



Behind the Wheels Podcast

Episode 2: A Rhyme and Reason to Every Fit

ANNOUNCER

You're listening to Behind the Wheels with Doug Mason, Dave Walters, and Mike Yagley. This is a show where we talk about heavy truck and medium duty axle ends. Doug, Dave, and Mike bring close to 100 years of experience and expertise in the transportation business.

Join us once a month to learn new things about axle ends. Sponsored by Alcoa® Wheels, the global leader in aluminum wheel innovation.

MIKE YAGLEY

All right, well welcome to another episode Behind the Wheels. I'm Mike Yagley

DAVE WALTERS

I'm Dave Walters.

DOUG MASON

And I'm Doug Mason.

MIKE YAGLEY

Well, the first episode we talked about wheel offs and when a hub no longer can hold the wheel.

MIKE YAGLEY

Now we're going to go to another component of things not holding together and we're going to go with what happens when a wheel can't hold the tire. So, you know, Doug, you want to talk a little bit about what's going on there?

DOUG MASON

Some very simple things at first to get into, and I'm sure many are aware of this, but obviously there's many different tire sizes. There are many different rim sizes or wheel sizes and there is a rhyme and reason to how these are all put together. They're very engineered components, as you can imagine with all of the load they have to hold. Again, we talked about the last episode, the amount of tension that you use and the force you use to hold a wheel on, but in this case there's a system and it's in North America, it's the Tire and Rim Association and other areas. There's the European version, ETRTO and there's also a JATMA over in Asia. These organizations have put together standards that will show specifically a wheel size and what tires can fit on this wheel size.

DOUG MASON

So, if you have a 22 and a half by eight and a quarter, there are certain tires that can fit on this and there's many different sizes actually that can actually fit on that eight and a quarter inch rim. Only so many can go on there. If you try to put the wrong ones on, you can have a very bad situation. Whether it's too small or too large situation.



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DOUG MASON

That's just maybe a very general, initial thing to understand that this is an engineered component that goes together and there is rhyme and reason to how it works. But there are other situations.

MIKE YAGLEY

Well, one thing that I think is real important here is as we're talking about these components, the wheel and the tire going together, when somebody's looking at that wheel, they're thinking, I'm going to ask you to picture a wheel without a tire on it. What you've got is you've got the rim, it has a high point, it comes down straight, that we call that the rim flange, and then it goes down at an angle and then goes into what we call the drop off. Dips down into a little well type thing. Then it comes back up and back up at an angle and then you have the other rim flange. So, you have the two rim flanges on both ends of that. People think that rim flange is what's holding this whole thing together and well...

DOUG MASON

That's not the case. The tire is designed to sit on what we call the bead. There's a couple of different bead angles. You can have flat base, you can have 15 degree and you can also have a five degree, which is really primarily pass car and light truck.

DOUG MASON

We're talking heavy truck industry here and for the most part you're talking a 15-degree bead angle and the tires are designed, the steel beading and everything that's in them, to sit and adhere on that bead seat. The flange really doesn't hold the tire in place.

MIKE YAGLEY

Not when you have an angle there. If you have the angle, then it's not the flange that's holding it together. It's that angle, that machined angle that holds the whole thing together.

MIKE YAGLEY

What we've done is we've actually taken a wheel we've machined down that rim flange just to see how low and it will still hold together. We don't [group talking 00:04:15] it holds together though. What's really holding the whole thing together is that, in a heavy truck application and we mostly talk about heavy truck applications on this podcast, it's going to be that 15-degree bead seat is what we call it.

DAVE MASON

I can add in there are back in the days of cast spoke wheels, they used to call them flat bases. The flat bases are actually seated on the rim area.

MIKE YAGLEY

On the rim flange.

DAVE WALTERS

There was a bigger flange, but those flat base had tube types and it was a different world. When I always tell somebody in the field that the tire actually seats up on the 15-degree taper, I tell him that the rim flanges are put in there for engineering support and they're put in there for safety.

DAVE WALTERS

There's a reason for everything that we do, but when you explain to somebody, the tire actually seats on that 15-degree taper. So, when you're lubing up the tire and the wheel, it's so important to lube. Lube the tire, lube the wheel so they come out and see it up in the right spot.

MIKE YAGLEY

When you say lube the wheel, you're talking about specifically lubing on that 15-degree taper?

DAVE WALTERS

Yeah, you put lube in there so that tire can slide up there and see it in the proper spot. If it doesn't there's what we call concentric seating and that's a whole other show and topic.

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MIKE YAGLEY

Things get complicated quick.

DAVE WALTERS

Yeah, those are copied. What I really asked Doug now, the most famous one that I ever heard of in the whole world were about the 16 and the 16 and a half.

DAVE WALTERS

Can you tell us what happened in that case?

DOUG MASON

As you can see, they're so close in size, right? You've got a 16 and a half and a 16 together.

MIKE YAGLEY

This is the diameter of the wheel from bead seat to bead. So, if you take the wheel and you measure it across the diameter of the wheel, right where that tire mounts, where that tire seats, that's going to be either 16 inches or 16 and a half inches in these two different geometries you're talking about.

DOUG MASON

There was a lot of confusion about what tires could go on which one. When you put the wrong tire on you could literally blow it off. The force when you air up a wheel is significant. It's dangerous, very dangerous. There were unfortunately some situations that were very serious. We'll just leave it at that at this point. That brought about an understanding that there has to be more clarity around the wheel sizes and the tire sizes that go together and that was a big learning experience.

MIKE YAGLEY

One of the things I hear about are people buying heavy truck wheels and the heavy truck wheels tend to be in the half inch increments. So, you're going to have, when I say increments, it's going to be one-inch increments, but it's going to be at the half inch marks. So, it's 19 and a half inch, 17 and a half inches, a 22 and a half inch. It's these half inch markings that is the heavy truck applications typically. Those are going to be typically the 15-degree bead seat that we're talking about. That 15-degree taper.

MIKE YAGLEY

Automotive applications and light truck are going to be 20 inches, dubs, 22s, the 16 inch and so forth. Those are going to tend to be five-degree taper on those. Completely different engineering concepts go into each one of those. They're intended for different applications.

MIKE YAGLEY

You brought up the 16 inches versus the 16 and a half inches. These are two completely different engineered products, but they look identical.

DOUG MASON

Are really close.

DAVE WALTERS

Close enough, that's the problem.

MIKE YAGLEY

We run into the same problem today. Every so often we'll run into somebody who grabs a heavy truck wheel, thinks I want a heavy truck wheel, machine it up, put it on my SUV, get that nice bling and it's really going to look great.

MIKE YAGLEY

Regardless of how it looks, you've got a 22-and-a-half-inch wheel and there's a risk. They're going to, or 19-and-a-half-inch wheel, let's say they put a 19-and-a-half-inch wheel on there and then they put a 20-inch tire, that's not how it's designed. That's not how that's supposed to go together and you're going to have sorts of problems.

DOUG MASON

I guess just to summarize, it's very simple. Quite honestly, there's a list put out by Tire and Rim Association. Most tire shops very clearly abide by this. If you go in and I say I have this size wheel, they're going to put the proper size tire on it per the specifications. Same thing in the trucking industry, of course. But there are other reasons why a tire might come off a wheel.

DAVE WALTERS

Absolutely. And the one that I'll really talk about is in the industry we call it small wheel. It's basically when there's a tire fire or brake related incident, something happens on that truck and the heat basically will heat up and shrink the part of the wheel.

DAVE WALTERS

What happens is a tire can take about 290 degrees before it starts to get pliable. So normally the tire goes first, but you got to understand that that heat goes from the brake drums or from something through the wheels into the tire. So, if the tire is at two 90 and melts away on the wheel, what kind of heat went through that? So, Alcoa, we did something really fantastic. We actually put two heat sensors on the wheel, one at the end of the rural stamp and one in the middle of the wheel. These will turn colors. Brown will tell you there some heat going through it, but when they become black, you know that too much heat went through that wheel and you should remove that wheel from service.

DAVE WALTERS

Small wheels are a big safety issue because if you try to remount a tire on a small wheel, it's going to come off. That's when bad things can happen. If you don't follow OSHA regulations. OSHA regulations are twofold.

DAVE WALTERS

One is put the tire and wheel in a safety cage or it has to be actually, the wheel has to be bolted to the truck. Those are the only two ways that you're technically can inflate it. Then OSHA regulations is you have to have a clip-on chalk and stand out of the projectory when you air them up. People will say, "well I can't seek the beads in a tire cage. I can't seek the beads." You can actually, according to OSHA, seat the beads with a bead blaster or something. Anything that you can use that doesn't take more than five PSI. So, you've got to seat the beads. Then you can put it in a tire cage or put it on the truck. But it has to be restrained because if something, if it is a small wheel and you don't know that, these are critical.

MIKE YAGLEY

I want to take a couple of minutes here and talk a little bit and try to describe to you, we can't show you a picture, but I'm going to try to describe what a small wheel is.

MIKE YAGLEY

I'm going to ask you to take a moment and picture the wheel on your front axle of your car. What you've got is you've got the disc side, which is mounted right there. It's with the nuts on it and everything. Then cantilevered inboard of that is the rim. That open side of the rim is what gets small. What happens is when you have a tire fire or you have a brake fire or something like that happens, what it does is it anneals the metal. Especially this happens with aluminum wheels and that metal will get annealed and what that means is that it loses its shape. It loses its ability to hold its shape.

MIKE YAGLEY

What happens is that opens side, the pressures of the tire or if you're driving on it, if you're driving after it's annealed, if the tire blows out and you're driving on the wheel, what will happen is that open side is going to get smaller. Now the wheel, the normal size at the closed end, at the disc side, but it's smaller on the open side. So, what happened?

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MIKE YAGLEY

Let's say you put a tire on that that looks okay. You can't tell the difference. You put a tire on that, you air it up, and what happens is that it lets go on that open side and all that force pushes the wheel and pushes it airborne. It's like a slingshot and it shoots out and it has enough energy to throw a 150-pound man, a hundred feet into the air. This is not hyperbole. This is not joking. This is not exaggeration. It can kill you. It kills people occasionally and we do everything we can to keep people alive by telling them about the dangers of having that small wheel event.

DOUG MASON

Just to maybe make it a little more visual. You've got to think about it as a diameter. That diameter of the open end was, say 20 inches and now by heating up the material, it's lost its strength and no longer can retain that same size and under the pressure of the tire creates the diameter to shrink.

DOUG MASON

We were talking about that 15-degree angle. Now that angle is dropping from where it's seated previously. Again, like we said, the wheel is held in position by that bead seat, not the flange, that's why it looks like the wheels.

MIKE YAGLEY

You see the flange, it looks okay.

DOUG MASON

But it's not. Now at that point then you can lose the air out of the wheel and create the situation you've talked about.

DOUG MASON

There are a number of ways which are very important to ensure that if a wheel, even you think a wheel has gone through a heat event or has been driven on that you can check. Dave, I think you have some real clear descriptions of this.

DAVE WALTERS

Years ago, at TMC we rode on RP and RP is a recommended practice for the industry. Basically, we're saying, look, when the wheel gets smaller, there are signs actually, it could be burnt looking, it could be charred. We said we got to do better. So, we created three ways of checking this.

DAVE WALTERS

The first way is the best way as we always put it. That's buying a TRA tape from Tire and Rim Association tape. This tape you can buy at 22 five or 24 five or you can buy a 17 five, they are by far the best method to do this.

DAVE WALTERS

Unfortunately, the tapes are a little pricey.

MIKE YAGLEY

And you may never use them.

DAVE WALTERS

And the industry doesn't buy them.

DAVE WALTERS

Then we went to the second method to buy a carpenter square. You can lay that carpenter square on the face of the wheel, run it across the two rim flange areas of the wheel. If you, on the open end, because this never really happens on the disc end, it's always on the open end, if you can put 30 thousands or a thickness of a driver's license or credit card underneath it, then you might have too much issues and you need to take that wheel out of service.

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DAVE WALTERS

The third one is simply a roll test. If you have a flat area that's about 10 feet long, you can roll that wheel. If that wheel turns towards the open end of the wheel, the chances that wheel be in small is good.

DAVE WALTERS

There are practical ways of checking these wheels to see if they got heat through them. Like I said, we put actual stickers on our wheels and at 400 degrees for five minutes, they will turn black. So, we know that.

DAVE WALTERS

We try to live safety, but what I always tell everybody, if you put that tire wheel in a safety cage when you're airing it up, that's the most safety thing you can do because you don't know what made it happen. You don't know when you get a zipper rupture out of the tire, so that's critical. When you get a small wheel, there are ways to check for them, make sure that you take proper care and then mount them in a cage or restrained on the vehicle.

DOUG MASON

I guess again, the indications would be obviously the sticker on maybe an Alcoa wheel or and any other wheel you're going to see evidence of heat. You're going to see a charring of a sticker or of a label or even some tire residue on there. In any of those situations you need to check and make sure that nothing has happened to the wheel.

DAVE WALTERS

When I do training classes, people always say, "When should I check a wheel for being small?" My comment is once one has been in the service, I would check it before I put it back on that tire. A carpenter square, and it's funny because the people will say it's that simple, it's that simple. You go around four different spots on the wheel and you make sure it's still round. Carpenter square costs you six, seven bucks. For six, seven bucks, you've got a tool that basically you can use and anybody can use that. Everybody has a driver's license or a credit card. Some people might not have 30,000 feeler gauges. So, we tried to make it simple.

DOUG MASON

Let's hope they have a driver's license.

DAVE WALTERS

We have, we hope.

MIKE YAGLEY

Okay, well that about does it. We covered wheels and tires, that you need to make sure that they're always going together properly. You don't want to put a 16-and-a-half-inch wheel with a 16-inch tire or anything like that. To make sure, one of the things we did not mention is that on those tires it says on them whether it's a 16 or 16 and a half or 22 or 22 and a half, it'll say on the tire and it will say on the wheel. It'll be marked right on the wheel if it's a 22 and a half or whatever that diameter is. That's real important when you're trying to evaluate the safety of putting that wheel with that tire.

MIKE YAGLEY

A couple other things is that you want to make sure you're mounting right on that taper. You need to remember that it's that taper that's holding everything together, so you want to lube everything up good. Lube the tire, lube the wheel on that taper and make sure that's all mounted up real nice.

MIKE YAGLEY

If you have any suspicion of a heat event, look for that indicator on the Alcoa wheels at least. That indicator will be right next to the roll stamp and it'll be in the top of the drop on, in the middle of the drop on the tire side.

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MIKE YAGLEY

That indicator, if it turns charcoal black, then you really need to check it and honestly, like Dave said, you probably want to check that every time anyway. When you're checking it, the way you check this sort of thing is if you're really going all out, you can use the TNRA gauge that's available. You can go to the Tire and Rim Association website and buy one. Or you can use the carpenter square. The carpenter square goes up like Dave mentioned, it goes up on the disc face of the wheel and then the other leg of the carpenter square goes from the rim flange to the rim flange. If you can get a credit card into that open-end side, it's time to take that wheel out of service.

MIKE YAGLEY

The last way to check it is if you don't have the carpenter square, if you don't have the TNRA rim gauge, take the wheel, get a nice flat surface about 10 feet and roll it. If you see it roll off to the side, then you most likely have a small wheel there.

MIKE YAGLEY

When you're air inflating a wheel, a tire on a wheel, you want to make sure you use that inflation cage. Every tire shop I've been to in North America and even the tire shops I've been to around the world have those. So, use those inflation cages. That will make sure that everything's okay if there is something that goes wrong.

MIKE YAGLEY

Finally, if you don't have access to an inflation cage, put the wheel onto a vehicle, mount it up and then air it. That's going to hold that wheel in place and get away, use a clip-on chuck, walk away, have some length of inflation hose between you and that wheel. I'd say 10 feet or more.

DAVE WALTERS

10 feet.

DOUG MASON

Stay out of the trajectory.

MIKE YAGLEY

Right. Stay off to the side, air it up and like Doug mentioned, you need to stay out of that trajectory.

MIKE YAGLEY

That's a lot we've covered in a relatively short show, but I think that does it.

MIKE YAGLEY

Thank you for joining us on this episode of Behind the Wheels. If you'd like to contact us with any questions, comments, or suggestions for future episodes, you can write us at alcoawheels@arconic.com. See you next time.

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