MIL-SPEC TORTURE TEST

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GEMTECH MGS SUPPRESSOR

TESTED FULL AUTO ON AN OHIO ORDNANCE WORKS 240P MACHINE GUN

SMALL ARMS DEFENSE JOURNAL


GEMTECH

Gemtech's Derek Smith feeds 7.62x51mm on M13 links into the Ohio Ordnance Work's M240 machine gun, brass in the air.

Gemtech Tames the Beast:

"MGS" Suppressor MilSpec Test

Why perform a MilSpec test on a machine gun suppressor? Because that is the next level of where firearms are headed. Over the past 10 years the military and police have been becoming more and more aware of the damage being done to shooters' hearing and the costs associated with their healthcare. Operationally, it's no longer just about concealing location, it's about an increased ability to communicate among the squad, minimizing the effect of muzzle blast on the operator's concentration, making for a more effective combat team by lessening some of the mayhem of the immediate area on the battlefield. There is also the ever-increasing awareness of how heavy metals such as lead and antimony are working their way into the bloodstream of shooters and how to use new suppressor designs to decrease the blowback gases as opposed to increasing the gases like many traditional suppressors do. There are heavy metals in the aerosol of firearms gases, and moving them forward away from the shooter is a major focus at present.

This series of tests was performed to answer questions—not just the questions asked by operators and high-speed shooters who want to see how many rounds go through the suppressor before it glows white and the guts go downrange. The questions we need answered are how the suppressor will hold up over time in the training environment. Logistics and procurement personnel need to know how the suppressors they add to their TO&E will perform over time. If used in training once a year for 8 squad members to qualify, or twice a year, or once a month, what is the degradation, if any, of the suppression? What is the degradation of accuracy over a simulated 10 years? Answers for heavy combat use must be found as well. Thus, we at ***Small Arms Defense Journal*** designed this test series for Gemtech after consulting with SOCOM testers, Army procurement personnel and a number of scientists in the field. There are no universally accepted test criteria for suppressors other than the MilSpec for firearms sound measurement, which we adhered to. For the rest, we adjusted machine gun test requirements and the suppressor tests some military groups have done to design this test. This means the testing is boring for the testers, keeping a cadence of fire and resisting the urge to speed it up too much. Mandatory cooling cycles, cleaning cycles and temperature measurements as well as accuracy checks make for a tedious day, but for many shooters, any day at the range beats a day at the office.

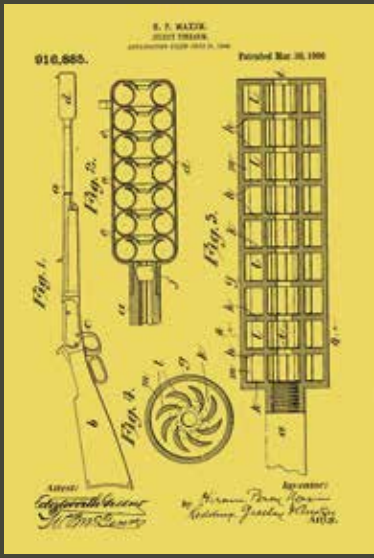
We at ***SADJ*** sincerely hope that not only the end users, but the people in procurement will be able to take these results and apply them to their requirements. This author will state that the Gemtech MGS Suppressor performed astonishingly well, as you will see.

What are Firearms Suppressors?

The first modern firearm suppressors were actually on Greener's Humane Cattle Killer in the 1890s, basically a large chamber after the muzzle of a cattle killer. There were many patents filed for sound suppressors in the 1900 through 1930 era, perhaps the most famous being from the Maxim Silencer Company. There is a long history of attempts to quiet the effects of a firearm being fired. The theoretical boundaries of simple mechanical suppression have been plateaued; instead of incredible leaps in level of suppression, modern manufacturers now must concentrate on smaller size and longer life under use.

How do we suppress a firearm? By taking the products of combustion of rapidly burning and expanding powder/gases and cooling as well as disturbing their forward motion. Slow, expand in a chamber, and cool the gases before they exit into the atmosphere. There are many variations on a theme, but essentially that's it. Slow and cool the gases. This requires the construction of a suppressor to be a heat sink, as well as a radiator for that heat, and to have channels to internally redirect and slow the gases. Those can be baffles or any of a number of bizarre designs. A simple large chamber with enough material strength to withstand the hoop stress of the expanding, burning gasses will provide some sound reduction; proper scientific designs can amplify that effect. Some suppressors use large volume to good effect; others unique baffle or core designs, others based on the heat qualities of the materials. In extreme cases, all of the firearm's actions can be reduced; buffers used where metallic surfaces connect, barrel porting to bring projectile velocity under the speed of sound, etc.

In the case at hand, Gemtech is trying to harness a true beast: the U.S. M240 machine gun, firing full military 7.62x51mm NATO Ball ammunition through a 24.8-inch barrel at 2,800 feet per second, in fully automatic mode at a cyclic rate of around 700 rounds per minute. This is not a gentle project calling for muffling the sound of a bolt slamming home, nor is it time to reduce velocity. Gemtech is taking on a full work-horse medium machine gun, and that requires robust design, solid materials and the impeccable application of science. The intended purpose? To make the beast hearing safe at the shooter's ear according to OSHA and Military standards, i.e., 140 dB or under, and survive in long-term training as well as in full-tilt boogie combat conditions.



Maxim's patent for his improved silencer, the successful Model 1910.

What is Firearms Sound?

Before we can discuss the sounds a firearm makes and what we can adjust about them, the first question to answer must be "What is Sound?" We're actually talking about "audible sound," the sounds that humans can hear. Many animals can hear other wavelengths outside the human spectrum, and just because we can't hear it doesn't mean the mechanical events are not happening. There is sound both above (Ultrasound) and below (Infrasound) the range we can hear, and in this discussion we're not concerned with this other than in weighting our testing to make it more understandable.

A common definition would be that "Sound" is composed of vibrations that travel through the air or another medium and can be heard when they reach a person's or animal's ear. On a more complex level (discussing only sound traveling through a medium of air), sound is a wave with three levels of description: mechanical because sound requires a medium to travel through—in this case air (Sound cannot travel through a vacuum); longitudinal because the air particles vibrate parallel to the sound wave direction; and pressure variations. Pressure is mostly what concerns us in this discussion; a pressure wave is high and low pressure regions moving through the air, and this can be measured. What we hear is related to the modulations in that pressure. Obviously, a firearm creates some very high pressure events of very short duration. Measuring this is trickier than it might seem.

The sounds a firearm makes can be divided into seven describable events; simplifying this there are three main ones: there is the noise the firearm's action makes whether semi-automatic or bolt; the sound when the bullet uncorks from the barrel allowing the heated expanding gases to break out into the atmosphere with their incumbent pressure waves; and the sound of the projectile traveling through the air, which may be supersonic and create a ballistic crack as it passes the sound barrier.

Trying to quiet these noises and mask the location or presence of the shooter is one goal of suppressing a firearm; another is protecting the firearm operator's hearing. Sounds above a certain decibel level cause permanent damage to the operator's hearing leading to debilitating diseases that require many billions of dollars to treat over the course of soldiers' and officers' lives. So, motives to suppress sound are not simply for use during a combat action; the long-term debilitating effects and costs of training come into play as well.

How Do We Measure Firearms Sound?

The basic measurements of pressure are performed in a unit called "Pascals." The pressures we deal with in firearm sounds produce very large numbers, difficult to deal with. Instead we use Decibels (dB). Decibels are a logarithmic scale- a 10 dB increase is a 10-fold increase in absolute pressure; however, subjectively it is perceived as twice as loud. This is because of the non-linear response of the human ear.

Setting up equipment to test the sound levels has many nuances to it. The microphone placement is critical and must be homogenous—the same each time. There have been protocols requiring a 10-meter distance from the muzzle, others that required 1 meter to the left and others at the shooter's ear.

Our test decision was to use MIL-STD 1474D which dictates a placement of the microphone 1.6 meters above a non-reflective ground surface and 1 meter to the left of the muzzle of the suppressor, perpendicular to the ground—this produces a grazing incidence where the sound wave is going directly over the microphone's sensing area (Transducer). We elected to also perform "At Shooter's Ear" testing, about 15 cm from the shooter's left ear.

The older analog meters are probably the best equipment for testing. We had two Larson Davis 800B meters on site and used both with A weighting. Why older equipment? It's the weakest link in the chain theory—the quality of the information gathered is only as good as the least accurate piece of equipment. In other words, if you use new digital equipment that can't record the fastest part of the event, then your data will not reflect what's truly happening. There will always be "Rise time," which is a lag between the start of an event and the ability to begin gathering data. If the equipment isn't able to respond quickly enough, the true event will be misstated. Decibels are a logarithmic scale- a 10 dB increase is a 10-fold increase in absolute pressure; however, subjectively it is perceived as twice as loud. This is because of the non-linear response of the human ear. The microphone must also be able to withstand the high pressure coming from a firearm. That will give a true picture of the decibel level the firearm has produced. Doc Dater has trained hundreds of scientists and designers on suppressor measurement and history, and for a better understanding of this, ***SADJ*** suggests the interested student take his course or review Doc's online tutorials.

Actual sound level recordings of the MGS during the test

Rounds	Notes	Rd 1	Rd 2	Rd 3	Rd 4	Rd 5	Average dB
First 5	Muzzle	146	141	138	138	137	140
3,200	Muzzle	141	140	141	141	142	141
3,200	At shooter's ear	132	133	133	132	131	132
7,000	Muzzle	143	140	138	139	139	140
7,000	At shooter's ear	134	137	139	134	135	136

This chart shows minor degradation in suppression after 7,000 rds. While the sound at shooter's ear was very low to start, it was still significantly within the OSHA and Military safety guidelines after 7,000 rds. We performed inspections of the suppressor at every 1,000 rds and cleaning of the M240 at 3,200 and 7,000 rds.

Testing the BEAST

Typical Military Requirements

How do we best design a test that will answer the questions for the procurement/logistics people, as well as end users?

First, we have to simulate the training environment that the MGS will be used in. Most U.S. military personnel fire 50 rounds during qualifications, and many do this on a yearly basis. If eight soldiers are put on the same gun, there will be 400 rounds fired in short-burst cadence, and then their issue M240 and MGS will be put away until the next cycle. There are a thousand variations of this possible in the system—monthly training, cadre that use it every day to cycle students from multiple units so this M240 and suppressor will be consistently fired and retired faster. We chose to test for the longer term unit training use, with a torture test segment called "Hasty Defense"—one minute of cyclic rate of fire of the weapon. After all, if you have a machine gun you should know how to use it to save the lives of your unit and cover their movement from an area if maneuvering against a large hostile force. Putting the hammer down.

Logistics people want to know how the system is going to work over time. The U.S. military is in its 240th odd year, and it's clear that personnel will cycle through and weapons will be reused. How will Gemtech's MGS suppressor perform in the long run? Is there sound reduction degradation? Is there accuracy degradation? At 10 years and x amount of rounds, what can a unit expect from the suppressor? Finally, is this protecting our soldiers' hearing, and is it a good value?

We set out to get the answers to these questions, using 7,000 rounds of linked 7.62x51mm ammo.

MGS SPECIFICATIONS

Caliber: 7.62x51mm NATO
Weight: 36oz
Length: 8in
Diameter: 2in
Mount method: Threaded
Material: All parts 17-4 stainless
Construction: Monocore with outer tube, welded exterior
Finish: Bare, sandblast for non-reflective optical flat finish

Gemtech's MGS on the M240

After a few weeks of preparation and gathering materials, we met at the Parma Rod & Gun Club in Parma, Idaho. Gemtech personnel were Blake Young, Jake Kunsky, Travis Bundy, Jason Harper, Derek Smith, Doc Dater, Jerry Hurd from Ohio Ordnance Works with the OOW M240P and this author from ***SADJ***.

On a relatively nice day, we assembled the guns, ammo, testing equipment and cooling system and proceeded to start putting rounds downrange. The cyclic rate of fire of the M240 tested at 615 RPM, then at 778 RPM with MGS installed. Any muzzle device like a suppressor is going to affect rate of fire; in this case, it increased it. Thankfully due to design, it did not increase blowback of gasses.

Environmental conditions can affect sound suppression data and were as follows: sunny/ light cloudy day on both days, low wind.

	Day 1	Day 2
Temperature	57 °F	60°F
Humidity	46%	40%
Barometric Pressure	27.34	27.41

Air Cooling the OOW M240P with Gemtech MGS.

Gemtech & The British MG Suppressor Tests

Law Enforcement International, Ltd (LEI) from St. Albans, UK, is well past 25 years in the suppressor design/supply business, and Greg Felton of LEI and Doc Dater are close friends and colleagues. Great Britain has been working on the idea of suppression of all of the firearms in its inventory since the mid-2000s, much of it inspired from presentations by Doc Dater as well as their health services community. In early 2014, LEI was awarded an MoD Competitive Contract; GB-UK: DTECH/0026, beating out B&T, SIG, B.E. Myers and Surefire in the competition to design five suppressors on different firearms for MoD. The contract was a research and development (R&D) contract and was a joint contract with LEI and Gemtech. One of the suppressors was for the "Jimpy," the GPMG Machine gun, which is designated as the L7 series in British use and is in the MAG58 family just like the U.S. M240.

The joint design work was Greg Felton from the LEI end, and Doc Dater and Blake Young from the Gemtech team. The suppressor is a thread-mounted unit which was supplied in multiples for the testing by MoD and was a "Core within a Core" based on a Gemtech design. Delivery of the suppressors was very quick, in late 2014. The basis of the UK test is classified, but this author can share that it revolved around fast firing far more than the SOCOM Hasty Defense test of 600 rounds cyclic. The joint LEI/Gemtech design performed so well that it out-performed the MAG58 machine guns; the multiple guns got so hot that the operators had to stop firing. The suppressors were just chugging away, handling the intense firing very, very well. Phase 2 of the contract is under consideration.

This obviously led to the Gemtech team taking lessons learned and applying them into a completely new design; the Gemtech MGS (Machine Gun Suppressor) which is the subject of this test.

1) After initial suppressor testing, accuracy was fired for five rounds. Firing was started with 400 rounds in 3-5 round bursts at 3 second intervals, and the suppressor and barrel started at ambient air temperatures. We then cooled the barrel and suppressor down to approximately 90°F or under and repeated this throughout the testing. We reduced time between bursts to 1 second due to low temperatures on the MGS, so we could raise the cadence. After a few thousand rounds, we increased the starting temperatures to observe any changes—nothing of consequence.

2) Day 2 we fired in the same cadence, using a different OOW M240 (Jerry Hurd had to go to another engagement). This M240 was much more worn and experienced some problems unrelated to the MGS.

Accuracy Testing

Single fire from an M240 GPMG can be problematic; the OOW patented select fire trigger group fixed that problem and allowed smooth, accurate single fire. The first photo shows the original group from a new barrel and new MGS Suppressor. The second photo is a test of the barrel without suppressor after 3,200 rounds fired. The third is the barrel with MGS can installed, showing a minor spreading of the group. The last picture shows the MGS suppressed group after 7,000 rounds. The groups were approximately 1.5 inch from start to finish, with one flyer on the last group. Firing was at 25 meters. Even after one minor baffle strike, the accuracy shows very little degradation, if at all.

Temperature Chart

This temperature chart represents the data taken from our testing records to show consistency in temperature depending on intervals between bursts. Temperatures are measured in Fahrenheit:

GemTech Mil Spec	Rounds	Notes	Can Muzzle	Can Rear	Barrel	Gas Block	Core Internal
Starting temp	-	Before firing	82	82	82	82	82
3-5 round bursts	2,000	Lake city	885	892	775	549	1322
3-5 round bursts	3,200	Lake city	879	986	832	575	1374
3-5 round bursts	3,600	Lake city	863	994	904	578	1408
3-5 round bursts	4,800	British 2010 L44A1 Ball	778	913	773	580	1258
3-5 round bursts	5,200	Lake city	763	777	698	523	1299
3-5 round bursts	6,000	Lake city	806	905	764	560	1280
3-5 round bursts	6,600	British 2010 L44A1 Ball	868	960	795	540	1351
3-5 round bursts	7,000	British 2010 L44A1 Ball	841	952	850	568	1330
Mean average temperatures			**835**	**922**	**798**	**559**	**1327**

Note: In the testing, we switched ammunition from Lake City 2015 to British L44A1 for 1,200 rounds to observe any temperature differences. There were none to speak of.

Malfunctions

We had three malfunctions related to the trigger pack—these had nothing to do with the MGS suppressor or the M240; the semi-automatic mode on the trigger pack requires a positive trigger pull and let-off and firing loosely by a first-time user can cause a failure to feed. At 5,600 rounds we had a cook-off in the last few rounds. This was not suppressor-related; it was related to leaving an unfired round in the chamber due to chamber dirt. At 6,400 rounds a projectile became stuck during a misfire of ammunition. On inspection, we found a small metal piece in suppressor and a small baffle strike clearly not from a projectile. The part in the suppressor appeared to be a piece of an M13 link, or spring part from the top cover, which had been driven down the bore by a previous projectile. This didn't compromise the suppressor, didn't affect either accuracy or suppression, and the test kept on running. The sound and accuracy results in the charts speak to how robust and reliable the MGS suppressor is.

In Conclusion

What does all of this mean to a procurement person? It's simple: the Gemtech MGS Suppressor is one outstanding, robust, high-performing can. There were zero malfunctions due to the suppressor—that's Zero Failures. Accuracy degradation over the torture testing? None to speak of. Suppression degradation after 7,000 rounds and high temperatures? Slightly more than 2%. This is excellent performance over a simulated long-term training use. Easily surviving core temperatures in excess of 1,300°F, as well as a foreign metal object getting inside the suppressor, the MGS kept on working. ***SADJ*** puts a big stamp of approval on the Gemtech MGS. Of course, we'd like to fire 50,000 rounds through one, but time and budget dictate otherwise—and this 7,000-round torture test has proven how well designed and effective the MGS is. Additionally, there was a marked reduction in blowback gases, evident to all who fired the M240 with MGS installed.

Ohio Ordnance Works' select fire trigger group for the M240 machine gun.

Ohio Ordnance Works M240P

Jerry Hurd brought an M240P (P for Patrol) machine gun out to use as a test firearm at the range. It has the Trijicon TA648 ACOG optic in place—a very popular machine gun optic for 7.62x51mm, allowing clear vision and an outstanding field of view. With the Darley Defense bipod mounted for accuracy shooting and using the M192 lightweight tripod for stabilized full auto, the day went very smoothly. Ohio Ordnance Works has been working to lighten the M240 system and make it more user friendly.

Jerry Hurd from Ohio Ordnance Works feeds ammo as Dr. Philip H. Dater fires fully automatic through the son to be introduced OOW240P on M192 tripod with Trijicon ACOG 6x48 and the excellent Gemtech MGS Suppressor.

Gemtech

Gemini Technologies has its roots back in 1976, when Dr. Philip H. Dater started Automatic Weapons Company in New Mexico. His experiences with suppressor design had begun in the early 1960s. This author had conversations with him about rebuilding the Vietnam Era MAC Ruger MKI suppressors in the 1970s and has traveled with "Doc" around the world testing hundreds of historical and modern suppressor designs. "Doc" Dater joined with some other experienced designers in the early 1990s and formed Gemini Technologies, or "Gemtech." Through a number of evolutionary moves, Gemtech has evolved into one of the top suppressor design/manufacturers in the world. Recently acquired by Smith & Wesson, Gemtech products are all from (ISO) 9001:2008 certified manufacturing, and they have suppressors in active use by all branches of the U.S. military, as well as many Special Operations Forces, military and police in other friendly countries around the world. Gemtech is a name recognized worldwide as a quality suppressor designer and manufacturer. When Gemtech teamed up with LEI in England for the British MoD Suppressor R&D contract and applied lessons learned to their new Machine Gun Suppressor (MGS) it was a natural progression that ***SADJ*** would be asked to test it. This author performs all MilSpec tests personally and did so on this MGS test.

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ABOUT THE AUTHOR: *Dan Shea is a U.S. Army veteran and has 40 years' experience with suppressors; from hobby use after ETS and small level design, to supplying end users. He organized and ran the 1997 and 1999 Suppressor Trials, coordinating groups of scientists, designers and engineers to allow hundreds of examples to be submitted by manufacturers and tested by multiple scientists including Dr. Philip H. Dater, Al Paulson and Dr. Chris Luchini. Dan is the National Defense Industrial Association's 2017 Colonel George M. Chinn Awardee, as well as the Editor-in-Chief and Technical Editor of* **Small Arms Defense Journal, Small Arms Review,** *the old* **Machine Gun News** *and many technical books on firearms. He was the founder and General Manager of the now closed Long Mountain Outfitters for almost 40 years and is currently the General Director of Phoenix Defence, an armorer training and weapons supply company.*