SENSIA
Rockwell Automation + SLB

NUFLO Liquid Turbine Flowmeter

User Manual

Manual No. 9A-100062201, Rev. 03

SYMBOLS AND TERMS

CAUTION
A hazardous situation which can lead to minor or moderate injury, property damage, or economic loss.

Important	Non-urgent information that may impact the outcome of a process or procedure.
Note	Additional information or a tip that may help the user to work more efficiently.

CONTACT SENSIA

For technical support, please refer to https://www.sensiaglobal.com/Technical-Support

For all other inquiries, please refer to https://www.sensiaglobal.com/Customer-Care or dial 1-866-773-6742.

REVISION HISTORY

Revision	Description of Change	Issuer	Approver	Date
3	Added CE Markings for PED meters, Minor branding updates.	KM	JM	02/27/2025

PUBLISHER NOTES

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WARRANTY

Product warranty is specified in Sensia Terms and Conditions at the time of purchase.

Table of Contents

Description

The NuFlo™ Liquid Turbine Flowmeter (Figure 1) is a rugged versatile sensor capable of handling a wide variety of liquids including many types of slurries and suspensions. The flowmeter contains a rotor secured to a tungsten carbide shaft. The shaft is supported at each end in tungsten carbide bearings. The rotor is made of a magnetic material, while the flowmeter body is non-magnetic. A magnetic pickup consisting of a magnet and coil is mounted externally in the body in the same plane as the rotor. Fluid moving through the flowmeter causes the rotor to rotate at a speed proportional to the fluid velocity. The rotor blades cutting the magnetic field in the vicinity of the magnetic pickup create a frequency signal proportional to the fluid velocity. This signal is used to represent flow rate and can be accumulated to totalize the volume of liquid through the flowmeter.

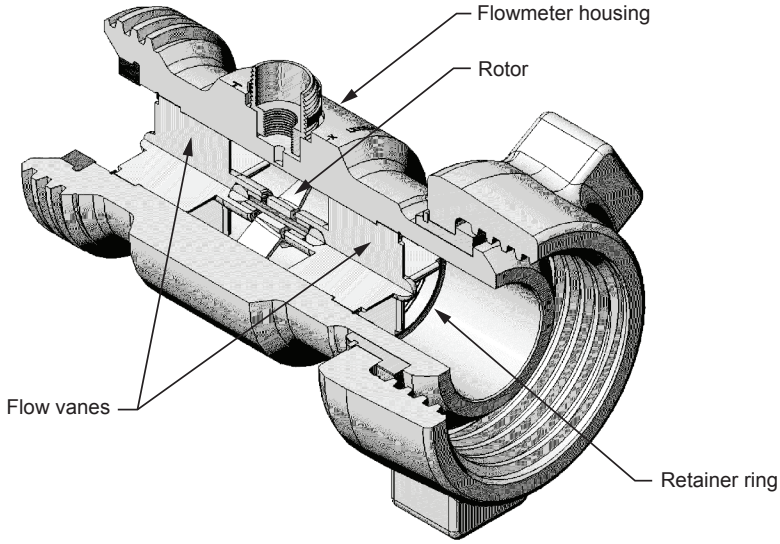

Figure 1—Nomenclature

For easy reference, the meter specifications to include part number, serial number, maximum working pressure, and minimum/maximum operating temperature are imprinted on a stainless steel tag (Figure 2 and Figure 3 on page 2) or engraved on the meter body (Figure 4, page 3). Meters with a working pressure up to 7500 are marked with a CSA single seal rating.

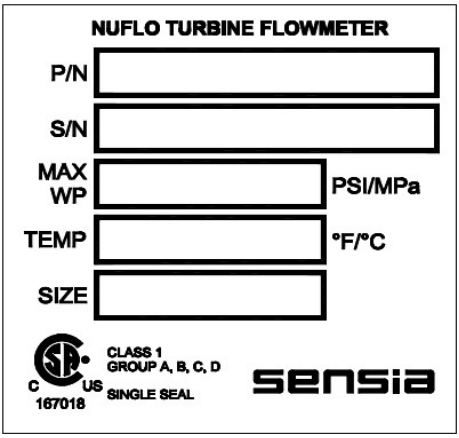

Figure 2—Product identification tag on flowmeter body

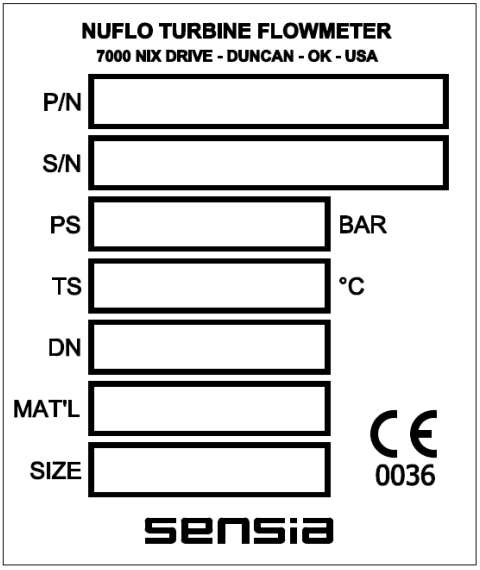

Figure 3—Product identification tag on flowmeter body (PED only)

CE Markings (for PED flowmeters only)

NuFlo flowmeters that are built to conform to the European Union Pressurized Equipment Directive (PED) are marked with the following:

- Part number
- Serial number
- Maximum working pressure
- Maximum Temperature (°C)
- Minimum Temperature (°C)
- Nominal diameter
- Material
- Manufacturer's name and address
- CE mark*
- Notified body identification number

*1-in. and smaller flowmeters are not CE-marked. The basis for PED conformance is Sound Engineering Practice (SEP).

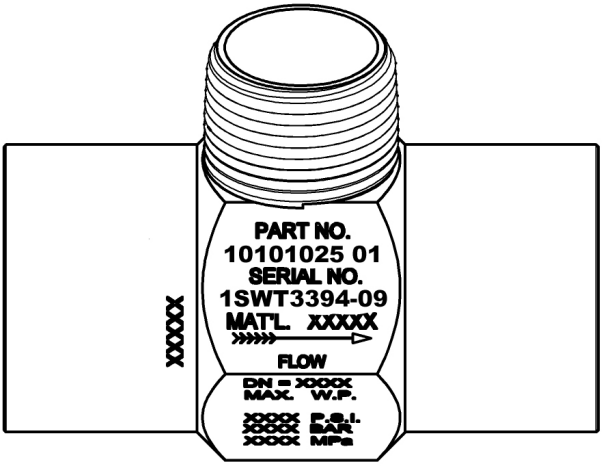

Figure 4—Product identification engraved on flowmeter body (shown on hex body)

Each flowmeter is furnished with a calibration factor representing the number of pulses per gallon produced during the calibration process. Precalibrated rotor and vane kits are available for field replacement (see Table 3, page 10). Meters and kits are available in industrial grade with a linearity of ±0.5% or standard grade with a linearity of ±1%.

Note	3/8” meters and kits are furnished as ±1% linearity for industrial grade and ±2% linearity for standard grade.

Safety Precautions

Always observe the following precautions when installing or operating the flowmeter:

- Clean all upstream lines before installing the flowmeter.
- Do not blow out lines with compressed air or gas after the meter is installed.
- Do not slug the flowmeter with fluid. Initial filling of line with fluid should be done with care.
- Do not exceed maximum recommended flow rates through the flowmeter (Table 2, page 9).
- Do not exceed the meter’s maximum working pressure.
- Avoid hammer blows or other sharp impacts on the flowmeter; it may break the shaft.
- If the end connection leaks at the time of installation, remove pressure before attempting to seal.
- The customer is responsible for ensuring chemical compatibility between the meter materials and any fluids being metered.
- The meter will retain the temperature of the fluid. Use caution when touching the meter body.

Pipe/End Connection Installation

A straight section of pipe with required end connections should be installed on either side of the intended meter’s location prior to installing the meter. This pipe must be the same nominal pipe size as the meter with a length of at least 10 pipe diameters upstream and 5 pipe diameters downstream. (For example, a flowmeter with a 2-in. nominal diameter requires a 2-in. pipe. The section of straight pipe upstream must be 20 in.; the section downstream must be 10 in.)

Important	Do not install throttling valves upstream of the flowmeter.

Flowmeter Installation

Install the NuFlo™ Liquid Turbine Flowmeter as follows. The flowmeter may be installed in any orientation (vertical, horizontal, etc.).

1. Align the meter bore with the pipe, ensuring that the direction of flow corresponds with the direction of the arrow engraved on the meter body.
2. Attach the meter to the end connections provided using customer-supplied hardware and tighten to form a leak-proof seal:
   - For an NPT threaded meter, apply an appropriate sealant to the meter threads, screw the meter into the threaded pipe connection, and tighten. Avoid the use of Teflon® tape on body threads. Strands can enter the flowstream and collect on the rotor, causing measurement error.
   - For a flanged meter, install a gasket between the meter flange and the pipe flange, install studs and nuts, and tighten the nuts evenly to the gasket manufacturer's specifications.
   - For a WECO® 1502 union meter, using caution, tighten the hammer union nuts. Do not strike the meter, as impact to the side of the meter can damage the internals.
   - For a grooved meter, install the seal and clamp per manufacturer instructions.
3. Install the magnetic pickup (Figure 5 page 5) as follows:
   a. Screw the magnetic pickup clockwise into the conduit adapter until finger-tight. Then rotate the pickup counter-clockwise one quarter turn. Do not tighten with pliers.
   b. Turn the jam nut clockwise until the pickup is secure. A ¾-in. 12-point deep thin wall socket wrench (Part No. 9A-100013146) is required.

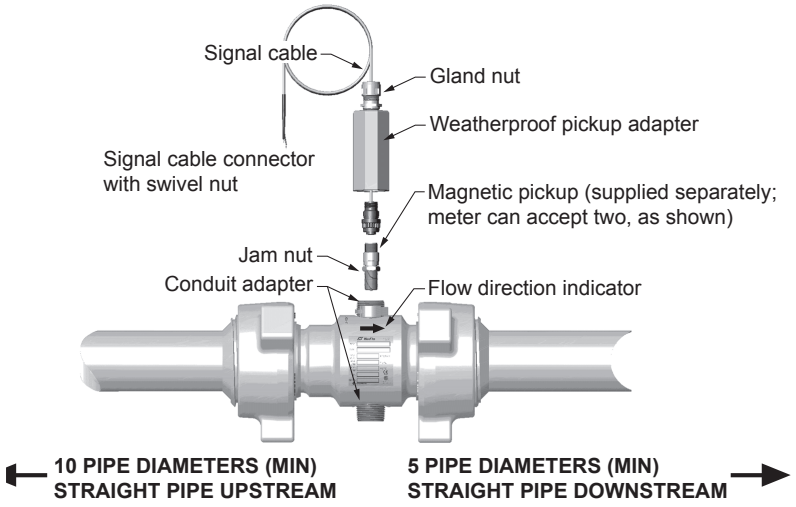

Figure 5—General flowmeter installation diagram

c. Attach the signal cable connector to the pickup and turn the swivel nut until the connection is snug. Do not over-tighten.
d. Loosen the gland nut so that the weatherproof pickup adapter rotates freely without twisting the signal cable.
e. Slip the weatherproof pickup adapter over the pickup and tighten.
f. Tighten the gland nut until the rubber grommet seals around the signal cable.

Electrical Installation

Where possible, minimize the length of signal transmission cables from the pickup. The signal from the turbine is a low-voltage AC sine wave that can be as low as 30mV peak-to-peak. Electrical noise on the wires will cause false counts on the readout instruments. Direct-mounting a totalizer or preamplifier is preferred. If this is not possible, ensure that the signal cable is not near power cables, other signal cables, or routed where electrical noise may interfere with signal transmission.

Follow common wiring installation practices, using quality cable (twisted pair, shielded with ground wire).

Flowmeter Maintenance

The flowmeter may be disassembled for inspection, cleaning or repair.

Important	If the meter internals are damaged, always replace the entire kit (Table 3, page 10). Never exchange only the damaged piece. The kits are provided as a calibrated set of components. Accuracy will be sacrificed by replacing just individual parts.

Disassembling the Flowmeter

1. Screw the magnetic pickup out of the meter body to avoid damage during handling of the meter.
2. Remove the retainer ring from one end of the meter body.
3. Slide the vane from the meter body.

Note	Some slotted meters may require a slight twist of the vane to align the vane with the slot in the meter body. If the vane is stuck, insert a brass rod through the opposite vane and through the rotor and drive the vane out by tapping on alternate blades.

4. Remove the rotor. Handle it with care to prevent damage to the rotor shaft.
5. Remove the retainer ring from the other end of the meter body.
6. Remove the second vane.
7. Do not attempt to remove the bearings and thrust balls from the vanes.
8. Clean all parts with a solvent suitable for removing the material that has flowed through the meter. A cotton swab is very useful for cleaning the inside diameter of the bearings.

Reassembling the Flowmeter

The meter is assembled in the following manner:

1. Note that the arrows that are cast or engraved on each part, indicating the direction of flow. When the meter is assembled, these arrowheads and the arrow engraved on the meter body (see flow direction indicator in Figure 4, page 3) must point in the direction that product will flow through the meter.
2. Note that one of the blades on each vane has an arrow on it. Also note that retainer pins or notches are provided at each end of the meter body. The marked blade must be inserted between these retainer pins or notches that are opposite the conduit adapter (or on the bottom of the meter body). The meters are calibrated in this position, and should be reassembled in this position for the greatest accuracy.
3. Insert one of the vane assemblies in the meter body bore, taking care to orient the flow direction arrows correctly. The vane should fit snugly but should not require excessive force to install. Install the retainer ring.
4. Install the rotor, being careful to properly orient the direction arrow on the rotor. Care should be taken to avoid chipping the tungsten carbide rotor shaft.
5. Insert the second vane assembly. If this vane does not fall into position when placed in the meter body, rotate the rotor, if possible, to align the bearing and rotor shaft. Do not attempt to drive the vane in, as this will result in a broken rotor shaft. Install the retainer ring.
6. Spin the rotor by hand, making sure that the rotor moves freely. If the rotor will not turn or stops abruptly, the meter should be disassembled and checked.
7. The meter is now ready for installation. Follow the flowmeter installation procedure as described on pages 5 and 6.

Specifications and Parts List

Table 1—Temperature/Pressure Ratings for Flanged-End Flowmeters

Flange Classification	150		300		600	
Flange Material	**Carbon**	**Stainless**	**Carbon**	**Stainless**	**Carbon**	**Stainless**
Design-Operating Temperature Range	**Maximum Working Pressure psi (mPa)**					
-20 to l00°F	285	275	740	720	1480	1440
(-28.8 to 37.7°C)	(1.96)	(1.89)	(5.1)	(4.96)	(10.2)	(9.92)
-20 to 200°F	260	235	680	600	1360	1200
(-28.8 to 93.3°C)	(1.79)	(1.62)	(4.69)	(4.14)	(9.38)	(8.27)
-20 to 400°F	200	195	635	495	1265	995
(-28.8 to 204.4°C)	(1.38)	(1.34)	(4.38)	(3.41)	(8.72)	(6.86)
-20 to 450°F	185	183	620	480	1235	963
(-28.8 to 232°C)	(1.28)	(1.26)	(4.27)	(3.31)	(8.52)	(6.64)

Flange Classification	900		1500		2500	
Flange Material	**Carbon**	**Stainless**	**Carbon**	**Stainless**	**Carbon**	**Stainless**
Design-Operating Temperature Range	**Maximum Working Pressure psi (mPa)**					
-20 to l00°F	2220	2160	3705	3600	6170	6000
(-28.8 to 37.7°C)	(15.3)	(14.9)	(25.5)	(24.8)	(42.5)	(41.3)
-20 to 200°F	2035	1800	3395	3000	5655	5000
(-28.8 to 93.3°C)	(14.03)	(12.41)	(23.4)	(20.68)	(38.99)	(34.47)
-20 to 400°F	1900	1490	3170	2485	5280	4140
(-28.8 to 204.4°C)	(13.1)	(10.27)	(21.8)	(17.13)	(36.4)	(28.54)
-20 to 450°F	1855	1443	3093	2408	5153	4010
(-28.8 to 232°C)	(12.79)	(9.95)	(21.33)	(16.60)	(35.53)	(27.65)

Table 2—Linear Flow Range[1,2,3]

Flowmeter Size *see note 3* in. (mm)	GPM	M^3/hr	BPD	Nominal Cal. Factor *see note 2* pulses/gal (pulses x 1000/m^3)	Max. Output Frequency pulses/sec	ΔP at Max. Flow *see note 2* psi (kPa)
3/8 (10)	.3 - 3	0.068 - 0.68	10-100	12000 (3170)	600	31 (213)
1/2 (13)	0.75 - 7.5	0.17 - 1.70	25-250	6300 (1664)	790	46 (317)
3/4 (19)	2 - 15	0.45 - 3.41	68-515	6300 (1664)	1575	46 (317)
7/8 (22)	3 - 30	0.68 - 6.81	100 -1000	2350 (621)	1175	20.0 (138)
1 (25)	5 - 50	1 .14 - 11.36	170-1700	900 (238)	750	20.0 (138)
1 ½ (38)	15 - 180	3.41 - 40.88	515-6000	325 (86)	975	16.0 (110)
2 (51)	40 - 400	9.09 - 90.85	1300-13000	55 (14.5)	365	22.0 (152)
3 (76)	80 - 800	18.16-181.66	2750-27500	57 (15.2)	760	20.0 (138)
4 (102)	100 - 1200	22.71 - 272.55	3400-41000	30 (7.9)	600	10.0 (69)
8 (203)	350 - 3500	79.49 - 794.94	12000- 120000	3 (.8)	175	6.0 (41)

1. The linear flow range of non-lubricating liquids is limited to the upper 60% of rating.
2. Based on water.
3. Consult Sensia's Measurement Systems Division for assistance with applications involving liquids of viscosities greater than 5 centistokes on 3/8 in. through 3/4 in. meters.

Compliances

- CSA Certified for Hazardous Areas, Class I, Div. 1, Groups A, B, C, D
- Meters with maximum working pressures below 7500 psi are compliant with ANSI 12.27.01-2003 Single Seal.
- Certified by Sensia in compliance with pre-qualified materials of NACE MR0175/ISO 15156. This certification does not imply or warrant the application of the product in compliance with NACE MR0175/ISO 15156 service conditions in which the customer/user installs the product.
- Canadian Registration Number 0F00123.2
- Conformity to PED 2014/34/EU for EZ-IN, Flanged, and WECO models.

Pickup Adapter/Coil Boss

The pickup adapter/coil boss is certified to the following ratings for safe use with NuFlo turbine meters:


II 2 G
Ex db IIC Gb
Sira 03ATEX1474U
IECEx CSAE 22.0003U
Ambient Temp: -20°C to 60°C
1”- 11-1/2 NPT

- Flameproof joints are not intended to be repaired.
- Not Ex equipment.
- For models utilizing threaded attachment (UNF threads) to the flow meter body: Special consideration is required in the end-product manufacture and the flameproof assessment of this component in each application. See IEC 60079-1, Table 4, footnote a, regarding the threaded flamepath at the interface with the flowmeter body.

Replacement Kits

Each replacement kit contains a rotor, two vane assemblies, two retainer rings, and a calibration tag. All components are calibrated as a set and should be installed as a set. Components should not be installed individually.

Table 3—Replacement Kits

Meter Kit Size (in.)	Standard Grade Part No.	Industrial Grade Part No.
3/8	9A-100003521	9A-100003378
1/2	9A-100003531	9A-100003379
3/4	9A-100003449	9A-100003380
7/8	9A-100005124	9A-100061059
1	9A-100003527	9A-100003381
1-1/2	9A-100003469	9A-100003382
2	9A-100003474	9A-100003383
3	9A-100003470	9A-100061056
4	9A-100003473	9A-100003384
6	9A-100003471	9A-100061057
8	9A-100003472	9A-100061058

CAUTION
A hazardous situation which can lead to minor or moderate injury, property
Do not install a Standard Grade kit in an Industrial Grade flowmeter. Doing so will void the Industrial Grade linearity of the flowmeter.

Troubleshooting Tips

Turbine meter system malfunctions are usually electrical/electronic, or mechanical in nature.

When a malfunction occurs, check the electrical/electronic systems in accordance with the manufacturer's recommended procedures first. If the source of the malfunction cannot be found in the electrical or electronic systems, inspect the turbine meter.

Table 4—Troubleshooting Tips

Symptom	Possible Cause	Corrective Action
Erratic output	Sensitivity, noise, or foreign material disturbing the fluid profile through the meter.	Verify proper sensitivity setting of electronic readout instrument; remove intermittent noise signals; remove meter from the line and inspect flow straighteners for foreign material; inspect the rotor for broken blades; check meter run for proper length of upstream and downstream straight pipe installation (see page 8).
No output	Wrong or poor electrical cable connections.	Check connections, correct as necessary.
	No flow.	Verify flow through pipe.
	Defective pickup coil.	Remove and check the pickup coil for continuity between the pins, replace if defective.
	Frozen rotor.	Remove meter from the line and check the rotor for free-spin. If the rotor does not spin, disassemble the meter and clean or replace the components (see Replacement Kits, page 10).

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