

## K-27 Pulling Ability

Original Topic URL: [http://www.mylargescale.com/forum/topic.asp?TOPIC\\_ID=27974](http://www.mylargescale.com/forum/topic.asp?TOPIC_ID=27974)

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Topic author: fkrutzke

Posted on: 26 Jan 2005 21:46:55

At Diamondhead each year there is a pulling contest to measure a locomotives comparative draw bar pull. At this years contest, David Bailey's Accucraft C-21 out pulled everything in sight. See the Steam in the Garden website for results. How was this accomplished?

Although the loco is coal fired, and has larger steam piping, a comparison with my coal fired K-27 on Tuesday prior to DH provided some very interesting observations. David and I ran together, doubleheading for a time. Although my K-27 at times pulled adequately, on the rougher and oilier sections of the track it would just spin the drivers. Power was obviously there, I'm also coal fired with large steam piping, but traction was decidedly wanting. A close examination of what was happening, together with several hours of digging into the suspension by David and myself revealed several serious problems.

To begin with the lead and trailing trucks support considerably more weight than they should, being sprung to provide significant down force on the rails. Second, the springing on the driving axles is so stiff as to make the drivers solid in the frames. Third, the two center sets of the drivers are shy by .015 of an inch from touching the rails. This was designed into the system by Accucraft to allow the loco to negotiate tight curves. This was also the case on David's C-21 prior to his reworking it.

On Davids C-21, which does not have a trailing truck, David rebuilt the lead truck to provide relatively little down force, and he removed springs from all the drivers so that the weight on the front and rear driver sets would compress the springs enough to allow the center two driver sets to bear their share of the weight on the rails. The removal of springs also allowed all the drivers to move up and down in their pedestals on the rough track and be always in contact with the rail.

Where to begin on my K-27. First I cut 1 turn off each truck spring, then checked for down force, not enough. Another turn, and it was better, and finally 2 1/2 turns in the front and 2 turns in the rear, seemed about right. It was then noticed that the simulated equalizing levers to the rear truck were keeping it from lifting high enough to put adequate load on the rear drivers. Shortening the back half of the equalizing levers, drilling a new bolt hole and reattaching the rear links hanging down from the frame solved the problem. Now the drivers would bear the majority of the load.

Next came the drivers, The center spring on each driver was removed, and this provided some help, but still the front and rear drivers would not compress enough to place the center two driver sets on the rails. The problem is that the axle boxes of the two center sets are longer from the axle hole to their bottom than those on the front and rear axles. To solve this I removed .050 of an inch from the center of the pedestal binder. SEE BELOW DRAWING.



This allowed all the drivers to now share equal weight on the rails, and pulling ability was vastly improved. Now that I am home, I still want to do some spring adjusting. The axles are still a little stiff, and I suspect that taking a turn or two off each of the two remaining springs on each axle will do the trick. I will need to build a scaling track where I can measure the weight at each driver to adjust the springs further. I also want to modify the lead truck to pivot from a single point and be self centering.

Both Davids C-21 and my K-27 weigh about the same and should pull comparably. As soon as I can put together a test rig like the one used at DH I'll post the results. I'll post further information as experimentation takes place.

Torry

## Replies:

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**Reply author:** Dwight Ennis

**Replied on:** 27 Jan 2005 07:09:47

Torry - forgive my ignorance... what's a scaling track and how is it built?

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**Reply author:** David BaileyK27

**Replied on:** 27 Jan 2005 07:50:09

Since getting back from Diamondhead I have checked my second C21, which is as supplied, I placed it on my surface table with long parallels to represent the track, the wheels on the front 3 axles touched the track the trailing wheels did not, I was able to get a .015" feeler gauge between track and rails.

It would be worth checking the Accucraft loco's as there seems to be some variation in build quality and tolerances.

Torry forgot to mention that I have converted my C21 to Slidevalves and Stephensons Valve Gear which increased the power output considerably.

David Bailey

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**Reply author:** Dave Hottmann

**Replied on:** 27 Jan 2005 08:44:44

Torry,

I'm glad you showed the pedestal binder drawings. I re-worked the suspension on my K-27 and John Mower's C-21 so they wouldn't lift the lead driver flange by milling out .060" on the front binder only. This allows the front drivers to drop more when going over bumps. To get the center drivers to contact the track I

removed one spring from every axle bearing and added lead in the front for balance on my K-27. John's C-21 is very nose heavy so I removed one spring on each side at the front driver and two springs on the rest. I also made sure that the springs in the bearing were not too long preventing movement. On both our engines I removed the springs and added lead to the trucks. The trucks are just going for the ride and all the engine weight is on the drivers.

David,

I think you did the best thing a person could do to a C-21 by changing to slide valves. Did you make new cylinders for the port change?

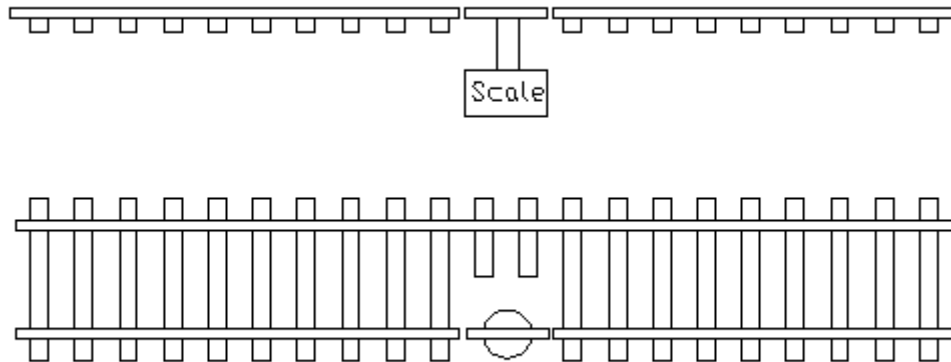
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**Reply author:** fkrutzke

**Replied on:** 27 Jan 2005 09:07:03

Dwight:

A scaling track is a length of track set up to allow you to measure the down force each driver applies to the rail. SEE DRAWING



Basically a section of rail long enough for one wheel is removed from a section of track and attached to a scale such that it is even in height with the rails sections on both sides. The loco is then positioned on the track such that each driver is weighed in turn. Face the loco the other way and weight the other side.

This will allow you to adjust the springs on each driver to get them to apply a somewhat equal down force. On an 2-8-2 drivered loco, each driver should support about 11 to 11.5 percent of the loco weight. That is, 88 to 92 percent on the drivers and 8 to 12 percent on the trucks, with the weight on the trucks slightly favoring the lead truck, ie. 5 to 8 percent. You need the weight on the lead truck to help the loco track and keep the truck from derailing through switches and such. The trailing truck on our locos is just along for the ride, and usually will trail OK with relatively little weight. On my K-27, which weighs 30 pounds, the lead truck supports about 1 1/2 pounds and the trailing truck about 3/4 of a pound, all the rest is on the drivers.

It taking weight, that is down force, off the trucks causes the locomotive to sit low on one end or the other you can change the weight distribution by adding weight to one end of the locomotive to get it to balance better on the drivers. Also Dave H's comment on adding lead to the trucks and removing all spring loading is a good one. The only problem with that is it could take a LOT of weight to keep the lead truck from bouncing off the rails on REALLY ROUGH track.

Torry

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**Reply author:** Dwight Ennis  
**Replied on:** 27 Jan 2005 09:26:25

Thanks for the clear explanation and diagram Torry. It's a terrific learning experience for me! 😊

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**Reply author:** Dave Hottmann  
**Replied on:** 27 Jan 2005 09:40:54

Torry,

I installed 3/4 ounces to the lead truck of my K-27. Without the drag from the down force spring they quit picking switches on curves. The rear truck on my K-27 has verticle slot axle bearings. Running at John Mower's track is more like four wheeling that railroading. It falls under the catagory of "REALLY ROUGH".

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**Reply author:** David BaileyK27  
**Replied on:** 27 Jan 2005 10:02:34

Dave, on my C21 I removed the cylinders and cut off the bar soldered between them, I then machined 3/16" off the port face, I made up a port plate 3/16" thick with all the ports and steamways in it, I also opened up the steam holes into the cylinders each end, these I made 3/32" two each end.

The exhaust port comes out the rear of the cylinder where the cross bar used to be, I have 1/4" OD brass tube for the exhaust pipes and 3/16" od for the inlet pipes between the steamchests, I machined out the original steam chests and used the old piston valve to drive the Slidevalve

I used the original steam chest cover but made more fixings to keep it steamtight, it has a gasket under neath.

I altered all my springing so that the loco sits on the springs and not the keep plates.  
I shall be publishing drawings for these mods as soon as I can find time to get on the drawing board.  
David Bailey

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**Reply author:** Chris Scott  
**Replied on:** 27 Jan 2005 10:20:34

Torry David, Dave:  
Echo Dwight's comment and thanks.

Ideally would you replace the factory's driver springs with matched set or different type of springs vs cutting them? Do you plan to replace the factory springs on all the drivers once you've worked out the down forces.

How much compression should there be in the driver springs when the loco is not moving?

Why not a scale for each driver to allow for measureing the down forces simultaneously?

With the center drivers now contacting the rail what becomes the minimum track curve radius for the loco, C-21 and K-27?

I'm not sure I understand the modifications you made to the trailing truck. Could you post a simple sketch or maybe a pic or two?

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**Reply author:** FH&PB

**Replied on:** 27 Jan 2005 10:47:22

In addition to removing the down-force spring on the pilot truck, I would also suggest adding centering springs. I haven't done this on my large locos yet, but after seeing what I did on my 2-4-0 Ruby, a club member did the same on his K-27 and it stopped fouling in the switches. So, the C-16 and Mogul are next for the treatment.

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**Reply author:** Dave Hottmann

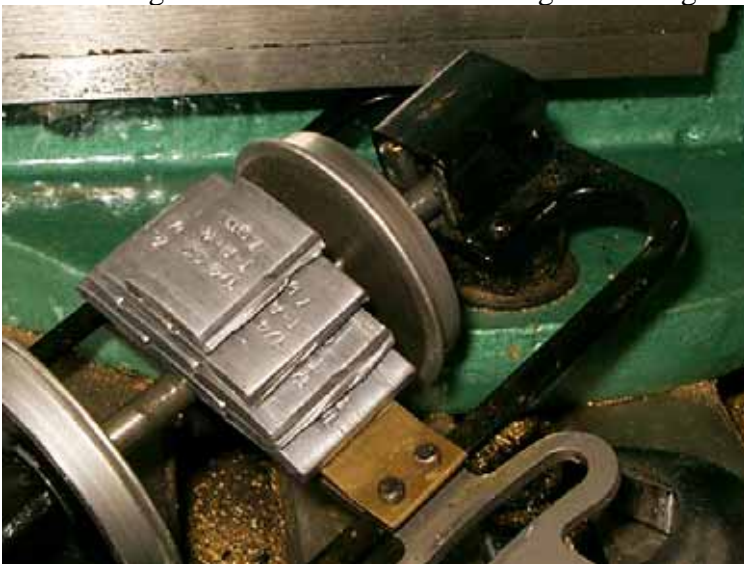
**Replied on:** 27 Jan 2005 11:09:59

Chris,

I am using the factory springs. I measure the fully compressed length to weed out the ones that are too long. They seem to vary about .050" in compressed length. I have not had to grind or trim any because I always end up with extras. I judge a spring being too long when I am not able to compress it in the engine. These usually measure around .200" fully compressed. .185 to .190s I run at the heavy end, .170 to .180s I run at the light end.

As far as the center drivers (on anything with more than two sets of drivers) not contacting the rail on a level piece of track, this is a common practice among many manufactures. The reason for this is so when the engine goes over a hump the leading and trailing flanges aren't lifted above the rail. While Accucraft engines tend to be over sprung I don't mind, it gives me something to fuss with. If they came perfect out of the box the price would be out of my reach. Over springing also keeps the engines more stable vertically. As a side note my K-27 does a visible nose dive when I stop to quickly (RC control) and it leans over when the track isn't level side to side. It also binds up more on tight curves but still takes the same radius.

I removed the original axle bearings and installed two brass rods on each side. The truck itself has the normal up and down travel but the wheel set has a lot. To keep the wheel set from bouncing I have a piece of strap resting on the center of the axle with stick-on weights. The front of the strap is loosely bolted to the front of the truck frame. I replaced the original bolts with longer ones and have nuts on the bottom to keep the truck together. This mod solved the high centering in dips



**Reply author:** linuxhost  
**Replied on:** 27 Jan 2005 15:28:50

quote:

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*Originally posted by David BaileyK27*

Dave, on my C21 I removed the cylinders and cut off the bar soldered between them, I then machined 3/16" off the port face, I made up a port plate 3/16" thick with all the ports and steamways in it, I also opened up the steam holes into the cylinders each end, these I made 3/32" two each end.  
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I altered all my springing so that the loco sits on the springs and not the keep plates.  
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David Bailey

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David (Bailey),

I too think that the C-21 has a very restrictive exhaust system and am very interested in your mods.

PLEASE, PLEASE, PLEASE don't forget to tell us all when you get the drawings done.

Doug

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**Reply author:** linuxhost  
**Replied on:** 27 Jan 2005 15:35:43

With all of this talk about axle springage, I get the impression that some of you have a traction problem with only two drivers coming in contact with the rails.

Even with my C-21 running better than she ever has, I have never spun the wheels. And this is with only the #1 & #4 drivers touching.

Plz don't tell me that you can spin the drivers on yours. If so, mine is not running as well as I think.

Doug

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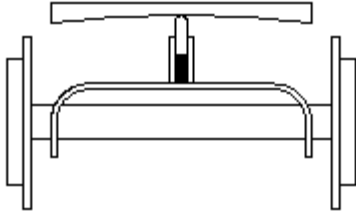
**Reply author:** fkrutzke  
**Replied on:** 27 Jan 2005 18:41:18  
**Message:**

Dave H:

Great picture of your rear truck. That kind of modification is out of the question on a coal fired conversion though; the ashpan needs all the space it can get, and drops down significantly between the wheels. This means I have to use some spring pressure.

In response to Vance, David B. redesigned the springing of his front truck such that at center the pressure is very light with the spring providing progressively more down pressure as the truck swivels away from center. This helps the truck lead the locomotive in the curve and provides a centering force.

SEE DRAWING



The truck frame has a tube attached to it that contains a spring and pin. The spring forces the pin up against a piece attached to the frame that is concave. As the truck moves sideways the spring is progressively compressed.

Torry

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**Reply author:** fkrutzke

**Replied on:** 27 Jan 2005 18:48:59

Dave H:

After David B. and I reworked the springs on my K-27 at DH, it was very easy to see why the D&RG called them "Mudhens." After the rework, the loco noticeably bobbed up and down in a very realistic fashion as it negotiated the rough track, and you could see the axle boxes, ie. journals, moving up and down in the pedestals to compensate for the irregularities.

Torry

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**Reply author:** jfrank

**Replied on:** 27 Jan 2005 20:30:05

quote:

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*Originally posted by linuxhost*

Plz don't tell me that you can spin the drivers on yours.

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Sorry to disappoint you Doug but my C21 will spin the drivers, just depends on the track conditions. At DH with all the oil on the track it would spin easily. On my back yard rr it depends on track conditions. Wet vs dry etc. If you get the boiler pressure up where it belongs it will pull close to the K27. This I believe is because of the springing of the leading and trailing trucks on the K27. They take away some of the K's tractive effort. Both these engines are sensitive to boiler pressure. They need between 40 and 60 psi to perform effectively. At least thats my experience. My engines are all stock as delivered.

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