

► **The Control System**

Again we have to put ourselves in the position of the robot. What does it have to do and what does it need to know to do it? Gear changes are performed using hydraulic actuators on each end of the selector shaft so it is simply a matter of applying pressure at one end and releasing it at the other, or is it?

When we drive we monitor the pressure we apply on the gear lever to feel for synchronisation and adjust that pressure to prevent forcing the gear. The control unit does this by monitoring the speeds of the input shafts; it 'knows' synchronisation has occurred when the speed of the shaft is at right speed for that gear.

Remember, the selection process is a relaxed affair because it happens before engagement, which in turn should prolong the length of life of the synchromesh unit. Travel sensors on the selector shafts allow the TCU to learn the position of the selector forks. These positions change slightly as the gearbox wears.

The dual clutch consists of two hydraulically and individually controlled multi-plate clutch packs. To apply the clutch, oil is forced behind a plunger/piston which clamps the clutch plates much in the same way as a clutch pack

in a conventional automatic transmission. The pressure applied is monitored and controlled, depending on the torque the clutch is required to transmit. The timing of the clutch change over is critical if engine 'flare-up' or drag due to overlap of the clutches is to be avoided. This is done by closely monitoring the engine speed. Clutch control is a complex driving skill. A hill start, for instance, is a much more complicated affair than a gear change. The TCU has information from engine speed, output shaft speed and direction (to detect back slip) and throttle position. Through the CAN network it also knows longitudinal acceleration from the ESP system so it can fine tune a hill start.

This DCT is becoming the transmission of choice for many manufacturers, especially in their prestige and sports ranges. It offers a new level of drivability with lightening fast gear changes, yet it has the same, if not better, fuel consumption as a manual transmission.

■ Many thanks to Chris Longhurst www.carbibles.com for permission to use images and to Dan Isles of PSA Peugeot/Citroen for his valuable assistance.

The next article will look at the continuously Variable Transmission CVT.

Torque and the 'bouncing bomb' risk

With today's sophisticated vehicles, correct torque settings on wheel nuts play a vital part in maximising performance, but of overriding importance is safety, reports Philip Brodey, sales and marketing director of Norbar Torque Tools.



Norbar's TrukTorque pneumatic torque multiplier.

The road safety charity Brake characterises loose wheels from vehicles as 'bouncing bombs'. It is estimated that 'runaway' wheels kill 8-10 people and injure many more each year in the UK, with Brake citing the following tragedies:

- A pensioner from Rochford killed when a wheel came off a trailer and careered into her while she was walking her neighbour's dog.
- A woman killed on the M62 after a wheel from a trailer carrying a speedboat bounced across the carriageway and collided with her car.
- A van driver killed on the M2 in a multiple accident caused by a detached wheel from a truck.

Precise control of torque is therefore hugely important. And not just for safety: Both in production and maintenance, it improves performance, reduces costs and allows joints to be designed more efficiently.

So when it comes to maintenance, technicians not only need to be skilled but be able to prove through correct procedures and documentation that a job has been carried out correctly. In any kind of product liability claim, it is not sufficient simply to state that you have faith in a worker's capabilities and experience.

The fatality mentioned earlier caused by a detached wheel from a truck underscores the need for accurate torque in commercial vehicle workshops, where recently there has been an increased use of torque multipliers in preference to traditional impact wrenches. Using impact wrenches requires torque to be checked using a torque wrench and frequently nuts may be over-tightened. A pneumatic torque multiplier undertakes accurate torque tightening in a single process.

The use of torque tools can have other beneficial effects. Tests carried out by the Health & Safety Executive have demonstrated that vibration exposure for operators using pneumatic torque multipliers to tighten 100 commercial vehicle wheel nuts was 10 times lower than when impact wrenches are used.

A video on how to use a torque wrench can be found on the Norbar website at <http://www.norbar.com/products/videos-on-how-to-use-torque-instruments/how-to-use-a-torque-wrench.aspx>.

For further information about Norbar products and services, contact: Norbar Torque Tools Ltd, Beaumont Road, Banbury, Oxfordshire OX16 1XJ Tel. 01295 270333 sales@norbar.com

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