WHEN — Q4 2013

Update #2314 A

Attention: Dayton Parts' Distributors and Business Partners.

The first issue... **WHEN** **(<u>WH</u>eel <u>E</u>nd <u>N</u>ews)**

I get a lot of phone calls on a daily basis (like all of us do) and there are some subjects that I get asked about quite frequently. Going forward I'll be addressing some of these questions in a new feature for our quarterly mailing called **WHEN** (**<u>WH</u>**eel **<u>E</u>**nd **<u>N</u>**ews). Truth be known, I actually call it WHEN because that is the most asked question in the service parts business. When will that be in? When will that ship? When are you going to stock that? When will my vehicle be done? When, when, when! You get the idea. We've all had days like that, eh?

"Value" Drums - From all the literature I've gathered, these "value" drums out in the market today, weigh right around 105.0 lbs. The OE weight for this popular drum is 112.0 lbs. and our HD1 weighs 114.4 lbs. When these "value" drums started showing up in the aftermarket my first thought was, "If a 105.0 lb drum is such a great "value" for this application then why does the OE drum weigh 112.0 lbs? I mean 7.0 lbs less material per drum, four drums per vehicle so that's 28.0 lbs less per unit times thousands of units. What OEM would pass up on those kinds of cost savings especially in today's market? Also, why did these drums only start showing up after the big economic downturn in 2009?" We all know the answer to those questions, eh? We looked into adding a "value" version of our HD1 drum and here's what we determined -

1. The largest part of the cost for a heavy duty brake drum is obviously material, how much and what kind or quality. It comes down to that in most products doesn't it? Let's take a look at these two first.

   a. Weight is one of the two main factors that determine if a brake drum can do the job it was designed for. As stated in the opening paragraph, drums that can be used for the same application do not necessarily weigh the same. Remember that whenever you're comparing brake drum pricing. For example, let's say you buy one of our HD1 drums that weighs114.4 lbs for $100. Your cost per pound for this drum would be $100/114.4 lbs = $0.874/lb. Now let's apply that same cost per pound to a 105.0 lbs "value" drum, 105.0 lbs x $0.874/lb = $91.77. A price difference of $8 and some change per drum or $32 something on a four wheel brake job which in today's market is huge. However, in actually you paid the same for what you got. The real difference is in the weight. The HD1 weighs 2.4 lbs more than the 112.0 lbs OE drum and the "value" drum weighs 7.0 lbs less. We'll go into more detail about the impact of that weight difference in just a bit. Now let's look at the other important factor, the quality of the material.

   b. Our HD1 drum is made from material that meets SAE grade G11H20 b (the old G3500 b) which is recommended for heavy duty brake drums. To quote SAE J431 Rev DEC2000 on G11H20 b, "*Brake drums and clutch plates for heavy duty service where high carbon and high hardness are both required to minimize heat checking and provide higher strength.*" The two offshore manufacturers we looked at offered a "value" drum made from material that met the old G3000 grade or G11H18 which is recommended for medium duty brake drums and passenger car/light truck applications. Needless to say these two suppliers are using the same grade of material for all of the drums they manufacture *<u>regardless</u>* of the application. Obviously one grade of material for everything would be a great way to keep the cost down but again if that's such a good idea, then why do we have different material specs for different applications? What happens if we use less material and a lower grade material for a heavy duty brake drum?

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Issue #1 - In a drum brake assembly, the hub/drum transfers the brake force from the foundation brake to the wheels/tires which in turn transfer it to the road and the vehicle slows down. Every time the brakes are applied the forward motion of the vehicle is changed into heat (energy is neither created nor destroyed but merely changes form). The brake drum absorbs this heat and dissipates it into the atmosphere. While the brake drum is absorbing all this heat it is also expanding or “growing” but there is a limit to how much heat a drum can absorb and dissipate. If the drum temperature rises above its ability to absorb and dissipate the heat accordingly it will start to “over expand” and separate. These points of separation are commonly referred to as heat checks. A brake drum with less material (weight) will reach the point of heat checking sooner simply because there is less mass to dissipate the heat. A lower quality material will take less time because it will expand at a faster rate. Once a drum has heat checks, they remain for the duration of its service life. When the brakes are applied, heat checks are like dragging a file across the friction material.

Issue #2 - As the brake temperature rises, so does the temperature of the friction material. The base ingredients in most friction material have the ability to reflect away a lot of heat (into the drum of course which is basically a heat sink). However, when the surface temperature (the top few thousandths of an inch) of the friction material spikes above 650 degrees the resin loses its bonding capabilities and friction material is lost a few thousandths at a time. It doesn’t matter what the base ingredients are once the surface temperature gets above 650 degrees, the resin can no longer hold them together. A brake drum with a lower weight/lesser quality material that can’t absorb the amount of heat the brake is generating and dissipate it sufficiently will have the surface temperature of the friction material spike above 650 degrees more often and stay there longer. A higher quality friction material will still have better, more consistent braking characteristics but the service life will be diminished thanks to the “value” drum. A lower grade friction material will have its service life shortened even more because it’s less able to reflect away heat. What a “value”, eh? Also, what usually determines when a brake job needs to be done? The condition of the brake drum or the thickness of the brake lining?

Summary – In all fairness there are probably a *few* over the road, general freight vocations with *no* severe braking, where you could use a “value” drum without any noticeable ill effects. However, this is not the usual customer for the wd/service shop/spring shop servicing the aftermarket and definitely not a big enough portion of the aftermarket to utilize all of the “value” drums being sold today. I fully realize we all have customers that buy on price alone and nothing else matters much to them. Not a lot you can do there. People believe what they choose to believe. You can talk “till the cows come home” and it probably won’t make any difference. However taking the time to explain to those who will listen that a “value” drum isn’t going to hold up for their application and *why it won’t* will go a long way in building a long term relationship with those customers.

Now on to the next subject -

Machine Balanced Drums – I get asked regularly if our HD drums are balanced. The short answer is very likely and the long answer is a bit longer (of course). If a heavy duty brake drum is cast properly and the tolerances held tight enough (very doable with the manufacturing processes available today) then the finished drum will be *within the specifications to be called balanced*. Sometimes this is referred to “as cast balanced”. Our HD1 drum is made this way. If that is the case and most quality as cast finished drums are within the specs to be called balanced then why offer a machine balanced drum? Because a machine balanced drum goes through an additional process to verify or *guarantee* that the drum is balanced.

So then, do you need a machine balanced drum for every type of application? Not really. Inboard mount trailer drums on cast spoke wheels like our HD4 comes to mind. This is an application where using a machine balanced drum isn’t really going to gain you anything. Drive axle applications for our HD1 drum I would say it’s a good idea but on trailer axles where the majority of these drums are used it’s not necessary. Steer axles on the other hand, especially with the larger 16.5" drums, are where a machine balanced drum makes really good sense. This is why over the last year Dayton Parts has changed all of our popular steer axle drums to a machine balanced version and that’s all we stock for these applications. Still from time to time we get back a machine balanced drum for being “out of round”. How can that be? How can a drum that has been checked and verified to be balanced be out of balance? There are several things to consider here.

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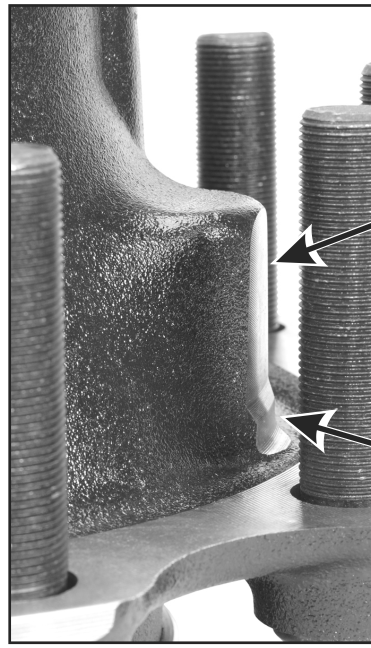
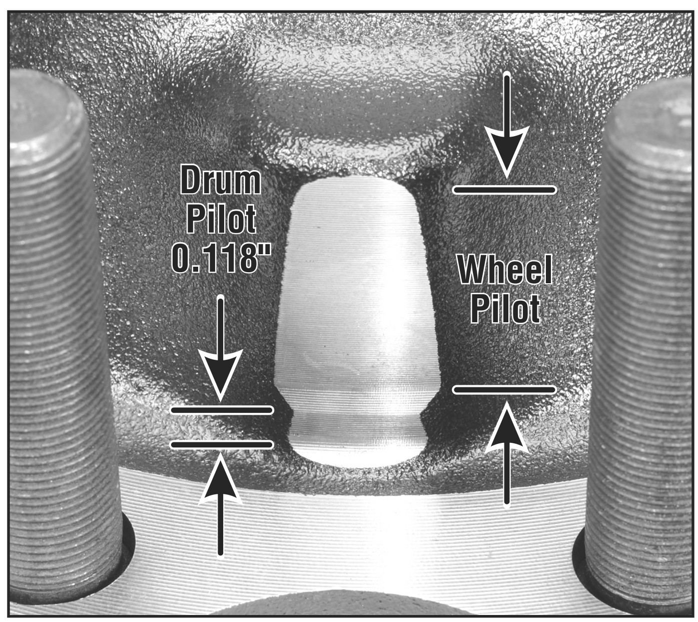


1. Hub design – In the old days of stud piloted wheels, an outboard mounted drum piloted on a radius that went around most if not the entire circumference of the hub and since the wheels did not pilot on the hub there was no limit on height either. The drum pilot radius could be tall enough to make full contact with the 1/2" thick mounting face of a cast drum or you could use a centrifuse drum with a 1/4" thick mounting face and there were no wheel mounting issues. With the advent of hub piloted wheels in the early 90's all that changed.

2. Hub Piloted Wheels – The most common outboard mount drum/hub piloted wheel set-up today uses one diameter for the drum pilot radius and a different diameter for the wheel(s). The drum pilots on an 8.78" diameter radius and the wheels on an 8.66" diameter radius. You can see the difference in the two diameters in the photo to the right.

3. Drum mounting face thickness - These two different diameters wouldn't matter much if all the brake drums used today had the same mounting face thickness but they don't. As stated earlier cast drums have a 1/2" mounting face thickness and centrifuse drums a 1/4". Since the wheel(s) mount after the drum and they pilot on a slightly smaller diameter, the height of the larger diameter for drum pilot radius becomes critical. If the drum pilot radius extends above the height of the mounting face of the drum it will keep the wheel(s) from drawing down properly and achieving the correct tension on the whole drum/wheel(s) set-up. Therefore the drum pilot radius on the hub *cannot* be taller than the drum with the thinnest mounting face which would be a centrifuse drum at 1/4" (0.25").

4. Drum pilot radius height – So the height of the drum pilot radius is limited to 1/4" (actually 6mm or 0.236") in order to accommodate a centrifuse drum if installed. Sounds okay doesn't it? A drum pilot radius a 1/4" tall for contact area between the hub and drum whether you use a cast or centrifuse drum (even though a cast drum has twice the mounting face thickness). Yes that would be the case if there wasn't a chamfer cut on the inside of the pilot diameter of a cast drum. The chamfer is there to make sure the drum seats properly against the hub face without any interference issues since all hubs are not machined exactly the same. This chamfer is usually 3mm deep (0.118") so that 1/2" thick mounting face just got cut to 0.382". Still pretty good, right? Not exactly. Remember the drum pilot radius can only be 0.236" tall (6mm) and the inside pilot chamfer is cut 0.118" (3mm) deep so that leaves you with 0.236" pilot radius height less the 0.118" inside pilot chamfer or 0.118" of contact area (0.236" – 0.118" = 0.118") or just under 1/8". See the amount of contact area in the photo to the right.



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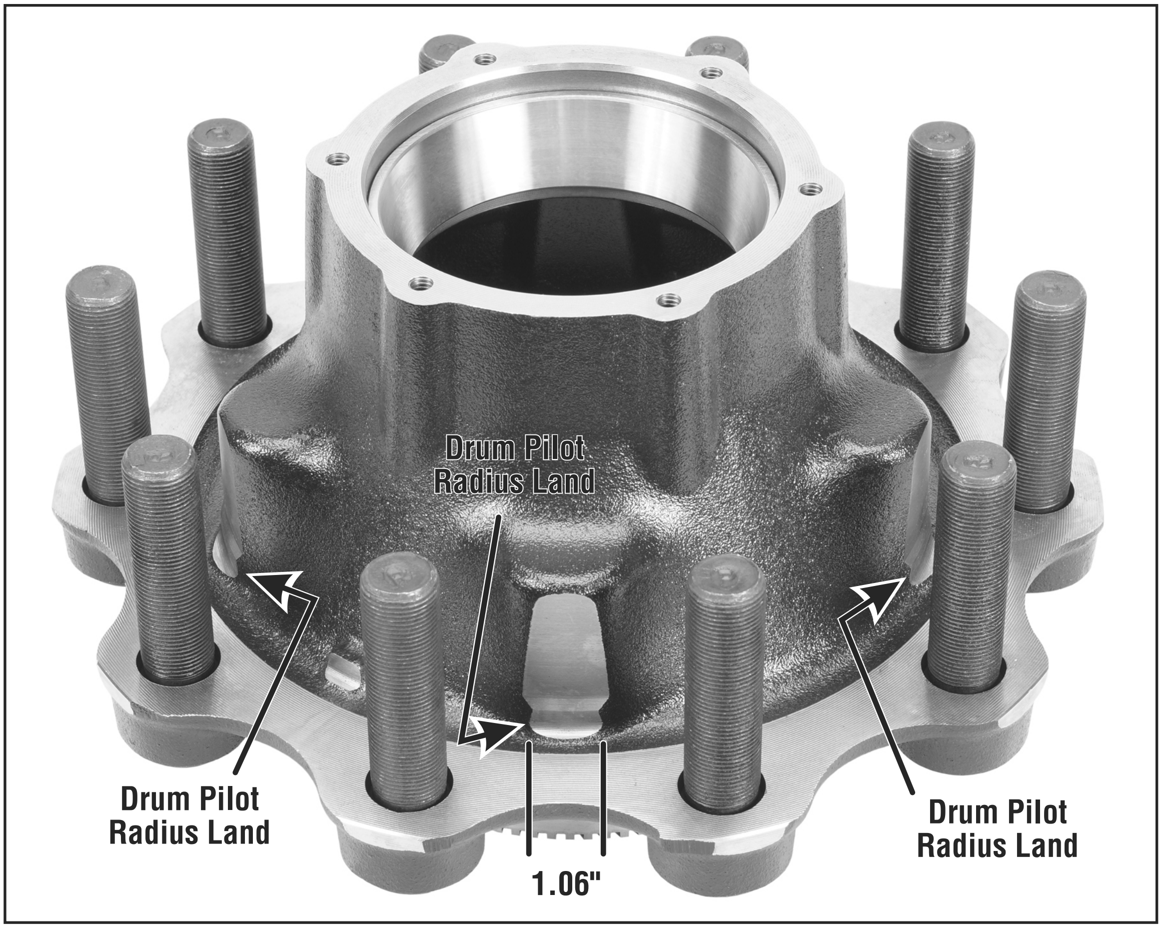
5. **Drum Pilot Radius Width –** The width of the contact area on this very popular trailer hub for tapered spindle axles is 1.06". So we have 0.118" of contact area by 1.06" long for a total contact area of 0.125 sq/in. (0.118" x 1.06" = 0.125") per drum pilot radius pad or land as they're sometimes called. There are 5 of these drum pilot radius lands on this hub (see photo below) for a total contact area between the hub and a cast drum of a whopping 0.625 sq/in (0.125" x 5 = 0.625").



6. **Drum Pilot Radius Lands –** As you can see with so little actual contact area between the hub and a cast drum the condition of these drum pilot radius lands is very critical. Remember, every time the brakes are applied the brake force generated by the foundation brake goes into the drum and is transferred to the hub through this very small amount of contact area. If any of these lands are worn to the point you can catch your thumb nail in the wear mark, the hub should be replaced. If the hub is not replaced it won't matter what drum you put on, the drum will be able to shift on the hub and give you the feeling that it is "out of round". This brings me to the third and final subject on drums in this first edition of WHEN, proper outboard mount drum installation.

Proper Outboard Mount Drum Installation – Most hubs today have small individual lands for the drum to pilot on. The trailer hub we're using, to illustrate here, is very common with 5 small lands (5 lands/10 studs) equally spaced around the drum pilot radius. Since the width of one of these lands is barely an inch it's very important to have them positioned correctly when the drum is installed. You should always have one of the lands at the vertical 12 o'clock position as shown in the following photo on page 5. Having the hub positioned like this gives the drum one of the lands to "hang on" to make sure it pilots correctly and is centered on the hub.

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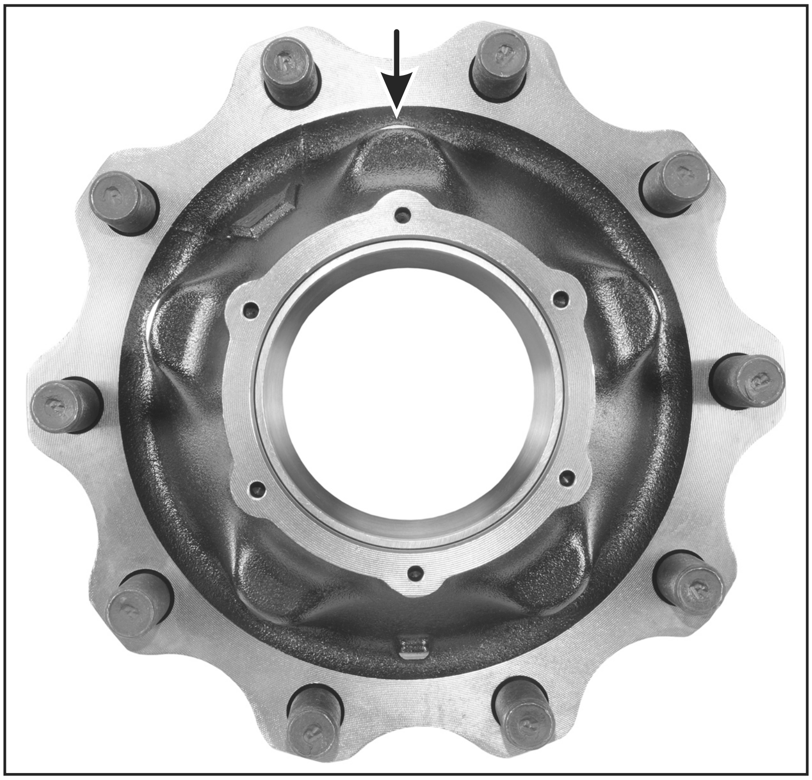
Pilot Land at 12 O'clock Position



If instead you have one of the lands at "10:30" and one at "2:30" (see photo below) the drum can be a few thousandths off-center and this will give you the feeling the drum is "out of round". It doesn't take much considering the weight of the drum and the RPM at which it's rotating when the brakes are applied.

So you made sure the drum pilot radius lands were in good shape, positioned the hub correctly, installed a machine balanced drum and it feels like one of the drums are out of round. What the heck, eh? What happened here? Usually a scenario like this only shows up on steer axles. If this happens there is one thing you can try. Determine which brake assembly is the culprit, take the tire off, rotate it 180 degrees and reinstall it. This will take care of the problem most of time. If it doesn't then you'll have to look further.

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Hope you got something out of this first edition of WHEN.

If you have something in particular you would like to see addressed in a future edition of WHEN, send me an email at:

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and put WHEN in the subject line.

Regards,

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