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ARES Research Note 7 – Cartridge Headspace

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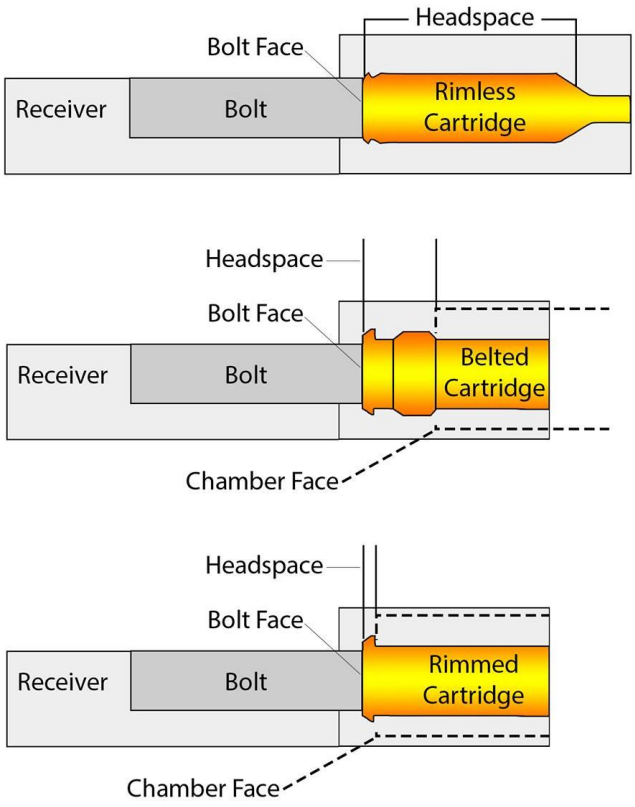
Definition

'Headspace', sometimes termed 'Cartridge Head Space' or ‘Cartridge Headspace’ (CHS), is the distance from the face of the closed breech of a firearm to the surface in the chamber on which the cartridge case seats. This point usually corresponds to the rim or shoulder of the cartridge case, and varies depending upon the type of cartridge being chambered (see below).

Background

Due to the high pressures involved, precise measurement and setting of CHS is crucial to the safe and reliable operation of a firearm. Insufficient headspace will hinder or prevent the chambering of a round. A certain amount of play or 'head clearance' is required to account for variance in ammunition production and fouling of the working parts during normal operation. However, too much head clearance, often referred to as 'excessive headspace', can result in (in order of severity):

- Reduced accuracy due to small inconsistencies in the positioning of bullet in the throat or leade of the barrel;
- Failure to fire resulting from the firing pin being unable to reach far enough to properly crush and therefore reliably detonate the primer. Correct firing pin protrusion (FPP) from the bolt face is therefore closely linked to correct CHS;
- Stretching of cases or case head separation as the case head is pushed suddenly backward under high pressure and without sufficient support from the bolt of an improperly headspaced weapon;
- Serious structural failure of the weapon (‘catastrophic failure’) and potential injury to the operator and/or bystanders as high pressure gases are released too suddenly and from the back of the barrel (which is intended to be tightly sealed) as well as its muzzle.



Checking headspace

Correct CHS is therefore essential. This is usually ensured through the use of 'go' and 'no-go' gauges of agreed size. These precision-machined, nominally cartridge-shaped tools will either permit or prevent closure of the bolt, indicating whether a weapon is within acceptable tolerances (i.e. whether it is correctly 'headspaced'). If headspace is incorrect, it may be adjusted, typically by substituting or modifying the bolt or bolt head. These checks and adjustments are best carried out by a qualified armourer, and are not within the skillset of the typical military or law-enforcement user. Many small arms encountered in conflict zones where logistics and supply are limited will not be correctly headspaced or otherwise properly maintained. Needless to say, care should therefore be taken by those who may have occasion to fire them in the field or be required to do so for purposes of test or evaluation.

Measurement

Traditionally, headspace is measured using the rim of a cartridge, in which case the weapon's headspace measurement consists of the rim itself, plus any excess gap between case head and bolt face. Head clearance in this instance therefore comprises the headspace measurement minus the thickness of the cartridge rim. Rimless, semi-rimless and rebated-rim cartridges are not 'headspaced' in this way. Instead, the equivalent measurement is taken from the case shoulder in the case of bottlenecked designs (as in rifles & machine guns), or from the case mouth for straight-walled designs (as used in most pistols). The thick 'belt' at the base of some large rifle and machine gun/autocannon cartridges is not, as popularly imagined, a case reinforcement, but an alternative means of headspacing a rimless cartridge without a well-defined shoulder profile.

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Sporting Arms and Ammunition Manufacturers' Institute (SAAMI) Definitions

Headspace

The distance from the face of the closed breech of a firearm to the surface in the chamber on which the cartridge case seats.

Head Clearance

The distance between the head of a fully seated cartridge or shell and the face of the breech bolt when the action is in the closed position. Commonly confused with headspace.

(SAAMI, n.d.)

Safety Information

Remember, all arms and munitions are dangerous. Treat all firearms as if they were loaded, and all munitions as if they were live, until you have personally confirmed otherwise. If you do not have specialist knowledge, never assume that arms or munitions are safe to handle until they have been inspected by a subject matter specialist. You should not approach, handle, move, operate, or modify arms and munitions unless explicitly trained to do so. If you encounter any unexploded ordnance (UXO) or explosive remnants of war (ERW), always remember the 'ARMS' acronym:

AVOID the area

RECORD all relevant information

MARK the area to warn others

SEEK assistance from the relevant authorities

Disclaimer

This report is presented for informational purposes only. It is not intended to provide instruction regarding the construction, handling, disposal, or modification of any weapons systems. Armament Research Services (ARES) strongly discourages non-qualified persons from handling arms and munitions. Arms or munitions of any variety should not be handled without the correct training, and then only in a manner consistent with such training. Subject matter experts, such as armourers, ATOs, and EOD specialists, should be consulted before interacting with arms and munitions. Make a full and informed appraisal of the local security situation before conducting any research related to arms or munitions.

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