

## Making Big Pipes

In 1910, in Adelaide nearly a century ago, Walter and Ernest Hume set up the world's first concrete pipe spinning plant. Their quality was poor until they used wire reinforcement – an example of how the marriage of steel with concrete made the modern world possible. For another Australian contribution to this progress, download [The Rise and Rise of Concrete](#).

Humes still make **concrete pipes** by dropping concrete into horizontal spinning steel moulds presprayed with mould release agent (MRA). The mixture is then compacted and excess water is squeezed out by spinning at 600 rpm – 40 times the force of gravity. Then pipes are steam cured. The job for the MRA is to provide a lubricating waterproof layer between the concrete and its mould. That layer must stay intact from the time of pouring, through compaction, then through the curing process during which the concrete becomes sufficiently dry and rigid to stand alone without its mould.



Extreme forces of abrasion and friction are created between concrete and its mould when pipes are compacted. It seems impossible that an MRA can form and maintain a chemical membrane under these conditions, but premium grade oil-based MRAs had worked well in this environment for decades. So did the very first batch of water-based **Repel 54**. It didn't work the first time because the guys sprayed it on too thickly – it was the middle of winter and they had increased their spray pressure to cope with thicker oil, but **Repel** doesn't thicken in winter. Like Goldilocks, you need just enough, neither too much nor too little.

Broken sockets are the worst thing in concrete pipes, caused by failure of the MRA to release the cured pipe from its mould. The socket is critical because it fits over the back end of another pipe. This connection needs to be set and sealed to give reliable service for a century or more. The largest pipes, two metres or more across, are the most prone to failure of the MRA because the angle of curvature is much smaller than in smaller pipes. A tiny bit of shrinkage breaks the bond when making small pipes, but not nearly so well with big pipes.

**Repel** never failed to release sockets well on big and small pipes. All those in this picture are 2 metre Humes pipes made with **Repel 54**.

A disadvantage of the Humes process is that spinning puts most of the cement, aggregate and strength near the outer surface. The outsides of these pipes look perfect, but the functional part of the pipe is the inside surface where the concrete is weakest in cement. This tends to fret and decay. The **Rocla** spinning process is similar to that of Humes but rotation is slower. When the concrete pour is nearly complete and the spinning mixture is almost at full thickness, the exposed surface of the mixture meets a fast spinning horizontal roller set inside the mould near the top. This roller partly bears the weight of the spinning pipe, compacting all the concrete as it passes between the roller and the mould. Like the Humes process, this is labour intensive.

In 2000 Hunter Concrete commissioned an altogether different type of plant at Thornton near Newcastle – capital intensive but labour lean. This was Australia's first BiDi (bidirectional) pipe making plant, built by Besser Company, a century-old US manufacturer of concrete equipment. Hunter soon found that the forces during moulding are so extreme that all MRAs failed. Then they realized that they had bought an expensive machine whose manufacturer could not recommend to them any mould release which would allow the machine to perform as it was designed!

## ***Making Big Pipes - 2***

This BiDi plant is designed to compact freshly poured concrete by two different, simultaneously operating processes. Pipes are made vertically – poured, moulded and compacted by trowelling wet concrete against a vertical steel cylindrical mould set above a heavy steel ring which moulds the socket. At the same time, the ring, supporting the entire weight of the mould and concrete, is rotated by an underfloor machine, clockwise and anticlockwise, changing direction about every second. These forces acting together mould the barely wet concrete mixture into a rigid shape which stands erect as soon as the process is finished. The major improvement over spinning processes is that the pipe has uniform strength and durability inside and out.

On Besser's own admission, no MRA known to them could allow the ring to be oscillated to anywhere near the plant's design capacity. Hunter have a movie of MRAs under test being literally boiled out of the interface between the ring and the concrete because of the heat due to the extreme friction. The compromise, before **Repel**, was to lessen or even omit the gyration of the ring, relying on the inside trowelling motion to compact the pipe. But Hunter Concrete were not satisfied because the pipe exteriors looked awful – full of voids.

Worse, the sockets showed obvious voids and frequent damage. Voids were unsightly, always raising the question of the internal strength. Also, sockets commonly had chunks broken out of them because the MRA had failed to release the socket from its ring. The MRA had been destroyed, so the concrete bonded to the ring.

***Without a good MRA, the bond between steel and setting concrete is often greater than the concrete's own internal bonding.***

Hard to believe, but true. For a much bigger, more costly example go to [Quality Needs for Concrete Mould Release](#).

This was a double problem – both the socket and the ring had to be repaired. Sockets had to be manually made good. These repairs never looked as good as unbroken sockets, and were never as strong. And the company had to employ a worker full time power wire brushing rings after each moulding.

It was hard to sell these pipes to customers used to the perfect surfaces of spun pipes. Hunter's frustration was that these voids could have been obliterated by more aggressive compaction, but when they tried to do so, every MRA failed.

***Every MRA tried by Hunter Concrete before Repel, including samples supplied from the US by Besser, failed dismally when the compaction process was vigorous enough to stop formation of voids.***

***Repel solved their problem – the only MRA allowing Hunter Concrete to make what they confidently claim to be the world's best pipe sockets.***

That claim, which has grown their business substantially, is entirely due to their exclusive use of **Repel 64** continuously for the past seven years.

This ring of heavy steel which moulds the socket has several names – a ring, pallet, mould, or flange former. The foreman pictured is wiping the ring with **Repel 64** on a rag dipped into the cut-down cube behind him. The ring is then placed over the gyrating platform with the moulding cylinder positioned over it. The cylinder, which is virtually a hinged pair of butterfly doors, is opened and removed immediately after moulding, long before the concrete starts to dry and stick to every unprotected surface, so the ring is the only part of the BiDi plant which needs to be coated with MRA. By contrast, MRA is needed over the whole mould surface in the Humes and Rocla processes because the mould is needed to support the pipe until it is cured.



## Making Big Pipes - 3

The picture below left shows freshly moulded pipes, still supported on their socket moulds, starting to cure in the steaming room. The next image shows the forklift holding a cured pipe, raised slightly to extract its ring. After 3 hits from the guy on the left with with the copper mallet, the ring fell out. This turnaround between lifting the pipe to drop the ring and recoating the ring for the next moulding is typically 3 minutes.



**Repel 54 and Repel 64 are the only MRAs known to withstand the extreme aggression of this process while providing easy release of the ring after curing.**

Compare the processes using different release agents –

	Besser BiDi + standard MRA	Besser BiDi + Repel
pipe body	never look as good as spun pipes – more voids	excellent appearance without defects
socket	often damaged by chunks broken off due to poor release	no damage when applied correctly
ring/pallet/mould	labour-intensive cleaning job or expensive machining	flick of a rag, no more than 10 seconds
release time and effort	difficult, typically 5-10 minutes	usually easy, typically 0-10 seconds
ring turnaround time	45 minutes with special machine	3 minutes

The finished product –



**Performance of the mould release on the ring is a major factor affecting the profitability of the whole operation because it determines –**

- **the quality of the socket moulding,**
- **the ease of separation of the ring from the cured pipe,**
- **the turnaround time and cost of cleaning the ring, and**
- **the ability of the MRA to withstand oscillation of the mould enough to maximize compaction throughout the pipe.**