Punching slots in a hand-cut gasket calls for the steady hand and keen eye of an expert

NEW SERIES

HOW DO THEY make gaskets?

In this fascinating occasional series, we'll be looking beyond the part numbers and the workshop manual to see how components are actually made. First up is the humble gasket

Who cares about gaskets? We may lie awake wondering where we can get the cash for a roof tent or some bigger tyres, but we don't give gaskets a second thought.

Yet, gaskets are vital components – and there are masses of them in a Land Rover. If they're the right specification and fitted properly, you'll never know they're there. But if they're wrong, life becomes a misery – how many older Freelander 1.8s are on their umpteenth head gasket?

Given that they're such critical parts, we know so little about them – but, here, that's about to change. We've been given access to E Dobson & Co (Gaskets) at Keighley in West Yorkshire.

Dobson's makes some Land Rover gaskets, and much of its business comes from mass-manufacture orders. However, it's one of those wonderful companies that will make any quantity – right down to a single gasket (it won't be cheap, mind).

That's good for us, because a hand-making process means we'll be able to see in detail exactly what happens. Let's take a look at the manufacture of a cylinder head gasket.

The process starts from a customer's drawing or sample. This ends up as a dimensioned drawing on the planning computer, together with a list of materials and components.

A cylinder head gasket is basically a sheet of material (or in many cases, it's a sandwich of materials) with holes through for the head bolts, pistons, waterways and so on.

It's possible to make a head gasket completely by hand with sheet material and snips – if only a few are needed. But, more typically, the sheet material of the head is punched out on a die-cutting press. For that we'll need a cutting forme – think biscuit-cutter and you're getting the idea. But Dobson's die-cutting formes are made from super-hard, razor-sharp steel rule that slices through brass, tin, and other materials.

First, a straight-cut guillotine cuts individual rectangular 'blanks' from the sheet materials. Next, a rectangular blank is put on top of the cutting forme. Then blank and cutting forme slide under a press and pressure is applied. The cutter chops through the gasket sheet material, and we end up with something cylinder-head shaped.

Some of the holes in the gasket will need reinforcing at the edges: for example, there'll be a reinforcing ring around each piston aperture to stop pressure and hot gas eating away the gasket's sheet material. These rings need to be partially pre-formed – and

1 Start here – planning on the computer

2 Selecting the sheet material

3 Cutting formes – thousands of 'em!

4 Rectangular-cut sheet material goes in the die-cut press

5 Stripping a die-cut head gasket sheet off the die-cutter

6 Checking the die-cut dimensions against the client's specifications

E Dobson & Co, Springfield Mills, Oakworth Rd, Keighley BD21 1QQ: dobsongaskets.com, 01535 607257.

Not just cars – Dobson's makes gaskets for steam boilers, jet engines and just about anything that needs a joint between two surfaces. It'll handle bulk production and one-offs – and the firm is the UK's leading maker of gaskets for classic cars.

You think a Land Rover has problems? Try something this size

WORDS AND PHOTOS: PETER GALILEE

MATERIALS

A Oil- and petrol-proof paper
Tough paper for carbs and other fuel system joints. Doesn't stick easily and good when disassembling.

B Standard gasket paper
Many variations, for flat joints between machined surfaces, retaining oil only. Not good for fuel and water. Easily torn, so handle carefully.

C Cork
Small-grained particles bonded and oil-proofed with synthetic rubber. Used where residual 'spring' is needed and where surfaces may not be flat. Deforms slightly when fitted; low compression only needed to create good seal. Not good in very hot locations.

D Nitrile rubber/ aramid fibre
Slightly compressible. Resists fuel and oil, and temperatures up to 350ºC. Usage: petrol pumps, exhaust gaskets.

E Nitrile rubber/ aramid fibre
As above but more rigid, with lower temperature tolerance.

F Thermiculite/mica with metal foil
Withstands up to 800ºC. Use between flat surfaces.

G Nitrile rubber/aramid fibre with surfacing
Oil- and fuel-resistant. Not flexible. Temperatures up to 430ºC.

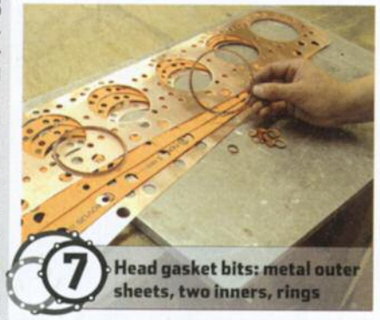
H Specialist non-asbestos bonded to stainless steel
Temperatures up to 500ºC. Use between machined surfaces for exhaust gaskets or as base for head gaskets.

I Stainless steel sheet
Mainly for making shims.

J Copper sheet
Deforms well to suit application. Usage: shims, outer layer of multi-layer gaskets, head gaskets and insert rings. Or, in thicker sizes, as copper washers.

K Synthetic rubber
For use where residual 'spring' is required; good between uneven surfaces when clamped tightly. Not ideal for hot locations unless special formulation is specified.

L Felt
Special, non-fibrous felt, used where an airtight seal is not desirable; for example, the top of a dipstick tube. Also good where oil needs to be retained near to surfaces.


7 Head gasket bits: metal outer sheets, two inners, rings


8 Rings for cylinder sealing, fresh from annealing

as they're being fitted to the gasket's sheet material, they have to be formed in a tight radius. So, these rings will often be annealed (hardened) at high temperatures to make them easier to work. At the end of all this, we have our components – punched sheet material and insert rings.

The rings can then be put into the sheet material semi-automatically but, for clarity, Dobson's technician Dave Capstick shows us how it's done by hand.

First, lay the sheet materials together. Then push the rings up from underneath, and gradually turn the exposed upper edge of the ring from vertical towards flat by working around the inside of the ring with a brass rod, turning over the edge of the ring a little at a time.

When all the rings are in place, Dave knocks the edges flat, does any other finishing-off, cleans off annealing debris with wire wool, and then the head gasket's complete.

It looks simple, but it's not. There's a huge amount of skill in this job. Dave's working with materials that will damage easily, but the finished gasket doesn't show any marks – in fact, it looks like it's been made on a machine. Perfect. These gaskets can now go off to the client – the Rolls-Royce Owners' Club.

A head gasket is just one example of the breed, though. The simple flat gaskets we use for gearbox, axles and many other joints are die-cut out of sheet material in the same way, but you can forget the idea that a Rice Krispies packet will do for anything and everything – some of these uninteresting-looking sheets of brown and grey stuff on the racks at Dobson's are more high-tech than you may expect.

Take sheet cork material, for example – the cork grains have to be a particular size, and those little bits of black stuff are synthetic rubber, so the material is strong and oil-resistant. Copper-asbestos gaskets? Not asbestos now, of course – instead, it's a sheet material mostly composed of glassfibre, but it works just as well.

Millboard is a sort of cardboard, but tougher than any you've ever seen – other companies make suitcases with it. Many head gaskets now are based on a single die-cut sheet of heat-resistant composite material: it's more expensive but, since there's only one sheet of material, assembling the gasket is faster.

Another surprise is oil- and-petrol-resistant paper, which you'll need for any fuel system gaskets if you don't want a smelly engine bay. In case you're wondering, 'ordinary' gasket paper is designed to absorb just a little oil – that saturates the paper fibres and prevents any more oil seeping out.

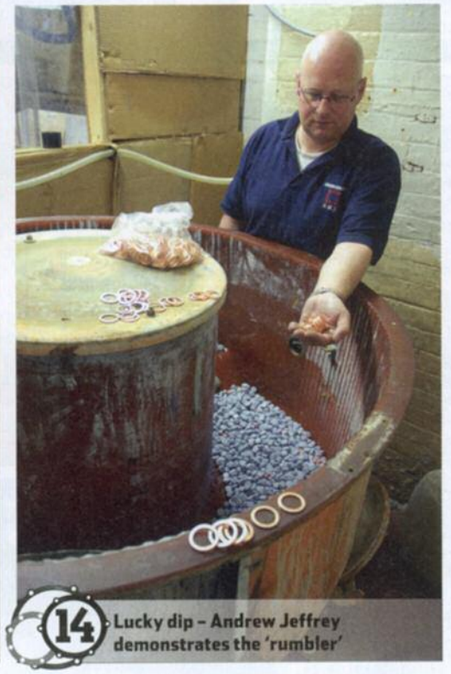

9 Dobson craftsman Dave Capstick forms the cylinder seal rings in the gasket


10 Forming the rings with a brass tool (inset); Dave forms cylinder seal rings in gasket


11 Finishing off this head gasket


12 Part-assembled gasket (left); and that's the finished item on the right


13 Pipe-join gasket (bottom left); die for forming it (top right); components


14 Lucky dip – Andrew Jeffrey demonstrates the 'rumbler'

Rubber sheet is good for uneven joints and where the seal has to remain springy. And all of this, of course, comes in different compressibility, different thicknesses, various temperature resistances… no wonder that a big chunk of Dobson's space is taken up just with material storage.

The more you start to think about where all the little bits and pieces on your Land Rover come from, the more you realise that many of them started life as sheet material.

Take front axle swivel-pin shims, for example. Or those little star-shaped seals made of rubber-backed felt, used on a Series front axle. Copper or fibre washers are often used as seals – circular discs the size of the washer's outer diameter are die-cut from full-size sheets, then these discs go into a punching press to cut out the middle, leaving a ring-shaped washer.

Copper washers will be smoothed off in the 'rumbler', which is a bit like a massively scaled-up vertical-tub washing machine that slowly rotates gravel (yes, gravel) around a central core. Chuck in the copper washers (or anything else small that needs de-burring) and the gravel will remove all sharp edges. Impressive!

As I mentioned earlier, most people don't think too much about gaskets – and if the gasket they want isn't to hand they'll bodge something from a bit of paper that just happens to be lying around. Or even that old standby, 'instant gasket' – ugh.

Such cheap and simple fixes aren't a good idea: although they usually work, it'll only be for a while. A lot of effort has gone into making correct-specification gaskets for your Land Rover and – for the job they do – gaskets aren't dear.

Fit the right thing, fit it properly, and you'll never have a problem with it. LRO


15 Punching out centre of fibre washers


16 Computer-controlled cutter handles rigid sheet plastics

GASKET DO'S AND DON'TS

1. Some symmetrical gaskets and seals should be fitted only one way around. Check your workshop manual if you're not sure.

2. Have you got the right gasket? Tdi engines are built to tight limits – fit a thinner gasket and there's a risk that the pistons might touch the cylinder head. These gaskets are punched ('notched'), with different numbers of notches for different thicknesses. Check the old gasket to see how many notches it has.

3. Check it's the right specification – Freelander 1.8 petrol engines should be fitted with the new, improved head gasket to stop water loss.

4. Use manufacturer's gaskets, as they're properly specified. For example, carburettor gaskets need to be made from petrol-proof paper.

5. Don't re-use gaskets; they'll almost always leak sooner or later.

6. Don't use a hard scraper when removing old gasket material – you could score the metal surface. Take special care with aluminium castings.

7. Don't prise under the edge of a cylinder head, except gently. Turning the engine on compression can work (head bolts loosened but not removed), but loosen spark plugs or injectors a little so the compression effect isn't too fierce.

8. Use gasket remover when cleaning up old gaskets.

9. Gasket paper from motoring accessory shops is the simplest type – fine for good, flat surfaces and oil retention, but not much else. You probably won't get a choice of thicknesses, either.

10. If components won't separate because the old gasket is sticking them together, knock them apart by gently hitting sideways (parallel to the gasket) with a soft-faced heavy mallet. You don't need a lot of force, just persistence. Eventually, the gasket will split.

11. Try not to use gasket jointing material – it's less reliable than a correct gasket, and it's often very difficult to split the components next time they're disassembled. Also, excess can get squeezed out internally and cause trouble.

12. When scraping off an old gasket, plug any bolt-holes with scraps of rag first. If debris gets in, blow out the holes or run a tap down them.

13. When fitting gaskets in vertical or difficult locations, hold them in place with a dab of grease (except cooling system, where grease in the water might confuse diagnosis of problems later).