

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 Yetter, Jr.

Date Prepared: 2-8-82

Proofread and Cleared By:

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Signature

Date

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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

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

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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 TESTDATABy R.E. NIGHTINGALEDate 2-2-82FIREARM:Make REMINGTONModel 700Grade CLASSIC Gauge 375 H&H Serial Number 86346231Origin CUSTOM SHOPTest Number Assigned WIR # 820284Comments STRENGTH TESTHISTORY:Condition NEWPrevious Rounds Fired 35 rd

Headspace at Test \_\_\_\_\_

Test Date 2-2-82ABUSIVE  
LOAD USED:Powder Type H198Powder Weight 77 grCase Make and Type REMINGTONTotal 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 1/4")

PRESSURE [Psi]

SAAMI  
375-300-1-R

65997.5  
63124.7  
65741.0  
63538.4  
65125.4  
64125.0

60611.0  
62739.9  
64868.9  
60739.2

63871.1

Note: All pressures are  
calculated from chamber  
strain.

RADIAL RECEIVER STRAIN

PRESSURE [Psi] STRAIN

65971.8 286.3  
62714.3 291.0  
62970.8 302.3  
68100.8 282.8  
64586.7 280.3

64868.9 296.4

54870.2 308.3  
53813.7 298.0  
58585.3 303.9  
55585.0 308.3  
57584.3 312.0

57127.7

306.1

FACTORY  
300gr.

PRESSURE [Psi]

67612.0  
63994.0  
58639.2

58405.1

270gr

PRESSURE [Psi]

48606.8  
44092.4

46349.6

SAAMI

61867.8

270gr

45892.7

Proof

PRESSURE [Psi]

94639.8  
86902.2

90801.0

270gr.

PRESSURE [Psi] STRAIN

50812.7 286.3  
49833.8 281.3  
44169.3 291.3  
48198.7 280.3  
48155.1 287.8

48385.2 287.3



CALIBER: 375MAG  
 Inside Radius= .485  
 Outside Radius= 1.134  
 Modulus= 30000000  
 Constant= 192.6

PRESS.=CHAMBER STRAIN\*CONSTANT

LONGITUDINAL RECIEVER STRAIN  
 PRESSURE [Psi] STRAIN

SAAMI 61790.9 324.0

300gr 56532.6 188.6  
 270gr 50402.3 174.0

45gr 4198  
 Hand load 2117.3 120.3

~~correct strain~~  
 PRESSURE [Psi] STRAIN  
 106242.3 447.0

PROOF  
 loading  
 649r  
 PRESSURE [Psi] STRAIN  
~~103321.3 882.8~~  
 92442.6 882.8

103215.6 452.0

479r 4198 300gr  
 PRESSURE [Psi] STRAIN  
 47693.4 149.1  
 42784.2 134.7  
 43040.7 117.4  
 -----  
 44502.8 130.4

509r  
 51507.8 182.0  
 49478.9 116.1  
 -----  
 50543.3 149.1

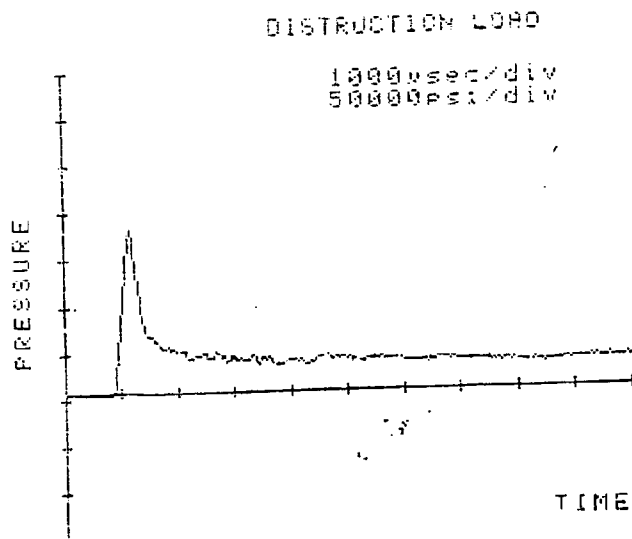
539r  
 55121.9 169.0  
 54249.8 201.7  
 -----  
 54685.8 185.8

SAAMI  
 PRESSURE [Psi] STRAIN  
 64638.0 244.4  
 -----  
 64638.0 244.4

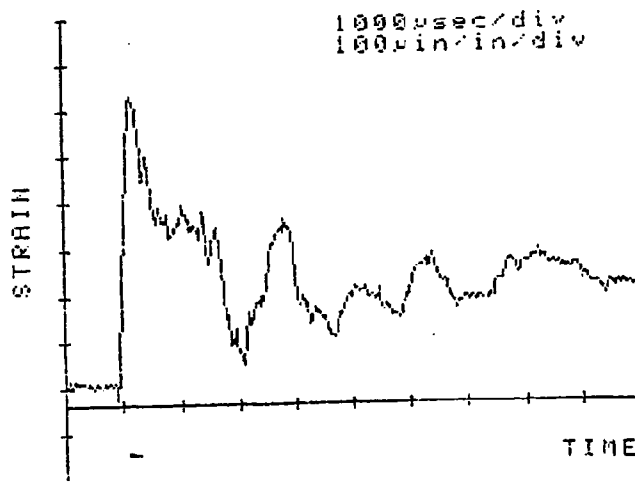
569r  
 66095.9 282.3  
 74154.2 287.0  
 65022.8 217.5  
 -----  
 69357.6 262.3

579r  
 PRESSURE [Psi] STRAIN  
 61508.7 221.2  
 72769.1 305.5  
 60867.5 222.4  
 -----  
 65048.4 249.7

DISTRUTION LOAD  
PRESSURE [psi]    STRAIN [in/in]  
176369.4        686.5



LONGITUDNAL RECIEVER STRAIN



COMPUTER PRINTOUT OF LOG  
CURVE FIT OF PRESSURE VS  
POWDER GRAINS

ROW: LOG REG CODE 2  
SOURCE/OF 33 MS F  
TOTAL 5 237.5  
REG 1 233.8 233.8 255 5  
RESID 4 3.7 0.3  
R SQUARE = 0.985

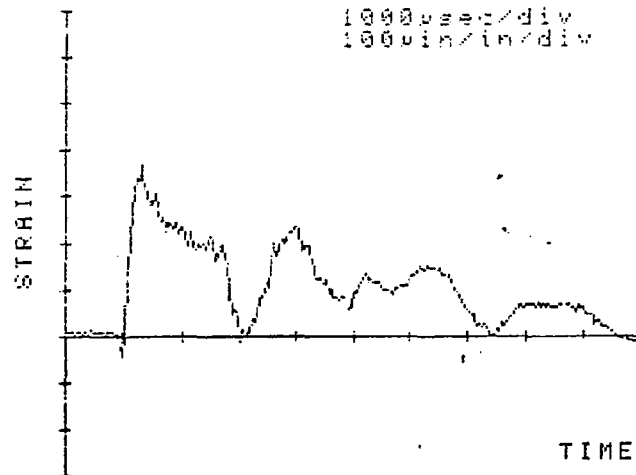
Empirical formula  
YHAT = Powder grains  
x = Pressure

YHAT = -32.419 + 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
100.50	64.00	64.24	-0.24
X(I)	YHAT		
150.00	72.62		
X(I)	YHAT		
180.00	76.44		
X(I)	YHAT		
195.00	77.91		
X(I)	YHAT		
190.00	77.57		

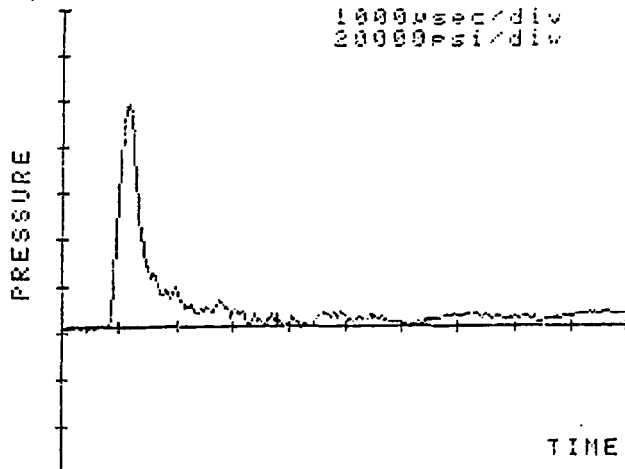
LONGITUDINAL RECIEVER STRAIN

PROOF LOAD  
1000µsec/div  
100µin/in/div



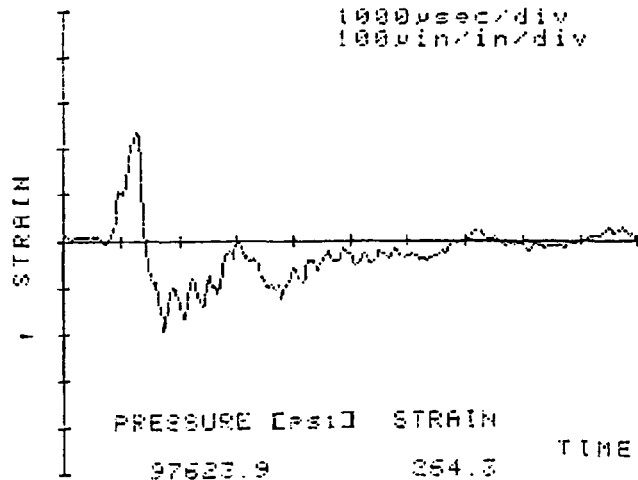
CHAMBER PRESSURE

PROOF LOAD  
1000µsec/div  
20000psi/div



RADIAL RECIEVER STRAIN

1000µsec/div  
100µin/in/div



PRESSURE [psi] STRAIN

97623.9

254.3

TIME