USER'S GUIDE

HOT ROD CALC™

MR. GASKET CO.®

Model 8703

STREET AND STRIP PERFORMANCE CALCULATOR

Designing and building the Hot Rod Calc™ *could not have been done without the support and input from individuals knowledgeable in all aspects of motorsports racing, especially those with deep understanding of the relationship between weather conditions and engine performance.*

Calculated Industries gratefully acknowledges Patrick Hale (Drag Racing Pro) and Marko Glush (independent engine builder and bracket racer) for their generous time and expertise during the development of this calculator.

HOT ROD CALC™

The *Hot Rod Calc™ Street and Strip Performance Calculator* is specifically designed for today's hot rod owner/builders, drag and bracket racers, engine builders, and car and truck enthusiasts. Whether you're into hot rods, street performance, off-road, or drag racing, the *Hot Rod Calc* can help with its built-in solutions for carburetor size, volumetric efficiency, tire ratios, gear ratios, engine displacement, compression ratio, HP, torque and RPM. In addition to solutions for performance modifications, the *Hot Rod Calc* also includes features for predicting elapsed time and trap speed at 1/8 and 1/4-mile intervals. The *Hot Rod Calc* is a powerful, cost-effective tool for every performance car and truck owner's toolbox.

Helps you at the track

- Air Density Solutions
- Density Altitude Solutions
- Adjust your ET prediction with Horsepower and Motorsport Standard Atmosphere Corrections
- Adjust your ET prediction with Wind Speed and Direction Corrections

Helps you improve engine performance

- Calculate Carburetor Size, Engine Displacement, Bore and Stroke
- Estimate Rear Wheel Horsepower, Flywheel Horsepower and Torque

Answer hundreds of car and truck "What If I..." questions

- Calculate Effects of Changing Tire Sizes
- Speed, RPM, Gear Ratios and Tire Relationships
- US/Metric Math Conversions and Solutions
- And more!

TABLE OF CONTENTS

GETTING STARTED

You may want to practice getting a feel for your calculator keys by reading through the key definitions and learning how to enter data, how to store values, etc., before proceeding to the examples.

KEY DEFINITIONS

Basic Function Keys

[On/C]	***On/Clear Key –*** Turns on power. Pressing once clears the last entry and the display. Pressing twice clears all non-permanent values.
[Off]	***Off –*** Turns all power off. Clears all non-permanent values.
[+] [−] [×] [÷] [=]	Arithmetic operation keys.
[0]–[9] and [•]	Keys used for entering numbers.
[Conv]	***Convert –*** Used with the dimensional keys to convert between units or with other keys to access special functions.
[Rcl]	***Recall –*** Used with other keys to recall stored values and settings.
[Conv] [Rcl]	***Memory Clear (M-R/C) –*** Clears Accumulative Memory without changing current display.
[M+]	***Accumulative Memory –*** Adds displayed value to Accumulative Memory.
[Conv] [M+]	***M- –*** Subtracts value from Accumulative Memory.
[%]	***Percentage –*** Used to find a given percent of a number.

Dimensional Function Keys

mm	***Millimeters –*** Identifies entry as Millimeters, with repeated presses toggling between linear, area and volume units. Converts dimensional value to units of Millimeters, with repeated presses toggling between Millimeters and Meters.
Conv mm	***Meters (m) –*** Identifies entry as Meters, with repeated presses toggling between linear, area and volume units. Converts dimensional value to units of Millimeters, with repeated presses toggling between Millimeters and Meters.
inch	***Inch –*** Identifies entry as Inches, with repeated presses toggling between linear, area and volume units. Converts dimensional value to units of Inches, with repeated presses toggling between Inches and Feet.
Conv inch	***Feet –*** Identifies entry as Feet, with repeated presses toggling between linear, area and volume units. Converts dimensional value to units of Inches, with repeated presses toggling between Inches and Feet.
Conv 0	***Pounds (lbs) –*** Enters or converts to pounds.
Conv 1	***Fluid Ounces (fl oz) –*** Enters or converts to fluid ounces.
Conv 2	***Celcius (°C) –*** Enters or converts to degrees Celsius.
Conv 3	***Fahrenheit (°F) –*** Enters or converts to degrees Fahrenheit.
Conv 4	***Gallons (gal) –*** Enters or converts to gallons.

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Conv 5	***Liters (liters) –*** Enters or converts to liters.
Conv 6	***Milliliters (mL) –*** Enters or converts to milliliters.
Conv 7	***Pound-Foot (lb-ft) –*** Enters or converts to pound-force foot.
Conv 8	***Cubic Centimeters (cc)*** – Enters or converts to cubic centimeters.
Conv 9	***Newton-meters (N-m)*** – Enters or converts to Newton-meters.
Conv •	***Kilograms (kg)*** – Enters or converts to kilograms.

Miscellaneous Function Keys

Conv %	***Square Root ($\sqrt{x}$) –*** Calculates the square root of the number on the display.
Conv ÷	***Reciprocal (1/x) –*** Finds the reciprocal of a number (e.g., 8 Conv ÷ **0.125**).
Conv ×	***Clear All*** – Returns all stored values to the default settings. Does not affect Preference Settings.
Conv +	***Pi –*** Displays value of π (3.1415927).
Conv –	***Change Sign (+/–)*** – Toggle displayed value between negative and positive value.
Conv =	***Preference Settings (Prefs)*** – Accesses various customizable settings, such as dimensional answer formats (see ***Preference Settings*** section on page 13).

ET Prediction Keys

Air Temp	***Air Temperature –*** Enters the current local Air Temperature. Unitless entries assumed °F in US mode, °C in Metric mode. Calculates the MSA Air Temperature if an Elevation has been entered. Default value is 60° F (US)/15.556° C (Met).

Conv **Air Temp** — ***Pressure –*** Enters the current local absolute Pressure as reported by a weather meter such as an aircraft altimeter or absolute barometer (not corrected by Internet, local radio or TV news sources). Unitless entries assumed inHg in US mode, mbar in Metric mode. Calculates the MSA absolute Pressure if an Elevation has been entered. Default value is 29.92 inHg (US)/1013.207 mbar (Met).

Moisture — ***Moisture –*** Enters the current local air Moisture content. Stores unitless and percent values as the relative humidity and stores temperature values as the dew point temperature. Given Moisture entry and Air Temperature, continued presses calculate and display Moisture as relative humidity (**RH%**), water vapor pressure (**P-WV**), saturation water vapor pressure (**P-SAT**), and dew point temperature (**DEW**). Default value is 0% relative humidity.

Conv **Moisture** — ***Wind Speed –*** Enters current local Wind Speed. Unitless entries assumed MPH in US mode, km/h in Metric mode. Calculates corrected ET (**ETc**) and corrected speed (**SPDc**) given entered ET, speed, Vehicle Weight, Frontal Area, Wind Speed and Drag Coefficient (Wind Direction is optional). Calculations are also affected by the Air Density Index.

Elev/ADI — ***Elevation / Air Density Index –*** Enters current local Elevation. Unitless entries assumed Feet in US mode, Meters in Metric mode. Calculates Air Density Index (**ADI**) and Density Altitude (**D-ALT**) given Pressure, Air Temperature and Moisture. Default Elevation is 0, Air Density Index is 100% and Density Altitude is -0.001 feet (effectively 0 feet).

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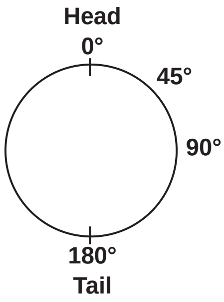
Conv **Elev/ADI**

Wind Direction – Enters the current local Wind Direction. A direct headwind is entered as 0°, a direct crosswind is entered as 90°, and a direct tail-wind is entered as 180°. You can enter a value from 0° to 360°.



Vehicle Wt

Vehicle Weight – Enters or calculates the Vehicle's Weight. Unitless entries assumed pounds in US mode, kilograms in Metric mode. Vehicle Weight typically includes the driver's weight. Calculates Vehicle Weight given entered ET and HP or speed and HP. If all of these values are entered, the calculation based on ET and HP takes precedence. Vehicle Weight calculations are adjusted when the appropriate environmental conditions are entered.

Conv **Vehicle Wt**

Frontal Area – Enters the vehicle's Frontal Area when correcting for wind conditions. Unitless entries assumed square Feet in US mode, square Meters in Metric mode. This is the view of the vehicle from "head-on", measuring from bottom of front bumper to the top of the roof and the widest point-to-point of the race car (e.g., door handle-to-door handle).

ET ***Elapsed Time –*** Enters or calculates the vehicle's quarter-mile dragstrip Elapsed Time, in seconds. Given entered quarter-mile dragstrip Elapsed Time and speed, calculates the vehicle's eighth-mile dragstrip Elapsed Time and speed. Given entered HP and Vehicle Weight, calculates the vehicle's Elapsed Time and speed for both the quarter-mile and eighth-mile dragstrips. When the appropriate environmental conditions are entered, both methods calculate the vehicle's Horsepower correction factor (**HPc**) and provide the Motorsport Standard Atmosphere (MSA) adjusted Elapsed Times and speeds.

Conv **ET** ***Drag Coefficient (Drag Coeff) –*** Enters the vehicle's Drag Coefficient when correcting for wind. See ***Appendix A*** for typical body styles and associated Drag Coefficient values. Default value is 0.35.

MPH ***Miles per Hour –*** Enters or calculates speed in miles per hour. Given entered speed, assumes value as the vehicle's quarter-mile dragstrip speed and calculates its eighth-mile dragstrip speed. Given entered HP and Vehicle Weight, calculates the vehicle's speed for both the quarter-mile and eighth-mile dragstrips. When the appropriate environmental conditions are entered, both methods calculate the vehicle's Horsepower correction factor (**HPc**) and provide the Motorsport Standard Atmosphere (MSA) adjusted speeds. Given Gear Ratio, RPM and New Tire Diameter (HP and Vehicle Weight not entered), calculates current speed.

Conv **MPH** ***Kilometers per Hour (km/h) –*** Enters or calculates speed in kilometers per hour. Functions the same as **MPH**, displaying calculations in km/h instead.

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Performance Keys

Tire Ratio	***Tire Ratio –*** Calculates Tire Ratio, effective drive ratio (**D-EFF**), equivalent drive ratio (**D-EQV**), actual speed (**SPD►A**) and indicated (gauge) speed (**G►SPD)** given entered Old Tire Diameter, New Tire Diameter, Gear Ratio and speed.
Conv Tire Ratio	***Old Tire Diameter (Old Tire Dia) –*** Enters the current tire size for solving Tire Ratio problems. Unitless entries assumed Inches in US mode, mm in Metric mode.
Gear Ratio	***Gear Ratio –*** Enters or calculates overall Gear Ratio. Calculates overall Gear Ratio, as well as gear ratios adjusted for manual (**GR-M**) and automatic (**GR-A**) transmissions given entered RPM, speed and New Tire Diameter.
Conv Gear Ratio	***New Tire Diameter (New Tire Dia) –*** Enters or calculates new tire size. Unitless entries assumed Inches in US mode, mm in Metric mode. Calculates tire size given entered speed, Gear Ratio and RPM.
Engine Displ	***Engine Displacement –*** Enters or calculates Engine Displacement. Unitless entries assumed cubic Inches in US mode, Liters in Metric mode. Calculates Engine Displacement and cylinder volume given entered Bore diameter, Stroke length and Number of Cylinders.
Conv Engine Displ	***Number of Cylinders (# Cylinders) –*** Enters the Number of Cylinders in an engine. Default is 8 cylinders.
CR	***Compression Ratio –*** Enters or calculates the Compression Ratio. Calculates Compression Ratio given entered Bore diameter, Stroke length, Gasket Bore diameter, Gasket Thickness, Deck Height, Dome Volume and Chamber Volume.

Conv CR **Mill Amount –** Enters a new Compression Ratio and calculates the amount to cut out of the cylinder's head in order to increase Compression Ratio given entered Stroke length, old Compression Ratio and new Compression Ratio.

Piston Speed **Piston Speed –** Enters or calculates an engine's Piston Speed. Unitless entries assumed ft/min in US mode, m/min in Metric mode. Calculates Piston Speed in feet per minute (**FPM**) and meters per minute (**M/MIN**) given entered RPM and Stroke length.

Conv Piston Speed ***Mechanical Efficiency (Mech Eff %)* –** Enters the engine's Mechanical Efficiency, a numeric value representing a percentage of the power available inside the engine's cylinders that makes its way to the flywheel (e.g., less friction losses from rings, pistons, bearing friction, oil pumps, etc.). Default value is 85%.

Carb Size ***Carburetor Size* –** Enters or calculates a Carburetor Size as a flow rate of cubic feet per minute. Calculates User, Theoretical, Street and Race Carburetor Sizes given entered Engine Displacement, RPM and Volumetric Efficiency. If Volumetric Efficiency is 100%, User Carburetor Size is not calculated.

VE ***Volumetric Efficiency* –** Enters or calculates the Volumetric Efficiency of an engine. Calculates Volumetric Efficiency and Theoretical Carburetor Size given entered Engine Displacement, RPM and Carburetor Size.

Bore ***Bore* –** Enters or calculates Bore diameter. Unitless entries assumed Inches in US mode, mm in Metric mode. Calculates Bore diameter given entered Engine Displacement and Stroke length.

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Conv Bore — ***Gasket Bore (Gskt Bore) –*** Enters Gasket Bore diameter. Unitless entries assumed Inches in US mode, mm in Metric mode. Used in calculating Compression Ratio.

Stroke — ***Stroke –*** Enters or calculates Stroke length. Unitless entries assumed Inches in US mode, mm in Metric mode. Calculates Stroke length given entered Engine Displacement and Bore diameter.

Conv Stroke — ***Gasket Thickness (Gskt Thickness) –*** Enters Gasket Thickness. Unitless entries assumed Inches in US mode, mm in Metric mode. Used in calculating Compression Ratio.

RPM — ***RPM –*** Enters or calculates RPM. Calculates RPM given entered speed, Gear Ratio and New Tire Diameter or given entered Stroke and Piston Speed. If all of these values are entered, the calculation based on speed, Gear Ratio and New Tire Diameter takes precedence.

Conv RPM — ***Deck Height –*** Enters cylinder Deck Height. Unitless entries assumed Inches in US mode, mm in Metric mode. Used in calculating Compression Ratio.

Torque — ***Torque –*** Enters or calculates flywheel engine Torque. Unitless entries assumed lb-ft in US mode, N-m in Metric mode. Calculates Torque given entered RPM and HP. When the appropriate environmental conditions are entered, calculates the vehicle's Horsepower correction factor (**HPc**) and provides the Motorsport Standard Atmosphere (MSA) adjusted Torque.

Conv Torque — ***Dome Volume (Dome Vol) –*** Enters Piston Dome Volume. Unitless entries assumed cubic centimeters. Used in calculating Compression Ratio.

HP — ***Horsepower –*** Enters or calculates the engine Horsepower. Calculates engine Horsepower given entered speed and Vehicle Weight. Calculates rear wheel Horsepower given entered ET and Vehicle Weight. Calculates flywheel Horsepower given entered RPM and Torque. When the appropriate environmental conditions are entered, all methods calculate the vehicle's Horsepower correction factor (**HPc**) and provide the Motorsport Standard Atmosphere (MSA) adjusted Horsepower.

Conv **HP** — ***Chamber Volume (Chamber Vol) –*** Enters cylinder Chamber Volume. Unitless entries assumed cubic centimeters. Used in calculating Compression Ratio.

PREFERENCE SETTINGS

Press **Conv**, then **=** to access the Preferences menu. Continue pressing **=** to toggle through different Preferences. Press **+** or **–** keys to toggle between options of the different Preferences. Press **On/C** to exit Preferences. Your calculator will keep Preference settings until a Full Reset alters your settings to the default values (see ***Appendix D*** for more information).

KEYSTROKE	DISPLAY
Conv **=** *(Prefs)* *(Functional Result Rounding)*	**F-RND 0.000**
+	**F-RND 0.00**
+	**F-RND FLOAt**
+ *(repeats options)*	**F-RND 0.000**
Second press of **=**: *(Default Unit Format)*	**US UNItS**

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KEYSTROKE	DISPLAY
+	**METRC UNItS**
+ *(repeats options)*	**US UNItS**
Third press of =: *(Meter Rounding)*	**METER 0.000 M**
+	**METER FLOAt M**
+ *(repeats options)*	**METER 0.000 M**

ENTERING DIMENSIONS

Distance/Length Dimensions

Examples of how linear dimensions are entered (press On/C after each entry):

DIMENSIONS	KEYSTROKE
4.5 inches	4 • 5 inch
95 millimeters	9 5 mm
1,320 feet	1 3 2 0 Conv inch
201 meters	2 0 1 Conv mm

Square and Cubic Dimensions

Examples of how square and cubic dimensions are entered (press On/C after each entry):

DIMENSIONS	KEYSTROKE
14 square inches	1 4 inch inch
11 square millimeters	1 1 mm mm
450 cubic inches	4 5 0 inch inch inch
3 cubic feet	3 Conv inch inch inch

Distance/Length Conversions

Enter and convert 1,320 feet to meters.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1 3 2 0 Conv inch *(Feet)*	**1320 F**
Conv mm mm **(m)*	**402.336 M**

** Repeated presses of mm will toggle between meters and millimeters.*

Enter and convert 4.5 inches to millimeters.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
4 • 5 inch	**4.5 IN**
Conv mm *	**114.3 MM**

** Repeated presses of mm will toggle between meters and millimeters.*

Speed Conversions

Enter and convert 65 miles per hour to kilometers per hour.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
6 5 MPH	**SPEED S 65. MPH**
Conv MPH *(km/h)*	**SPEED S 104.60736 KM/H**

Engine Displacement Conversions

Enter and convert 450 cubic inches (CID) to liters.

KEYSTROKE	DISPLAY
On/C On/C	**0.**

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KEYSTROKE	DISPLAY
4 5 0 inch inch inch	450 CU IN
Conv 5 *(liters)*	LITER 7.3741788

Enter and convert 5.0 liters to cubic inches (CID).

KEYSTROKE	DISPLAY
On/C On/C	0.
5 Conv 5 *(liters)*	LITER 5
Conv inch	305.11872 CU IN

Torque Conversions

Enter and convert 42 lb-ft to Newton-meters.

KEYSTROKE	DISPLAY
On/C On/C	0.
4 2 Conv 7 *(lb-ft)*	LB-FT 42
Conv 9 *(N-m)*	N-M 56.944354

Enter and convert 25 N-m to lb-ft.

KEYSTROKE	DISPLAY
On/C On/C	0.
2 5 Conv 9 *(N-m)*	N-M 25
Conv 7 *(lb-ft)*	LB-FT 18.439054

Weight Conversions

Enter and convert 2,700 pounds to kilograms.

KEYSTROKE	DISPLAY
On/C On/C	0.
2 7 0 0 Conv 0 *(lbs)*	LBS 2700
Conv • *(kg)*	KG 1224.6994

Volume Conversions

Enter and convert 5.5 gallons to liters.

KEYSTROKE	DISPLAY
On/C On/C	0.
5 • 5 Conv 4 *(gal)*	GAL 5.5
Conv 5 *(liters)*	LITER 20.819765

Enter and convert 15.25 liters to gallons.

KEYSTROKE	DISPLAY
On/C On/C	0.
1 5 • 2 5 Conv 5 *(liters)*	LITER 15.25
Conv 4 *(gal)*	GAL 4.0286238

MEMORY OPERATION

Whenever the M+ key is pressed, the displayed value will be added to the Memory. Other memory functions:

FUNCTION	KEYSTROKE
Add to Memory	M+
Subtract from Memory	Conv M+
Recall total in Memory	Rcl M+
Display/Clear Memory	Rcl Rcl
Clear Memory	Conv Rcl

Memory is semi-permanent, clearing only when you:

1) turn off the calculator
2) press Rcl Rcl
3) press Conv Rcl
4) press Conv ⊠ *(Clear All)*

When Memory is recalled (Rcl M+), consecutive presses of M+ will display the calculated average and total count of the accumulated values.

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Using M+

KEYSTROKE	DISPLAY
3 5 5 M+	M+ 355. M
2 5 5 M+	M+ 255. M
7 4 5 Conv M+ *(M-)*	M- 745. M
Rcl M+	TOTAL - 135. M
M+	AVG - 45. M
M+	COUNT 3. M
Rcl Rcl	M+ - 135.

USING THE *HOT ROD CALC*

Note: *The* Hot Rod Calc's *built-in Horsepower correction calculations are based on formulas designed for naturally aspirated gasoline burning engines.*

The *Hod Rod Calc* helps you get the most out of your bracket racing efforts by assisting you at the dragstrip in two very critical ways:

- Calculates the Air Density Index, based on your current local measured weather inputs, to assist you with changing your carburetor jet settings.
- Calculates a Horsepower correction factor, based on your current local measured weather and/or track Elevation inputs, to assist you with predicting changes in your engine's performance enabling better ET and speed predictions.

To further understand the *Hot Rod Calc's* outputs and how to use the calculator, please get familiar with the following technical and weather related terms used throughout this section of the user's guide.

IMPORTANT:* All examples are based on the default US units mode, displaying entries and calculations in US units. Also note that if an attempt is made to find a solution (using the motor, performance or environmental functions) without having stored the minimum required values, the calculation will not be performed. Instead, the currently stored value for the selected function will be displayed (Tire Ratio displays NONE). See** **Key Definitions** ***section on page 4 for function requirements.

Motorsports Standard Atmosphere (MSA)*

Motorsports Standard Atmosphere, MSA, is a term defined by Drag Racing Pro's Patrick Hale, and is a methodology implemented in this calculator. Simply stated, it is a standard, reference set of ambient weather conditions. Engine and race car performance can be corrected back to MSA in order to understand the effects of environmental changes.

As a rule, if the local weather changes, so does your vehicle's performance. Some basic guidelines to know are that the higher the absolute Pressure, the faster your vehicle will go, but the higher the temperature, the slower it will go. More specifically, engine performance is impacted by the ambient air's density.

MSA includes three parameters: absolute Pressure (29.92 inHg), temperature (60° F), and relative humidity (0% RH, or "dry air").

Horsepower Correction Factor (HPc)*

The Horsepower Correction Factor is calculated and implemented within HP, ET and speed estimations on the *Hot Rod Calc*. The current local weather conditions and/or Elevation entered into the calculator are used to calculate HPc.

As a guideline, the closer the HPc is to 1.0, the faster the vehicle will run (more Horsepower is produced). Conversely, the higher the HPc, the slower it will run (less Horsepower is produced).

***** Patrick Hale, "Motorsports Standard Atmosphere and Weather Correction Methods", Arizona: DRPro, 2008.***

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Density Altitude

Density Altitude is an MSA Elevation that has the same air density as the current local measured weather conditions. Meaning, your physical Elevation might be 4,000 feet above sea level, but the current air conditions are like a “theoretical” perfect day at 5,000 feet. Density Altitude is simply a corrected Elevation, and is calculated using the current local measured weather conditions entered into the calculator.

Air Density Index

Air Density Index, ADI, is a ratio (expressed as a percentage) of the current air’s density to that of MSA. The ADI at MSA is 100%. ADI is calculated using the current local measured weather conditions entered into the calculator. Once you have established an air/fuel ratio for the current track and weather conditions, calculate and record the current ADI.

As a rule, ADI will be less than 100% for Elevations above sea level as well as for temperatures above 60° F. Conversely, ADI will be more than 100% for temperatures below 60° F.

As a guideline, ADI can be used to tune your engine’s air/fuel requirements when conditions change from your baseline conditions. For each percentage point the current ADI is above your recorded baseline ADI, your engine will require that much more fuel. Conversely, for each percentage point the current ADI is below your recorded baseline ADI, your engine will require that much less fuel to maintain the same level of performance.

Be careful! It’s safer to be 3% rich than to be 1% lean. ADI can tell you a lot about what you need to know for carburetor jetting changes, however, you must understand all the relationships before making a change. Surging or hesitating will indicate that your vehicle is likely running too lean an air/fuel ratio. If you’re seeing black smoke out the exhaust, it is likely you are running too rich an air/fuel ratio. Combine your experience with theory, always refer to your carburetor manufacturer’s jetting size and change instructions, and make air/fuel changes in small, incremental steps.

Lastly, data is knowledge, and knowledge is power! Always record your air/fuel and jet number settings along with the *Hot Rod Calc’s* calculated ADI and Density Altitude for those last minute adjustments as weather conditions change throughout the day or for dialing in at different track locations.

Pressure

There are two types of commonly referenced Pressure, **Absolute Pressure** and **Corrected Pressure**.

Absolute Pressure is the actual, ambient local Pressure. There are several tools available to help you measure absolute Pressure, such as altimeters, absolute barometers, and motorsports weather stations. You do not need to know your track’s Elevation when utilizing absolute Pressure on your calculator.

Corrected Pressure is a measurement you might get from the local radio station, TV station, from the Internet, or from a “corrected” barometer. It is corrected for sea level and is not suitable for motorsports. *Do not use corrected Pressure on the* Hot Rod Calc*.*

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Elapsed Time

Elapsed Time, or ET, is the amount of time in seconds it takes a vehicle to travel from start to finish over a measured distance, typically one quarter of a mile. Your calculator's ET predictions may vary from other ET prediction sources primarily due to traction. The *Hot Rod Calc* assumes ideal conditions with no tire slippage and 100% converter lockup, and the predictions are for estimation purposes only.

ADI, DENSITY ALTITUDE AND WATER VAPOR CONTENT

Calculating ADI and Density Altitude Using Absolute Pressure

For this example, you are at the Los Angeles County Fairplex Auto Club Raceway in Pomona, Calif. The track's Elevation is about 1,025 feet above sea level. The current local measured weather conditions are 63.2° F, absolute Pressure of 28.83 inHg and 58% relative humidity at 9 a.m.

Note: *Elevation entry is not required if absolute Pressure is entered.*

Calculate the Air Density Index (ADI) and Density Altitude.

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter current local measured weather conditions:	
6 3 • 2 Air Temp	TEMP S 63.2 °F
2 8 • 8 3 Conv Air Temp *(Pressure)*	P-ABS S 28.83 INHG
5 8 Moisture	RH% S 58. %
2. Calculate ADI and Density Altitude:	
Elev/ADI	ELEV S 0.
Elev/ADI	ADI 94.641 %*
Elev/ADI	D-ALT 1873.414 F

** Recall that ADI is a ratio, expressed as a percentage, of the current air's density to that of MSA. At the Auto Club Raceway under the aforementioned weather conditions, the air's density is about 94.6% of that of MSA. Notice that the current air conditions at 1,025 feet above sea level are theoretically the air conditions at an Elevation of about 1,873 feet above sea level.*

In the next example, you are at the Firebird International Raceway, just outside of Phoenix, Ariz. The track's Elevation is about 1,082 feet above sea level. The current local measured weather conditions are an unseasonably chilly 33° F, absolute Pressure of 28.77 inHg, and a relative humidity of 64% at 8:30 a.m.

Calculate the Air Density Index (ADI) and Density Altitude.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Enter current local measured weather conditions:	
3 3 Air Temp	**TEMP S 33. °F**
2 8 • 7 7 Conv Air Temp *(Pressure)*	**P-ABS S 28.77 INHG**
6 4 Moisture	**RH% S 64. %**
2. Calculate ADI and Density Altitude:	
Elev/ADI	**ELEV S 0.**
Elev/ADI	**ADI 101.002 %***
Elev/ADI	**D-ALT - 341.909 F**

** While these weather conditions at Firebird International Raceway are unlikely, this example demonstrates an ADI value of over 100%, which is certainly a possible situation. As stated previously, air density is typically over 100% when temperatures are well below 60° F.*

Calculating ADI and Density Altitude Using Elevation

For this example, you are at Top Gun Raceway in Fallon, Nev., and only have access to air temperature and humidity data. However, you know the track's Elevation is about 3,963 feet above sea level. With these three variables — Air Temperature, humidity and Elevation — you can still calculate ADI and Density Altitude. The current weather conditions are posted as 51° F and 5% relative humidity at 9 a.m.

Calculate the Air Density Index (ADI) and Density Altitude.

KEYSTROKE	DISPLAY
1. Clear all stored values and enter track Elevation:	
Conv × *(Clear All)*	ALL CLEArEd
3 9 6 3 Elev/ADI	ELEV S 3963. F
2. Enter current local measured weather conditions:	
5 1 Air Temp	TEMP S 51. °F
5 Moisture	RH% S 5. %
3. Calculate ADI and Density Altitude:	
Elev/ADI	ELEV S 3963. F
Elev/ADI	ADI 87.969 %
Elev/ADI	D-ALT 4323.207 F

Calculating ADI Using a Fuel Correction Index

For this example, the current local measured weather conditions are 80° F, absolute Pressure of 29.15 inHg, and 53.5% relative humidity. Your race car ran best, under these baseline conditions, with #78 jets.

***Note:** In this example, it is assumed that your current air/fuel settings and jet numbers are correct for your engine's requirements at wide open throttle. This example uses a basic Holley carburetor with squared jetting and identical primary and secondary main metering circuits. This example demonstrates how to compare a baseline ADI value to a new ADI value and the meaning of the difference between the two. In practice, this example can be used between ADI calculations at the same track throughout the day or between ADI calculations at two different tracks; the theory is the same.*

Calculate the Air Density Index (ADI) and Density Altitude.

KEYSTROKE	DISPLAY
1. Clear all stored values and enter current local measured weather conditions:	
Conv x *(Clear All)*	**ALL CLEArEd**
8 0 Air Temp	**TEMP S 80. °F**
2 9 • 1 5 Conv Air Temp *(Pressure)*	**P-ABS S 29.15 INHG**
5 3 • 5 Moisture	**RH% S 53.5 %**
2. Calculate ADI and Density Altitude:	
Elev/ADI	**ELEV S 0.***
Elev/ADI	**ADI 92.038 %**
Elev/ADI	**D-ALT 2813.209 F**

** Notice that the Elevation output is 0 feet. This is because the example did not include entering an Elevation. Elevation is only a required input if absolute Pressure is not available. Record the calculated ADI of 92.038% and Density Altitude of about 2,813 feet in your log, along with your air/fuel settings and jet numbers. In this example, these are your baseline settings for this particular track location.*

You are now at a different track location and the current weather conditions have changed significantly. The Air Temperature is now 60° F, absolute Pressure is 24.72 inHg and relative humidity is 39%.

Calculate the current ADI in order to determine if an adjustment is necessary.

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
On/C On/C	0.

3. Enter current weather conditions:

6 0 Air Temp	TEMP S 60. °F
2 4 • 7 2 Conv Air Temp *(Pressure)*	P-ABS S 24.72 INHG
3 9 Moisture	RH% S 39. %

4. Calculate ADI and Density Altitude:

Elev/ADI	ELEV S 0.
Elev/ADI	ADI 81.94 %
Elev/ADI	D-ALT 6662.18 F**

Record the calculated ADI of 81.94% and Density Altitude of 6,662 feet in your log.

5. Calculate a fuel correction index, which is simply the current ADI of 81.94, divided by the baseline ADI of 92.038, then multiply by 100:

8 1 • 9 4 ÷	81.94
9 2 • 0 3 8 ×	0.8902844
1 0 0 =	89.028445*

** The fuel correction index is about 89%, indicating air density is about 89% of the air density from which you baselined your jet numbers. In other words, the new air density has gone down about 11% from your baseline air density calculation. Some experts say that as a general rule, a change of +/- 4% or more in air density is enough to consider a jetting change.*

*** Also, notice that the Density Altitude at the new track location, about 6,662 feet, is much higher than the previous track's Density Altitude of about 2,813. Typically, as Density Altitude goes up, you may require less fuel whereas if Density Altitude goes down, you may require more fuel.*

To translate a fuel correction index to a new jet number, recall your baseline was recorded with #78 jets, which according to the Holley Jet Chart (see ***Appendix B***), have a flow of 645 cubic centimeters per minute. Recall your fuel correction index is about 89%.

KEYSTROKE	DISPLAY
6. Calculate a new flow requirement:	
8 9 % × 6 4 5 =	**574.05***

** Using the chart in **Appendix B**, the closest flow number to 574 is the 566 cubic centimeters per minute flow which corresponds to a #75 jet, which would be a change of three jet numbers down (in this example, Density Altitude has gone up, so it stands to reason that a leaner jet number may be required). A conservative change, however, would be to go from the #78 to the #76, which has a flow of 587 cubic centimeters per minute.*

Calculating Water Vapor Content

Using a different set of track and weather conditions at Top Gun Raceway, let's calculate water vapor content (water vapor pressure, saturation water vapor pressure and dew point).

The track's Elevation is about 3,963 feet above sea level. The current local measured weather conditions are 73° F, absolute Pressure of 25.88 inHg and 14% relative humidity at 10 a.m.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Enter current local measured weather conditions:	
7 3 Air Temp	**TEMP S 73. °F**
2 5 • 8 8 Conv Air Temp *(Pressure)*	**P-ABS S 25.88 INHG**
1 4 Moisture	**RH% S 14. %**

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
2. Calculate water vapor content:	
Moisture *(Water Vapor Pressure)*	**P-WV 0.115 INHG**
Moisture *(Saturation Water Vapor Pressure)*	**P-SAT 0.819 INHG**
Moisture *(Dew Point)*	**DEW 21.071 °F***

** Dew Point is a helpful temperature to know as it tells you approximately at what temperature you can expect to see moisture on the track surface. As you can see from the example above, the racers at Top Gun Raceway won't need to worry about any dew on the track surface since it is extremely unlikely with those weather conditions for the temperature to reach 21° F.*

ELAPSED TIME

Note: *Your calculator's ET predictions may vary from other ET prediction sources primarily due to traction. The* Hot Rod Calc *assumes ideal conditions with no tire slippage and 100% converter lockup, and the predictions are for estimation purposes only.*

Calibrating Your *Hot Rod Calc* for ET Predictions at the Track

When using your *Hot Rod Calc* for ET predictions at the track, following these steps will result in the most accurate predictions. You should go through these steps at each track you race at during your dial-in session to establish a Baseline HP. The Baseline HP value will be the number you use for that track and that day.

Once you have selected your dial-in ET in the morning during your dial-in session, enter your ET, Vehicle Weight with driver, and enter your track's conditions when you recorded your selected dial-in, including Elevation, Moisture, and Air Temperature. Solve for your Baseline HP, and record this number. Here are the steps:

1. Enter your dial-in ET.
2. Enter Vehicle Weight.
3. Enter track Elevation.
4. Enter Temperature at the time of your dial-in.
5. Enter Moisture at the time of your dial-in.
6. Press the HP key, and record the HP value associated to the aforementioned track conditions (not the HP MSA value, which is a value calculated under sea level conditions).

Before each successive run, check your weather station or other locally-measured weather data, enter those numbers and your Baseline HP and solve for an accurate ET prediction.

Basic ET Prediction

Given your 1970 Ford Mustang Notchback, with a 411 HP-producing, stroked 351-CID engine, weighing in at about 3,840 pounds (including driver), calculate a simple Elapsed Time (ET) prediction. For a basic ET prediction, the calculator only requires Vehicle Weight and HP to be entered. The entered HP is assumed to be the engine's rated HP in ideal or MSA conditions with no tire slippage and 100% converter lockup.

KEYSTROKE	DISPLAY
1. Clear all stored values and enter Vehicle Weight (including driver):	
Conv ✕ *(Clear All)*	**ALL CLEArEd**
3 8 4 0 Vehicle Wt	**LBS S 3840.**
2. Enter vehicle's estimated rear wheel HP:	
4 1 1 HP	**HP S MSA 411.**

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
3. Calculate ET and speed prediction:	
ET	**1/4ET 12.269 S**
ET	**1/4 111.101 MPH**
ET	**1/8ET 7.864 S**
ET	**1/8 88.316 MPH**
ET	**HPc 1.**
ET	**P-ABS MSA 29.92 INHG**
ET	**TEMP MSA 60. °F**
ET	**RH% S 0. %**
ET	**ELEV S 0.**
ET	**LBS S 3840.**
ET	**HP S MSA 411.**

— DO NOT CLEAR CALCULATOR —

ET Prediction and HPc

Building off of the previous Basic ET Prediction example, let's zoom your 1970 Ford Mustang Notchback to Top Gun Raceway in Fallon, Nev., and calculate an ET prediction using some additional inputs. The inputs demonstrated in this example are not required for an ET prediction, however, this example will demonstrate the *Hot Rod Calc's* ability to calculate a Horsepower correction factor (HPc) and output for current weather conditions as well as MSA conditions.

For this example, the track's Elevation is 3,963 feet above sea level. Recall that our race car weighs in at about 3,840 pounds, including the driver, and produces about 411 HP in ideal or MSA conditions. The current local measured weather conditions are 73° F, absolute Pressure of 25.88 inHg and 14% relative humidity.

KEYSTROKE	DISPLAY
4. We have already entered the vehicle's weight and HP, so we can skip to the next input – local measured weather conditions:	
7 3 Air Temp	TEMP S 73. °F
2 5 • 8 8 Conv Air Temp *(Pressure)*	P-ABS S 25.88 INHG
1 4 Moisture	RH% S 14. %
5. Calculate ET and speed prediction:	
ET	1/4ET 13.045 S
ET	1/4 104.491 MPH
ET	1/4ET MSA 12.269 S
ET	1/4 MSA 111.101 MPH
ET	1/8ET 8.362 S
ET	1/8 83.061 MPH
ET	1/8ET MSA 7.864 S
ET	1/8 MSA 88.316 MPH
ET	HPc 1.202
ET	P-ABS S 25.88 INHG
ET	TEMP S 73. °F
ET	RH% S 14. %
ET	ELEV S 0.
ET	LBS S 3840.
ET	HP S MSA 411.

— DO NOT CLEAR CALCULATOR —

Notice within the ET output sequence, the ET predictions are displayed in 1/4 and 1/8 prediction sets based on current track conditions as well as a HPc of 1.202. Each set displays the Horsepower corrected predictions (HPc) followed by the MSA adjusted predictions.

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KEYSTROKE	DISPLAY

6. Display the entered MSA HP, corrected HP and the calculated Horsepower correction factor (HPc):

HP	HP S MSA 411.
HP	HP 341.92
HP *	HPc 1.202

** Repeated presses of HP will toggle through the inputs and outputs, starting with the entered absolute Pressure.*

— DO NOT CLEAR CALCULATOR —

Note: *Recall from the key definitions for Mechanical Efficiency (ME%) that ME% is a numeric value representing a percentage of the power available inside the engine's cylinders that makes its way to the flywheel (e.g., friction losses from rings, pistons, bearing friction, oil pumps, etc.). The default value is 85%, which is a fairly acceptable value in practice. ME% is a variable in calculating the HPc, and can be changed as in the following keystroke example.*

KEYSTROKE	DISPLAY

7. Change the Mechanical Efficiency value from 85% to 80% and see the change to HPc:

8 0 Conv Piston Speed *(Mech Eff %)*	M-EFF S 80. %
HP	HP S MSA 411.
HP	HP 339.44
HP	HPc 1.211

Notice that by changing the ME% from 85% to 80% (reducing the engine's Mechanical Efficiency), the corrected HP was reduced, whereas the HPc was increased.

ET Prediction and Wind Conditions

Now let's say you ran your 3,840-pound 1970 Ford Mustang Notchback at Top Gun Raceway in Fallon, Nev., where there are often raging winds. You can use your actual ET and determine what your ET would have been without the windy conditions. You will need several new pieces of information. At a minimum, you need to know what the Wind Speed and direction were when the ET was recorded. Additionally, you need to know the race car's Frontal Area and Drag Coefficient.

To determine your race car's Frontal Area, measure the vehicle from "head-on", measuring from the bottom of the front bumper to the top of the roof and the widest point-to-point of the race car (e.g., door handle-to-door handle). It is also helpful if you know your race car's shape factor, though most are between 80% and 85% of the race car's Frontal Area (excluding dragster-style race cars).

Here's an example of calculating a race car's Frontal Area using a height of 46 inches, a width of 70 inches and a shape factor of 85%.

KEYSTROKE	DISPLAY
1. Clear all stored values and calculate the Frontal Area:	
Conv × *(Clear All)*	**ALL CLEArEd**
4 6 inch	**46 IN**
× 7 0 inch	**70 IN**
× 8 5 %	**2737. S IN**
Conv inch inch *(Feet)*	**19.006944 S F**
2. Store the estimated Frontal Area value:	
Conv Vehicle Wt *(Frontal Area)*	**AREA S 19.006944 S F**

— DO NOT CLEAR CALCULATOR —

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Based on ***Appendix A,*** we will use a Drag Coefficient of 0.45. Your disappointing ET was 13.85 at 102.304 MPH and the Vehicle Weight is 3,840 pounds. Use a Wind Speed of 30 MPH and a Wind Direction of 5°.

KEYSTROKE	DISPLAY
3. Enter the Drag Coefficient of our 1970 Ford Mustang Notchback:	
[•] [4] [5] [Conv] [ET] *(Drag Coeff)*	**DRAG S 0.45**

Note: *A direct head-wind direction is entered as 0°; a direct cross-wind direction is entered as 90°; a direct tail-wind direction is entered as 180°. See diagram within* **ET Prediction Keys** *section on page 8.*

KEYSTROKE	DISPLAY
4. Enter the Vehicle Weight, and your actual ET and speed:	
[3] [8] [4] [0] [Vehicle Wt]	**LBS S 3840.**
[1] [3] [•] [8] [5] [ET]	**ET S 13.85 S**
[1] [0] [2] [•] [3] [0] [4] [MPH]	**SPEED S 102.304 MPH**
5. *Enter the Wind Speed and Wind Direction to calculate how the wind affected your speed and time*:	
[3] [0] [Conv] [Moisture] *(Wind Speed)*	**WIND S 30. MPH**
[5] [Conv] [Elev/ADI] *(Wind Direction)*	**WIND° S 5. °**
6. Calculate the corrected ET and corrected speed:	
[Conv] [Moisture] *(Wind Speed)*	**WIND S 30. MPH**
[Moisture] *(Corrected ET)*	**ETc 13.281 S**
[Moisture] * *(Corrected speed)*	**SPDc 105.85 MPH**

** Repeated presses of* [Moisture] *will toggle through the inputs and outputs, starting with the entered Wind Direction.*

So, if you were to re-do your run, everything being the same except the wind conditions at the time of your recorded ET, you would run a 13.281 at 105.85 MPH.

VEHICLE WEIGHT AND HORSEPOWER

Often, a racer (or a fan, or a friend of a racer) will try to figure out what a particular race car's weight is, what Horsepower is required to achieve a recorded ET, what speed a race car can run, or how much Horsepower a race car has.

Vehicle Weight — *Based on HP and ET*

Your buddy has a 1978 Ford Mustang II with an estimated Horsepower of 575 HP and made an ET run of 9.540 seconds.

Calculate the estimated Vehicle Weight.

KEYSTROKE	DISPLAY
1. Clear all stored values and enter the estimated HP:	
Conv ✕ *(Clear All)*	**ALL CLEArEd**
5 7 5 HP	**HP S MSA 575.**
2. Enter the 1/4 ET:	
9 • 5 4 0 ET	**ET S 9.54 S**
3. Solve for the vehicle's weight:	
Vehicle Wt *	**LBS 2525.953**

** Repeated presses of Vehicle Wt will toggle through the inputs and outputs, starting with the HP correction factor.*

Vehicle Weight — *Based on HP and Speed*

In this example, your buddy has a 2005 Ford Mustang GT with an estimated Horsepower of 520 HP and ran a 1/4 mile at 121.6 MPH.

Calculate the estimated Vehicle Weight.

KEYSTROKE	DISPLAY
On/C On/C	**0.**

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
1. Enter the estimated HP:	
5 2 0 HP	HP S MSA 520.
2. Enter the speed at 1/4 mile:	
1 2 1 • 6 MPH	SPEED S 121.6 MPH
3. *Solve for the vehicle's weight:*	
Vehicle Wt *	LBS 3705.529

** Repeated presses of Vehicle Wt will toggle through the inputs and outputs, starting with the HP correction factor.*

Vehicle Speed — *Based on HP and Vehicle Weight*

In this example, you want to calculate the 1/4-mile speed for a 1970 Chevelle SS with an estimated 400 HP and weighing 4,100 pounds.

Calculate the Chevelle's 1/4-mile speed.

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter the estimated HP:	
4 0 0 HP	HP S MSA 400.
2. Enter the Vehicle Weight:	
4 1 0 0 Vehicle Wt	LBS S 4100.
3. *Solve for 1/4-mile speed:*	
MPH *	1/4 107.723 MPH

** Repeated presses of MPH will toggle through the inputs and outputs, starting with the 1/8-mile speed.*

Horsepower — *Based on Speed and Vehicle Weight*

In this example, you want to calculate the Horsepower for the 1970 Chevelle SS, knowing it weighs 4,100 pounds and had a 107.723 1/4-mile speed.

Calculate the estimated Horsepower.

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter the Vehicle Weight:	
4 1 0 0 Vehicle Wt	LBS S 4100.
2. Enter the speed at 1/4 mile:	
1 0 7 • 7 2 3 MPH	SPEED S 107.723 MPH
3. *Solve for Horsepower:*	
HP *	HP MSA 400.001

** Repeated presses of HP will toggle through the inputs and outputs, starting with the HP correction factor.*

Estimating Rear Wheel Horsepower — *Based on Vehicle Weight and ET*

In this example, your buddy has a 1973 Dodge Charger Rallye with an estimated Vehicle Weight of 4,280 pounds and made an ET run of 13.656 seconds.

Calculate the estimated Horsepower.

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter the estimated Vehicle Weight:	
4 2 8 0 Vehicle Wt	LBS S 4280.
2. Enter the 1/4 ET:	
1 3 • 6 5 6 ET	ET S 13.656 S

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY

3. Solve for the vehicle's estimated rear wheel HP:

HP *	**HP MSA 332.17**

** Repeated presses of HP will toggle through the inputs and outputs, starting with the HP correction factor.*

— DO NOT CLEAR CALCULATOR —

Estimating Rear Wheel Horsepower — *Based on Vehicle Weight, ET and Weather Conditions*

Building from the prior example, let's correct the estimated rear wheel HP based on current local measured weather conditions of 73° F, absolute Pressure of 25.88 inHg and 14% relative humidity, then calculate the estimated Horsepower again.

KEYSTROKE	DISPLAY

4. Enter current local measured weather conditions:

7 3 Air Temp	**TEMP S 73. °F**
2 5 • 8 8 Conv Air Temp *(Pressure)*	**P-ABS S 25.88 INHG**
1 4 Moisture	**RH% S 14. %**

5. Solve for the vehicle's estimated MSA HP, Corrected HP and HPc:

HP	**HP MSA 399.281**
HP *(Corrected HP)*	**HP 332.17**
HP * *(HP Correction Factor)*	**HPc 1.202**

** Repeated presses of HP will toggle through the entered weather conditions, followed by the entered ET and Vehicle Weight.*

Calculating Effects of Changing Tire Sizes

Your daily commuter has four-wheel drive, and you want some extra ground clearance for those occasional off-highway excursions on the way home from work. However, before you make the switch to a taller tire, you want to know what the effects will be to your final-drive ratio and even more importantly, to your speedometer as you don't want to draw any unnecessary attention while you are cruising down the highway.

In this example, your current tires are LT235/75R15's. Your local tire store informed you that your current Sport Truck T/A tires have a diameter of 28.9 inches, whereas the mud tires you are looking to upgrade to have a tire diameter of 33 inches. Your four-wheeler currently has a final-drive ratio of 3.08.

Calculate the equivalent drive ratio (that is, the drive ratio that will provide you with similar performance and responsiveness) and the effect to your speedometer by going to a larger tire diameter.

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter current final-drive ratio:	
3 • 0 8 Gear Ratio	GEAR RATIO S 3.08
2. Enter Old (current) and New Tire Diameters:	
2 8 • 9 Conv Tire Ratio *(Old Tire Dia)*	TIREo SIZE S 28.9 IN
3 3 Conv Gear Ratio *(New Tire Dia)*	TIREn SIZE S 33. IN
3. Calculate the effect to your final-drive (D-EFF) and the equivalent final-drive (D-EQV):	
Tire Ratio	TIRE RATIO 1.142
Tire Ratio *(Final-Drive Ratio)*	D-EFF RATIO 2.697**
Tire Ratio* *(Equivalent Drive Ratio)*	D-EQV RATIO 3.517

(cont'd)

(cont'd)

** Repeated presses of [Tire Ratio] will toggle through the inputs and outputs, starting with the current final-drive ratio input.*

— DO NOT CLEAR CALCULATOR —

*** The effect to the final-drive (**D-EFF**) of going from a tire diameter of 28.9 to 33 inches is an estimated ratio of 2.697, which will create a fairly noticeable loss in your four-wheeler pickup from a stop or while rolling down the highway. To get back to a similar responsiveness on the new 33 inch diameter tires, you would want to install a set of final-drive gears closer to a 3.5 ratio (**D-EQV**).*

Next, calculate the effect of the tire change to your speedometer. You made the switch to the 33 inch tires, and you want to know what your actual speed will be with an indicated (gauge) speed of 65 MPH.

KEYSTROKE	DISPLAY
4. Enter the target indicated (gauge) speed of 65 MPH:	
[6] [5] [MPH]	**SPEED S 65. MPH**
5. Calculate the effect to speedometer:	
[Tire Ratio]	**TIRE RATIO 1.142**
[Tire Ratio] *(Final-drive ratio)*	**D-EFF RATIO 2.697**
[Tire Ratio] *(Equivalent drive ratio)*	**D-EQV RATIO 3.517**
[Tire Ratio] *(Actual speed)*	**SPD►A 74.221 MPH****
[Tire Ratio] *(Gauge speed)*	**G►SPD 56.924 MPH**
[Tire Ratio]*	**SPEED S 65. MPH**

** Repeated presses of [Tire Ratio] will toggle through the inputs and outputs, starting with the entered current final-drive ratio.*

*** For the entered indicated (gauge) speed on your speedometer of 65 MPH, the actual speed is 74.221 MPH (**SPD►A**) after switching from 28.9 to 33 inch diameter tires. So, if you want to be going the legal 65 MPH, you want your speedometer to read about 57 MPH (**G►SPD**).*

SPEED, RPM, GEAR RATIOS AND TIRE RELATIONSHIPS

Speed, RPM, Gear Ratios and tire sizes are interrelated, and with any three values, the fourth value can be solved on your calculator. Getting these four areas set up properly on your road or dragstrip vehicle can have very positive performance effects.

For the following examples, we will use a 1990 Ford Mustang 5.0 LX with a 5.0 liter V8 engine and the T-5, 5-speed manual overdrive transmission. The manual transmission ratios are 3.35 for 1st gear, 1.99 for 2nd, 1.32 for 3rd, direct drive 1.00 in 4th, and an overdrive 0.68 in 5th. The final-drive ratio is 3.08. Lastly, the tires have a diameter of 26 inches.

Speed — *Based on Gear Ratio, RPM and Tire Diameter*

In this example, calculate your top speed in 2nd gear, assuming you are shifting at 5,500 RPM. You will need to find the correct multiplier for 2nd gear. Recall that the final-drive ratio is 3.08 and 2nd gear is 1.99.

KEYSTROKE	DISPLAY
1. Clear all stored values:	
Conv × *(Clear All)*	**ALL CLEArEd**
2. Multiply the final-drive ratio and 2nd gear ratio, and enter that as your Gear Ratio:	
3 • 0 8 × 1 • 9 9 Gear Ratio	**GEAR RATIO S 6.1292**
3. Enter your shifting RPM and tire diameter:	
5 5 0 0 RPM	**RPM S 5500.**
2 6 Conv Gear Ratio *(New Tire Dia)*	**TIREn SIZE S 26. IN**
4. Calculate the speed:	
MPH*	**SPEED 69.409 MPH**

** Repeated presses of MPH will toggle through the inputs and outputs, starting with the entered Gear Ratio.*

(cont'd)

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— DO NOT CLEAR CALCULATOR —

RPM — *Based on Gear Ratio, Speed and Tire Diameter*

From the above calculation, it is estimated that the mighty 5.0 LX will be going about 70 MPH at 5,500 RPM in 2nd gear.

In this example, calculate your RPM at 65 MPH in 5th gear. You will need to find the correct multiplier for 5th gear. Recall that the final-drive ratio is 3.08 and 5th gear is 0.68.

KEYSTROKE	DISPLAY
5. Multiply the final-drive ratio and 5th gear ratio, and enter that as your Gear Ratio:	
3 • 0 8 × • 6 8 Gear Ratio	GEAR RATIO S 2.0944
6. Enter your cruising speed of 65 MPH:	
6 5 MPH	SPEED S 65. MPH
7. Calculate the RPM:	
RPM*	RPM 1760.004**

** Repeated presses of RPM will toggle through the inputs and outputs, starting with the entered speed.*

— DO NOT CLEAR CALCULATOR —

*** It is estimated that the 5.0 LX will be cruising at about 1,760 RPM while going down the highway at 65 MPH in overdrive, resulting in decent fuel mileage due to a low load on the 5.0 liter engine.*

Gear Ratio — *Based on RPM, Speed and Tire Diameter*

In this example, you want to solve for performance out on the highway. The 5.0 LX peaks in Torque at about 3,000 RPM. When you want to downshift from 5th to 4th and safely overtake another car at the LX's peak Torque RPM, what final-drive ratio will enable the LX to reach 3,000 RPM at 65 MPH in 4th gear? Recall that 4th gear is direct drive and therefore would be the same as the final-drive ratio you are solving for.

KEYSTROKE	DISPLAY
8. Enter your RPM and cruising speed of 65 MPH:	
3 0 0 0 RPM	**RPM S 3000.**
6 5 MPH	**SPEED S 65. MPH**
9. Calculate the final-drive ratio:	
Gear Ratio *(Final-drive ratio)*	**GEAR RATIO 3.57****
Gear Ratio *(Manual trans final-drive ratio)*	**GR-M RATIO 3.529**
Gear Ratio* *(Auto trans final-drive ratio)*	**GR-A RATIO 3.582**

** Repeated presses of Gear Ratio will toggle through the inputs and outputs, starting with the entered RPM.*

*** It is estimated that in order to reach 3,000 RPM in 4th gear at 65 MPH, the LX will need a final-drive ratio of 3.57. And for the users who have experience with the Larry Shepard correction method, your calculator also shows a manual transmission (***GR-M***) final-drive ratio of 3.529 and an automatic transmission (***GR-A***) final-drive ratio of 3.582.*

Tire Diameter — *Based on RPM, Speed and Gear Ratio*

Instead of changing your final-drive ratio as in the previous example, you could have solved for the performance another way – by changing the tire size. Using the known parameters of 65 MPH, 3,000 RPM, and our current final-drive ratio of 3.08, calculate a new tire size that will give similar results as the final-drive ratio change in the previous example.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Enter your RPM, cruising speed of 65 MPH and Gear Ratio:	
3 0 0 0 RPM	**RPM S 3000.**
6 5 MPH	**SPEED S 65. MPH**
3 • 0 8 Gear Ratio	**GEAR RATIO S 3.08**
2. Calculate the New Tire Diameter:	
Conv Gear Ratio* *(New Tire Dia)*	**TIREn SIZE 22.431 IN****

(cont'd)

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** Repeated presses of [Gear Ratio] will toggle through the inputs and outputs, starting with the entered final-drive ratio.*

*** It is estimated that in order to reach 3,000 RPM in 4th gear, at 65 MPH, the LX could utilize 22.4-inch diameter tires to achieve roughly the same performance as the previous example where you solved for a new final-drive ratio. It may not give you the look you like, but it would be a cost effective way to reach your goal. Just remember, by changing the tire size, your speedometer will be effected (see* **Calculating Effects of Changing Tire Sizes** *section on page 39 for more information).*

CARBURETOR SIZE

The *Hot Rod Calc* can calculate Carburetor Sizes in four configurations based on different Volumetric Efficiency (VE) values: User, Theoretical, Street and Race. See ***Volumetric Efficiency*** section on page 46 for more about VE.

The User Carburetor Size configuration utilizes a user-entered VE value, whereas Theoretical uses a predefined VE value of 100%, Street uses a VE value of 85% and Race uses a VE value of 110%.

When calculating the Carburetor Size for your application, be careful about what RPM you enter. Selecting an overstated/unrealistic RPM for your engine at wide open throttle (WOT) will result in a mathematically valid Carburetor Size, but will likely not work well with your application. It is best to consult your vehicle's manual or an expert regarding the WOT maximum engine RPM for your vehicle.

Lastly, while carburetors come in many sizes, they are not available in just any size. It is quite possible you won't find one that is of the exact size you calculated on your *Hot Rod Calc*. Carburetor Sizes are designated by airflow capacity in cubic feet per minute (CFM).

Carburetor Size — *Based on RPM and Engine Displacement*

In this example, you want to upgrade your 1968 Pontiac GTO's carburetor. With all the engine and accessory modifications you have made, your Ram Air II 400-CID engine makes its peak Horsepower RPM at about 5,400 RPM. Calculate the Theoretical, Street, and Race Carburetor Sizes.

KEYSTROKE	DISPLAY
On/C On/C	0.

1. Enter your RPM and Engine Displacement:

5 4 0 0 RPM	RPM S 5400.
4 0 0 Engine Displ	ENG SIZE S 400. CU IN

2. Calculate the Carburetor Sizes:

Carb Size	THEOR CARB SIZE 625. CFM**
Carb Size	STRET CARB SIZE 531.25 CFM
Carb Size*	RACE CARB SIZE 687.5 CFM

** Repeated presses of Carb Size will toggle through the inputs and outputs, starting with the Volumetric Efficiency.*

— DO NOT CLEAR CALCULATOR —

*** The Theoretical Carburetor Size of about 625 cfm was calculated based on the theoretical air capacity at the entered RPM and engine size (100% theoretical capacity). In this example, you want to upgrade to an application that leverages your modifications, the Race Carburetor Size of about 688 cfm might be your answer (calculated at 110% of theoretical capacity). However, it is unlikely that you will find a carburetor in the exact calculated size, so you might have only a couple options in a reasonable range such as a 650-cfm or a 750-cfm Carburetor Size.*

Notice that a User Carburetor Size is not included in this example. This is because a known VE was not entered into the calculator.

(cont'd)

(cont'd)

Carburetor Size — *Based on RPM, Engine Displacement and Volumetric Efficiency*

Building off of the previous example, you want to calculate your user-defined Carburetor Size based on a known VE value. Suppose through your experience and knowledge of your 1968 Pontiac GTO's engine specs and modifications, you know you can reach a VE of 95%.

KEYSTROKE	DISPLAY
3. Enter your user-specified VE of 95%:	
9 5 VE	EFF% VOL S 95. %
4. Calculate the Carburetor Sizes:	
Carb Size	USER CARB SIZE 593.75 CFM**
Carb Size	THEOR CARB SIZE 625. CFM
Carb Size	STRET CARB SIZE 531.25 CFM
Carb Size*	RACE CARB SIZE 687.5 CFM

** Repeated presses of Carb Size will toggle through the inputs and outputs, starting with the entered VE.*

*** Notice the User Carburetor Size appears first in the output. This Carburetor Size is calculated using the entered VE value of 95%. As previously mentioned, you are not likely to find an exact size of 594 cfm.*

VOLUMETRIC EFFICIENCY

Volumetric Efficiency (VE) is the actual measured airflow capacity at a particular RPM divided by the theoretical airflow capacity at the same RPM. VE is generally expressed as a percentage. To calculate the VE of your vehicle, you need to know a few things. First, you need to know your actual measured airflow capacity at maximum speed or maximum Torque (a local dyno shop can help you with this if they have an air-flow meter), as well as your Engine Displacement.

Volumetric Efficiency — *Based on RPM, Engine Displacement and Carburetor Size*

In this example, your 1968 Pontiac GTO has a Ram Air II 400-CID engine and you want to calculate the engine's VE at 7,000 RPM, which is the RPM at your maximum speed. Your measured airflow capacity at 7,000 RPM is said to be 625 cfm.

KEYSTROKE	DISPLAY
On/C On/C	0.

1. Enter your RPM, Engine Displacement, and actual measured airflow capacity at 7,000 RPM:

7 0 0 0 RPM	RPM S 7000.
4 0 0 Engine Displ	ENG SIZE S 400. CU IN
6 2 5 Carb Size	USER CARB SIZE S 625. CFM

2. Calculate your engine's VE:

VE*	EFF% VOL 77.143 %**

** Repeated presses of VE will toggle through the inputs and outputs, starting with the calculated Theoretical Carburetor Size.*

*** The calculated VE of your GTO, at 7,000 RPM, is about 77%. This value is just under 80%, which for many typical street applications is on track.*

TORQUE

Estimating Flywheel Horsepower *— Based on Torque and RPM*

If you know Torque output at a specific RPM, you can calculate Horsepower at that same RPM.

In this example, your 400-CID engine produces 445 pounds-feet of Torque at 3,800 RPM. Calculate flywheel Horsepower for the same RPM.

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter your Torque and RPM:	
4 4 5 Torque	LB-FT S MSA 445.
3 8 0 0 RPM	RPM S 3800.
2. Calculate the HP at 3,800 RPM:	
HP*	HP MSA 321.966**

** Repeated presses of HP will toggle through the inputs and outputs, starting with the HP correction factor.*

*** At 3,800 RPM, when your 400-CID engine is producing 445 pounds-feet of Torque, it is also producing about 322 HP at the flywheel.*

Estimating Flywheel Torque — *Based on HP and RPM*

If you know Horsepower output at a specific RPM, you can calculate Torque at that same RPM.

In this example, your 400-CID engine produces 366 HP at 5,400 RPM. Calculate the Torque for the same RPM.

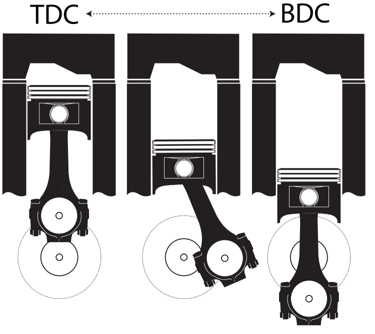
KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter your HP and RPM:	
3 6 6 HP	HP S MSA 366.
5 4 0 0 RPM	RPM S 5400.
2. Calculate the Torque at 5,400 RPM:	
Torque*	LB-FT MSA 355.977**

** Repeated presses of Torque will toggle through the inputs and outputs, starting with the HP correction factor.*

*** At 5,400 RPM, when your 400-CID engine is producing 366 HP, it is also producing about 356 pounds-feet of Torque at the flywheel.*

COMPRESSION RATIO AND MILL AMOUNT

Compression Ratio is the relationship between cylinder volume with the piston at bottom dead center (BDC) and cylinder volume with the piston at top dead center (TDC).



There are several Compression Ratio effects to consider when determining the appropriate ratio for your application:

- The greater the Compression Ratio, the greater the amount of air/fuel mix will be compressed.
- The greater amount of air/fuel mix that is compressed, the greater the combustion power will be.
- The greater the combustion power is, the hotter the combustion is, which can lead to detonation.
- Detonation (pinging and knocking) can be resolved by using higher octane fuel (at a higher cost, of course) and/or a change in ignition timing curve.

So, to get big power, you need big Compression Ratios to get more powerful combustion, which requires higher octane fuels.

Your *Hot Rod Calc* needs several inputs to calculate a Compression Ratio, which you may need to track down and in some cases, measure manually:

(cont'd)

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- **Bore and Stroke –** You should be able to find this in your engine repair manual.
- **Head Gasket Bore and Thickness –** You should be able to measure or get Head Gasket Bore and Thickness from the gasket manufacturer.
- **Deck Height –** You should be able to measure this manually.
- **Piston Dome Volume –** You can measure this, or the piston manufacturer likely can tell you the valve relief volume. Domed piston volumes should be entered as a negative number (also, domed pistons take away from the Chamber Volume and as such, raise compression), whereas dished piston volumes should be entered as a positive number (they add to the Chamber Volume, and have a lowering effect on compression).
- **Cylinder Head Combustion Chamber Volume –** You will need to measure this manually.

Note: *Your* Hot Rod Calc *User's Guide does not go into details on measuring Piston Dome Volume or Combustion Chamber Volume. You will need to consult an auto repair or engine building resource for that procedure.*

Calculating Compression Ratio

For this example, you have a typical Chevrolet 350-CID engine. Your known Bore and Stroke are 4 inches and 3.48 inches, respectively, and you measured your Combustion Chamber Volume at 76 cubic centimeters. From your gaskets, you find that your Head Gasket Bore is 4.100 inches and Head Gasket Thickness is 0.038 inches. Your Deck Height is 0.015 inches (distance from top of piston at top dead center to the block deck surface). Your piston manufacturer informed you that your dished valve reliefs are 4.5 cubic centimeters.

KEYSTROKE	DISPLAY
On/C On/C	**0.**

KEYSTROKE	DISPLAY
1. Enter the values from the example:	
4 Bore	BORE S 4. IN
3 • 4 8 Stroke	STROK S 3.48 IN
4 • 1 Conv Bore *(Gskt Bore)*	G-BOR S 4.1 IN
• 0 3 8 Conv Stroke *(Gskt Thickness)*	G-THK S 0.038 IN
• 0 1 5 Conv RPM *(Deck Height)*	DECK S 0.015 IN
4 • 5 Conv Torque *(Dome Vol)*	DOME VOL S 4.5 CC
7 6 Conv HP *(Chamber Vol)*	CHMBR VOL S 76. CC
2. Calculate the Compression Ratio:	
CR*	COMP RATIO 8.805**

** Repeated presses of CR will toggle through the inputs and outputs, starting with the entered Bore.*

— DO NOT CLEAR CALCULATOR —

*** The calculated Compression Ratio is about 8.81:1. At this point, if you were not satisfied with this ratio, you can use your* Hot Rod Calc *to play out some other scenarios.*

For this example, to raise your Compression Ratio, you could enter a thinner Head Gasket Thickness of 0.015. All the other inputs are stored in your calculator.

KEYSTROKE	DISPLAY
3. Change the Gasket Thickness by entering 0.015 inches:	
• 0 1 5 Conv Stroke *(Gskt Thickness)*	G-THK S 0.015 IN
4. Re-calculate the Compression Ratio:	
CR	COMP RATIO 9.253

Notice the increase in the calculated Compression Ratio. In summary, lowering the overall Chamber Volume will increase the Compression Ratio, whereas raising the overall Chamber Volume will decrease the Compression Ratio. Piston Dome, Deck Height, and Head Gasket Thickness are several ways to effect your Compression Ratio. In the next section, you can read about one of the more popular ways to increase Compression Ratio, which is a process known as milling.

Calculating Mill Amount

Another method of increasing the Compression Ratio on your engine is to mill, or remove material from, the heads. Generally, you will have a target Compression Ratio you want to achieve and you want to determine how much material to remove from your engine's heads.

Note: *Your* Hot Rod Calc *User's Guide does not go into details on the milling process. Your local engine building shop will likely have the necessary knowledge and tools for milling your heads to your specs.*

For this example, you want to increase your Compression Ratio from 8.5:1 (current Compression Ratio) to 10.5:1. Your Stroke is 3.48 inches. The following keystrokes will show you how to calculate the amount to mill.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Enter your Stroke and current Compression Ratio:	
3 • 4 8 Stroke	**STROK S 3.48 IN**
8 • 5 CR	**COMP RATIO S 8.5**
2. Enter your target Compression Ratio and calculate the Mill Amount:	
1 0 • 5 Conv CR* *(Mill Amount)*	**MILL 0.098 IN****

** Repeated presses of CR will toggle through the inputs and outputs, starting with the entered Stroke.*

*** To raise your compression from 8.5:1 to 10.5:1, your engine building shop would need to remove 0.098 inches of material from the surface of your heads, thus reducing the overall Chamber Volume and increasing compression.*

Notice the answer to your mill amount question is given in inches, 0.098 inches, but it's a simple press of a key to convert to millimeters, if necessary. If you press the mm key, your calculated mill amount of 0.098 inches is converted to about 2.48 millimeters.

PISTON SPEED

Piston Speed is an important factor when building an engine, especially if that engine is being built to run short distances at wide open throttle, such as drag racing. Piston Speed is the speed, typically in feet per minute, at which the piston moves up and down within a cylinder.

As your engine's crankshaft rotates once, your cylinder's piston travels two strokes (up one and down one). The piston's speed is not constant throughout its travel. It may go from 0 to 100 miles per hour and back to 0 during a single stroke. However, if the Piston Speed is too fast, the result can be disastrous for your engine.

With advanced math, you could calculate the exact Piston Speed at any particular point in the crankshaft rotation. Fortunately, knowing the average Piston Speed is all you need to calculate when you are building your engine. Modern metal materials enable higher Piston Speeds today, upwards of 3,500 feet per minute.

Piston Speed — *Based on RPM and Stroke*

For this example, your Stroke is 3.48 inches, and you want to calculate the Piston Speed at 4,000 RPM.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Enter your Stroke and the RPM for which you want to determine Piston Speed:	
3 • 4 8 Stroke	**STROK S 3.48 IN**
4 0 0 0 RPM	**RPM S 4000.**
2. Calculate the Piston Speed at 4,000 RPM:	
Piston Speed	**FPM 2320.**
Piston Speed*	**M/MIN 707.136**

(cont'd)

(cont'd)

* Repeated presses of [Piston Speed] will toggle through the inputs and outputs, starting with the entered Stroke.

— DO NOT CLEAR CALCULATOR —

At 4,000 RPM, that is a Piston Speed of 2,320 feet per minute or about 707.1 meters per minute. What about at 5,000 RPM?

KEYSTROKE	DISPLAY
3. Enter the new RPM for which you want to determine Piston Speed:	
5 0 0 0 [RPM]	**RPM S 5000.**
4. Calculate the Piston Speed at 5,000 RPM:	
[Piston Speed]	**FPM 2900.***
[Piston Speed]	**M/MIN 883.92**

* *At 5,000 RPM, your Piston Speed is 2,900 feet per minute and is pushing the edge of what modern metal materials can handle, even in short durations.*

RPM — *Based on Piston Speed and Stroke*

Your *Hot Rod Calc* can also calculate an RPM limit should you want to calculate a limit based on a particular Piston Speed. Calculate an RPM with a Piston Speed of 3,500 feet per minute and a Stroke of 3.48 inches.

KEYSTROKE	DISPLAY
[On/C] [On/C]	**0.**
1. Enter the Piston Speed for which you want to determine an RPM limit, along with Stroke of 3.48:	
3 5 0 0 [Piston Speed]	**FPM S 3500.**
3 • 4 8 [Stroke]	**STROK S 3.48 IN**
2. Calculate the RPM limit:	
[RPM]*	**RPM 6034.483**

* *Repeated presses of [RPM] will toggle through the inputs and outputs, starting with the entered Stroke.*

ENGINE DISPLACEMENT, BORE AND STROKE

You could simply check the factory specs on the Engine Displacement of your vehicle, but that number is usually a rounded up or down number. If you are building an engine to your specification, or modifying one and want to know the effects on displacement by changing Bore and/or Stroke, the *Hot Rod Calc* can do it.

Engine Displacement — *Based on Bore and Stroke*

In this example, your 1968 Pontiac GTO's Ram Air II engine has a published Engine Displacement of 400 CID. The spec Bore and Stroke are 4.12 inches and 3.75 inches, respectively. Calculate the exact cubic-inch displacement. Your calculator defaults to 8 cylinders.

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter your Bore and Stroke:	
4 • 1 2 Bore	BORE S 4.12 IN
3 • 7 5 Stroke	STROK S 3.75 IN
2. Calculate the actual Engine Displacement:	
Engine Displ	ENG SIZE 399.95 CU IN**
Engine Displ	ENG SIZE 6554.004 CC
Engine Displ	ENG SIZE 6.554 L
Engine Displ*	CYL VOL 49.994 CU IN

** Repeated presses of Engine Displ will toggle through the inputs and outputs, starting with the entered Bore.*

*** While the exact displacement of the 1968 Ram Air II engine is about 399.95 CID, it's a tough number to market by the factory. To make it simple on the guys in the suits, the displacement was rounded up to a nice even 400 CID. Notice the Engine Displacement is also displayed in cubic centimeters and liters, and lastly, the cylinder volume is calculated and displayed in cubic inches.*

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In this example, your 1962 Ford Falcon straight-6 engine has a published Engine Displacement of 169.95 CID. The spec Bore and Stroke are 3 inches and 2.94 inches, respectively. Calculate the exact cubic-inch displacement by going to a larger Bore of 3.75. Your calculator defaults to 8 cylinders, and since the 1962 Ford Falcon only has 6 cylinders, you will need to change the Number of Cylinders.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Change from 8 to 6 cylinders:	
6 Conv Engine Displ *(# Cylinders)*	**QTY S 6.**
2. Enter your Bore and Stroke:	
3 • 7 5 Bore	**BORE S 3.75 IN**
2 • 9 4 Stroke	**STROK S 2.94 IN**
3. Calculate the actual Engine Displacement:	
Engine Displ	**ENG SIZE 194.828 CU IN**
Engine Displ	**ENG SIZE 3192.656 CC**
Engine Displ	**ENG SIZE 3.193 L**
Engine Displ*	**CYL VOL 32.471 CU IN**

** Repeated presses of Engine Displ will toggle through the inputs and outputs, starting with the entered Bore.*

Bore — *Based on Engine Displacement and Stroke*

Building from one of the previous examples, you want to push your cubic-inch displacement to a maximum of 405 CID to be competitive at your local club races, as well as meet class engine requirements. Recall that the stock Bore and Stroke on the 1968 Ram Air II engine is 4.12 and 3.75 inches, respectively. Keeping the stock Stroke length, calculate a new Bore size.

KEYSTROKE	DISPLAY
1. Clear all stored values:	
Conv ✕ *(Clear All)*	**ALL CLEArEd**
2. Enter the target displacement of 405 CID and current Stroke length:	
4 0 5 Engine Displ	**ENG SIZE S 405. CU IN**
3 • 7 5 Stroke	**STROK S 3.75 IN**
3. Calculate the new Bore:	
Bore*	**BORE 4.146 IN****

** Repeated presses of Bore will toggle through the inputs and outputs, starting with the entered Stroke.*

*** In order to be within your class requirements, you could go to an over-bored size of 4.146 inches.*

Stroke — *Based on Engine Displacement and Bore*

Next, go the other way. Keeping your stock Bore, solve for a longer Stroke length.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
4. Enter your stock Bore of 4.12 inches, and a target displacement of 405 CID:	
4 • 1 2 Bore	**BORE S 4.12 IN**
4 0 5 Engine Displ	**ENG SIZE S 405. CU IN**
5. Calculate the new Stroke length:	
Stroke*	**STROK 3.797 IN****

** Repeated presses of Stroke will toggle through the inputs and outputs, starting with the entered Bore.*

*** Notice you can also meet your goals by keeping the stock Bore and going to a longer Stroke of 3.797. In terms of cost, it will be more cost effective to go over Bore to reach your goals in this particular example.*

APPENDIX A – *BODY STYLE AND DRAG COEFFICIENTS**

BODY STYLE	DRAG COEFFECIENT
Open Convertible	0.5 – 0.7
Station Wagon and Van Body	0.5 – 0.6
Notchback or Sedan	0.4 – 0.55
Fastback	0.3 – 0.4
Fairings all around, streamlined shape	0.2 – 0.25
K-shape	0.23
Optimum streamliner	0.15 – 0.2
Motorcycles	0.6 – 0.7
Trucks	0.8 – 1.5
Buses	0.6 – 0.7

* *Aerodynamic drag data from Bosch Automotive Handbook*

APPENDIX B – *REFERENCE CHARTS*

HOLLEY JET CHART

JET NO.	DRILL SIZE	FLOW
40	.040	117
41	.041	122
42	.042	129
43	.043	135
44	.044	142
45	.045	149
46	.046	156
47	.047	163
48	.048	170
49	.049	178
50	.049	185
51	.050	194
52	.052	203
53	.052	212
54	.053	221
55	.054	230
56	.055	240
57	.056	251
58	.057	262
59	.058	273
60	.060	285
61	.060	298
62	.061	311

(cont'd)

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JET NO.	DRILL SIZE	FLOW
63	.062	325
64	.064	341
65	.065	357
66	.066	374
67	.068	392
68	.069	411
69	.070	429
70	.073	448
71	.076	470
72	.079	492
73	.079	517
74	.081	542
75	.082	566
76	.084	587
77	.086	615
78	.089	645
79	.091	677
80	.093	703
81	.093	731
82	.093	765
83	.094	795
84	.099	824
85	.100	858
86	.101	890
87	.103	923
88	.104	952

JET NO.	DRILL SIZE	FLOW
89	.104	987
90	.104	1014
91	.105	1080
92	.105	1150
93	.105	1200
94	.108	1260
95	.118	1320
96	.118	1375
97	.125	1440
98	.125	1500
99	.125	1570
100	.128	1640

JET ORIFICE AREA CONVERSION CHART

Jet Size Dia. (")	Jet Size Area (sq. ")	Jet Size Dia. (")	Jet Size Area (sq. ")	Jet Size Dia. (")	Jet Size Area (sq. ")	Jet Size Dia. (")	Jet Size Area (sq. ")	Jet Size Dia. (")	Jet Size Area (sq. ")	Jet Size Dia. (")	Jet Size Area (sq. ")
0.02	0.00031	0.049	0.00189	0.078	0.00478	0.107	0.00899	0.136	0.01453	0.164	0.02112
0.021	0.00035	0.05	0.00196	0.079	0.0049	0.108	0.00916	0.137	0.01474	0.165	0.02138
0.022	0.00038	0.051	0.00204	0.08	0.00503	0.109	0.00933	0.138	0.01496	0.166	0.02164
0.023	0.00042	0.052	0.00212	0.081	0.00515	0.11	0.0095	0.139	0.01518	0.167	0.0219
0.024	0.00045	0.053	0.00221	0.082	0.00528	0.111	0.00968	0.14	0.01539	0.168	0.02217
0.025	0.00049	0.054	0.00229	0.083	0.00541	0.112	0.00985	0.141	0.01562	0.169	0.02243
0.026	0.00053	0.055	0.00238	0.084	0.00554	0.113	0.01003	0.142	0.01584	0.17	0.0227
0.027	0.00057	0.056	0.00246	0.085	0.00568	0.114	0.01021	0.143	0.01606	0.171	0.02297

(cont'd)

(cont'd)

Jet Size Dia. (")	Jet Size Area (sq. ")	Jet Size Dia. (")	Jet Size Area (sq. ")	Jet Size Dia. (")	Jet Size Area (sq. ")	Jet Size Dia. (")	Jet Size Area (sq. ")	Jet Size Dia. (")	Jet Size Area (sq. ")	Jet Size Dia. (")	Jet Size Area (sq. ")
0.028	0.00062	0.057	0.00255	0.086	0.00581	0.115	0.01039	0.144	0.01628	0.172	0.02324
0.029	0.00066	0.058	0.00264	0.087	0.00595	0.116	0.01057	0.145	0.01651	0.173	0.02351
0.03	0.00071	0.059	0.00273	0.088	0.00608	0.117	0.01075	0.146	0.01674	0.174	0.02378
0.031	0.00076	0.06	0.00283	0.089	0.00622	0.118	0.01094	0.147	0.01697	0.175	0.02405
0.032	0.0008	0.061	0.00292	0.09	0.00636	0.119	0.01112	0.148	0.0172	0.176	0.02433
0.033	0.00086	0.062	0.00302	0.091	0.0065	0.12	0.01131	0.149	0.01744	0.177	0.02461
0.034	0.00091	0.063	0.00312	0.092	0.00665	0.121	0.0115	0.15	0.01767	0.178	0.02489
0.035	0.00096	0.064	0.00322	0.093	0.00679	0.122	0.01169	0.151	0.01791	0.179	0.02517
0.036	0.00102	0.065	0.00332	0.094	0.00694	0.123	0.01188	0.152	0.01815	0.18	0.02545
0.037	0.00108	0.066	0.00342	0.095	0.00709	0.124	0.01208	0.153	0.01839	0.181	0.02573
0.038	0.00113	0.067	0.00353	0.096	0.00724	0.125	0.01227	0.154	0.01863	0.182	0.02602
0.039	0.0012	0.068	0.00363	0.097	0.00739	0.126	0.01247	0.155	0.01887	0.183	0.0263
0.04	0.00126	0.069	0.00374	0.098	0.00754	0.127	0.01267	0.156	0.01911	0.184	0.02659
0.041	0.00132	0.07	0.00385	0.099	0.0077	0.128	0.01287	0.157	0.01936	0.185	0.02688
0.042	0.00139	0.071	0.00396	0.1	0.00785	0.129	0.01307	0.158	0.01961	0.186	0.02717
0.043	0.00145	0.072	0.00407	0.101	0.00801	0.13	0.01317	0.159	0.01986	0.187	0.02747
0.044	0.00152	0.073	0.00419	0.102	0.00817	0.131	0.01348	0.16	0.02011	0.188	0.02776
0.045	0.00159	0.074	0.0043	0.103	0.00833	0.132	0.01369	0.161	0.02036	0.189	0.02806
0.046	0.00166	0.075	0.00442	0.104	0.00846	0.133	0.01389	0.162	0.02061	0.19	0.02835
0.047	0.00174	0.076	0.00454	0.105	0.00866	0.134	0.0141	0.163	0.02087	0.191	0.02865
0.048	0.00181	0.077	0.00466	0.106	0.00883	0.135	0.01431				

APPENDIX C – *DEFAULT SETTINGS*

After a Clear All (Conv ⊠), your calculator will return to the following settings:

STORED VALUES	DEFAULT VALUE
Air Temperature	**60 °F** *(US)*, **15.556 °C** *(Metric)*
Absolute Pressure	**29.92 inHg** *(US)*, **1013.207 mbar** *(Metric)*
ADI	**100%**
Drag Coefficient	**0.35**
Mechanical Efficiency	**85%**
Number of Cylinders	**8**
Volumetric Efficiency	**100%**

If you replace your batteries or perform a Full Reset* (press Off, hold down ⊠, and press On/C), your calculator will return to the following settings (in addition to those listed above):

PREFERENCE SETTINGS	DEFAULT VALUE
Functional Result Rounding	**0.000**
Default Unit Format	**US**
Meter Linear Display	**0.000**

** Depressing the Reset button located above the Air Temp key will also perform a Full Reset.*

APPENDIX D – *PREFERENCE SETTINGS*

The *Hot Rod Calc* has Preference Settings that allow you to customize or set desired unit formats and calculations. If you replace your batteries or perform a Full Reset* (press Off, hold down ⊠, and press On/C), your calculator will return to the following settings (in addition to those listed on the previous page), with the default setting for each preference listed first:

(cont'd)

(cont'd)

PREFERENCE	OPTIONS
1) Functional Result Rounding	– **0.000:** calculation results obtained using the motor, performance and environmental functions are always displayed to three decimal places. – **0.00:** calculation results obtained using the motor, performance and environmental functions are always displayed to two decimal places. – **FLOAT:** calculation results obtained using the motor, performance and environmental functions are always displayed to the maximum number of decimal places.
2) Default Unit Format	– **US:** unitless values stored within the motor, performance and environmental functions are automatically assigned the corresponding default US units of the selected function. Additionally, calculation results obtained within these functions are displayed in US units. – **METRIC:** unitless values stored within the motor, performance and environmental functions are automatically assigned the corresponding default Metric units of the selected function. Additionally, calculation results obtained within these functions are displayed in Metric units.
3) Meter Linear Display	– **0.000:** linear Meter answers are always displayed to three decimal places. – **FLOAT:** linear Meter answers are always displayed to the maximum number of decimal places (for example, 1.234 M + 2.56871 M = 3.80271 M).

** Depressing the Reset button located above the Air Temp key will also perform a Full Reset.*

APPENDIX E – *CARE INSTRUCTIONS*

Please follow the guidelines listed in this section for proper care and operation of your calculator. Not following the instructions listed below may result in damage not covered by your warranty. Refer to the ***WARRANTY*** section on page 67 for more details.

Do not expose calculator to temperatures outside the operating temperature range of 32ºF – 104ºF (0ºC – 40ºC).

Do not expose calculator to high moisture such as submersion in water, heavy rain, etc.

APPENDIX F – *ACCURACY/ERRORS, AUTO SHUT-OFF, BATTERIES, RESET*

ACCURACY/ERRORS

Accuracy/Display Capacity — Your calculator has an eight-digit display. You may enter or calculate values up to 99,999,999. Each calculation is carried out internally to 12 digits.

Errors — When an incorrect entry is made, or the answer is beyond the range of the calculator, an error message will display. To clear an error condition you must press the On/C key once. At this point, you must determine what caused the error and re-key the problem.

Error Codes

DISPLAY	ERROR TYPE
OFLO	Overflow (too large)
MATH Error	Divide by 0
DIM Error	Dimension error
ENT Error	Invalid entry error
NONE	Attempt to calculate Tire Ratio without entering all required values

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Auto-Range — If an “overflow” is created because of an input and calculation with small units that are out of the standard eight-digit range of the display, the answer will be automatically expressed in the next larger units (instead of showing “**OFLO**”) — e.g., 200,000,000 mm is shown as 200,000 m. Also applies to inches and feet.

AUTO SHUT-OFF

Your calculator is designed to shut itself off after about 8-12 minutes of non-use.

BATTERIES

The *Hot Rod Calc* uses two LR-44 batteries. Should your calculator display become very dim or erratic, replace the batteries.

Note: *Please use caution when disposing of your old batteries, as they contain hazardous chemicals.*

Replacement batteries are available at most discount or electronics stores. You may also call Mr. Gasket at **1-216-688-8300**.

Battery Replacement Instructions

To replace the batteries, slide open the battery door (at top backside of unit) and replace with new batteries. Make sure the batteries are facing positive side up.

RESET

If your calculator should ever “lock up,” press Reset – a small hole located above the Air Temp key – to perform a total reset.

REPAIR AND RETURN

Return Guidelines

1. Please read the ***Warranty*** in this User's Guide to determine if your Calculated Industries product remains under warranty **before** calling or returning any device for evaluation or repairs.
2. If your product won't turn on, check the batteries as outlined in the User's Guide.
3. If you need more assistance, please go to the website listed below.
4. If you believe you need to return your product, please call a Mr. Gasket representative between the hours of 8:30am to 5:00pm Eastern Time for additional information and a Return Merchandise Authorization (RMA).

1-216-688-8300
www.mr-gasket.com

WARRANTY

Warranty Repair Service – U.S.A.

Mr. Gasket warrants this product against defects in materials and workmanship for a period of **one (1) year from the date of original consumer purchase in the U.S.** If a defect exists during the warranty period, Mr. Gasket at its option will either repair (using new or remanufactured parts) or replace (with a new or remanufactured calculator) the product at no charge.

THE WARRANTY **WILL NOT APPLY** TO THE PRODUCT IF IT HAS BEEN DAMAGED BY MISUSE, ALTERATION, ACCIDENT, IMPROPER HANDLING OR OPERATION, OR IF UNAUTHORIZED REPAIRS ARE ATTEMPTED OR MADE. SOME EXAMPLES OF DAMAGES NOT COVERED BY WARRANTY INCLUDE, BUT ARE NOT LIMITED TO, BATTERY LEAKAGE, BENDING, A BLACK "INK SPOT" OR VISIBLE CRACKING OF THE LCD, WHICH ARE PRESUMED TO BE DAMAGES RESULTING FROM MISUSE OR ABUSE

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To obtain warranty service in the U.S., please go to the website. A repaired or replacement product assumes the remaining warranty of the original product or 90 days, whichever is longer.

Non-Warranty Repair Service – U.S.A.

Non-warranty repair covers service beyond the warranty period, or service requested due to damage resulting from misuse or abuse. Contact Mr. Gasket at the number listed on the previous page to obtain current product repair information and charges. Repairs are guaranteed for 90 days.

Repair Service – Outside the U.S.A.

To obtain warranty or non-warranty repair service for goods purchased outside the U.S., contact the dealer through which you initially purchased the product. If you cannot reasonably have the product repaired in your area, you may contact Mr. Gasket to obtain current product repair information and charges, including freight and duties.

Disclaimer

MR. GASKET MAKES NO WARRANTY OR REPRESENTATION, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT’S QUALITY, PERFORMANCE, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. AS A RESULT, THIS PRODUCT, INCLUDING BUT NOT LIMITED TO, KEYSTROKE PROCEDURES, MATHEMATICAL ACCURACY AND PREPROGRAMMED MATERIAL, IS SOLD “AS IS,” AND YOU THE PURCHASER ASSUME THE ENTIRE RISK AS TO ITS QUALITY AND PERFORMANCE.

IN NO EVENT WILL MR. GASKET BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECT IN THE PRODUCT OR ITS DOCUMENTATION.

The warranty, disclaimer, and remedies set forth above are exclusive and replace all others, oral or written, expressed or implied. No Mr. Gasket dealer, agent, or employee is authorized to make any modification, extension, or addition to this warranty.

Some states do not allow the exclusion or limitation of implied warranties or liability for incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific rights, and you may also have other rights, which vary from state to state.

FCC Class B

This equipment has been certified to comply with the limits for a Class B calculating device, pursuant to Subpart J of Part 15 of FCC rules.

Legal Notes

Designed in the United States of America.
Printed in China. 3/10

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UG8703E-B