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TECHNICAL NOTE 60: MEASURING HEADSPACE

BACKGROUND:

Measurement of a firearm's headspace is a key technical inspection and has profound implications for the safety and durability of a firearm. The measurement technique itself is, oddly enough, so simple that it is frequently performed incorrectly. The purpose of this technical note is to provide facts and instructions for performing correct headspace checks.

FACTS:

1. Headspace is defined as *the linear dimension from the breech of a firearm to some point in the chamber of the firearm; either a contact surface or designated datum in the chamber or to the rear of the barrel.* Every dimension on a physical part must have a tolerance range. Headspace is no exception. It has minimum and maximum acceptable dimensions. Acceptable headspace ranges are established for every cartridge and its associated firearm chamber by industry advisory bodies, government bodies, or by individual manufacturers. The measurement points and dimensions chosen depend on the particular cartridge case used and its design (rimmed, rimless, semi-rimmed, or belted). In a narrow sense, headspace is the size of the cartridge chamber designed to accept a particular cartridge. In a broader sense, the characteristics of the firearm design must be considered when defining headspace.

Some firearms can successfully fire cartridges that are physically similar but not identical in dimensions and tolerances. Examples of this would be .223 Remington / 5.56mm NATO and 308 Winchester / 7.62mm NATO. These sets of cartridges will function interchangeably in our firearms; however, each cartridge has its own set of headspace gages. ArmaLite uses NATO dimensioned gages.

2. A headspace gage is a precision-made device that measures the headspace of a firearm. It is normally cylindrical in shape, but depending on the design may resemble a washer or even a small plate. Its key dimensions are based on industry standards or, more appropriately, industry standards that are adjusted to suit the characteristics of the firearm and ammunition being tested. These considerations guide the design of the *headspace gage*.

Because of normal dimensional variations (tolerances) in both the firearm and the ammunition, an acceptable *headspace range* for a firearm is established, and *minimum* and *maximum* gages are produced. The minimum headspace gage is often referred to as a *go gage*, and verifies that the chamber being measured is *at least* long enough for the intended cartridge. The *maximum* headspace gage is often referred to as a *no-go gage*, and if accepted by the firearm verifies that the chamber being measured is *too long* for safety. Other gages may be produced at dimensions between the minimum and maximum dimensions to allow other considerations to be tested such as remaining barrel life for a particular purpose (i.e. "overseas deployment" or "field reject").

Successful use of the gage requires proper techniques that assure that the gage is not damaged and provides a proper reading.

MEASURING HEADSPACE:

1. General instructions for proper use of the headspace gage.
 - a. Clean all measurement surfaces, i.e. the gage, the bolt face, and the chamber and its locking lugs (rimless cartridges) or the rear of the barrel (rimmed cartridges). Sand and grit in the chamber may damage both the firearm and the gage. If the gage is damaged, all subsequent checks will be suspect.
 - b. If the firearm is self-powered, remove the recoil spring so that it cannot push the bolt or slide forward.
 - c. Test with the GO gage first. If the GO gage won't enter chamber, the longer NO-GO gage obviously will not. Insert the GO gage into the chamber with light force. NEVER feed it into the firearm through the feed mechanism. Any contact that can damage the gage must be avoided.
 - d. By hand, attempt to *gently* close the bolt. This will normally require eliminating contact between the ejector and/or extractor and the gage. This contact should be prevented by removing the extractor and ejector, or by designing or modifying the gage so that there can be no contact between the gage and those parts. Failure to eliminate this contact may cause erroneous measurements or damage to the gage. The bolt should close on light finger pressure. In no case should the action be allowed to slam closed on the gage.
 - e. If the GO gage fits, repeat the test with the NO-GO gage.
2. Specific instructions for use of the headspace gage on AR-style firearms
 - a. Prepare the gages by cleaning them gently with a solvent and then drying.
 - b. Prepare the chamber and locking lug area of the barrel by cleaning with a chamber brush followed by patches soaked in a solvent (such as isopropyl alcohol) and then dry patches until the chamber is clean.
 - c. The ejector can cause false readings. Remove the ejector and ejector spring from the bolt. If your headspace gages are relieved so that they do not touch the extractor, you may leave it in the bolt. Otherwise, remove the extractor and extractor spring from the bolt.
 - d. Prepare the bolt by cleaning all debris from the bolt face and bolt lugs. Then clean the bolt face and bolt lugs with a solvent (such as isopropyl alcohol) and follow with a dry cloth.
 - e. Reassemble the bolt (without its ejector and, if necessary, without its extractor) into the bolt carrier.
 - f. Insert charging handle into upper receiver.
 - g. Hold upper receiver muzzle end down on the work bench.
 - h. Reaching through the bottom of the upper receiver, gently slide the appropriate go gauge into chamber.

- i. Insert carrier into the upper receiver slowly and carefully until it comes in contact with the gauge.
- j. With two fingers depress end of carrier with only moderate pressure. If the carrier closes on the gauge, remove the gauge and proceed to the next step. If the carrier does not fully close, the barrel/ bolt combination is under headspace.
- k. Repeat process 6-9 using appropriate no-go gauge making sure the carrier does NOT close on the gauge.
- l. If the carrier does close on the no-go gauge, the barrel/ bolt combination is over headspace.

HEADSPACE GAGE CALIBRATION:

Gages must be periodically *calibrated* to assure that they remain accurate. Successful calibration requires either periodic measurement with precise tools, or replacement of the gages themselves if that proves more economical.

MISCONCEPTIONS:

There are a number of popular misconceptions concerning headspace, notably that the shorter the headspace, the better, that longer headspace is dangerous, and that one particular dimension is best. None of these common beliefs is totally true.

Insufficient (too short) headspace tends to cause malfunctions such as failure to lock. It often makes extraction difficult and can cause dangerous stresses on the mechanism that shorten its life expectancy or lead to failure. Excessive (too long) headspace may lead to gas leakage around the case or head separation and the sudden release of high-pressure gas. Most shooters fear excessive headspace, but insufficient headspace is also dangerous.

While a fairly wide range of dimensions work, manufacturers normally narrow their tolerances to conservative ranges that allow a reasonable combination of safety, reliable function, accuracy, and useful life.

3. Like all mechanical devices, headspace gages are fabricated with some tolerance. And headspace gages vary from manufacturer to manufacturer. It is important to know the exact headspace dimensions on the go and no-go gages that you are using. And, gages do wear, so it's also important to have your gages regularly calibrated. The very tight tolerances that need to be held on the gages require calibration in a climate-controlled laboratory.