

Existing production uniformity machines can gain a new life with ERV measurement and control...



"ERV" Upgrade Kits available for D70 Series Tire Uniformity Machines with Akron Standard™ Tire Quality Controller-PC (TQC-PC™)



"ERV" Measurement Package is available as an option on the ASTEC® Model "C" Tire Uniformity Machine from Akron Standard™

Micro-Poise Measurement Systems, LLC
 Mail: P.O. Box 1869, Akron OH 44309-1869
 Ship: 1624 Englewood Ave., Akron OH 44305-4205
 Tel : 330.784.1251
 Fax: 330.784.1641
 Website: www.micropoise.com

MicroPoise
 MEASUREMENT SYSTEMS LLC

- **What is the Akron Standard™ "ERV" Package?**
 - ❑ Hardware and software for uniformity machines with TQC-PC™ controllers and ASTEC® uniformity machines.
 - ❑ ERV measurement on a low speed uniformity machine results in only a 7-8 second addition in cycle time. And, can be selected when data is desired. All other times, the uniformity machines run at normal cycle times.
- **What measurements does it provide?**
 - ❑ First, second, and third harmonic magnitudes and angles in runout units, as well as access to waveforms.
- **How should I use the measurement information?**
 - ❑ First, monitor production, compare with high-speed results and ride evaluations.
 - ❑ Second, for critical applications, grade and sort.
 - ❑ Third, use the measurements to understand where in the manufacturing process the variation may be introduced.
 - ❑ Fourth, improve the process to reduce ERV.
- **What conditions in the tire cause ERV?**
 - ❑ Typical causes are; belt placement, non-symmetrical bead setting, building drum variation, tire mold irregularities, etc. One or more of these can contribute to ERV.
 - ❑ The Akron Standard™ ERV measurement system provides the information to help isolate the conditions and improve the process.
- **What do I fix in the process?**
 - ❑ Conditions to correct can be found in the building process, including but not limited to first and second stages. Tread and belt building as well as placement are factors to be examined. Curing conditions and stock preparation are other sources of conditions contributing to ERV. One or more of these conditions may contribute to ERV.
 - ❑ The Akron Standard™ ERV package is a tool to assist in isolating, measuring and help you control the process.

Micro-Poise Measurement Systems, LLC reserves the right to make changes in specifications shown herein, add improvements, or discontinue manufacture at any time without notice or obligation. Contact your Micro-PoiseSales Representative for the most current information.

April 2007

Effective Radius Variation Measurement

On your Production Uniformity Machine

- The Missing Link for Control of Fore-Aft Force Variation -

"Tire Ride is the most important driver of replacement tire satisfaction"

"J.D. Power and Associates"
 Clemson Tire Industry Conference

... Introducing ERV



ERV is the remaining uncontrolled contributor to Fore-aft force variation currently not being measured in a production tire today.

Effective Radius Variation (ERV) is a major contributor to "Fore-aft Force Variation" and a cause of annoying vehicle vibrations.

Measuring ERV provides the only realistic economic solution to **controlling fore-aft variation** in a production atmosphere.

ERV measurement on a low speed uniformity machine is an **economical way to measure** contributing factors **and** provides information for process improvement.

For a **fraction of the cost** of a High Speed Uniformity (HSU) machine, upgrade your existing low speed uniformity machines to measure Effective Radius Variation (ERV)... one of the last unmeasured root causes of fore-aft force variation in a tire.

The Akron Standard ERV measurement provides the necessary information to improve the tire building process. HSU measurement in a production atmosphere only provides information to make "Go" or "No-go" decisions.

Tires exhibit different fore-aft force values at different vehicle speeds. The tire contribution to ride quality varies with speed and will feel different to the vehicle operator at different speeds... HSU measurement is a **"Point in Time"** measurement and is typically made at a single speed.

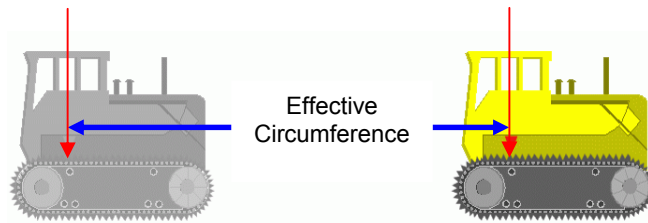
ERV Is Constant At Different Vehicle Speeds!

"Highway" or "High speed" uniformity (HSU) machines will not provide this information; they can only help set the specification limits for ERV.

MicroPoise
 MEASUREMENT SYSTEMS LLC

What Is The Effective Radius?

- Effective Circumference is defined as the distance the **center** advances for one rotation (cycle) of the “tire”.
- Effective Radius equals the Effective Circumference divided by 2π

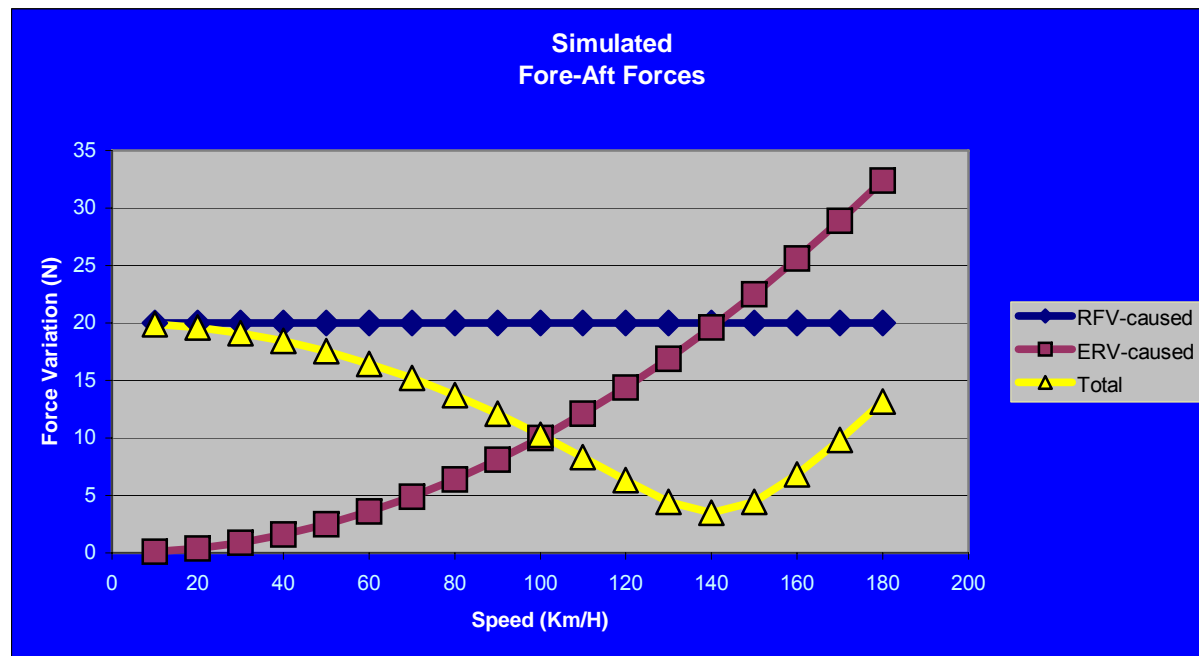


What Is Effective Radius Variation?

- The tire's linear velocity, v , is the rate at which the **center** advances per unit of time
- The tire's angular velocity, ω , is the rate at which the **tire** rotates per unit of time
- The instantaneous effective radius is the linear velocity divided by the angular velocity
- The effective radius of a radial tire varies around the tire, just like radial force variation.

e

High Speed Uniformity Machines Measure Only One Point In Time



- No single speed predicts overall Fore-aft results... a major limitation with “Highway” or “High speed” uniformity (HSU) machines.
- Effective Radius Variation (ERV) is the remaining uncontrolled contributor to Fore-aft force variation currently not being measured in a production tire today.

Radial Vibrations

- **Caused by:**
 - Radial force variation
 - Static unbalance
 - Wheel runout
 - Wheel mounting clearance
 - Vehicle spindle runout
- **Controlled by:**
 - Uniformity measurement and correction
 - Balance measurement and correction
 - Specification and wheel uniformity measurement
 - Pilot hole/spindle clearance control
 - Spindle runout specifications and process control

Fore-Aft Vibrations

- **Caused by:**
 - Effective radius variation
 - Radial force variation
 - Unbalance of tread ring
 - Static unbalance
 - Runout sources
- **Controlled by:**
 - **ERV Measurement & Process Control & Screening**
 - Uniformity measurement and correction
 - Balance measurement
 - Balance measurement and correction
 - Traditional Methods

ERV Measurements Compared To High Speed Production Uniformity Limitations:

Description	ERV... Tire production Measurement	HSU... Tire Fore-aft Measurement
Cycle Time	Minimal cycle time effect... ... 7 to 8 second increase	Each test up to 3-minutes per tire per machine
Expense and number of machines	Equivalent 8 to 10 machines can be equipped for the price of one (1) HSU machine	Up to €800,000 per machine... very expensive for production application
Accuracy	Accurate and usable values at existing 60-RPM test speed	Measured value varies depending on Tire RPM... Not usable
Control of process	ERV measurement	None
Process Control Vs Gauge	Sorting as well as in process control	Go/No-go gauge only
Improvement Vs Inspection	ERV measurement provides information for in-process control	No information for process control
Adaptable to older machines	Yes... adapts to existing uniformity machines	No... requires new machine
Control at all vehicle speeds	Yes... ERV value is same at any vehicle speed	No... Fore-aft value changes at different speeds