

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

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"CONFINE YOUR LETTER TO ONE SUBJECT ONLY" \_\_\_\_\_

RESEARCH TEST and MEASUREMENT REPORT - Report No. 820284

M/700 CLASSIC 375 H&H MAGNUM  
STRENGTH TEST

Prepared by: Edward Vetter, Jr.

Date Prepared: 2-8-82

Proofread and Cleared By:

J.H. Hennings, / R.E. Nightingale,  
Foreman-Test Lab / Foreman-Measurement Lab

Signature

Date

C.E. Ritchie,  
Sr. Supervisor - Testing,  
Meas. & Mech. Analysis Lab

Signature

Date

TEST & MEASUREMENT LAB REPORT

REPORT NUMBER: 820284  
REPORT TITLE: M/700 Classic 375 H&H Magnum Strength Test  
MODEL(S): M/700 Classic  
GAGE OR CALIBER: .375 H&H Magnum  
DATE: 2-8-82  
WORK ORDER NO.: C-1803-000  
PART NAME:  
DESIGNER/ENGINEER: F.E. Martin

TEST TYPE:

- I. PHOTO LAB
2. X STRENGTH TEST- NO. OF GUNS TESTED 1
3. FUNCTION TEST- NO. OF GUNS TESTED \_\_\_\_\_
4. ACCURACY TEST- NO. OF GUNS TESTED \_\_\_\_\_
5. X MEASUREMENTS- TYPE: Pressure and Strain
6. ENVIRONMENTAL TEST
7. AMMUNITION TESTING & EVALUATION- TYPE: \_\_\_\_\_
8. VISUAL EVALUATION- \_\_\_\_\_ OUT OF \_\_\_\_\_ GUN SAMPLE
9. ENDURANCE- NO. OF GUNS TESTED: \_\_\_\_\_  
NO. OF ROUNDS PER GUN: \_\_\_\_\_  
TOTAL ROUNDS FIRED IN TEST: \_\_\_\_\_  
AMMO TYPE: MAGS. \_\_\_\_\_; TARGET: \_\_\_\_\_  
RIMFIRE \_\_\_\_\_ CENTERFIRE: \_\_\_\_\_

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M/700 Classic 375 H&H Magnum - Strength Test

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#### ABSTRACT

A high pressure test was designed for the .375 H&H Magnum M/700 Classic to evaluate strength. This test provided a good opportunity to experiment with new measurement equipment and techniques. Several rounds of factory, SAAMI, and handloaded ammunition were shot with measurements of receiver strain and pressure taken using strain gages. Some computer analysis was also made.

#### SCOPE OF TEST

To determine the strength of a M/700 receiver and barrel in Caliber .375 H&H Magnum.

#### TEST RESULTS

The receiver strain from the high pressure load (chamber pressure - 176,000 psi) was 43% of yield strain for that material. At that pressure, the bolt froze in the receiver with no other damage noticed. The receiver strain at proof load was only 17% of yield strain. A further result of this test is evidence to the accuracy of chamber pressure measurements using a strain gage mounted on the chamber section of the barrel.

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M/700 Classic 375 H&H Magnum - Strength Test

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REPORT TEXT

The gun used was a M/700 Classic, Serial No. B6346231.

SAAMI rounds were fired to provide a base line. Chamber pressure averaged 63,871 psi over 10 shots. Some factory and proof ammunition was also fired.

A strain gage was mounted on the receiver to measure radial strain. The full range of ammunition was fired through the gun and strain measured. Strain was very low and did not follow pressure (that is, when pressure went down, strain did not always go down and vice-versa). Another gage was mounted to measure longitudinal strain and more shots fired. Longitudinal strain was of slightly higher magnitude than radial and followed pressure. This direction was assumed to be the principal stress at that point.

Several handloads were made with various powder weights to provide a workup of pressure vs. powder weight. Curve fitting this data yielded a formula with 97% certainty.

Powder (grains) =  $32.419 + 20.962 \text{ Log pressure (psi} \times 1000)$   
(Computer printout in appendix)

Handloads

300 grain bullets  
grains 4198 powder

1	45 gr.
1	64 gr.
3	47 gr.
3	50 gr.
3	53 gr.
3	56 gr.
3	57 gr.
1	77 gr.

After an initial series of shots to establish a pressure base line, receiver strain was measured on every shot.

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From this point the theoretical pressure of 180,000 psi was calculated for 77 grains of 4198 powder (max. load for case). This load was made and fired. A pressure of 176,369 psi was measured (curve in appendix). This shot froze the gun's action.

#### TEST PROCEDURE

A program was written on the HP85 Computer to take the barrel dimensions, compute the strain to pressure constant, acquire the maximum strain from the Tektronix 7854 scope and print out the converted pressure.

A strain gage was mounted on the barrel to measure radial stress. Its location was determined as follows. The exact position of the bolt face was determined using a cleaning rod. A cartridge was placed at this mark and a new mark struck on the barrel at the neck of the case. This is the strain gage location.

Two gages were mounted on the receiver behind the barrel. One gage was mounted radially, the other longitudinally. The following ammunition was used in this test:

SAAMI	375 - 300 - 1 - R
Rem.	375 w/ 300 gr. bullet
Rem.	375 w/ 270 gr. bullet
Rem.	375 Proof

EWY:T

A P P E N D I X

REMINGTON ARMS COMPANY, INC.  
Ilion Research Division

SUMMARY OF INTENTIONAL GUN ABUSE TEST

DATA

BY R. E. NIGHTINGALE

Date 3-2-82

FIREARM: Make REMINGTON Model 700  
Grade CLASSIC Gauge 275 H&H Serial Number B6346231  
Origin CUSTOM SHOP  
Test Number Assigned WIR # 820284  
Comments STRENGTH TEST

HISTORY: Condition NEW  
Previous Rounds Fired 35 Rd.  
Headspace at Test \_\_\_\_\_  
Test Date 3-2-82

ABUSIVE LOAD USED: Powder Type 4198  
Powder Weight 77 gr.  
Case Make and Type REMINGTON  
Total Bullet Weight 300 gr.  
Total Shot Weight \_\_\_\_\_  
Estimated Pressure 175,000 (STRAIN GAGE)

ADDITIONAL COMMENTS: NO OUTSIDE DAMAGE.  
LARGE HAMMER USED TO DRIVE BOLT HANDLE  
TO OPEN BOLT.  
THERE IS CHAMBER SET (450 u")

SAAMI  
375-3001-R

PRESSURE [Psi]

65997.5  
63124.7  
65741.0  
65639.4  
65125.4  
64125.0

60611.0  
62739.9  
64868.9  
60739.2

63871.1

Note: All pressures are  
calculated from chamber  
strain.

SAAMI

RADIAL RECIEVER STRAIN

PRESSURE [Psi] STRAIN

65971.8 286.3  
62714.3 281.5  
62970.8 302.3  
68100.8 282.8  
64586.7 280.3

64868.9 286.6

3009r  
54070.2 308.3  
53813.7 298.5  
60585.3 303.5  
59585.0 308.3  
57584.3 312.0

57127.7

306.1

FACTORY  
3009r

PRESSURE [Psi]

67612.0  
67894.0  
63609.2

66405.1

2709r

PRESSURE [Psi]

48606.8  
44092.4

46349.6

SAAMI

61867.8

2709r

45092.7

PROOF

PRESSURE [Psi]

94699.8  
86902.2

90801.0

2709r

PRESSURE [Psi] STRAIN

50812.7 286.3  
49553.8 281.3  
44169.3 291.3  
49195.7 290.0  
48198.4 287.5

48385.2 287.3

CALIBER: 375MAG  
 Inside Radius= .485  
 Outside Radius= 1.134  
 Modulus= 300000000  
 Constant= 102.6

PRESS.=CHAMBER STRAIN\*CONSTANT

LONGITUDINAL RECEIVER STRAIN  
 PRESSURE [Psi] STRAIN

SAAME 61790.9 224.0

300gr 55532.6 188.6  
 270gr 50402.3 174.0

45gr 4198  
 Handload 42117.3 120.3

Proof  
 Loading  
 64gr  
 PRESSURE [Psi] STRAIN  
 106242.3 447.0

PRESSURE [Psi] STRAIN  
~~103521.3 392.0~~  
 92442.6 382.0

103215.6 452.0

47gr 4198 300gr

PRESSURE [Psi] STRAIN

47593.4 149.1  
 42784.2 124.7  
 43040.7 117.4  
 -----  
 44502.8 130.4

50gr

51607.8 182.0  
 49478.9 116.1  
 -----  
 50543.3 149.1

53gr

55121.9 169.9  
 54249.3 201.7  
 -----  
 54685.6 185.8

SAAME

PRESSURE [Psi] STRAIN

64638.0 244.4  
 -----  
 64638.0 244.4

56gr

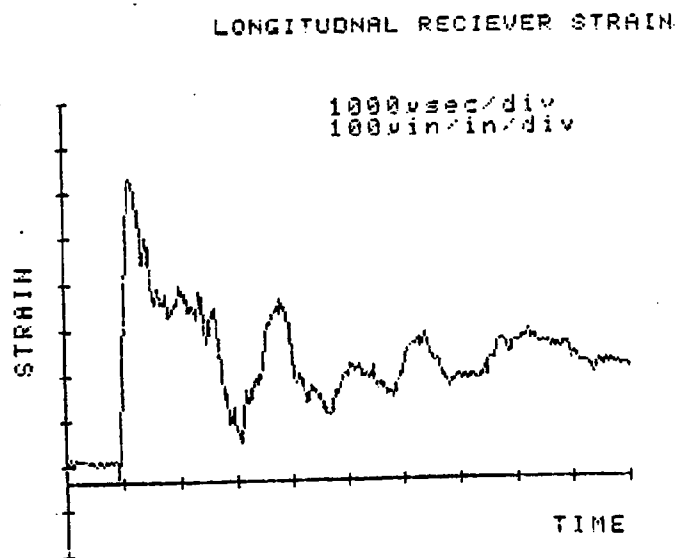
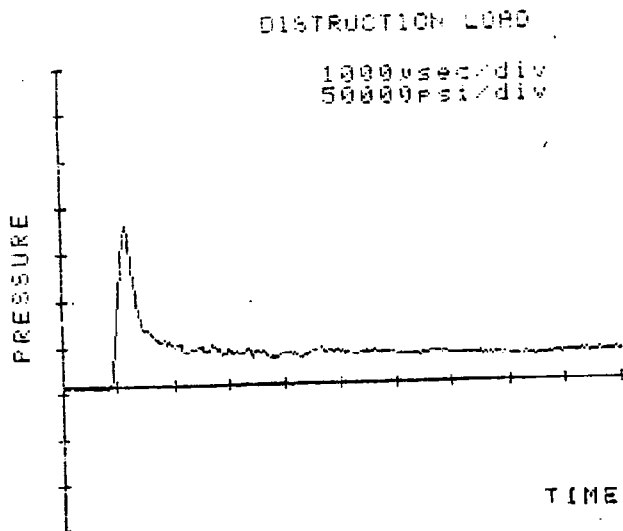
68895.9 282.3  
 74154.2 287.0  
 65022.8 217.5  
 -----  
 69357.6 262.3

57gr

PRESSURE [Psi] STRAIN

61502.7 221.2  
 72769.1 305.5  
 60867.5 222.4  
 -----  
 65048.4 249.7

DISTRUCTION LOAD  
PRESSURE [psi]    STRAIN [in/in]  
176369.4        688.5



COMPUTER PRINTOUT OF LOG  
CURVE FIT OF PRESSURE VS  
POWDER GRAINS

ADJ: LOG REG CODE 2  
SOURCE/DF 88 MS F  
TOTAL 5 237.3  
REG 1 233.8 233.8 255 5  
RESID 4 3.7 0.3  
R SQUARE = 0.985

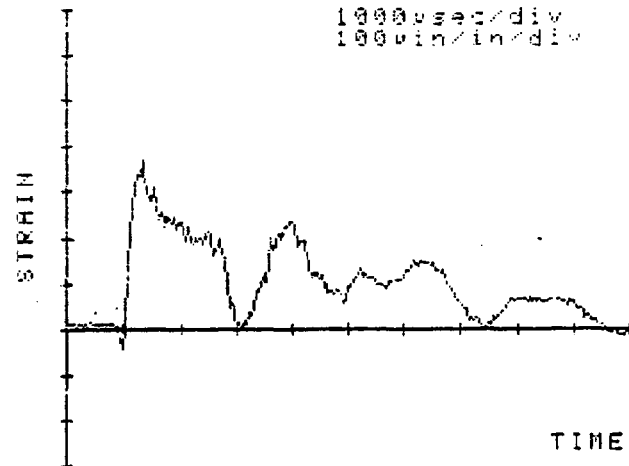
YHAT = -32.412 + 20.962 LOG X

X(I)	Y(I)	YHAT	RESIDUALS
42.00	45.00	45.93	-0.93
44.50	47.00	47.14	-0.14
50.50	50.00	49.79	0.21
54.50	53.00	51.43	1.57
69.40	56.00	56.46	-0.46
100.60	64.00	64.24	-0.24
X(I)	YHAT		
150.00	72.62		
X(I)	YHAT		
180.00	76.44		
X(I)	YHAT		
185.00	77.01		
X(I)	YHAT		
190.00	77.57		

Empirical formula  
YHAT = Powder grains  
x = Pressure

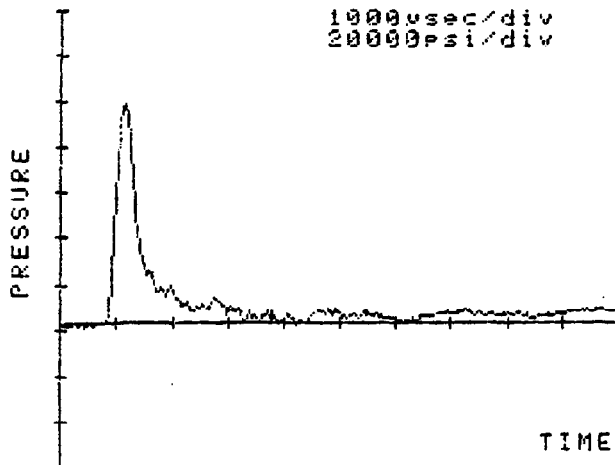
LONGITUDINAL RECEIVER STRAIN

PROOF LOAD  
1000usec/div  
100vin/in/div



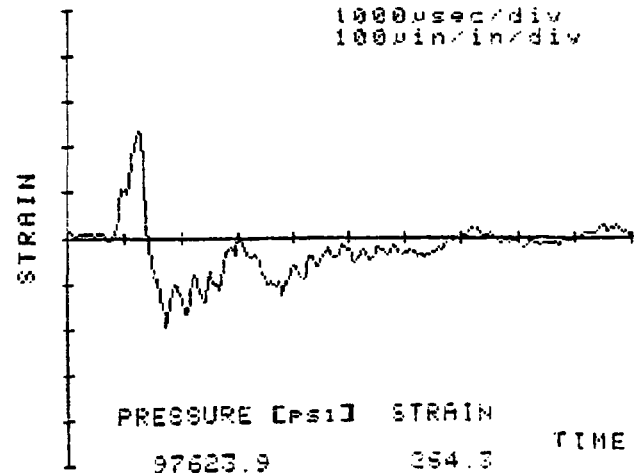
CHAMBER PRESSURE

PROOF LOAD  
1000usec/div  
20000psi/div



RADIAL RECEIVER STRAIN

1000usec/div  
100vin/in/div



PRESSURE [Psi] STRAIN  
97623.9 254.3