

Data Input [With Units Conversions to MKS Units]:

[Sample data values for a known accurate Heavy Barrel 6.5x47 Lapua are included and must be modified as needed for your rifle.]

[MKS Data Inputs and Calculated Values to be used in subsequent calculations are all in **Column F**. Many have to be copy/pasted or manually entered.]

[Formulations used are noted in comments.]

[User Inputs for units conversion are indicated in **Bold**.]

Barrel Material Specification (isotropic steel)**Density (rho) =**

Units Conversions:

lbm/ft^3**484.000**

483.817

Steel Type =**416R****Kg/m^3**

7752.94

7750.00

kg/m^3

Young's (Linear) Modulus of Elasticity (E) =**Shear Modulus of Elasticity (G) =**

Units Conversions:

Pounds/Sq. In. (psi)**29,000,000**

29,007,368

GigaPascals

199.95

200.00**200.00**

GPa

72.30

GPa

Calc. Transverse Shear-Wave Propagation Rate =**SQRT(G/rho) =****3054.35**

m/s

Bore Inside Diameter (Caliber, d) =

Units Conversions:

Inches**0.2640**

0.2640

meters

0.006706

0.006706**0.006706**

meters

Actual Barrel Length (L') from Bolt-Face to Muzzle =

Units Conversions:

27.0000

0.685800

0.685800

meters

Actual Barrel Length (L") from Receiver-Face to Muzzle =

Units Conversions:

26.0000

0.660400

0.660400

meters

Barrel Mass (M' if known) Excluding Any Muzzle Attachment (kg) =

Pounds =

8.8632

4.0203

Ounces =

0.0000

0.0000

Sum (kg) =

4.0203

kg

Estimated Barrel Mass (M') based on M' = rho*L'*(Pi/4)*(Dm^2 - d^2):**D(Midpoint) = Dm =****1.2500**

0.031750

4.0203

kg

Muzzle Attachment Mass =

Pounds =

0.000

0.0000

Ounces =

0.000

0.0000

Sum (kg) =

0.0000

kg

Summed Total Barrel Mass (M) Including Any Muzzle Attachment =**4.0203**

kg

Unthreaded Muzzle OD of Barrel (D") =**0.031750**

meters

Calculated Average OD of Barrel (D') =**0.031750**

meters

Calculated Vibrationally Effective OD of Barrel (D) = SQRT(D" * D') =**0.031750**

meters

Calc. Vibrationally Effective Barrel Length with Attachment (L) =

[Extending the Average OD (D') to Match Total Mass (M)]

0.685800

meters

Measured Rifle CG Offset (dCG) Below Bore Axis =

[Measured at CG by Suspending Rifle via Bore vs Plumb Line]

0.010000

meters

Interior Ballistics Data [All times in microseconds (mu-sec) based on t = 0 at 10-percent P-Max]

Time of Bullet Engraving (6.0 ksi) =

109

mu-sec

Rise time to 60-percent Peak Base-Pressure (t60) =

322

mu-sec

Time of Peak Base Pressure (tp) =

511

mu-sec

Time of Bullet Exit from Muzzle (tb) =

1328

mu-sec

Bullet Muzzle Velocity (fps) =

2746

836.98

m/s

Peak Base Pressure (CIP Transducer psi) =

54,790

377.76

MPa

Bullet Exit Velocity per Double Barrel Length =

610.22

hertz

Ring-Damping Time Constant = Round Trip Delay =

449.06

mu-sec

Suggested Steel Properties:

Steel Type =		Cro-Mo	Stainless	
		4140	416R	
Density	rho =	7850	7750	kg/m^3
Linear Elasticity	E =	205.00	200.00	GPa
Bulk Elasticity	B =	160.00	160.00	GPa
Shear Elasticity	G =	80.00	72.30	GPa
Poisson's Ratio	nu =	0.29	0.30	
Linear Rod "Speed of Sound" = SQRT(E/rho) =				
		5110.25	5080.01	m/s
Bulk Material "Speed of Sound" = SQRT(B/rho) =				
		4514.66	4543.69	m/s
Transverse Shear-Wave Speed = SQRT(G/rho) =				
		3192.35	3054.35	m/s

120,250 in/sec

0.2640 inches

[Measured Internally with a rod]

[Measured Externally]

or 8.8632 pounds

or 8.8632 pounds

or 0.0000 pounds

or 8.8632 pounds

or 1.2500 inches

or 1.2500 inches

or 1.2500 inches

or 27.0000 inches

or 0.3937 inches

[6,000 psi]

[About 0.98% of Time to P-Max]

[Affected by Barrel Length]

[Affected by Barrel Length]

[About 90% of P-Max]

[Frequency Mode 2/3 Discriminator]

[2*L/Propagation Rate, microseconds]