



PENN MACHINE COMPANY LLC

December 6, 2021

TO: PMC Resilient Wheel Customers

Subject: Wheelset Back-to-Back Measurements with Resilient Wheels

Penn Machine is aware of the recent focus that has been placed on taking back-to-back measurements of wheelsets in the Transit Industry following a recent directive from the Federal Rail Administration to transit agencies. To support our customers, we want to highlight some issues with and procedures for taking this measurement on the 2-piece and 3-piece resilient wheels manufactured by PMC.

Drawing Tolerances

The tolerances listed on drawings and inspection reports for back-to-back measurements between tires specifically are for wheelsets in a test stand and supported on the journal bearings. These dimensions **do not** apply to wheelsets that are installed under a vehicle, or under any load.

Tire Back-to-Back Measurement Variation

When a wheelset is under load, many factors will alter the back-to-back measurement between tires on resilient wheels.* These factors include:

- **Tire Canting** – The tire may not sit perfectly vertical due to the geometry of the rail and the tire profile. Is the rail profile correct? Is the wheel profile new or worn?
- **Rubber Block Set** – The rubber blocks are a spring, but they do not always come back to their “home” point every time. This is especially true as rubber blocks age, and in wheelsets with independent wheels that don’t have the “self-steering” effect of a traditional wheelset. These wheels are often subjected to higher forces during curves.
- **Rail Spacing** – The wheel / rail interface is critical, and a change in this could affect the tire
- **Axle Load** – Tires on a wheelset with a heavy load may sit slightly different than tires on a wheelset with a lighter load.
- **Immediate Previous Conditions** – If a wheel has been sitting in a certain condition for a longer period of time, the rubber blocks develop a “memory”. Once the wheel is in service a few miles, the rubber blocks are “exercised” and the temporary memory is typically erased.

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Resilient Wheel Spacing Verification

The proper way to verify the spacing of PMC resilient wheels is by measuring the distance between wheel centers. This eliminates the variation allowed by the rubber blocks. The back-to-back between wheel centers is the key design criteria, and therefore what needs to be monitored in service. See Photo 1.

Note: Accurate measurements can **only** be obtained when the measuring instrument contacts bare metal on the wheel centers. It is best to check this distance in multiple locations and average the measurements.

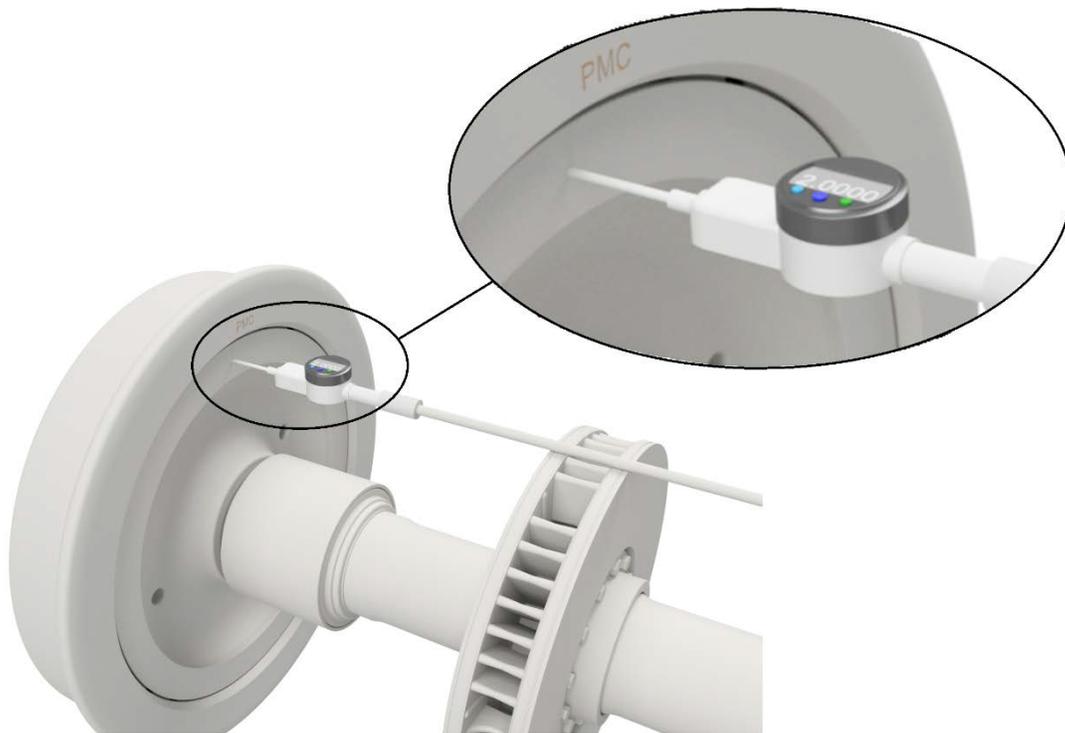


Photo 1

Resilient Wheel Design

The tires on PMC manufactured resilient wheels are designed to “float” relative to the wheel center, up to approximately 3 mm. The highly engineered rubber blocks allow tire movement reducing flange wear compared to a solid wheel. This proprietary design, including the rubber block as well as the design of the rubber block’s interaction with the tire, wheel center and conical ring (for a 3-piece wheel), constitutes a system that has been used in the Transit Industry for over 50 years with hundreds of thousands of wheels in service world-wide.

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Measurement Results

Back-to-back measurements between wheel centers should be compared to drawing tolerances to monitor wheel / axle movement. If a wheelset is measured under a car and found to be slightly out of tolerance, the wheelset should be measured in an unloaded condition for proper analysis. Any wheelset that is found out of tolerance in an unloaded condition should be pulled from service.

Service Proven Design

PMC resilient wheels have been operating without any derailment issues for over 50 years. On a resilient wheel, the tire is designed to move relative to the wheel center, but the wheel centers are not designed to move on the axle. Measure the wheel centers as part of routine maintenance and operation to make sure they are in the proper location and to ensure the performance of your Penn Machine manufactured resilient wheels.

*** Note that this applies to Bochum 54, Bochum 84, and Bochum 2000 style wheels only, and not SAB style wheels. While we manufacture tires for those wheels, they are not our design, so we cannot comment on how those wheels will behave in service.**

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