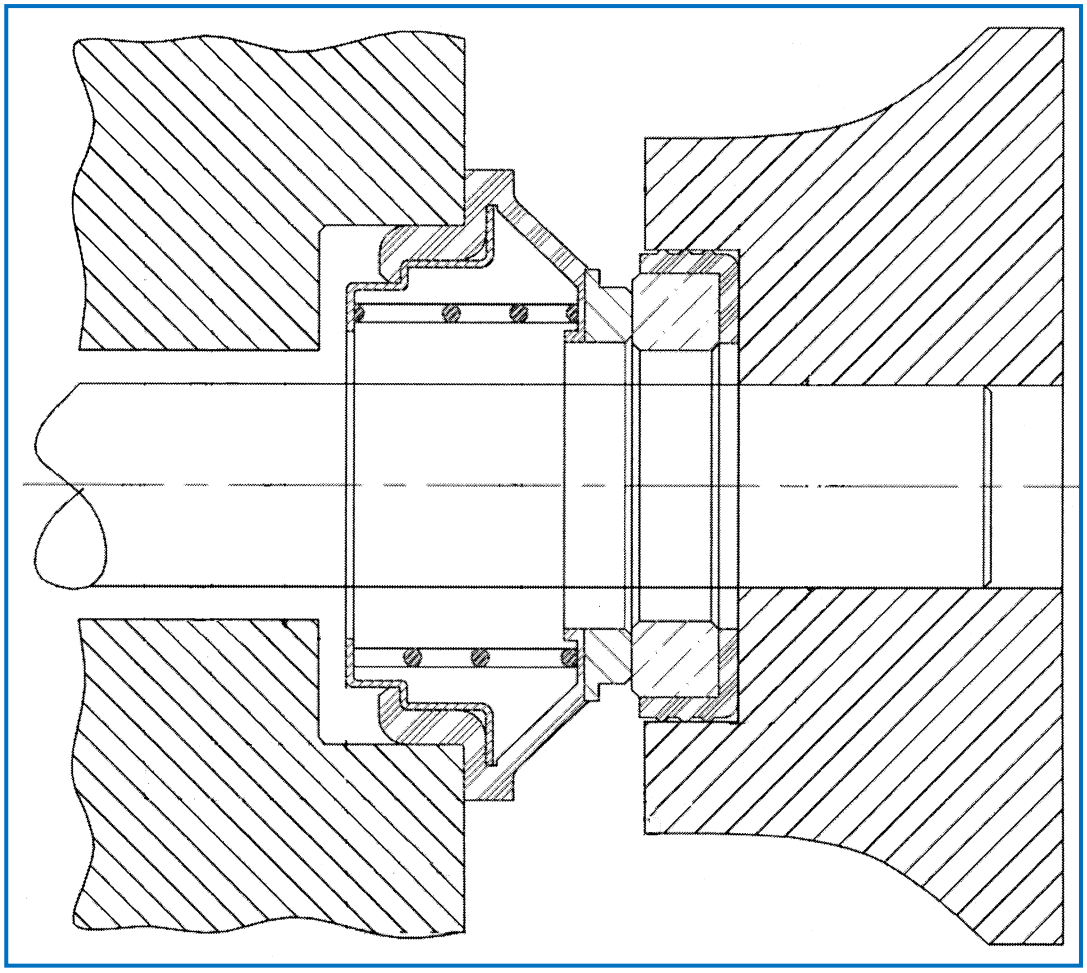
TECHNICAL NOTES SERIES

JOWETT JAVELIN – PA, PB, PC, PD & PE
JOWETT JUPITER – SA & SC



Above: A cross section of the mechanical seal installed in the front housing with the carbon face running against a ceramic ring – schematic only.

– PART XXI –

AVON WATER PUMP MECHANICAL SEALS

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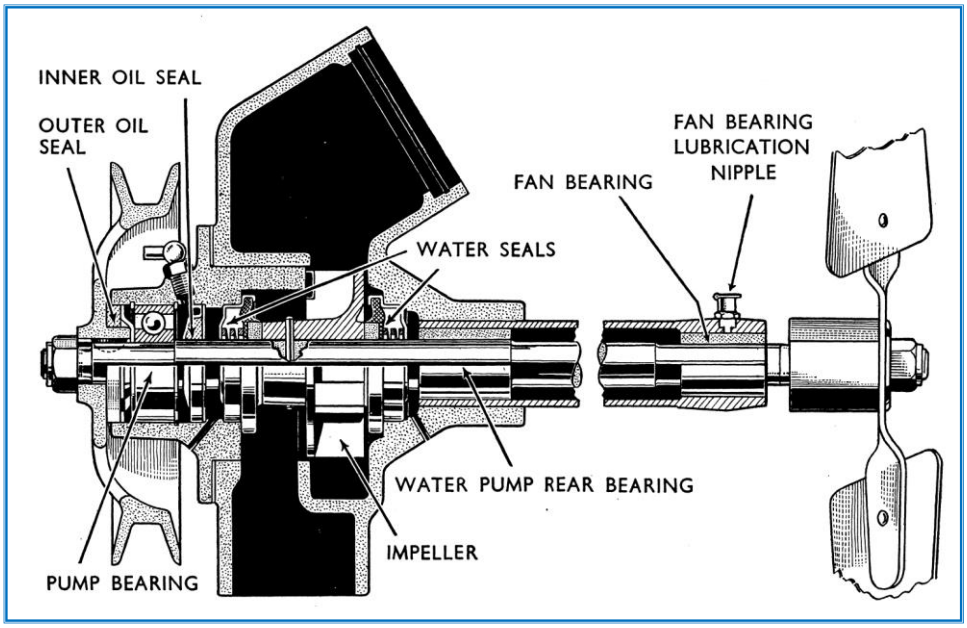
Compiled by Mike Allfrey – 12th November, 2015.
Revised – TBA

A MATTER OF IMPORT – A VIRTUAL NON-EVENT (Part 1.)

I have been asked to write in a non-technical manner about the water pump mechanical seal saga. This will be quite difficult in that our research into an alternative seal has been purely technical! As they always say, "You can't please them all, all of the time!" However, anyone contemplating work on a Jowett water pump, should have a basic understanding and also be aware of the amount of voluntary work put in by such members as Tony George, Brian Holmes, Tim Kelly, Peter Coakley and, to a certain extent, myself. It is also obvious that our Jupiter has a sixth sense, in that it waited for some decent quality mechanical seals to become available, before it decided to exhaust its front bearing's grease all over the front of a nice clean engine.

This episode has triggered a thorough overhaul, yet again, of the recalcitrant pump. However, before we discuss that matter, let's have a look at the mechanical seal situation. First a spot of history and then there will be a description of the pump's overhaul. The mechanical seals discussed here are those that are fitted to the front and rear of the pump's impeller. The seals stop the escape of coolant by having spring loaded carbon rings that, due to their matching faces permit the impeller to rotate and yet, in theory, keep the coolant in its proper place.

So, first up, a fairly technical drawing of the Jowett water pump assembly. The drawing contains several cross sections. But it best illustrates what is being discussed here. The pump shown here, taken from the Javelin/Jupiter Maintenance Manual, shows what is actually a compromise combining various upgrades. The illustration has also been digitally doctored to include the extension shroud on the front cover. In truth, showing a taper fitting of the fan in conjunction with a small diameter rear spindle is not correct. The seals discussed here are described as 'Water Seals' in the drawing at right.



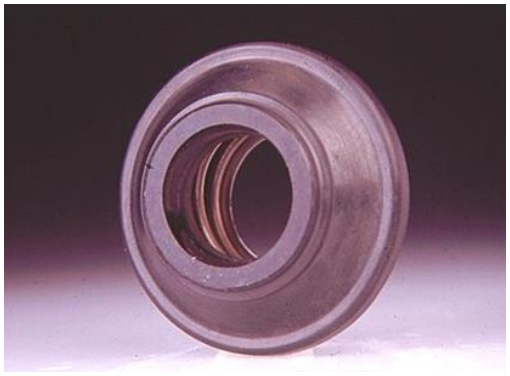
There have been several stages in the saga of the Javelin/Jupiter water pump mechanical seal project. The pump, that '*assists a thermosiphon cooling system*', to use words issued by Jowett Cars Limited, is but a small component part of the entire motor car – but its importance in two disciplines, circulating coolant and keeping that coolant inside the system, are well known. For some time now, our club has manufactured pump components such as pullies, spindles, impellors, front covers and pump housing bodies. All of this to ensure that our beloved Javelins and Jupiters are kept in reliable order. Lately, beyond our control and in the continuing march of progress, it had become very difficult to obtain mechanical seals of the same type as the originals. A great amount of research was put in by Tony George, to ensure that a 'modern' type seal could be installed in the front cover and in the pump body. This required some machining to ensure that the new style mechanical seal had sufficient room for its deeper spring housing. This was all very well, until it was found that mechanical seals purchased from various vendors, to suit the one 'Holden' specification, were in fact very different. The Jowett pump, being virtually on its own having two seals, was a candidate for double misfortune. It was discovered that, even though, ostensibly, seals were supposedly the same, they most certainly were not. Two mechanical seals that appeared visually the same, could have different amounts of spring travel.

In the Jowett application, this meant that, in some cases, during assembly, the gland spring could become coil-bound and rupture the rubber internally located sealing gland – before the pump had even done any work! Tony George put in a great amount of research to find a mechanical seal supplier who could supply seals that were consistent in spring travel and in spring tension. He found that the seals stocked by Bearing Service Company stores met our demanding criteria. I have to say that, even after such research, there is an element of doubt about the BSC seal assembly. Firstly, at the same price, some come complete with a ceramic ring and rubber ring sleeve, some don't, even though they carry the same part number! Secondly, a pair of BSC seals were installed in Richard Homersham's water pump. Within two years they leaked profusely – both of them. After dismantling the pump, it was found that the seals had seized and the springs could not exert carbon ring contact pressure on the impeller faces, hence copious leakage of coolant.

Investigation into another source of seal supply commenced. Peter Coakley kindly offered sample MAN bus engine seals for evaluation. A pair of these seals have been working for a long time in his Javelin, without any sign of leakage. This resulted in a visit to a MAN dealership in Dandenong and we found out that the seals were part of a kit that cost $85.00 each. It is very likely that there would not be a single Jowetteer willing to fork out $170.00 to resurrect his water pump! We did try to obtain a broken-down part number for the MAN seal, but it was not possible. The Internet's guru, Google, was consulted to try and find the maker of the MAN seals. This was a dead end, and it was found that most

avenues finished up in China. The MAN seal looked really well made and, if made in Germany instead of Brazil, would have possibly justified the $85 on its own!

Then I had a brainwave. I Googled “Automotive Water Pump Seals” and surfed a few Websites until I came upon a very interesting site – Avon Seals Private Ltd. Lo! and behold! There on the screen was an image of our original style seal! I had a look at their seal for 16 mm shaft size and up came all the pertinent dimensions that matched our water pump. So much work had been done, over the past few years, that the dimensions were well known. The “Contact Us” tab was clicked upon, and an E-mail address was presented. An initial enquiry drew the response that yes, the seals are still being manufactured and, yes, Avon were prepared to sell small quantities direct to our club. They also advised that the seals are still used in the Hindustan Ambassador (1956 Morris Oxford to us) motor car that is still in volume production. Because of that, this style seal should remain in production well into the foreseeable future. The locals get really long lives out of their cars!



Avon Seals’ sales department very kindly E-mailed an engineering drawing of the mechanical seal installation, so at last we had a drawing that informed us just how much crush should be applied to the spring loaded carbon ring.

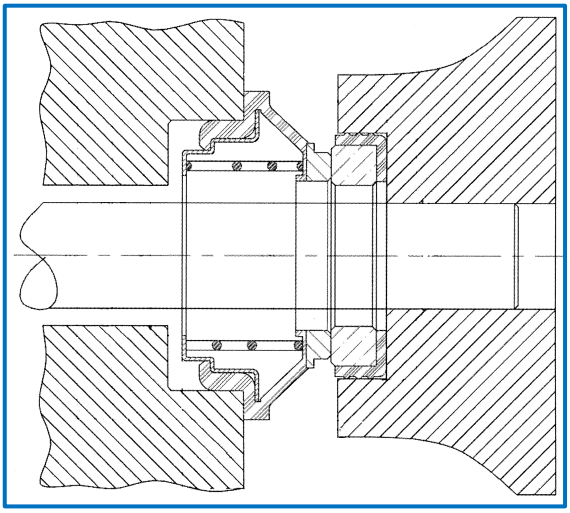
Left: An image of the Avon Seals ‘B’ type mechanical seal.

Avon Seals, as you may have worked out by now, is based in India, and through relatives in Bombay, four seals have arrived for evaluation. One was quickly sent over to Tony and he has expressed great excitement about our ‘find’. The seal discovery has also banished our concerns with the ‘modern’ type of mechanical seal. All of this has worked out most conveniently, having relatives in India willing to pay for the seals locally, and the fact that I will be in India in November to pay for them, means that our club can enjoy really cheap water pump seals of the original type, without having to pay crippling bank transfer fees. A large quantity has been ordered and they should be in club stock soon.

One point that should be noted is that the Avon mechanical seal will fit in a cover or pump body that has been machined to accept the ‘modern’ type seal. The Avon drawing shows a typical seal installation with open space behind the seal’s spring casing and the seal seated on its lip for location purposes.

Getting Technical

For those of us who have no desire to read technical matters, you can now skip to Grumpy Doug’s next juicy item of non-technical stuff.



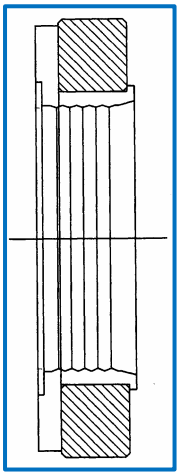
Right: Part of the mechanical seal installation drawing. At left is the stationary component – pump housing or front cover. At right is one face of the impeller, with a ceramic ring installed.

Avon Seals, as mentioned above, have sent us an installation drawing of their 16B36 mechanical seal. In this drawing there is shown a section through an impeller which shows a ceramic ring and rubber boot type seal, that is employed as a replaceable wear surface at the impeller. The ceramic ring is shown as being sealed inside the counter bore in the impeller.

After receiving this drawing, Avon Seals were asked if they could supply a ceramic ring and seal assembly that fitted on the spindle itself. Another drawing, illustrating such a ceramic ring installation was soon sent over the ether. The overall diameter is somewhat smaller and is the same diameter as the nose of the Jowett impeller. Its rubber mounting boot is a good sealing fit on the spindle, and incorporates a vertical leg that seals against the impeller face. There are four major attractions that justify its use in a Jowett water pump:

1. With the mechanical seal’s carbon face against the revolving ceramic face, wear is restricted to a replaceable component.
2. With the rubber seal being a sealing fit against the face of the impeller and on the spindle diameter, coolant can not migrate along the spindle. This may sound strange, but corrosion inhibitors contain ethylene glycol which has self seeking qualities that can be envied, or – in our application – utterly frustrating. Corrosion inhibitor can migrate through machining marks, and if an impeller is only marginally a tight fit on the spindle, migration will most certainly occur! The same applies at the locating Mills pin.
3. An impeller using ceramics as wear surfaces, can be run dry for long periods. Not much of a bonus for my application – but it is there.
4. Bedding in time for the carbon ring is greatly reduced,

Four of the spindle mounted ceramic rings were ordered and came with the sample seals. A couple of new impellers were also ordered from club stock. Initial investigation has shown that it will be a simple matter to machine sufficient metal from the front face of the impeller to allow for the thickness of the ceramic ring assembly. The rear face could be a bit more difficult, in that a recess, as deep as the ring thickness, will need machining into the face of the impeller. It appears that there is enough metal to allow a recess to be machined, Setting up a water pump in this way is very attractive.



*Left: Ceramic ring that mounts on spindle. The right hand face is that which contacts the carbon ring on the mechanical seal. The ceramic ring alone, is cross-hatched. Note the sealing ribs on the inside diameter of the rubber '***L***' seal.*

The assembly drawing that Avon Seals have sent shows that the 'crush' at the carbon ring face should be 2.5 to 3.0 mm. This is the dimension that will be aimed for during pump assembly. This crush factor will be used in close conjunction with Tony's research dimensions. It has to be remembered that a certain amount of Tony's research was based on guesswork and a degree of assumption. We have never had the luxury of a Jowett Cars Limited assembly drawing for neither the water pump nor the mechanical seal.

Now it gets a bit personal. Over the forty-plus years of ownership, several mechanical seals have been installed in my Jupiter's pump. The first time, I used a pair of Ferguson TE-20 tractor seals. Simply because they looked the same and were cheap. Having never seen, nor used, a genuine Jowett Cars Limited seal, I have often wondered if I had used the correct specification seal. While installing the Ferguson seals, it was felt that the crush was excessive. When the pump was dismantled for a subsequent overhaul, inspection of the seals showed that the carbon ring had been pushed flush with the seal's mounting lip – probably 7 mm of crush. Here in Australia, Holden water pump seals have been used for close to fifty years, but on dismantling local pumps, the seals have been found to have worked with the same amount of crush as the Ferguson seals. The Jupiter Owners Auto Club currently use Triumph seals. Triumph? The sports car with a tractor engine! Ferguson. The Standard Motor Company built Ferguson tractors as well as Triumph cars, and it would be certain that there would have been commonality with respect to those seals.

After all of that, there is still a doubt in my mind that the Ferguson/Triumph/Holden seal is not the same as that used by Jowett. Or, did Gerald Palmer opt for extra crush for good measure? 'One for the pot', thinking? It is understood that the original seals were made by Payen. Did Payen manufacture several versions of the mechanical seal? Would Jowett's production level have justified a different (unique) seal?

A virtual non-event? Well, we have put in a fair amount of work into sourcing a 'modern' type mechanical seal that was consistent in specification, while all the time an original style seal was still being manufactured! Special thanks are due to Tony, Brian, Peter and Tim for the research that has been put in to this project.

It is my intention to overhaul my water pump, without delay if possible, while incorporating modification of the Jowett impeller so that ceramic wear surfaces can be installed. Watch out for how this is done.

Mike Allfrey

A MATTER OF IMPORT – A VIRTUAL NON-EVENT (*The Second Instalment*)

At the conclusion of the first part, it was mentioned that the Jupiter's water pump would be overhauled without delay. If possible. Well there have been delays, but they have been very useful delays and, such delays will be recorded in detail. Before the delays are discussed, I will endeavour to describe the circumstances surrounding our Jupiter's pump problem(s).

It was while driving to Camperdown for the 2007 Jowett Jaunt, that the rev-counter indicator needle settled back on its stop for a spell of a few seconds. The weather was atrocious and, having the hood down, we elected to keep going as we were only a short distance from our motel and dryness. While the rev-counter was enjoying its rest, there was a drop in engine power, the ammeter went absolutely ballistic and there was a loud clacking sound from the voltage regulator. Quite entertaining stuff really!

Suddenly, as we entered Camperdown, the situation returned to normal. Next morning a quick look revealed nothing except some grease thrown over the distributor body. A spot of over enthusiasm with the grease gun just before we left was thought to be the cause. The Jupiter's next important outing was to the British Motoring Show and there, the bonnet was opened for the non-believers. It was quickly closed again after noting the amount of grease over the front of the engine!

All of this was the instigator, as well as Richard Homersham's pump leakage, for the search for a half-decent mechanical seal, as explained in Part 1. The water pump was removed from the car and dismantled. This was a most revealing episode. The following points were noted:

- The front ball race had completely collapsed. The cage locating the balls had broken up and the spindle had been effectively running in the Shorlube bushes alone.
- The pressing that is located in front of the bearing had cut a groove in the front cover.
- The two Bearing Service Company ('modern') mechanical seals fell to pieces.
- There was very uneven wear at the bush journals on the spindle. Somewhat baffling.
- The two Shorlube bushes were excessively worn.

- The spindle was bent. Just forward of the front bush.
- The impeller faces where the carbon rings had made contact were worn.

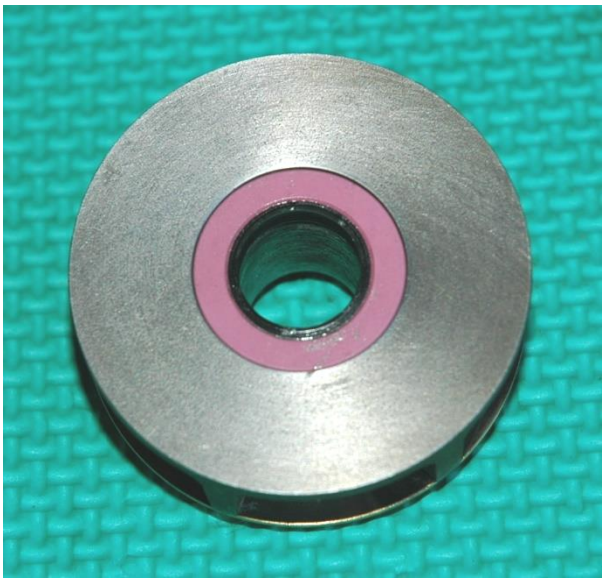
The incredible thing about the whole situation was that, in the described condition, the pump did not leak coolant while stationary! There was evidence of coolant having entered the chamber behind the bearing and having migrated into the bearing. In spite of that, there was no sign of external leakage. The pump had been overhauled two years previously, and the current situation was not at all good. This time around, it was going to get a thorough overhaul – no matter what!

It was very fortunate that, right at this time, our club was embarking on a production run of front covers. Straight away I placed an order for two of them. That was the first step. Then the spindle had to be dealt with. The old worn impeller was removed and the spindle was taken to Wagma Engineering to have the bushing journals metal sprayed and ground back to the standard nominal ⅝" diameter. This was when the bend was discovered. Thankfully, Wagma are experts in reclaiming machined shafts and they did a splendid job on the spindle, even restoring the corrosion pitted portion of the shaft in front of the impeller. It was a very expensive operation, but probably better than risking a mismatch of fan tapers if a new shaft had been bought from the Jupiter Owners Auto Club. First delay, Wagma were extremely busy and could only fit my job in between bigger jobs. No matter, so long as it was right when they had finished with it.

The next delay was getting the two new impellers that had been ordered, machined to accept the ceramic rings for the Avon mechanical seals. Once I had a pair of the ceramic rings in my hand, the decision was readily made to use them. This entailed creating a cross section drawing of the machining required. The old impeller was cut through along its axis to verify that there was enough metal to cope with a recessed, flush-fitting ceramic ring.

Figure 1: Rear face of impeller with machined recess.

It was found that the task could be done successfully, and the recess was designed so that the ceramic ring and boot assembly fitted as a sliding fit into the recess and sat flush with the rear face of the impeller when pushed fully home. It was then a simple matter of removing sufficient metal from the impeller nose so that the front face of the ceramic ring would replace the existing cast iron. It has to be appreciated that machining the recess and the nose had, actually shortened the effective length of the impeller. The club supplied impellers have been bored to match the smallest diameter spindle that was in club stock at the time. On my re-claimed spindle this provided a 0.002" press fit. It was decided at this time to dispense with the Mills pin and instead use a single 5 mm grub screw to secure the impeller in position. The machined impeller was installed on to the spindle using a smear of Loctite Antisieze anti galling compound. Not having a press, I was in a spot of trouble. Then I developed the notion that I could use my hydraulic jack under the work bench which has a very heavy plate in the middle. To my dismay, the entire work bench lifted and not much happened at the impeller.



After a while, it was decided that the frame of my independent work bench could be adapted. This worked well and the impeller was pressed too far onto the spindle. With my 'press' set up, it was too difficult to observe the impeller's actual position. The spindle was clamped in the bench vice and a three-legged puller was used to pull the impeller forward. Before the puller was attached, a large outside diameter half-inch plain washer was clamped against the ball bearing shoulder with spacers and a well tightened nut. Using a vernier calliper to measure the distance from the bearing shoulder to the nose of the impeller. As the puller exerted force, the impeller slid forward on the spindle.

Figure 2: Showing the ceramic ring and boot in place.

The impeller was pulled forward until the dimension from the front face to the bearing shoulder was 34.45 mm. This, with the front ceramic ring in place, provides exactly 29 mm. This is a key dimension when working on a Jowett water pump! Once the impeller was set correctly, the grub screw was installed and tightened. A minimal smear of rubber grease was applied to the ceramic ring boot and the assembly was slid over the shaft and pushed into the recess. Care needed to be taken to ensure that not too much grease was applied, otherwise a hydraulic lock could prevent the ceramic ring from being pushed fully home into the recess.

The front ceramic ring was pushed into place against the nose of the impeller. So far so good. This assembly was put aside and delay number three came into play. I had ordered and received two of the new water pump front covers. It was a surprise to find that the machined diameter for the mechanical seal to seat against, was not continuous in its diameter; at the area where the shroud opening is. This seems to be a dimensional error that has carried through earlier

production runs. It is thought that the pattern used for making the castings should have about 0.040” added at the shroud opening shoulder between ‘A’ and ‘B’, *Figure 3*.

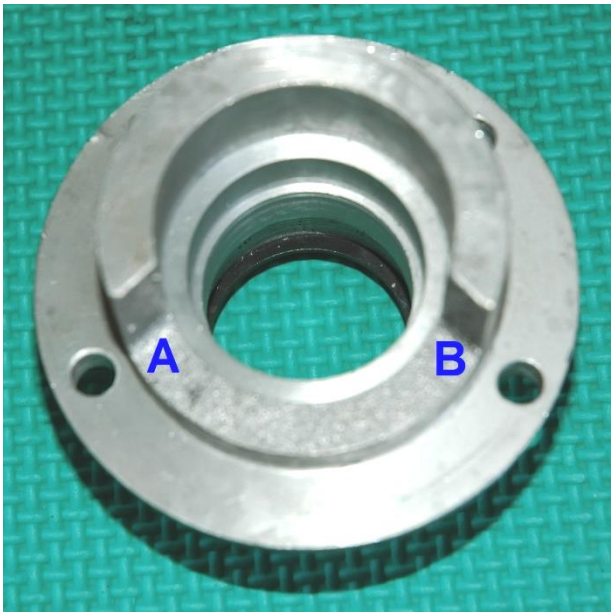


Figure 3: Front cover showing area machined..

In Figure 3, is shown the deeper machining that was carried out to provide a flat surface for the mechanical seal lip’s seat. Having the luxury of two front covers to play around with, the one shown here was machined to just clean up the seating area, The second cover was more adventurous, it was machined 0.080” deeper to effectively reduce crush at the mechanical seal. This action was purely experimental so that differing crush settings could be made using shims under the mechanical seal lip. Using this cover a suitable shim has provided an ideal 0.114” (2.9 mm) of crush That is a useful 0.020” less crush than would have been there with the less machined cover.

The method used for measuring the crush at the mechanical seal was as follows:

1. Assemble ball bearing and circlip in front housing.
2. With ceramic ring installed on spindle, fit front cover assembly to spindle assembly/.
3. Using suitable spacers, and a ⅜: BSF nut, tighten the bearing against the spindle shoulder. Note that the mechanical seal has not yet been installed.
4. Using good quality feeler gauges, accurately measure the gap between the rear face of the shroud and the front face of the impeller. Record this measurement.
5. Remove the front cover assembly from the spindle assembly.
6. Install the front mechanical seal, making sure that it is seated all the way round its lip.
7. Clamp the spindle in a soft jawed bench vice. Offer up the front cover assembly and, using the spacers and nut, tighten the nut until the mechanical seal ring just contacts the front face of the ceramic ring. This can be observed through the front cover shroud opening.

   Note: The mechanical seal and the ceramic ring must be pushed firmly into place.
8. Using the feeler gauge set, measure the gap as described in Step 4. Record this measurement.
9. To calculate actual crush at the mechanical seal, subtract the measurement taken at Step 4 from that taken at Step 8. The result is the amount of crush there will be when the pump is assembled

The front cover and spindle assemblies were then clamped firmly, and, essentially, the same exercise was carried out for establishing the crush at the rear seal:

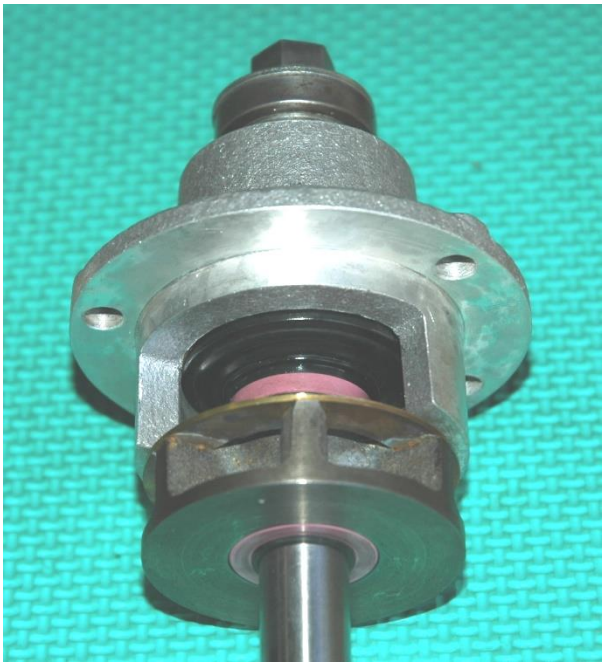
1. Oil the spindle bush journals and ensure that the spindle is a free spinning fit in the extension housing Shorlube bushes.
2. Push the rear mechanical seal fully home in the pump body.
3. Insert the spindle assembly rearwards until the ceramic ring just contacts the mechanical seal, use the front cover setscrews, without spring washers, to hold this position.
4. Using the feeler gauges to measure the gap between the gasket faces of the front cover and pump body. Record this measurement.
5. Accurately measure the thickness of the gasket. (typically 0.070”)
6. To calculate the amount of crush, subtract the measurement taken in Step 5 from that recorded in Step 4. The result of this calculation is the actual crush at the rear mechanical seal.

In the case for my pump, the crush at the front seal is measured at 0.114” and for the rear, was measured at 0.116” – probably as equal as can be achieved! A variance of just 0.002” is not worth worrying about. This is a most satisfying result, and fills me with confidence in the water pump’s increased durability.

Figure 4 shows the relationship of the front ceramic ring and the mechanical seal after installation. The ceramic ring can be seen, in this illustration, just above the glint of the impeller’s brass shroud. The mechanical seal can be seen just above the ceramic ring.

As mentioned in Part 1 of this article, I have never seen a genuine Jowett water pump seal. John Blazé in deepest Cornwall picked up this comment and very kindly sent a used genuine seal for direct comparison with the Avon mechanical seal.

The only difference found between the two mechanical seals was that the original Jowett seal had a slightly gentler spring tension. This could be for a couple of reasons. Firstly, because the seal tension is relied upon for holding the ceramic rings in place. Secondly, engines are running hotter these days. This extra tension, in the ‘modern’ style CBC mechanical seals probably accounts for the wear observed at the original impeller.



The next delay, self imposed this time, has been the scheduling of our *Workshop Wisdom* Saturday afternoon session to show members of the Victorian group the steps that have been taken to make our Jupiter's water pump more durable and, with that, supremely reliable. The pump now sports new Shorlube bushes that have been soaking in oil for a long time, new mechanical seals of the proper type, a new fully sealed front bearing (made in Germany), a new front cover and bearing retaining circlip, new impeller and a fully reclaimed spindle. Surely this package will be reliable, providing yet another trouble-free aspect of Jupiter motoring.

Figure 4: The assembled front cover.

The major worry that has come out of the whole story, is the falling to pieces of the 'modern' BSC type seals. The front seal did allow coolant to enter the front bearing. What is not known is whether the coolant penetrated the bearing chamber after the bearing had collapsed and its sealing ring had been forced out of the rear face of the bearing, when it collapsed. Coolant had been disappearing for a while and it now has to be assumed that it was at the water pump front mechanical seal. There was minimal evidence of leakage at the drain hole, but if it was leaking while the engine was running and the bearing was damaged to the extent that the spindle could chatter, then, dynamically, coolant could bypass the drain hole. All very ponderable.

The title of this article, *A Matter of Import – A Virtual Non-event* is very apt. After all of the good work in researching 'modern' mechanical seals, we are, essentially, back where it all started. Our club now has good stocks and further supply of genuine style mechanical seals – if only we had known sooner!

Mike Allfrey.