# FITTING AN:

# HID Kit

**Poor headlights can be one of the most frustrating things about driving your classic motor at night. Luckily retrofitting a set of HID lights can save your bacon. Here's how…** Words & Photos: David Bywater

One of the more popular and simple headlight upgrades is to fit a high intensity discharge (HID) kit to your car. There are a wide range of kits available, but many people don't appreciate the issues around them. Please note that this article relates to HID bulbs which are often called xenons. Do not confuse them with cheaper 'xenon white light' filament bulbs.

Most cars built in the last 30 years are fitted with halogen headlights as standard, HID being an expensive option on all but newer, high specification vehicles. HIDs don't have a filament like a conventional bulb, but use a high voltage to strike an arc. They generate more light for a given current consumption – a 35W HID will give more light than a 55W halogen, and there are even 55W HID kits available – and having no filament makes them more shock resistant. As a result, the aftermarket has filled the upgrade gap with a range of kits for the DIY mechanic. If your car is still running sealed beam units or tungsten headlight bulbs, this isn't really going to apply to you unless there is a halogen option available.

A single-beam HID kit (H1, H3, H7, etc) generally comprises two parts for each lamp – the replacement bulb itself and a ballast. The ballast is an inverter which generates a strike voltage for the bulb of about 23,000 volts. Count the zeros and be careful what you touch when the light is on, or it's going to smart in the morning! Some early kits or the super-slim digital systems split the ballasts into two parts (ballast and igniter), but many are integrated these days. A dual-beam HID kit (H4) will often also have an extra relay block and wiring loom, and sometimes extra ballasts as well!


## Selecting an aftermarket HID kit

The first thing is to decide which kit you are going to buy. The bulbs in the kit need to match the type that is fitted to the car as standard. If your car has bulb failure monitoring, consider a kit with 'digital' ballasts (slimline, more expensive, and sometimes advertised as CANBUS ballasts, although we have yet to see an aftermarket kit that connects to a vehicle data bus!). These seem to be designed to have a start-up characteristic that is closer to that of a halogen bulb, and as a result, many vehicles that are fitted with bulb failure systems will work happily with them. If necessary, there are other options to fool bulb monitoring systems, such as connecting shunt resistors in parallel with the ballast.

You also need to decide what colour of bulb you want to run with. This is shown as a number with a 'K' after it (which refers to colour temperature in Kelvins) – aftermarket kits are commonly supplied with 6000K or 8000K bulbs. Basically, the higher the number, the more blue the bulb. A 30000K bulb will look positively purple, and won't be as effective at lighting the road ahead. Many OEM HID bulbs are around the 4000K mark, while a 55W halogen bulb comes in at about 3200K.

We simply called a local motor factor and asked for an H4 HID kit. It sent over a kit that had 6000K bulbs with a halogen main beam, with a separate connector for each ballast and bulb combination. There are more sophisticated ways of buying them, if you are prepared to have a wander around the internet.

Aftermarket HID bulbs come with one of two types of mounting flange – either metal (like the original bulb) or thermoplastic. The plastic flanges are thicker, and some types of bulb mounting clip can struggle to hold them in place. It's not normally a problem if the clip goes right over the back of the bulb, but some holders just have clips that pinch the sides of the flange. With these, sometimes it's more effective to pull the retaining springs back so that the tips push against the back of the flange. It's not quite how it was meant to be done, but is far more secure. Depending on your car, you may find that you need to take the headlights out to make sure that the bulb is properly secured.

Some headlights are based on a 'projector' design. These can be identified by a hemispherical lens just in front of the bulb, behind the outer headlight cover. If you can see the bulb through the front of the headlight, it's not a projector. Some xenon replacement bulbs might be long enough to touch the back of the lens (which would be a problem), but we've never seen an issue with this.

## Fitting an aftermarket HID kit

In order to show how easy an HID installation can be, our H4 kit was temporarily fitted to a Mk3 Escort RS Turbo. Older cars generally have better access behind the headlights – another plus to running a retro vehicle!

It is worth checking to make sure that the connections are correct between the HID kit and the modular connector that mates with the back of the bulb. In this case everything was fine but if you are not sure, check the OEM wiring with a voltmeter. The positive wire in the HID kit is generally red, the negative black.

Unplug the connector from the halogen bulb, remove the rubber seal and unclip the bulb from the headlight. Because the connector on this car sits outside the seal, you will need to open the triple hole out slightly to allow the loom to be pushed through. Even with this, we found that the three pin connector that the OEM loom mates with needed to be dismantled as the body didn't fit through.

If you have to take contacts out of a connector be very careful to replace the pins in the right places and ensure that the locking tabs are holding them in place securely. You will notice that there is a circular grommet in the HID wiring loom, used if the back of the headlight is enclosed. It means that the bulb and connector can be inside the enclosure, with the ballast mounted outside. As the headlight connection is outside the headlight splash cover in this case, you might want to protect it with some petroleum jelly to prevent corrosion. You might also want to cut the grommet off, just for neatness. We photographed the single bulb upgrade shining on the back of the unit door. This shows that the beam of the xenon light is comparable with that generated by the halogen bulb in the other headlight.

Once the bulbs are fitted and connected, the ballasts must be secured. Remember that you need to allow space for any parts you have not refitted yet, and leave a little slack in the wires so there is no strain on the connectors. Keep the ballasts out of the way of excess water or too much heat. The RS Turbo had a conveniently redundant screw in the inner wing, so we recycled that. Ballasts are likely to warm up during use, so they should be mounted in such a way that this heat can be dissipated into the car.

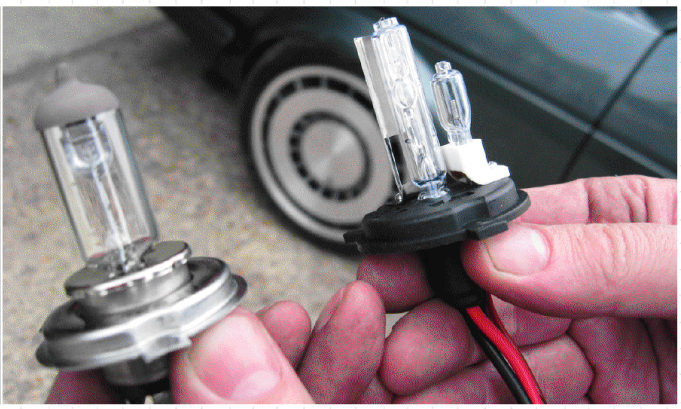
The final practical issue is for those who have a car fitted with a nicely obscure H2 bulb, such as a VW Golf Rallye. If you search online for an H2 HID kit, all you will find are references to an American SUV – none of the manufacturers seem to bother with such a niche bulb. It is possible to fit an H1 bulb into an H2 headlight, but you need to be very careful both to line up the arc position in the new bulb with the filament of the old, and to ensure that the new bulb is secure and won't move. It requires rather more ingenuity than a standard HID bulb fitment, but it has been done.

## Legislation

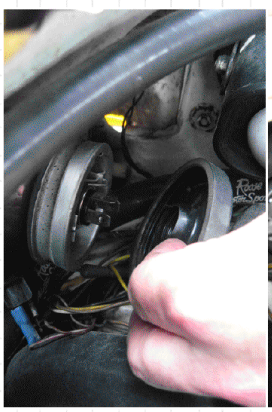
You may have noticed that many of the adverts for HID kits state that they are not for road use. This is because all external light units on a vehicle have to be approved, which is shown by an 'E' mark on the lens. Lights have to be offered for independent testing by the manufacturer and the resulting approval is only valid if the light is used in the manner that it was tested. Consequently, a light that has been signed off with a halogen bulb should not be used with a replacement xenon bulb.

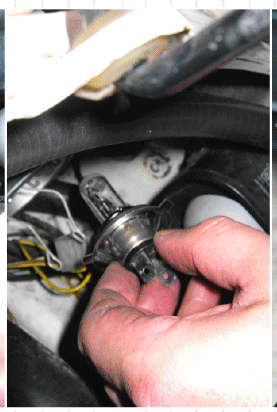
At the moment, a headlight can pass an MoT if it is fitted with an aftermarket HID kit. If the light is a suitable colour, well shaped, correctly aimed, and not over-bright, an MoT tester can accept it. The car does not conform to 'Motor Vehicle Construction and Use' legislation (naughty) but it can still pass an MoT.

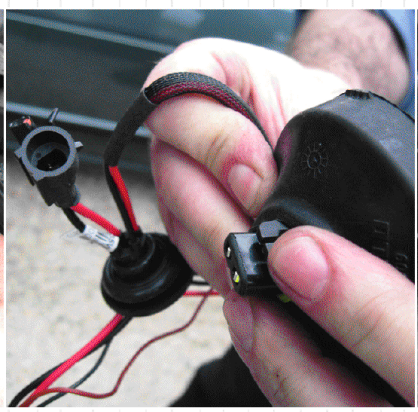
However, at the end of the year we are expecting the MoT test to change to specifically fail a vehicle fitted with an aftermarket HID kit, to take care of this anomaly. You might say that if a projector headlight is fitted with a 3000K HID kit it won't be easy for an MoT tester to spot that well-hidden ballast, but we couldn't possibly comment.

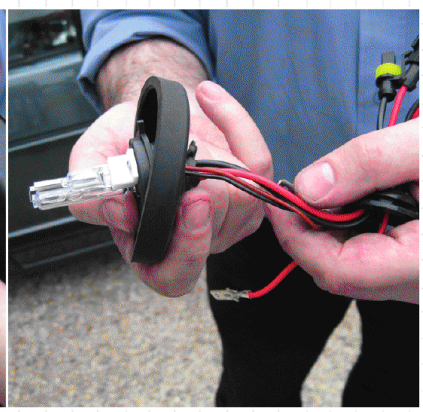



1) There are a wealth of xenon conversion kits available on the aftermarket scene. For the purposes of this guide we bagged a product manufactured by Ultra called the Virtual Daylight kit that retails for around £100 from most good stockists. Above right: HID bulbs are often visibly longer than the regular halogen bulbs









2) Removing splash guard and old bulb, new bulb and plug assembly is fed through. Given that most cars operate a kind of bayonet bulb fitting this aspect may require some ingenuity, and careful dismantling of the new wires and connectors in order to feed it all through successfully...

The approval outline for gas discharge headlights (HID xenons) says that they have to fulfil four criteria:

- The reflector and lens or projector has to be designed for use with that type of bulb.
- The headlight must have a washer or wash/wipe function fitted.
- There must be an auto-levelling mechanism.
- The dip beam light must stay on when full beam is enabled.

If you look at the photographs for the beam patterns, you can see that there is an obvious difference. The cut-off for a halogen dip beam (for a right-hand drive car) is shaped a little like a laid back 'L' – level to the front of the light with a triangle rising to the left – while the HID pattern has the top of the triangle levelled off. There might be some HID kits that can change the pattern of the light in which they are fitted, but we've never seen one… It's not just about the cut-off at the top of the beam pattern. You have to consider the light distribution under the cut-off and the range of the end result. Essentially, if you want to have an approved headlight that gives the correct pattern, you'll have to buy a whole suitable replacement unit. It's not an insoluble problem if you own a late BMW, but rather restrictive for older cars.

Should your car have been manufactured with a winter pack, that's the washer function sorted – unless you've a penchant for the smoothed look and it's all been taken off! It's not too hard to fit a headlight washer function, even for vehicles that were never supplied with one, but most people upgrading their headlights don't bother in spite of the regulation. The point is that as xenon lights are brighter, any beam deflection caused by dirt on a lens causes more of a problem for on-coming traffic. Having a washer or wiper function helps alleviate this.

OEM HID headlights generally have motors in them to adjust the vertical beam aim. These are driven by an electronic module which is associated with deflection sensors mounted on the front and rear suspension, and calculates the correct rake. Be careful with these sensors if your car is lowered as they can be damaged by being used over a different range of suspension deflection. Many cars fitted with this sort of self-levelling headlights lower and raise the lights' aim when they are turned on, to find the end-stop and prove the function is working properly. There is another approach that is acceptable, and that is to have suspension that automatically levels the whole car. Something as simple as self-levelling rear shock absorbers will do the job, you could fit air-ride with an active controller, or even a hydro-pneumatic system (like a Citroën CX) and use it to keep the car level.

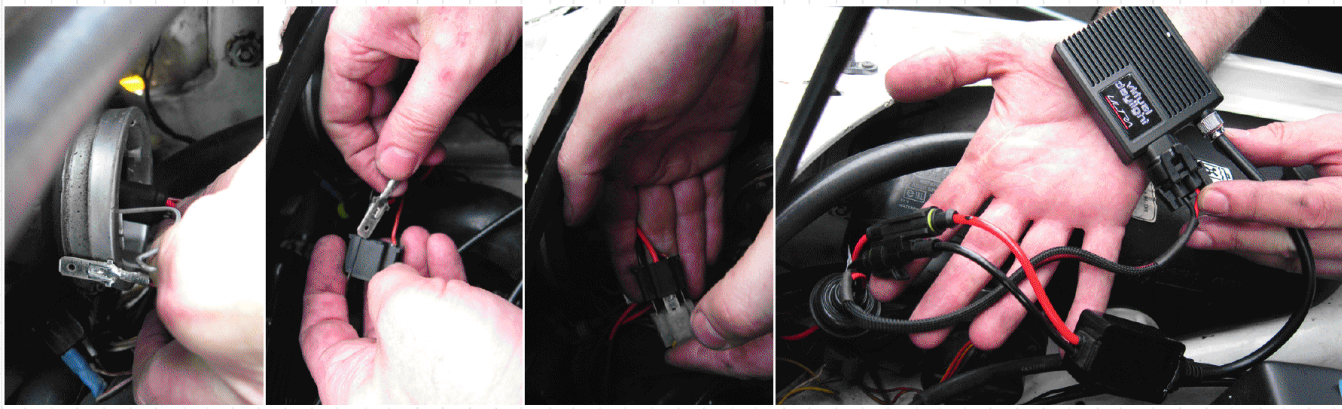
Finally, the dip beam needs to stay on when using full beam. Many OEM H4 headlights are wired so that when the full beam filament is turned on, the dip beam is turned off, and this can lead to a lack of light immediately in front of the car with an HID conversion.

## Beam pattern problems with H4 bulbs

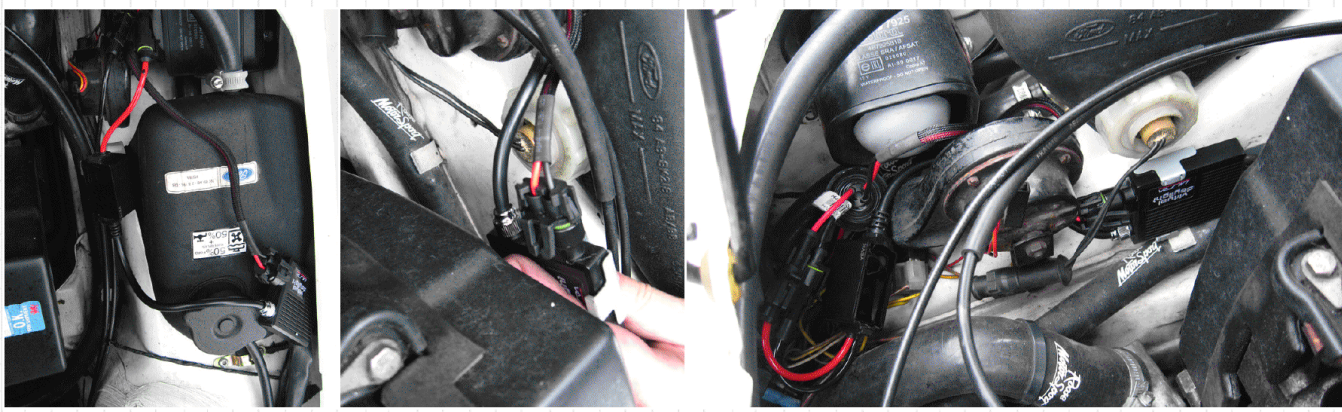
It's easy to assume that the bulb you have chosen will give a well-shaped beam pattern in your car, and this is generally true for single-function bulbs. However, lamps that take an H4 bulb need to be able to give both a dip and main beam pattern.

There are three types of aftermarket H4 HID bulbs. The kit shown with the Escort has an arc for the dip beam, and a halogen bulb for the main beam. Another type has only a single arc, thus requiring only one ballast. These bulbs have an electromagnet to move the arc position when the selection changes from dip to main beam. The final type has two arcs in two sub-bulbs. These require two ballasts per bulb, and the kits are inevitably more expensive.

Many of these kits come with an extra wiring loom and a relay block. These are powered through a new fuse directly from the battery, with the relay block being triggered by a connection to only one of the original headlights. There are two ways to wire an OEM



3) The most important thing to remember is not to handle the bulb itself, which again can make the process slightly tricky. Re-assembling the wires and connectors back together once the new bulb is in place, it's time to move onto the ballast box and the rest of the setup...



4) With changes in law due on the horizon, the location of your ballast box(es) could be vital to ensuring an MoT pass, but you'll also want to keep the installation looking as OEM as possible and tuck any wiring and electronics out of harm's way in your engine bay

H4 headlight – with a common ground (VAG, Ford) or with a common supply (Toyota). The ballast is polarised (must be connected the right way round), and the HID manufacturers use the relay block as a solution to avoid people from choosing the wrong style of H4 kit and blowing it up. Personally we think that there is a better way of doing it; we would discard the loom and relay block in favour of our own OEM+ wiring. With common supply bulb wiring, you may find that the full beam indicator on the instrument panel doesn't light after the HID system has been installed. If this is the case, the simplest solution is to add a constant-current drain to ground on the dip beam circuit (200mA should be sufficient), as this provides the negative path for the blue light.

Some H4 HID conversions can be a bit less effective in particular vehicles, for example, a magnetically adjusted bulb in a Toyota MR2 Roadster. Well, it'll be a retro car in a decade or so… The dip beam pattern looks absolutely wonderful, but when the bulb moves to the full beam position, all the light moves up. Although you can see things at distance, there is no light on the road immediately in front of the car – it's like looking at the world through a letterbox.

One alternative is to fit a kit with a dual arc bulb, and rewire the car so that the dip beam ballast stays on when full beam is selected. The same car has a different problem with this type of bulb in that the arc for the dip function is now in a less than perfect place. This leads to uneven dip beam light distribution on the road and a complete disaster during the MoT test. If you look at the picture of the dual arc bulb next to the halogen, it's clear just how far the arcs are from the filament locations. Another option might be to fit front foglights (standard on the later cars) and have these turn on with the full beam to fill in the darkness immediately in front of the car, but that would take some explaining if anybody ever investigated!

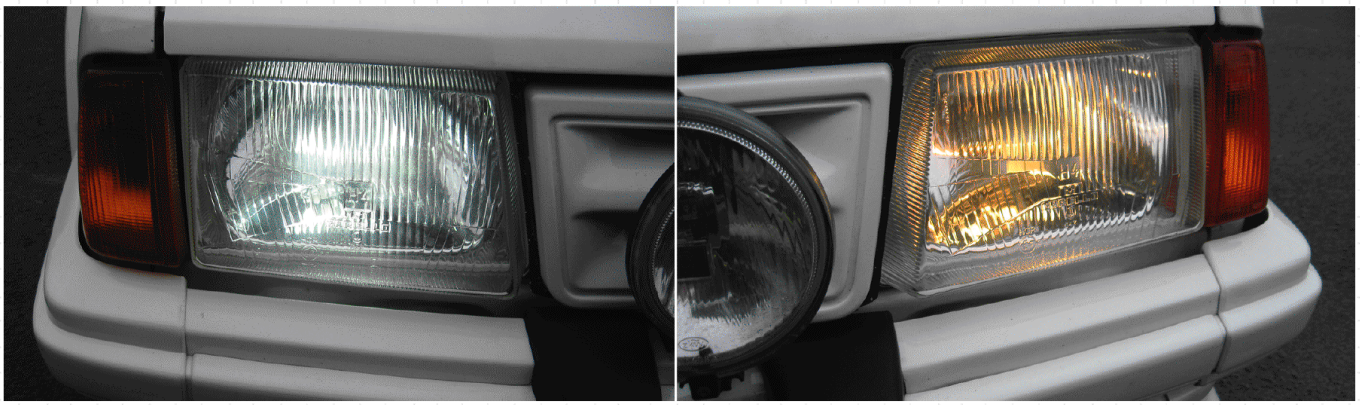
Any type of bulb might work to your satisfaction in your own car, but you still have to consider whether it will pass muster when it's checked officially. Even the most basic tests show the limitations of this installation!

## Conclusion

So, with the powers-that-be becoming less tolerant of aftermarket HID kits, are they worth the potential trouble of fitting them? They are a definite improvement over halogen bulbs if you're driving the vehicle, but if you only ever use your car on the road the law says that you shouldn't fit them, and it looks as though they are going to become rather more insistent on the subject. Fitting OEM xenon headlights is quite an undertaking, and isn't even an option for the majority of cars featured in *Retro Cars*.

If your car was factory fitted with HID lights, you might find that an aftermarket kit could be used to replace an original blown bulb or ballast. All of the legal requirements should have been met, and a whole kit is likely to be less expensive than a single bulb from a dealership.

You could argue a case for fitting a kit for cosmetic reasons if your car is on a stand at a show, although perhaps a filament bulb with a whiter light would do a good enough job for a fraction of the money. When you're in the campsite the night before the show, it's obviously vital to be able to count the whiskers on a rabbit at 300 yards, and as the car is not on the road an aftermarket HID kit is not illegal. Just remember that the kits are as easy to dismount as fit, and you should refit bulbs appropriate for the headlights for whenever the car is on the road



Above: Here you can easily spot the difference between the old lighting and new. The higher the Kelvin rating of the bulb the more purple the light will look. OEM kits run to around 4000K, most aftermarket kits are rated at 6000K (as seen here) or 9000K, some are more still but all have an impact on the kind of light you're generating


We parked the car up against the workshop roller door to get a good idea of alignment and beam pattern. This is one of the most important parts of the conversion, a badly aligned bulb will cost you at the MoT station…