

Wombat lives up to its name!

HARDMETALS 



The Wombat Series 4 is state-of-the-art when it comes to hole-opening and reaming.

In the field of hole-opening and reaming, Hard Metals Australia's Wombat Series 4 has set new benchmarks since its introduction in 2012

The Series 4 is the culmination of seven years' research and development by Hard Metals Australia, based in Eastern Creek in western Sydney, NSW.

THE CHALLENGES

It all began when Hard Metals Australia entered the field of trenchless technology in 2007.

Hard Metal Australia's (HMAs) first hole-opener was a fixed-wing type similar to existing fabricated offerings in the market. The unit worked effectively and was successful in the market, however this type of design presented engineering problems with axial accuracy and radial run-out of the cutter segments.

A cost issue also arose when the hole-opener was being used for different size bores at a site, or when the worn cutters had to be replaced. The entire body had to be removed and sent to a specialised engineering facility for the cutter wings to be cut off and new ones welded on.



As a company that strives to exceed customers' expectations rather than merely meet them, Hard Metal Australia resolved to overcome these challenges to increase the rate of penetration (ROP) and reduce costs.

Hard Metals Australia's first fully fabricated hole-opener met the industry standard, but the company decided to overcome inherent design problems

INITIAL DEVELOPMENTS

The first step was to replace the fabricated cutter wings with ones that could be changed in the field. They were fitted to a standard body, similar to imported roller cone bodies.



The first development step was to use field-replaceable cutter wings.

The cutters were Polycrystalline Diamond Composite (PDC) rather than the tungsten carbide ones that were generally used for hole-opening and reaming though difficult strata at the time.

PDC is up to 30 times more durable than tungsten carbide but it isn't not as robust, making stability a key factor.

These early units were very successful in generating ROP rates and excellent bore quality on small diameters and over short distances. However, difficulties were encountered with bores over 33cm/13in. and reaming further than 200m/656ft.

Investigation revealed that the problem centred on the wing fasteners, so a stabilising ring was used to hold the wings together and thereby improve structural stability.

The next version incorporated a stabilisation ring to locate the cutter wings more securely.

The innovation was successful to the extent that in 2008 a successful 46cm/18in. ream was made off a 6.75 inch pilot bore over 530m/1739ft in a single pass. For the next two years, Hard Metal Australia's design became the trenchless technology industry standard.

Increasing the number of blades from three to six produced another major advance in ROP: a 61cm/24in. ream off a 24cm/9.5in. pilot over 500m/1640ft through competent sedimentary and broken rock in five days.

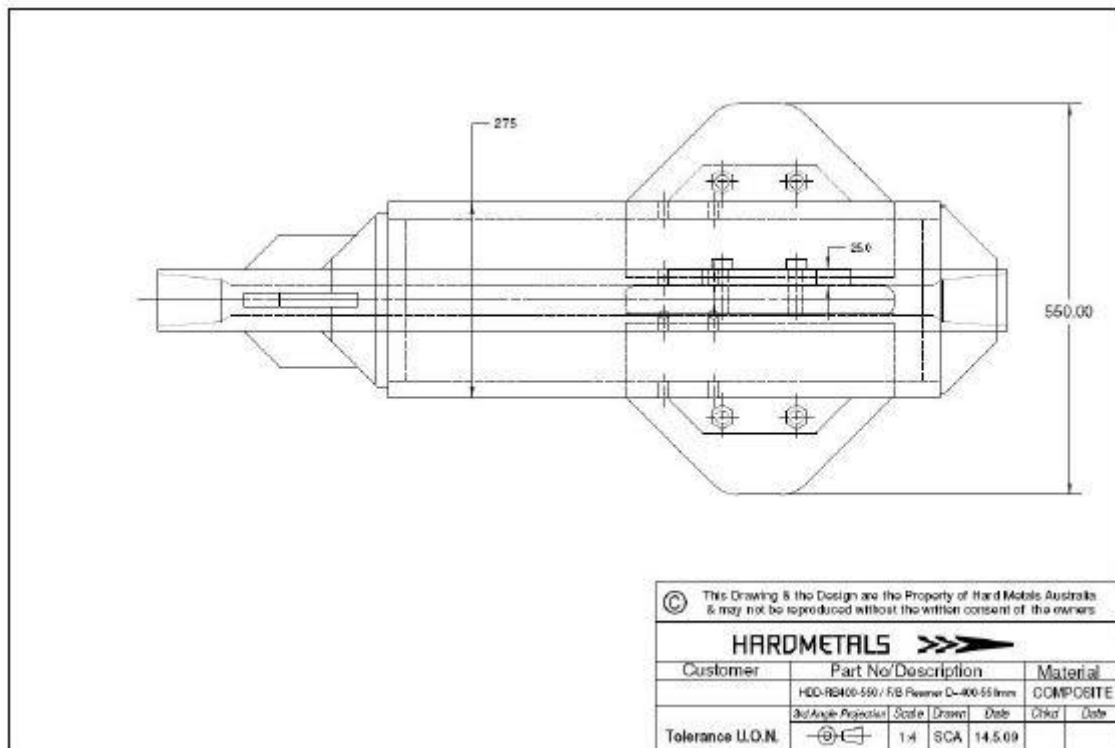


Further development increased the number of cutter blades from three to six.

While this unit ticked most the boxes, it still wasn't easy to service in the field. So Hard Metals Australia set about making more improvements – and the Wombat series was born!

A NEW BEGINNING

The Series 1 Wombat was a development of the previous roller cone body concept, featuring a revised system for the cutter wings for greater security. A larger diameter central body was used for stability instead of the previous stabilising ring.



Design drawing of the Wombat Series 1

While the Series 1 had advantages in heavy duty applications, on small machines with low torque and small diameter rods the unit's extra weight tended to make the rods 'wind up', causing it to whip.

The Series 3 was the next Wombat model to reach production (the Series 2 was an interim design exercise). Its major advance was to use two inline stabilisers ahead of and behind the reamer.

These allowed the body to have the sole purpose of carrying multiple cutter wings. The unit discarded the Series 1's excess weight, yet was more robust. In addition to delivering superior ROP, it was also easier to service in the field.

On one site, an extraordinary ROP of more than 30m/98ft per hour was achieved.



The Wombat Series 3 used a long body and separate inline stability rings.

SERIES 4 – THE LATEST GENERATION

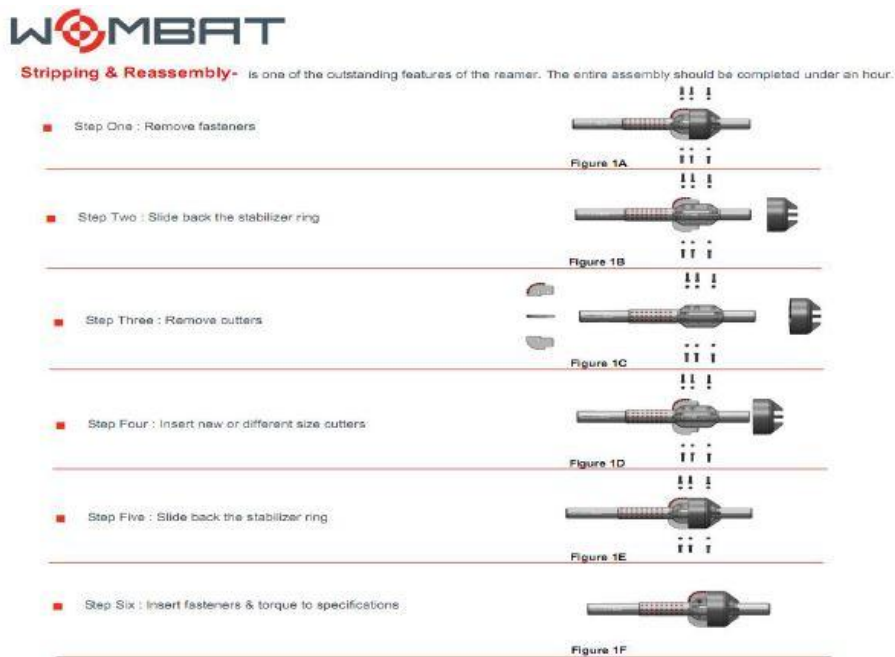
Despite the Series 3's advances, stabilisation still wasn't ideal, making the service life of the PDC cutters less than optimal.

Enter the Wombat Series 4 – the culmination of everything that Hard Metals Australia has learned from the first concept to the Series 3, with a quantum leap forward in performance.

It features several major improvements over the Series 3: near-face stability, an easily removable long body using conventional break-out jaws, large clearance paths to minimise clogging at high ROP, and forward and backward reaming capability.

The Series 4's brilliantly simple design incorporates stabilisation close to the face, making it possible to use long-life PDC cutters for strata that were previously out of the question, such as sandstone.

The cutters can be disassembled and reassembled in less than an hour!



The Wombat Series 4 can be disassembled and reassembled in less than an hour.

OUTSTANDING PERFORMANCE

Since its introduction in 2012, the Wombat Series 4 has proved to be an outstanding performer, as shown in the field trial results, below:

CASE STUDY 1

DATE: April 2012

LOCATION: NSW Central Coast, Australia

GEOLOGY: sandstone, 80MPa

DRILL: Vermeer D100 with 8.9cm/3.5in. x 6.1m/20ft Fire Stick rods

BORE LENGTH: 280m/918.4ft

PILOT (PDC bit on mud motor): 17.15cm/6.75in.

REAM 1 (Wombat Series 4 with PDC cutters): 45.72cm/18in.; ROP 20-30 min./rod

REAM 2 (Inrock Rock Roller with 4 cutters): 60.96cm/24in.; ROP 150-180min./rod

CASE STUDY 2

DATE: July 2013

LOCATION: Under Hawkesbury River at Cowan (outer northern Sydney), NSW, Australia

GEOLOGY: sandstone and ironstone

DRILL: Vermeer D100; 8.9cm/3.5in. x 6.1m/20ft Fire Stick rods

BORE LENGTH: 700m/2296ft

PILOT (PDC bit on mud motor): 17.15cm/6.75in.

REAM (Wombat Series 4 with tungsten carbide & PDC cutters): 22.86cm/9in. & 31.75cm/12.5in; Overall ROP 13 min./rod

DAMAGE & REPAIR COSTS: Wombat Series 4 – nil; pilot \$3060 (replacement of 31 damaged PDC inserts)

This was a particularly difficult project due to large cobblestones at the entry and exit points. Even though a casing had been installed, less durable but less costly tungsten carbide cutters were used for these sections, then replaced with PDC cutters for the mudstone and sandstone sections.



Less costly tungsten carbide cutters were sacrificed in the most difficult sections.

The cutters were replaced while the body was on the drill string in less than an hour, enabling pipe pull within two weeks of commencement.



The tungsten carbide cutters were replaced with PDC ones on site in less than an hour

CASE STUDY 3

DATE: April 2015

LOCATION: Galston, NSW, Australia

GEOLOGY: sandstone

DRILL: Vermeer D100/120 @ 28rpm; 8.9cm/3.5in. x 3m/10ft Fire Stick rods

BORE LENGTH: 630m/2066ft

PILOT (PDC bit on mud motor): 17.15cm/6.75in.

REAM 1 (Wombat Series 4 with PDC cutters): 26.67cm/10.5in.

ROP: 20-25 min./rod (average)



Galston NSW April 2015, 6-3/4" PDC pilot bore followed by the 10-1/2" Wombat 4S.

SUMMARY

These results disprove the long-held belief that PDC cutters are only suitable for soft sedimentary rock in trenchless drilling. PDC is now the first choice in oilfield and gas drilling through a wide range of strata.

The strategy that has led to this has been largely dependant on quantum leaps in stabilising the PDC at the drill bit rock interface.

While PDC is less impact resistant than conventional tungsten carbide cutters, PDC's capacity for wear resistance can exceed that of Tungsten by more than 30 times.

By creating a more stable environment at the cutting face, PDC's excellent wear characteristics can be exploited to the great benefit of the drilling operation.

Leading PDC bit manufacturers are aware of this, and much of their R&D focuses on this very subject.

Wombat Series 4 and its benefits:

- Near-face stabilisation – wear protection
- Quick-change replaceable PDC or tungsten carbide cutters – minimum downtime
- Flange-to-wing cutter locking system - stability
- Adjustable hole diameter by wing replacement - versatility
- Removable long body from drill string using conventional break-out jaws – easy accessibility
- Large clearance paths to reduce clogging at high ROP - durability
- Suitable for forward and backward reaming – flexibility

WORLD WIDE RECOGNITION

There has been a high level of interest in the Wombat worldwide. Recently the Wombat was displayed at No Dig Madrid 2014, Trenchless Middle East in Dubai 2015 and will be at Global Petroleum Show 2015, Aimex 2015, No Dig Dowunder 2015, Drillfest 2015, and Bauma Germany 2016.

BACKGROUND: HARD METALS AUSTRALIA

The Wombat hole-opener and reamer is one of a wide range of engineering products designed and manufactured by Hard Metals Australia.

Established in 1982 and located in Eastern Creek, western Sydney, in New South Wales, Hard Metals Australia has pioneered a number of developments in the drilling, mining, agricultural and construction industries.

One example was the use of tungsten carbide tips for agricultural ground-engaging tools during the 1980s and '90s. Today tungsten carbide is now the most popular material used for these purposes in the agricultural and drilling industry.

MORE INFORMATION

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