

# WORK, ENERGY, POWER

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BEHIND THE WHEEL | 2013 FERRARI F12 BERLINETTA

## Oxymoron From Italy: The Civilized Supercar



**BODY LANGUAGE** The surfaces of the F12, including the so-called aero bridge channel in the front fenders, are shaped to increase downforce.

If one considers the F12 Berlinetta to be nothing more than Ferrari's latest coupe, the point of the car has been missed. The supercar's body is merely the fancy wrapping for the gift that is a supremely powerful 12-cylinder Ferrari engine.

**QUESTIONS using concepts #2:** (a) Find kinetic energy (K) of the F12 at 62 mph? (b) Work done by F12's engine increases the F12 Kinetic energy. Find effective output P of F12 using Physics concept methodology #2? (c) The total HP of the F12 is stated in the article to be 730 HP. How efficient ( $P_{\text{output}}/P_{\text{input}}$ ) is the F12? Direct Injection engines are 10% more efficient than standard gasoline engines which are at maximum 25% efficient.

**ANSWERS:** (a) ~465,124 ft lb., (b) ~ 150,040 ft lb/s or 273 HP (c) ~ 37% Wow!

**INTRODUCTION:** The purpose for working on this application is to show the effective (used for actual motion of car) horsepower (HP) is at least 37% (due to superior Gasoline Direct injection- GDI) of total engine HP. You are to obtain the effective HP using two different applications of physics concept methodologies. #1 using

$$P(\text{power}) = W(\text{work})/t(\text{time})$$

$$\text{Where } W = Fx, \text{ and } F = ma$$

#2:  $P = W/t = \Delta K/t$ , K=kinetic energy

**PRELIMINARY HINTS:**  $X = V_{\text{ave}}t$ , Weight = mg  
 $V_{\text{ave}} = (V_o + V)/2$ ,  $a = (V_o - V)/t$ , 60 mph = 88 ft/s  
550 ft. lb/s = 1 HP,  $K = 1/2mV^2$

**QUESTIONS:** #1 (a) Convert 62 mph to ft/s? (b) Find acceleration (a) in ft/s<sup>2</sup> of the F12? (c) Find mass (m) of F12? (d) Find net force (F) on F12 accelerating from 0-62 mph? (e) Find displacement X accelerating from 0-62 mph? (f) Find work  $W = F X$  done? (g) Find effective (output) power (P) = W/t In ft lb/s and HP?

**ANSWERS #1:** (a) 90.933 ft/s, (b) 29.3 ft/s<sup>2</sup>  
(c) 112.5 slugs, (d) 3,300 lb., (e) 141.04 ft,  
(f) ~465,432 ft. lb (g) 150,139.36 ft lb/s, 273 HP

The F12 offers all that and more — and less. “It is a car with blistering performance,” Mr. Felisa (Pres. of Ferrari) said of the F12's new 6.3-liter V-12; **(((it delivers 730 hp)))** and 509 pound-feet of torque, and it does this without the aid of turbocharging or supercharging.

**(((The F12's 0-62 m.p.h. sprint is done in 3.1 seconds,)))** according to Ferrari, using the Launch Control feature. Top speed is “more than 211.”

But, Mr. Felisa added, “The F12 also can offer pleasurable performance at lower speeds.” It even has a hybridlike engine stop-start feature, to further save gas and reduce emissions.

Compared with the 599, the F12 is lighter — by more than 100 pounds with the “lightweight” options that hold the

**(((weight to about 3,600 pounds)))** — and more nimble. The F12 also has a **lower center of gravity**, increased torsional rigidity, better weight balance, a lower coefficient of drag and more precise steering response.

**The direct-fuel-injected engine (Increases efficiency to ~35%)** is based on the V-12 also found in the FF, but with notable improvements, including a higher compression ratio. It's a masterpiece of space-saving packaging, almost cube-shaped. Should you be one of those who want to know before making the commitment, Ferrari says **the F12 will start at \$315,888.**