

# Chapter 2

## Buying a project car

Undoubtedly the most crucial aspect in any project is the starting point. Pick a good car, and it's all smiles; pick a bad one, and you will spend more time fixing other people's mistakes than you will doing the jobs you had planned.

The ideal base car depends on what you are aiming to achieve. Some race formulas require a specific model to be eligible, and even if you are building a road car, some models offer more potential than others. Ultimately, budget is a major consideration, and for a given price it can be better to get a less-than-ideal model in a good condition, rather than buying a more desirable model in a rotten state.

Many people also buy a second rotten car just to harvest spare parts. Indeed, I have done exactly that in the past myself, when I bought a sound 316i two-door and a rotten 325i for the engine and gearbox, but there are a few traps with this approach. There was a face-lift in about 1987 that involved a number of detail changes to the shell, making some swaps a little more tricky. For instance, I found the radiator



**Well-proportioned and logically laid out, the interior is easy to use and accommodates a wide range of drivers.**

mounts and the mounting points for the prop centre bearing were completely different, necessitating fabricating adaptors and new brackets. So, if you are going to buy a scrapper for parts, just make sure it's compatible with your project car.

If you are buying a car for trackday

**Unfinished projects can be a bargain buy, but more often they are unfinished for a very good reason! If buying a non-runner, make sure you can transport it home.**



**Slim by modern standards, the E30 should fit most garages, and won't embarrass the driver in the car park.**



# COMMON FAULTS, SERVICING & RECOMMISSIONING



This disc has light surface rust, typical of a car that has stood for a few weeks.

## Subframes

The front subframe is prone to rust. Check behind each front wheel, where the subframe is bolted to the chassis rails.

The large bushes at the front of the rear subframe use large bolts to secure them to the body. As the bushes start to fail, the subframe can strike the body, causing a clonk when accelerating. Eventually a failed bush could cause the front of the subframe to drop, with severe consequences. Although bushes



There should be no oil dripping from the front or rear. Slight oil staining from the top is due to oil mist coming out of the breather, and is usually not an issue.

are cheap, they are pressed-in items so need a special tool to drift out.

## Brakes

Looking through the wheel spokes you can see the brake discs. If the disc is worn, a narrow ridge will have formed at the outer edge – if this is much more than 1mm, the disc needs replacing. As the disc wears, ridges and grooves form around the surface. Gentle undulations are usually okay, but if it looks like the surface of a vinyl record then it has probably expired.

With the steering on full lock, it's possible to see the flexible brake hose.



Check all the right warning lights come on as soon as the ignition is turned on, then go out when the engine starts.

Check for any cracks and fluid leaks.

Using the mirror and torch, you may just be able to see the brake pads. If there are only a couple of millimetres left, the pads need replacing.

Brake discs and pads are very reasonably priced, so it could be prudent to replace them on a new purchase as a matter of course.

## Rear axle

The differential pan gasket can leak oil. Oil starvation or contaminated oil can cause gear wear, leading to a whining noise when accelerating, and eventually failure.

The differential mounting bushes also wear, resulting in a 'clonking' or a droning noise.

## SERVICING

The E30 is a pleasantly simple car and needs a fairly low level of maintenance compared to many of its contemporaries, but that doesn't mean it should be neglected. In fact, the durability of these cars did allow some owners to skip expensive services to little obvious detriment, but left unchecked, badly maintained parts can fail without warning, with potentially disastrous results. Servicing schedules are well documented in workshop manuals and even in the owner's handbook, but here are a few things they might not cover ...



Beware of fake parts; always buy service items from quality suppliers. To get the maximum fun from your car, it needs to be reliable – don't cut corners on servicing.



The idle valve can gum up, making the engine prone to stalling. Removing and cleaning with WD40 can revive it.

Once the engine is mechanically modified, remapping the ECU becomes a lot more important. Whilst the standard system can cope with small changes in performance, once the airflow exceeds production limits the fuel and spark will be inadequate. The Motronic system was quite advanced for its time, and can be remapped by specialists with good results, although with the age of the electronic circuits approaching a quarter century, you might want to consider the potentially more reliable option of a modern ECU.

Mappable ECUs allow the engine to be tuned exactly to suit the setup you are running. To make sure you have the right fuel and spark under all conditions, you need to get the car on a rolling road dynamometer, or take the engine to an engine dynamometer.

One halfway house is the 'piggy back' ECU: a small computer wired between the standard ECU and the sensors and actuators. It reads the signals and adjusts them to cope with engine modifications. The system is mapped in a similar way to a standalone ECU, but because the standard ECU is doing a lot of the hard work it can be made a lot cheaper.

## Injector and fuel pump sizing

A petrol flow of 1.37cc/min has an energy flow equivalent to 1bhp, but engines are less than 30% efficient and



The biggest cause of problems with old fuel-injection systems are the connectors. Vibration loosens the contact's grip, and tarnishing increases resistance.



For heavily modified engines, it may work out easier and cheaper to change to a mappable ECU, such as this MBE941.

need a safety margin to allow for full load enrichment, so in reality you should aim for 5cc/min per bhp.

Ideally, fuel injectors at max power

will still be running at less than 100%. Most manufacturers aim for closer to 80%, so once you calculate your maximum fuel needs, add a safety margin of about 20%.

Similarly, it is wise to over-spec the fuel pump as well to cope with an aged fuel filter, etc. The universal Bosch in-line fuel pump 0-580-254-044 flows 4400cc/min at 3 bar – enough for over 400bhp.

Below are some injector values for E30 standard engines. I've indicated a potential bhp figure for both four- and six-injector configurations, to give an idea of the swap potential. This assumes 30% thermal efficiency and a duty cycle of 80%, so potentially you could get a bit more. These are all at 3 bar fuel pressure, so the figure could be improved with more pressure, too.

| Application (E30) | Engine type | Part number   | cc/min | Bhp 4-cyl | Bhp 6-cyl |
|-------------------|-------------|---------------|--------|-----------|-----------|
| 316, 318, 325i    | M40, M20    | 0-280-150-715 | 152.4  | 122       | 183       |
| 318               | M10         | 0-280-150-211 | 147.1  | 118       | 177       |
| 318is             | M42         | 0-280-150-714 | 213.9  | 171       | 257       |
| 2.7eta            | M20         | 0-280-150-126 | 191.8  | 154       | 230       |
| M3                | S14         | 0-280-150-201 | 258.0  | 207       | 310       |

Injector values for E30 standard engines. The old Bosch 0-280-150-126 injectors have been superseded by 0-280-150-160, which have the same characteristics.





The standard brakes are small by modern measures, but can still be improved with minimal expense.

increase the disc diameter, increase the piston area, or any combination of the three.

## Pads

There are some good pads ideal for fast road use, such as EBC Green Stuff, but getting the right grade of pad for the car usage is vital. Harder pad materials take longer to reach operating temperature, so for a road car that may need to work on a frosty morning they should be avoided. The heavier the car and the more powerful it is, the harder the pads have to be. Also, the drivers preferred driving style has a big effect on choice. Braking late and hard demands more from the pads, but gets them up to temperature faster. So what works well for one driver may feel awful for another.



The basics: performance brake pads, braided hoses, and racing brake fluid.



Grooved discs help disperse dust and gases, giving more consistent performance.

## Discs

The stopping force depends on the friction between the pad and disc. Just as different pad materials make a difference to stopping force, so does the disc material. However, there is very little choice – basically it's iron unless you can afford the ridiculous prices of composite discs. There are harder and softer types of iron; harder lasts slightly longer, but softer has slightly more grip. More importantly, there is a variation in quality of the disc material, which can be crucial. Discs made with cheap iron may contain contaminants and other irregularities, which cause uneven heating of the disc, leading to brake judder, warping, and reduction in braking force. So, as ever, spend your money on quality.

### Grooves and cross-drilled discs

Discs with grooves help to remove gases and any glaze that has built up, but only a few grooves are needed, if any. Cross-drilling also vents these gases, but often result in radial cracks

forming, which can lead to the disc breaking up. In both cases the edge of the hole or groove must be properly formed with a chamfer to avoid making weak spots. There are a great many highly successful race cars that do not use grooves or cross-drilling – make of that what you will.

### How big do you need to go?

The more power you have from the engine the harder you will have to slow down, but the downside of big brakes is higher weight at the wheel which gives the suspension a harder time, so again it is a matter of balancing each aspect to make the car feel right.

The stopping force depends partly on the disc radius – the further out from the hub the callipers are, the more leverage they have, but this is always limited by the wheel size. 280mm discs are about the limit for 15in wheels depending on the size of the calliper.

Another consideration is that when moving to bigger calliper pistons, more fluid needs to be passed through the

restricts traction, but this is perfectly balanced by the front anti-roll bar setting, which has been set to adjust the front end grip to match the rear.

By not over-stressing any part, it is a good reliable car that completes full trackdays without drama. It's lots of fun, and is quite acceptable as a road car too, although the roll cage is not ideal.

The great thing is that as most parts are standard, maintenance is cheap and easy, so this car spends the minimum time in the workshop and the maximum time available for driving.

### THE 335

This is an interesting car, because it made the big leap from a track car to a race car. Not only that, but owner Jim used this mighty machine for his first ever race, at Brands Hatch in the pouring rain against a huge range of racing machinery including a Ginetta, hot hatches, and a race-prepped M3. Amazingly, he drove past them all and won! Interestingly the owner/driver Jim Cameron's day job is teaching people to drive tanks, which may explain how he drifts the car so easily ...

### Basics

This car started life as a 318is, but Adil from A1 BMW Spares fame took the solid two-door, non-sunroof shell and fitted a 3.5 M30 engine from a 735i. Custom engine mounts allowed the engine to be mounted as far back as possible against the bulkhead. This also allowed a slightly wider high-flow radiator to be fitted.



Winning a very wet race at Brands Hatch. (Courtesy Jim Cameron)



This is what a winner's face looks like. (Courtesy Jim Cameron)

Both inner headlights are removed, the left one leading to a carbon fibre intake duct, and the right one being left open to help keep under-bonnet temperature down.

Originally the car was intended for trackday and road use, but Jim changed almost everything to turn it into a real race machine.

The shell is completely stripped, and stiffened with a full motorsports roll cage and strut braces front and rear. The driver and passenger benefit from very supportive race seats and five-point harnesses. The office is equipped with the usual race safety kit, including plumbed-in fire extinguisher and electrical cut-off switch.

### Engine and transmission

The exhaust features an Alpina equal length double exhaust manifold that

curves round the steering, leading to a custom stainless twin pipe system with a centre silencer built in two halves to clear the prop centre bearing carrier.

The flywheel is lightened to speed up gear changes. Other than that it's a reasonably standard engine, and produces 231bhp at 6258rpm, with a good spread of torque peaking at 245lb-ft at 4239rpm.

Gearing is still relatively long using the 735i gearbox and diff, but the combination of light weight and huge torque means that performance is rapid.

### Suspension

Jim had the car professionally set up by KW, using height adjustable coilovers at the front and separate height adjustable spring platforms at the rear. Both ends feature dampers that can be independently adjusted for bump and rebound.