ANSI/SAAMI Z299.2-1992

American National Standard Voluntary Industry Performance Standards for Pressure and Velocity of Shotshell Ammunition for the Use of Commercial Manufacturers

ANSI American National Standards Institute

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Z299.2-1992

American National Standard Voluntary Industry Performance Standards for Pressure and Velocity of Shotshell Ammunition for the Use of Commercial Manufacturers

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Approved October 27, 1992
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Abstract In the interests of safety and interchangeability, this Standard provides pressure and velocity performance and dimensional characteristics for shotshell ammunition. Included are procedures and equipment for determining these criteria.

American National Standard

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus and other criteria for approval have been met by the standards developer.

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Foreword

The development of this voluntary industry performance standard was initiated under the auspices of the Sporting Arms & Ammunition Manufacturers' Institute, Inc. (SAAMI). A Product Standards Task Force was established by the Institute in 1975 and charged with the drafting of standards and their subsequent periodic revision.

The material presented provides the commercial manufacturer of factory loaded ammunition with pressure and velocity performance and dimensional characteristics. Included are procedures and equipment for determining these criteria. For the purpose of this standard a commercial manufacturer is defined as one who produces ammunition by fabricating component parts from raw materials as opposed to remanufacture with parts originally made by others.

This standard for Shotshell Ammunition was first published in 1977. Subsequently, it was revised at five year intervals, in 1982 and 1988. Changes in the standard with each revision include minor adjustments of velocities, the addition of new load offerings, an updating of recommended equipment sources and the latest procedures for reporting reference ammunition assessments.

Suggestions for improvement of this standard will be welcome. They should be sent to The Sporting Arms and Ammunition Manufacturers' Institute, Inc., 555 Danbury Road, Wilton, Connecticut 06897.

Consensus for this standard was achieved by use of the Canvass Method.

The following individuals and organizations recognized as having an interest in the standardization of safety requirements for factory loaded sporting ammunition were contacted prior to the approval of this standard. Inclusion in this list does not necessarily imply that the individual or organization concurred with the submittal of the standard to ANSI.

Association of Firearms & Tool Mark Examiners - J. Hamby, M.A.
D.M.W. Laboratory Inc. - P.M. Dougherty
Federal Bureau of Investigation - T. Hollabaugh
Forensic Ammunition Service - G. Kass
Gourley Associates, Inc. - G.E. Gourley
Guilford Engineering Associates Inc. - D. Findlay, P.E.
A. Hill - Independent Expert
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Hodgdon Powder Company - R. Reiber
National Institute of Standards & Technology - D.E. Frank, PhD.
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H.P. White Laboratory - D. Dunn
Wilson Arms - G. Wilson III

SHOTSHELL
SAAMI VOLUNTARY PERFORMANCE STANDARDS

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SHOTSHELL - FULL NAMES AND METRIC EQUIVALENTS

The following tabulation lists recommended full names and metric equivalents of shotshells currently supplied for various types of firearms:

Full Names		Metric Equivalents	
Gauge	Nominal Length	Gauge	Nominal Length
10	2-7/8"	10	73mm
10	3-1/2"	10	89mm
12	2-3/4"	12	70mm
12	3"	12	75mm
12	3-1/2"	12	89mm
16	2-3/4"	16	70mm
20	2-3/4"	20	70mm
20	3"	20	75mm
28	2-3/4"	28	70mm
410 Bore	2-1/2"	410 Bore	65mm
410 Bore	3"	410 Bore	75mm

Velocity specifications are stated on the basis of a nominal mean velocity ± 90 feet per second, as listed in Section I.

In the testing of ammunition, subsequent to its manufacture, allowances must be made for factors which can influence both the average and the variability of velocity observed. Factors such as components, sampling error, differences in test methods and equipment, and in the actual test conditions may influence the observed results.

The specifications include allowances for these sources of variation which are standardized and controlled during the manufacturing cycle, but may vary considerably in subsequent tests.

Manufacturers of ammunition should control velocity during loading at a level which gives reasonable assurance that the product will, in tests subsequent to loading, meet the established specifications.

The following procedures are intended to serve as a guide in establishing loading control limits for velocity which are compatible with the established values. These procedures, based on a modification of the concept of Reject Limits for Averages, permit maximum latitude in loading control while providing adequate assurance that velocity specifications are met.

This procedure requires that a valid estimate of σ' (sigma prime) be developed through analysis of the within-sample variation of velocity. Sigma prime is most easily determined by finding the average range (or extreme variation) within samples of size 10 rounds or less and dividing by the factor d_2 to convert the average range to σ'. For sample sizes greater than 10, calculate the standard deviation of each sample and determine the average standard deviation $\bar{\sigma}'$. Divide $\bar{\sigma}'$ by the factor c_2 to obtain an estimate of σ'. (Note: Texts on Quality Control contain tables of c_2 and d_2.) The test results from at least 50 samples of n rounds each, which include data from the loading of several different lots of powder should be used in developing the value of sigma prime (σ').

Table A contains the factors (M_1) which are used as multipliers of σ' in determining the Upper and Lower Reject Limits for sample averages. The specific values for M_1 are given for several levels of assurance and a range of sample sizes. The values of t_2 are taken from a table of critical values for the two-tailed normal distribution. Values of M_1 are calculated as follows:

$M_1 = t_2/\sqrt{n}$ where t_2 is a defined above and

n = sample size. For example, the first value

of M_1 in TABLE A is computed as follows:

$1.65/\sqrt{2} - 1.17$

TABLE A
FOR TWO SIDED SPECIFICATIONS FOR AVERAGES
MULTIPLIER (M_1) OF o SHOWN
IN THE BODY OF THE TABLE

Selected Level of Assurance	SAMPLE SIZE								
%	T_2	2	3	4	5	10	15	20	25
90.0	1.65	1.17	.95	.83	.74	.52	.43	.37	.33
95.0	1.96	1.39	1.13	.98	.88	.62	.51	.44	.39
97.5	2.24	1.65	1.35	1.17	1.04	.74	.60	.52	.47
99.0	2.58	1.82	1.49	1.29	1.15	.82	.67	.58	.52
99.5	2.81	2.00	1.62	1.41	1.26	.89	.73	.63	.56
99.73	3.00	2.12	1.73	1.50	1.34	.95	.77	.67	.60

EXAMPLE OF THE USE OF TABLE A

Assume that -

1. The Product velocity specification is 1330 ± 90 feet per second. Then, the specified limits are 1420 and 1240 feet per second.
2. The value of o has been determined to be 30 ft/s.
3. The selected level of assurance = 99%
4. The sample size = 5 rounds.

Calculate the sample average Reject Limits -

Upper Reject Limit = 1420 - (30 x 1.15) = 1420 - 34.50 = 1385 ft/s.

Lower Reject Limit = 1240 + (30 x 1.15) = 1240 + 34.50 = 1274 ft/s.

Note: Because of the importance of o in this procedure, it is recommended that control charts for the range (or extreme variation) be used to monitor and control the variability of velocity. Procedures for the construction and use of these charts can be found in Quality Control text books.

There are three principal sources of factors affecting pressure measurements. These are instrumentation, ammunition and procedure. The following lists the principal items in each category that may cause difficulties.

INSTRUMENTATION

(1) Condition of test barrel (whether minimum or maximum bore, chamber size and headspace, amount of erosion at forcing cone and bore).
(2) Fit of transducer in barrel.
(3) Location of transducer.
(4) Tightness of barrel mounting.
(5) Shape, size and protrusion of firing pin beyond breech face.
(6) Force of firing pin blow.
(7) Characteristics of transducer.
(8) Quality of transducer.
(9) Quality of Read-Out system.

AMMUNITION

(1) Condition of shell.
(2) Temperature of ammunition.

PROCEDURE

(1) Failure to mount pressure barrel properly in test action to assure minimum headspace.
(2) Failure to fire warming shots.
(3) Overheating barrel by excessive rate of fire.
(4) Failure to clean bore and control metal fouling (leading).
(5) Failure to protect transducer against contamination such as oil or water.
(6) Transducer calibration.
(7) Read-Out system calibration.

EXPLANATION OF PRESSURE TERMINOLOGY

SAAMI recognizes one pressure measuring system for shotshell ammunition. That system is the piezoelectric transducer system with the bottom of the transducer mounted tangent to the chamber of the test barrel. Pressure developed by the burning propellant exerts force on the transducer through the shell case wall causing the transducer to deflect, creating a measurable electric charge. Pressures measured with this system are expressed in units of "pounds per square inch" (abbreviated psi).

Maximum Average Pressure - is the recommended maximum pressure level for loading commercial sporting ammunition. This pressure level is positioned two standard errors below the Maximum Probable Lot Mean (MPLM) pressure in order to assure there is a 97.5% probability that the Maximum Probable Lot Mean pressure is not exceeded. See Figure 1.

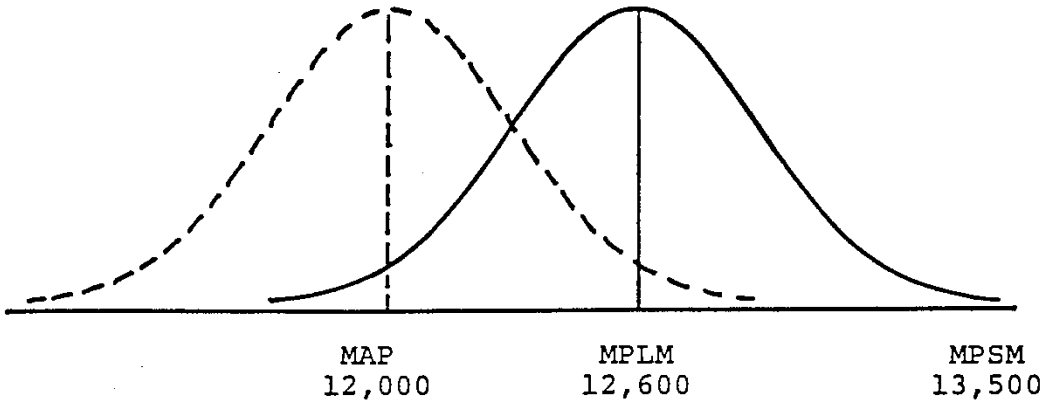


Figure 1

Standard Deviation (S.D.) - The Standard Deviation for each Maximum Average Pressure Level is based on a Coefficient of Variation of 7.5%. This 7.5% Coefficient of Variation is maintained throughout the SAAMI pressure spectrum providing a realistic Standard Deviation for each pressure level. To obtain the S. D. for a particular MAP multiply the MAP by 0.075 i.e., 12,000 x 0.075 = 900 psi.

Standard Error ($\sigma_{\bar{x}}$) - The standard error is calculated by dividing the Standard Deviation (population S. D. = σ) by the square root of the sample size $\frac{\sigma}{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

Maximum Probable Lot Mean (MPLM) - The MPLM is calculated by adding two standard errors to the Maximum Average Pressure.

The SAAMI pressures are calculated based on a sample size of 10. The Maximum Probable Lot Mean represents the midpoint of the upper service pressure distribution. See figure 1. For example, if the Maximum Average Pressure is 12,000 psi, the Maximum Probable Lot Mean (MPLM) is calculated as follows:

MPLM = Maximum Average Pressure + 2 standard errors
MPLM = 12,000 + (284 x 2) = 12,000 + 568 = 12,568 psi
rounded to 12,600 psi

Maximum Probable Sample Mean (MPSM) - is the maximum expected average pressure that may be observed in the testing of product subsequent to its manufacture and is not intended for use as a loading control point. The Maximum Probable Sample Mean is positioned 3 standard errors above the Maximum Probable Lot Mean i.e., MPLM + 3 $\sigma_{\bar{x}}$. See Figure 1.

Maximum Extreme Variation - The maximum allowable sample E.V. (Extreme Variation or Range) is a statistic derived from the knowledge of the population Standard Deviation. Applying table figures from the Relative Range Tables (Biometrika Tables for Statisticians) we calculate the Maximum E.V. or Range--- (population S.D.) x 5.16 (table constant for sample of 10 at 99.0% confidence level) i.e., 900 x 5.16 = 4,644 psi rounded to 4,600 psi.

VELOCITY AND PRESSURE DATA
SHOTSHELL

Gauge	Shell Length	Dram Equiv.	Lead Shot Wt.Oz.	Vel. ft/s Mean Inst. Vel. @ 3' (±90)	Pressure Limits (psi/100)* Maximum Average Pressure (MAP)	Maximum Probable Lot Mean (MPLM)	Maximum Probable Sample Mean (MPSM)
10	2-7/8"	4-1/4	1-5/8	1285	110	116	125
10	3-1/2"Mag	4-1/4	2	1210	110	116	125
10	3-1/2"Mag	4-1/2	2-1/4	1210	110	116	125
12	2-3/4"	2-3/4	1	1180	115	121	130
12	2-3/4"	-	1	1145	115	121	130
12	2-3/4"	2-3/4	1-1/8	1145	115	121	130
12	2-3/4"	3	1-1/8	1200	115	121	130
12	2-3/4"	3	1-1/4	1165	115	121	130
12	2-3/4"	3-1/4	1	1290	115	121	130
12	2-3/4"	3-1/4	1-1/8	1255	115	121	130
12	2-3/4"	3-1/4	1-1/4	1220	115	121	130
12	2-3/4"	3-1/2	1-1/8	1310	115	121	130
12	2-3/4"	3-1/2	1-1/4	1275	115	121	130
12	2-3/4"	3-3/4	1-1/4	1330	115	121	130
12	2-3/4"Mag	3-3/4	1-1/2	1260	115	121	130
12	2-3/4"	4	1-1/2	1315	115	121	130
12	3"	3-3/4	1-3/8	1295	115	121	130
12	3"	4	1-5/8	1280	115	121	130
12	3"	4	2	1175	115	121	130
12	3" Mag	4	1-7/8	1210	115	121	130
12	3-1/2"	4-1/4	2-1/4	1150	140	147	158
16	2-3/4"	2-1/2	1	1165	115	121	130
16	2-3/4"	2-3/4	1	1220	115	121	130
16	2-3/4"	2-3/4	1-1/8	1185	115	121	130
16	2-3/4"	3	1-1/8	1240	115	121	130
16	2-3/4"	3-1/4	1-1/8	1295	115	121	130
16	2-3/4"Mag	3-1/4	1-1/4	1260	115	121	130
20	2-3/4"	2-1/2	7/8	1210	120	126	135
20	2-3/4"	2-1/2	1	1165	120	126	135
20	2-3/4"	2-3/4	1	1220	120	126	135
20	2-3/4"Mag	2-3/4	1-1/8	1175	120	126	135
20	3" Mag.	3-1/4	1-1/8	1285	120	126	135
20	3" Mag.	3-1/2	1-3/16	1295	120	126	135
20	3" Mag.	3	1-1/4	1185	120	126	135

* Based on sample size n = 10
NOTE: All loads fired in full choke test barrels (Section III).
Pressures measured with transducers.

VELOCITY AND PRESSURE DATA
SHOTSHELL

Gauge	Shell Length	Dram Equiv.	Lead Shot Wt.Oz.	Vel. ft/s Mean Inst. Vel. @ 3' (±90)	Pressure Limits (psi/100)* Maximum Average Pressure (MAP)	Maximum Probable Lot Mean (MPLM)	Maximum Prob. Sample Mean (MPSM)
28	2-3/4"	1-3/4	5/8	1160	125	131	140
28	2-3/4"	2-1/4	3/4	1295	125	131	140
28	2-3/4"	2-1/4	7/8	1250	125	131	140
28	2-3/4"Mag	2-1/4	1	1205	125	131	140
410 Bore	2-1/2"	-	1/2	1200	125	131	140
410 Bore	3"	-	11/16	1135	135	141	150
12	2-3/4"	Skeet 2-3/4	1	1180	115	121	130
12	2-3/4"	Skeet	1	1145	115	121	130
12	2-3/4"	Skeet 2-3/4	1-1/8	1145	115	121	130
12	2-3/4"	Skeet-3	1-1/8	1200	115	121	130
16	2-3/4"	Skeet	1	1200	115	121	130
20	2-3/4"	Skeet 2-1/2	7/8	1200	120	126	135
28	2-3/4"	Skeet-2	3/4	1200	125	131	140
410 Bore	2-1/2"	Skeet	1/2	1200	125	131	140

* Based on sample size, n = 10

NOTE: All loads are fired in full choke test barrels (Section III) except skeet which are fired in improved cylinder barrels.

VELOCITY AND PRESSURE DATA
SHOTSHELL

Gauge	Shell Length	Dram Equiv.	Steel Shot Wt.Oz.	Vel. ft/s Mean Inst. Vel. @ 3' (±90)	Pressure Limits (psi/100)* Maximum Average Pressure (MAP)	Maximum Probable Lot Mean (MPLM)	Maximum Probable Sample Mean (MPSM)
10	3-1/2"	N/A	1-3/4	1260	110	116	125
10	3-1/2"	N/A	1-5/8	1350	110	116	125
12	2-3/4"	N/A	1-1/8	1365	115	121	130
12	2-3/4"	N/A	1-1/4	1275	115	121	130
12	2-3/4"	N/A	1	1375	115	121	130
12	3"	N/A	1-1/4	1375	115	121	130
12	3"	N/A	1-3/8	1265	115	121	130
12	3-1/2"	N/A	1-9/16	1300	140	147	158
16	2 3/4"	N/A	7/8	1300	115	121	130
20	2-3/4"	N/A	3/4	1425	120	126	135
20	3"	N/A	1	1330	120	126	135

* Based on sample size, n = 10

NOTE: All loads are fired in test barrels with a choke constriction of .005 ± .005. (Section III)

VELOCITY AND PRESSURE DATA
RIFLED SLUGS

Gauge	Length	Wt. Oz.	Vel. ft/s Mean Inst. Vel. (±90) @3'	@15'	Pressure Limits (psi/100)* Maximum Average Pressure (MAP)	Maximum Probable Lot Mean (MPLM)	Maximum Probable Sample Mean (MPSM)
10	3-1/2"	1-3/4	1265	1235	110	116	125
12	3"	1	1760	1730	115	121	130
12	2-3/4"	1	1550	1520	115	121	130
12	2-3/4"	1	1680	1650	115	121	130
12	2-3/4"	1-1/4	1460	1430	115	121	130
16	2-3/4"	4/5	1570	1540	115	121	130
20	2-3/4"	5/8	1570	1540	120	126	135
20	2-3/4"	3/4	1570	1540	120	126	135
410 Bore	2-1/2"	1/5	1815	1785	125	131	140

NOTE: All loads are fired in full choke standard test barrels (Section III). Cylinder bore test barrels may be substituted for test barrel with no significant difference in test results.

VELOCITY AND PRESSURE DATA
SABOTED SLUGS

Gauge	Length	Wt. Oz.	Vel. ft/s Mean Inst. Vel. (±90) @ 3'	Pressure Limits (psi/100)* Maximum Average Pressure (MAP)	Maximum Probable Lot Mean (MPLM)	Maximum Probable Sample Mean (MPSM)
12	3	1	1300	115	121	130
12	2 3/4	1	1200	115	121	130
12	2 3/4	1	1500	115	121	130
20	2 3/4	5/8	1400	120	126	135

NOTE: All loads are fired in rifled standard test barrels (Section III).

* Based on sample average.

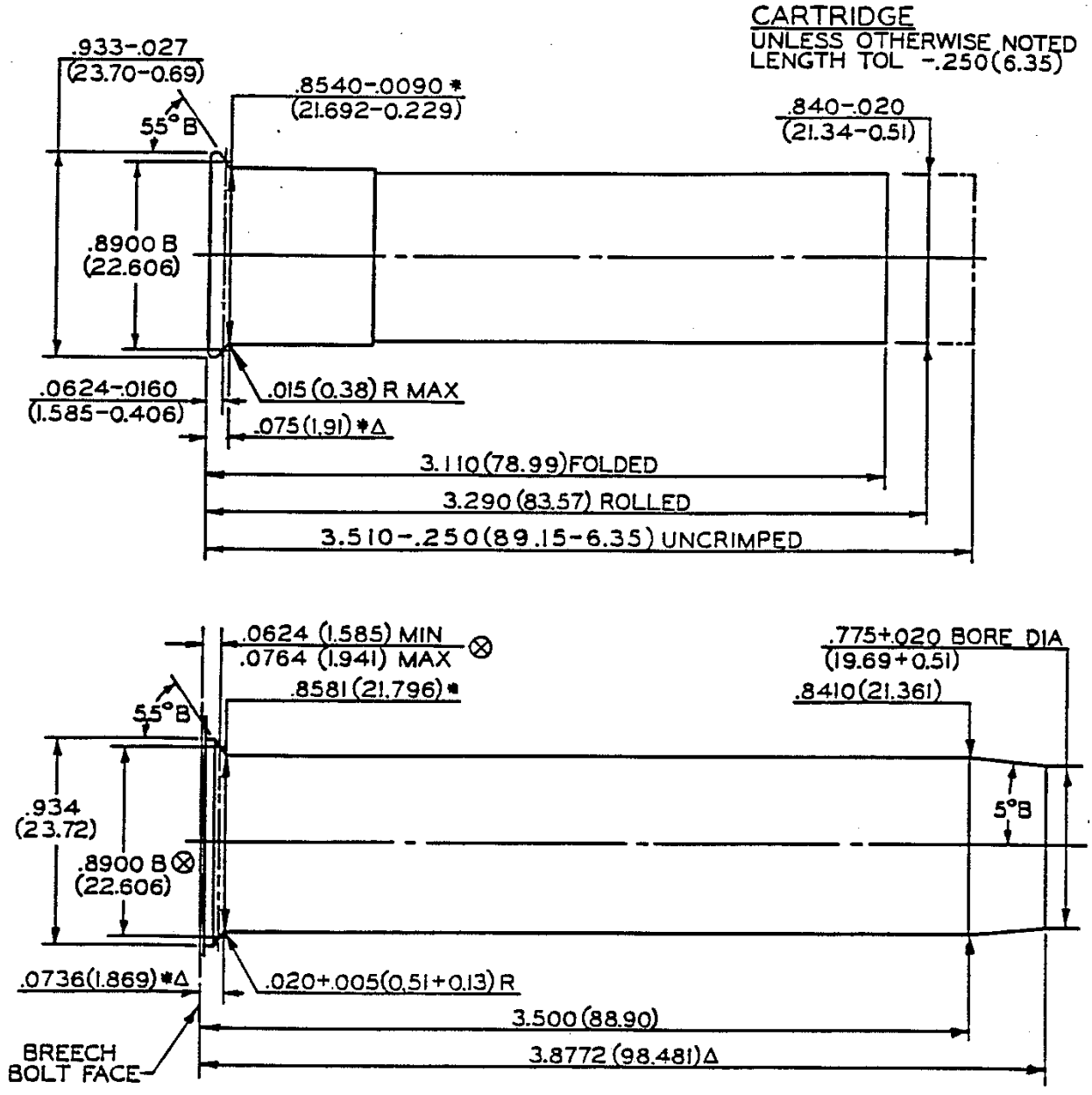
VELOCITY AND PRESSURE DATA
BUCK SHOT

Gauge	Length	Size of Buck	# of Pellets	Vel.ft/s Mean Inst. Vel. @ 3' (±90)	Pressure Limits (psi/100) * Maximum Average Pressure (MAP)	Maximum Probable Lot Mean (MPLM)	Maximum Probable Sample Mean (MPSM)
10	3-1/2"	00	18	1100	110	116	125
10	3-1/2"	4	54	1100	110	116	125
12	2-3/4"	000	8	1325	115	121	130
12	2-3/4"	00	9	1325	115	121	130
12	2-3/4"	00	12	1290	115	121	130
12	2-3/4"	0	12	1275	115	121	130
12	2-3/4"	1	16	1250	115	121	130
12	2-3/4"	1	20	1075	115	121	130
12	2-3/4"	4	27	1325	115	121	130
12	2-3/4"	4	34	1250	115	121	130
12	3"	000	10	1225	115	121	130
12	3"	00	15	1210	115	121	130
12	3"	1	24	1040	115	121	130
12	3"	4	41	1210	115	121	130
16	2-3/4"	1	12	1225	115	121	130
20	2-3/4"	3	20	1200	120	126	135
20	3"	2	18	1200	120	126	135

* Based on sample size, n = 10

NOTE: All loads are fired in full choke standard test barrels (Section III). Cylinder bore test barrels may be substituted for test barrel with no significant difference in test results.

CARTRIDGE & CHAMBER
10 GAUGE 3 1/2"



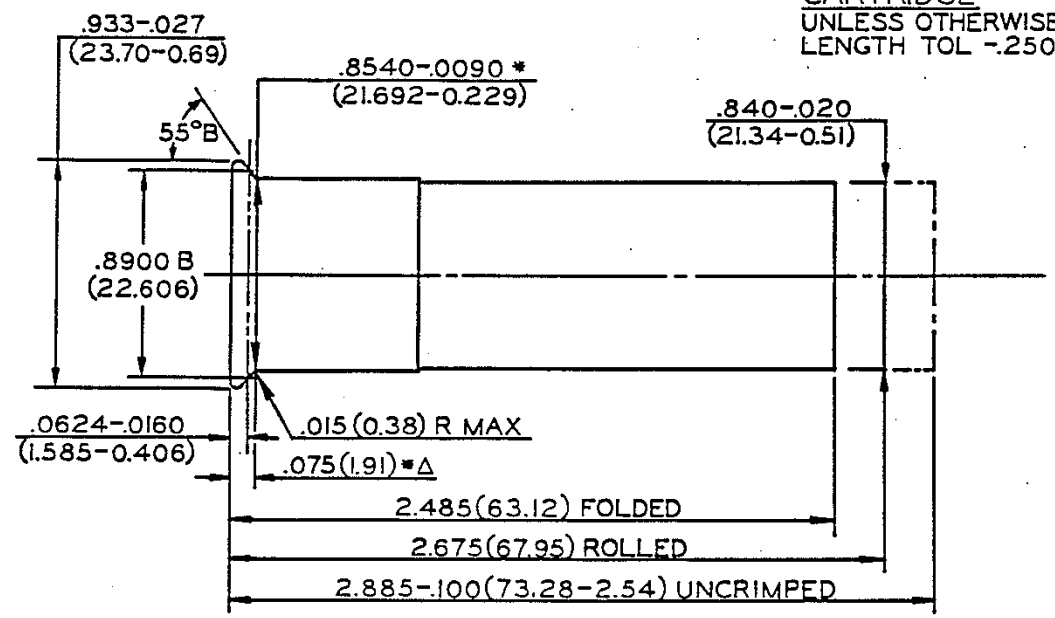
CHAMBER LENGTHS HAVE BEEN INCREASED. FORMER CHAMBER DIMENSIONS ARE ALSO CONSIDERED TO REPRESENT SAFE PRACTICE.

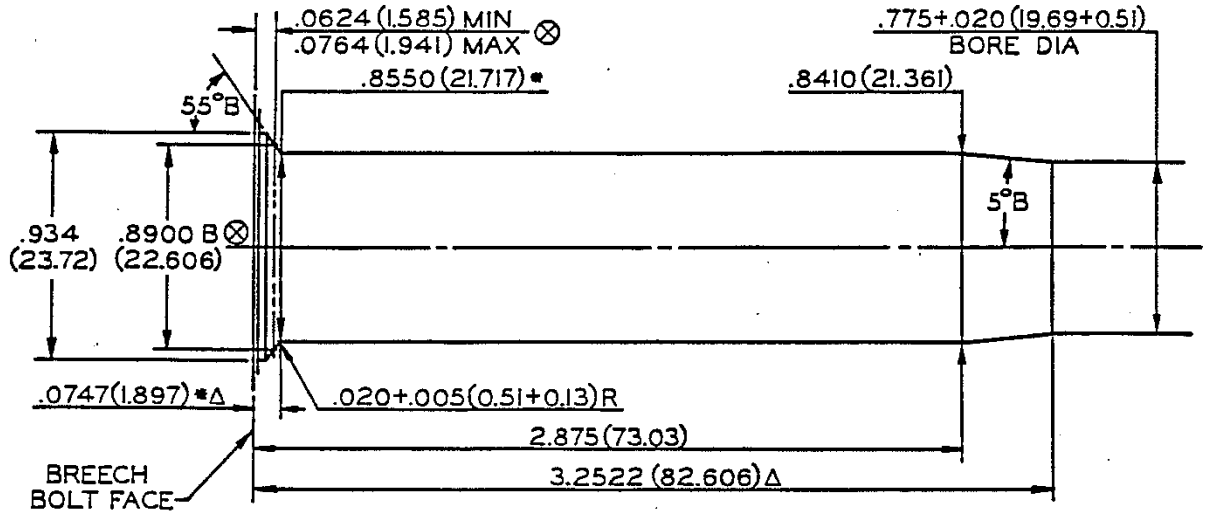
CHAMBER
UNLESS OTHERWISE NOTED
ALL DIA +.005 (0.13)
LENGTH TOL +.050 (1.27)

NOTE
B = BASIC
(XX.XX) = MILLIMETERS ⊗ = HEADSPACE DIMENSION
* DIMENSIONS ARE TO INTERSECTION OF LINES Δ=REFERENCE DIMENSION
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)

CARTRIDGE & CHAMBER
10 GAUGE 2 7/8"

CARTRIDGE
UNLESS OTHERWISE NOTED
LENGTH TOL -.250 (6.35)





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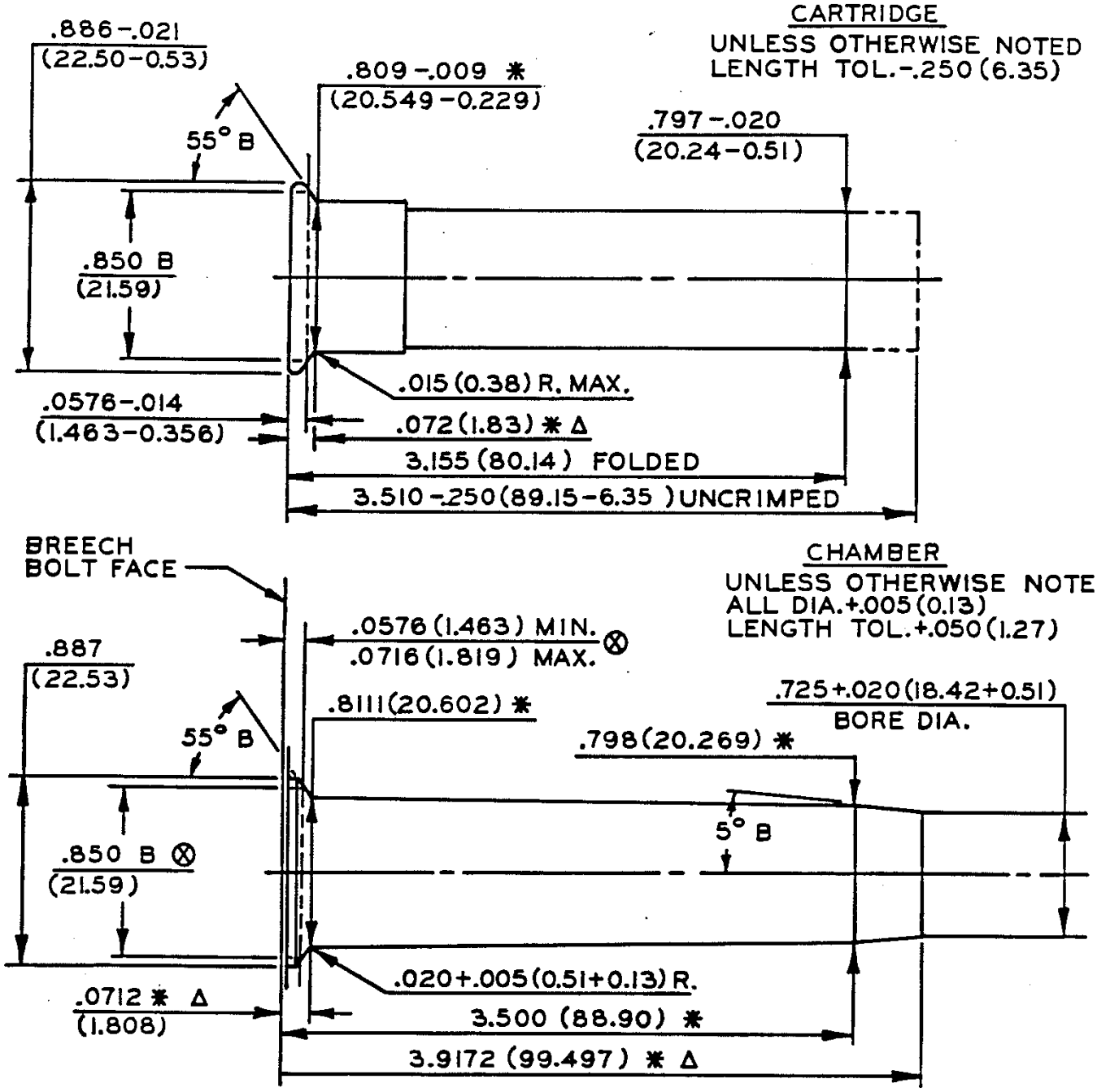

NOTE
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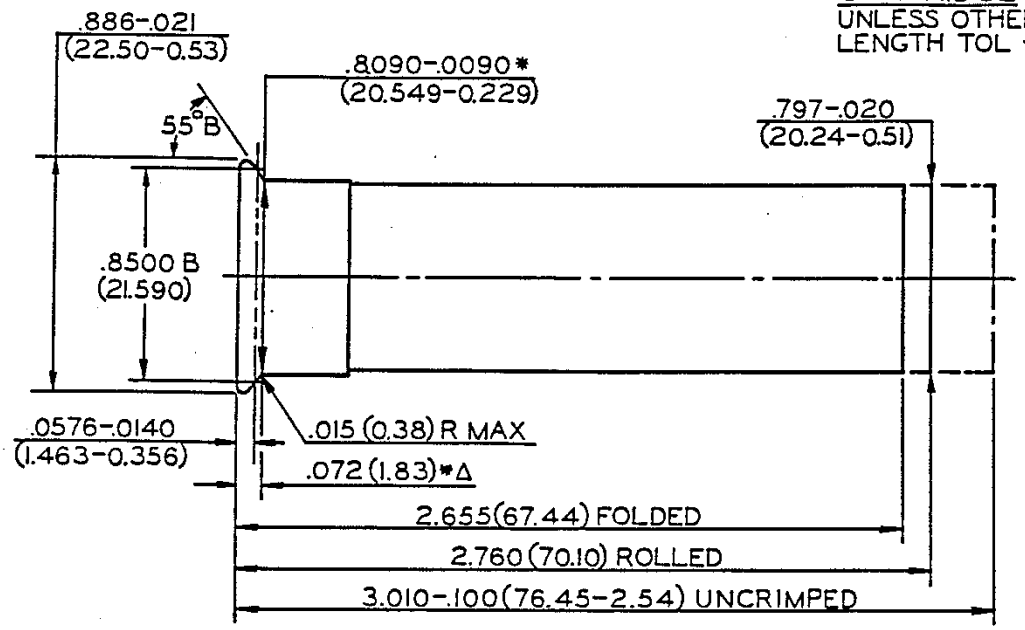
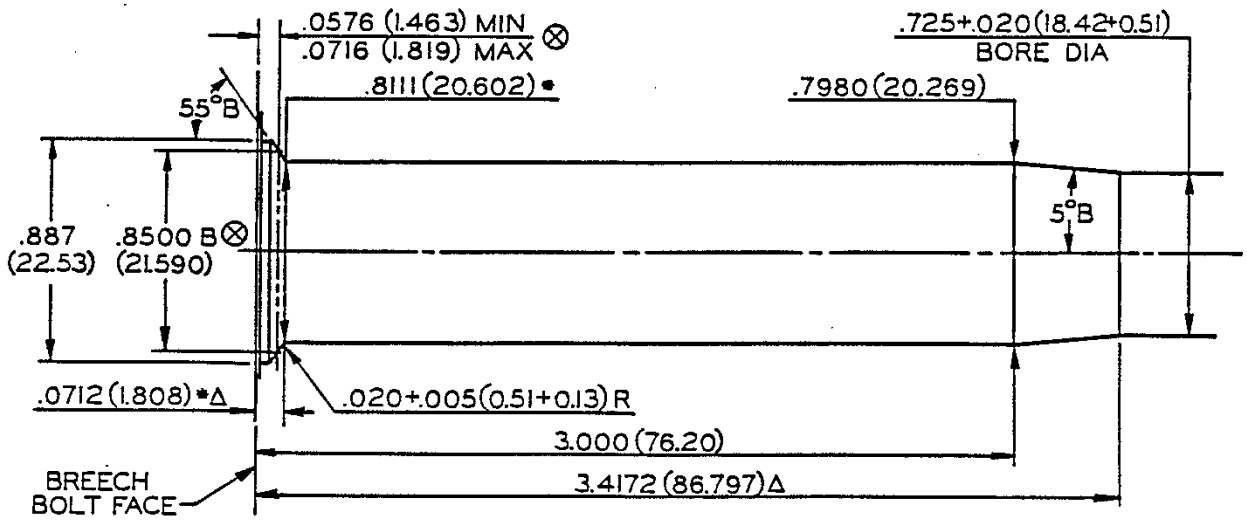
(XX XX)=MILLIMETERS
⊗=HEADSPACE DIMENSION
Δ=REFERENCE DIMENSION
* DIMENSIONS ARE TO INTERSECTION OF LINES
ALL CALCULATIONS APPLY AT MAXIMUM
MATERIAL CONDITION (MMC)

CARTRIDGE
UNLESS OTHERWISE NOTED
LENGTH TOL -.250 (6.35)





CHAMBER LENGTHS HAVE BEEN INCREASED. FORMER CHAMBER DIMENSIONS ARE ALSO CONSIDERED TO REPRESENT SAFE PRACTICE.

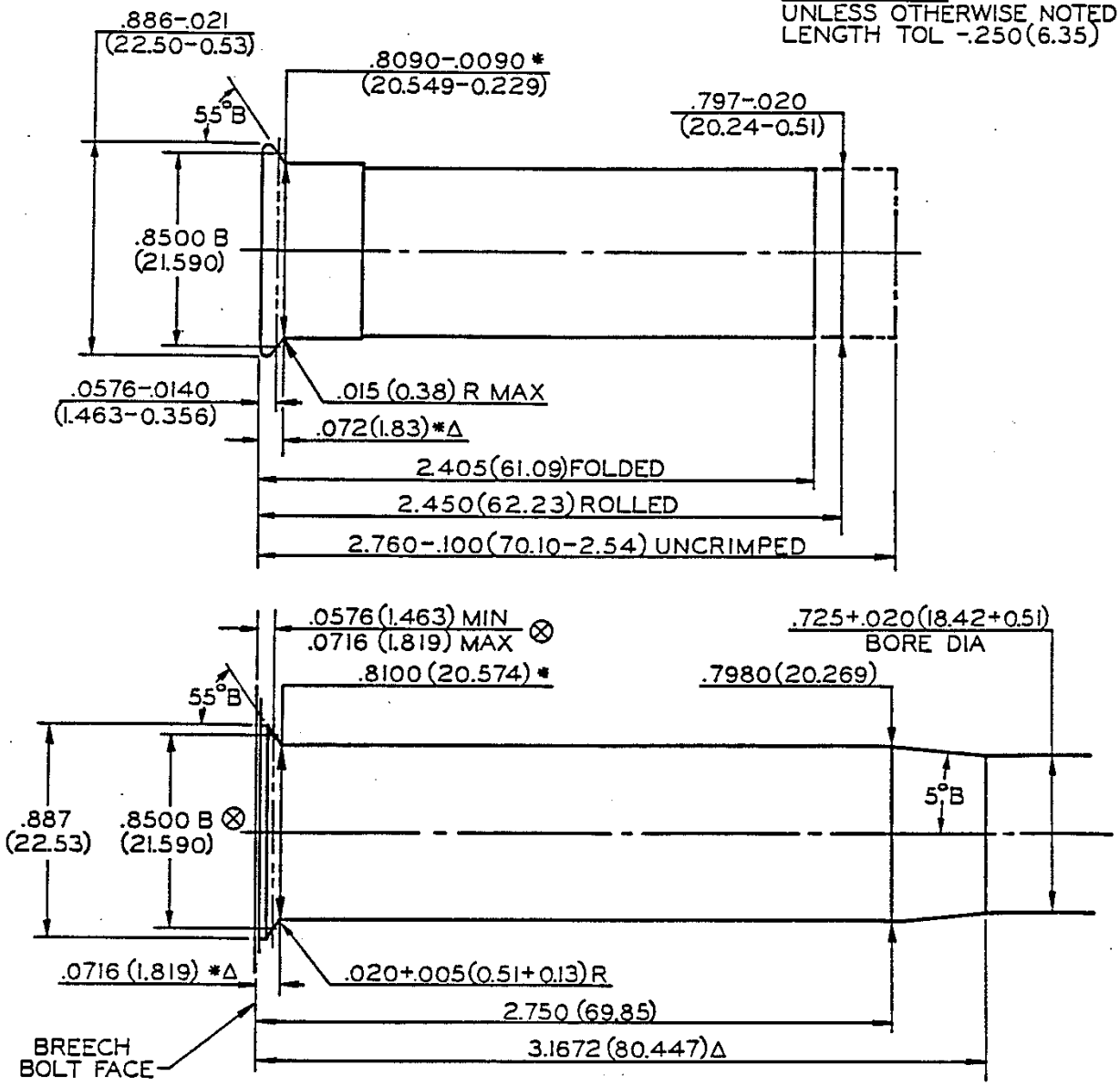
CHAMBER
UNLESS OTHERWISE NOTED
ALL DIA +.005 (0.13)
LENGTH TOL +.050 (1.27)

NOTE
B = BASIC
(XX.XX) = MILLIMETERS ⊗ = HEADSPACE DIMENSION
* DIMENSIONS ARE TO INTERSECTION OF LINES Δ = REFERENCE DIMENSION
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)

SECTION I - CHARACTERISTICS
SHOTSHELL
SAAMI VOLUNTARY PERFORMANCE STANDARDS

CARTRIDGE & CHAMBER
12 GAUGE 2 3/4"

CARTRIDGE
UNLESS OTHERWISE NOTED
LENGTH TOL -.250(6.35)



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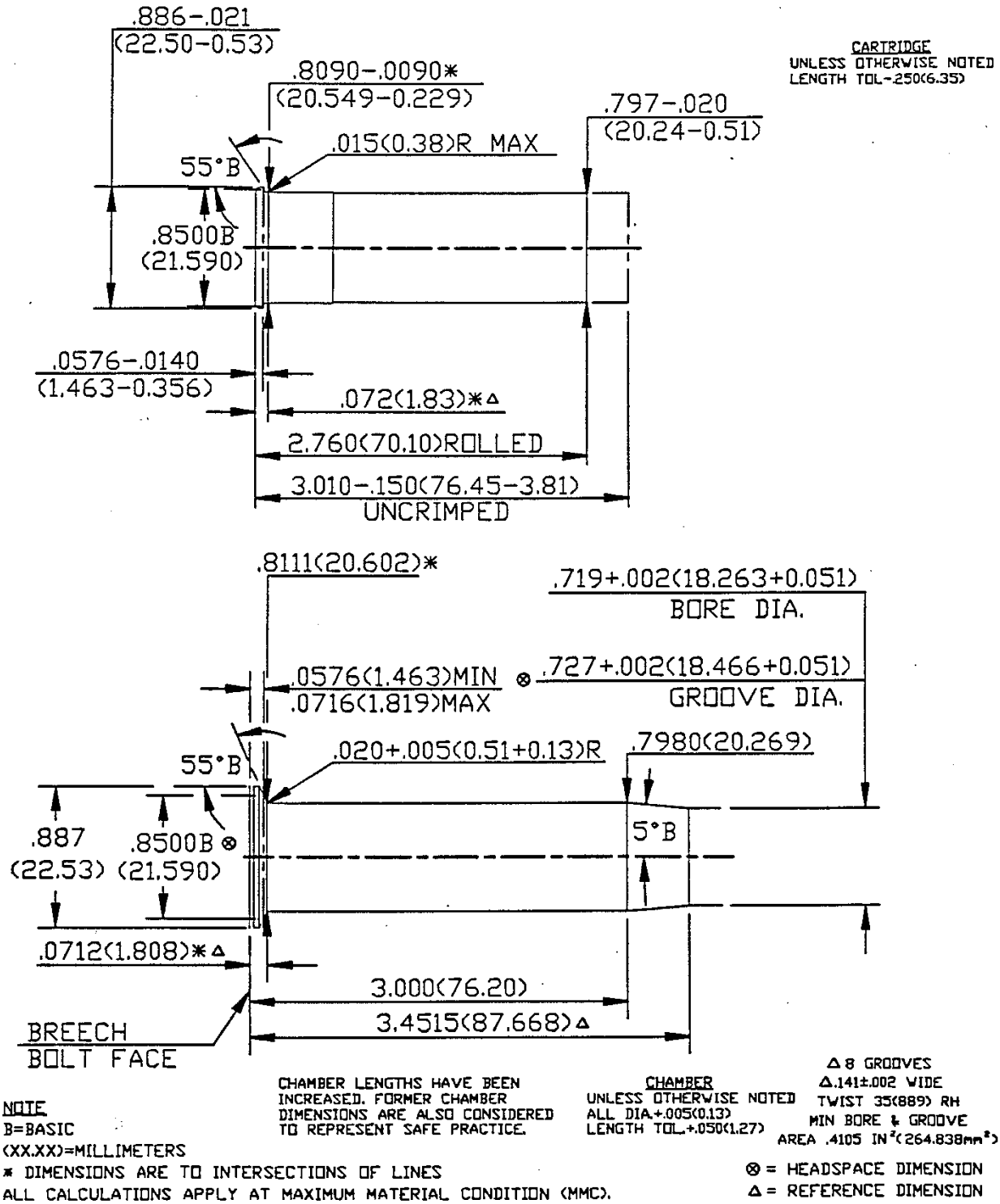

CARTRIDGE
UNLESS OTHERWISE NOTED
LENGTH TOL-.250(6.35)

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CHAMBER
UNLESS OTHERWISE NOTED
ALL DIA.+.005(0.13)
LENGTH TOL.+.050(1.27)

Δ 8 GROOVES
Δ.141±.002 WIDE
TWIST 35(889) RH
MIN BORE & GROOVE
AREA .4105 IN²(264.838mm²)

NOTE
B=BASIC
(XX.XX)=MILLIMETERS
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ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC).

⊗ = HEADSPACE DIMENSION
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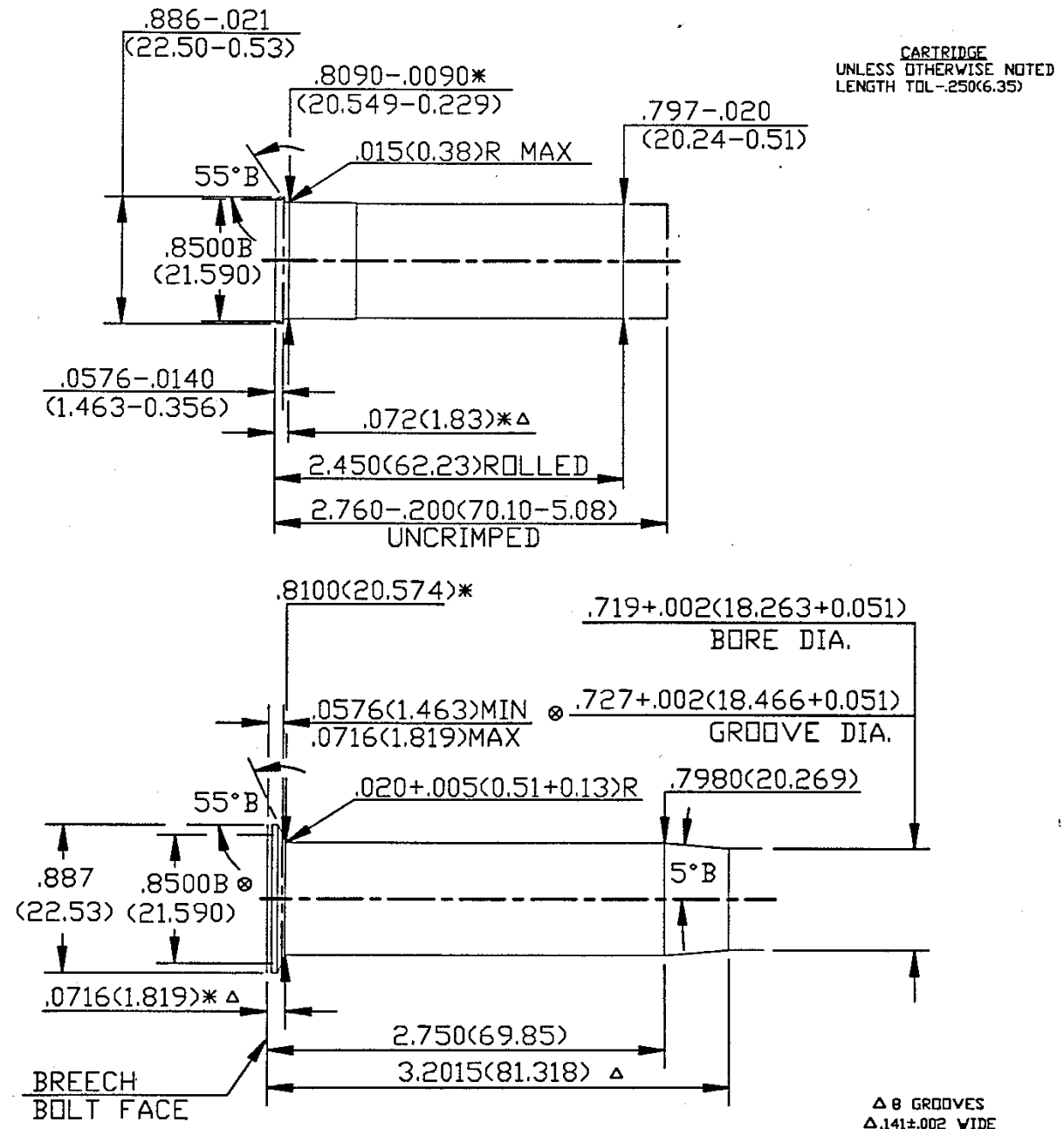

CARTRIDGE
UNLESS OTHERWISE NOTED
LENGTH TOL-.250(6.35)

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UNLESS OTHERWISE NOTED
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LENGTH TOL.+.050(1.27)

Δ 8 GROOVES
Δ.141±.002 WIDE
TWIST 35(889) RH
MIN BORE & GROOVE
AREA .4105 IN²(264.838mm²)

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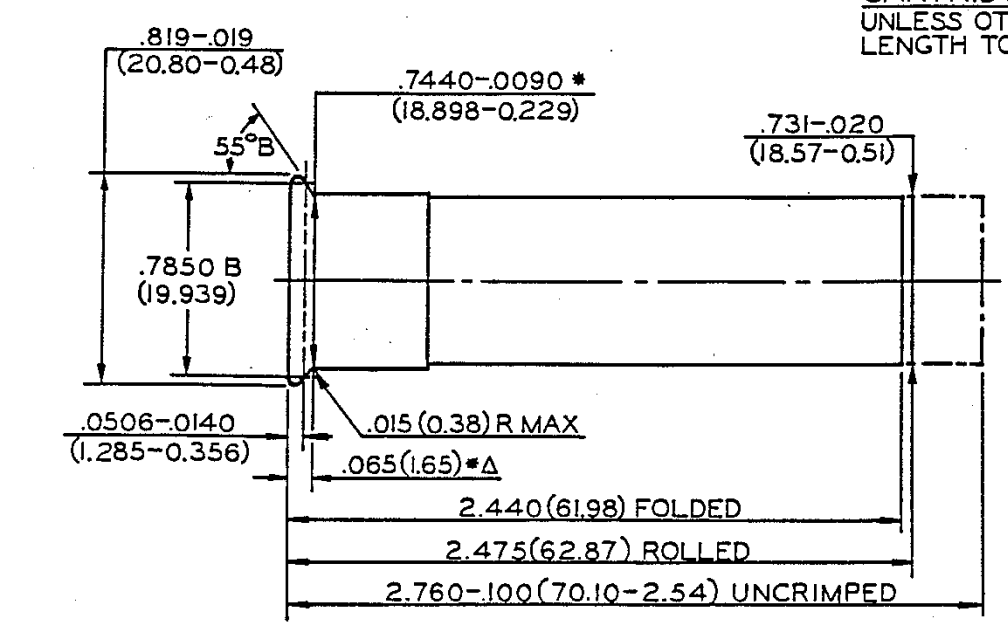
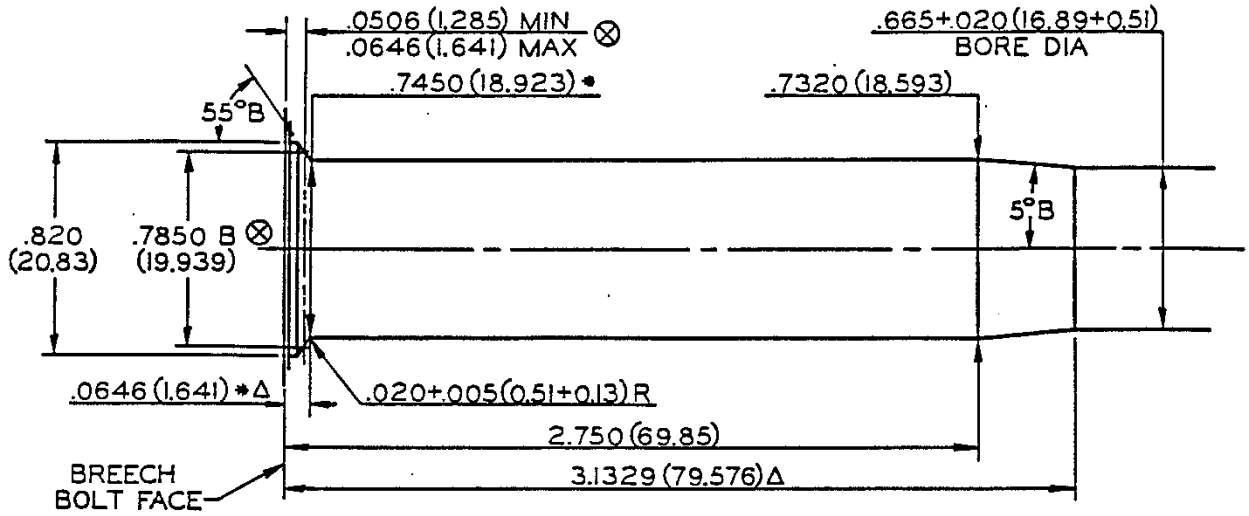
CARTRIDGE & CHAMBER
16 GAUGE 2 3/4"

CARTRIDGE
UNLESS OTHERWISE NOTED
LENGTH TOL -.250 (6.35)





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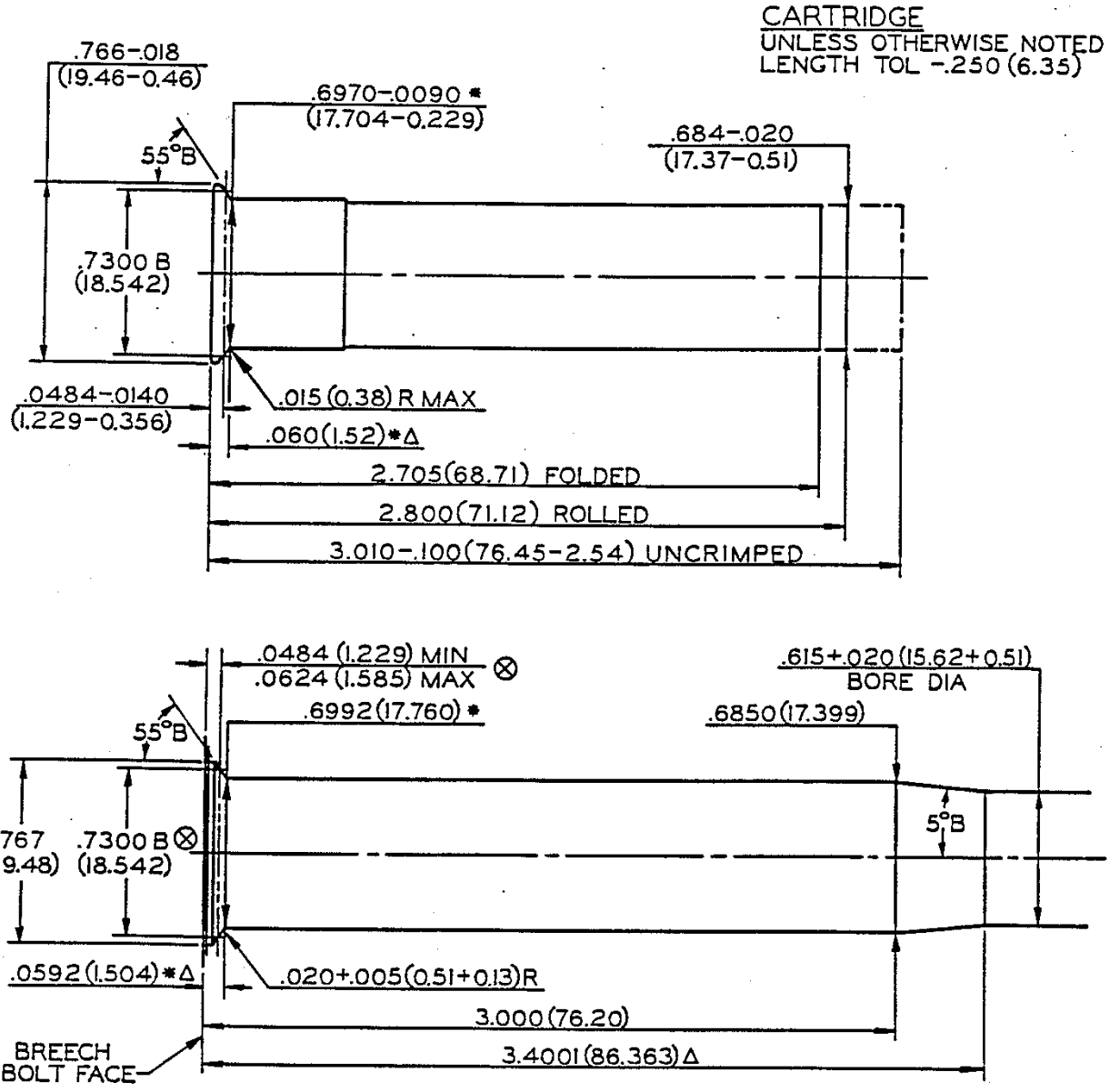
SECTION I - CHARACTERISTICS
SHOTSHELL
SAAMI VOLUNTARY PERFORMANCE STANDARDS

CARTRIDGE & CHAMBER
20 GAUGE 3"



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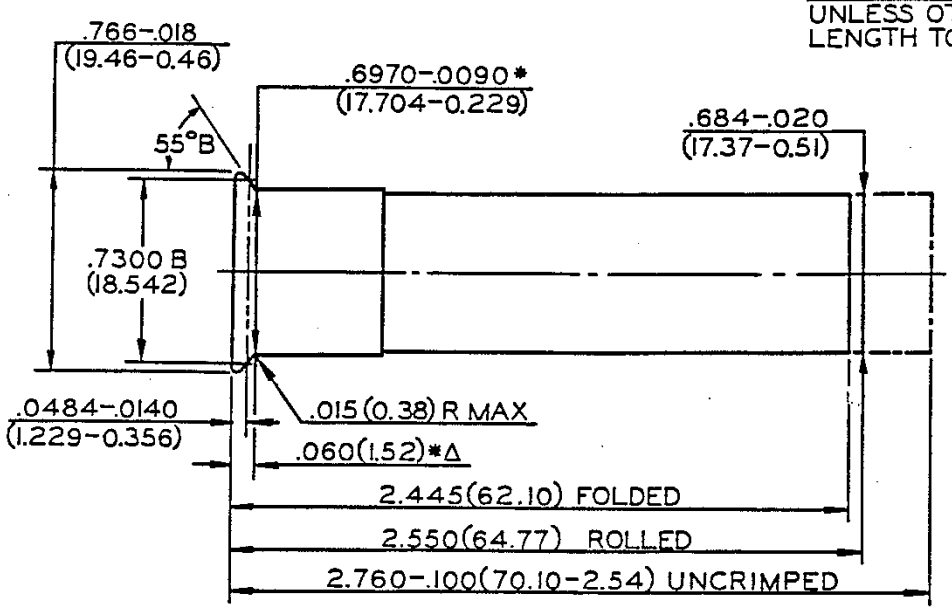
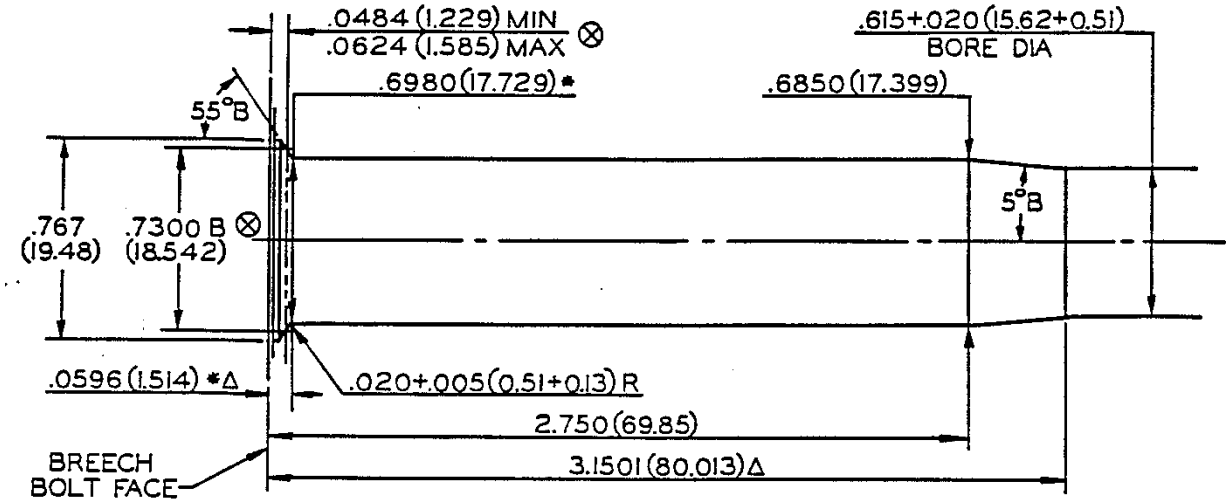
CARTRIDGE & CHAMBER
20 GAUGE 2 3/4"

CARTRIDGE
UNLESS OTHERWISE NOTED
LENGTH TOL -.250(6.35)





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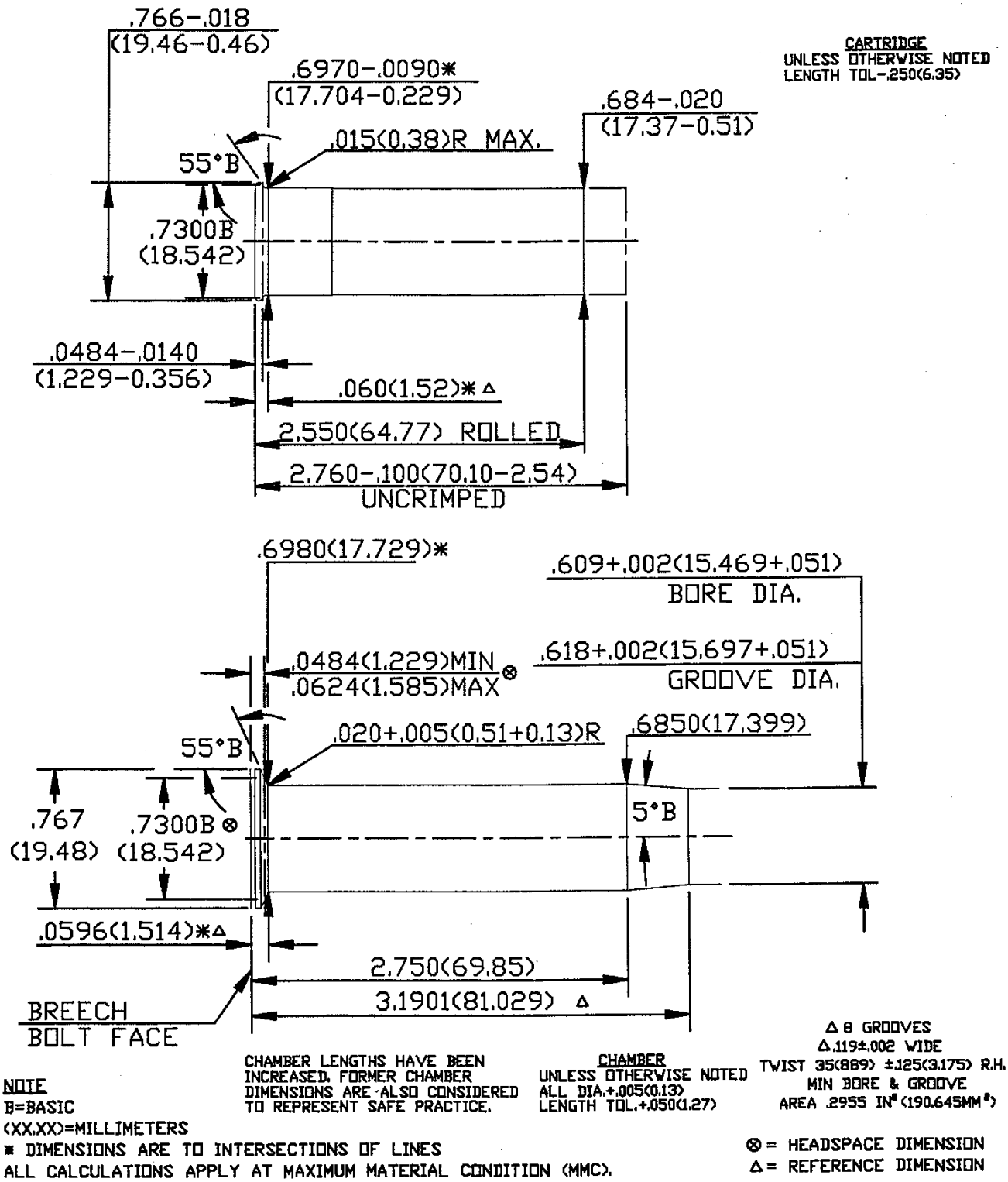

CARTRIDGE
UNLESS OTHERWISE NOTED
LENGTH TOL-.250(6.35)

CHAMBER LENGTHS HAVE BEEN INCREASED. FORMER CHAMBER DIMENSIONS ARE ALSO CONSIDERED TO REPRESENT SAFE PRACTICE.

CHAMBER
UNLESS OTHERWISE NOTED
ALL DIA.+.005(0.13)
LENGTH TOL.+.050(1.27)

Δ 8 GROOVES
Δ.119±.002 WIDE
TWIST 35(889) ±.125(3.175) R.H.
MIN BORE & GROOVE
AREA .2955 IN² (190.645MM²)

NOTE
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(XX.XX)=MILLIMETERS
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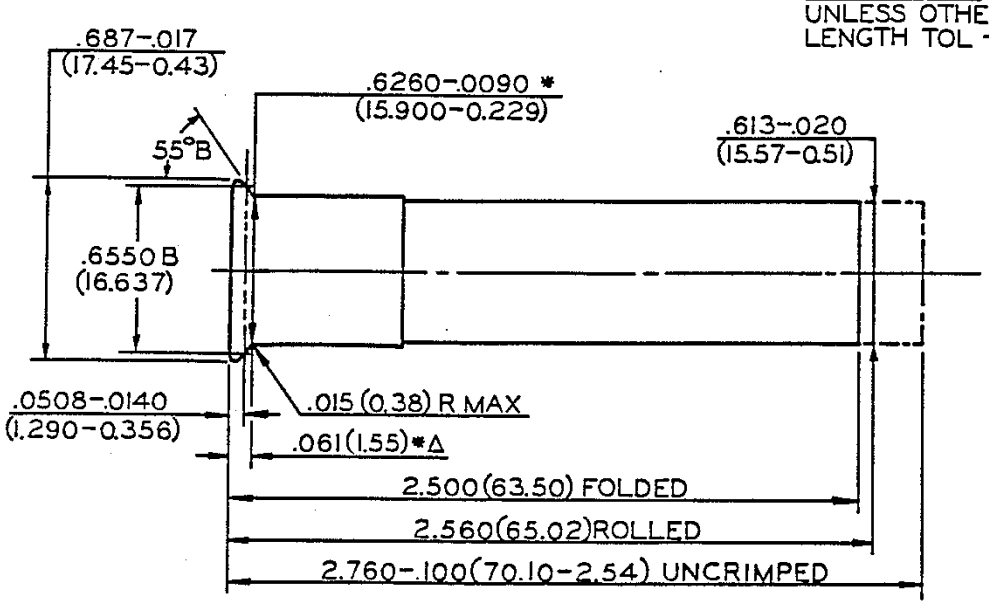
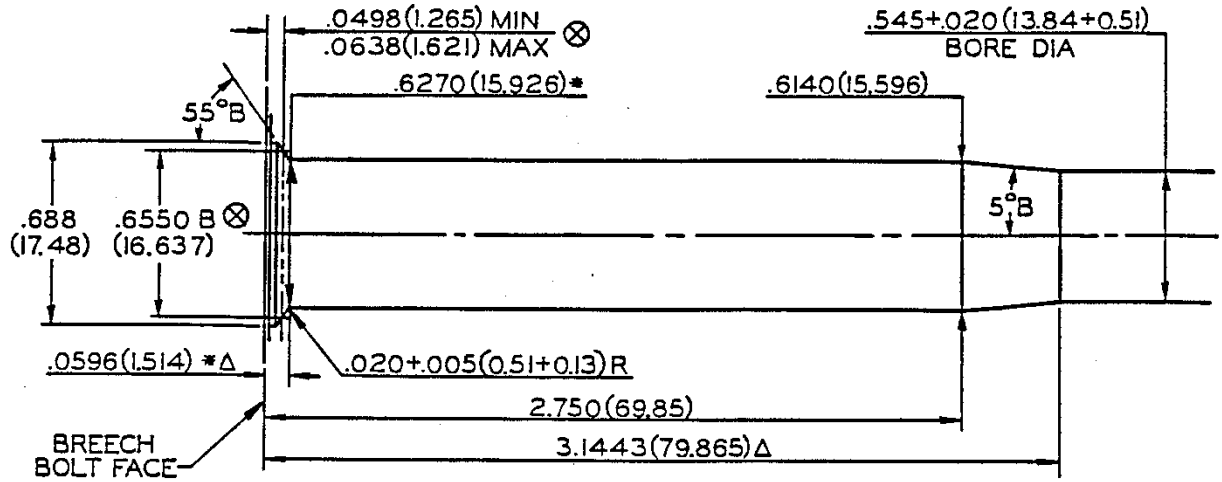
CARTRIDGE & CHAMBER
28 GAUGE 2 3/4"

CARTRIDGE
UNLESS OTHERWISE NOTED
LENGTH TOL -.250 (6.35)





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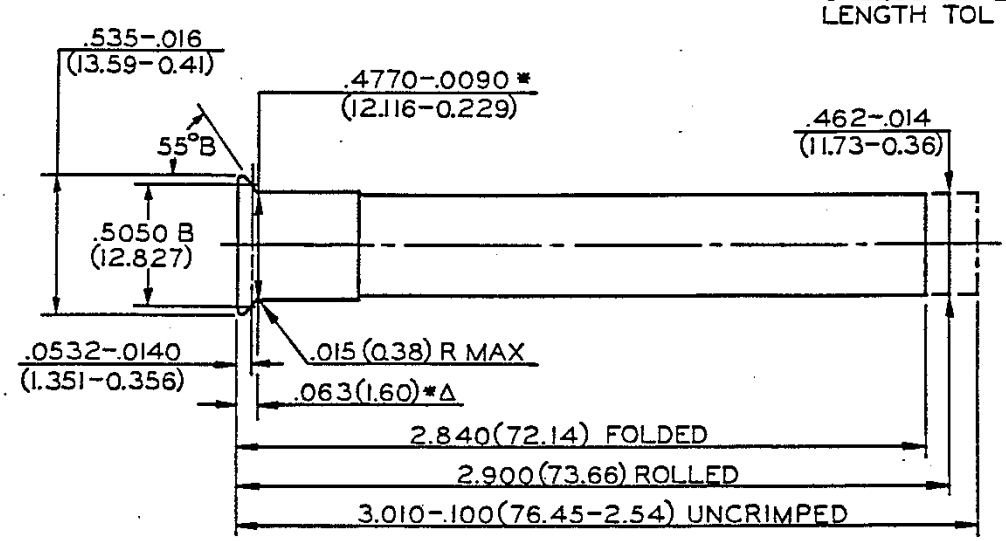
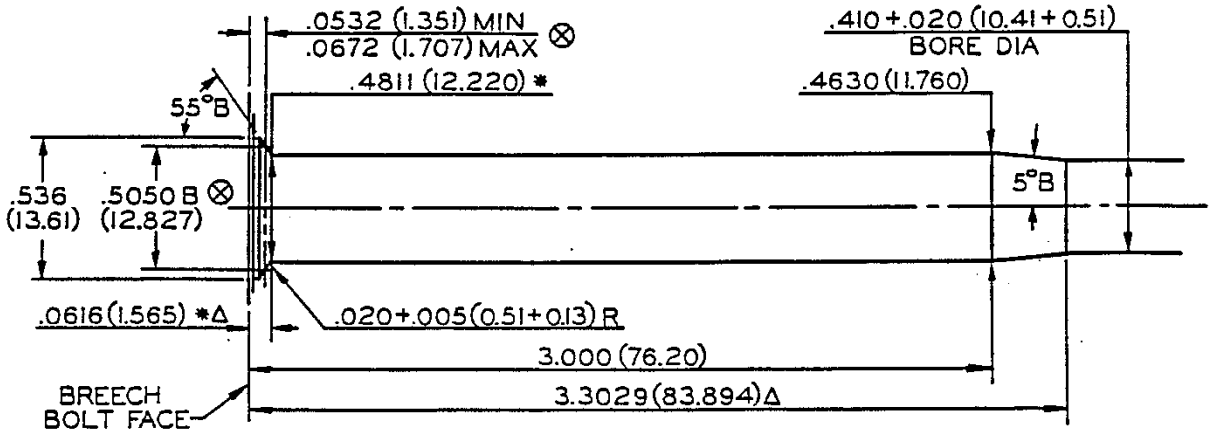
SECTION I - CHARACTERISTICS
SHOTSHELL
SAAMI VOLUNTARY PERFORMANCE STANDARDS

CARTRIDGE & CHAMBER
410 BORE 3"

CARTRIDGE
UNLESS OTHERWISE NOTED
LENGTH TOL -.250 (6.35)





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CARTRIDGE
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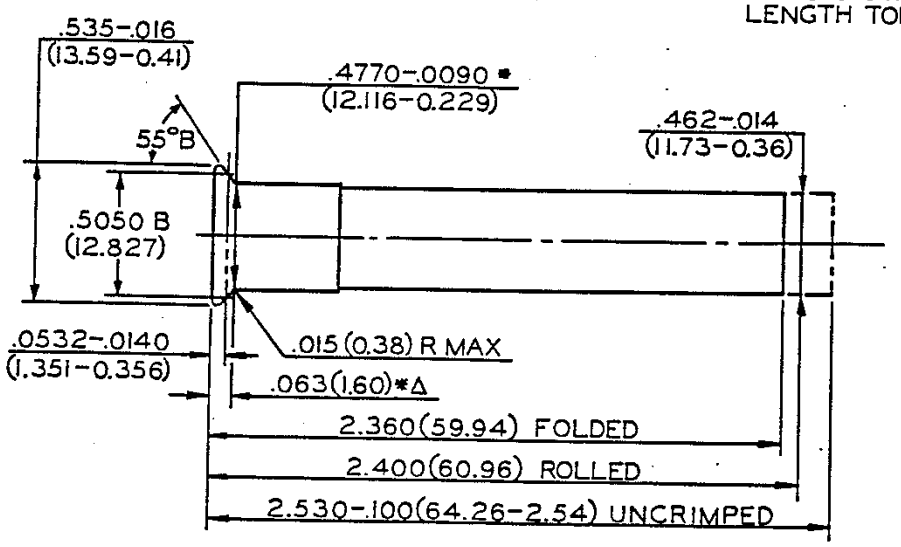

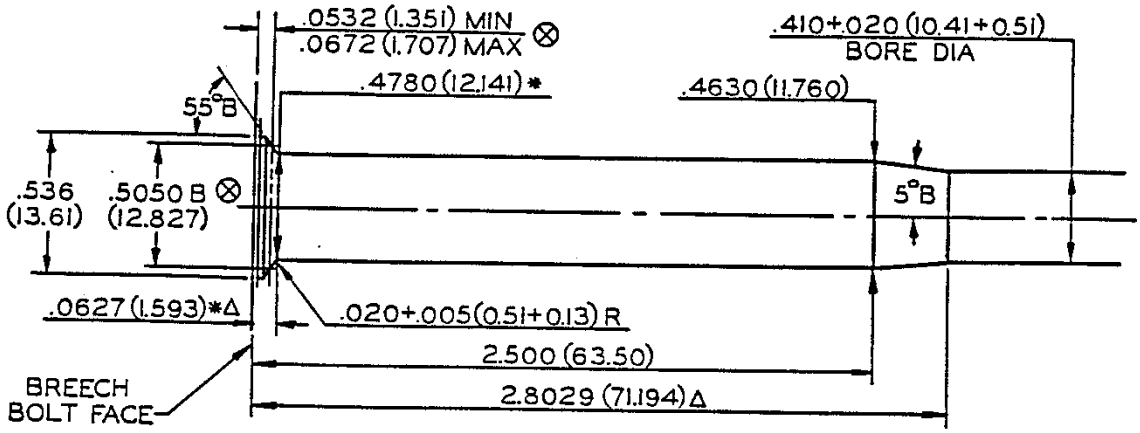

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UNLESS OTHERWISE NOTED
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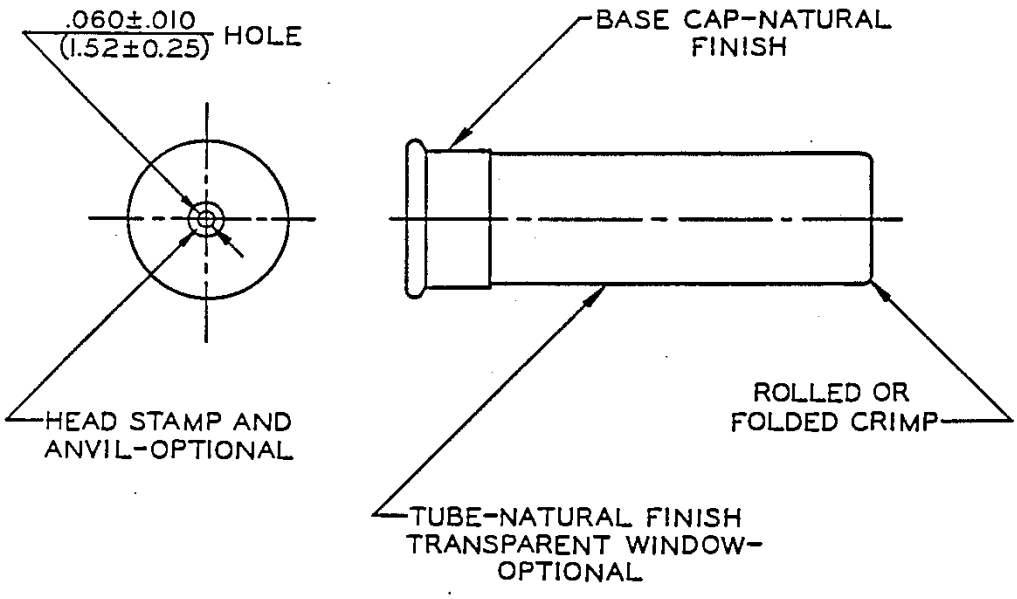


NOTE
ILLUSTRATES FORM ONLY-
PERTINENT DIMENSIONS SHOWN ON APPROPRIATE CARTRIDGE DRAWING

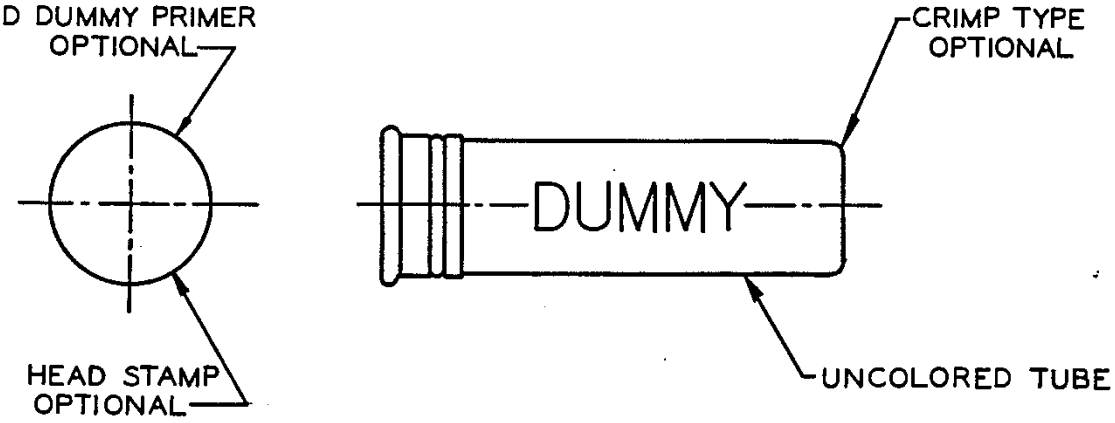
(XX.XX) = MILLIMETERS

DUMMY SHOTSHELL–GUN
FUNCTIONING
ALL GAUGES

FOR LOADED LENGTH
SEE SHOTSHELL DRAWING

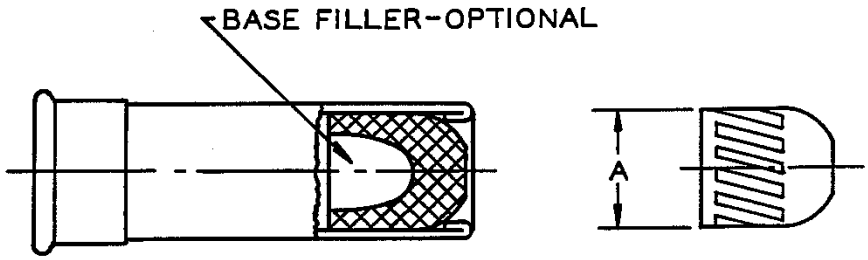
HEAD

HIGH OR LOW BASE CUP,
OXIDIZED BLACK
USE OF PRIMER POCKET
AND DUMMY PRIMER
OPTIONAL



"DUMMY" TO BE PRINTED IN TWO PLACES,
LENGTHWISE, 180° APART, LETTERS
.38(9.7) HIGH APPROXIMATELY

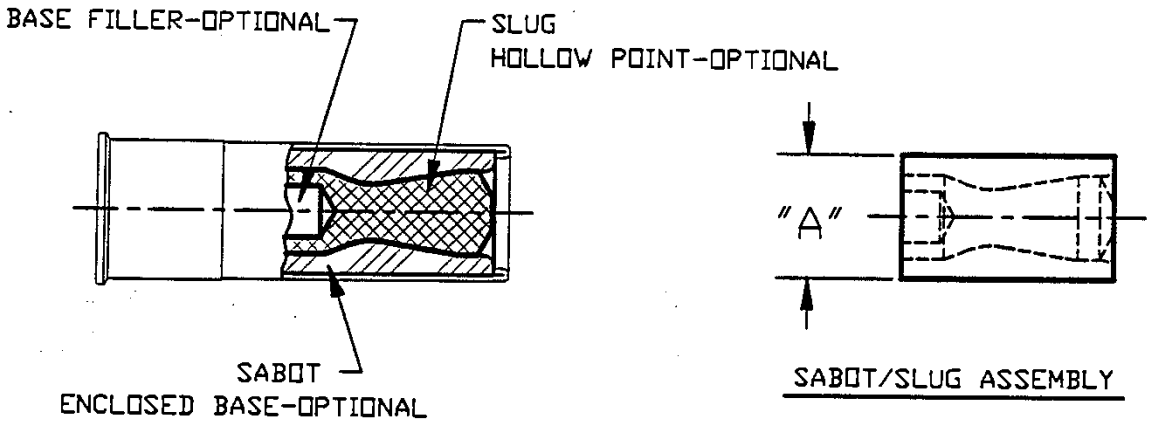
NOTE
ILLUSTRATES FORM ONLY – PERTINENT
DIMENSIONS SHOWN ON APPROPRIATE
SHOTSHELL DRAWING
(XX.XX) = MILLIMETERS



GAUGE SLUG	MAX DIA A	APPROX OUNCES	APPROX GRAMS
10 GA	.765 (19.43)	1 3/4	49.61
12 GA	.735 (18.67)	1	28.35
12 GA	.735 (18.67)	1 1/4	35.44
16 GA	.651 (16.54)	4/5	22.68
20 GA	.606 (15.39)	5/8	17.72
20 GA	.606 (15.39)	3/4	21.26
28 GA	.535 (13.59)	1/2	14.17
410 BORE	.403 (10.24)	1/5	5.67

NOTES

1. THESE DIAMETERS APPLY ONLY TO HOLLOW BASE, RIFLED, SOFT LEAD SLUGS.
2. ILLUSTRATES FORM ONLY - PERTINENT DIMENSIONS SHOWN ON APPROPRIATE CARTRIDGE DRAWING
3. (XX.XX) = MILLIMETERS
4. HOLLOW POINT-OPTIONAL



SABOT/SLUG ASSEMBLY

GAUGE SLUG	MAX DIA "A"	APPROX OUNCES	APPROX GRAMS
12 GA	.745 (18.92)	1	28
20 GA	.640 (16.26)	5/8	18

NOTES

1. THESE ASSEMBLY DIAMETERS APPLY ONLY TO PLASTIC SABOTED LEAD SLUGS.
2. ILLUSTRATES FORM ONLY - PERTINENT DIMENSIONS SHOWN ON APPROPRIATE CARTRIDGE DRAWING.
3. (XX.XX) = MILLIMETERS

CALCULATED STEEL PELLET COUNT PER OUNCE
AMERICAN STANDARD SIZES

Shot Name	Nominal Dia. in.	(mm)	Number/Ounce
Dust	.04	(1.02)	6569
12	.05	(1.27)	3363
11	.06	(1.52)	1946
10	.07	(1.78)	1226
9	.08	(2.03)	821
8 1/2	.085	(2.16)	685
8	.09	(2.29)	577
7 1/2	.095	(2.41)	490
7	.10	(2.54)	420
6	.11	(2.79)	316
5	.12	(3.05)	243
4	.13	(3.30)	191
3	.14	(3.56)	153
2	.15	(3.81)	125
1	.16	(4.06)	103
B	.17	(4.32)	86
Air Rifle	.175	(4.45)	78
BB	.18	(4.57)	72
BBB	.19	(4.83)	61
T	.2	(5.08)	53
TT	.21	(5.33)	45
F	.22	(5.59)	39
FF	.23	(5.84)	35

NOTE: ACTUAL PELLET COUNTS PER OUNCE IN A SHOTSHELL MAY VARY FROM THE CALCULATED VALUES TABULATED ABOVE DUE TO SMALL VARIATIONS IN DENSITY FROM THAT ASSUMED FOR THIS TABLE. ($0.284\ lb/in^3$) AND TOLERANCES IN SHOT DIAMETERS.

CALCULATED LEAD PELLET COUNT PER OUNCE
AMERICAN STANDARD SIZES

Shot Name	Nominal Dia. in.	(mm)	Nominal Antimony Content (percent by weight) 0.5%	2%	4%	6%
Dust	0.040	(1.02)	4610	4637	4719	4799
12	0.050	(1.27)	2360	2374	2416	2457
11	0.060	(1.52)	1366	1374	1398	1422
10	0.070	(1.78)	860	865	880	895
9	0.080	(2.03)	576	579	589	599
8-1/2	0.085	(2.16)	480	483	491	500
8	0.090	(2.29)	404	407	414	421
7-1/2	0.095	(2.41)	344	346	352	358
7	0.100	(2.54)	295	296	302	307
6	0.110	(2.79)	221	222	226	230
5	0.120	(3.05)	170	171	174	177
4	0.130	(3.30)	134	135	137	139
3	0.140	(3.56)	107	108	110	111
2	0.150	(3.81)	87	87	89	91
1	0.160	(4.06)	72	72	73	74
B	0.170	(4.32)	60	60	61	62
Air Rifle	0.175	(4.45)	55	55	56	57
BB	0.180	(4.57)	50	50	51	52
BBB	0.190	(4.83)	43	43	44	44
T	0.200	(5.08)	36	37	37	38
TT	0.210	(5.33)	31	32	32	33
F	0.220	(5.59)	27	27	28	28
FF	0.230	(5.84)	24	24	24	25

ACTUAL PELLET COUNTS PER OUNCE IN A SHOTSHELL WILL VARY FROM THE CALCULATED VALUES TABULATED ABOVE DUE TO VARIATION IN ANTIMONIAL CONTENT OF THE SHOT IN THE SHELL AND TOLERANCES IN SHOT DIAMETERS.

BUCKSHOT

SHOT NAME OR NUMBER	DIAMETER IN INCHES (mm)	APPROX. PELLETS PER POUND *	
		HARD	SOFT
NO. 4 BUCK	.24 (6.10) 		338
NO. 3 BUCK	.25 (6.35) 		299
NO. 2 BUCK	.27 (6.86) 		238
NO. 1 BUCK	.30 (7.62) 		173
NO. 0 BUCK	.32 (8.13) 		143
NO. 00 BUCK	.33 (8.38) 		130
NO. 000 BUCK	.36 (9.14) 		100

NOTE
APPROXIMATE PELLET COUNTS CALCULATED FROM NOMINAL DIAMETERS USING 0.5 % ANTIMONIAL CONTENT.

* ONE POUND = 0.45 KILOGRAM

NOTE: Drawings of shot pellets show relative size and are not to scale.

I Shot Weight per Shell

Game loads	+4%	-7%
Target loads	+3%	-5%

II Pellet Count per Ounce (28 Grams)

Nominal	±10%

III Buck Shot Pellet Count per Shell

0 & 00	Nominal	-1 pellet
1 & smaller	Nominal	-2 pellets

IV Diameter

Game Shot	Nominal	±0.010"	(.250mm)
Target Shot	Nominal	±0.005"	(.125mm)
Buckshot	Nominal	±0.015"	(.375mm)

DEFINITION OF SHOT HARDNESS - LEAD

Lead Shot pellet hardness is established by the amount of antimony alloyed with the lead in the pellets and is varied by the manufacturer depending on the purpose for which the shotshell is designed.

Hardness increases as the antimonial content increases.

Shot containing up to 0.5% antimony is generally called soft shot. Shot containing more that 0.5% is known as hard shot.

In view of the above, pellet counts per shell increase with antimony content since shot charges are designated by weight and the addition of antimony decreases the individual pellet weight.

DEFINITION OF SHOT HARDNESS - STEEL

Steel Shot pellets are fabricated from low carbon steel wire and are in-process annealed so that the shot has an average maximum hardness of R15T 69 on the Rockwell Superficial Hardness Scale. No individual reading may exceed R15T 79. Hardness is to be measured using the procedure in Section II, Procedures and with the Steel Shot Countersink Anvil described in Section III, Equipment.

The SAAMI recognized pressure measuring system for shotshell pressure is the piezoelectric transducer system.

A brief explanation of this system follows:

PIEZOELECTRIC TRANSDUCER SYSTEM

This system employs a piezoelectric transducer flush mounted in the chamber of the test barrel. Pressure developed by the gases from the burning propellant exerts force on the transducer through the cartridge case wall causing the transducer to deflect, creating a measurable electric charge. This electrical charge is converted into a reading of pressure.

The Sporting Arms and Ammunition Manufacturers' Institute has adopted the pressure units designation of "pounds per square inch" (abbreviated psi) for this system. This designation applies to values obtained with transducers and methods as outlined in this Manual.

1. Velocities and pressures should be measured simultaneously in horizontally mounted test barrels of the appropriate gauge and choke for the load to be tested.

2. Recommended values for velocity and pressure of all Shotshell loads are tabulated in Section I.

   When required, a minimal retest of double the original quantity may be fired with statistically equivalent tolerances.

3. Drawings and descriptions of the required equipment are listed and shown in Section III of these standards.

4. Handling of Ammunition:

   a. Special handling not required.

   b. The rate of fire should not be rapid enough to cause excessive heating of the barrel. The time between rounds depends on the equipment, as the barrel may be cooled by a constant stream of air on the outside or by directing air through the bore after each ten rounds.

   c. Conditioning should be between a temperature of 60°- 80°F (15.6°- 26.7°C).

5. Two warming shots should be fired before firing each series for record. The velocity and/or pressure of these shots may be recorded, but should not be included in the record of the sample.

6. Pressure Determination

   a. The SAAMI recommended piezoelectric transducer installation in a pressure barrel is illustrated in Section III.

   b. The piezoelectric transducer assembly consists of two components; the pressure transducer and a steel seal ring that fits over the shank of the transducer. The seal ring is slightly crushed when the transducer is torqued into the barrel.

   c. Care must be exercised in the installation of the pressure transducer to ensure that the diaphragm of the transducer, when the transducer is properly torqued into the barrel, is tangentially positioned to the sidewall of the chamber, and that the diaphragm is not protruding into the chamber, nor is recessed into the barrel.

Pressure Determination - (Continued)

d. Before installing the transducer in the barrel, check the mounting cavity in the barrel to assure that the seal seat is free of dirt and that previously used seal rings are not present.

e. Plastic caps should be put on the transducer and cable connectors when not in use, during installation and for removal of the transducer from the barrel, to avoid contamination.

f. Install the transducer and seal ring with a torque wrench. Torque not to exceed transducer manufacturer's maximum torque recommendation.

g. Insert shotshell to be fired in the chamber of the test barrel.

h. The chronograph and pressure recording device are then reset and the breech mechanism gently closed. The round may then be fired.

7. Velocity Determination

Time of flight of the shot charge should be measured with a 100 Kilohertz (minimum) electronic counter chronograph using Inductance Sensors spaced 3 feet apart with the first sensor at 18 inches from the muzzle of the test barrel.

8. Recording of Test Results

The following data should be recorded for each series of shots fired for velocity and pressure.

a. Ammunition data

(1) Date of test.
(2) Nominal load identification.
(3) Shell - gauge and type.
(4) Wadding.

Recording of Test Results (continued)

(5) Powder charge, type, lot number.
(6) Shot weight and size.
(7) Primer.
(8) Type of crimp.
(9) Code or date of loading.

b. Average velocity uncorrected.

c. Average pressure uncorrected.

d. Maximum and minimum individual velocity.

e. Maximum and minimum individual pressure.

f. Extreme variation (range) of velocity.

g. Extreme variation (range) of pressure.

h. Other statistical indication of variation. (Optional)

i. Correction to results from firing Reference Ammunition. (Optional)

j. Corrected average velocity. (Optional)

k. Corrected average pressure. (Optional)

l. Recommended values.

(1) Average velocity.
(2) Average pressure.
(3) Velocity and pressure variation.

m. Test firearm and range data.

(1) Barrel length, choke, and serial number.
(2) Barrel history.
(3) Type of chronograph and Inductance Sensors.

n. Test personnel.

Use of Reference Ammunition

a. Purpose

Reference Ammunition, assessed by firings at the ranges of member companies, is available for calibrating ranges, firearms, and other equipment for velocity and pressure only.

b. Supply

On request, the SAAMI Office, P. O. Box 838, Branford, Connecticut 06405, will supply information on the manufacturer of specific Reference Ammunition. The method of identifying Reference Ammunition is shown in this section.

Request for Reference Ammunition should be addressed to the manufacturer of the specific cartridge.

c. Assessment

Details of the assessment tests are shown in Section II.

d. Clearing House

Results of assessment tests of Reference Ammunition are tabulated, analyzed and distributed by the SAAMI Office.

e. Corrections

For method of applying corrections to tests of service loads, see Section II.

f. Calibration

For method of calibrating ranges and equipment, see Section II.

All barrels are not necessarily suitable for use in determining pressure or velocity levels, even though they may conform to the dimensions given on the appropriate Standard Velocity and Pressure Barrel drawing in this Standard. New barrels may require a number of rounds to be fired to remove sharp corners or burrs resulting from the manufacturing process. Barrels in service do not have an unlimited life and may become unserviceable from wear and erosion. There is no predictable number of rounds to which a barrel should be exposed before use for pressure and velocity determinations, nor is there a predictable round life for such equipment.

The following procedure is suggested for determining the suitability of any barrel for pressure or velocity test use:

> Fire ten rounds of SAAMI Reference Ammunition following the procedures shown in this Standard. The average velocity and pressure results of the test should be within the Inclusion Limits as given on the latest assessment for the lot fired.

In the case of a new barrel, the firing of more breaking-in shots may be indicated after which the Reference Ammunition test should be repeated.

In the case of barrels which have been in service, removal of fouling or other corrective procedures may be implemented followed by a retest.

VELOCITY & PRESSURE BARRELS MOUNTING IN RECEIVERS

It is essential that close headspace be maintained in velocity-pressure testing equipment if reliable test results are to be achieved.

In mounting test barrels to Universal Receivers or test actions a headspace not exceeding 0.005" (0.13 mm) over minimum should be maintained. This may be measured by headspace gages, shim stock or feeler gages, or a combination thereof, whichever is most appropriate for the type of equipment being used.

Headspace adjustments with the Universal Receiver may be accomplished by several methods:

1. Formed shim stock behind the Firing Pin Plate.
2. Formed shim stock on the rear bearing shoulder of the barrel Collar.
3. Adjustment of the Breech Block Locking Screws.

I. Equipment Preparation

A. All instruments should be operational and calibrated per manufacturer's specification. Establish the transfer function of the charge amplifier (on a selected range) to be used in the transducer calibration.

B. The transducer calibrator and instruments used to calibrate the charge amplifier, peak detector and digital voltmeter should have a certified calibration traceable to the National Institute of Standards and Technology.

C. Transducers should be properly maintained per manufacturers' recommendations and stored in a desiccator when not in use.

D. CAUTION: Cable, transducers and instrument connectors should be covered with plastic caps when not in use to prevent contamination.

E. Measure the internal resistance of the transducer and low noise cable. If the resistance is less than 10^{12} ohms, bake-out transducer and low noise cable as described in Section III, Transducer Initialization. If the resistance is in the 10^{12} to 10^{14} ohm range, proceed to Section IV Transducer Calibration.

II. Transducer Calibration

A. Initial Set-Up

1. Allow instrumentation to stabilize for at least thirty minutes.

2. Install the transducer with seal ring to the calibrator and torque to manufacturer's specification.

3. Cycle the calibrator to 30,000 psi and check for oil leaks. Correct if necessary.

4. Connect equipment as shown in this Section.

5. Set the charge amplifier sensitivity dial to a suitable range to obtain the desired voltage reading on the digital voltmeter, and time constant to long.

6. Manually adjust the calibrator dial indicator to 0 psi with no pressure applied.

B. Procedure

1. Reset the charge amplifier with no pressure applied to the transducer and verify zero volts displayed on the digital voltmeter.

2. Cycle the calibrator to 30,000 psi in 3,000 psi increments beginning at 6,000 psi.

3. At each pressure increment, allow the pressurized system to stabilize for 10 to 15 seconds and record the voltage reading on the digital voltmeter. If pressure stabilization does not occur, a leak is suspect. Calibration must be stopped, and leak corrected.

4. Repeat steps 1 through 3, three times consecutively.

5. CAUTION: Always increase pressure to desired level, never decrease pressure to desired level.

C. Data Reduction

1. Calculate the average value for the three output voltages recorded at each pressure increment. Multiply these average values by the charge amplifier range transfer function (pC/v) to obtain the transducer charge output (Q) at each pressure increment (P).

2. Obtain a least square line equation using the transducer charge output (Q) as the dependent variable and pressure (P) as the independent variable. $Q = mP \pm q$.

3. A manual method of calculating the least square line equation is given in tabular form in this Section. It is recommended that when using this technique, all numbers be carried to the third place.

4. Obtain the pressure (P) offset value when Q in the line equation is zero.

D. Transducer Records

Historical records of the transducer should be maintained and include the following:

1. Date of calibration.
2. History of rounds exposed to test firing.
3. Calibration pressure (P), charge amplifier voltage output (V), and transducer charge output (Q).
4. Charge amplifier range and transfer function.
5. Least square line equation.
6. Pressure offset.
7. Transducer identification.

III. Firing Test

A. Pressure Barrel Preparation

1. Refer to the SAAMI recommended piezo pressure transducer installation in a pressure barrel illustrated in Section III.

B. Initial Set-Up

1. Allow instrumentation to stabilize for at least thirty minutes.

2. Inspect the transducer mounting cavity in the pressure barrel to assure that the seal seat is free of dirt and any other foreign matter.

3. Install the transducer into the barrel cavity and torque to manufacturer's specification. Care must be exercised in the installation to ensure the diaphragm of the transducer, when properly torqued into the barrel, is positioned tangentially to the chamber side wall. The diaphragm should not protrude into the chamber nor be recessed into the barrel.

4. Remove protective caps from the equipment connectors and connect equipment as shown in Section II.

5. Set the charge amplifier controls as follows:

   Range switch to a position that will allow for maximum test pressures and direct pressure readout on the digital voltmeter; time constant as required, and sensitivity dial to the value of slope m obtained from the transducer least square line equation.

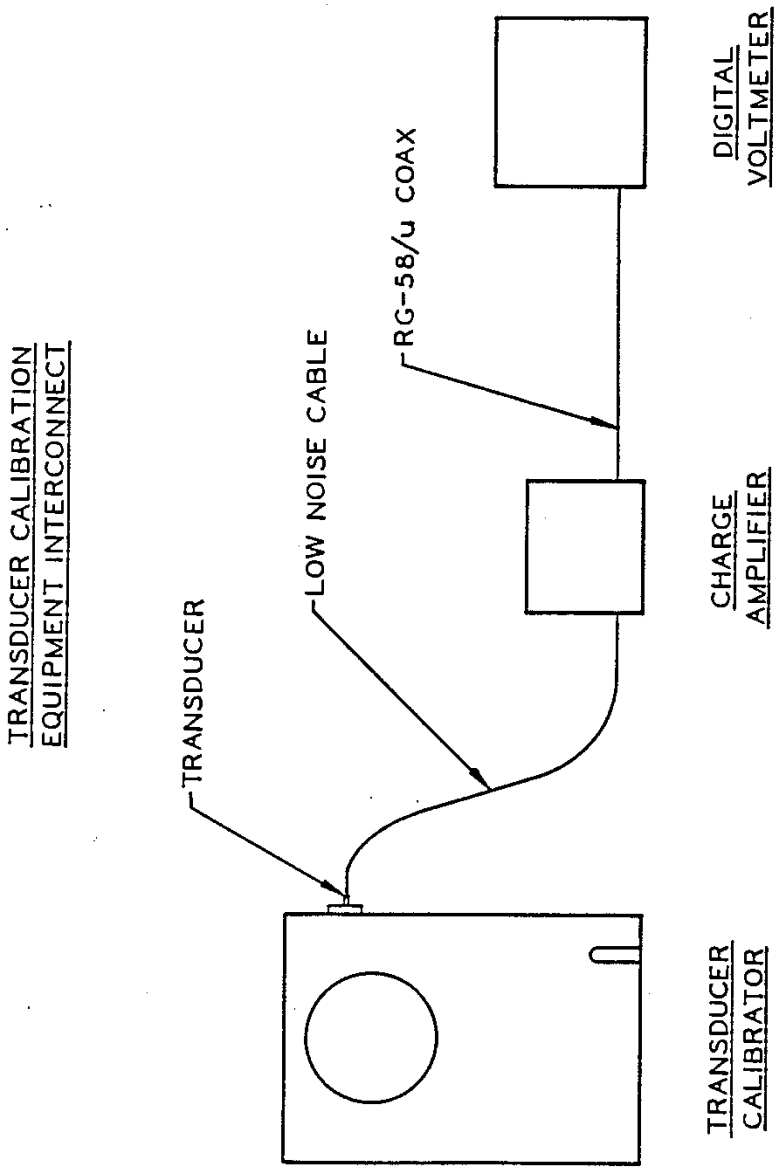
6. Select peak meter for AC coupling and positive input.

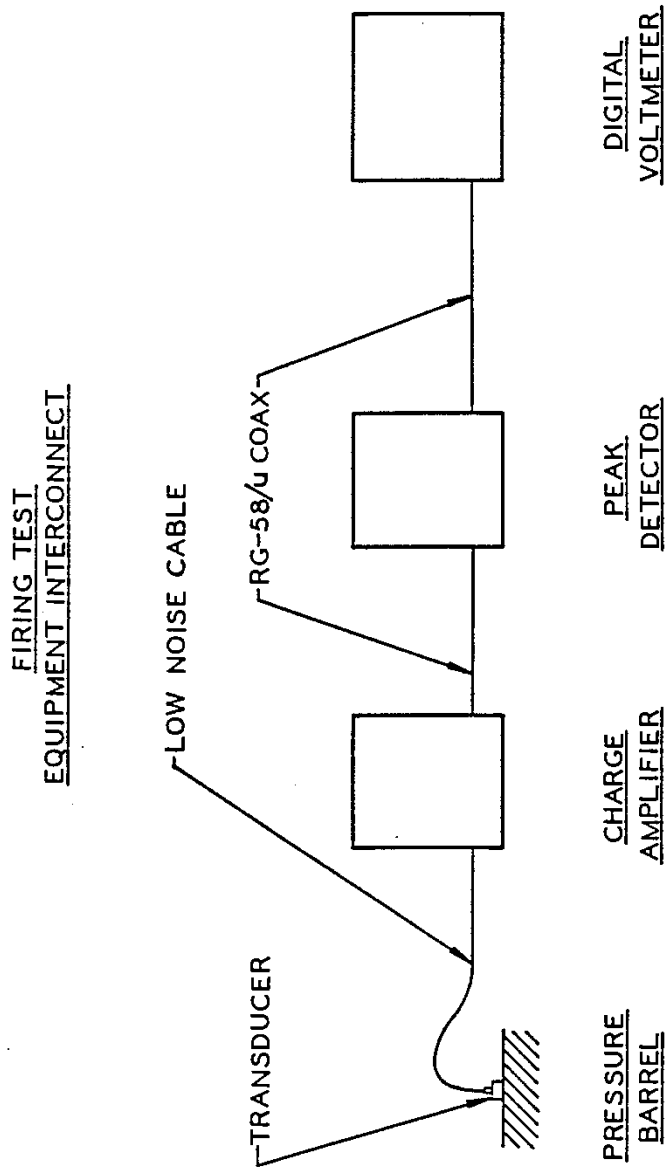
C. Procedure

1. Reset all pressure instrumentation and assure that the digital voltmeter (DVM) displays all zeros. Test rounds may now be fired.

D. Peak Pressure Determination

1. To determine peak pressures, add or subtract as required, the pressure offset value to the pressure readings obtained in the firing test.
2. For each round fired, the pressure reading on the DVM should be recorded and pressure instrumentation reset.





LEAST SQUARE LINE COMPUTATION

$Q = mP \pm q$

where:

Q - Charge in picocoulombs

m - Slope $\Delta Q/\Delta P$

P - Pressure in pounds per square inch

q - Charge intercept in picocoulombs

$$m = \frac{\Sigma PQ - \frac{\Sigma P \Sigma Q}{n}}{\Sigma P^2 - \frac{[\Sigma P]^2}{n}}$$

$$q = \frac{\Sigma P \Sigma PQ - \Sigma P^2 \Sigma Q}{[\Sigma P]^2 - n\Sigma P^2}$$

P	Q	PQ	P^2
TOTAL			

FIGURE 3

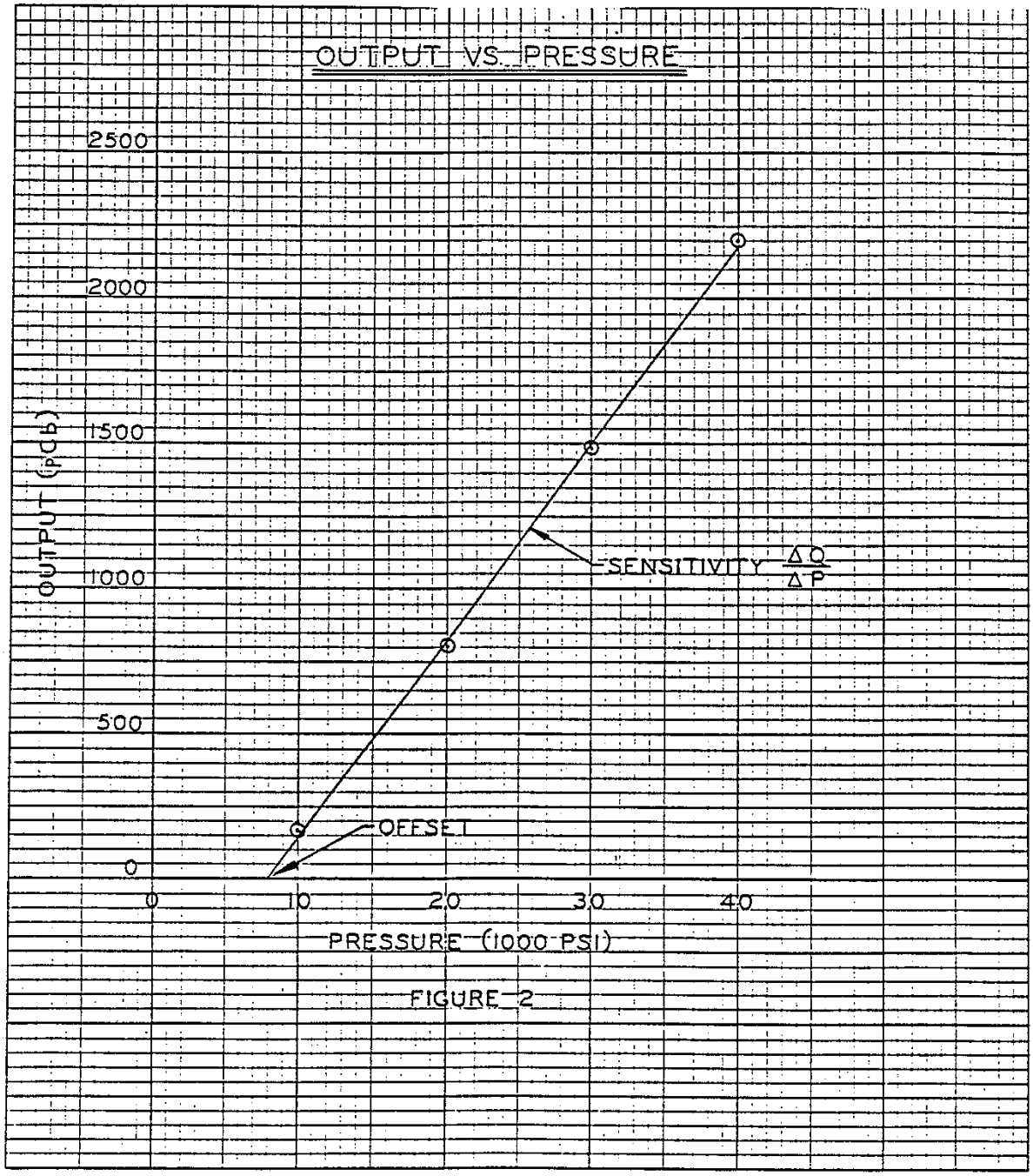


FIGURE 2

NEW REFERENCE LOTS

I. GENERAL

Reference Ammunition lots have been established for those lots or loads designated by the Technical Committee. Responsibility for production of each of the selected lots is assigned to a member company which is responsible for maintaining a supply. A five-year supply is recommended. It is desirable that Reference Ammunition be consistent with Manual values for that particular round.

When a new lot has been prepared by a producer, it shall be the producer's responsibility to announce the lot to the SAAMI Office, giving a tentative assessment and other data.

The SAAMI Office will announce the availability of the new lot to the participating ranges, giving the tentative assessment and other pertinent data.

II. METHOD OF ASSESSMENT - NEW LOTS

A. Before announcing a new lot of Reference Ammunition to the SAAMI Office, the manufacturer should make sufficient tests to determine Tentative Values of pressure and velocity for the lot.

1. The test barrels shall conform to SAAMI specifications for internal dimensions, length and transducer location.

2. Counter-chronographs and electronic Inductance Sensors shall be used in velocity measurements.

3. Ammunition shall be conditioned for 72 hours at 70° ± 2°F (21.1° ± 1.1°C) with relative humidity of 60% ± 5% before firing.

4. Only an approved transducer shall be used in pressure measurements.

NEW REFERENCE LOT REPORTING FORM AND INSTRUCTIONS

These instructions pertain to the form shown in this Standard, which is used for a Reference Ammunition producer to announce new lots to the SAAMI Office, as well as for the SAAMI Office to announce the new lot to participating ranges.

SUBJECT: T-4015 Reference Ammunition - Shotshell
New Reference Lot

TO: (When used by a producer):

SAAMI OFFICE

(When used by SAAMI Office to notify test stations):

Current Address of all stations and personnel.

(1) Name and address of source for procurement as shown in this standard.

SIGNED: Authorized Person
Producer Company Name
Address (Include Zip Code)

DATE:

ANNOUNCEMENT OF NEW REFERENCE AMMUNITION LOT

SUBJECT: T-4015 Reference Ammunition - Shotshell
New Reference Lot

TO:

SHELL_____ LOT NO._____

TENTATIVE ASSESSMENT: ORDER SYMBOL_____

VELOCITY (ft/s)		PRESSURE (psi) (in Units of 100)	
Average	S.D.	Average	S.D.

Lot Number This Replaces_____

Please order the ammunition, test and report results to the SAAMI Office on Range Comparison Report as soon as possible. Address your orders to the address given in the left-bottom corner of this letter.

SIGNED:

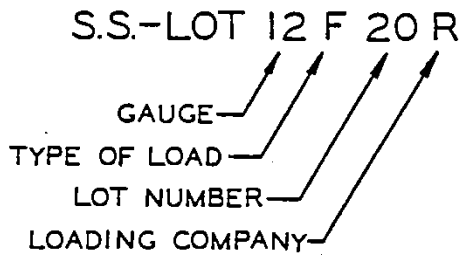
(1)

DATE:

SAAMI REFERENCE AMMUNITION

THIS AMMUNITION IS TO BE USED ONLY FOR CALIBRATION
OF TEST GAGES FOR VELOCITY AND PRESSURE

LOT NUMBERING SYSTEM
(TYPICAL NUMBERS)



LOT SYMBOLS-MANUFACTURER

WW = OLIN
F = FEDERAL
R = REMINGTON

TYPE OF LOAD

3M = 3"(76.2) MAGNUM
SM = SHORT MAGNUM
F = FIELD
T = TRAP
S = SKEET
ST = STEEL SHOT
3.5M = 3½"(88.9) MAGNUM

NOTE

BLACK LETTERING
(XX.XX)=MILLIMETERS

ASSESSMENT - PERIODIC

I. PROCUREMENT

Reference Ammunition is procured as noted in this Standard.

II. PERIODIC TESTS

A. Stations

1. All test conditions should conform as closely as possible to those prescribed in this Standard, and the following conditions should be met:

   (a) Test should consist of ten (10) rounds for velocity and pressure fired during a single day.

   (b) Test barrels shall conform to SAAMI specifications for internal dimensions, length and transducer location.

   (c) Counter-chronographs and electronic Inductance Sensors shall be used in velocity measurements.

   (d) Ammunition shall be conditioned for 72 hours at 70° ± 2°F (21.1° ± 1.1°C) with relative humidity of 60% ± 5% before firing.

   (e) Only an approved transducer shall be used in pressure measurements.

2. Each station should report results of its firing in the test on approved forms to the SAAMI Office. A sample for the report form is shown in Section II.

II PERIODIC TESTS (Continued)

B. Clearing House

1. The SAAMI Office serves as a clearing house for all Reference Ammunition ballistics and related information. It shall be the responsibility of the SAAMI Office to schedule testing and to assemble and distribute results of periodic tests. This should be done on the proper Reference Ammunition report form.

2. The Reference Ammunition report shall contain the average pressure, velocity and related standard deviations as reported by each station for that lot. From this data, the SAAMI Office will calculate and report the Raw Average, Corrected Average, Standard Deviation Averages and Inclusion Limits.

3. To obtain the Raw Averages, the SAAMI Office shall include the 10 round averages for both mean and sigma (S.D.) of pressure and velocity of all reporting stations and the first and second previous assessment value. If the 10 round average from any station varies from the Raw Average by more than plus or minus 35 FPS in velocity OR 1000 psi in pressure, the pressure or velocity data from that station(s) should be discarded. The mean pressure and velocity should be recalculated omitting the discarded data. The new mean is the "Corrected Average." If the mean pressure value of a station is outside of the limits as defined above, but the velocity is in, the pressure data should be dropped and the velocity data retained. The converse is true, as well. Using the Corrected Averages, the Inclusion Limits are determined as follows:

VELOCITY:	MEAN = Same as Corrected Average
	HIGH = MEAN + 35 FPS
	LOW = MEAN - 35 FPS
PRESSURE:	MEAN = Same as Corrected Average
	HIGH = MEAN + 1000 psi
	LOW = MEAN - 1000 psi

T-4015
STATION REPORT
REFERENCE AMMUNITION - PERIODIC ASSESSMENT
SHOTSHELL

STATION_____ SAAMI REFERENCE LOT_____

DATE_____ PREVIOUS ASSESSMENT:

PRESSURE BBL. NO._____ Velocity_____
Pressure_____

PRESSURE BBL. HISTORY_____

VELOCITY BBL. NO._____ TYPE OF GAGE_____

VELOCITY BBL. HISTORY_____ NO._____

	VELOCITY	PRESSURE
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

AVG. _____ _____

S.D. _____ _____

TECHNICAL SERVICES REPORT - REFERENCE AMMUNITION

PERIODIC ASSESSMENT - SHOTSHELL

MARCH - 1990

LOT NO: 12T107R GAGE: PIEZO

	VELOCITY	S.D.	PRESSURE	S.D.
FEDERAL	1218	15.0	117	5.8
HERCULES	1215	16.0	118	5.8
OLIN - MFG.	1207	13.1	129	4.7
OLIN - R&D	1226	6.0	124	3.0
OLIN - ST. M.	1226	9.0	117	3.2
REM - ILION	1236	8.0	116	3.0
REM - LONOKE	1212	15.0	120	4.4.

1ST PREV. AVG.	1213	121
2ND PREV. AVG.	1223	120

	VELOCITY	S.D.	PRESSURE	S.D.
RAW AVG.	1220		120	
CORRECTED AVG.	1220		120	

INCLUSION LIMITS @ 99.95%

UPPER LIMIT	1255	130
LOWER LIMIT	1185	110

ASSESSMENT:.....1220 120

A. PURPOSE

Reference Ammunition is for the purpose of relating pressure and velocity test results at all ranges.

B. PROCUREMENT

Reference Ammunition is procured as noted in this Section.

C. USE

The use and usefulness of Reference Ammunition in connection with the testing of ammunition for velocity and pressure is predicated upon two basic assumptions as follows:

1. Associated with a given batch of Reference Ammunition at a given time is an assessed average velocity, an assessed average pressure, as well as Upper and Lower limits for each, which the averages of any ten round test may be expected to fall within when:

   a) The user has blended the Reference Lot before use.

   b) The ammunition is tested only after being conditioned under controlled temperature and humidity.

   c) The ammunition is tested in standard test equipment.

   d) The ammunition is handled strictly in accordance with the specified method.

   e) All auxiliary measuring equipment is in proper working condition.

2. Although there will be changes with time in the velocity and pressure assessments, the changes occur sufficiently slowly to be detected by periodic reassessments before they have achieved a magnitude sufficient to impair the usefulness of the reference rounds. In other words, the velocity and pressure assessments are reasonably stable with time.

The average velocity and average pressure, that may be developed by a sample of Reference Ammunition in any given gun, under given conditions may be different from the results obtained under the test conditions referred to above in assumption 1. Such values may be perfectly real, providing no errors are introduced by the auxiliary equipment. However, the average of any ten round test with a lot of Reference Ammunition, fired under the conditions listed above, should fall within the limits given with the assessment of that lot under the heading, "Inclusion Limits."

In order to realize the benefits of Reference Ammunition, some rules must be adhered to. Nevertheless, the final judgments concerning how often it is used and the use of the data, must be made by each individual user. It is important, therefore, that there be a clear realization of what it can and what it cannot tell the ammunition tester.

Reference Ammunition cannot guarantee the absolute accuracy of any test system. It does, however, provide simple and direct data from any given ammunition test equipment to determine how closely it duplicates the acceptable, average system as used by other SAAMI members.

In line with the preceding discussion, the following recommendations are made for the use of Reference Ammunition:

A. Each Reference Lot should be blended at each station or range and conditioned before use.

B. How often Reference Ammunition is used shall be determined by the accuracy required.

C. The minimum sample size shall be 10 rounds.

D. The Upper and Lower "Inclusion Limits", for both velocity and pressure, are the limits within the averages of a 10 round test may be expected to fall.

E. A correction need not be applied to the test equipment as long as the velocity and pressure averages are within the Inclusion Limits.

F. If one average is outside of the Inclusion Limits and the other within, the average that exceeds the limits shall be corrected according to the procedure given in Step H.

G. If both averages are outside of the Inclusion Limits, a second 10 round test should be fired to verify the data.

H. If the correction is to be applied, the correction shall be the difference between the assessed value and the observed average of the 20 round test.

SECONDARY REFERENCE AMMUNITION

Occasionally, a test station will have need for an inordinately large supply of Reference Ammunition in considerable excess to the usual volume. In order to minimize the premature exhaustion of any particular lot, it is suggested that the station create its own secondary reference lot to fill the special need.

A secondary reference lot should consist of a supply of off-the-shelf-ammunition, each box bearing the same manufacturer's code number. The secondary reference lot should be approximately equivalent to the Reference Ammunition which it replaces.

METHOD FOR TESTING STEEL SHOT

I The hardness is measured using the Rockwell Superficial R15T scale (15Kg 1/16" Ball) according to ASTM E-18.

1. Readings are taken on the spherical surface with no correction.

2. A countersunk anvil is used to support the shot. (see Section III, Equipment.)

II Procedure

1. A random sample of 30 pellets are to be tested.

2. Each shot is placed on the test anvil without regard for orientation or surface defects.

3. The hardness is taken by following the normal R15T procedure.

4. The arithmetic average hardness of the 30-piece sample must be R15T 69 or lower, and no individual reading may exceed R15T 79.

List of Equipment

1. Electronic Counter Chronograph - 100 Kilohertz (minimum)

   Oehler Research or equivalent

2. Inductance Sensor

   Oehler Research or equivalent

3. Machine rest - Frankford Arsenal type

   Cannatech, Inc. or equivalent

4. Receiver

   a. Universal Receiver

      Cannatech, Inc.

   b. Equivalent

5. Barrels

   a. Remington Arms Co., Inc.

   b. Wilson Arms Co.

   c. H-S Precision Inc.

   d. Equivalent

6. Digital Voltmeter

   a. Fluke Model 8110A

   b. Equivalent

List of Equipment (continued)

7. Ballistic Peak Pressure Meter (combines 8 & 9 below)
   a. PCB Model 400A20
   b. Equivalent
8. Charge Amplifier
   a. PCB Model 462B52
   b. Equivalent
9. Peak Meter
   a. PCB Model 451A07
   b. Equivalent
10. Transducer
   a. PCB Model 167A
   b. Equivalent
11. Low Noise Cable
   a. PCB Model 003A05
   b. Equivalent
12. High Pressure Calibrator
   a. PCB Model 905A Series
   b. Equivalent
13. Calibration Fixture
   a. PCB 61M109 Series
   b. Equivalent

SECTION III - EQUIPMENT
SHOTSHELL
SAAMI VOLUNTARY PERFORMANCE STANDARDS

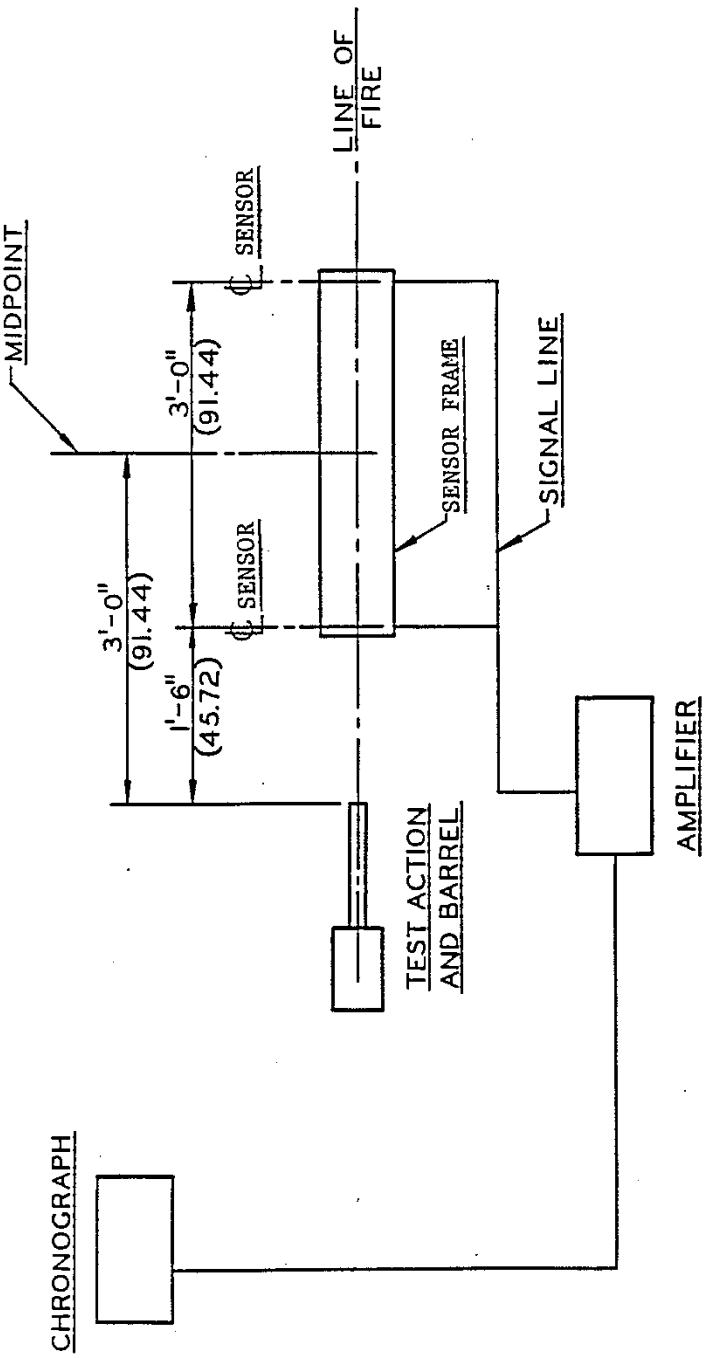
RECOMMENDED EQUIPMENT SOURCES

1.	Electronic Equipment	Oehler Research P.O. Box 9135 Austin, Texas 78766
2.	Inductance Sensors	Oehler Research P.O. Box 9135 Austin, Texas 78766
3.	Gun Rest	Cannatech, Inc. 15 Spring Hollow Drive Erial, NJ 08081
4.	Receivers	Cannatech, Inc. 15 Spring Hollow Drive Erial, NJ 08081
5.	Barrels	Remington Arms Co. Attn: Custom Shop 14 Hoefler Avenue Ilion, NY 13357 Wilson Arms Co. 63 Leetes Island Rd. Branford, CT 06405 H-S Precision Inc. 1301 Turbine Drive Rapid City SD 57701
6.	Digital Voltmeter	John Fluke Mfg. Co., Inc. P.O. Box 9090 Everett, WA 98206
7.	Charge Amplifier	PCB Piezotronics, Inc. 3425 Walden Ave. Depew, NY 14043-2495
8.	Peak Detector	PCB Piezotronics, Inc. 3425 Walden Ave. Depew, NY 14043-2495

RECOMMENDED EQUIPMENT SOURCES

9.	Transducer	PCB Piezotronics, Inc. 3425 Walden Ave. Depew, NY 14043-2495
10.	Low Noise Cable	PCB Piezotronics, Inc. 3425 Walden Ave. Depew, NY 14043-2495
11.	Transducer Calibrator	PCB Piezotronics, Inc. 3425 Walden Ave. Depew, NY 14043-2495
12.	Calibration Fixture	PCB Piezotronics, Inc. 3425 Walden Ave. Depew, NY 14043-2495

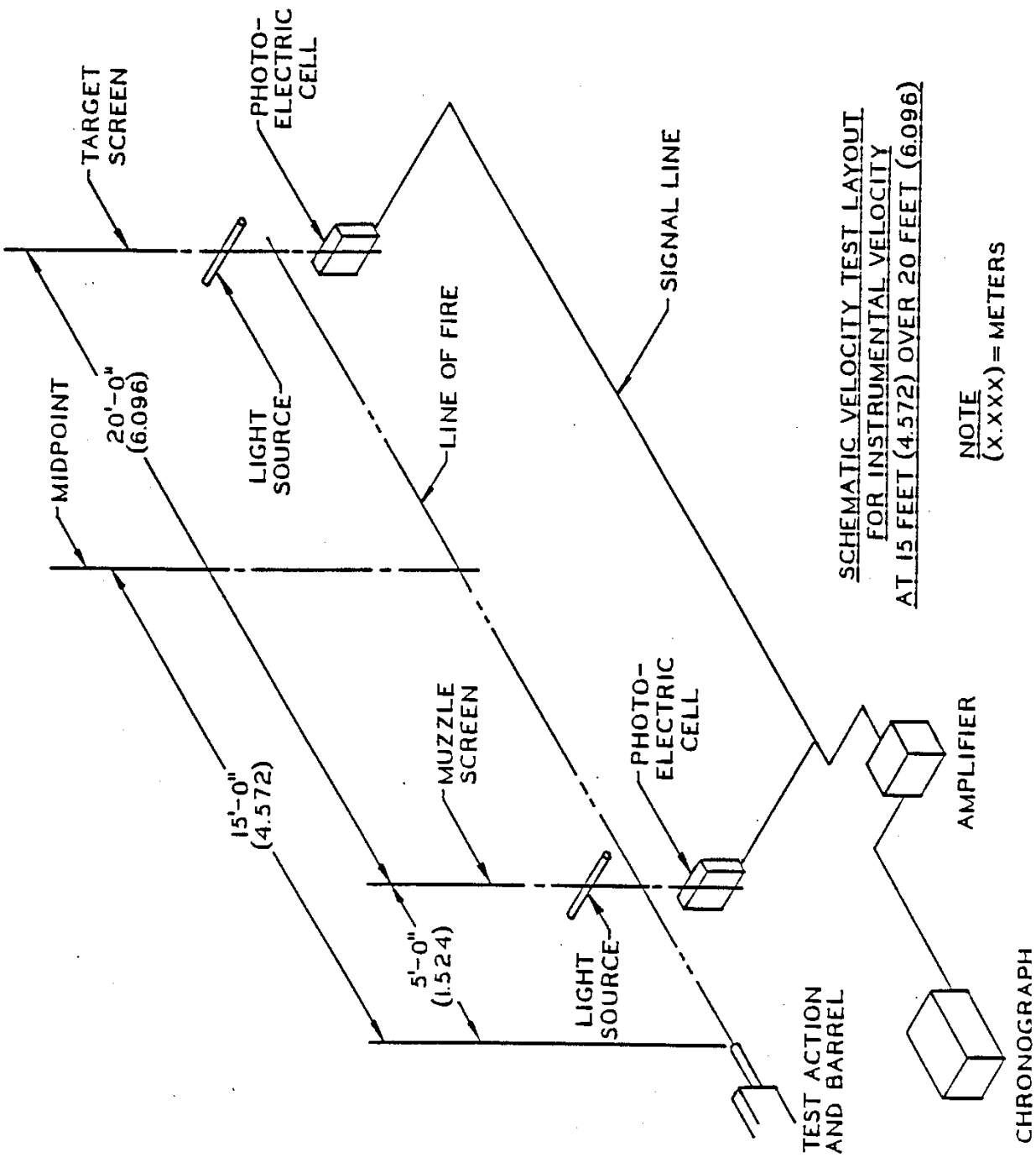
SCHEMATIC VELOCITY LAYOUT - INDUCTANCE SENSORS



SCHEMATIC VELOCITY TEST LAYOUT FOR INSTRUMENTAL VELOCITY AT 3 FEET (91.44) OVER 3 FEET (91.44)

NOTE
(XX.XX)= CENTIMETERS

SCHEMATIC VELOCITY LAYOUT-SCREENS
OPTIONAL - FOR RIFLED SLUGS



The following gauges and loads of Shotshell Reference Ammunition for the verification of ranges, barrels and other equipment may be obtained from the manufacturer listed below.

Current assessment data are maintained by a Technical Committee representative at the SAAMI Office, P.O. Box 838, Branford, CT 06405.

Gauge	Shell Length	Type	Load	Supplier	Order Symbol
10	2-7/8"	High Velocity	4-3/4 - 1-5/8 - 4	Remington	21580
10	3-1/2"	Magnum	1-3/4 - BB STEEL	Win Group	SA10SSMBB
12	2-3/4"	Magnum	1-1/2 - 4	Win Group	SA12PH4
12	2-3/4"	High Velocity	3-3/4 - 1-1/4 - 6	Remington	20328
12	2-3/4"	Skeet	3 - 1-1/8 - 9	Federal	SAMC118-9
12	2-3/4"	Trap	3 - 1-1/8 - 7-1/2	Remington	21584
12	3"	Magnum	1-5/8 - 4	Win Group	SA12MXC4
12	3-1/2"	Magnum	2-1/4 - 4	Federal	SAMST135-
12	2-3/4"		1-1/8 - 2 STEEL	Federal	SAMW147-2
12	3"	Magnum	1-1/4 - 2 STEEL	Remington	21586
12	3-1/2"	Magnum	1-9/16 T STEEL	Winchester	SA1235T
16	2-3/4"	Max	15/16 - 2 STEEL	Federal	SAMW168-2
16	2-3/4"	High Velocity	2-3/4 - 1-1/8 - 6	Federal	SAMF162-6
20	2-3/4"	Magnum	1-1/8 - 4	Remington	20378
20	2-3/4"	High Velocity	2-3/4 - 1 - 6	Federal	SAMF203-6
20	2-3/4"	Skeet	2-1/2 - 7/8 - 9	Win Group	SA20AAP9
20	2-3/4"	3 1/4	3/4 - 4 STEEL	Federal	SAMW208-4
20	3"	Magnum	1-1/4 - 6	Federal	SAMF207-6
20	3"	Magnum	1 - 2 STEEL	Federal	SAMW209-2
28	2-3/4"	High Velocity	2-1/4 - 3/4 - 9	Federal	SAMF280-9
410	2-1/2"	Skeet	1/2 - 9	Remington	21582
410	3"	High Velocity	11/16 - 6	Win Group	SA4136

ORDER PROCEDURE

Each order should contain the following information in the following order:

1. Number of rounds desired. (See NOTE below)

2. Appropriate order symbol

3. Designation "SAAMI Reference Ammunition".

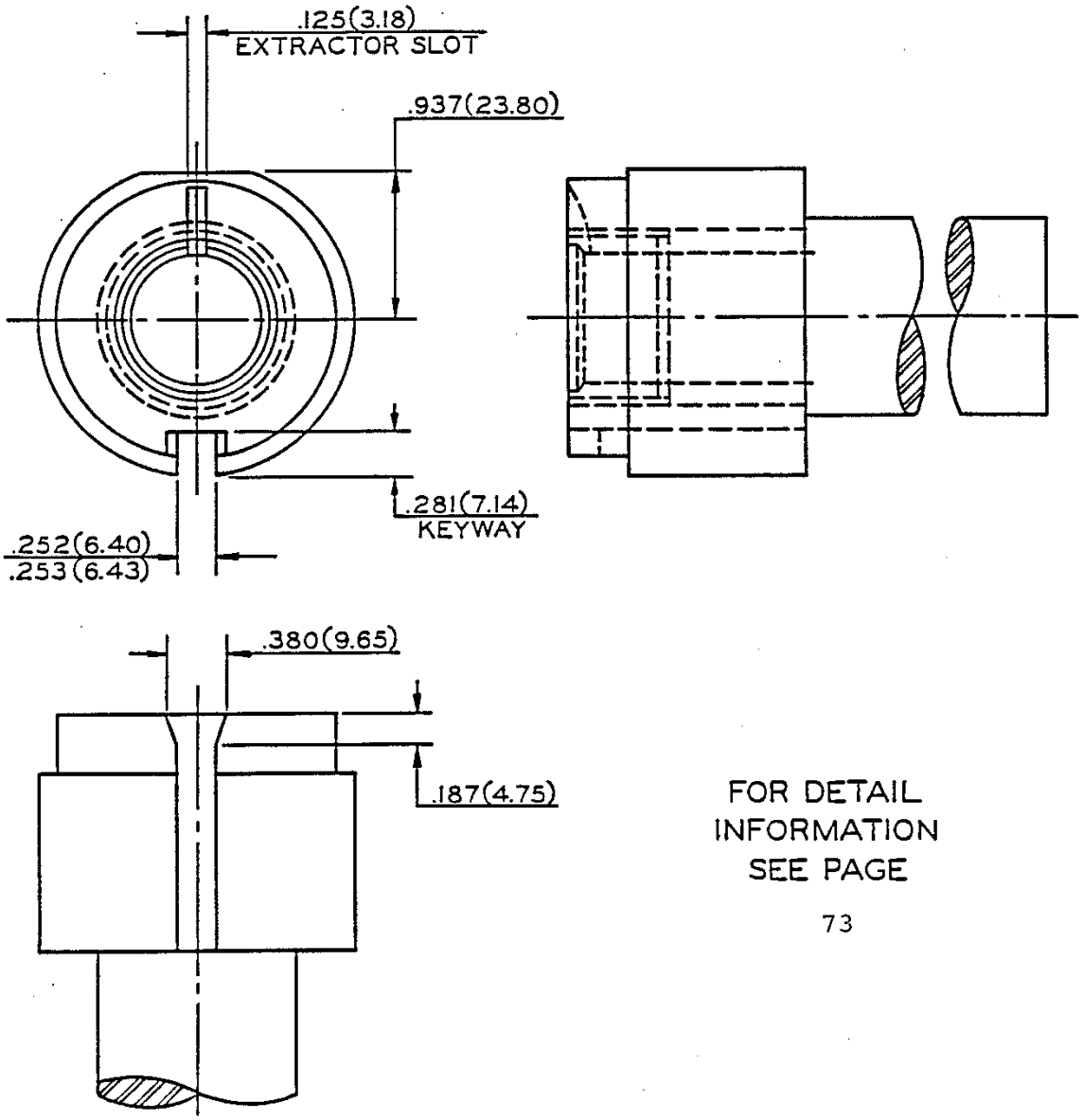
4. Shell Name

5. SAAMI Lot Number. Current lot numbers are given on latest assessment value sheets issued by the SAAMI Office.

EXAMPLE: 300 Rounds, Order Symbol 60839
SAAMI Reference Ammunition
28 ga. - 2-1/4 - 3/4 - 9, SAAMI Lot 61F

NOTE: Recommended Maximum Order - 500

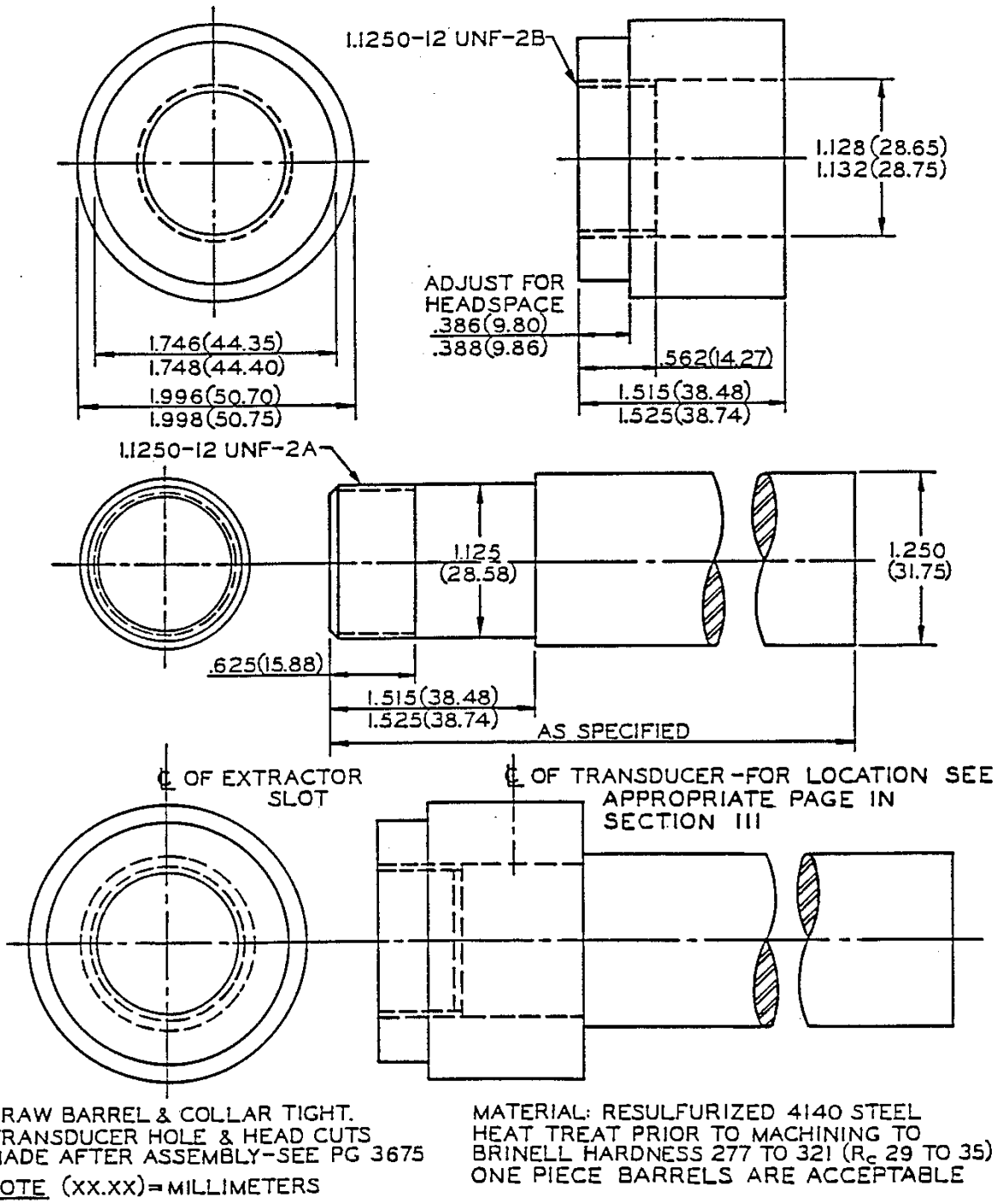
UNIVERSAL RECEIVER
COLLAR & TEST BARREL



FOR DETAIL
INFORMATION
SEE PAGE
73

NOTE
(XX.XX) = MILLIMETERS

UNIVERSAL RECEIVER
COLLAR & TEST BARREL

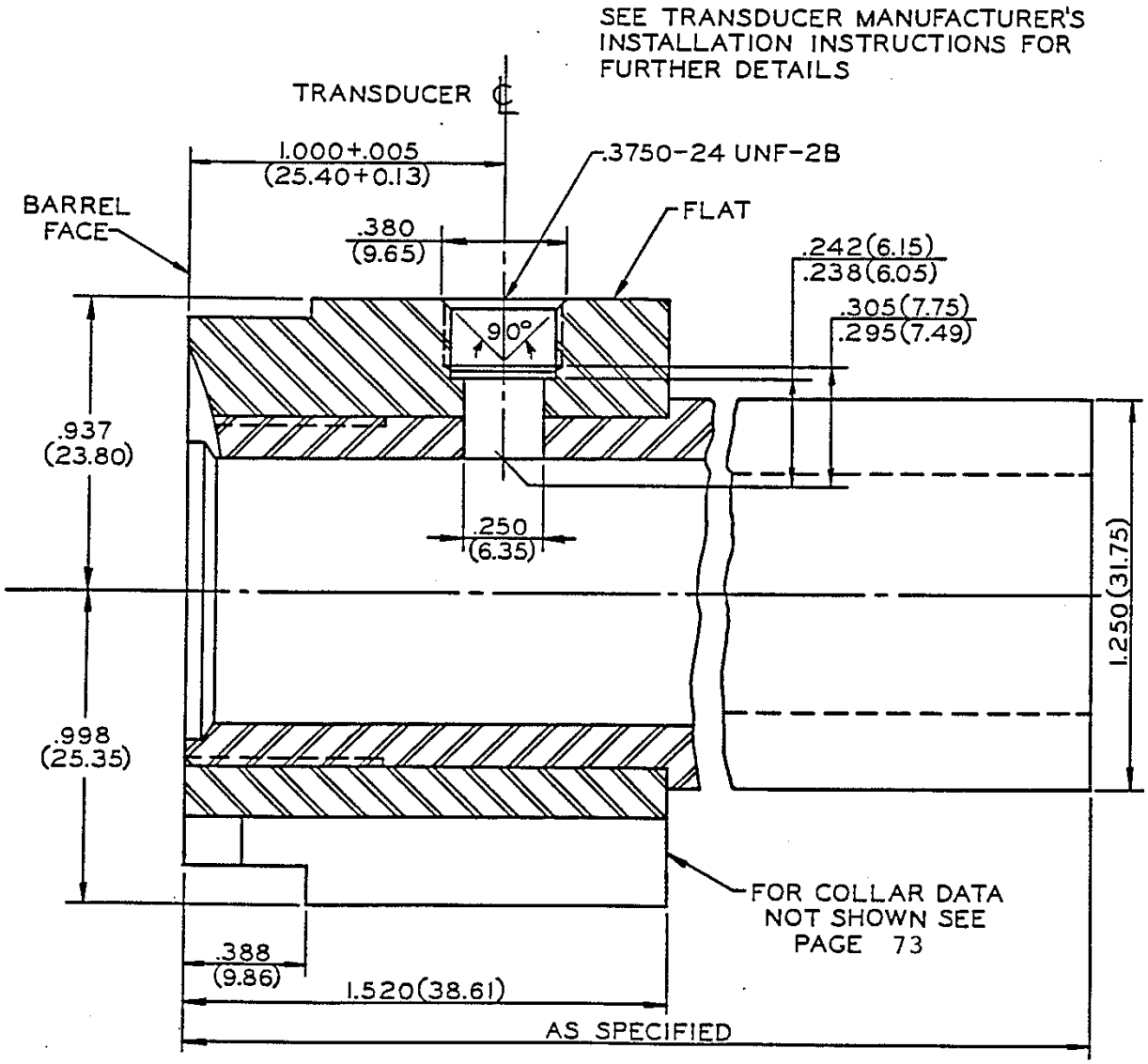


DRAW BARREL & COLLAR TIGHT.
TRANSDUCER HOLE & HEAD CUTS
MADE AFTER ASSEMBLY-SEE PG 3675

NOTE (XX.XX)= MILLIMETERS

MATERIAL: RESULFURIZED 4140 STEEL
HEAT TREAT PRIOR TO MACHINING TO
BRINELL HARDNESS 277 TO 321 (R_c 29 TO 35)
ONE PIECE BARRELS ARE ACCEPTABLE

UNIVERSAL RECEIVER
TEST BARREL
INSTALLATION OF PRESSURE
TRANSDUCERS



NOTE
(XX.XX) = MILLIMETERS

PROCEDURES FOR DIMENSIONING CHAMBERS OF VELOCITY AND PRESSURE TEST BARRELS

Chamber and bore dimensions of velocity and pressure test barrels shall conform to the dimensions of the minimum chamber and bore for each cartridge as originally introduced.

It is recognized that changes may be made to shotshell or chamber dimensions in order to improve the velocity-pressure relationship, accuracy and patterns, or functioning in shotguns as production experience indicates. However, none of these changes should be of such nature that they would cause a significant increase in pressure level of a given lot of ammunition.

No changes will be made to velocity and pressure barrel dimensions which would result in a reduction of the recorded pressure level of any given lot of ammunition, because this would result in the possibility of future lots of ammunition being loaded with increased powder charges, which would cause increased pressure in existing shotguns.

Production barrels may be adapted for velocity and pressure testing provided that they conform to all dimensions shown on the appropriate test barrel drawing.

Procedure for Measuring Barrel Length:

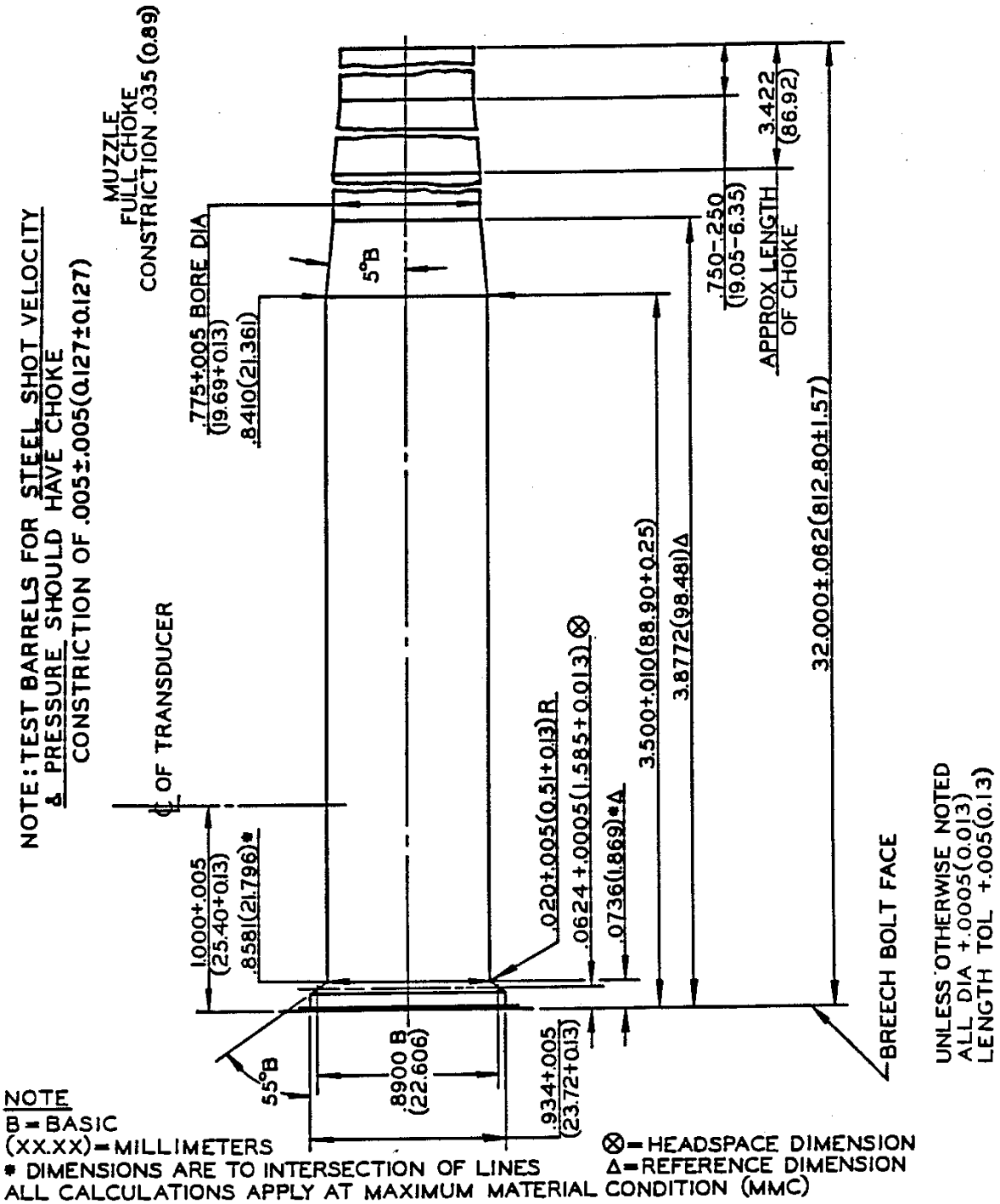
Shotgun test barrels are measured by inserting a rod down the bore from the muzzle until it touches the breech face with the action closed and the firing pin retracted.

The thumb, a stop collar or other marking means is utilized to mark the point on the rod adjacent to the most forward part of the barrel.

The rod is then removed and the distance form the mark to the end of the rod is measured with a scale or rule. This is recorded as the barrel length.

It is recognized that shotguns designed for rifled slug loads are sometimes manufactured with bore diameters smaller than the dimensions shown on the cartridge and chamber drawings and on the test barrel drawings. Velocity and pressure tests in 12 ga. and 20 ga. have shown no significant effect on pressures.

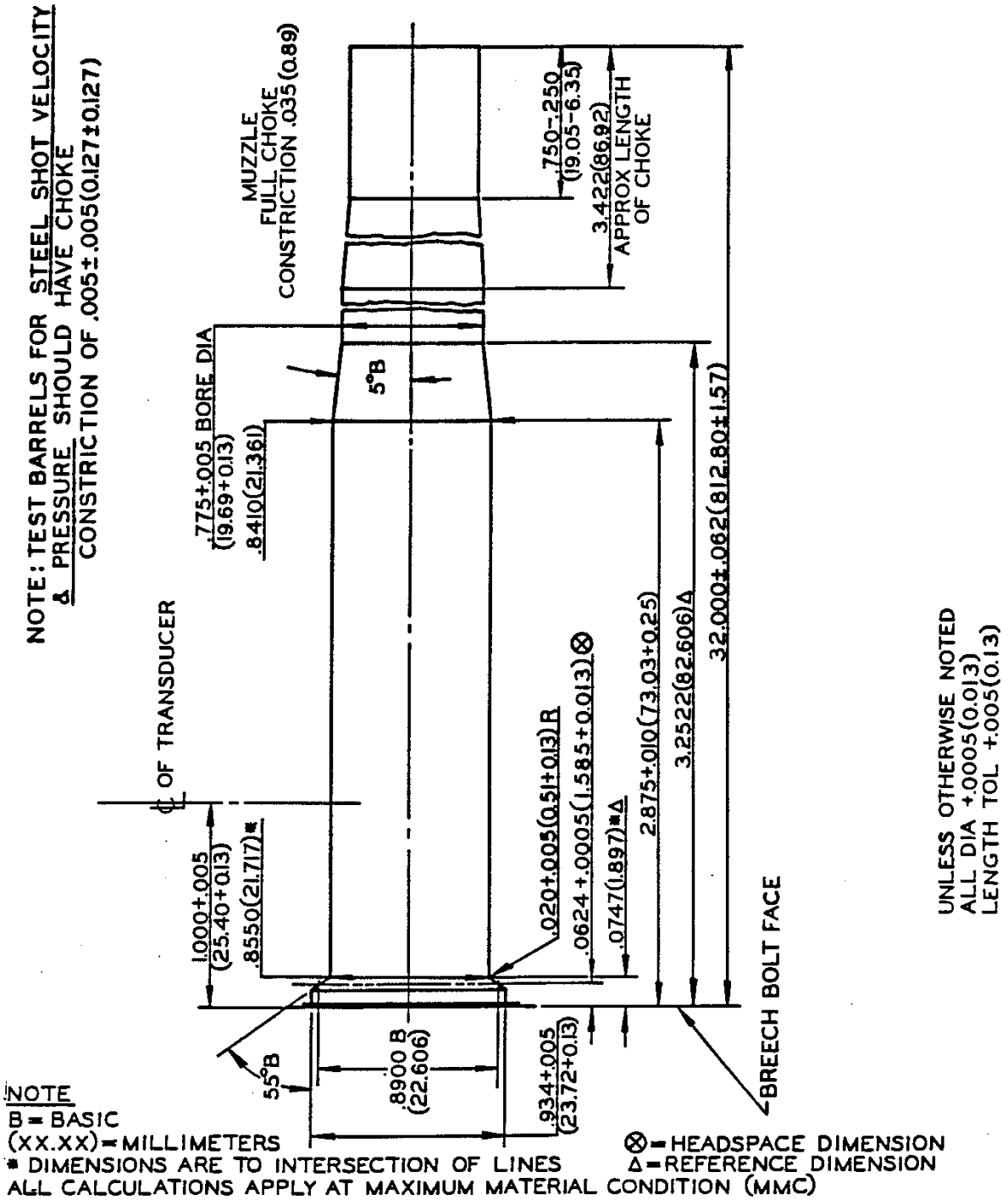
STANDARD VELOCITY &
PRESSURE BARREL
10 GAUGE-3 1/2 INCH -
FULL CHOKE



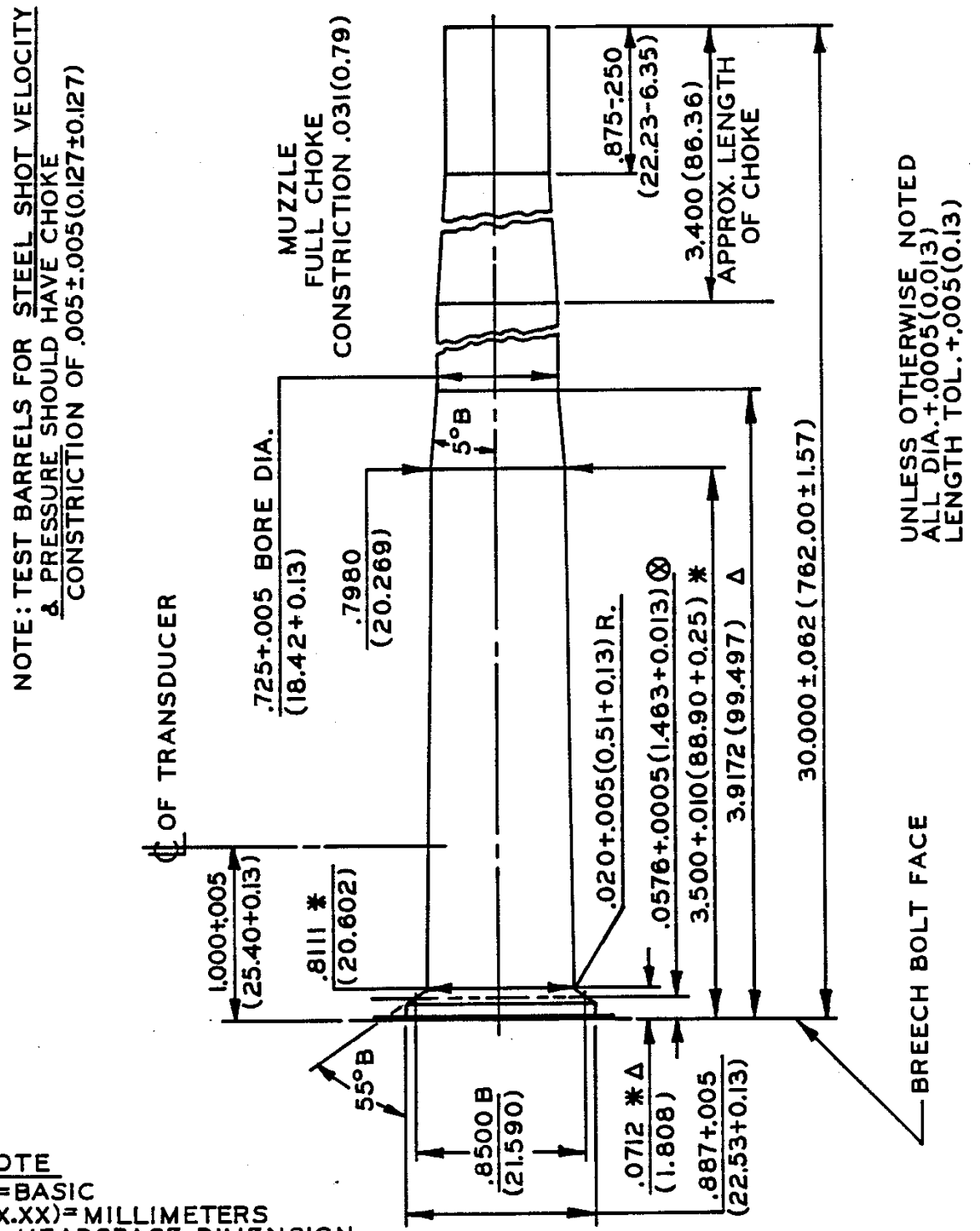
NOTE
B = BASIC
(XX.XX) = MILLIMETERS
* DIMENSIONS ARE TO INTERSECTION OF LINES
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)

⊗ = HEADSPACE DIMENSION
Δ = REFERENCE DIMENSION

STANDARD VELOCITY &
PRESSURE BARREL
10 GAUGE-2 7/8 INCH -
FULL CHOKE

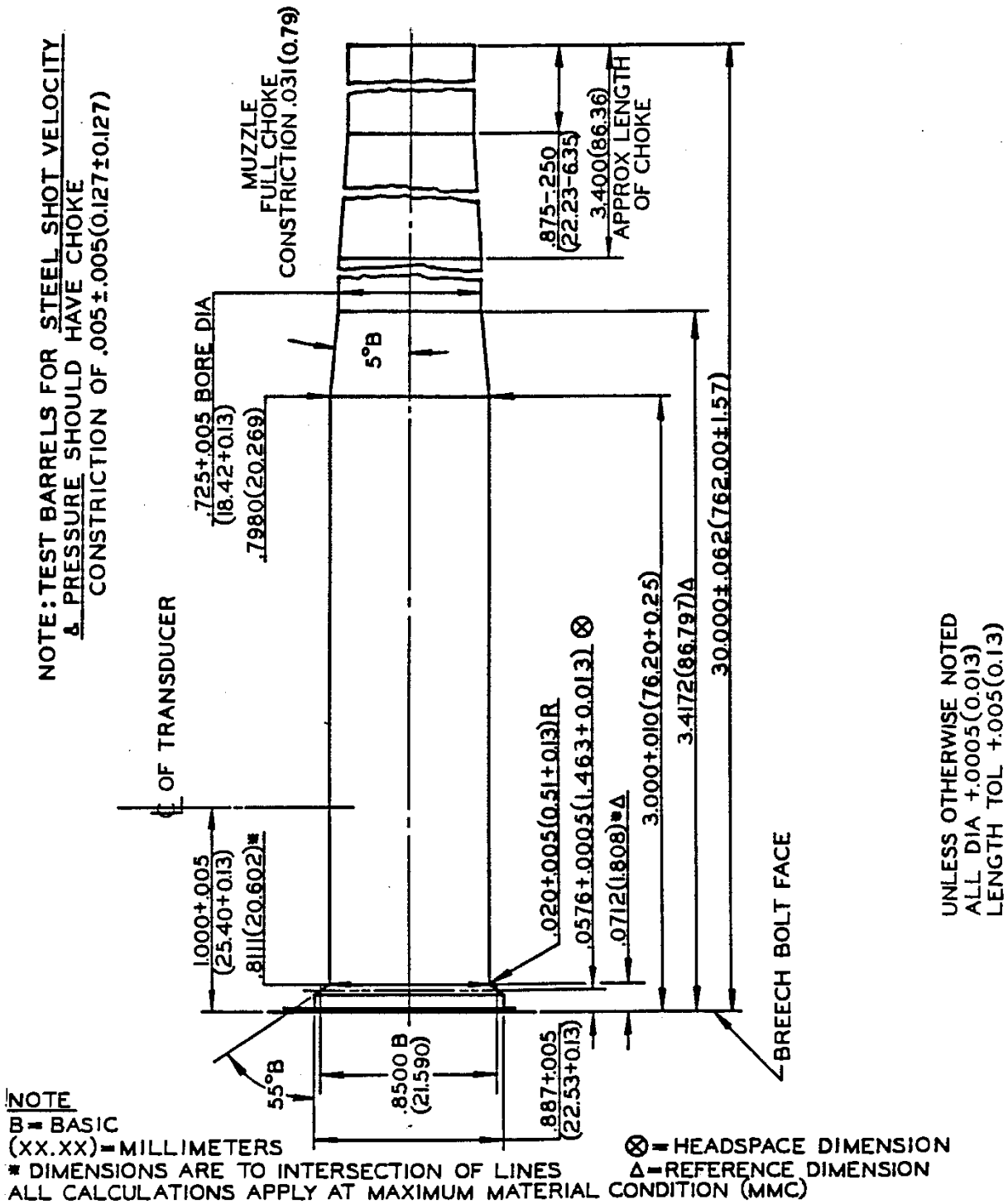


STANDARD VELOCITY & PRESSURE BARREL
12 GAUGE 3 1/2 " - FULL CHOKE



NOTE
B=BASIC
(XX.XX)=MILLIMETERS
⊗=HEADSPACE DIMENSION
Δ=REFERENCE DIMENSION
* DIMENSIONS ARE TO INTERSECTION OF LINES
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)

STANDARD VELOCITY &
PRESSURE BARREL
12 GAUGE-3 INCH -
FULL CHOKE



NOTE
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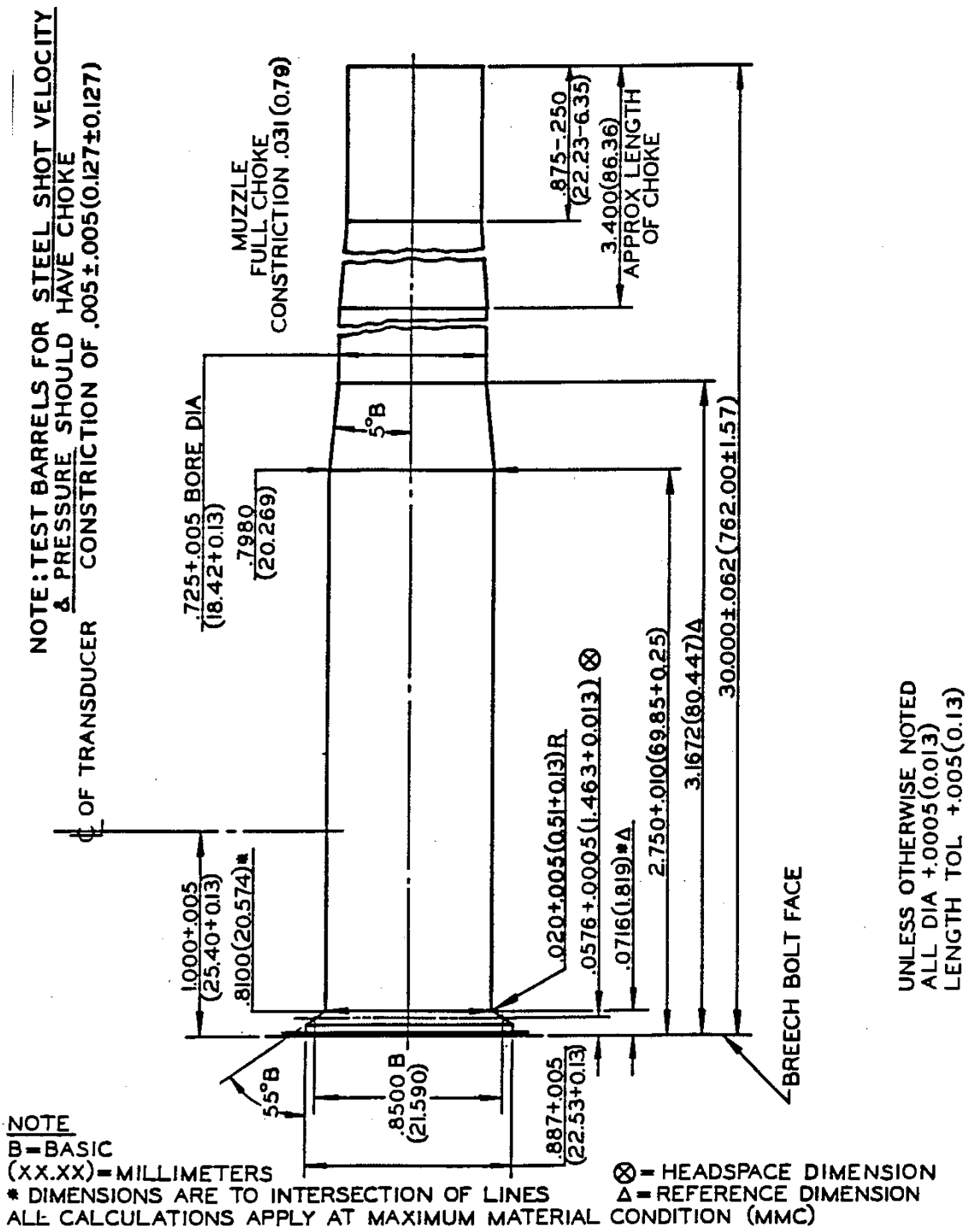
* DIMENSIONS ARE TO INTERSECTION OF LINES
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)
⊗ = HEADSPACE DIMENSION
Δ = REFERENCE DIMENSION

STANDARD VELOCITY &
PRESSURE BARREL
12 GAUGE-2 3/4 INCH -
FULL CHOKE



NOTE
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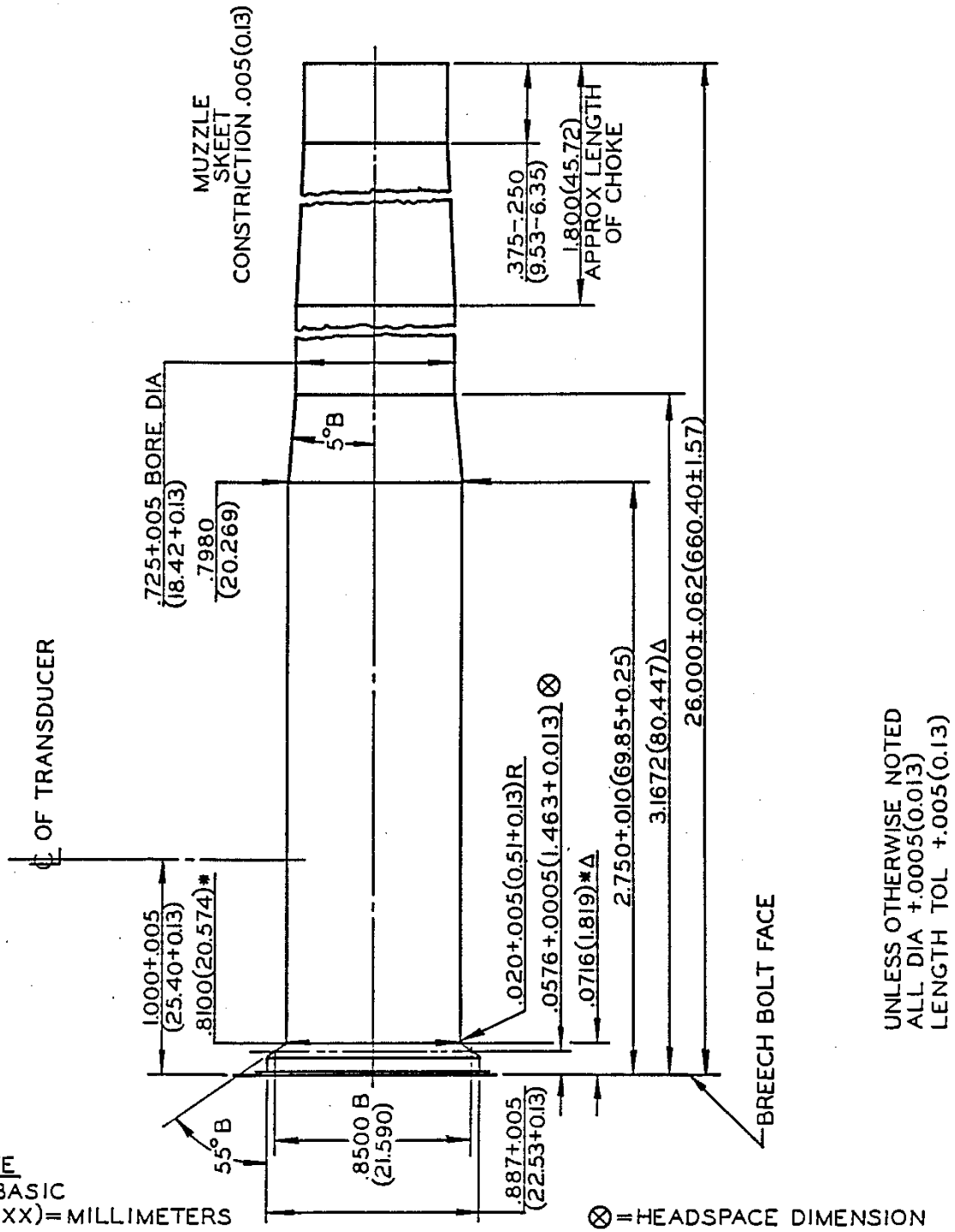
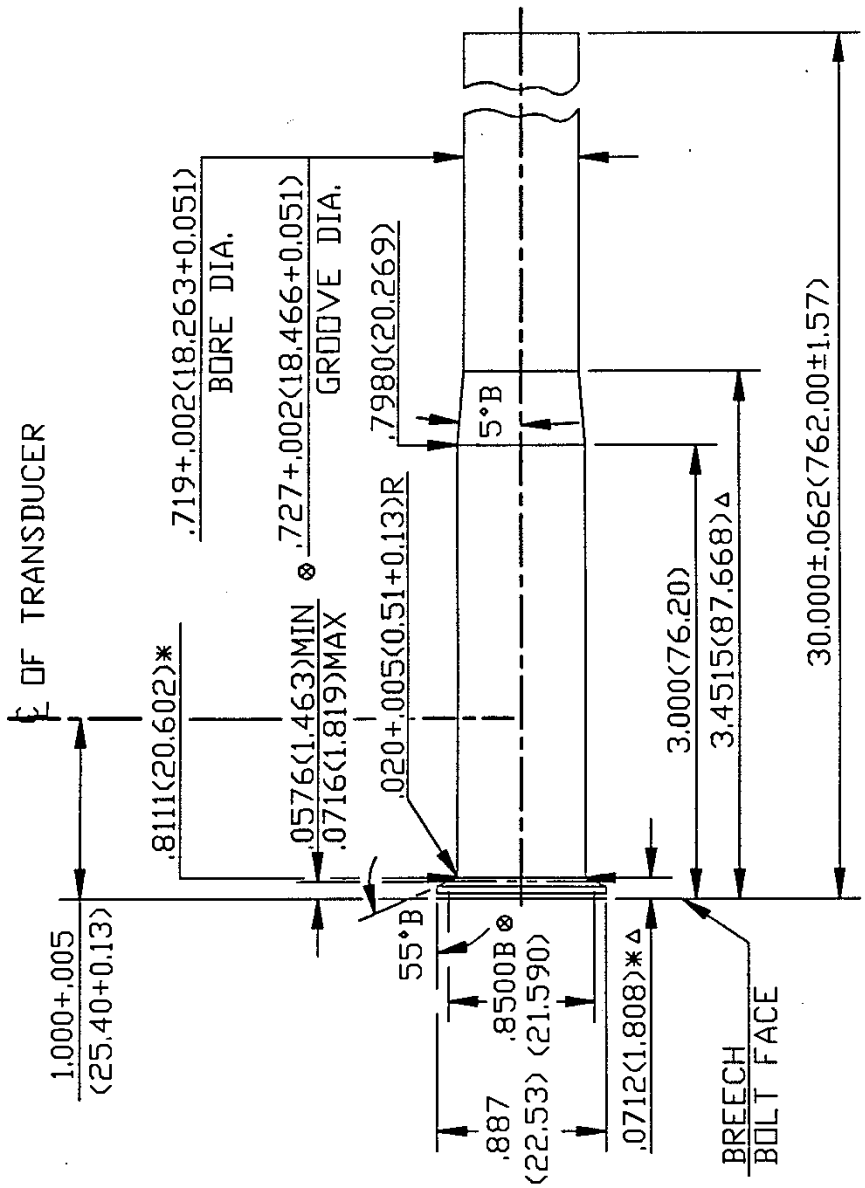
(XX.XX)=MILLIMETERS
* DIMENSIONS ARE TO INTERSECTION OF LINES
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)
⊗ = HEADSPACE DIMENSION
Δ = REFERENCE DIMENSION

STANDARD VELOCITY &
PRESSURE BARREL
12 GAUGE-2 3/4 INCH -
SKEET



NOTE
B = BASIC
(XX.XX) = MILLIMETERS
* DIMENSIONS ARE TO INTERSECTION OF LINES
⊗ = HEADSPACE DIMENSION
Δ = REFERENCE DIMENSION
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)



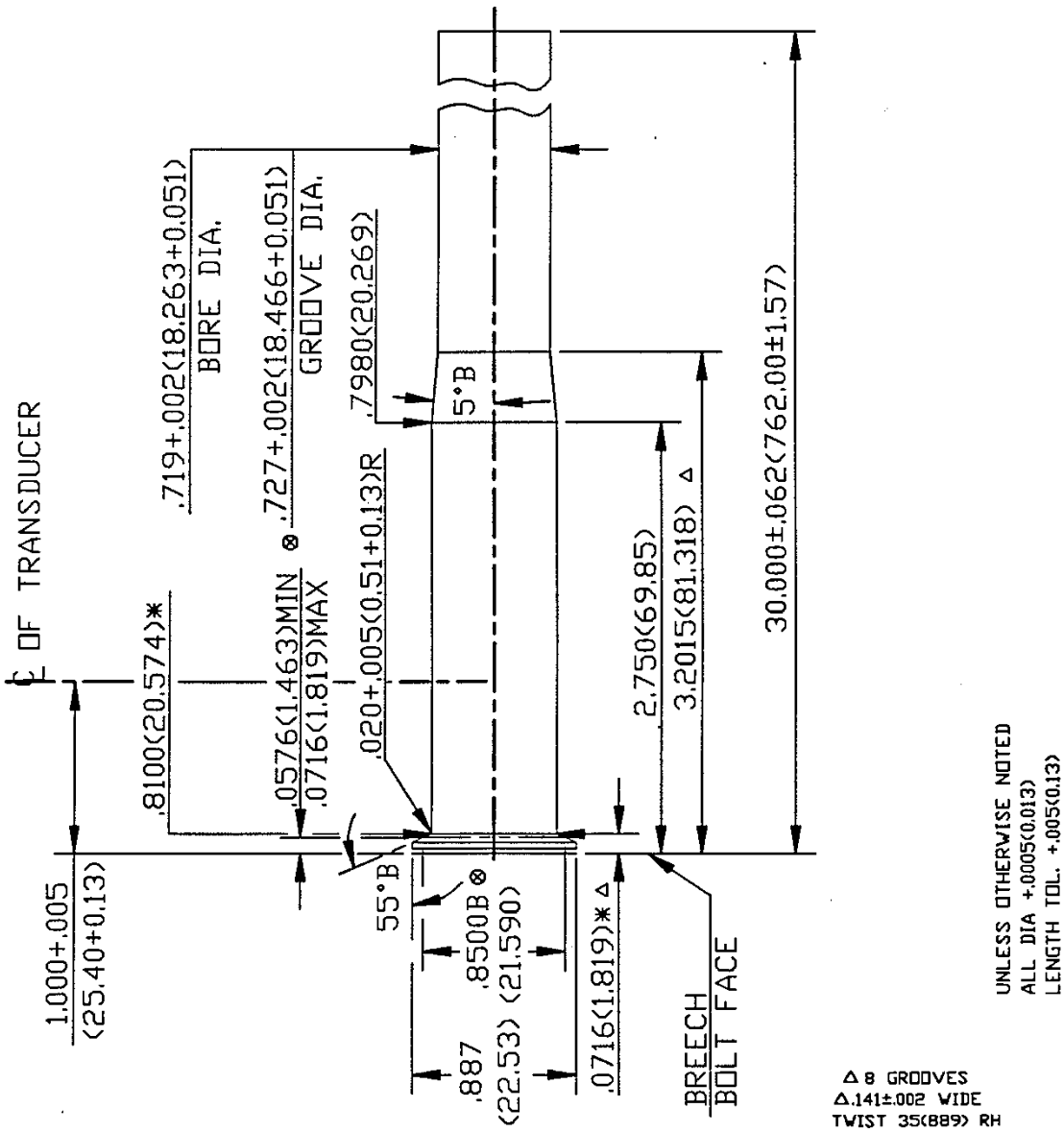
UNLESS OTHERWISE NOTED
ALL DIA +.005(0.013)
LENGTH TOL. +.005(0.13)

△ 8 GROOVES
△.141±.002 WIDE
TWIST 35(889) RH
MIN BORE & GROOVE
AREA .4105 IN²(264.838mm²)

⊗ = HEADSPACE DIMENSION
△ = REFERENCE DIMENSION

NOTE
B=BASIC
(XX.XX)=MILLIMETERS
* DIMENSIONS ARE TO INTERSECTIONS OF LINES
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC).

STANDARD VELOCITY &
PRESSURE BARREL
12 GAUGE-2 3/4" RIFLED



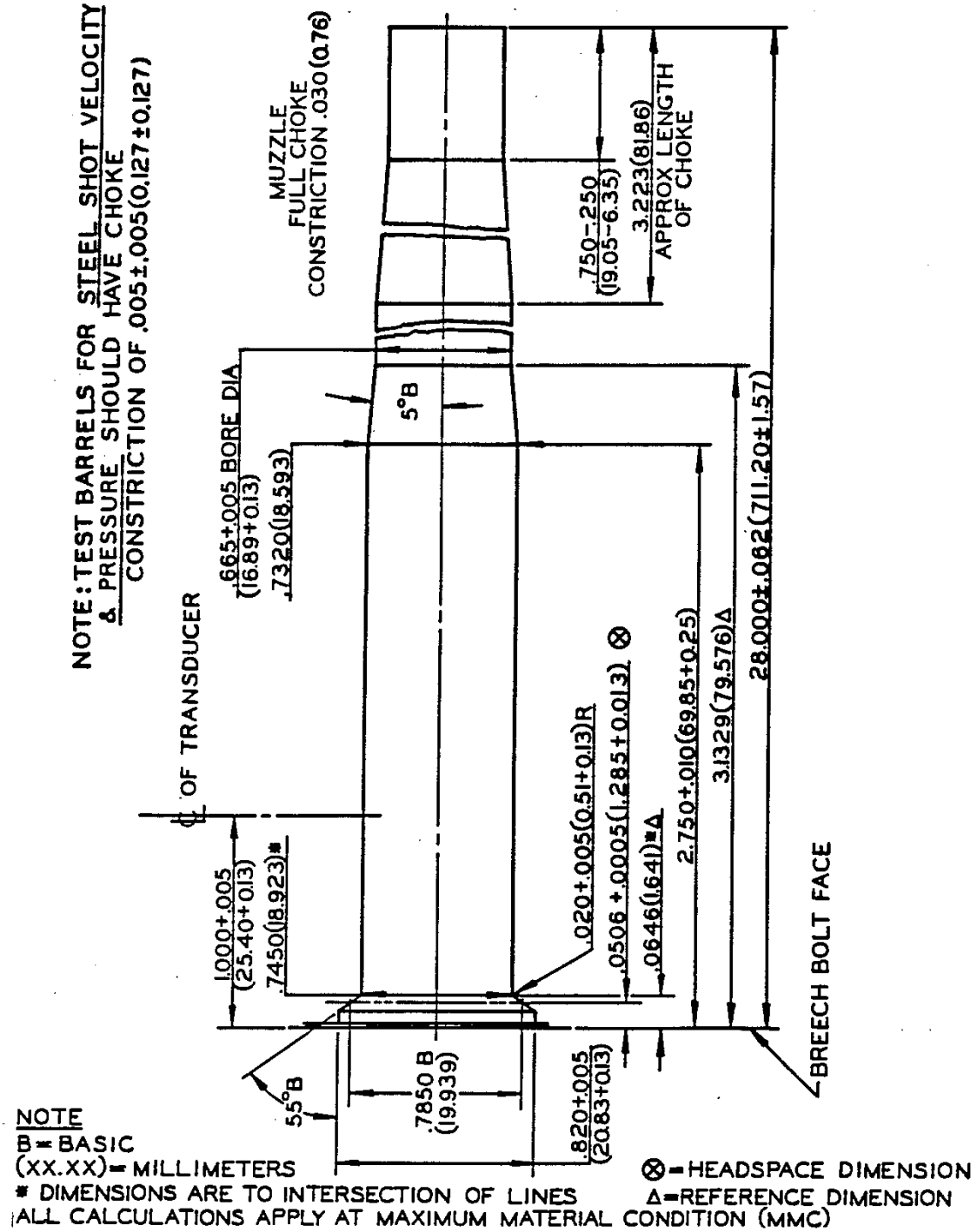
UNLESS OTHERWISE NOTED
ALL DIA +.0005(0.013)
LENGTH TOL. +.005(0.13)

Δ 8 GROOVES
Δ.141±.002 WIDE
TWIST 35(889) RH
MIN BORE & GROOVE
AREA .4105 IN²(264.838mm²)

⊗ = HEADSPACE DIMENSION
Δ = REFERENCE DIMENSION

NOTE
B=BASIC
(XX.XX)=MILLIMETERS
* DIMENSIONS ARE TO INTERSECTIONS OF LINES
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC).

STANDARD VELOCITY &
PRESSURE BARREL
16 GAUGE-2 3/4" &
2 9/16" - FULL CHOKE



NOTE
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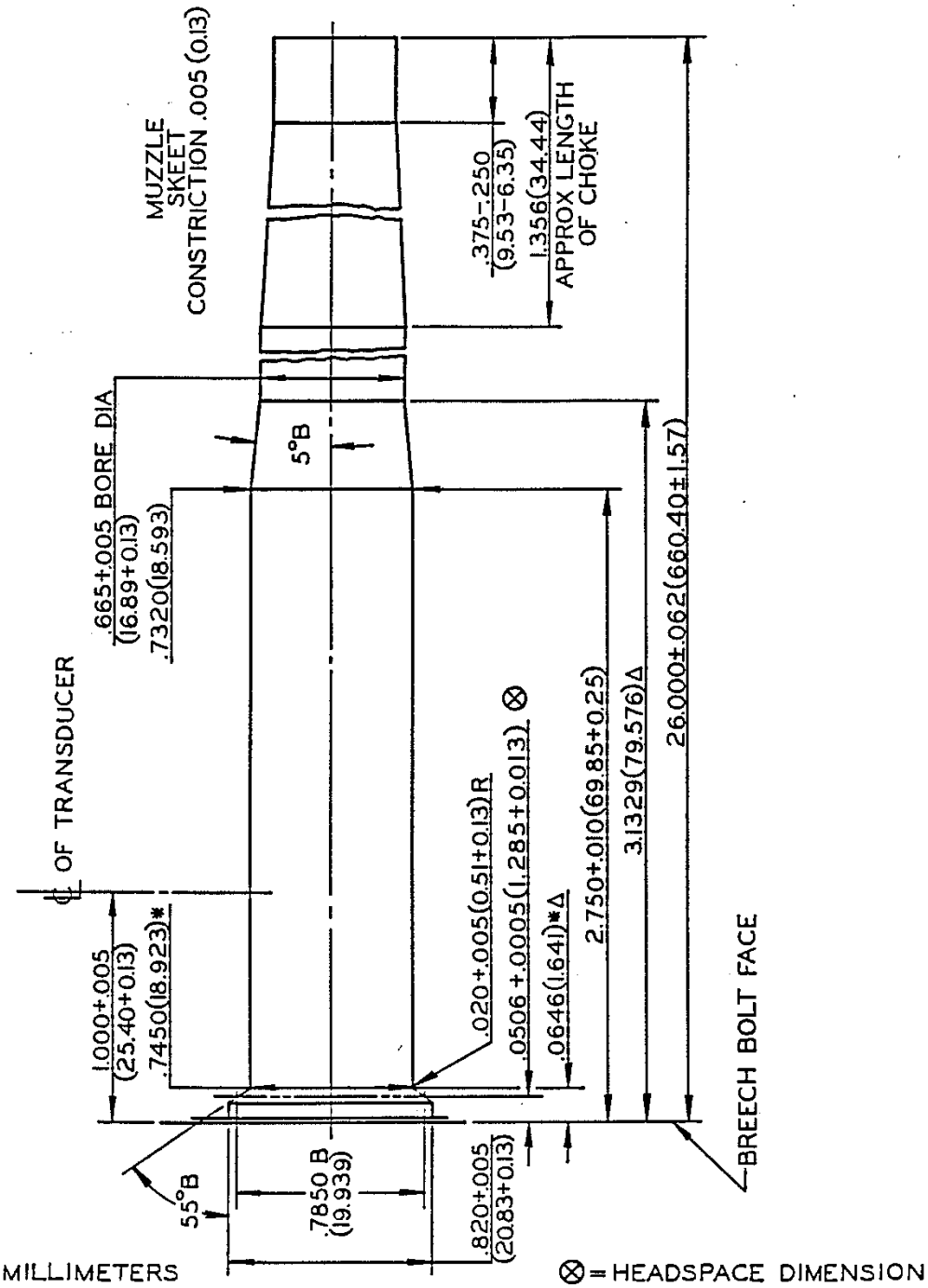
(XX.XX) = MILLIMETERS
* DIMENSIONS ARE TO INTERSECTION OF LINES
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)
⊗ = HEADSPACE DIMENSION
Δ = REFERENCE DIMENSION

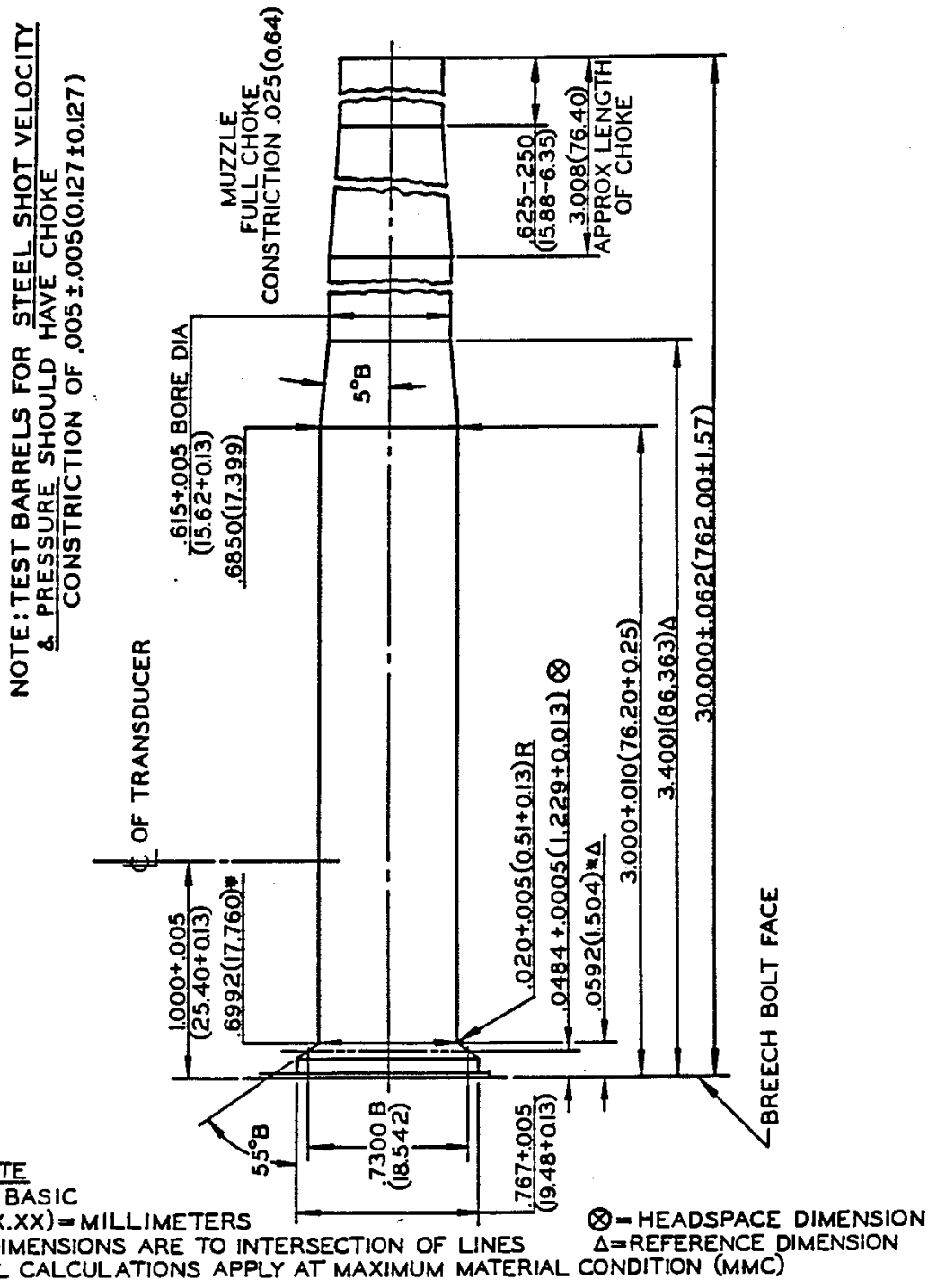
STANDARD VELOCITY &
PRESSURE BARREL
16 GAUGE-2 3/4 INCH -
SKEET



UNLESS OTHERWISE NOTED
ALL DIA +.0005(0.013)
LENGTH TOL +.005(0.13)

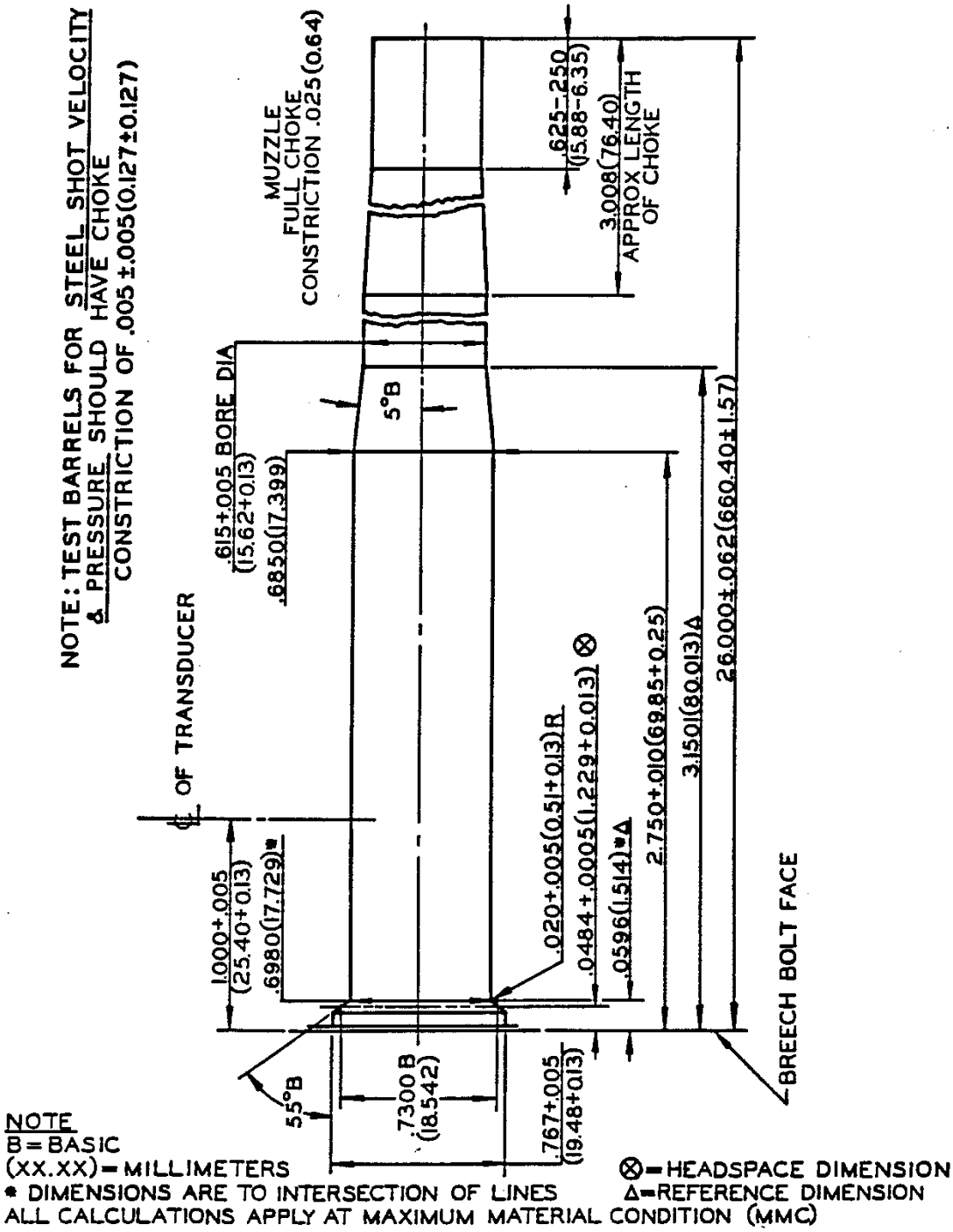
NOTE
B = BASIC
(XX.XX) = MILLIMETERS
* DIMENSIONS ARE TO INTERSECTION OF LINES
⊗ = HEADSPACE DIMENSION
Δ = REFERENCE DIMENSION
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)

STANDARD VELOCITY & PRESSURE BARREL
20 GAUGE-3 INCH - FULL CHOKE

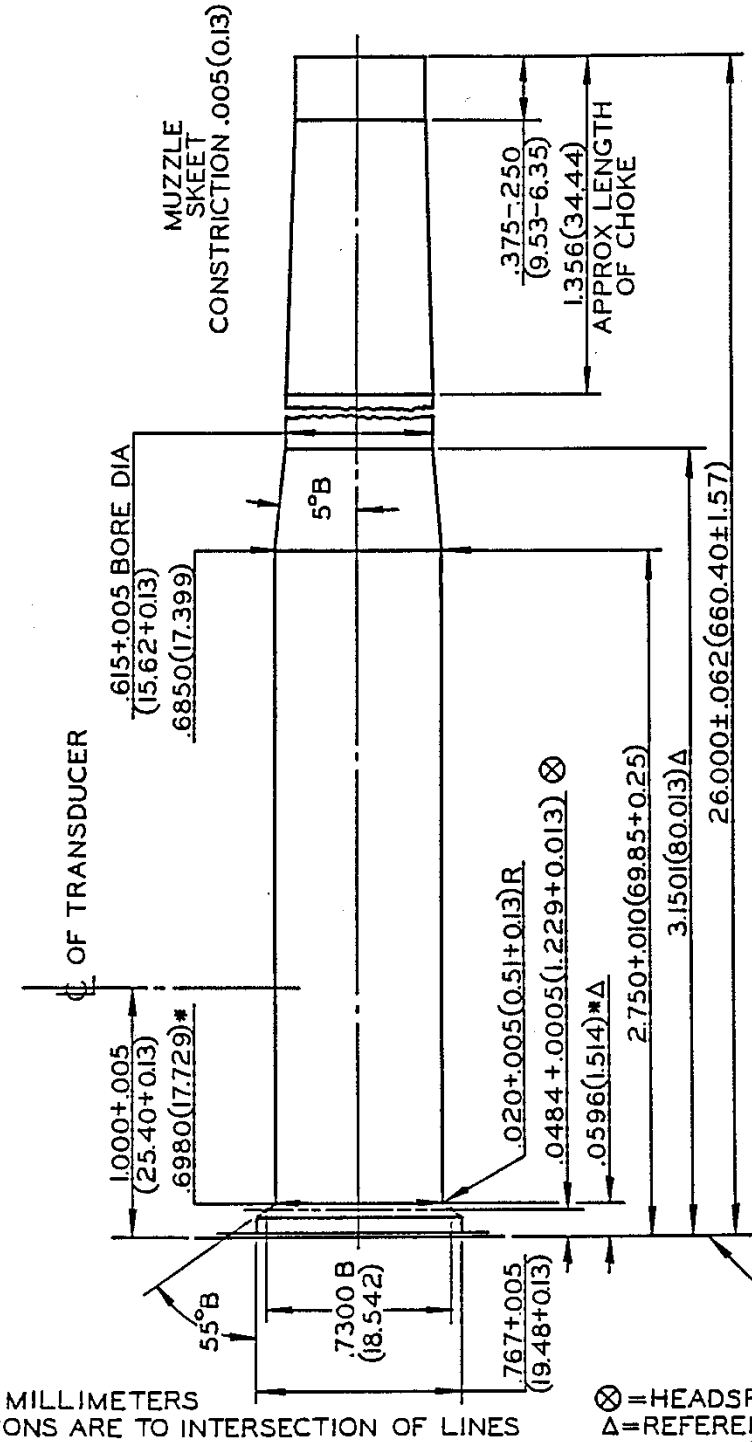


NOTE
B = BASIC
(XX.XX) = MILLIMETERS
* DIMENSIONS ARE TO INTERSECTION OF LINES
⊗ = HEADSPACE DIMENSION
Δ = REFERENCE DIMENSION
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)

STANDARD VELOCITY & PRESSURE BARREL
20 GAUGE-2 3/4 INCH - FULL CHOKE



STANDARD VELOCITY & PRESSURE BARREL
20 GAUGE-2 3/4 INCH - SKEET



UNLESS OTHERWISE NOTED
ALL DIA +.0005(0.013)
LENGTH TOL +.005(0.13)

NOTE
B=BASIC
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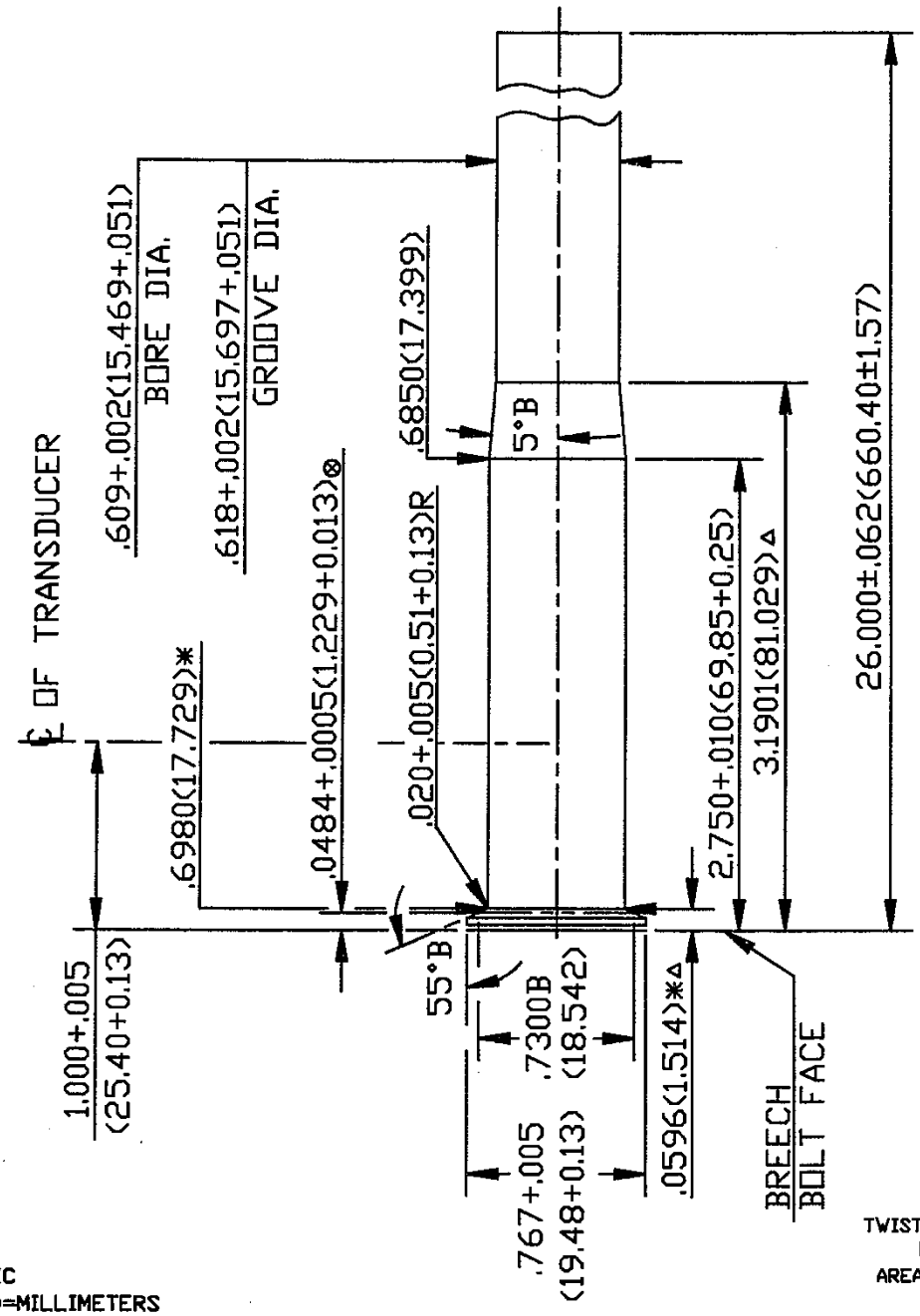
⊗=HEADSPACE DIMENSION
Δ=REFERENCE DIMENSION
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)

STANDARD VELOCITY &
PRESSURE BARREL
20 GAUGE-2 3/4" RIFLED



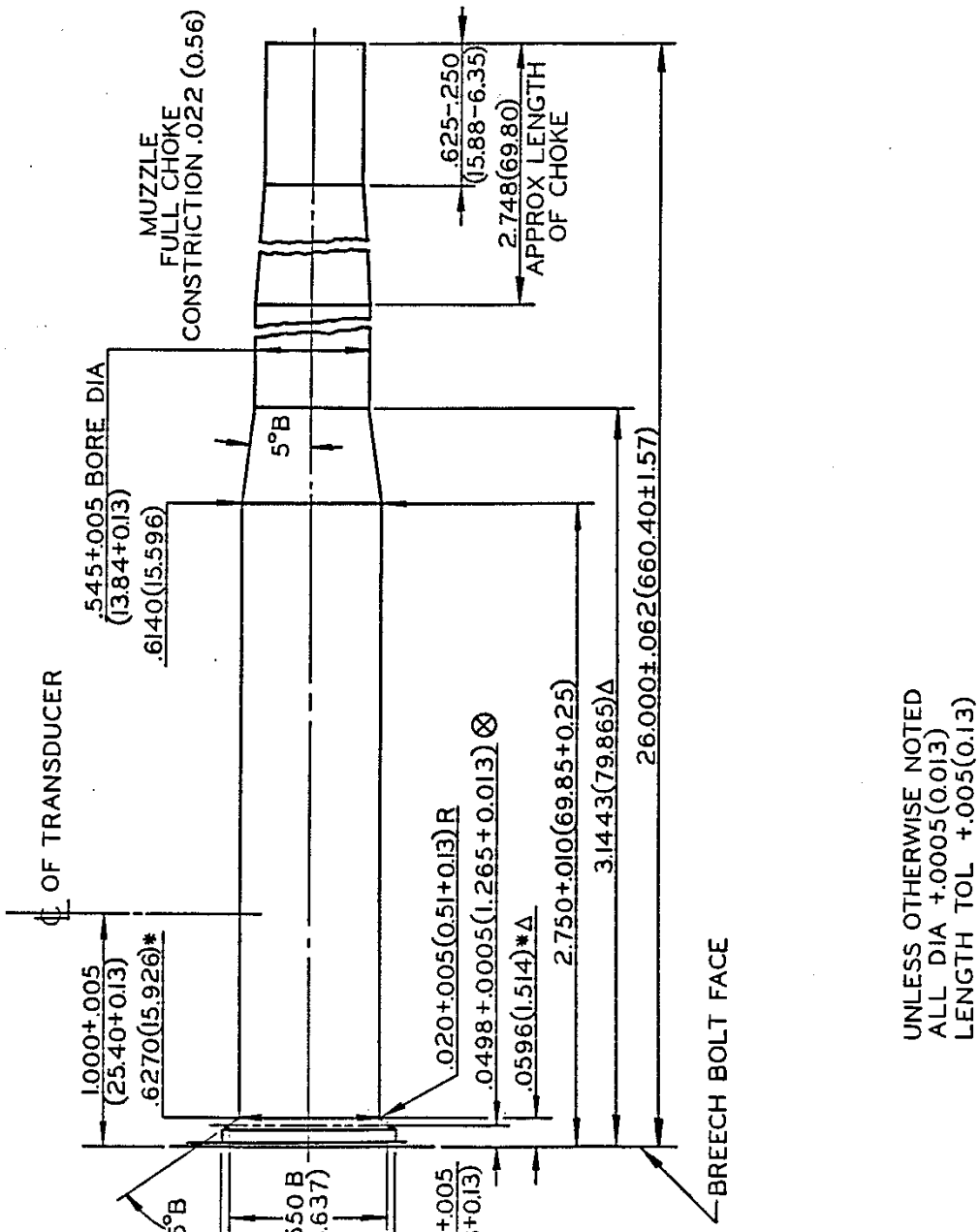
UNLESS OTHERWISE NOTED
ALL DIA +.0005(0.013)
LENGTH TOL. +.005(0.13)

Δ 8 GROOVES
Δ.119±.002 WIDE
TWIST 35(889) ±.125(3.175) R.H.
MIN BORE & GROOVE
AREA .2955 IN² (190.645mm²)

⊗ = HEADSPACE DIMENSION
Δ = REFERENCE DIMENSION

NOTE
B=BASIC
(XX.XX)=MILLIMETERS
* DIMENSIONS ARE TO INTERSECTION OF LINES
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC).

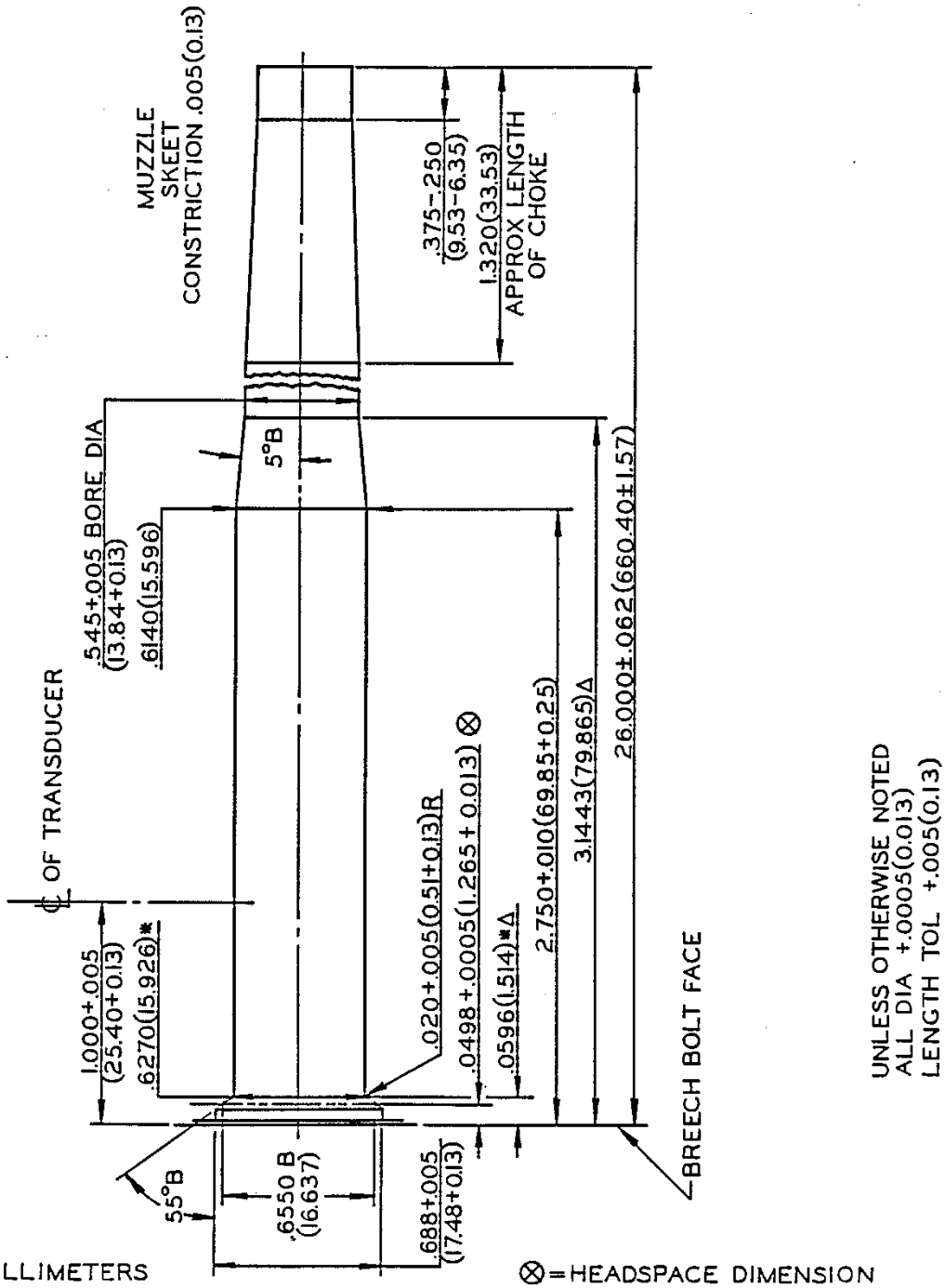
STANDARD VELOCITY &
PRESSURE BARREL
28 GAUGE-2 3/4 INCH -
FULL CHOKE



UNLESS OTHERWISE NOTED
ALL DIA +.0005(0.013)
LENGTH TOL +.005(0.13)

NOTE
B = BASIC
(XX.XX) = MILLIMETERS
* DIMENSIONS ARE TO INTERSECTION OF LINES
⊗ = HEADSPACE DIMENSION
Δ = REFERENCE DIMENSION
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)

STANDARD VELOCITY &
PRESSURE BARREL
28 GAUGE-2 3/4 INCH -
SKEET



UNLESS OTHERWISE NOTED
ALL DIA +.0005(0.013)
LENGTH TOL +.005(0.13)

NOTE
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ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)

⊗ = HEADSPACE DIMENSION
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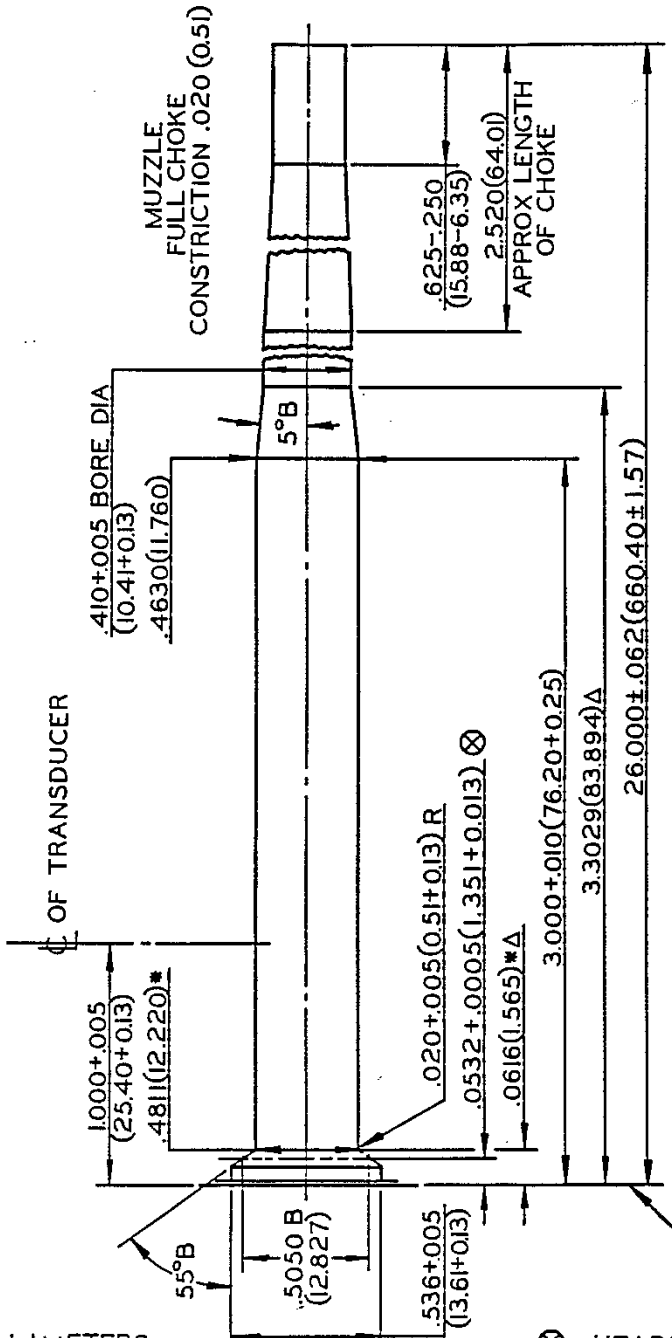
STANDARD VELOCITY &
PRESSURE BARREL
410 BORE-2 1/2" & 3" -
FULL CHOKE



UNLESS OTHERWISE NOTED
ALL DIA +.0005(0.013)
LENGTH TOL +.005(0.13)

NOTE
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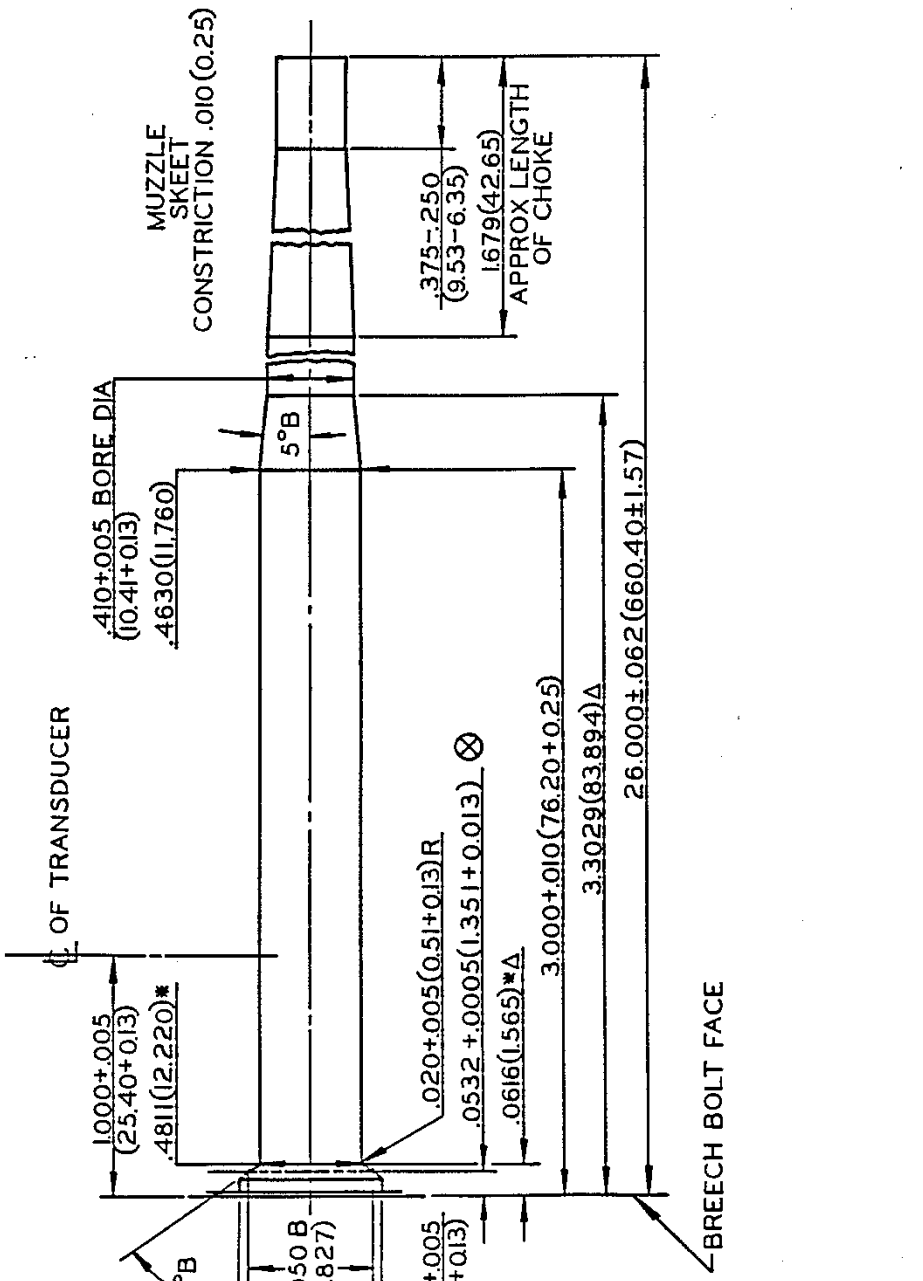
* DIMENSIONS ARE TO INTERSECTION OF LINES
⊗ = HEADSPACE DIMENSION
Δ = REFERENCE DIMENSION
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)

STANDARD VELOCITY & PRESSURE BARREL
410 BORE-2 1/2" & 3" - SKEET



UNLESS OTHERWISE NOTED
ALL DIA +.0005 (0.013)
LENGTH TOL +.005 (0.13)

NOTE
B = BASIC
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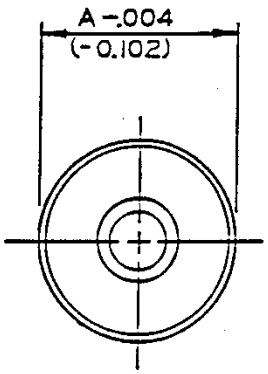
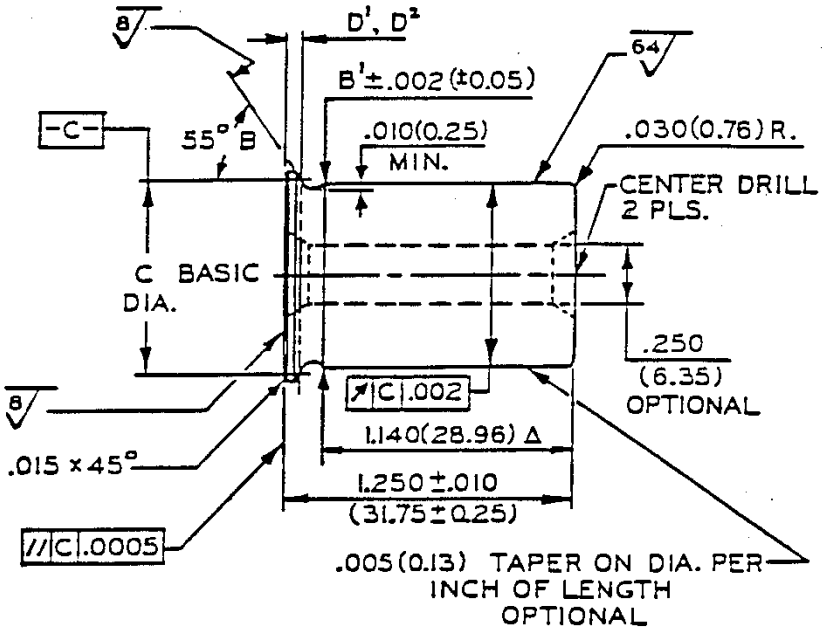
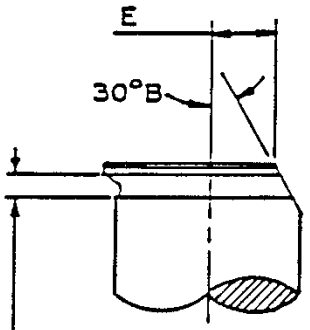
ALL CALCULATIONS APPLY AT MAXIMUM MATERIAL CONDITION (MMC)







PARTIAL VIEW
EXTRACTOR CLEARANCE
OPTIONAL

GAUGE	A	B¹	C	D¹ MIN.	D² MAX.	E
10	.929 (23.597)	.846 (21.488)	.8900 (22.606)	.0624 (1.585)	.0764 (1.9406)	.413 (10.4902)
12	.882 (22.403)	.802 (20.371)	.8500 (21.590)	.0576 (1.463)	.0716 (1.819)	.391 (9.9314)
16	.815 (20.701)	.736 (18.694)	.7850 (19.939)	.0506 (1.2852)	.0646 (1.641)	.358 (9.0932)
20	.762 (19.355)	.689 (17.501)	.7300 (18.542)	.0484 (1.2294)	.0624 (1.585)	.335 (8.509)
28	.683 (17.3482)	.618 (15.697)	.6550 (16.637)	.0498 (1.265)	.0638 (1.621)	.229 (5.817)
410	.531 (13.4874)	.468 (11.887)	.5050 (12.827)	.0532 (1.3513)	.0672 (1.707)	.224 (5.690)

D^1 MIN.= +.0005 (+0.013)
D^2 MAX.= -.0005 (-0.013)

MATERIAL: AISI-06 STEEL OR EQUIVALENT
HEAT TREAT TO R_c 60-64

UNLESS OTHERWISE NOTED ALL
TOLERANCES TO BE ±.005(±0.13)

NOTE
B=BASIC
(XX.XX)=MILLIMETERS
Δ=REFERENCE DIMENSION

DEFINITION AND PURPOSE

SAAMI Definitive Proof loads are shells commercially loaded by SAAMI member companies to develop pressures substantially exceeding those developed by normal service loads. The pressure levels are designed to assure firearms safety when using ammunition loaded to service pressures in accordance with accepted American practices.

Proof loads are designed to stress firearms components which contain the cartridge in order to assure safety in the recommended use of firearm during its service life.

It is important from the safety standpoint that Definitive Proof loads be used only for the proof of firearms. Adequate precaution must be taken to protect personnel performing firearms proof testing.

Definitive Proof loads are loaded with the heaviest shot charge commercially available for the particular gauge and shell length. The slowest powder which will meet the pressure values is used in order to maintain effective pressure-distance relationships.

SECTION IV - DEFINITIVE PROOF LOADS CHARACTERISTICS
SHOTSHELL
SAAMI VOLUNTARY PERFORMANCE STANDARDS

The following specifications define proof loads based on tests fired in standard test barrels with the ammunition at a temperature of 60°- 80°F (15.6°- 26.7°C). Tests shall be in accordance with the procedures and equipment shown in Sections II and III of these Standards.

Pressure values are given on the following pages in terms of minimum and maximum averages and extreme variations for 10-round tests in standard test barrels.

For Shotshell, the standard deviation is the same for Definitive Proof loads and service loads.

The minimum and maximum average Definitive Proof pressures for Shotshell are 55% and 70% greater than the MPLM service pressure and are computed as follows:

The Minimum Average Definitive Proof pressure is calculated by multiplying the Maximum Probable Lot Mean (MPLM) service pressure by a factor of 1.55 (i.e., 155%) and rounding up to the nearest multiple of 500 lbs.

The Maximum Average Definitive Proof pressure is calculated by multiplying the Maximum Probable Lot Mean (MPLM) service pressure by a factor of 1.70 (i.e., 170%) and rounding downward to the nearest multiple of 500 lbs.

Example:

20 gauge Shotshell MPLM Pressure = 12600 psi S.D. = 900 psi

1. Min Avg Proof pressure = Max Probable Lot Mean Pressure x 1.55
   i.e. 12,600 psi x 1.55 = 19,500

2. Max Avg Proof pressure = Max Probable Lot Mean Pressure x 1.70
   i.e. 12,600 psi x 1.70 = 21,400 rounded down to 21,000 psi.

The maximum proof pressure E.V. is a statistic derived from knowledge of the population standard deviation. Applying table figures from Relative Range Tables (Biometrika Tables for Statisticians), we calculate the maximum E.V. or Range equal to the population S.D. times the table constant 5.16 (for sample of 10 at 99.0% confidence level). For example, 20 gauge Proof S.D. = 900 psi, 900 psi x 5.16 = 4600 psi which is the maximum allowable E.V. for the 20 gauge Proof load shell.

PRESSURE DATA

Shell	Shot Weight (Ounces)	Service Maximum Average Pressure	Minimum & Maximum Pressure Values of Proof Cartridges (psi/100)		
			Minimum Average	Maximum Average	Max. E.V.
10 Ga. 2-7/8"	1-5/8	110	180	195	41
10 Ga. 3-1/2"	2	110	180	195	41
12 Ga. 2-3/4"*	1-1/2	115	190	205	46
12 Ga. 3-1/2"	1-9/16	140	228	245	51
16 Ga. 2-3/4"	1-1/4	115	190	202	46
20 Ga. 2-3/4"*	1-1/8	120	195	210	46
28 Ga. 2-3/4"	1	125	205	220	46
410 2-1/2"	1/2	125	205	220	46
410 3"	11/16	135	220	235	51

* These shells used for proofing shotguns chambered for 3" shells.

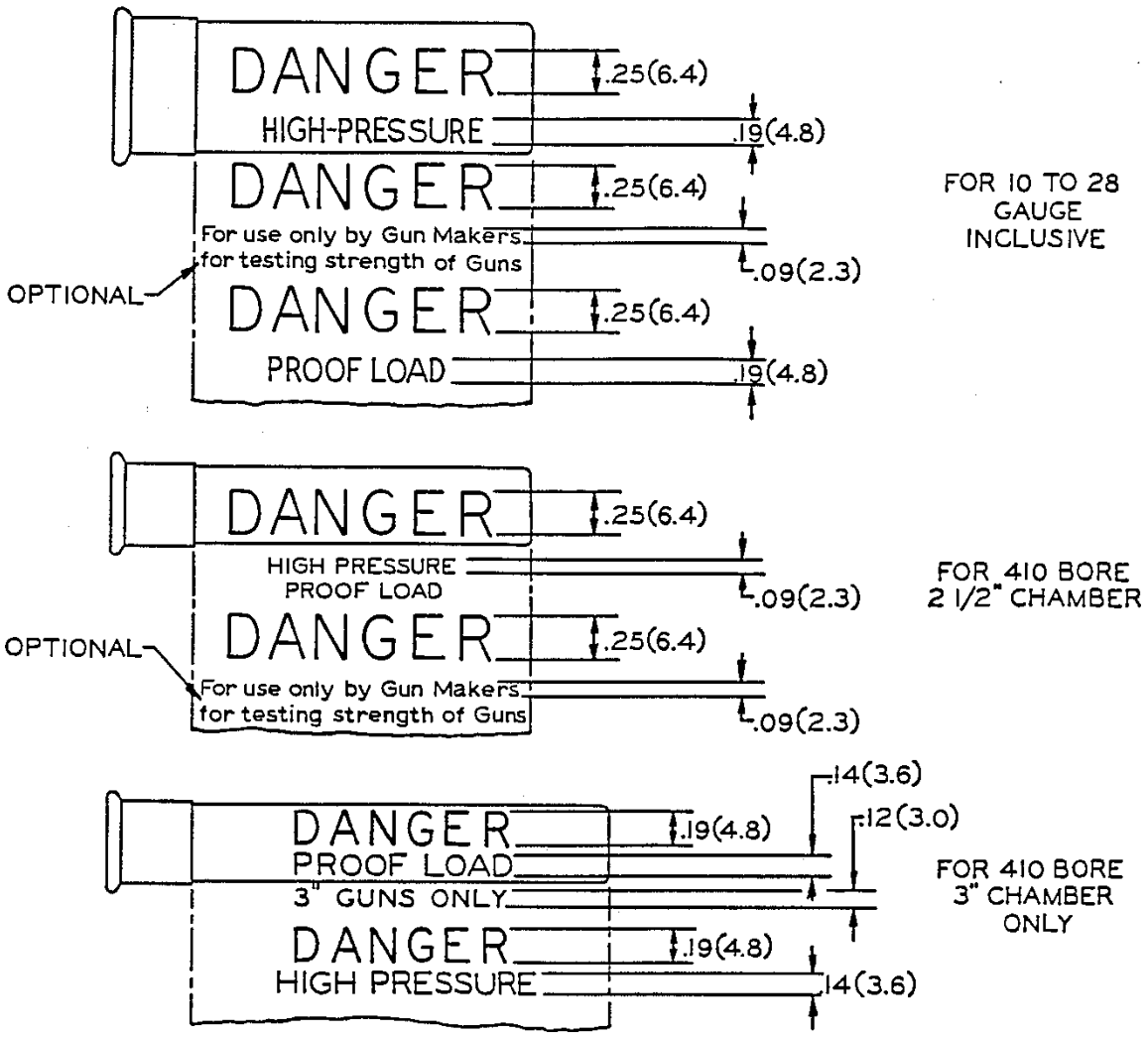
NOTE: All Definitive Proof loads are fired in full choke test barrels (Section III).

SOURCE

Shotshell Definitive Proof Loads should be used for one purpose only: The proof testing of shotguns.

A list of suppliers of Shotshell Definitive Proof Loads may be obtained from the SAAMI Office.

PROOF LOAD-IDENTIFICATION



NOTE
SHOTSHELL BODY-UNCOLORED
PRINTING-RED LETTERS
HEAD-MATTE SURFACE
TIN PLATED OR VISUAL EQUIVALENT

(XX.XX)=MILLIMETERS

SHOTSHELL

DEFINITIVE PROOF PACKAGE IDENTIFICATION

HIGH PRESSURE PROOF LOADS

For Gun Manufacturers' Proof Test Use Only: Fire only from fixed rest with operator properly protected from injury should the firearm be damaged. Purchaser should restrict proof loads to manufacturing premises. To dispose of proof loads, contact producer for instructions. DO NOT reload or dispose of fired proof shells in a manner that may make them available for reloading. Failure to follow the foregoing can result in a personal injury.

Shotshell proof loads are identified by a tin plated head and uncolored body with red printing on the body.

For consistent results, proof loads should be stored for 2 weeks at 70°F ±5°, and 60% relative humidity before use.

"WARNING: KEEP OUT OF REACH OF CHILDREN"

(Red lettering on white background)