Porting Terminology

Engine Terminology

Nicasil = **Nikasil** = **NiCaSil** = **NiComm** - A combination of nickel, silicon, and carbide are electro-plated to an aluminium cylinder and then diamond honed to a precise diameter. The advantage of this process is increased heat transfer and less weight compared to steel/cast sleeves. Note: There are several proprietary processes of applying nickel silcon carbide to aluminium cylinders. For lack of a better term; Nicasil, is like saying "Ski-Dooing," instead of "Sledding."

Top Dead Center (TDC) - The top of the piston's stroke.

Bottom Dead Center (BDC) - The bottom of the piston's stroke.

Deck - Top of Cylinder or Sleeve.

Deck Height - Top of cylinder down to top of piston "negative deck."

Positive Deck - If piston is above top of cylinder.

Squish Clearance - Verticle distance between top of piston and head. Measured at the edge of piston. See "Squish Test" for measuring with soft lead solder over wrist pin.

Effective Stroke - The distance from TDC to where the piston starts to open the exhaust port. (Also called: Power Stroke) A longer effective stroke helps low-end power and helps maintain compression at high altitude.

Swept Volume - Volume of cylinder with piston at exhaust port opening to TDC. (4-stroke would be volume/cc's displaced by piston from BDC to TDC.)

Trapped Volume - Volume of combustion chamber with piston at TDC.

Compression Ratio (CR) - Volume of cylinder and combustion chamber with piston at exhaust port opening, divided by, volume of combustion chamber with piston at TDC. This is the "corrected" compression ratio. Most accurate way is to "cc" with a syringe or burette. Note: Power valves will change CR until valve is wide open.

BMEP - Brake Mean Effective Pressure. See "BMEP Page"

Porting and Port Timing Terms

Port - Air passageway/duct that is cast and/or machined into the cylinder.

Port Window - The part of the port that opens into the cylinder bore.

Exhaust Port - The large port where the burnt gasses exit the cylinder.

Bridged Exhaust Port - Exhaust port with a center divider.

Sub-Exhaust Ports - The small exhaust ports on each side of the main exhaust port. Measure at "choke point" not necessarily the port window.

Triple Exhaust Ports - One main exhaust port with one sub exhaust port on each side.

Transfer Ports/Ducts - The air passageways that allow the air/fuel mixture to transfer over the top of the piston to fill the cylinder.

Main/Front Transfers - The 2 transfer ports located closest to the exhaust port (5 port).

Secondary/Rear Transfers - The 2 rear transfer ports located closest to the boost port(s) (5 port).

Boost Port(s) - The port or ports that are located opposite of the exhaust port and in-line with the intake port. These ports are usually angled sharply upwards to help scavenging.

Auxiliary Transfers - Some cylinders have another set of transfers located between the front and rear sets (7 port).

Transfer Base - Where the air enters the ducts/passagways at the bottom of cylinder & top of crankcase.

Crank Angle - Crankshaft rotation measured in degrees. Total = 360 degrees.

Port Timing - Degrees of crankshaft rotation after TDC to where port starts to open.

Duration - The number of degrees of crankshaft rotation that a port is open.

TA = Time-Area = TimeArea - The time and area required for a phase of the 2-stroke cycle at a specific RPM and BMEP. Examples: Transfer Port TA, Exhaust Port TA, Blowdown TA, and Intake Port TA.

Port-TimeArea - The amount of time and area required for a port to flow the necessary air at a specific rpm and BMEP. The higher an engine rpm and/or pressure (BMEP) the more TimeArea required.

Chordal Width = 90 degrees to Gas Flow or shortest straightline distance between sides.

BlowDown - Measured in degrees of crankshaft rotation from Exhaust Port opening to the Transfer Ports opening.

BlowDown TA - Must allow the cylinder pressure to drop below the pressure of the fuel air mixture at time of transfer ports opening. If the Blowdown pressure is to high when transfer ports open, it will stall or reverse, the incoming charge of fuel and air.

LowBlow Width - Width of exhaust port when transfer ports open. Used to calculate BlowDown TimeArea.

Port Height above BDC - With piston at BDC, measure from bottom of port, or piston, depending on which is *higher*, to top of port roof.

Port Roof Angle - The angle of the top of the port at the window. Flat =’s 0 degrees.

Scavenging - The process of pushing the burnt gas out of the cylinder and combustion chamber with a fresh fuel air charge. The transfer ports shape and direction of flow determines how the fresh charge will fill the cylinder and combustion chamber without short circuiting out the exhaust port. A good pipe will help the scavenging process.

Tuned Pipe Terms

Tuned Length - Total length from piston to end of baffle cone and start of stinger. All measurements made down centerline of pipe.

Header - Exhaust flange to Diffuser. The header is usually a constant taper cone between 2 and 3.5 degrees. Approximately 30% of tuned length.

Diffuser - The Diffuser Cone starts at the header with increasing divergent angles to the Dwell. The diffuser is approximately 28% of tuned length.

Dwell - Center portion of pipe with parallel sides. Approximately 18% of tuned length.

Baffle - Tapered cone from the dwell to the stinger that reflects the wave back to the piston. Approximately 22% of tuned length.

Stinger- Stinger or Tailpipe provides the backpressure to amplify the wave back to the piston. Stinger length and diameter determine how the back pressure is built.

Some Considerations: To much backpressure and the heat will build and the engine will burn down. Not enough backpressure and the engine will not make power. Wide open lake racing requires less backpressure due to heat build up in pipe over time. Drag racing and hillclimbing need more backpressure due to short time wide open and off/on throttle.

High altitude needs more backpressure due to less air as elevation increases. We use a restricter bolt in the stinger at the end of the baffle cone to set the backpressure.

IF, on a very long pull in deep powder your engine starts to fade, it is due to "heat phase" (provided clutching is right!) or to much restriction in the stinger or silencer. Use a larger diameter or shorten the stinger.

Heads and MSV

MSV - Maximum Squish Velocity rates the maximum velocity of the fuel air traveling across the squishband just before the piston reaches TDC. If MSV is to low the flame front will not burn the fuel air mixture effectively. If MSV is to high, detonation will occur and cause engine damage. The TSR programs calculate MSV for various types of heads.

Tub Head - Shape of the combustion chamber - like a tub or hat.

Hemi Head - Hemispherical shape for the combustion chamber.

Squish Band - Outer area of head that forces the unburned fuel air mix into the center

chamber for combustion. The squish band angle is usually 1-2 degrees greater than the angle of the piston dome. Verticle clearance and squishband width affect MSV.

Squish - Verticle distance between top of piston and head. By measuring the step in the head and subtracting this number from the squish clearance you will have the distance the piston is below deck (negative deck). The negative deck measurement is needed to calculate port timing.

Squish Band Area - Varies from 30% - 60% of Bore area.

Step or **Step Cut** - The step cut in the head at the bore diameter. The squish band angle starts at the bottom of the step cut in the head. Measure the depth at the very edge of the step cut.

Note: Some heads have the step cut diameter 0.020"-0.030" thou more than the bore diameter. This allows the head to be offset to the piston. This creates less verticle clearance on one side. By moving head back and forth, leave extra clearance over exhaust port side. Then, center the head, by doing a squish test, on each side of the piston, over the wrist pin. Try to get the variation to within 0.001" thou. This is important if you are running near the mechanical limit for verticle (Squish) clearance.