

TAKING THE PLUNGE



Article & Photo's
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One of the latest pieces of technology to reach the Australian Off Road Racing scene is the Plunging Axle setup on the Porter Pro Class buggy of Matt Hanson's Start Me Up Racing. Sean McTigue investigates...

Whilst not a new concept in motor vehicle designs, the plunging axle has only recently been used in off road racing. Developed by McKenzie's Performance Products in conjunction with Engineering Innovations in the USA, this concept allows more power to be put safely through the drive shafts. Plus greater suspension travel through the increased angle that the shaft/CV can run at. The traditional fixed length drive shaft, or axle, running

through a CV joint has been a limiting factor in the design and performance of the latest high-tech buggies for some time.

A fixed length axle limits suspension travel. The suspension can only travel so far before the angles between the shaft and its CV joints become too extreme. This has meant that suspension has been limited to approximately 21" (~530mm) of travel.

An axle's weakest point is its spline and forcing it to slide through the splined star of the CV greatly increases wear at its weakest point, making it failure prone. Another side effect of the axle sliding through the star of the CV joint is that a substantial amount of extra heat is generated, and when this is combined with high power and torque, it often leads to the axle binding, or welding itself to the CV joint. This results in either a broken axle



The length of the overall plunging axle assembly can change by up to 175mm

or CV joint, or both. Not only does this put an end to the days racing, but it also becomes very expensive to replace. The plunging axle is made up of five main components. These are the stub axle (1), tripod housing (2), tripod (3), axle guide assembly (4) and axle (5).

In the setup used by Start Me Up Racing, the team are using a CV that has been sourced from an independent supplier after much research and testing. The specifications of this item are kept a tightly guarded secret by the team, for obvious reasons.

The stub axle is made from 300M chrome moly, and hours of research were poured in to determining the correct radiuses and thickness to ensure maximum strength. As the stub axle does not float, clips are used on both sides of the spline to retain the axle in the CV.

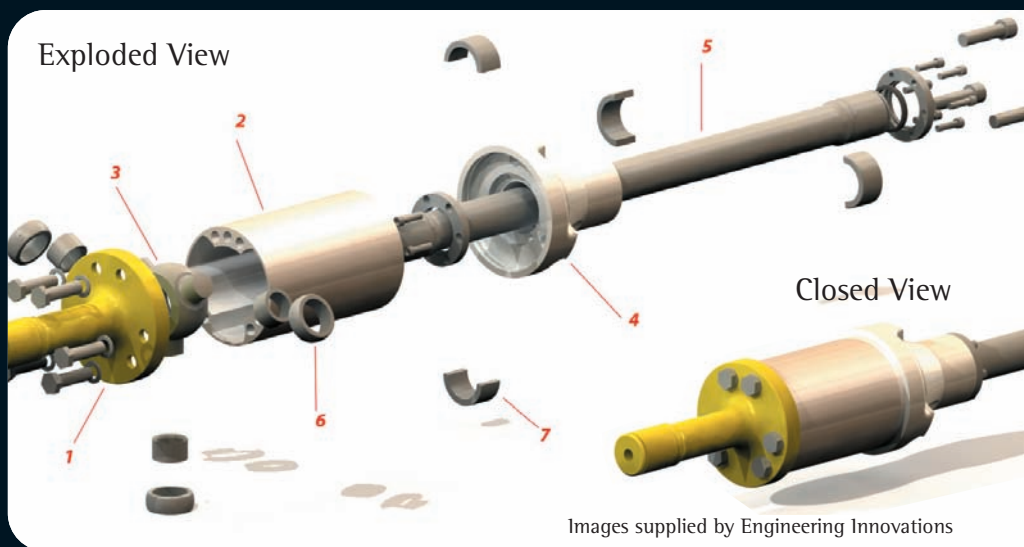
The tripod housing is probably the most visible part of this system. It has “channels” inside that keep the tripod in place as it moves through the housing, allowing the length of the overall assembly to change by up to 175mm (approximately 7”). Once again, this part is made of 300M, and when in use it also holds the all important lubricating grease that allows the system to keep working in even the harshest of conditions. The grease used is a special formula chosen by the designers after countless hours of experimentation. More 300M is used to manufacture the tripod. The tripod’s splines mated to those on the axle and allow the transfer of power

through to the rear wheels. The tripod is held in place on the axle shaft by two retaining clips, and rollers (6) on the end of each “leg “of the tripod allow the unit to glide smoothly through the tripod housing.

The axle guide assembly is mounted to the other end of the tripod housing, and is in place simply to keep the axle shaft in position as it glides in and out of the tripod housing. Brass bushings (7) are used to

ensure that this task is taken care of, and they also prevent any foreign material from entering the unit.

The final component of the unit is the axle. As with most of the other components, 300M is used. It goes through a number of very specific processes to create the finished product (these include heat treating, etc). The axle is gundrilled, which has a very limited impact on the overall strength while making a substantial weight saving.



Images supplied by Engineering Innovations

What has lead Start Me Up Racing to introduce the Plunging Drive Shaft to Australia? A mixture of extreme power and torque coupled with the tough terrain encountered whilst racing proved to be too much for the traditional drive shaft and CV setup to cope with.

When Matt Hanson was looking to upgrade from his Australian Championship winning Super 1650 buggy to join the Pro Class

ranks, he wanted something a bit different to the other new vehicles that were hitting the track around that time. Matt's chassis of choice was the Porter PRC-1 and he decided on King shock absorbers all round to keep the suspension under control. An Albins Off Road Gear 6-Speed sequential gearbox was chosen, and an all alloy, naturally aspirated BMW 5.0 litre V10 engine was sourced to provide the power. Sticking

to his formula of wanting something a little different, Matt chose the BMW engine after being very impressed by the same engine in his road-going M6 Coupe. In what is believed to be a world first, the Start Me Up Racing V10 is the first engine of its type in the world to be installed in a non-BMW vehicle. The BMW engine has impeccable credentials, having being awarded World Engine of The Year a record four times. In





(Left) A combination of King Bypass and coilovers manage the Porters suspension travel. (Above) A pair of Motec ECU's run the BMW V10, feeding to info direct to the digital dash mounted amidst a sea of carbon fibre.



road going form, the engine has some impressive statistics, and while Start Me Up Racing have done only limited modifications to install the V10 in the back of the Porter, it is safe to say that these figures are most likely exceeded. Maximum power is a very healthy 373 kW (507 Hp) and torque is a staggering 520 nM.

The engine is also one of the most technically advanced in the world. Utilising some of the most cutting edge technology in order to keep weight to a minimum and to ensure performance is more than adequate. Ten individual throttle bodies allow the engine

to breathe easily, and the lightweight valve train ensures that the approximate maximum of 8000 RPM is easily obtained. Debuting part way through the 2007 season, the team have struggled to get the car consistently to the finish line. Initial concerns with the handling were overcome, however the problems of overheating and binding CV's and snapped axles frustrated the team.

Various fixes were trialled, with limited success, and it was finally decided to upgrade the car to the plunging axle setup. This change required some reworking of the rear end of the Porter, which forced the team

to miss some races through 2008. After substantial testing through the off season, and more time spent fine-tuning the suspension setup, the team are now much more confident in the setup of the car. So far, 2009 hasn't been kind to the team, with a \$2 part failing at Hyden and a roll over at Finke. However when Matt and brother Sam returned to the track at the ARB Pines Enduro, the team put in a solid performance. Finishing just outside the top ten and giving the team some confidence that better days are ahead.