



## HOW TO SELECT A PERFORMANCE CAMSHAFT

When selecting a performance camshaft, consider the use for which the vehicle will be required.

We all know the claims: 20 BHP extra. This sounds great – but think! These automotive manufacturers can't be that silly to disregard 20 BHP by changing a camshaft.

Ask yourself! Where is this 20 BHP? Probably not where you will ever use it at 7500 rpm. Well, probably we will use it, occasionally; it would be nice to have in reserve.

Hold on! In this world there is no such thing as a "free meal". What's the possible trade-off of this 20 BHP? It could be a loss of 10 BHP at 2500 rpm. This means, each time you accelerate through 2500 rpm, you could lose 10 BHP. This to me, doesn't sound too good.

### SOLUTION

Be conservative! Don't over-cam your engine. Choose your cam for the correct application. Consider! Fit a milder cam and increase your power by 10 BHP at 3500 rpm.

Remember! You get this 10 HP every time you accelerate through 3500 rpm. Multiply this by 10 HP each time you drive through 3500 rpm then deduct the times you reach 7500 rpm.

I'm sure you will find more horsepower on the 3500 rpm side than the 7500 rpm calculation.

## CAMSHAFT SELECTION

You will see that each camshaft has a Part No and Phase No. The Part Number designates the make and model/the duration period of the inlet camshaft/the valve lift of the inlet camshaft and whether the camshaft profile is hydraulic. So if we look at the Ford 1300/1600 CVH RS Turbo XR3i XR2 Camshaft Data Sheet we see the following:-

FORC/206/420/H PH2

FORC	Specifies the make and engine type
260	Specifies the duration
420	Specifies the lift on the inlet valve
H	Specifies that the camshaft is designed for hydraulic cam followers
PH2	Specifies the type of use the camshaft is recommended for

## SELECTING YOUR CAMSHAFT

All the camshafts in this brochure have a Phase Number after the Part Number. Phases 1 to 5 will help you to select the camshaft that meets your requirements.

### PHASE 1 (PH1) ROAD CAMSHAFT

This is a camshaft that would be used for road use and will normally run with standard carb or injection system and can be fitted without additional tuning equipment. It is meant for town use and will have a smooth tick-over and will give its increase in power in the low mid-range. Other modifications to the engine will increase the performance of this cam.

## PHASE 2 (PH2) FAST ROAD CAMSHAFT

This is a camshaft for increasing mid-range of the engines and is meant for mild competition use and where the driver requires an increase of power in the mid-range without suffering too much loss of power in the low-range. The tick-over will be heavier than a standard engine. The fuel system may have to be modified and the cam will work to its optimum with modifications to the cylinder head, inlet/exhaust system and possibly the management system.

## PHASE 3 (PH3) FAST ROAD RALLY

This type of camshaft is really the limit for normal road use. It will require fuel system and management modifications. It will have a noticeable loss of low-down power and the tick-over will be heavy. For competition use, where mid-range power is important and road use where the maximum power is required.

## PHASE 4 (PH4) TARMAC RALLY SPRINT RACE CAMSHAFT

This camshaft is for competition use only and can be considered as a \_ race cam. It could be used on the road, but would not be suitable for use in traffic. It will have a very heavy tick-over and there will be a noticeable loss of power below 3500 rpm. Its main use is for a torque race cam, giving a strong surge of power in the upper range power, yet still having the ability to floor the throttle below 5000 RPM and pull cleanly away. It will require modifications to the carb/injection system, cylinder head and induction exhaust system.

## PHASE 5 (PH5) FULL RACE CAMSHAFT

For race use only. Not suitable for road or rally use,. Little power below 5000 RPM . Will have virtually no idle and will require carb/injection, exhaust/induction., cylinder head and engine management modifications.

## **MATERIAL TYPE (PERFORMANCE CAMSHAFTS)**

You will note that we have a material description at the end of the camshaft specification. This informs of the following:

### **Billet**

This means that the camshaft has been turned from a round steel bar and will normally be nitrided after grinding. We use this method for low volume production and, due to the work involved, they are always more expensive than cast blanks

### **Blank**

Unless specified, the camshaft is made from a chilled iron casting. This is the best material for camshafts, as it has far superior wear characteristics than any other material.

### **REPRO**

A regrind on an existing camshaft, only suitable for mild grinds on existing chilled iron camshafts. If you regrind case hardened steel camshafts you will remove the case hardening. We only regrind chilled iron cams, but prefer to supply new units

# **INFORMATION ON CAMSHAFT MATERIAL**

Camshaft material, i.e., what the camshaft is made from, is the most important detail in stopping premature wear of performance camshafts.

There are various materials that camshafts are manufactured from:-

## **CAST IRONS**

### **1.HARDENABLE IRON**

This is Grade 17 cast iron with an addition of 1% chrome to create 5 to 7% free carbide.

After casting, the material is flame/or induction hardened, to give a Rockwell hardness of 52 to 56 on the C Scale.

This material was developed in the 1930's in America as a low-cost replacement for steel camshafts and is mainly suited in applications where there is an excess of oil, i.e., camshafts that run in the engine block and that are splash-fed from the sump. (This is the material that the Ford OHC camshafts were manufactured from).

It is not the most suitable material for performance camshafts in OHC engines.

As a company, we only use this material for performance camshafts if the camshaft is splash-fed in the sump.

## **2.SPHEROIDAL GRAPHITE CAST IRON KNOWN AS SG IRON**

A material giving similar characteristics to hardenable. Its failing as a camshaft material is hardness in its cast form, i.e., Rockwell 5, which tends to scuff bearings in adverse conditions. The material will heat treat to 52 to 58 RockwellC. This material was used by Fiat in the 1980's.

## **3.CHILLED CHROME CAST IRON**

Chilled iron is Grade 17 cast iron with 1% chrome. When the camshaft is cast in the foundry, machined steel moulds the shape of the cam lobe are incorporated in the mould. When the iron is poured, it hardens off very quickly (known as chilling), causing the cam lobe material to form a matrix of carbide (this material will cut glass) on the cam lobe.

This material is exceedingly scuff-resistant and is the only material for producing quantity OHC performance camshafts.

## **CONCLUSION OF CAST CAMSHAFTS**

When purchasing a camshaft, enquire which material the camshafts are produced from. A chilled iron camshaft may be more expensive, but its resistance to wear in all conditions, far exceeds any other type of cast iron.

## **STEEL CAMSHAFTS**

### **1.CARBON STEEL – EN8/EN9**

Used mainly in the 1930 to 1945 period and is currently used for induction hardened camshafts in conjunction with roller cam followers, due to the through-hardening characteristics of the material.

### **2.ALLOYED STEELS – EN351 AISI 8620 and EN34 etc**

Used by British Leyland in the A Series and B Series engine and best when run against a chilled cam follower.

### **3.NITRIDING STEEL – EN40B**

The best steel for camshafts. When nitrided it gives a surface hardness and finish similar to chilled iron. We used this when replacing chilled iron camshafts in competition engines. This material is used on several of the current F1 engines.

## **CONCLUSION**

In general, steel is a good camshaft material. However, the type of steel has to be matched with the cam follower it runs against, as different grades of steel have different scuff characteristics.

## **GENERAL CONCLUSION OF CAMSHAFT MATERIAL**

This has been a very simplified explanation of camshaft materials, based on over 38 year's experience. It may assist you to ask the correct questions when purchasing performance camshafts.

# CAMSHAFT INSTALLATION

1. We recommend new cam followers be fitted, purchased from us or from a Main Dealer.
2. Check that on full lift on the inlet and exhaust valve spring there is 0.030"/0.75mm clearance between the centre coils of the valve spring,. On hydraulic engines a dummy solid cam follower should be used for this purpose.
3. Rotate the engine by hand and ensure that the valves miss the pistons and block by 0.060/1.5mm
4. Don't over-spring the camshaft. Most modern engines have valve springs that can be used for Phase 1 and 2 camshafts and in some applications Phase 3 cams. So use the lightest spring possible.
5. Before starting the engine, remove spark plugs and spin the engine up until the oil pressure is indicated.
6. Ensure that the cam being fitted is identical to the unit being replaced, except for the cam profiles.
7. Set the camshafts up on the timings supplied on the data sheet. You can change the characteristics of the engine by moving the opening and closing points. This will not have any great effect on the Phase 1 and 2 type of cams, but can make a noticeable difference to the Phase 4 and 5 camshafts, due to the effect on the air wave pulses in the induction and exhaust systems.  
The air wave pulses can be affected by induction length/diameter, exhaust length and silencer baffling, so the timing figures we supply are based on experience, but to obtain the maximum power, it may be necessary to adjust the cams to suit the characteristics of the engine. A trip down to your rolling road is the favourite way to obtain the best performance from your engine.
8. There is no need for you to run the camshaft in, except for the first 25 miles. Do not exceed the normal running in procedure, as recommended by the vehicle manufacturer.