

## CNC Heads

CNC Heads have developed an extensive range of CNC engineered gas flowed cylinder heads for European and Japanese engines. These heads are developed exclusively for circuit racing, rallying and fast road applications.

We have invested heavily in a state of the art development facility which enables us to develop the very best prototype heads and manufacture each head with 100% accuracy. Our simulation and manufacture process allows us to guarantee flow on every head we produce and give a predicted BHP. All our heads have been tested on our engine dyno facility to verify our power predictions.

The end result is a head which performs exactly as we predict. Each cylinder in the head exactly matches the others in the head. Each head we produce gives the exceptional flow we claim which is why we publish our flow figures and many other cylinder head specialists do not.

## Prototype development.

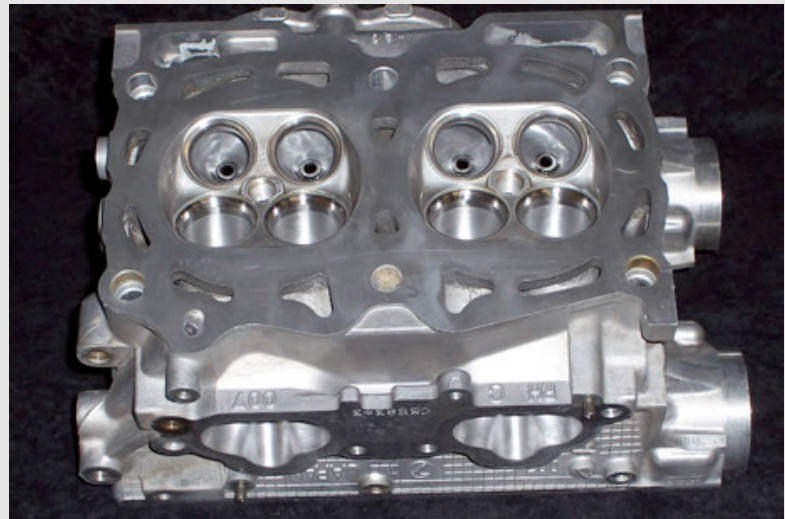
We have over 20 years of experience in developing racing cylinder heads. We use the latest Superflow flow bench and PortFlow Analyzer software to measure and analyse flow. This is supported by sophisticated software which allows us to simulate a full engine build with all the known parameters such as valve size, bore, stroke, piston speed, target max revs and many more. Simulation is a vital tool to measure changes made in the head and set a target power output for the engine. Typically a new head will take weeks of meticulous development work before it is considered ready for production.

## Replication.

Gas flowing a cylinder head used to be a very hit and miss affair. Fundamentally it is a labour intensive, highly skilled but manual process. By manual processes alone it is near impossible to produce a series of heads with identical flow characteristics. Another factor is ensuring each cylinder in the head has the same flow, ensuring a balanced engine and maximum power output. We utilise digital scanning technology to precisely measure the dimensions of the new cylinder head. These form a pattern which our CNC machines can follow to manufacture the new head.



## Subaru 2.0l & 2.5l – CNC Engineered Gas Flowed Cylinder Head.



Introducing our new gas flowed cylinder head for the Subaru 2.0 16 valve engine as fitted to the Impreza, Legacy and Forester. We provide heads for all versions of these cars from version 1 to version 10. This engine has a well deserved reputation for excellent performance and handling and a very affordable cost. The performance to cost ratio is extremely good and there is plenty of scope for tuning. As with most modern turbocharged cars, significant power increases can be gained by Engine Management system changes. These changes can take the form of standard 'chips' or custom made maps derived from hours on a rolling road. Larger intercoolers, free flow exhausts, up-pipes, down-pipes, dump valves, boost controllers can and do make significant differences to power output and delivery.

When we looked at the standard Sti head we were quite impressed. In standard form it ran at 170CFM inlet on our flow bench. That's pretty impressive for a standard head. We would have a tough job improving on that. During our development phase, we were also fortunate enough to acquire a pair of heads from a works WRC Subaru as used in the world rally championship by Prodrive. Obviously the first thing we did was check the flow on our flow bench. The result was, shall we say, rather surprising. Rather than showing higher than standard flow, it actually shows less. 159 CFM. Why the team would choose to use these heads over a standard head might seem strange but it pointed us to where the real weakness was with the standard head.

The Prodrive head was a one off casting. To improve the flow ratio between inlet and exhaust, the WRC head had smaller ports. Flow ratio is important as a means to measure efficiency of a particular head design. Improving the ratio helps to improve flow derived from the supercharging effect of exhaust "draw" on the inlet where pressure pulses in the exhaust tract helps boost inlet flow. This is particularly important with a turbocharged engine where it is important to keep turbine speeds up with an efficient exhaust tract. What they managed to do in this case was boost the exhaust flow and improve the ratio by a reducing inlet flow. Understandably, to reduce turbo lag for rally applications, Prodrive focused on improved

## Manufacture.

Taking a standard head as a start point, our 3 and 5 axis CNC machines begin work to machine the new head. We manufacture to very fine tolerances and a single head can take up to 16 hours to re-profile the ports. Valve seats are given special treatment on our Newen CNC valve seat cutting machine which ensures the very best valve seating possible. The end result is a head which gives 99% of the flow we achieved on the initial prototype. The final 1% is achieved with manual, hand finishing of the ports.

## Quality control.

The first heads produced are measured on the flow bench again to check flow. We also fit the head to a new engine build to check predicted power output on our in-house engine dynamometer. Often heads are developed for customer race engines. Dyno results are used to modify our simulation models. We also carry out random flow measurements on production runs as part of our quality control procedure. As a result we are able to guarantee the flow and power capabilities of our heads.

## Results.

With this process, our customers have achieved superb competition results at very reasonable cost. Using CNC production techniques has enabled a price and quality breakthrough in this area of race engine building. Considering the performance potential and quality of our heads, they represent superb value for money.

inlet/exhaust ratio, however, this head is limited in terms of absolute power potential.

The standard exhaust flow of 104 CFM is nothing to shout about (A standard Ford Cosworth exhaust is 119.6 CFM) so improvements here will help turbo efficiency and turbo boost. The inlet CFM is very good so we had to work hard to improve that. We managed to achieve both after a great deal of development work.

Our Subaru head offers better inlet flow than the standard head and the WRC head. Inlet is up 8% and exhaust is up 31%. It also gives 14% improvement in inlet/exhaust ratio over the standard head improving turbo response.

The summary below shows the ratio and derived power prediction for a normally aspirated engine with our head. We do not publish turbo power predictions because boost figures are variable. We can confidently say that this head will provide huge power (500bhp+) with the right turbo set up and improve turbo response over standard.

	Inlet	Exhaust	Ratio	N/A Power potential
Standard	170	104	61%	292.4
WRC	159	130	82%	273.48
CNC head	182	136	75%	313.04

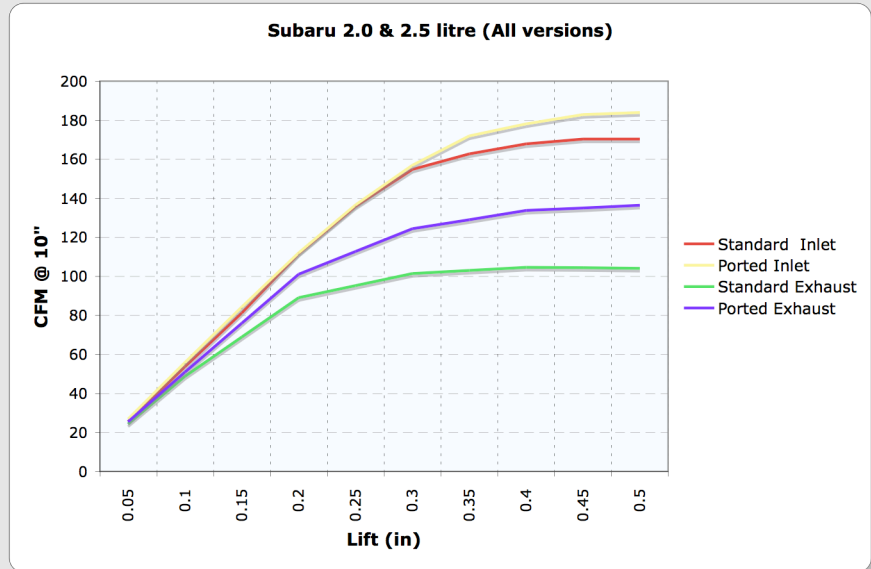
Fundamentally, what ever other modifications you make to an engine, they will always be restricted by the flow of the existing head. Customers who are ready to take the performance of their engine to the next level should seriously consider a quality gas glowed cylinder head with guaranteed flow characteristics. Not only will it improve the existing state of the engine but will also benefit further tuning if required.

A CNC Heads cylinder heads offers:

- The best flow available as a result of extensive R&D. This is the key. Our heads are fully developed racing specification, gas flowed cylinder heads.
- Developed and manufactured in the UK with full 12 month guarantee and support.
- Installation and tuning advice is available.
- Fully tested from flow bench to Engine Dyno to race track.
- Absolute accuracy guaranteeing claimed flow for each head and cylinder (giving full power balance across the head)
- A genuine price breakthrough offering custom gas flow engineering at production run prices.
- By any measure, price/performance ratio is extremely good and should appeal to racers and road enthusiasts alike.

Please note : When ordering this head as a new (non exchange) item, we require the exact model specification for your engine. There are many Subaru engine variants. Please contact us for advice on identifying your engine type.

See below for more details of our measured flow for this head. Unlike many gas flow engineering firms we publish all our flow stats. This is because we are 100% sure we can deliver this flow to the customer on every head and cylinder. We also give predicted power output based on our unique simulation to dyno testing development lifecycle.



Vital statistics		
<b>Standard Inlet</b>	<b>Ported Inlet</b>	<b>% change</b>
170.4 CFM	184 CFM	7.98%
<b>Standard Exhaust</b>	<b>Ported Exhaust</b>	<b>% change</b>
104.1 CFM	136.4 CFM	31.03%

**CUSTOM CAMSHAFTS :** With all of our gas flowed heads we also provide a custom made camshaft service. These camshafts are designed to optimise the flow characteristics of our heads. They can also be specifically designed to deliver the power characteristics you require for your specific application. Your existing camshaft will work with our heads, however, if you want to get the most from one of these heads or you have a particular power characteristic you are looking for, we recommend that you consider our custom camshafts.

For further details on CNC Heads , our manufacture process and our extensive range of Gas Flowed Cylinder Heads, visit our website : <http://www.cncheads.co.uk>. Or you can Email us on [sales@cncheads.co.uk](mailto:sales@cncheads.co.uk)

We are happy to discuss customer requirements and give support and advice on the use of our heads. We are experienced race engine builders and can offer many more services from component sales through to full engine build.

We look forward to hearing from you..