Nitrous Oxide Introduction

Nitrous Oxide is a colorless, nonflammable gas. The chemical composition is N_2O—two atoms of nitrogen combined with one atom of oxygen—and in suitable concentrations it exhibits a slightly sweet taste and odor.

At standard atmospheric temperature and pressure, nitrous oxide is a gas, but when the gas is sufficiently compressed, it will transform to a liquid. When the pressure is released in liquid form, it will undergo very rapid expansion and this pressure drop will cause a temperature decrease. The temperature drop gives the intake air charge a "super-cooling" effect.

We can establish the percentage of oxygen, by weight, in each nitrous oxide molecule. The atomic weight of a nitrogen atom is 14. The atomic weight of an oxygen atom is 16. This means that the nitrogen weight would be 2 x 14 = 28. The weight of the oxygen is 1 x 16 = 16. The combined weight is equal to 44. The calculation for oxygen percent: 16 divided by 44 = .3636, which is expressed as 36% oxygen by weight.

Oxygen is essential for combustion, and from a performance standpoint, the importance of oxygen is simple: When more air/oxygen is induced, the engine can burn more fuel, resulting in more power. In effect, nitrous oxide is a form of "liquid oxygen." However, with this extra oxygen, extra fuel must be added to keep the ratio correct for efficient combustion. As the total fuel/oxygen consumption increases, the power output increases. The ideal situation is a "chemically correct" mixture, but in actual practice, maximum power is usually developed in a 25-50% rich condition on the nitrous ratio, and a 15-20% rich condition overall, depending upon type of fuel being used. The excess fuel aids by virtue of intake air charge cooling and in the process promotes slightly better combustion characteristics.

A generally accepted number based upon dyno results: 1lb. Nitrous per 10 sec. = 100 crankshaft horsepower. Old aircraft data would sometimes show different figures than this, but was normally obtained from various types of engines operating at lower rpm, varying fuel curves, ignition lead, and altitude.

Air/Fuel is calculated based upon air being approximately **21% oxygen**.
Nitrous/Fuel is calculated based upon nitrous being **36% oxygen**.

From the tables that you will see later, at a 12.8/1 air/fuel ratio, we have 73.3 % nitrogen in the chamber, yet on the nitrous side of the engine at a 5.5/1 nitrous/fuel ratio, we have 54.1% nitrogen. It becomes easy to see that as the % of nitrous horsepower begins to increase, the nitrogen content is going down. This is one of the reasons that we decrease ignition timing. When the nitrogen content is reduced, the flame speed increases and rather than a controlled burn, we have an explosion.

Example: 500hp on motor, and 250hp on nitrous….. = 66.9% nitrogen in the chamber.

Many other factors go into determining the ultimate ignition lead for a particular engine. Some of those would be: chamber size, type of fuel, spark plug heat range, fuel curve, cam design, etc.

Making more reliable power and understanding why, is the name of the game. My advice is to stay with a reputable engine builder who has experience on the dyno and the track with nitrous oxide. Once nitrous horsepower starts to exceed 37-40% of the total, you better have a big pocket book or a good tuner.

On gasoline, we normally recommend starting at a 5/1 nitrous/fuel ratio and never run leaner than 6/1. On E-85, our recommendation would be to start at 3.75/1 and no leaner than 4/1. We always recommend 950-1000 PSI bottle pressure. Be aware of low bottle pressure. Our low side is 850-875 PSI. Any lower than this and the engine goes extremely rich and can cause as much damage as being lean.

5/1 fuel curve = 5lb. nitrous to 1lb. fuel
6/1 fuel curve = 6lb. nitrous to 1lb. fuel

Fuel calculation for 10 sec.

Example with Gas: 5.5/1 fuel curve and 300hp; 3 divided by 5.5 = .545lb. of fuel in 10 sec/100hp.

> If the fuel weighs 6lb. per gallon, this would = .545 divided by 6 which = .0908 gallons. We know that 1 gallon is 3785 ml or cc's. 3785 x .0908 = 343.7 ml. This is the amount of fuel that you should flow in 10 sec for the correct 5.5/1 fuel curve.

Example with E-85: 3.75/1 fuel curve and 400hp; 4 divided by 3.75 = 1.067 of fuel in 10 sec/100hp.

> If the fuel weighs 6.5lb. per gallon, this would = 1.067 divided by 6.5 = .164 Gallons. We know that 1 gallon is 3785 ml or cc's. 3785 x .164 = 621 ml.
> * Always flow through the jet that will be used @ 6-6.5 PSI