IRONMAN HILUX
- Custom shocks and springs explained
- The devil's in the detail
- More than just suspension

Spruce 'n BOOST

Aftermarket firm Ironman shows Overlander 4WD the ins and outs of upgrading a HiLux to make it even more Outback-ready.

Toyota's HiLux is as popular as ever and as a result there's plenty of aftermarket accessories. But there's a story behind how those accessories are developed, and to find out more *Overlander* spent a day in the bush with Ironman and its 2006, V6 HiLux.

Fitted to the truck are the usual suspects; a steel, airbag-compatible winch bar, snorkel, dual battery system, Icom UHF radio, canopy and of course Ironman's replacement suspension. The 9500lb winch is of particular interest as it can be remotely controlled. Before we used it I thought that the remote was a gimmick, but in the field I changed my mind, especially as the entire winch kit is only $799.

In almost all winch situations the guy who should control the winch is the one outside the vehicle as that's where you can see what's going on, and using the remote beats shouting or radioing the driver instructions. Of course, the driver and winchman still need to work closely as a pair but this little gadget can save time and effort during winching and that's what you want on a hot day, scrabbling up a steep hill trying to find a tree to winch from. We liked the belt clip, which stayed on even when we didn't stay upright.

The remote also means the control box can be mounted in the engine bay, but as the remote isn't bombproof it would be wise to also wire in a dash and/or bullbar mounted switch in the event it is lost or damaged, or just use the supplied control box lead. We range-tested the remote and it worked far beyond its rated range of 60m, even from behind the truck.

The winch itself is one of the Chinese-made copies of a

popular brand, but Ironman has made many changes to the design such as upgrading the motor, waterproof bearings and control box, hardened gears and various mods for heat resistance such as uprated grease, end caps and wiring.

Winches are wonderful, but Ironman's speciality is suspension and that means they are well qualified to explain just how shocks and springs are made, especially as they have their own production lines. After deciding to bring out a replacement kit for a vehicle the standard suspension is assessed, and then decisions made as to the lift height and shock absorber rates. Whether a coil spring is made progressive or linear depends on what the manufacturer has originally specified for the vehicle. Ironman typically brings out a range of spring rates from A to E, with A being the softest and E being only for 79-Series mining utes.

Most 4WDers will go for the B and C springs which are designed for a slight lift and a heavier load than standard. The lift can come from a taller spring, but also from a stiffer one. In fact, some lifted coils are the same height or even slightly shorter than stock because a thicker diameter bar is used, anything from 1 to 5mm thicker depending on the application. The other factor is the number of turns in the coil; the more turns, the softer the coil for a given height.

To create the coil the bar is first cut to length, and then the diameter is checked to ensure it's within the +/- 0.2 mm tolerance. It's important that a coil spring has a consistent diameter, as otherwise the coil will bend around the thinnest parts, which are then likely to break, and that also means the coil won't compress and rebound as designed.

If the bar diameter is 18mm or less the coil is cold-wound – bent by a special machine into shape. Greater than 18mm and it's hot-wound at a temperate of about 850°C. Cold-winding is preferable as the fewer times a metal is heated the less strength it loses. The top and bottom parts of the coil are also flattened to form a base for a secure fitting, and to allow the slight rotation of the coil when it is compressed.

The coil is now checked for height, which has to be within +/- 3mm. Then any changes are made for handedness; many vehicles don't have an even weight distribution left/right and so the springs are often slightly taller on one side.

At this stage the coil is not a spring – if it was compressed it would stay compressed. To convert it to a spring it is heat-treated by heating it to about 500°C, and quenching it in oil. This gives the coil a memory, and it's now a spring, but not one ready for vehicle use.

When a coil is compressed the surface of the coil is placed under tension. This stresses the metal, and that can lead to fatigue. To relieve the tension the coil is shot-peened, which is a process of firing thousands of tiny little balls at the coil. The balls are less than 1mm in diameter and the indentations they make expand the surface of the coil, relieving the tension that would otherwise be there when it compresses and expands.

The coil is now ready for scragging, which is an over-compression to metal-on-metal, a situation the coil will never reach in practice because the bumpstops prevent it. Scragging removes 'set', which is the length change caused by a compression beyond the elastic limit of the material. Scragging is done three times to remove all the set.

The isolator switch for the winch is for safety and helps prevent vandalism.

1. Before…
2. and after.
3. Greaseable shackle with long nut to protect the nipple.
4. The corrugated metal is designed to collapse in the same way as the standard bar mount so the airbag deployment operation is unaffected.
5. A standard recovery kit bag should be high on a 4WDer's list of initial purchases.
6. A 'military wrap'.
7. The spring on the left side of the vehicle is fully compressed, on the right fully extended.

Then there are two load tests. The first places a pre-determined load on the coil and then its height is measured. The second compresses the coil to a given height and then the load required is measured.

Assuming the coil passes the tests it is then heated to around 80 degrees and powder coated. The coil is also electromagnetically charged to attract the powder particles. Finally, it's stamped with a part number and is then ready for fitting.

Much the same process is followed with the build of a leaf spring. The material is cut to strips of the correct length, but then the centrebolt is punched. The strips are then heat-bent, heat-treated to make it a spring and shot-peened on the inside of the curve. Leaves are made up of several distinct thin springs, so these are now all assembled into a pack with a centre bolt and clips. Then there's the three scrag tests, and the two load tests before a final spray with enamel paint.

The design of an aftermarket leaf spring differs from the OEM equipment. The replacement leaves are typically thinner, but there are more of them, for example the original set may have three leaves of 10mm thickness and the aftermarket five at 6mm. This means the spring is more progressive and less harsh.

The leaves in a leaf spring set naturally rub

Leaf springs rear and independent-front are never going to provide the ultimate in flex, so it's important to maximise what travel there is through low-friction leaves and careful choice of springs and shocks.

A small suspension lift also helps with clearance offroad.

against each other during compression and expansion, and this has some effect as a damper (shock absorber). For light-duty springs this action restricts spring movement, so for the A-rated springs Ironman inserts a small polyurethane shim on the tip of the leaves, where the inter-leaf load is greatest, so they can move more freely. The problem isn't as significant on the heavier-duty springs, but these are diamond-cut at the end. If the leaf was just cut off square that would, over time, stress the point at which the lower leaf meets an upper leaf. The diamond-cut spreads the stress and prolongs the leaf life.

Quality leaves shouldn't break, but if they do then a 'military wrap' is what you want. While the spring may be made up of several leaves, only one is actually joined to the chassis. If that breaks, there's a problem. Ironman applies a military wrap to the leaf below the top leaf so it loops around the top of the chassis pin. If the top leaf breaks, the next one down hangs on the pin. Not good, but better than a total collapse.

Another leaf-spring improvement is the shackles, which join the leaves to the chassis at the rear of the vehicle. As a leaf compresses, it must straighten and a shackle allows it to straighten. OEM shackles typically use rubber bushes, but there's a lot of friction between the rubber and the metal. Ironman uses polyurethane bushes, which rotate smoothly and permit the shackle to move far more freely, which in turn allows the spring to work more effectively. However, poly bushes require greasing and to that effect the Ironman shackles have greaseable nipples that are protected against damage by long nuts. It's the little details like these that are the mark of the quality aftermarket supplier, and it's those same details that are worth paying for when you're out in the bush, where quality matters. OL