

## **Lotus Twin-Cam Cylinder Head Version History**

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I have been collecting, rebuilding and modifying twin-cam heads since the mid 70's and the evolution of the head over the years of its production have always intrigued me. In recent years I have tried to understand it in more detail and the summary below is where I have got to.

This summary is the best I can do based on all the usual reference sources (e.g. Miles Wilkins book on Twin-Cams) and posts of photos and histories by various people over the years on LotusElan.net and other forums and from the heads I have personally bought or seen. As with all things Lotus there are many variations that have never been formally documented, but occurred to meet particular needs, on a particular day. I am sure there are further variations out there I have not seen and would appreciate any information people have that's adds to the story.

I have added photos to illustrate the various versions where I have them. I have tried to acknowledge the source of the photos where they are not of my own cylinder heads and I can remember where the photos came from.

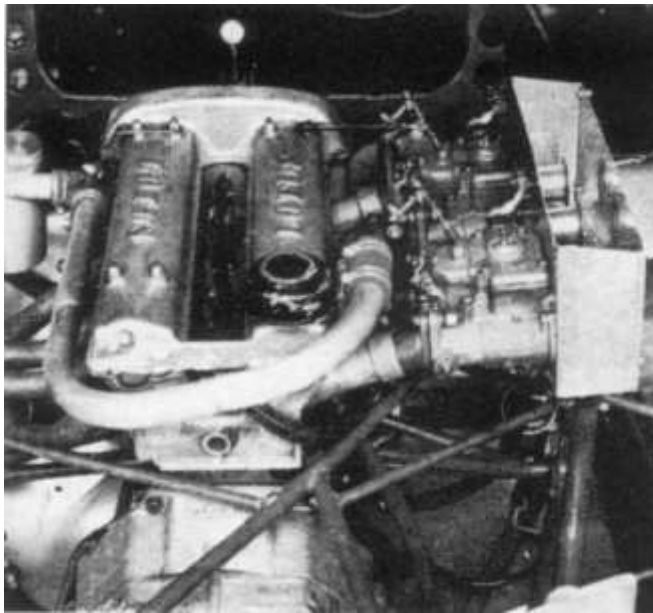
Cheers

Rohan

1. First prototype and development heads were sand cast by Birmid<sup>(1)</sup> and also it appears Williams and Mills ( see second pair of photos below) and had many variations including some having a centre rib in the plug well and some not, different length intake runners, the addition of the breather vent oil knockout chamber, only 4 rather 5 bearings per cam and the thermostat housing on the inlet side and bolt on inlet manifold. First prototype ran October 1961 and versions were developed for racing and as part of Elan and Cortina development programs until production heads appeared in February 1963. I suspect many other versions existed than the ones I have photos of below.

Very early prototype – Appeared in Lotus 23 and Prototype Lotus Cortina. Adjustable inlet lengths, thermostat on inlet side, 5<sup>th</sup> cam bearing location appears in casting but not used, no webs in spark plug well. The inlet tracts appear to have an adjustable length with the bolt secured outer ends fitted into a spigot (Photos from LotusElan.net)





This type head installed in a Lotus 23. The adjustable ends of the inlet tracts appear to be made of steel not aluminium.



A similar head in the Lotus Corina prototype ( photo from the Miles Wilkin Lotus Twin-Cam Engine book). Note that the inlet are substantially shorter and appear to be bolted to the head like conventional inlet manifolds. The picture is distorted as it spanned 2 pages in the book

The cam cover in these prototypes is different to the later production version with a more rounded chain cover and the oil filler on the right hand inlet cam (it is blanked off in the dry sumped Lotus 23 version). The development history of the cam cover itself is also worth documenting at some time also with at least 5 or 6 casting versions plus all the colour variations!!

Later preproduction head – Thermostat now on exhaust side and fixed length but longer inlets than production versions, 5 cam bearings installed, webs in spark plug well, no breather vent oil catch box, sand cast by Williams and Mills. Inlets this long would not fit in a Lotus Cortina or Elan easily I think so from the racing development program maybe?(photos from LotusElan.net)



A similar pre-production version below used in a competition engine but no 5<sup>th</sup> cam bearing cap. Maybe the 5<sup>th</sup> bearing cap in the above head was a later addition. Note the pin for bearing cap location versus the collets on the studs



2. Type 1 Heads – First production heads, by now they are the same for the Elan and Cortina and were die-cast by Williams and Mills and machined by JAP and introduced February 1963. They had half- moons down the centre well and square reinforcing blocks on the inlets and a centre rib in the spark plug well between cylinders 2 and 3, it is not the known number of these produced. At some stage Lotus changed back to sand casting but it is not clear if this occurred with the change to the type 2 style heads at around engine LP 5332 in late 1965 (earliest engine number type 2 head located so far) or prior to that time within the Type 1 head production run without changing the basic casting style. I would need to see more type 1 heads in the LP1xxx to LP4xxx range to see if any change in casting method can be identified



The key identification feature of the type 1 head is the half-moon protrusions into the centre spark plug well. The inlet tracts on the Type 1 head were smaller in diameter than the later Type 2 head and less suitable for race porting so it is rare to see one on an historic race car of the period now.



Another early type 1 head but with a boss in front of the No1 spark plug. The development sand cast heads and later Type 2 sand cast heads have this boss. Is this an example of a sand cast Type 1 head? Did Lotus make some production sand cast Type 1 heads before the diecast heads commenced production given the reported delays in getting the die casting heads to work.?





Type 1 head showing the square reinforcing blocks on the front 2 inlets.

3. Type 2A heads- Earliest versions of type 2 Heads had no reinforcing webs on 1 and 2 inlets, when these webs were introduced is not clear. All type 2 heads did not have the half- moons down the centre well and had larger diameter intake runners than the Type 1 heads.  
(Photos courtesy of James Lambert)



4. Type 2B heads - The next version added the reinforcing webs on the inlets, (not known when) and added the cross drilling behind no 4 exhaust port for oil drainage and / or sand removal from castings. It appears the webs were introduced first and then the cross drilling later as I have seen a head with the webs but no cross drilling. Both these changes appear to have been in place at latest by around 1968 and the 6 bolt crank engines introduction with the Mk2 twin-cam engine and production by Lotus at Hethel commencing. The Big Valve head casting was unchanged but was machined differently for a larger inlet valve and thinner thickness of 4.600 inch versus 4.640 inch for a higher compression ratio.



Cross drilling in Type 2B head on right just next to No4 exhaust port versus no cross drilling on Type 2A head on left. Ignore the plug above the normal core plug on the type 2A head this was a later modification I think to improve oil drainage from the head in lieu of the cross drilling in the type 2B head. The head was used in a dry sump race car before I purchased it. I have seen other dry sump race heads with a similar modification



The webs reinforcing the front two inlets ports added for the Type 2 B heads.



5. Final versions were variations on the type 2B heads with the Stromberg version in 1968 and modification for the Twincam Europa with the extended inlet cam installation driving the alternator in 1971



The Stromberg head with siamesed inlet tracts to suit 2 Stromberg 125CD carburetors for emission regulations purposes versus the previous two dual barrel Weber 40DCOE carburetors (or Dellorto equivalent)



The Europa Twin-Cam head with larger D cut-out on the inlet cam rear to allow mounting of a seal for a cam extension out the back of the head for a pulley to drive the alternator. The Cam cover had a matching cut-out to mount the seal in. This is a Stromberg head originally that has had a John McCoy Omnitech conversion for Webers

## **Still working on the following sections**

6. *After the end of production by Lotus various other developments have occurred that you may come across.*

*Stromberg to Weber conversions by QED and Omnitech (John McCoy)*

*Insert photo McCoy head and scan article on QED head*

*Heads cast for Caterham / Vegantune for Caterham Seven production with twin-cam engines built by Vegantune. Supposedly 50 made?*

*Insert any photo publicity info?*

*New replica heads cast by QED, SAS and in USA?*

*Insert photos from Web sites*

7. *Head Numbering*

*LPnnnn – up to around 67 and LP 7xxx? Stopped with Mk2B heads*

*AAnn 67 / 68 on?*

*Some with no numbers – where these Cortina and Escort?*

*LM8 and LM25 casting appears on some heads*

*WM*

*Lotus part number 026xxxxx appears on type 2B heads on bottom face only?*

*Lots of other original cast in and stamped numbers plus lots of stamping on heads by modifiers and rebuilders*

8. *Competition Versions*

*Earlier competition version by Cosworth and BRM had limited modification mainly just minor porting but hard to tell what was originally done by them and what had been done subsequently.*

*The last “in era” competition versions by Hart ( the 416B engine for USA Formula B racing) were substantially more modified with much bigger porting and bigger valves (1.7 and 1.4 inch heads) that were recessed into the head further to provide clearance on overlap and modified combustion chamber to accommodate these recessed valves and the head milled down to well under standard head 4.600 inch thickness to help restore compression ratio in combination with the intruders used on the piston.*

*Many other privateers have done all sorts of mods!!!*

*9. Machining Variations (as opposed to casting versions covered above)*

*Cam follower sleeves - none, exhaust, both*

*Head thickness / Valve size in Big Valve heads*

*Blunted splitter in Stromberg head.*

*References*

*(1) Miles Wilkins – Lotus Twin-Cam Engine*