

TEST PROCEDURE

-Excessive Pressure Test-

1.0 Background

- 1.1 Experience has demonstrated the cause of gun accidents may be categorized as either inadvertent firings or internal pressure which exceed the strength of the assembly.
- 1.2 Universally accepted test procedures which address the latter are limited to Proof Testing of firearms which, in the United States, is recommended by ANSI/SAAMI, Sporting Arms and Ammunition Manufacturers' Institute. The objective of Proof Testing is to demonstrate that the assembly will withstand an internal overpressure of approximately 25-50% without hazard to the shooter, damaging of the gun or deterioration in gun performance.
- 1.3 Compliance with that recommendation is voluntary and includes no sanctions for non-compliance short of product liability litigations.
- 1.4 Failure of a gun assembly from internal pressure may be from either of two (2) failure mechanisms.
 - 1.4.1 The general perception is that those failures are the result of a single exposure to a **CATASTROPHIC PRESSURE** level. This may be an over simplification in that the strength of the assembly may have been degraded by previous repeated exposures to excessive, but lesser, levels of pressure whose cumulative effect is to reduce the ultimate strength of the assembly.
 - 1.4.2 Repeated exposure to pressures which exceed the elastic limit of a material will continually reduce the ultimate strength of the material until the ultimate strength is exceeded by a relatively low pressure level causing fatigue failure.
- 1.5 Successful compliance with recommended Proof Testing does not establish the pressure at which a previously unstressed gun assembly will fail and, therefore, does not establish the margin of safety inherent in the assembly, nor does Proof Testing provide any insight whatsoever into the likelihood of a fatigue failure induced by repeated, moderately excessive pressures.
- 1.6 In response to repeated requests for a test procedure which would increase the level of confidence in the ability of a gun assembly to resist excessive pressure failures, H.P. White Laboratory, Inc has developed Pressure Tests which are intended to supplement Proof Testing and establish the safety margin, in terms of pressure, between service and proof pressures on one hand and the pressures required to create a hazardous condition on the other.

2.0 Scope

- 2.1 The scope of this test procedure is limited to establishing the minimum internal pressure necessary to induce failure or hazardous conditions in a new gun assembly.

3.0 Discussion

- 3.1 Establishing the ultimate strength of a new gun assembly would necessitate destruction of a large number of guns by firing one new gun at each of many, incrementally increasing pressures.
- 3.2 Inasmuch as fatigue failures are due to the cumulative effect of the number of exposures AND the specific level of overpressure of each exposure, establishing the failure limits of a gun assembly in terms of fatigue would necessitate destruction of an infinite number of gun assemblies and firing of an infinite number of overpressured cartridges.
- 3.3 Believing these procedures to be prohibitively expensive, a compromise procedure was developed to provide a reasonably accurate approximation of the pressure characteristics of a gun assembly.

4.0 Test Sample

- 4.1 Two (2), new condition firearms are necessary to fulfill the testing requirements of this standard.
- 4.2 One (1) on the two (2) test guns shall be tested in accordance with the "Excessive Pressure Test" procedures of Paragraphs 6.3 and 6.5.
- 4.3 The second test gun of the two (2) gun sample shall be tested in accordance with the "Catastrophic Pressure Test" procedures of Paragraphs 6.4 and 6.5.

5.1 Applicable Standards

- 5.1 The latest revisions of the following standards apply to the pressure requirements of this standard for testing of commercial firearms:
- 5.1.1 ANSI/SAAMI Z299.1-1992, Voluntary Industry Performance Standards of Pressure and Velocity of Rimfire Sporting Ammunition for the use of Commercial Manufacturers.
- 5.1.2 ANSI/SAAMI Z299.3-1993, Voluntary Industry Performance Standards for Pressure and Velocity of Centerfire Pistol and Revolver Ammunition for the use of Commercial Manufacturers.

5.1.3 ANSI/SAAMI Z299.4-1992, Voluntary Industry Performance Standards for Pressure and Velocity of Centerfire Rifle Sporting Ammunition for the use of Commercial Manufacturers.

5.1.4 ANSI/SAAMI Z299.2-1992, Voluntary Industry Performance Standards for Pressure and Velocity of Shotshell Ammunition for the use of Commercial Manufacturers.

5.2 The latest revisions of U.S. Military ammunition standards shall, unless otherwise noted, apply to testing of military firearms in accordance with the procedures of this standard.

6.0 Procedure

6.1 Each of the test samples shall be visually inspected prior to initiation of testing to determine its physical characteristics and functional acceptability.

6.1.1 This inspection may be augmented with an **OPTIONAL** magnetic particle inspection of the components exposed to stress from internal pressures.

6.2 In preparation for these tests the recommended proof pressure for the appropriate caliber of ammunition shall be determined.

6.2.1 Proof pressures for calibers not published by ANSI/SAAMI, the U.S. Military or other competent authority shall be determined in accordance with the ANSI/SAAMI recommended procedures of Table I.

TABLE I.

Service Ammunition Pressure	Proof Ammunition	
	Multiply Service Pressure By	
	Minimum Average	Maximum Average
<u>Shotshells</u> - MPLM(1)	1.55	1.70
<u>Centerfire</u> - MPLM(1)	1.30	1.40
<u>Centerfire Pistol and Revolver</u> - MAP(2)		
15,000 or less	1.40	1.55
15,100 - 18,000	1.35	1.50
18,100 - 21,000	1.30	1.45
21,100 or greater	1.30	1.40
<u>Rimfire</u>	1.25	1.40
(1) Maximum Probable Lot Mean pressure		
(2) Maximum Average Pressure		

- 6.3 Cartridges, producing peak pressures consistent with proof pressures determined in accordance with Paragraph 6.2 and 8-10,000 LUP, CUP or PSI increments over proof pressure, shall be fired from one (1) gun of the two (2) gun sample until an observed safety hazard is produced or deformation and breakage prevent further firing. For purposes of identification, this test shall be termed "Excessive Pressure Test".
- 6.4 Cartridges, producing peak pressures equal to 5000 LUP, CUP or PSI less than that of the last cartridge fired in the testing of the first gun of the two (2) gun sample (Paragraph 6.3), shall be repeatedly fired from the second gun until an observed safety hazard is produced or deformation and breakage prevent further firing. For purposes of identification this test shall be termed "Catastrophic Pressure Test".
- 6.5 "Excessive" and "Catastrophic Pressure Testing" (Paragraph 6.3 and 6.4) of multi-barrel and/or multi-chamber guns shall be conducted using the following firing sequences:
- 6.5.1 The firing sequence of multi-barrel guns shall alternate between barrels with each increase in pressure of the "Excessive Pressure Test" and with each firing of the "Catastrophic Pressure Test".
- 6.5.2 The firing sequence of multi-chamber guns in either the "Excessive" or "Catastrophic Pressure Tests" shall progress sequentially through the chambers so that at no time does any chamber have more than one (1) firing more than any other chamber.

7.0 Recorded Data

- 7.1 Data recorded during the initial inspection and after each shot of both the "Excessive" and "Catastrophic Pressure Tests" will include, but not necessarily be limited to, that required by sample data sheets (01-04-01 and 01-05-01) appended hereto.
- 7.1.1 Supplemental, but optional, post-test photographs may be used to clarify the post-test condition of the test sample(s).



-CATASTROPHIC PRESSURE TEST-

(HPW-TP-0101.00)

Date _____

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Pressure

Gun: _____, _____, _____, _____, _____
(manufacturer) (model) (serial No) (type) (caliber)

Condition: _____ (Headspace: _____)

Ammunition: Load ammunition to the following specifications which have been experimentally determined to produce the indicated peak pressure.

Primer: _____ Bullet/Shot: _____
Case: _____ Wad/Cup: _____
Propellant: _____ grains of _____

Procedure: Using ammunition intentionally loaded to produce consistent but extremely high pressures repeatedly fire the gun from a remote location recording all damage (breakage and distortion) (HPW-TP-0100.00).

Results:	Round No.	Chamber No. (Revolver)	Headspace	Damage/Distoration

Comments: _____

