

Welding 100 – Welding Performance Indicators

Practical applications
and benefits

Airgas[®]
an Air Liquide company



The Welding 100 report from Airgas, an Air Liquide company, establishes a national benchmark for U.S. welding efficiency.

Built on 20 years of baseline data from over 3,000 manufacturing, fabrication and welding locations, it analyzes 100 diverse operations ranging from custom fab shops to large industrial corporations.

This resource tracks industry-wide efficiency shifts while giving companies actionable guidance to boost their own quality, productivity, and operational performance.



A proven formula makes manufacturers more competitive by driving sustainable quality improvements, while simultaneously increasing productivity and lowering costs.”

— Bill Pharmer | Senior Director of Advanced Fabrication | Airgas

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Welding Performance Indicators

For two decades, the Advanced Fabrication team at Airgas has worked to help customers better understand and improve the efficiency and competitiveness of their welding operations through the Unlocking the Hidden Cost of Welding™ program.

The process begins with a **Welding Efficiency Analysis™ (WEA)**. Airgas Weld Process Specialists gather and analyze key inputs to pinpoint wasted resources and benchmark performance. From there, the optimization cycle flows in three steps:

1. **Initial Assessment:** Conduct the baseline WEA.
2. **Action Plan:** Implement a continuous improvement strategy.
3. **Tracking Results:** Complete a **Digital Welding Efficiency Analysis™ (DWEA™)** to keep operations on target.

While specialists evaluate dozens of factors, **five core metrics** drive Gas Metal Arc Welding (GMAW) efficiency:

- 1. Gas-to-Wire Ratio**
- 2. Wire-to-Tip Ratio**
- 3. Wire-to-Grinding Ratio**
- 4. Wire-to-Liner Ratio**
- 5. Operator Factor**

These five Welding Performance Indicators (WPIs) power the Welding 100 report. By measuring 100 real, anonymized customer locations — from small custom job shops to major industrial plants — this report creates an authentic cross-industry benchmark.

Leaders can use these benchmarks as a baseline to spot hidden operational gaps in their own organization. From there, Airgas Weld Process Specialists can work directly with teams to implement customized procedures that lower costs, increase output and improve weld quality.

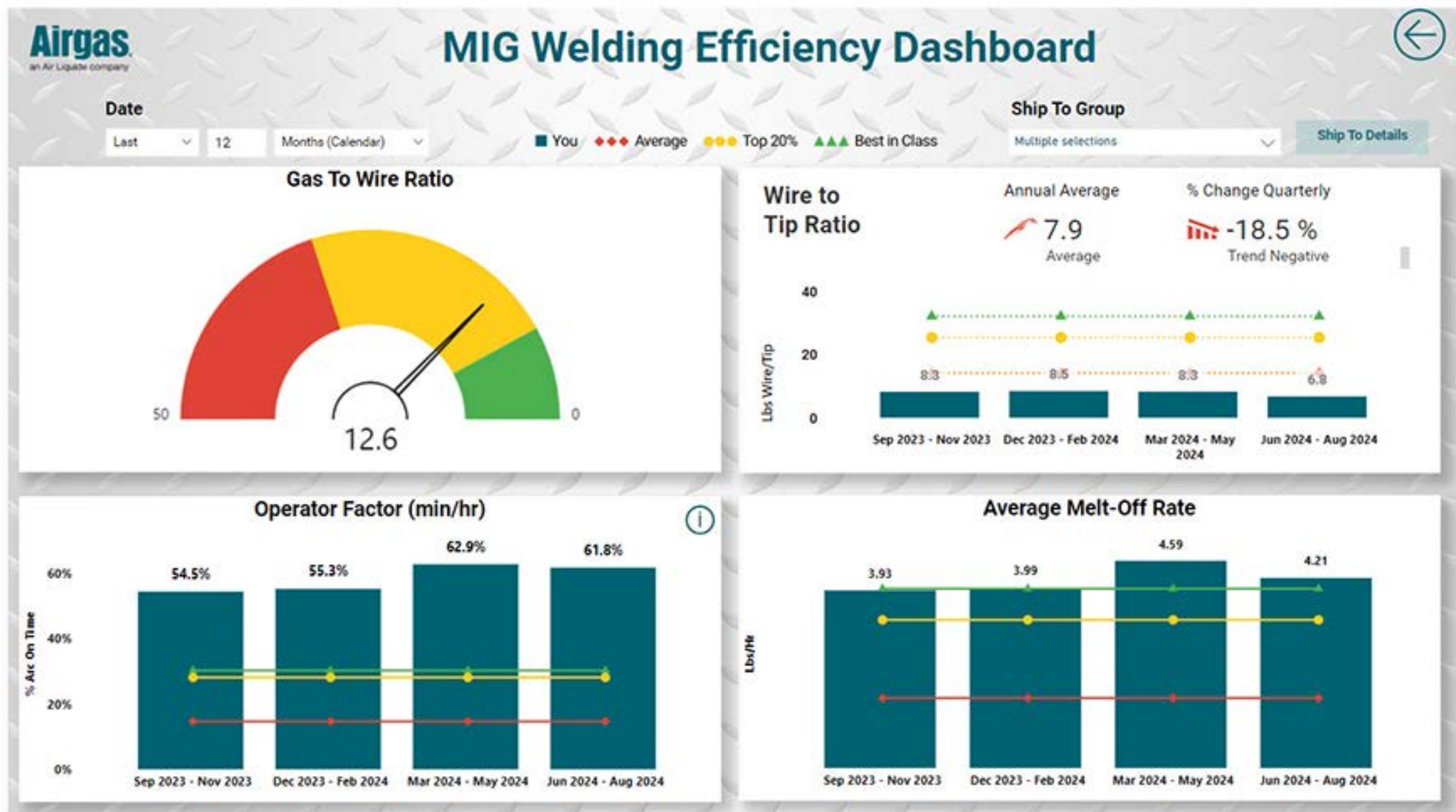


Figure 1: A MIG Welding Efficiency Dashboard, provided to customers who participate in our patented DWEA from Airgas, provides a snapshot of an organization's overall welding performance.

WPI 1: Gas-to-Wire Ratio

The **gas-to-wire ratio** measures shielding gas volume against wire weight used in GMAW. Getting this ratio right is critical:

$$\text{Gas-to-Wire Ratio} = \frac{\text{Shielding Gas Volume}}{\text{Wire Weight Used}}$$

- **Too Low:** Causes weld defects, porosity and costly rework.
- **Too High:** Wastes expensive gas and can introduce turbulence into the weld pool.
- **Bonus Diagnostic:** Spikes in this ratio instantly alert you to gas line leaks or improper flow rates.

The 20-year Trend

Industry-wide gas-to-wire ratios have climbed steadily, likely due to welder turnover, better data accuracy and shifts from cylinders to bulk gas. On average, that number has increased an average of 37% among customers working with a specialist

and up to 150% among customers not working with Airgas.

Benchmark Stats & Real-world Goals

- **Welding 100 Average:** 16.25 ft³ of gas per lb of wire.
- **Top Performers:** Close to 6 ft³/lb — ideal, but tough to hit in heavy production.
- **Sample Goal Baseline:** 15.4 ft³/lb — a solid starting point for targeting waste reduction.

Key Business Takeaway

Efficiency > Gas Savings: While cutting gas waste saves money, the real ROI comes from reducing rework and cylinder changeout downtime. With rising labor rates and welder shortages, optimizing this ratio can drop total operating costs by **20% to 40%**.

For shops using standard cylinders, upgrading to **ARCAL™ cylinders with EXELTOP™ or SMARTOP™** valves offers immediate gains:

- **30% less gas loss** compared to traditional valves.
- **Faster switchouts** to maximize arc-on time.
- **Lower gas moisture** for fewer weld defects and less post-weld cleanup.

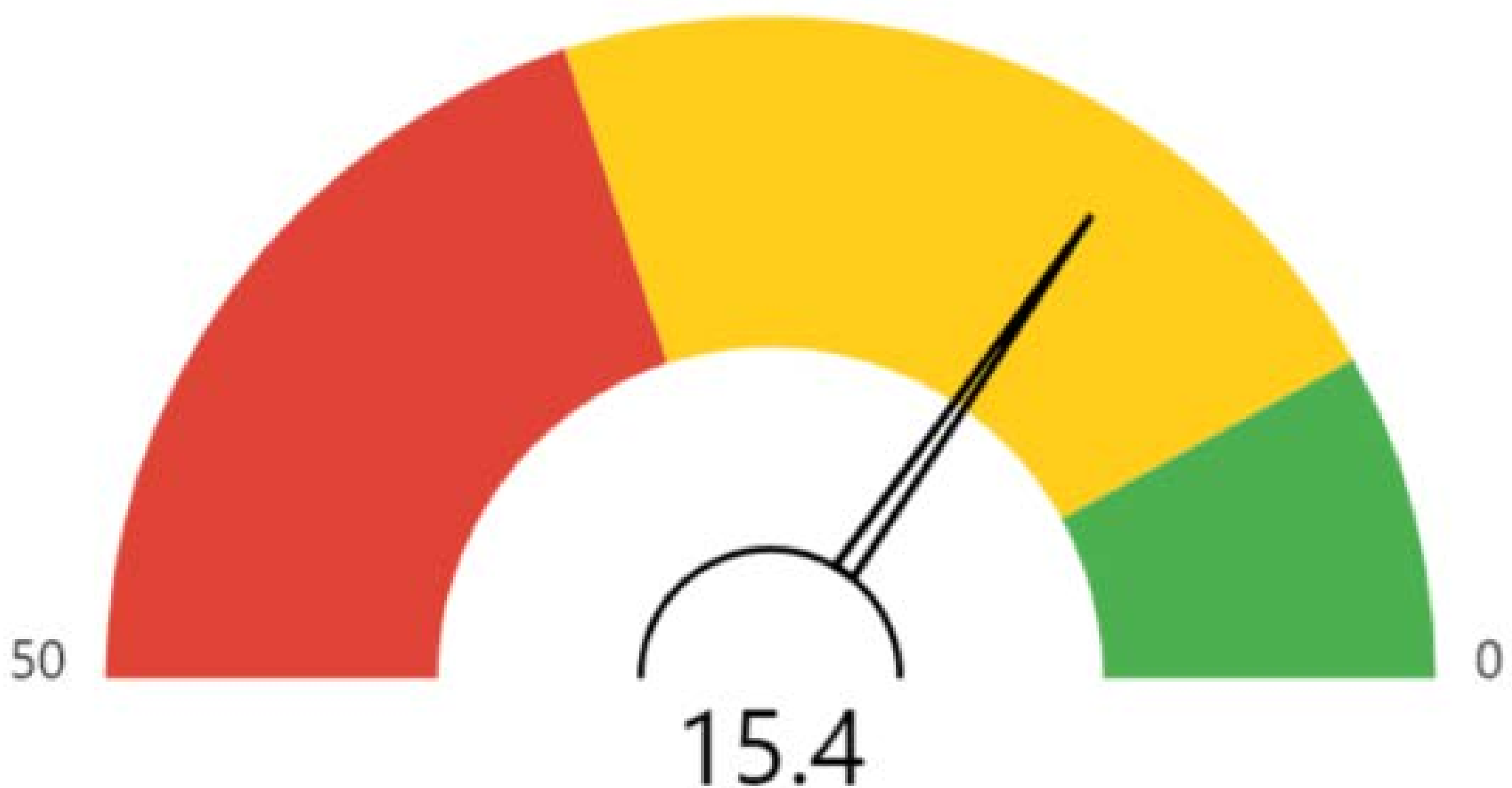


Figure 2: The gas-to-wire ratio is one of most widely used metrics. This example shows a customer who is using 15.4 cubic feet of gas for each pound of wire.

WPI 2: Wire-to-Tip Ratio

The **wire-to-tip ratio** tracks the pounds of wire fed through a contact tip before replacement is required:

$$\text{Wire-to-Tip Ratio} = \frac{\text{Pounds of Water Used}}{\text{Contact Tips Used}}$$

Factors That Impact Tip Life

- **Material & Wire Type:** Harder alloys and flux-cored wires wear tips faster.
- **Electrical Grounding:** Poor grounding causes premature arc-backs and burnbacks.
- **Shop Standard Operating Procedures:** Lack of clear guidelines often leads welders to change tips prematurely based on subjective judgment.

The Hidden Cost: Arc-off Downtime

On average, welders are getting **11.6% less wire per tip** than in past years. While contact tips are cheap, the hidden drain on profitability is **lost arc-on time**.

The 10-minute Reality Check:

Changing a tip rarely takes just 5 minutes. Between stopping work, removing PPE, walking to supply storage, grabbing parts and returning, **a single tip change averages 10 minutes of downtime**. At a modest \$27/hr labor rate, that's **\$4.50 in lost labor per swap**, which adds up quickly over multiple welders in the course of a year.

Real-world Savings Potential

Reducing tip consumption by just 250 tips per quarter reclaims significant productive capacity:

Metric	Baseline	Optimized	Difference
Tips Used / Year	4,000	3,000	-1,000 tips
Wire-to-Tip Ratio	10 lb/tip	13 lb/tip	+30% lifespan
Reclaimed Hours / Year	—	—	166.7 hours
Labor Savings (\$27/hr)	—	—	\$4,500/year

(Assumes 10 minutes per tip change + direct tip purchasing savings)

WPI 3: Wire-to-Grinding Ratio

The **wire-to-grinding ratio** compares the pounds of welding wire used against the consumption of grinding wheels and abrasive discs:

$$\text{Wire-to-Tip Ratio} = \frac{\text{Pounds of Wire Used}}{\text{Grinding Discs Used}}$$

20-Year Trend & Benchmark Gap

This ratio has steadily declined over the last two decades, largely driven by shop transitions from traditional, long-lasting grinding wheels to shorter-lived disposable discs.

- **Welding 100 Average:** ~8 lbs of wire per disc.
- **Best-in-Class Benchmark:** Close to 250 lbs of wire per disc.

The Business Impact

A low ratio indicates excessive grinding time — often caused by poor weld quality, improper joint prep or over-welding.

Key Business Takeaway: Grinding is non-value-added labor. Partnering with an Airgas Weld Process Specialist helps shops improve weld quality upfront, drastically reducing post-weld cleanup time and abrasive consumption.

Wire to Grinding Wheel

Annual Average

61.0
Average

% Change Quarterly

118.4 %
Trend Positive

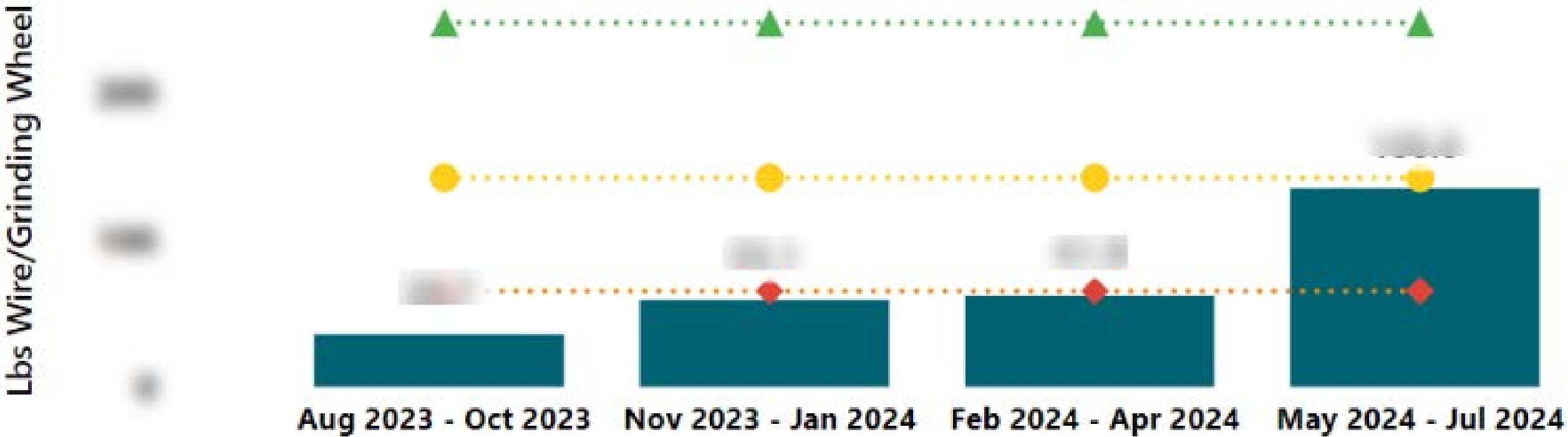


Figure 3: This customer’s wire-to-grinding wheel ratio has steadily improved during a 12-month period, bringing their average ratio to 61 pounds of wire for each grinding wheel.

WPI 4: Wire-to-Liner Ratio

The **wire-to-liner ratio** tracks the volume of wire fed through a MIG torch liner before replacement:

$$\text{Wire-to-Liner Ratio} = \frac{\text{Pounds of Wire Used}}{\text{Liners Replaced}}$$

Benchmarks & Industry Progress

Liners guide wire from feeder to tip. Replacing them proactively prevents erratic wire feeding, burnbacks and costly weld defects.

- **Welding 100 Average:** ~400 lbs of wire per liner.
- **Best-in-Class Goal:** 500 lbs of wire per liner.

Key Takeaway: Scheduled Maintenance Wins

Unlike other ratios, the wire-to-liner ratio has steadily **improved industry-wide** over the years.

Key Business Takeaway: Fabrication shops are increasingly adopting preventive maintenance schedules rather than waiting for liners to fail. Working with Airgas specialists accelerates this curve (see Figure 4), ensuring liners are changed before degradation causes arc-off downtime or poor weld quality.

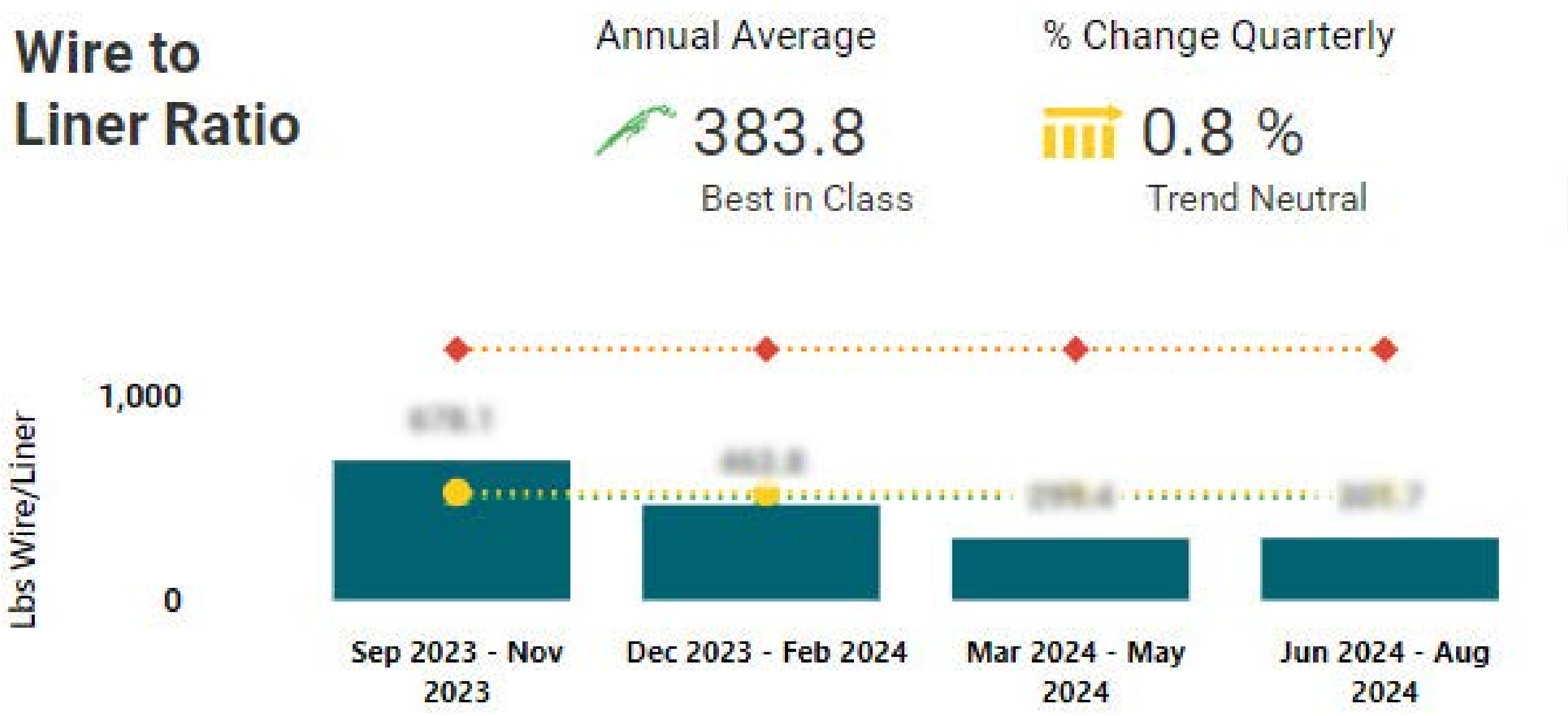


Figure 4: This customer has managed to improve their wire-to-liner ratio during the past 12 months by establishing a regular schedule that calls for changing out their liners more frequently.

WPI 5: Operator Factor (OF)

Operator Factor measures the percentage of paid time a welder spends actively welding:

$$\text{Operator Factor (OF)} = \frac{\text{Arc-On Time}}{\text{Total Hours Worked}}$$

Operator Factor reflects total operational efficiency. Any time spent changing tips, grinding or retrieving cylinders directly lowers this number. Even a 0.8% increase in Operator Factor, just 30 seconds more arc-on time an hour, can have a significant impact.

Benchmarks & Industry Averages

- **Welding 100 Average:** 8.87% (Less than 5.5 minutes of arc-on time per hour).
- **Typical Baseline:** 15% (9 minutes of arc-on time per hour).
- **Best-in-Class Goal:** 28.17% (Nearly 17 minutes of arc-on time per hour).

The Power of Small Gains

Even fractional improvements in arc-on time compound into massive productivity gains across a facility:

Facility Scenario: 20 full-time welders (40,000 total labor hours/year)

Table 3: Hours Gained from Increased Operator Factor of .08%		
	Old	New
Operator Hours	40,000	40,000
Operator Factor	15%	15.8%
Arc Time/Hour	9 mins	9.5 mins
Arc Hours	6,000	6,320

Key Business Takeaway: Gaining just **30 seconds** of arc-on time per hour yields **320 additional productive welding hours** per year without adding headcount.

Conclusion

Mastering these five Welding Performance Indicators (WPIs) unlocks measurable operational gains across three core areas:

- **Higher Productivity:** Eliminating non-value-added downtime lets welders focus on high-quality arc time.
- **Lower Operating Costs:** Reducing waste in gas, tips, liners and grinding abrasives directly drops consumable expenses.
- **Superior Quality:** Standardized procedures lead to fewer defects, less rework and a stronger finished product.

Take the Next Step with Airgas

Benchmarking your shop against the Welding 100 is the fastest path to identifying hidden profit leaks. Backed by 20+ years of research across 3,000+ locations, Airgas Specialists can help you:

1. **Assess:** Measure your current WPI baseline.
2. **Optimize:** Implement tailored procedures to cut waste.
3. **Sustain:** Track ongoing gains using the Digital Welding Efficiency Analysis™ (DWEA™).

Ready to Benchmark Your Operation?

Contact the Airgas Advanced Fabrication Team to build a continuous improvement plan that delivers sustainable savings and best-in-class performance.

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