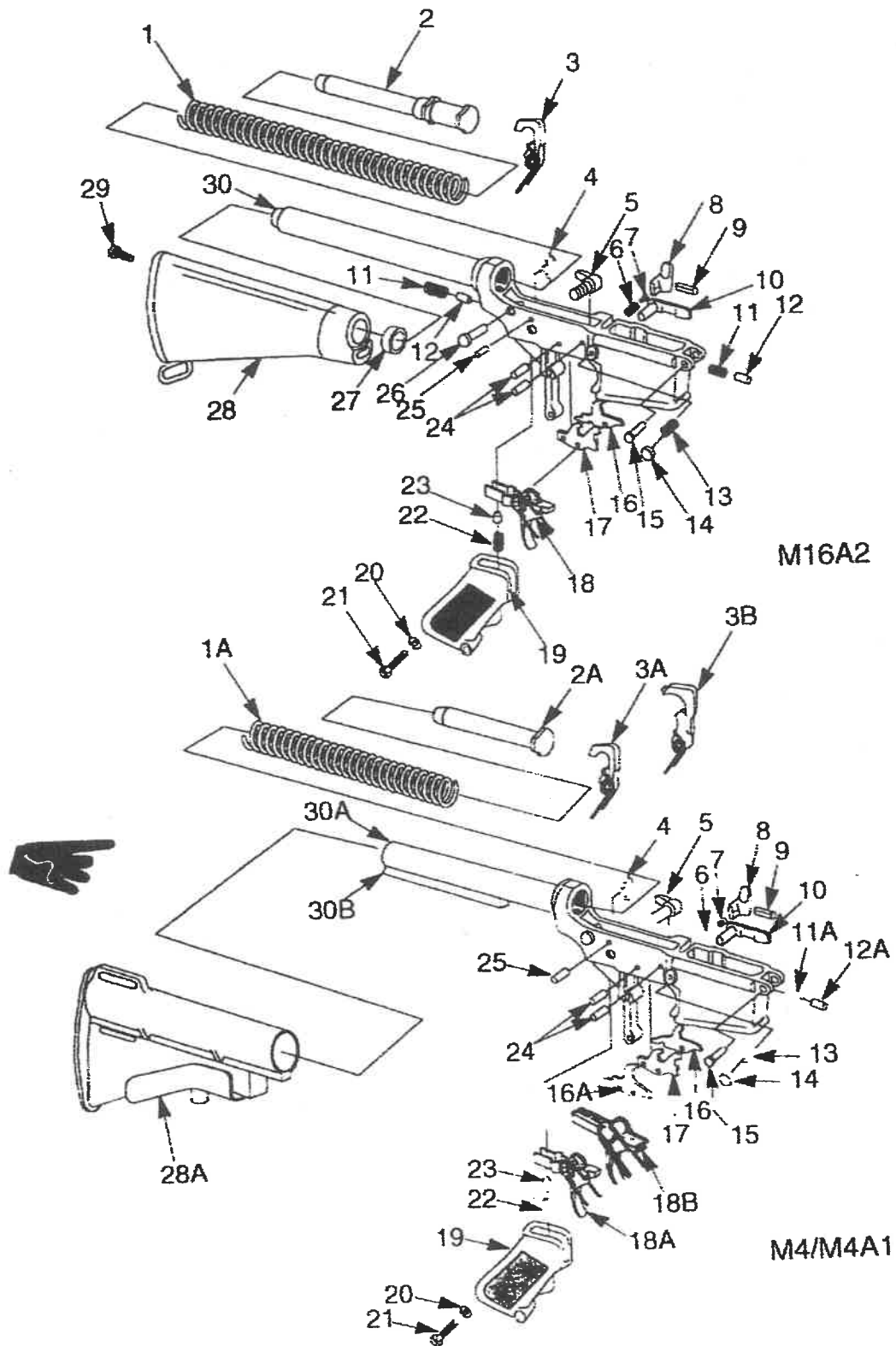


5.56x45mm

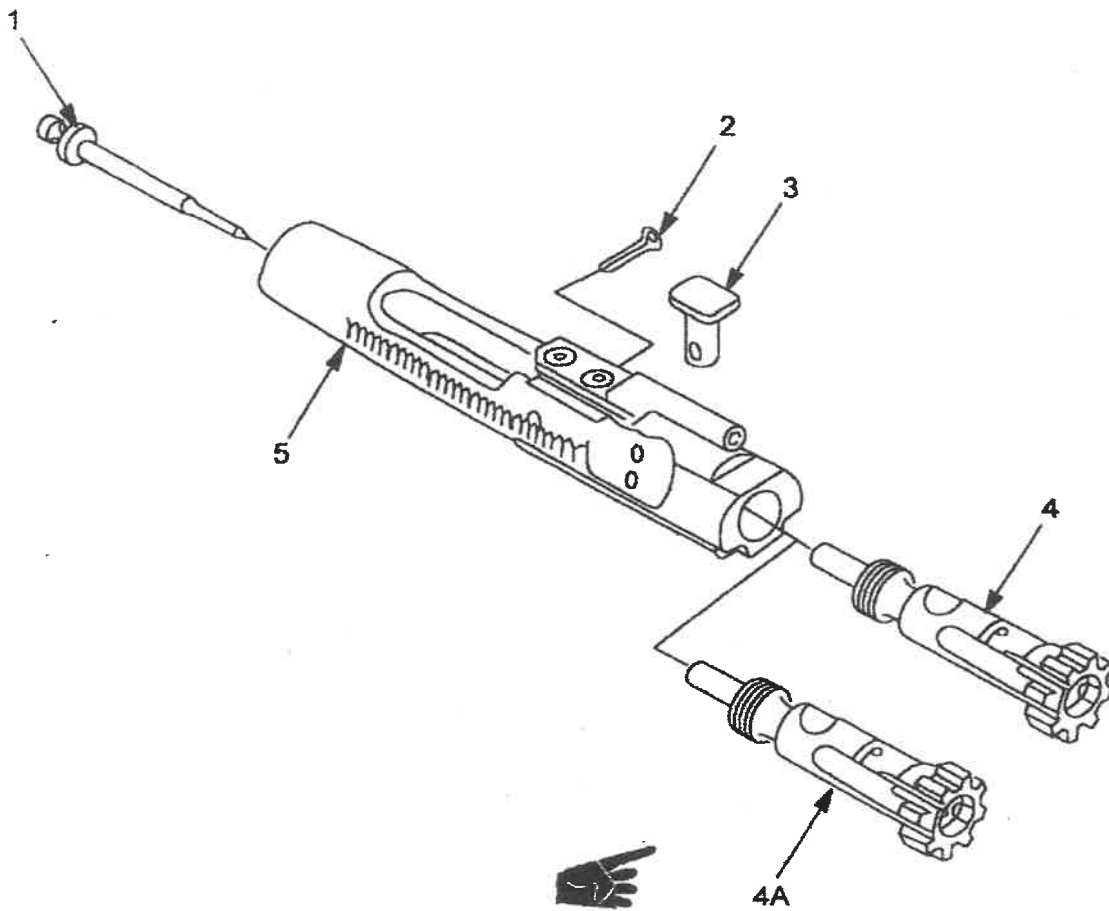
Freebore .226 Dia.  
Freebore Length  
.059 Inches

Throat Angle  
1 Degree 13 Minutes  
20 Seconds

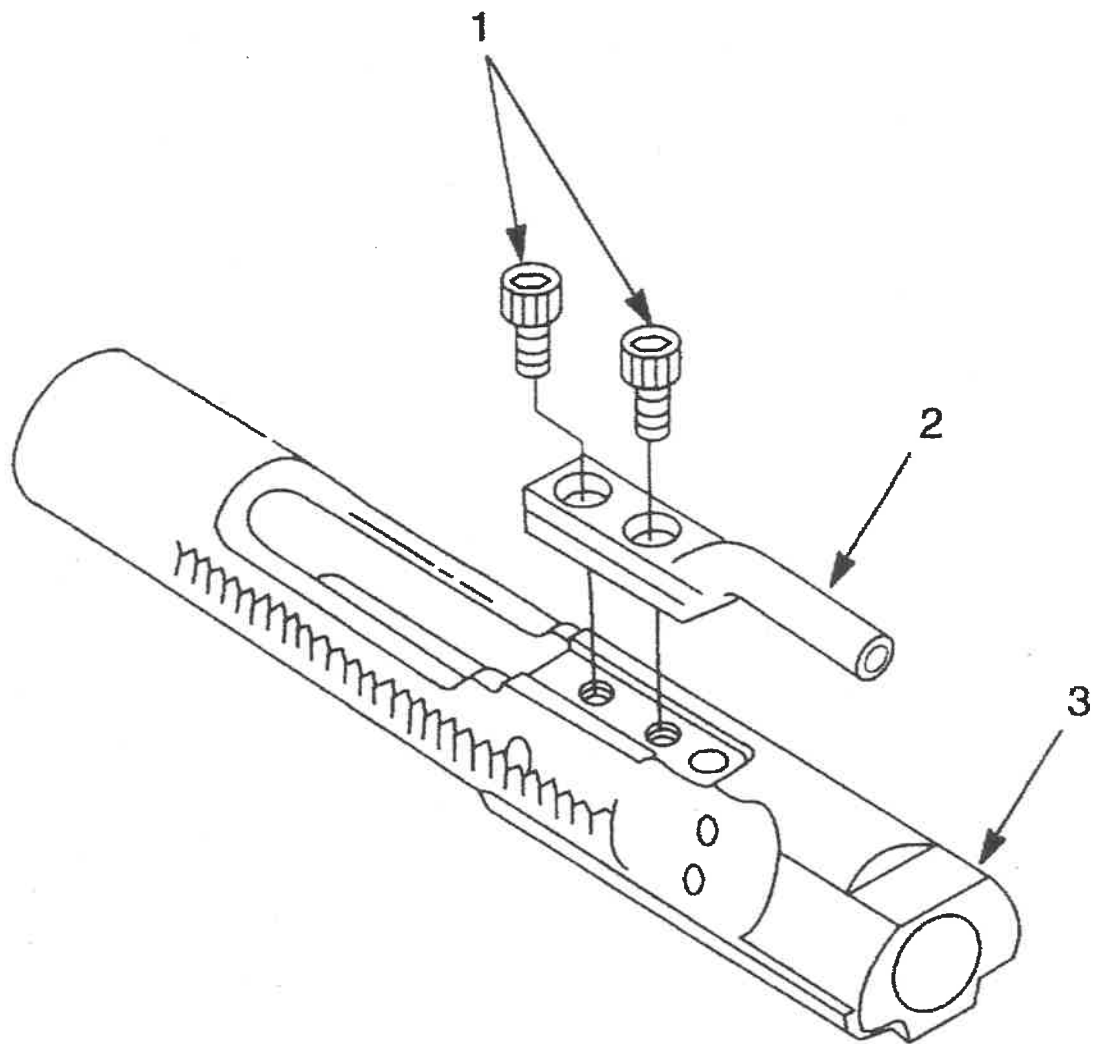
Both of these popular calibers feature a .224-inch-diameter bullet and an identical overall length. However, the throat length for 5.56x45mm is longer than that of 223 Rem. As a result, you can safely shoot 223 ammunition in a 5.56 chamber, but not 5.56 in a 223 platform, as it can result in excessive pressures upon ignition.



<b>Part</b>	<b>Identification</b>
1	Action Spring (Rifle)
1A	Action Spring (Carbine)
2	Buffer Assembly (Rifle)
2A	Buffer Assembly (Carbine "H")
3	Hammer Assembly BURST (M16A2/M16A4) Black Cam
3A	Hammer Assembly BURST (M4) Nickel Cam
3B	Hammer Assembly AUTO (M16A3/M4A1)
4	Automatic Sear
5	Selector Lever
6	Bolt Catch Spring
7	Bolt Catch Plunger
8	Bolt Catch
9	Bolt Catch Spring Pin
10	Magazine Catch
11	Takedown/Pivot Pin Detent Spring
12	Takedown/Pivot Pin Detents
13	Magazine Catch Spring
14	Magazine Catch Button
15	Front Pivot Pin
16	Semi-Auto Disconnect (M16A2/M4)
16A	Auto Disconnect (M16A3/M4A1)
17	Burst Disconnect (M16A2/M16A4/M4)
18	Trigger Assy (M16A2/M16A4)
18A	Trigger Assembly (M16A2/M16A4)
18B	Trigger Assembly (M16A3/M4A1)
19	Pistol Grip
20	Pistol Grip Lock Washer
21	Pistol Grip Screw
22	Safety/Ejector Spring
23	Safety Dent
24	Hammer/Trigger Pin
25	Automatic Sear Pin
26	Rear Takedown Pin
27	Stock Spacer (M16A2/M16A3/M16A4)
28	Buttstock Assy (M16A2/M16A3/M16A4)
28A	Buttstock Assy (M4/M4A1)
29	Buttcap Screw (M16A2/M16A3/M16A4)
30	Lower Receiver and Receiver Extension Assembly (M16A2/M16A4)
30 A	Lower Receiver and Receiver Extension Assembly (M4)
30B	Lower Receiver and Receiver Extension Assembly (M4A1)

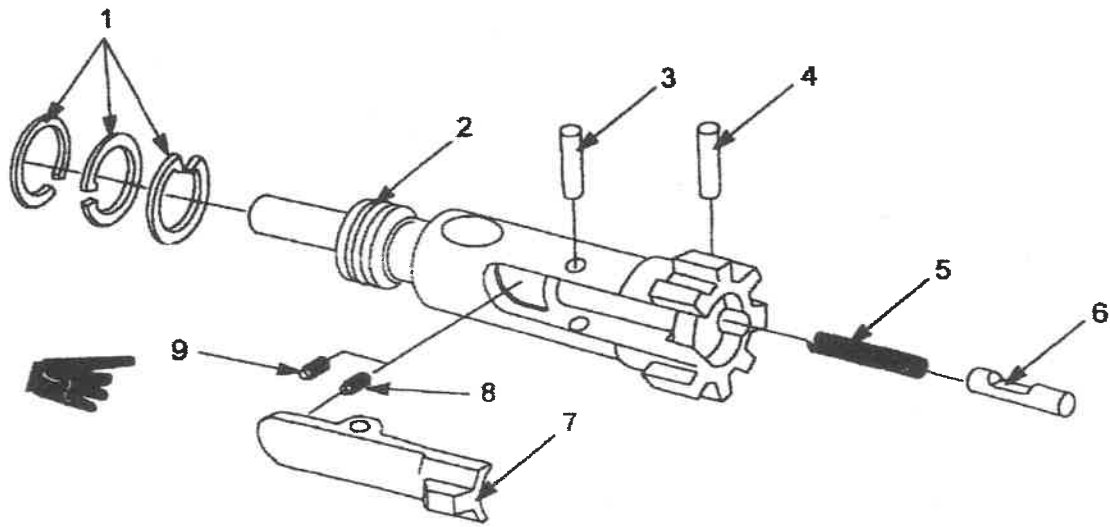


Part	Identification
1	Firing Pin
2	Firing Pin Retainer Pin
3	Cam Pin
4	Bolt Assembly Rifle (Obsolete)
4A	Bolt Assembly Carbine (Updated Gold Extractor Spring)



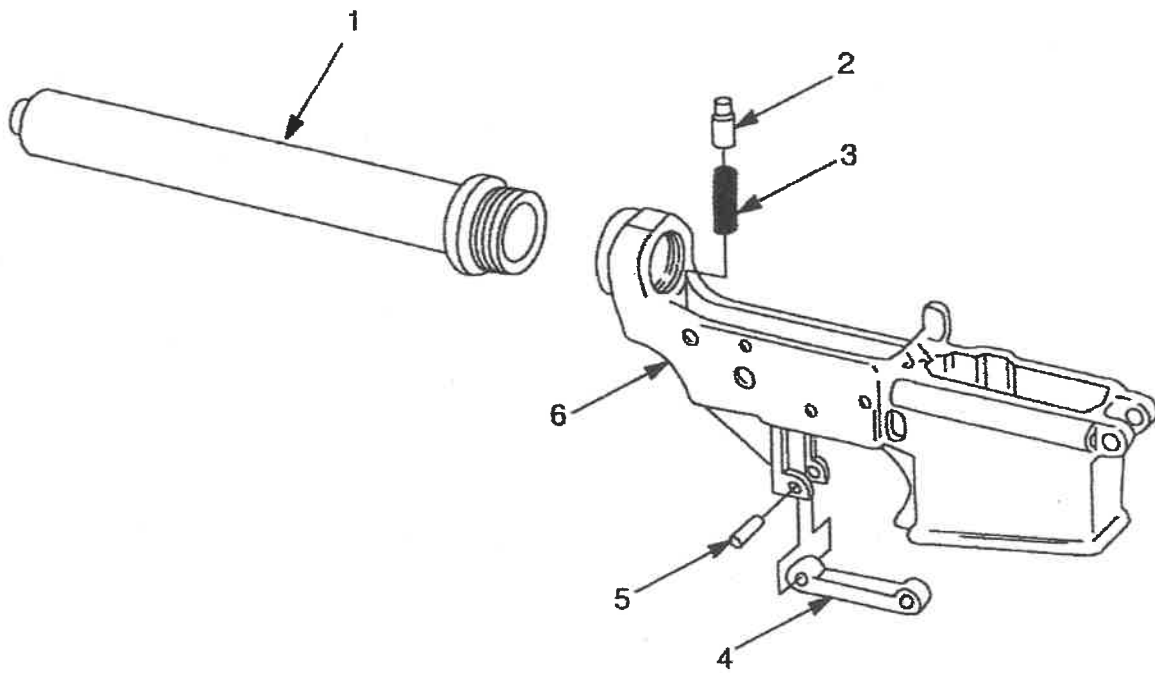
<b>Part</b>	<b>Identification</b>
1	Bolt Carrier Key Screws
2	Bolt Carrier Key
3	Bolt Carrier

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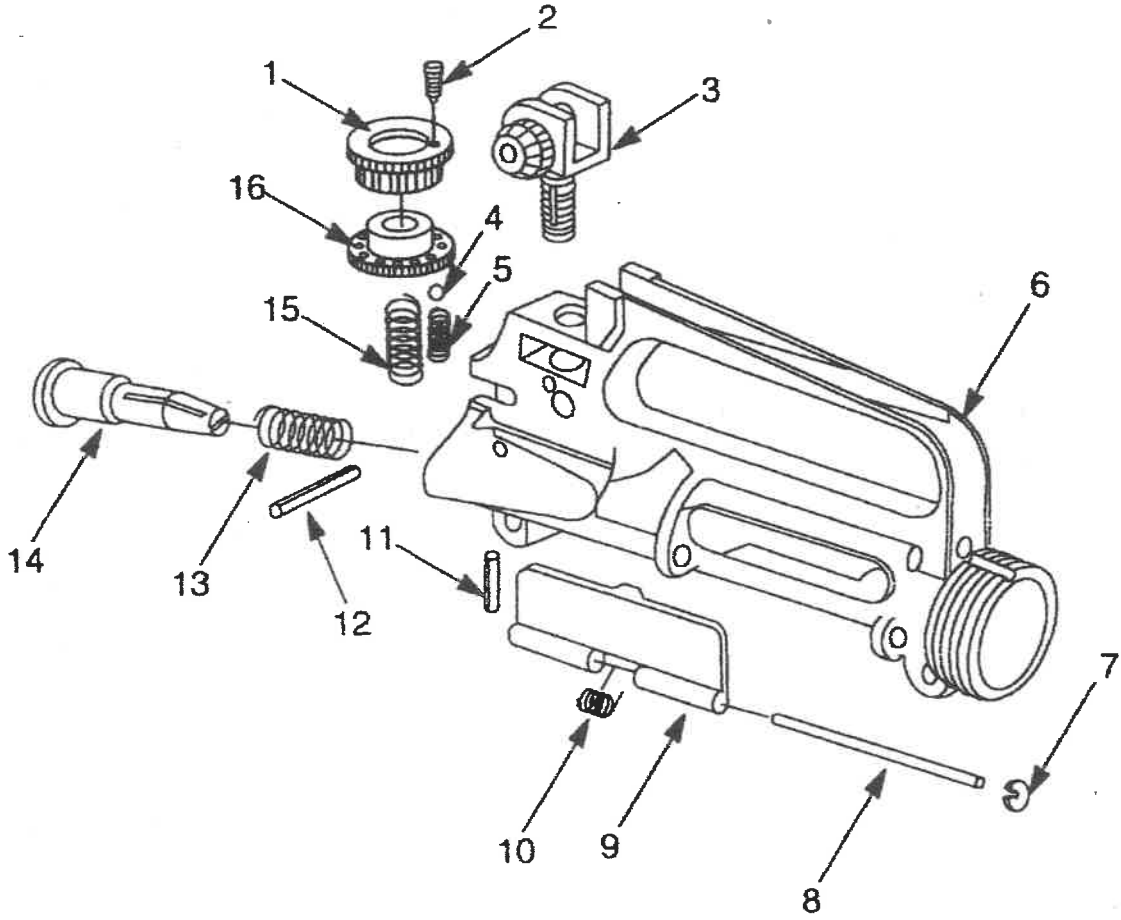
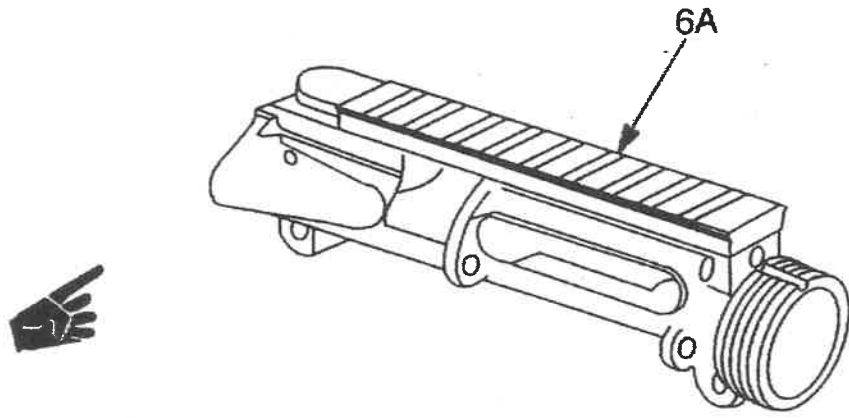


Part	Identification
1	Gas Rings (x3)
2	Bolt
3	Extractor Pin
4	Pin, Spring, Ejector
5	Ejector Spring
6	Ejector
7	Extractor
8	Extractor Spring Assembly (spring and buffer) Rifle
9	Extractor Spring Assembly (Gold Spring and Black Buffer) Carbine



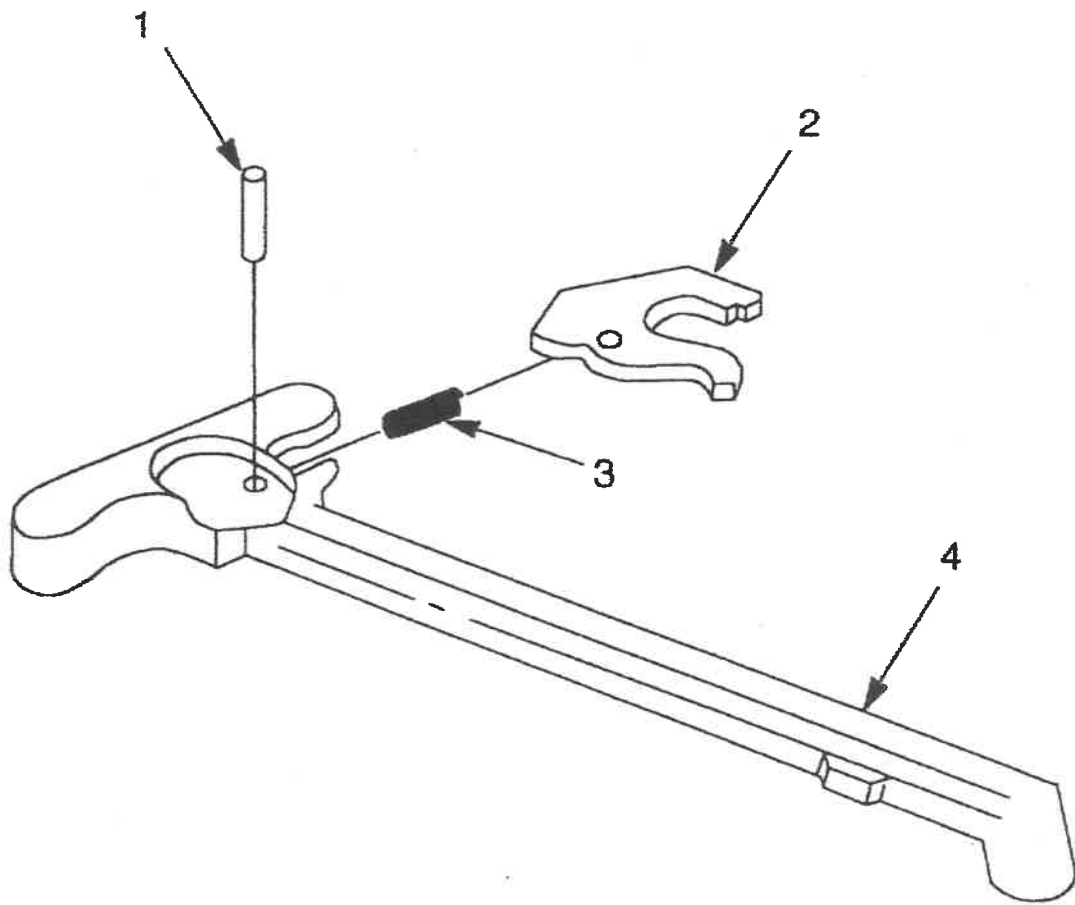


<b>Part</b>	<b>Identification</b>
1	Receiver Extension (M16A2/M16A3/M16A4)
2	Buffer Retainer Pin
3	Buffer Retainer Spring
4	Trigger Guard Assembly
5	Trigger Guard Pin
6	Lower Receiver



<b>Part</b>	<b>Identification</b>
1	Index Elevation (M16A2)
2	Index Screw
3	Sight Assembly (M16A2)
4	Ball Bearing
5	Spring, Helical, Compression
6	Upper Receiver (M16A2)
6A	Upper Receiver (M4/M4A1)
7	C Clamp, Ejection Port Cover Rod
8	Ejection Port Cover Pin
9	Ejection Port Cover
10	Ejection Port Cover Spring
11	Forward Assist Spring Pin
12	Pin, spring (M16A2)
13	Forward Assist Spring
14	Forward Assist Assembly
15	Elevation Knob Spring (M16A2)
16	Elevation Knob (M16A2)

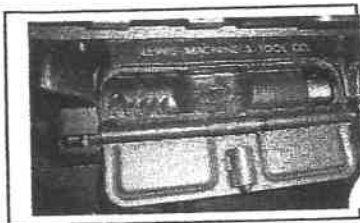
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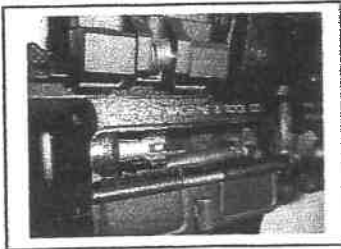


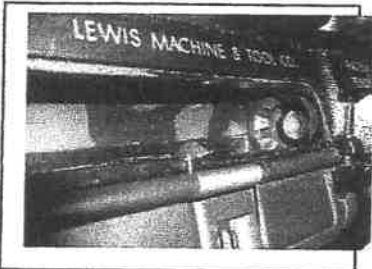
<b>Part</b>	<b>Identification</b>
1	Pin, Spring, Charging Handle
2	Latch, Charging Handle
3	Spring, Helical, Compression
4	Handle, Charging

## TROUBLESHOOTING

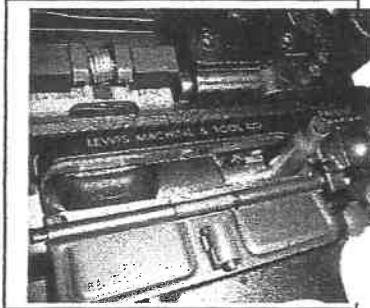
The troubleshooting instructions, which follow, are to assist the armorer to diagnose, repair the weapon system to get it back into service. Each failure is specific to the part of the cycle of operation in which it occurs and narrows down what parts affect that particular malfunction.

Failure	Possible Problem	Solution
1. Failure of magazine to lock in place.	Magazine catch is dirty or rusted.	Remove catch and clean. Lubricate with CLP.
	Damaged or broken magazine catch	Replace spring
2. Failure to Feed	Damaged or broken magazine catch	Replace spring.
	Damaged or broken magazine catch.	Replace catch.
	Magazine catch is out of adjustment.	Adjust magazine catch.
	Check to insure proper buffer is used. Check and replace if needed.	
	Defective magazine.	Replace.
	"Short Recoil"	See "Short Recoil"
3. Failure to Chamber	Weak or broken action spring.	Replace action spring.
	Defective magazine.	Replace magazine.
	Defective cartridge.	Replace cartridge.
	"Short Recoil"	See "Short Recoil".
4. Failure of Bolt to lock.	Missing cam pin.	Replace cam pin.
	Damaged bolt carrier.	Find area of malfunction.
	Loose carrier key screws.	Remove and replace carrier key and screws.
	Improperly assembled extractor assembly.	Assemble properly.

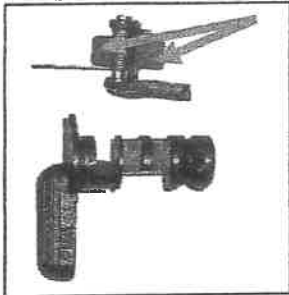


<b>Failure</b>	<b>Possible Problem</b>	<b>Solution</b>
Failure of bolt to lock continued...	Bent gas tube.	Either bend back or replace gas tube.
	Weak or broken action spring.	Replace action spring.
	“Short Recoil”	See “Short Recoil”.
5. Failure to Fire	Not loaded.	Load rifle.
	Carbon in firing pin recess.	Clean and lubricate.
	Broken hammer or hammer spring.	Replace hammer or spring.
	Improperly assembled hammer spring.	Assemble properly.
	Seized Burst Cam, not rotating.	Remove and clean Burst cam.
	Missing or damaged firing pin retainer pin.	Replace retainer pin.
	Seized selector lever in SAFE.	Remove selector, clean and lubricate.
6. Failure to Unlock	Damaged firing pin.	Check with gauge and Replace if needed.
	Burred or damaged locking lug.	File burr or replace bolt.
	Burred or damaged locking lug on barrel extension.	File or replace the entire barrel assembly.
7. Failure to Extract	“Short Recoil”	See “Short Recoil”
	Defective extractor.	Replace extractor.
	Defective extractor spring assembly.	Replace extractor spring assembly.
	Possible pitted chamber.	Check with bore reflector tool. Replace barrel if

		Defective over pressure ammo.	Chamber is pitted. Replace ammunition.
	Failure to extract Cont....	Debris in chamber.	Clean chamber.
8.	Failure to eject	Broken or missing ejector.	Replace.
		Ejector stuck/seized.	Disassemble and clean.
		Broken or weak ejector spring.	Replace.
		Defective underpowered ammo.	Replace ammo.
		"Short Recoil"	See "Short Recoil"
9.	Failure to cock	Worn or broken trigger nose.	Replace trigger assy.
		Worn or broken trigger notch.	Replace hammer.
		Worn or broken disconnecter notch.	Replace hammer.
		Worn or broken auto sear hook.	Replace hammer.
		Worn, missing or broken auto sear spring.	Replace automatic sear
		The burst cam is seized and not rotating.	Disassemble and clean.
10.	Short Recoil	Damaged or weak action spring.	Replace.
		Improper gaps in gas rings.	Stagger gas rings.
		Loose bolt carrier key.	Remove and replace carrier key and screws.
11.	Can not zero	Loose barrel.	Retighten/torque barrel.
		Bent barrel.	Re-bend or replace barrel.
		Barrel out of alignment with	Align barrel with sights.
		Defective front sight post.	Replace front sight post.

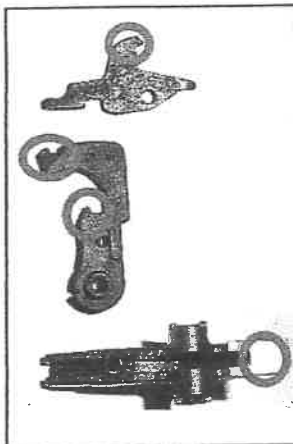


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|--|--------------------------------------|------------------------------|
|  | Defective rear sight.                | Replace rear sight assembly. |
| Can not zero cont...                         | Loose rear sight.                    | Tighten                      |
|  | Worn barrel.                         | Replace barrel.              |
| 12. Failure to cycle with selector on BURST. | Broken auto sear.                    | Replace auto sear.           |
|  | Faulty selector lever.               | Replace selector lever.      |
|  | Broken or damaged cam teeth.         | Replace the burst cam.       |
|  | Broken or damaged cam clutch spring. | Replace cam clutch spring.   |
|  | Damaged Burst disconnecter.          | Replace disconnecter.        |
|  | "Short Recoil"                       | See "Short Recoil"           |
| 13. Failure to cycle with selector on AUTO   | Damaged auto sear or pin.            | Replace auto sear or pin.    |



- |                        |                         |
|------------------------|-------------------------|
| Faulty selector lever. | Replace selector lever. |
| "Short Recoil"         | See "Short Recoil"      |

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| 14. Fires two rounds with one pull of the trigger. | Perform function test. | See where problem is. |
|--|------------------------|-----------------------|

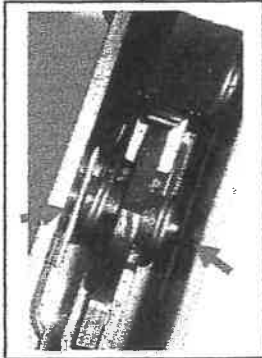


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|---|--|
| Defective semi-auto disconnecter.                     | Replace disconnecter.                            |
| Defective sear surface on hammer.                     | Replace the hammer.                              |
| Defective sear surface on trigger.                    | Replace the trigger.                             |
| Gauge hammer/trigger pin holes in the lower receiver. | Replace lower receiver if any hole is oversized. |



15. Fires with selector On SAFE or on Trigger release on SEMI      Check selector lever.      Clean, assemble correctly or replace selector lever.

16. Hammer pin "walks". Hammer spring not assembled properly.



Remove and assemble properly.

Hammer J-Pin damaged or missing. Replace hammer.



17. Bolt fails to lock after last round.

Damaged magazine follower.

Replace magazine.

Defective magazine spring.

Replace magazine.

Inspect feed lips.

Replace magazine.

Underpowered ammunition.

Replace ammunition.

"Short Recoil"

See "Short recoil".

Bolt catch binding.

Disassemble and clean.

Bolt catch spring worn or damaged.

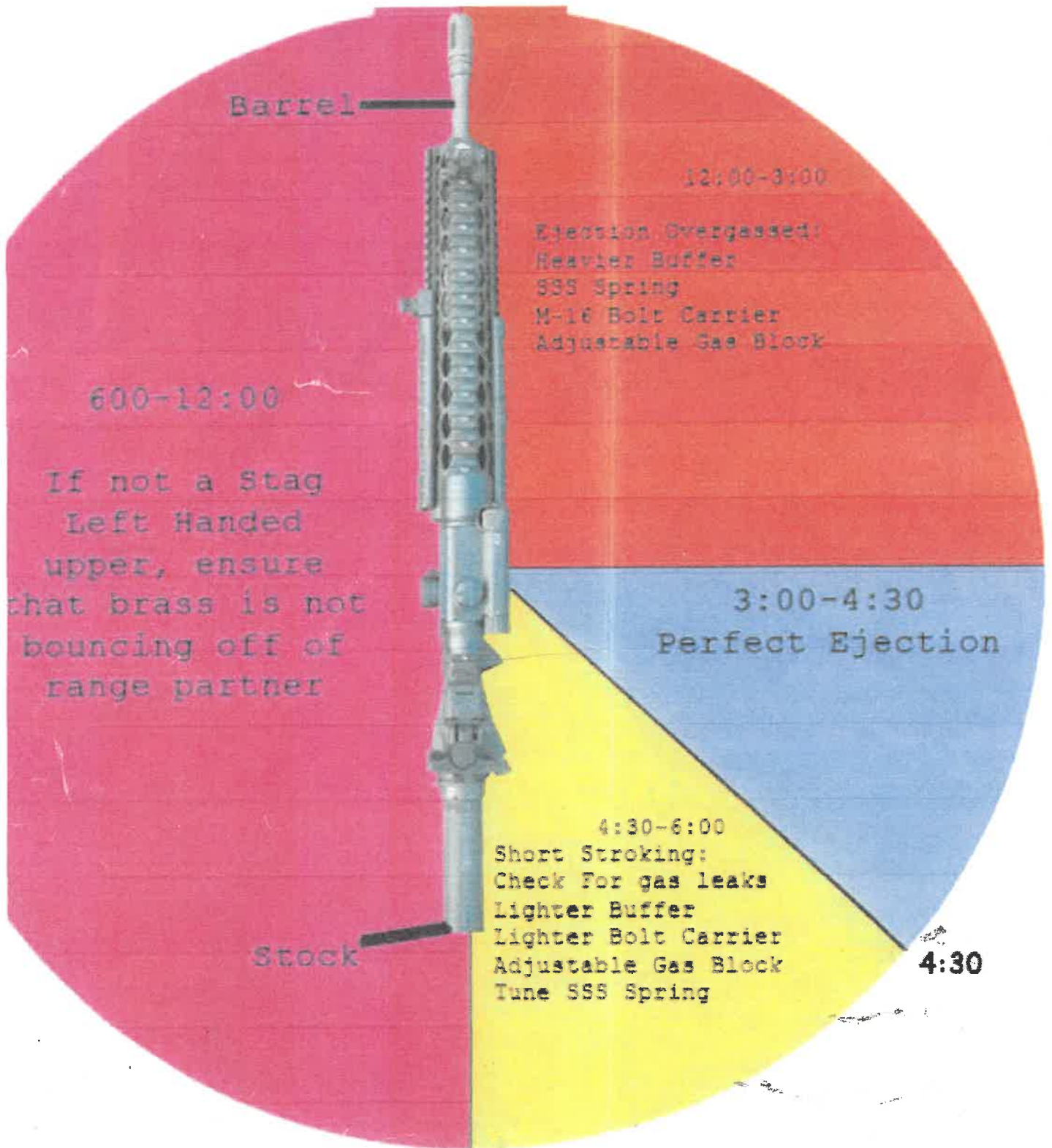
Replace bolt catch spring.

Bolt catch damaged.

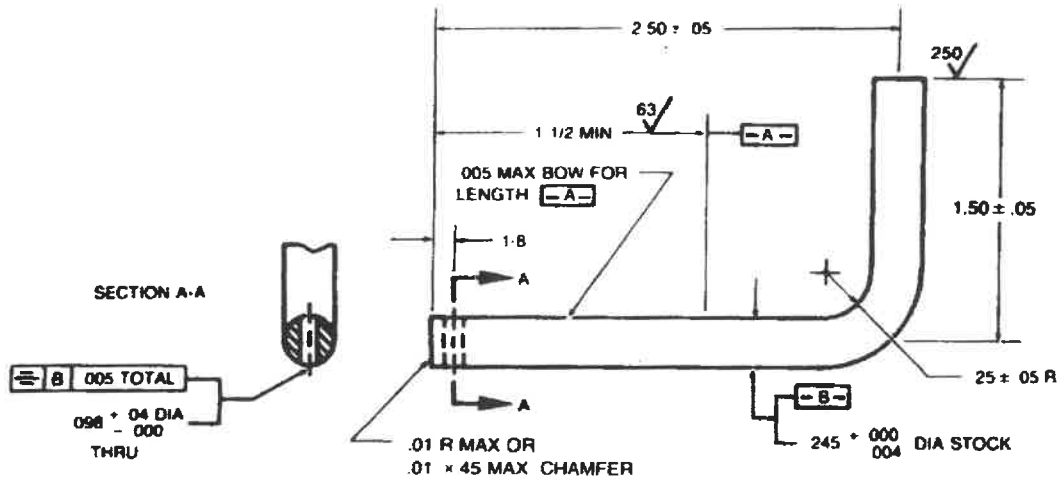
Replace bolt catch.

# Ejection Angle Chart

12:00



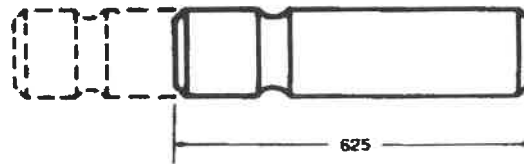
600



MATERIAL BLOCK  
STEEL - A1S1 1095

- NOTE: 1. FABRICATE FROM .245 IN. STEEL A1S1 1095 OR EQUIVALENT.  
2. HEAT TREAT: HARDEN AND TEMPER TO RC 57-61 FOR LENGTH -A-.  
3. FINISH: 5.3.1.2 OR 5.3.2.2 OF MIL-STD-171.  
4. ALL DIMENSIONS ARE IN INCHES.

Figure E-6. Pivot pin installation tool.



MATERIAL BLOCK  
WIRE, STEEL ALLOY  
GRADE 4140 ASTM-A547

- NOTE: 1. FABRICATE FROM STEEL ALLOY WIRE OR MODIFY P/N 8448609.  
2. HEAT TREAT: QUENCH AND TEMPER TO HARDNESS SPECIFIED.  
3. FINISH: 5.3.1.2 OF MIL-STD-171.  
4. ALL DIMENSIONS ARE IN INCHES.

Figure E-7. Modified old trigger "stave" pin.

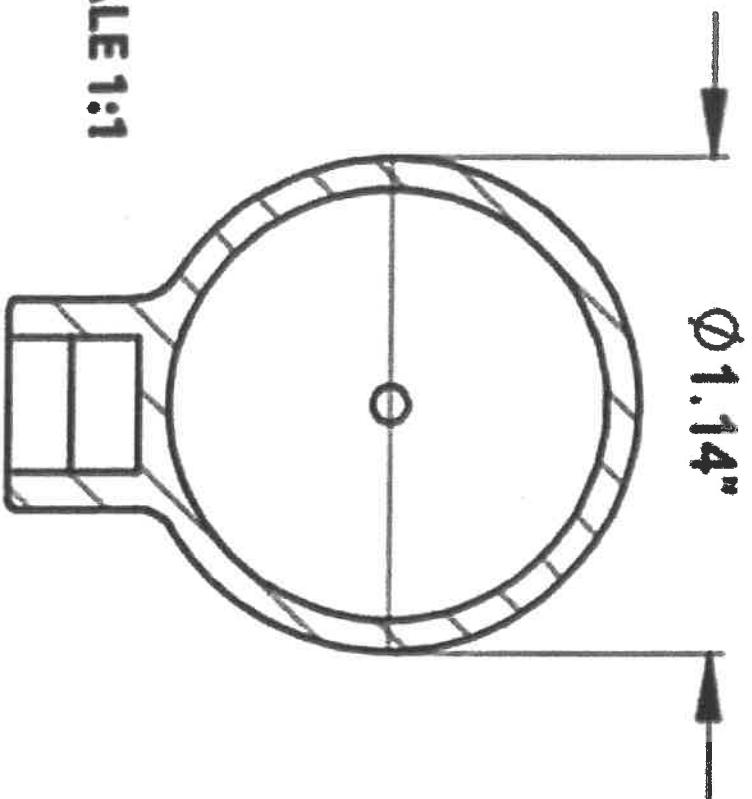
## APPENDIX F TORQUE LIMITS

**F-1. INTRODUCTION.** This appendix includes torque limits for the compensator, barrel nut, carrier key screws, and lower receiver extension.

*STANDARD TORQUE TABLE*

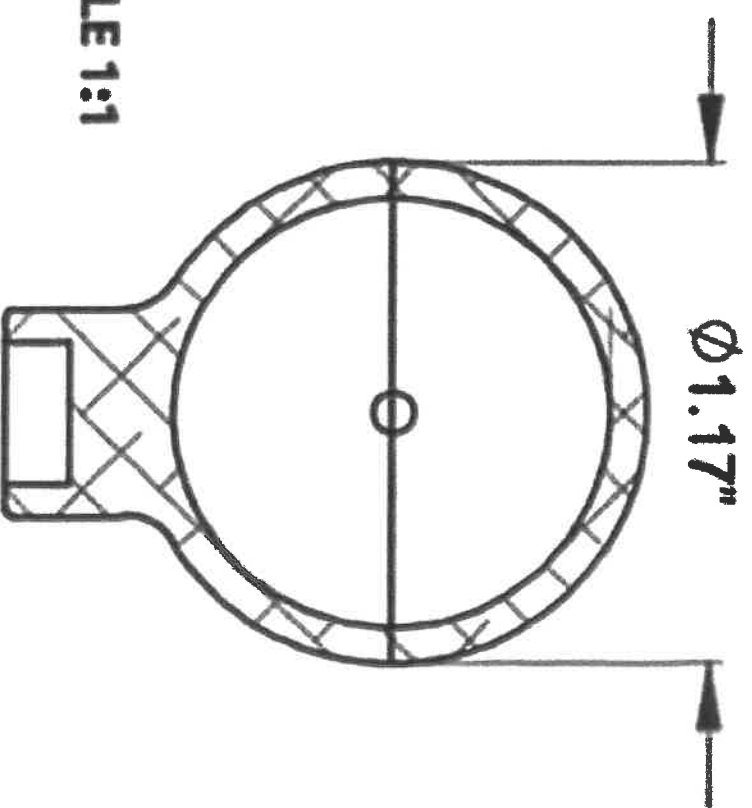
ITEM	TORQUE TO	PAGE NO.
COMPENSATOR	15 FT LBS TO 20 FT LBS	3-36
<b>NOTE</b>		
See page 3-33 for barrel nut alignment procedure. Torque is measured when torque wrench and combination wrench are used together.		
BARREL NUT	31 FT LBS MIN. DO NOT EXCEED 80 FT LBS TO ALINE SLOT.	3-33
CARRIER KEY SCREWS	35 IN. LBS TO 40 IN. LBS	3-20
LOWER RECEIVER EXTENSION	35 FT LBS TO 39 FT LBS	3-70

**• MIL-SPEC TUBE CROSS SECTION:**



Mil-spec receiver extensions have a slightly smaller diameter of 1.146", and have a flat back. Both the Mil-spec and Commercial stock will fit over this tube, but the commercial stock will be loose.

**2. COMMERCIAL TUBE CROSS SECTION:**



Commercial receiver extensions have a slightly larger diameter of 1.170", and sometimes have slanted backs. Only a Commercial stock body will slide easily over this tube. **Do NOT force a Mil-spec stock over a Commercial tube!**

1. Is the civilian carbine buffer tube bigger or smaller than the military specification sized tube?

(Circle one)

BIGGER

SMALLER

2. Are trigger and hammer pins interchangeable?

YES

NO

3. Where is the "key" located? \_\_\_\_\_

4. Which produces more chamber pressure, the 5.56 Nato cartridge or the .223 cartridge?

5.56

.223

5. How many gas rings should be on the bolt carrier? \_\_\_\_\_

6. In the term AR-15, what does "AR" stand for? \_\_\_\_\_

7. What part is responsible for removing a cartridge, fired or unfired from the chamber? \_\_\_\_\_

8. What is best ejection angle pattern? 12:00-2:00

3:00-4:30

4:30-6:00