

FLOW METER SELECTION GUIDE

Spur Gear vs. Oval Gear Flow Meters: How to Choose the Right Positive Displacement Meter

Both technologies can deliver accurate volumetric measurement. The better choice depends on what your process asks the meter to do.

By Justin Dunkerson, AW-Lake Application Engineer

Positive displacement flow meters are often the first technology considered when a process involves oil, resin, adhesive, fuel, hydraulic fluid, or another liquid that must be measured directly by volume. They do not infer flow from velocity. Instead, they repeatedly capture and release known pockets of liquid, creating an output proportional to the volume that passes through the meter.

Spur gear and oval gear meters both use this principle, and both can perform very well. Their internal geometry, however, affects pulse resolution, low-flow behavior, dynamic response, usable flow range, and application fit. Understanding those differences can make it easier to choose a meter that supports the process—not merely one that produces a flow reading.

First, What Do the Two Technologies Have in Common?

In both designs, flowing liquid turns a pair of precision-machined rotating elements inside a close-fitting chamber. Because a known volume is displaced with each movement, the meter can produce a repeatable volumetric signal. Neither technology normally requires the long straight pipe runs associated with many velocity-based meters, making positive displacement meters useful in compact equipment and OEM systems.

Both technologies are commonly used with clean liquids and can be configured for pulse, frequency, analog, display, totalizing, batching, and control functions. Both also need to be sized for the actual fluid and operating conditions. Viscosity, lubricity, temperature, pressure, filtration, flow range, and required output all matter.

How a Spur Gear Flow Meter Works

A spur gear meter contains two round, intermeshing gears. As fluid moves through the measuring chamber, it rotates the gears and carries discrete pockets of liquid around the outside of each gear. A non-intrusive sensor detects gear movement—often as individual teeth pass the pickup—and converts that movement into electrical pulses. The pulse frequency represents flow rate, while the accumulated pulses represent total volume.

Because a spur gear has multiple teeth that can be detected during each revolution, these meters can produce a dense pulse signal. That high pulse resolution is especially valuable when a controller must react to very small changes in volume or stop a dispense close to a precise target.

How an Oval Gear Flow Meter Works

An oval gear meter uses two oval-shaped rotors that turn within the measuring chamber. As the rotors rotate, fixed pockets of liquid move from the inlet to the outlet. A magnetic or electronic sensing system converts rotor movement into pulses that can be used to indicate rate or total volume.

Oval gear technology is well established for clean, viscous liquids and is available in a wide variety of body materials, connection sizes, and flow ranges. It is often a practical choice for oil, fuel, lubricant, chemical, resin, ink, syrup, and general batching or totalizing duties.

Where the Differences Matter Most

1. Pulse Resolution and Control Granularity

Resolution describes how small a change in volume the meter's output can distinguish. It is not the same as accuracy, but it has a major influence on how finely a PLC, batch controller, or dispensing system can monitor the process.

Spur gear meters often have an advantage here because the sensor can detect many gear teeth per revolution. More pulses per unit of volume give the control system more frequent updates. That can help tighten cutoff control, improve small-batch consistency, and reveal short-duration flow events that a lower-resolution signal may smooth over.

Oval gear meters can also provide high-resolution pulse outputs, and electronics vary considerably by model. When resolution matters, compare the actual K-factor or pulses per unit—not the gear shape alone.

2. Low-Flow Performance

At very low flow, internal leakage—often called slip—and the force required to start and keep the gears turning become increasingly important. A purpose-built spur gear meter with very tight clearances can be a strong choice for low-viscosity liquids and micro-flow applications. Select AW-Lake models are designed for flow rates down to approximately 0.0005 gpm (about 1.9 mL/min), depending on the meter, fluid viscosity, and operating conditions.

Oval gear meters are also available for low flow, particularly when the liquid has enough viscosity to help seal the clearances. The correct conclusion is not that one geometry always measures lower; it is that the specific meter's minimum rated flow should be checked at the application's actual viscosity.

3. Starts, Stops, Pulsation, and Fast Process Changes

Positive displacement meters are generally well suited to intermittent flow. For fast cycling, short shots, or pulsating pump output, however, signal density and response time become especially important. The high-frequency output and short response times available from spur gear meters make them attractive for dosing, dispensing, chemical injection, hydraulic test stands, and cyclic machine processes.

Oval gear meters can also perform well in fluctuating and intermittent service. For either technology, confirm the meter's frequency limit, allowable acceleration, pressure-drop behavior, and the controller's sampling speed before making a selection.

4. Viscosity Range

Both designs can measure viscous liquids, but viscosity should never be treated as a single yes-or-no specification. Spur gear meters are available in designs optimized for low-, medium-, or high-viscosity service. Clearances and bearing materials may be selected for low-lubricity, abrasive, or filled materials as well.

Oval gear meters have a long track record with medium- and high-viscosity fluids and are commonly available in larger line sizes and broad flow ranges. This can make them an efficient choice for general transfer, totalizing, and batching of clean oils, fuels, resins, syrups, and similar products.

The most reliable selection comes from matching the exact meter construction to the fluid rather than assuming all spur gear meters—or all oval gear meters—behave alike.

5. Accuracy and Repeatability

It is tempting to name a universal winner, but published specifications show that well-designed meters of either type can be highly accurate and repeatable. Accuracy depends on the complete meter design, sizing, calibration, fluid properties, and operating range. Linearization and application-specific calibration can also change the result.

For a fair comparison, review accuracy as a percent of reading or full scale, repeatability under the same conditions, turndown, and the portion of the range where the specification applies. If the liquid's viscosity changes significantly with temperature, ask whether the meter should be calibrated with the actual fluid or a closely matched substitute.

6. Installation, Filtration, and Maintenance

Neither design should be selected on the assumption that it can ignore contamination. Positive displacement meters use close internal clearances, so foreign material can jam the rotating elements or accelerate wear. Follow the manufacturer's filtration recommendation, flush new piping before startup, and avoid letting reactive or hardening materials dry inside the meter.

Pressure drop also varies with meter size, flow rate, and viscosity. Compare pressure-drop curves at the expected operating conditions instead of relying on a general statement that one gear shape is always easier to drive.

Spur Gear vs. Oval Gear at a Glance

Selection factor	Spur gear	Oval gear
Signal resolution	Often very high because multiple gear teeth can be detected per revolution; well suited to fine control.	Can be high, but varies by rotor and sensor design; verify the published K-factor.
Very low flow	Strong option when the meter is purpose-built with tight clearances for the fluid and viscosity.	Capable at low flow, especially with viscous liquids; minimum flow is model- and viscosity-dependent.
Dosing and dispensing	Frequently favored for small shots, rapid feedback, and precise cutoff control.	Well suited to many batching and dosing applications when its resolution and range meet the target.

Selection factor	Spur gear	Oval gear
Viscous liquids	Broad capability with model-specific clearances, bearings, and materials.	A common choice for clean medium- and high-viscosity liquids, often across broad sizes and flow ranges.
Pulsating/intermittent flow	High pulse density and fast response can be advantageous in dynamic processes.	Capable; confirm frequency response and operating limits for the specific model.
Contaminants	Requires appropriate filtration; specialized constructions may handle filled or abrasive fluids.	Typically intended for clean liquids; filtration and particle limits remain important.
Best-fit mindset	Choose when measurement must support precise control, detailed diagnostics, or demanding OEM integration.	Choose when dependable volumetric measurement, batching, or totalization is the primary need.

A Practical Selection Checklist

Before choosing either technology, define the conditions the meter will actually see:

- Minimum, normal, and maximum flow rate
- Fluid name, viscosity range, lubricity, and temperature
- Operating pressure and allowable pressure drop
- Particle content and available filtration
- Required batch size, response time, and pulses per unit of volume
- Accuracy and repeatability goals—and how those specifications are stated
- Output, communications, hazardous-area, and directional-flow requirements
- Cleaning, flushing, and maintenance expectations

KEY TAKEAWAY

When a process depends on very fine volumetric control, high pulse resolution, low-flow capability, or rapid feedback, a properly selected spur gear meter deserves close consideration. When the job is dependable measurement or totalization of a clean viscous liquid—particularly across larger sizes or broader transfer ranges—an oval gear meter may be an equally practical fit.

The Best Meter Is the One Matched to the Application

Gear geometry is an important part of the decision, but it is not the whole decision. A correctly sized and calibrated oval gear meter will outperform a poorly selected spur gear meter, and the reverse is equally true. The strongest results come from evaluating the entire application and comparing actual model specifications under the same conditions.

AW-Lake offers spur gear positive displacement flow meters for applications ranging from micro-flow chemical injection to hydraulic testing, paint systems, adhesives, fuels, lubrication monitoring, and OEM equipment. Our application engineers can help evaluate the fluid, flow range, process dynamics, materials, calibration, and output requirements to identify the right solution for you.

Need help selecting a flow meter? [Contact AW-Lake](#) to discuss your application.

Editorial note: Product specifications are examples, not universal limits for either gear geometry. Confirm current specifications for the exact model and operating fluid before publication or selection.