HEAVY METAL

High-strength and abrasion-resistant (AR) steel alloys are becoming commonplace in tipper body manufacture. What does this mean for durability, and will they replace aluminium in tipper bodies, asks Toby Clark

SSAB (Swedish Steel) has done a terrific job of marketing its speciality steels such as Hardox and Domex; these have almost become generic names for abrasion-resistant and high-strength steel alloys. But other manufacturers also produce 'high-yield' steel alloys with similar properties to Domex, covered by standard BS EN 10149-2:2013 'Hot rolled flat products made of high yield strength steels for cold forming'. This defines a variety of alloys in terms of their yield strength (see box), ranging from S315MC (yield strength 315MPa) to S960MC (960MPa).

Abrasion-resistant or AR steels, also known as wear plate, are also available from suppliers such as Tata Steels (with Valast 450) and Voestalpine (Durostat 450). There is considerable variety in this category, with SSAB alone producing at least ten different grades of Hardox: the very hardest is Hardox Extreme, which has a hardness of 57-63 on the Rockwell scale, about the same as a chisel! Other grades include acid-resistant and high-temperature types, which do not lose their wear-resistant properties even operating at 300-500°C.

Andy Noble, co-managing director of Boweld Truck Bodies, says: "The tipper market has gone very Hardox-led. Customers seem to request this as the main requirement, so I would suggest that 85% is now 450HB material. We use the high-strength steel for the back posts, mudguard hangers and V Runners; basically, where you need a more malleable steel." (A Boweld Taperlite SD body is pictured at right).

Steel remains vital for Thompsons (UK) tipper bodies, reports Scott Burton, joint managing director. Although it also produces aluminium tipper bodies, its best-known product is the Loadmaster, a steel body optimised for heavy-duty shifting – 'muck and bullets', as Burton puts it. He continues: "Aluminium makes up only about 5% of our business. That's down to the market we represent. But today you can build a steel body that's far more durable than an ally body and the weight difference is not that bad.

"On the floor [AR steels] give nearly three times the impact- and abrasion-resistance of mild steel [pictured below]. An aluminium body would generally be used by somebody carrying stone or coated material, or sand or soil."

Aluminium is often used where the body needs insulation (carrying tar, for instance, as shown above in a Thompsons body), which increases the weight. "You can make an aluminium body very strong, but you've got to use a good grade of alloy and a good thickness on the floor. This puts the weight up, reduces payload

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Scott Burton

and increases cost." That is why manufacturers are using 'composite' construction, with an aluminium structure and steel wear plate on vulnerable areas such as the floor.

Burton says that a lot of imported granite is particularly hard: "it would rip through an ally body very quickly."

However, Jamie Boyce, sales manager for Wilcox Commercial Vehicles, states: "Most customers don't realise that they don't need a steel body." He points out that most tar tippers might run one load of asphalt and 6-7 loads of aggregate each day – and an all-aluminium body is fine for that. "We've been converting a lot of customers from steel to aluminium," he says. Its standard body uses a 10mm floor and 4.8mm sides, with double layers on some areas (pictured, far bottom left).

"If you're doing a lot of concrete or muckaway work then you do need a steel body," says Boyce (and Wilcox makes those, too) but aluminium does not need paint and there is still a weight saving of 750-1,000kg: with over 20 tonnes of payload, the £1,000-£1,500 price premium over steel seems reasonable.

Aluminium has typically provided a challenge to welders, particularly on the scale of a tipper body: both MIG and TIG welding are possible, but the excellent heat conductivity of the material makes it tricky to maintain the correct temperature.

On the other hand, high-strength alloy steels have their own difficulties: if they are overheated, they can lose much of their additional strength, and they may require the use of specialist shielding gases. Rather than MIG (metal inert gas), a similar process called MAG (metal active gas) is sometimes used.

High-yield and AR steels are, by definition, more difficult to form into the desired shape than standard structural steel: a 5mm-thick sheet of standard S355MC steel can be bent to an inside radius of 2.5mm (0.5t , where t is thickness), whereas a similar sheet of S700MC can only be bent to 10mm (2.0t). Andy Noble of Boweld says, "Although you can bend the 450HB you have to be careful with the radius, as it can get brittle." But bodybuilding using specialist steels has become much easier with the advent of precision techniques such as laser and water jet cutting.

"There is a myriad of materials in steel or aluminium," says Scott Burton of Thompsons, "and the more superior the material the higher the cost. It is vital to help the customer understand what they really want." TE

TENSILE STRENGTH, YIELD STRENGTH AND HARDNESS EXPLAINER

Although 'high-tensile' is a shorthand for extra-strong materials, tensile strength is not usually the most important property of the steel or aluminium used in tipper bodies.

Ultimate tensile strength (UTS) represents the point at which a material breaks catastrophically under tension, and is measured in N/mm² or the equivalent MegaPascals (MPa). A typical low-carbon structural steel might have a tensile strength of 400-500MPa while 5454 aluminium alloy has a UTS of 250-305MPa (but a density of around a third of steel).

Yield strength is the point at which the material undergoes plastic deformation (an irreversible stretching, compression or bending), usually defined as the point of a 0.2% change in length. This figure is always lower than UTS – low-carbon steel has a yield strength of about 250-300MPa – and is often more relevant when specifying materials. Steels are often described in terms of 'toughness' – defined in whatever way suits the manufacturer – but this usually relates closely to yield strength.

'High-yield' steel alloys (such as SSAB's Domex, Arcelor Mittal's Amstrong or Tata's Ympress) have a much higher yield strength but not necessarily a sky-high UTS: S700MC (as defined by BS EN 10149-2:2013) has a yield strength of 700MPa, but the UTS is around 790-900MPa.

Wear-resistant steels such as Hardox are also rated in terms of Brinell hardness (450HB being typical); 5454 aluminium, by contrast, is about 74HB. Hardness can relate to 'toughness' in that a harder material can deflect some of the energy of an angled impact, making it less likely that a component will deform or fail, but a thicker section of aluminium offers some structural advantages.