



Trelleborg Cassette Seal CSL 1500

TURNING CONVENTIONAL THINKING INSIDE OUT



CSL 1500
REDUCED FRICTION
LOW FUEL
CONTAMINANT EXCLUSION
EFFECTIVE SEALING



This is a transcript of Fluid Power World's webinar Eight New Advances in Cassette Sealings with Trelleborg Sealing Solutions Expert Bill Bishop.

This webinar features a unique cassette seal design for very difficult environments. The unitized seal design improves contaminant exclusion and static sealing ability, while its advanced lip technology helps reduce friction and wear to lengthen seal life.

Watch this webinar to learn:

- How the Trelleborg Cassette Seal CSL1500 is different than other seals available on the market
- How Trelleborg used the technology developed during the Cassette Seal CSL1500 development to improve their rotary designs.
- How outside-the-box thinking enabled Trelleborg to open a whole new market for cassette seals.

Paul Heney: Well good afternoon. Thank you everyone for attending today's webinar, 8 New Advances In Cassette Sealings brought to you by Trelleborg's Sealings Solutions, and Power World Magazine. Just a couple of house keeping details before we get started. You will see several boxes on your desktop. All of which can be moved and resized to your unique preferences. You may open, close, and change the layout as you like. You should ask all questions relayed to the webinar in the QnA box, that is initially in the bottom left corner. Answers will be asked during the remaining time. If we do not get to your answer, our presenter may reach out to you afterwards.

The webinar's slides, as well as additional resources, can be found in the resource box, initially in the bottom right side of the screen We do encourage you to tweet with us. Simply sign in with the Twitter box, and today's hashtags is automatically added to your tweet. If you have any questions [inaudible 00:01:05] or any help, please refer to the help widget on the bottom of your screen.

My name is Paul Heney, and I'm the editorial director of Fluid Power World. A little background of me, I have a mechanical engineering degree, from Georgia Tech. And I've been covering the engineering and manufacturing world for more than 20 years. I'm pleased to be your moderator today.



I'd like to take this opportunity to thank our presenter for being here today and introduce him. Bill Bishop is Rotary Segment Manager for Trelleborg's Sealing Solutions. In his 50, excuse me, 35 year career, Bill's worked with every type of rotary seal manageable. He said he has replaced seals on wind turbines 300 feet up in the air, as well as underwater on a nuclear submarine. He's worked in various areas including, engineering, sales, quality, marketing, manufacturing, and R & D's. Very well-rounded career. Bill is currently responsible for Trelleborg's Rotary Center of Excellence, which is a virtual department made up of the top rotary experts within the company. Bill also led the team that designed and tested the company's Cassette Seal CSL5000. And now without further ado, I'm gonna hand the mic over to Bill.

Bill Bishop: Thanks a lot, Paul. And I appreciate you giving me 50 years of experience but I only got 35.

Paul Heney: All right well you got 15 years more to go. And we'll try it again.

Bill Bishop: I appreciate it. Let me start off by telling you a little bit more about who Trelleborg is, who Bill Bishop is, and why you should listen to him tell you a story about cassette sealings. Trelleborg Sealing Solutions was founded in 1952 and has their history in a number of independent seal companies, which produced elastomer seals.

Forshada, Dowty, Busak, and Shamban were some of those companies. And they along with a number of others all came together under the Trelleborg umbrella in the early 2000's. Today Trelleborg Sealing Solutions is a leading global supplier of polymer based sealing solutions used in industrial vehicle and airspace environment. We make all types of seals. Anything that seals, damps, or protects, we like to say. In a variety of materials, including rubber, PTFD, and engineered plastics. With more than 25 manufacturing facilities, 8 R & D's centers, 54 marketing companies, we work to deliver the high quality solutions anywhere in the world. We're a one stop shop. We offer the broadest portfolio of products and materials in the market. Whether it's standard products, or custom solutions.



Now I came from the Forshada side of the business. I started as an engineer at Forshada in 1979. And in my years at Forshada and subsequently Trelleborg's, I've worked in engineering, manufacturing, quality, sales, marketing, as Paul mentioned. I guess people just can't stand to have me around for too long. I'm currently part of Trelleborg's Sealings Solution Research and Development department, and product manager of our rotary seals, and I head up our Rotary Center of Excellence ... But I'll talk about that a little bit more, later.

Forshada, was one of the pioneers in the cassette seal mark. In the 1970's, they developed one of the original cassette seals, it was called MSO seal. But it was subsequently renamed the system 500. It was originally designed for Class C trucks. But within a decade, they were used by most of the big truck manufactures in Europe including Volvo, Scania, and DAF. And from there, they branched into a number of different markets, including agricultural construction, military, and automotive.

And here are some of the many designs that we've over the years. These are the legacy seals, which Trelleborg's is known around the world. They're what we would consider our standard cassette designs First two are for rotating outer diameters like most trucker hubs. But the one on the right, is for rotating shaft, like a semi-truck.

Now, perhaps not everybody listening knows what I mean by cassette seal, so I'm gonna explain a little bit. Let's say you're a designer and you're designing a seal package for a [inaudible 00:05:26]. You're gonna need to design an oil seal to keep the lubricating oil in the hub. Oh and you're also gonna need the seal to keep out the nasty contaminants like dirt, and mud, and water. If it's a really critical application, you wanna include two dirt seals, but you gotta make sure you put grease in between them. You'll also need finely finished surfaces for all those seals to run on. And you have to be sure that you've designed enough room for all of those components. So the seal design is not as easy as you first thought. But what if you could eliminate the headache, and the all of those components in a single product? That would be [inaudible 00:06:09], wouldn't it? Well that's what cassette seal does. Also called a unitized seal, a cassette seal brings all of those components together in a single unit. And instead of seven parts, now you only need one.



So why would we use a cassette seal? Well, there are a number of reasons. A rough shaft finish would cause a seal to wear out quickly. So the shaft has to be finished, and, or, finished in the seal area and this can get pretty costly. But the sealing done with a cassette seal doesn't ride on the shaft, it rides on the cassette seal itself. So no expensive finishing, or improvement is necessary. Rotary seals that ride on the shaft can also wear a groove in the shaft, under where the seal would ride. This is especially true in contaminated environments, where dirt goes up around the seal, acts like a lapping compound, and just wears right into the shaft. And once that shaft is groomed in that way, the seal will begin to leak. If you replace the seal, that won't help. Cause it's the shaft that's damaged, not the seal. And replacing or machining the shaft could be very expensive, and in some cases impossible. But in a cassette seal, the sealing rides up on the shaft itself, so that type of shaft building is eliminated. And when the seal is replaced, the seal surface is replaced at the same time. So it's renewed.

Now, the moldable seals are used in one application. It's usually recommended to put grease in between those seals, preventing them from running dry, and this means extra expense, and assembly time. But cassette seals typically have the grease already inside. So that's not a concern. One of the major causes of the seal failure, is damage during assembly. This happened a lot. Any nick or cut on the seal will leak right from the beginning leading failure, and warranty issues. And that gets expensive. But the sealants on the cassette seal are typically internal and they're protected by the cassette outer part, so they cannot be damaged in handling, or on assembly. Many applications call for moldable seals to be used, especially if you're sealing two things such as oil and [inaudible 00:08:35]. And every seal adds expense except space and that means one more step on the assembly process, and one more part you have to include [inaudible 00:08:44]. But the cassette seal has all the components in one single package. So there's fewer components to design in, fewer parts, inventory, and fewer parts to install.

But what about the CSL1500? Isn't this webinar supposed to be about that? Oh yeah let me give you the background on that. About five years ago, Trelleborg's Rotary Center of Excellence was tasked with designing a new cassette seal for the agricultural market that will perform as well or better, than the current offering, but was less expensive to produce and sell, yet still maintain the high level of quality Trelleborg's was known for.



We knew we couldn't just do what we've done before, which is basically looking at what we had, and than tweaking it until we got something that worked.

Now we had to start from a blank slate, and optimize each aspect of the seal design, and manufacturing process. We took nothing for granted and in doing so, we learned a lot about our perception and prejudice about what seals could do, or, couldn't do. For example, when I was an engineer, I was sold that the [inaudible 00:09:55] should never be rotated. Because its centrifugal force would act on the spring, and that would affect the sealing box. But we found that with the right design, and under the right conditions, this was no problem. This allowed us to design a sprung contaminated lip, which increased the efficiency and [inaudible 00:10:15] a lot. Also conventional thinking was that an oil sealant had to be round on the machine surface, so even on a cassette seal, you had the machine part where the seal would land. But we found that the metals were made well, and they were treated in a special way, no machine was necessary. And this saved steps, and eliminated an expensive manufacturing process.

Also, in a cassette seal we needed to have an internal space that showed where the cassette seal was pushed into place. Those spacers would keep it from collapsing on assembly. But the classic design of those types of spacers would have generated too much friction during operation. So we've analyzed those spaces themselves. We redesigned the geometry of them. And we changed the surface to [inaudible 00:11:07] the concept for an operation, which allowed the seal to run cooler, and last much longer. We learned a lot of things when we developed this seal, and we cataloged each one of them. And we put hem in our toolbox for future use. And that's how the CSL1500 was born.

Now we're gonna have a little video, which will step through the advantages if the CSL1500. That's a combine, and this is what the hub, form that combine would look like. Now cutaway to of the CSL1500 so you can see what's happening inside. This has air on one side, oil on the other, keeping dirt off and lube in. Now the metal rubber OD is a positive static seal but it still allows sufficient heat from the contaminant lip to keep the seal running cooler. We've deigned the metal cans in such a way that no crimp is needed to keep them together and this meant less expensive manufacturing. The oil facing lip is open to the oil, which allows a cooling flush of oil during operation that keeps the seal running cool. Well the oil seal lip is based on Trelleborg's world class design standard, which has been superior in their oil sealing [inaudible 00:12:30].



We can go through the bonding methods that give a fine enough finish for the riding surfaces don't need grinding. And the stack design, allows us room to put more into the package and add components. And a much larger volume of grease in between the seals. The definite outside metal can adds stability to prevent declamation during assembly and the axial lip turn the first line of defense against contamination. Those are eight departures from the conventional things you work. With regards to cassette seals, that we developed, over the period of time that we're working on the CSL1500. A lot of those things were things that had never been done before.

We thought we had a pretty good design, but just how well will it work? First we put it through an accelerated test in hot oil, and it passed with flying colors. Then we ran it in the toughest lab tests we run. A 24/7 constant running test from a slurry of mud, water, and sand. We ran it for 1500 hours without leakage. And we ran it for 3200 hours without leakage. And finally, we let it run for 5000 hours with no measurable leakage.

This is longer than any of our cassettes has ever gone. But no lab test can truly duplicate field figures [inaudible 00:14:00] CSL1500 hasn't been in field on a agricultural wheelhouse. And after two years of continuous service in the field, we finally call it a success. And hard work for the Rotary Center of Excellence has paid off.

And what about the Rotary Center of Excellence, what exactly is that? Well, the constantly changing group of seal experts within Trelleborg's, which is not unlimited to geography, department, or job type. Its mission is to grow Trelleborg's business through education of our people and customers. And increase our knowledge base, and develop our rotary projects and products. It's a virtual department. Now what do I mean about virtual department? Well, it has no physical location. It only has two permanent members, myself, and my European counterpart. And all other members rotate in and out of the group as needed, depending upon, the projects we're working on. Members may come in from marketing, manufacturing, engineering, or many other areas in the company, or even outside of the company. And each one brings their unique talent and perspective to develop the rotary solution. And once the solution is reached, that team is dissolved and a different one is born to take on a new challenge. And that's how the CSL1500 was developed. And we've used that same system on a number of other rotary projects. Every time we do, we learn something new, and we catalog that knowledge for later use. We put all that in our toolbox.



I talked about how we considered all the individual aspects of the CSL1500 design was developed on. And now, we know how each one of those components works. And how to combine them at a modular way. When we need a new seal, we use our toolbox, and we can only take those components necessary to fit that particular application. We've used this the philosophy to design dozens of cassette seals, catered to particular customers, and particular applications.

To give you an example of what I'm talking about, when we first developed the CSL1500 we're targeting severe environments. Like agricultural, construction firms. But one day, one of our sales people asked us if we could make one small enough to be put into a centrifugal pump. Why would we want top put a dirt seal into a centrifugal pump? Well, it seems that one of their customers was using an oil seal, which is grooving the shaft, despite a fine finish and even rowing the shaft. We deigned it the cassette, using our toolbox, and it worked perfect.

Cause the seal just arrives on the shaft, it couldn't groove the shaft, it couldn't damage the expensive element. So they were able to eliminate that problem altogether and eliminate finely finishing the shaft. And despite the fact that our seals cost many times their seal, with the previous had cost. It saved the customer many times the difference by eliminating the need for special grooving of the shaft. And the expensive [inaudible 00:17:28]. We've subsequently design cassettes for automotive, machine tool, and other applications as well.

We've squeezed the base of CSL design down to the smallest, just over an inch. And we've scratched the largest into 13 inches. And we've been able to turn around designs much faster because we don't have to reinvent our wheel every time. Look at some of these examples, and you'll see a similarity. In many of the components, the component parts make up for each one of these cassettes, and that's our toolbox philosophy in action. You get the full story on the CSL1500. For any of our other seals, check out Trelleborg's Sealing Solutions' In the Groove magazine archive, where you'll find an article on it, as well as many of the other seals that we produce. Heres a link here. And that link is also gonna be available in the resources.

The CSL1500 just went on the many rotary seals that we produce. And if you'd like to learn more about any of our products, go to our website which is www.tss.trelleborg.com. Or you can call 2607499631 for our North American headquarters. And please, come out and visit us at the IFPE comment show that's gonna be taking place in March. We'll be in booth S81616.



We'll be featuring the CSL1500 as well as a number of our other products and services. And we'll also be showcasing our service plus program. A total solution program that simplify the work flow at every part of your value chain. From engineering to manufacturing, to [inaudible 00:19:45] to marketing. It's also a toolbox. A toolbox of enhanced services to match our customers' needs at every step in the business process. Ultimately, reducing total cost. If you are coming to the show and you'd like to schedule a time to sit down and talk about the CSL1500, or any of our other products and services, contact me, at bill.bishop@trelleborg.com and I'll be happy to arrange a meeting with me or whichever one of our colleagues would be best able to help you.

Everything that we do builds on a collaboration with and an understanding of our customers' business and their markets. This strives our strategy, and how we make it easier for our customers to do business with us. Well, that's it for me do we have some questions?

Paul Heney: We do. Thank you so much Bill. All right for all our listeners we're gonna use the remaining time for questions. We have a few that have come in, but is it not too late to send in your question. If you have a question please use the dialogue box that you see there on the screen.

First question Bill, could you talk a little bit about what different materials are available?

Bill Bishop: Yes. The CSL1500 and most of the cassettes that we do are available in standard elastomer materials such as MBR, or Nitrol. FKM, HNBR, etcetera We haven't done too much to cassette designs in the PTFE or engineered plastics but that's on our radar screen.

Paul Heney: Makes sense. So is there a standard line of these seals?

Bill Bishop: No there's not. And we found that the reason for that is that so many of these are unique in where they are used. Unlike oil seals which have standard envelopes that they fit in to. Cassette seals could be used on tracker axels, they could be used on pumps, they could be used on tunnel blind equipments. They could be used on so many different things that we have to approach each one on an individual basis. And that's why it's so important for us to have a modular type of toolbox approach. Cause we never know going into it what we're going to be up against as far as the application or the envelope that we're presented with.



- Paul Heney: That makes sense. Can you talk a little bit about what other types of seals Trelleborg's makes in addition to cassette seals?
- Bill Bishop: Sure. Trelleborg's makes a full line of of rotary, reciprocating, and static seals. We do all different types of rotary seals including, ready oil seals, cassettes. We do PTFE seals. We do duo cone or mechanical face type seals. Those are some of our rotary seals and that's my specialty. But we also get involved in all different types of static seals. From O Rings, to gaskets, to huge gaskets that might be on part of a fuselage body on an aircraft. Where the gasket itself would be ten feet long. I personally have fit some rotary seals that are up to 16 feet long, that went on a trap on a destroyer, for the US Navy. We also gave all manner of reciprocating seals including, U Cups, zipper seals, and a variety of other reciprocating products.
- Paul Heney: All right thank you. Now one last question is coming in. Can you talk a little bit about the pressures the seals operate at? What are the different ranges?
- Bill Bishop: Sure. The CSL1500 as it's designed was made to seal very little pressure. Because in a tractor axel, you just don't have that much pressure. Most of the cassettes that we've deigned, have been for low or zero pressure. We can design for higher pressures but we have to make sure we beefed up the oil seal lip, and minimize the other lips because when you have pressure involved you end up generating higher friction because of that. We do that all the time, designing seals for higher pressure. So, we know what we're doing and if we had a cassette application come up that had to see a higher pressure, we can do it. But so far, we haven't had that issue.
- Paul Heney: All right Bill it looks like you have completely educated us all and that's all the questions that we have so far. And to the listeners if you have additional questions that come to mind, over the next few day or two you are welcome to email those to me directly, and I will forward them onto Bill. Thank you everyone for attending this webinar from Fluid Power World and from our sponsor, Trelleborg's sealing solutions. Now this presentation will be emailed to everyone in the coming day and it will also be available eventually on www.fluidwprld.com. Thank you once again Bill for all of your insights. We appreciate you being here.



Bill Bishop: Paul I would like to thank you and also Fluid power World for hosting me today.

Paul Heney: All right, thank you Bill. And to all our viewers, thank you for coming and have a great last few days everyone.

Bill Bishop: Bye.



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