

DRIVEHEAD REVISED

DRIVELINE COMPONENT MANUFACTURER DANA IS MAKING BIG STRIDES IN INSTILLING ULTRA-DURABILITY INTO ITS AUSTRALIAN-SPEC HEAVY-DUTY TANDEM-AXLE DRIVEHEADS. THIS IS LARGELY DUE TO THE RECENT DEVELOPMENT OF AN INNOVATIVE FORCE-FED LUBRICATION SYSTEM.

The trucking industry is such a competitive industry that operators simply cannot afford not to get the maximum mileage out of each and every component. Durability remains the key aspirational goal in which to measure product for heavy duty application. Dana is well aware of this and also the fact that Australian operating conditions are much tougher than other parts of the world. As a result, the company has worked tirelessly to develop ways to improve durability under the harshest conditions. The BD70 SLS (B-Double 70T self-lubricating system), a force-fed lubrication system locally designed, is currently being developed for its Australian drivehead units. It's yet another important step in automotive product development that has been going on since the formative years of the

automobile in the late 19th and early 20th centuries, and a mammoth amount of technical development and progress has taken place. The crude and clunky designs of yesteryear were slowly but surely refined, culminating in the technically advanced masterpieces of engineering and design we are spoiled with today. Among the goals pushing development are improved safety and increased longevity of components, the latter being the driving force for much progress in metallurgical techniques and lubricant developments. One of the significant revolutions in car engine design early last century involved the introduction of force-fed lubrication where a pump pressurises and circulates the oil through a series of galleries within the crankcase, cylinder head and other components to ensure

the continuous and targeted application of the life-giving lubricant. Prior to this engine lubrication was achieved by a 'hit and miss' approach known as splash-feed and executed by dippers located on the crankshaft that dipped into the sump oil every revolution and flung it skywards in the hope that enough would rain down on the various components and seep in between the bearing surfaces to reduce metal-to-metal contact. Not surprisingly, engines of that era didn't have an overly-long life expectancy. Other vehicle components like transmissions and differentials have continued to be lubricated in a similar fashion, although the action of gears rotating in oil does a far better job of distributing the lubricant to where it's needed. While heavy-duty truck components like differentials and power

dividers continue to be successfully lubricated in this manner in many applications, manufacturers like Dana realise that heavy haulage under Australian operating conditions puts added stress on driveline components compared to Europe or North America. Factors like high gross combination masses, long hauls, relatively fast operating speeds and high ambient temperatures all conspire to put enormous pressure on these components and the oil protecting and lubricating them. In extreme circumstances this can result in life-to-overhaul intervals being reduced due to the inability of the oil to keep doing its job under

these conditions. The situation has been further exacerbated in recent times by downspeeding where taller final drive ratios are employed to reduce engine RPM at cruising speed in the quest for optimised fuel economy. This puts greater stresses on internal components like bearings and gears and shafts. In searching for a solution, it's possible the driveline engineers might have had a similar 'light-bulb' moment to their counterparts developing the early engines: 'We need to find a way to pressure-feed the oil directly to the critical bearing and gear surfaces...!' In Dana's case, the responsibility to develop this initiative fell to the company's Australian Engineering Manager, Tony Robinson. Tony is quick to point out that this is a product improvement program with the aim of increasing durability of the driveheads as operational demands increase. He says it's part of Dana's strategy to ensure its products have a minimum one-million plus kilometre first life. "This is a product improvement initiative that will ensure a longer service life for our driveheads, particularly under severe operating conditions," Tony

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Dana has developed a force-fed lubrication system for its tandem-axle BD70 SLS drivehead that is designed to considerably increase In-service life.

says. He then proceeds to outline a feature peculiar to Australian truck operation that puts subtle and recurring stress loading on the drivehead assembly of linehaul trucks. "In Australia trucks are road speed limited to 100km/h. So after a typical B-double on a linehaul journey reaches 100km/h the engine is constantly bumping the speed limiter which simultaneously reduces the power then reapplies it on an ongoing basis. Every time this happens it sends a very mild load through to the drivehead which over long periods can lead to wear in gears and bearings and shorten the unit's life," he says. "In the heavy haulage sector with gross combination masses (GCM) above 140 tonnes road speed is usually no higher than 85km/h so bumping the limiter isn't an issue but other wear factors due to the higher GCM come into play.

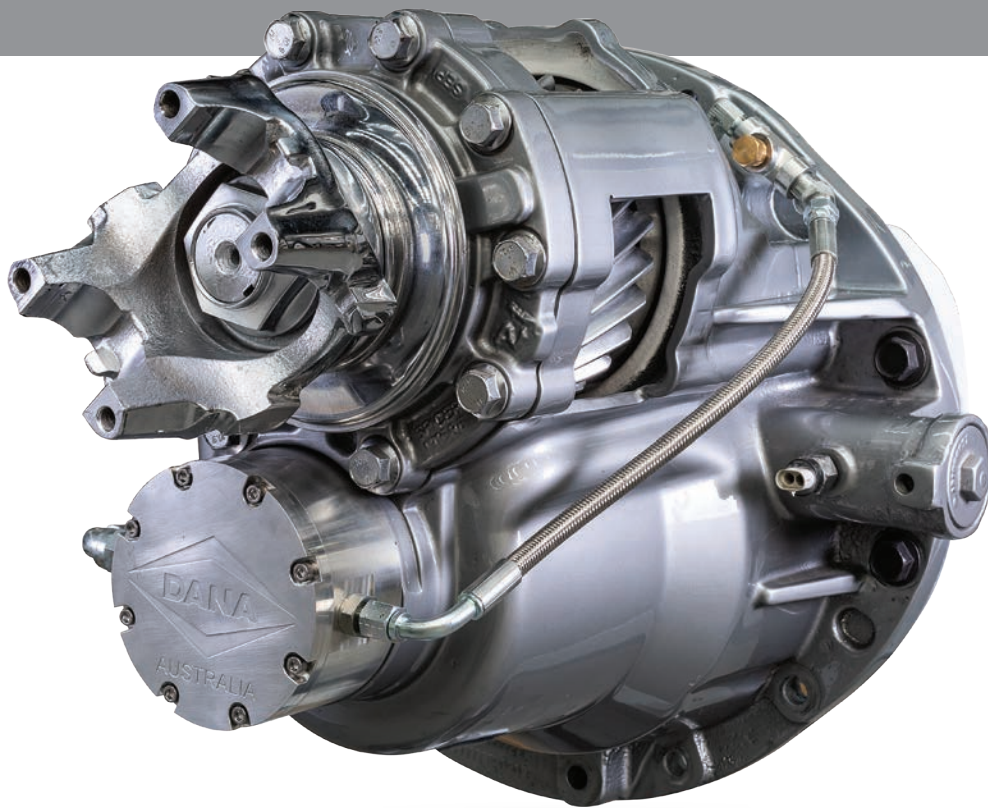
"So our focus was to address potential concerns with long-term durability of our products. We want to consistently achieve 1.2 million kilometres as the benchmark for life-to-overhaul of our driveheads. For this reason we started looking at what we could do to better lubricate the critical components inside the differential to minimise wear caused by the various stresses and enhance long term durability." Tony explains that one of the critical systems of the drivehead is the power divider unit (PDU) which transfers drive through the forward drivehead to the input of the rear diff. This complex transference of torque is achieved by an interaxle differential on the front driveheads' input shaft to a helical cut gear set which by design is prone to wear due to the road speed governing if not well lubricated. This is one of the key areas where the force-fed lubrication system has improved longevity of its PDU system. Dana's BD70 tandem drivehead is commonly used in B-double prime movers with GCM ratings of up to 70 tonnes. According to Tony, this is the product on which the force-fed lubrication system is being trialled. He says there are currently 20 trucks fitted with the modified driveheads operating across Australia in B-double applications. "We've been trialling the system for nearly two years and the results have been very

positive," Tony says. "Our earliest units have done 450,000km and we've disassembled a couple and found negligible wear in the critical areas." One of the issues with differentials operating under extreme conditions such as linehaul B-double work is heat build-up. With the relatively small amount of oil contained within the diff housing and limited heat transfer from the housing, diff oil temperatures can reach as high as 130 °C degrees in high ambient temps. Over prolonged periods this can degrade the oil and also lead to inadequate lubrication for the vital parts due to thinning of the oil. According to Tony, the pressure-fed lubricated driveheads are generally running up to 15 degrees Celsius cooler than conventional units under similar operating conditions. "We're seeing the improved thermal efficiency due to the fact that we're running oil lines external of the carrier," he says. "This potentially could provide the benefit of improved oil durability." Another benefit of the design is that the pump draws the oil through a 40-micron stainless steel gauze filter which is easily removed and cleaned when changing the oil. This type of filtration is not possible with a conventional splash-fed differential. Tony says the simplicity of design was an

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Australia has much harsher operating conditions than Europe and North America. This is the reason why Dana Australia tailors its driveline products to suit the local environment.

important factor in developing the system which is solely for the Australian market. "We redesigned our existing carrier with the relevant porting and with provision to mount the pump, which is driven from the pinion nut," Tony says. "So as soon as the truck starts to move, oil is continually being pumped through the system," he says. "We've tried to be as innovative as we can with the design of the system because obviously with the relatively small Australian sales volumes we have to make it cost effective and viable." Summing up, Dana's pressure-fed lubrication of the drivehead is a great example of Aussie ingenuity coming to the fore in the quest for improved durability and long-term performance of the product. It demonstrates the desire of Dana to keep improving its products in line with the demands of an industry that operates on slim profit margins and needs its equipment to last as long as possible. PM



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