NuFlo™

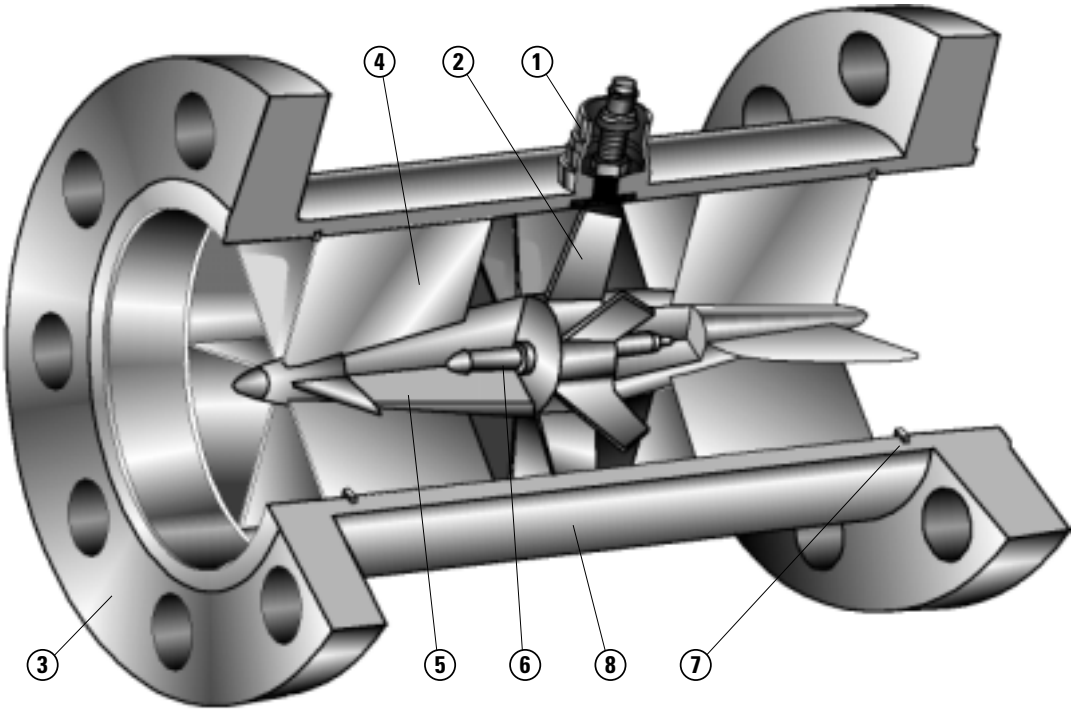
Liquid Turbine Flow Meters

Accurate Flow Measurement

NuFlo developed its first flow meter for oilfield applications in 1957. The meter incorporated a tungsten-carbide shaft and bearing to withstand the rugged conditions of the oilfield environment. Over the years, this flow meter has built an unsurpassed reputation for withstanding severe punishment while maintaining operational and measurement integrity.

NuFlo turbine flow meters indicate flow rate and measure total throughput of a liquid line. As liquid flows through the meter and over the rotor, the rotor turns at a speed that is directly proportional to the flow rate. A magnetic pickup senses the rotor blades as they pass and generates an electrical (sine wave) signal. These electrical pulses are then transmitted to the flow measurement readout equipment.

Inside Story Reveals First Class Design for First Class Performance



1. Permanent conduit connection is standard.
2. ROTOR is pitched and pre-calibrated to determine accuracy.
3. END CONNECTIONS available, flanged or threaded, standard or special.
4. FLOW VANES increase performance at low rates.
5. FLOW VANE HUB supports rotor assembly.
6. ROTOR SHAFT, BEARINGS, AND THRUST BALL are tungsten carbide for long service without lubrication other than by the liquid being measured.
7. RETAINING RINGS make disassembly easy.
8. FLOW METER BODY is sturdy, one-piece construction, precision finished.

Applications

NuFlo offers turbine flow meters for applications in a variety of end connections and accuracy levels. Typical applications are:

- Water-injection measurement
- Heater treaters
- Test and production separators
- Disposal wells
- CO2 injection
- Steam generator fuel and feed water
- Food and beverage industry
- Metering liquid fertilizer
- Water, fuel, and chemical measurement in plant settings
- Chemical tank loading and unloading
- Measuring liquid propane
- Insitu mining and leaching

Specifications

Accuracy*

NuFlo meters are classified as Standard Grade and Industrial Grade, based on the linearity of the meter. The Standard Grade meter provides a cost-effective measurement solution for applications where higher accuracy is not required. For higher accuracy applications, an Industrial Grade meter can be used. Such meters can achieve even greater accuracy if the range of the flow through the meter is specified.

- Standard Grade ± 1% of reading
- Industrial Grade ± 0.5% of reading
- Enhanced Accuracy (Consult Factory)

Note: 3/8" Meters

- Standard Grade ± 2% of reading
- Industrial Grade ± 1% of reading

Repeatability

- Standard Grade ± 0.05%
- Industrial Grade ± 0.02%
  (Based on water calibration)

Temperature Range (magnetic pickup)

- Standard -67 to 250˚ F (-55 to 121˚ C)
- Medium -67 to 450˚ F (-55 to 232˚ C)
  (Requires medium temperature magnetic pickup)
- High -67 to 850˚ F (-55 to 454˚ C)
  (Consult NuFlo Measurement Systems Technology for any use of turbine flow meters above 450˚F (232˚C).

Mating Output Connection

AN3106A-10SL-4S

Compliances

- CSA Certified Hazardous Locations Class I, Group A,B,C,D, Div. 1
- NACE MR01-75 (NACE traceability available on pressure containing components - on request)
  *Accuracy is the combination of linearity and repeatability.

Materials of Construction

- Meter Body & Vanes Grade 316L stainless steel
- Rotor CD-4MCu
- Shaft & Bearings Tungsten Carbide

Optional Materials

- Shaft Binderless carbide for enhanced corrosion resistance to selected chemicals
- Shaft & Bearings Silver brazing to withstand temperatures to 550˚F and chemicals that attack epoxy bonding bearing materials
- Rotor Duplex electroless nickel plating for enhanced corrosion resistance to selected chemicals (especially acids that corrode ferrous materials)

Benefits

- More accurate and repeatable measurement
- An economical solution for turbine flow meter applications
- Easy installation and a variety of end connections
- Minimum maintenance required
- Long service life even in severe applications

Meter Size Selection

Flow meter size selection should be based on the instantaneous flow rate of the line into which the meter will be mounted. Meter size should never be based on the nominal piping size of the installation. Refer to Linear Flow Range Chart for meter size selection. The meter will remain accurate at flow rates higher than its rating, but bearing wear and pressure drop across the meter can shorten the life span of the meter. NuFlo flow meters can be over-ranged by 10% for short periods without damage.

Installation

- The meter should be installed with the arrow on the meter body corresponding to flow direction of the line.
- A 10-diameter length of straight unrestricted pipe must be upstream and a 5-diameter length of straight unrestricted pipe must be downstream of the flow meter. Both pipe sections should be the same nominal pipe size as the flow meter's end connection.
- Throttling/Control valves should be located downstream of the flow meter.

NuFlo Turbine Flow Meter Conduit Thread Data

Temperature Rating	250˚F (121˚C)	450˚F (232˚C)
Thread Size	1" NPT	1" NPT

Note: Consult NuFlo Measurement Systems Technology for any use of turbine flow meters above 450˚F (232˚C).

End Connections

NuFlo flow meters are available in a variety of end connections.

Threaded (NPT) Connections

- Threaded meter sizes range from 3/8-in. to 2-in.
- Meter sizes from 3/8-in. to 1-in. pipe all have 1-in.
- NPT end connections to simplify meter size changes.
- All meter sizes other than the 2-in. have male threads.

Threaded End Connection Flow Meters Pressure Ratings

Meter Size (in)	3/8	1/2	3/4	7/8	1	1-1/2	2
Working Pressure	7500	7500	7500	5000	5000	5000	5000
PSI/MPa	51.71	51.71	51.71	34.48	34.48	34.48	34.48

Grooved End Connection Flow Meters Pressure Ratings & Length

Flow Meter Size x End Connection Size	**Length**		**Working Pressure**	
	in.	**mm**	**psi**	**MPa**
7/8 x 1	4.0	102	1000	6.9
1 x 1	4.0	102	1000	6.9
1-1/2 x 1-1/2	6.0	152	1000	6.9
1-1/2 x 2	6.0	152	1000	17.2
2 x 2-1/2	10.0	254	1000	17.2
3 x 3	12.5	318	1000	6.9
4 x 4	12.0	305	1000	6.9
6 x 6	12.0	305	800	5.5
8 x 8	12.0	305	800	5.5

Grooved Connections

Flow meters with grooved end connections are available in 7/8-in. through 8-in.

Flanged Connections

Turbine flow meters with flanged end connections are available in both raised-face (RF) models and ring-type joint (RTJ) models. Flanged materials can be carbon steel or stainless steel. All flanged NuFlo meters are equipped with slip-on flanges, which are then welded to the outside of the meter rather than being welded to the end of the meter body. Thus, the flange never comes into contact with the fluid being measured.

EZ-IN™ Connections

Series BF Turbine Flow meters with EZ-IN connections provide a cost-effective alternative to typical flanged-meter applications. Series BF meters with EZ-IN connections offer the accuracy, rugged construction, and maintenance-free operation of conventional NuFlo flow meters plus the following advantages:

- Lower installation cost.
- Less expensive than a conventional, flanged meter.
- Spreader nuts enable easy removal and inspection.
- The raised-face EZ-IN meter will mate to any flange rated ANSI 150# to 1500#. The new ring-joint (RTJ) version will mate to ANSI 900#, 1500# or 2500# RTJ flange. Specify flange type when ordering.

Weco® 1502 Union Connections

Flow meters with 1502 end connections are commonly used in high-pressure oilwell service applications. Meter sizes 1", 11/2" and 2" have 2" union end connections, and 3" meters have 3" union end connections. All 1502 union end meters have two pickup adapters.

Cast Body Flow Meters

Modern casting technologies allow us to now offer cast body standard grade meters. The cast body meters provide cost-effective measurement solutions for applications where higher accuracy is not required. These meters are available in 1" and 11/2" sizes.

Materials of Construction

- Meter Body & Vanes — 3F3M (cast grade 316L stainless steel)
- Rotor — CD4MCu
- Shaft and Bearings — Tungsten Carbide

Specialized Flow Meters

- High-pressure
- Nitrogen
- CO2
- Cement-Slurry
- Corrosive-Service
- Drilling Fluids

Contact NuFlo Measurement Systems for application assistance.

Linear Flow Range[1,2,3]

Flow Meter Size[3]	mm	GPM	m^3/HR	BPD	Nominal[2] Calibration Factor Pulses Gallon	Pulses x 1000/ m^3	Maximum Output Frequency (Pulses/Sec)	ΔP at Maximum Flow[2] psi	kPa
3/8	10	.3 - 3	0.068 - 0.68	10 - 100	22000	(5812)	1100	4.0	28
1/2	13	.75 - 7.5	0.17 - 1.70	25 - 250	14500	(3830)	1815	12.0	83
3/4	19	2 - 15	0.45 - 3.41	68 - 515	2950	(780)	740	18.0	124
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
1-1/2	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
6	152	250 - 2500	56.78 - 567.82	8600 - 86000	7	(1.8)	290	10.0	69
8	203	350 - 3500	79.49 - 794.94	12000 - 120000	3	(.8)	175	6.0	41

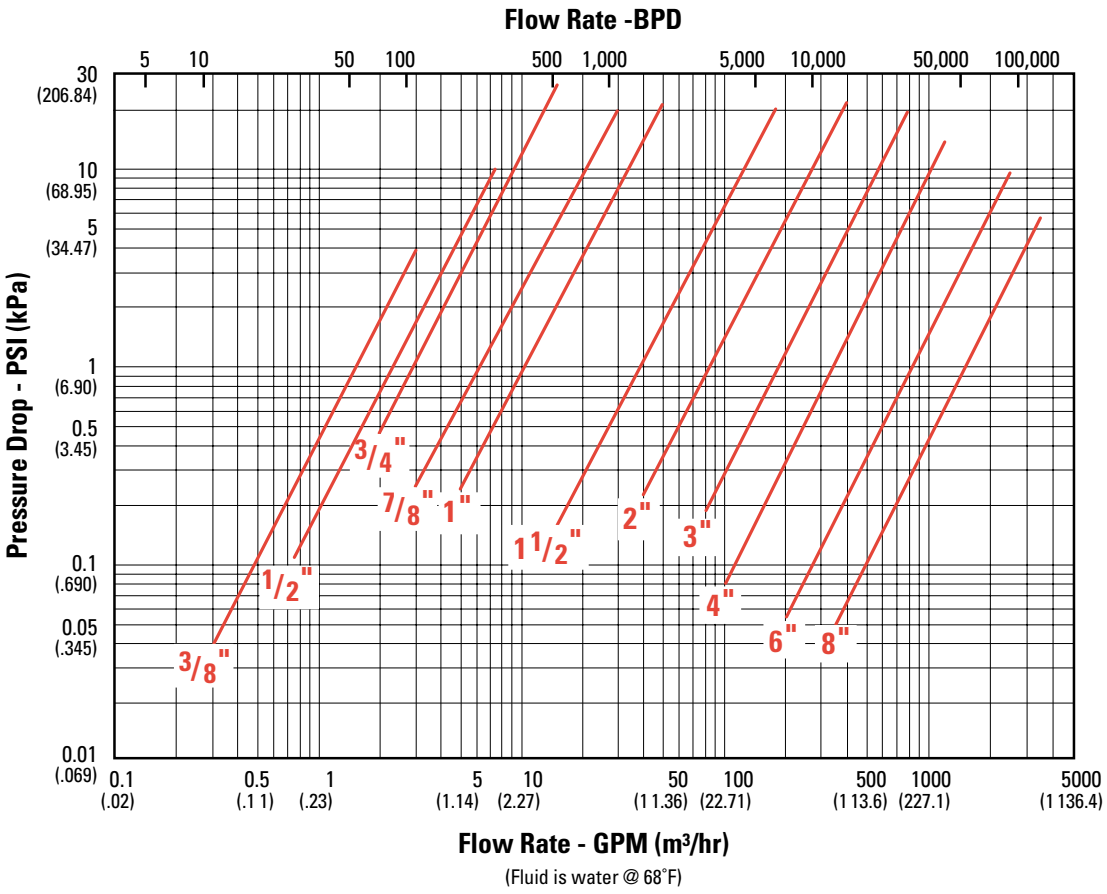
1. The linear flow range of liquids with non-lubricating characteristics is limited to the upper 60% of rating.
2. Based on water.
3. Consult NuFlo Measurement Systems for engineering assistance with applications involving liquids of viscosities greater than 5 centistokes on 3/8-in. through 3/4-in. meters.

Face to Face Dimensions

	Flanged Meters	Threaded	Grooved	EZ-IN 1" Flange	EZ-IN 2" Flange	EZ-IN 2" Ring Joint Flanged 1500 / 2500	Weco High Pressure
3/8*	5.00 (127.0)	4.0 (102)	N/A	4.0 (102)	2.5 (63.5)	N/A	N/A
1/2*	5.00 (127.0)	4.0 (102)	N/A	4.0 (102)	2.5 (63.5)	N/A	N/A
3/4*	5.00 (127.0)	4.0 (102)	N/A	4.0 (102)	2.5 (63.5)	N/A	N/A
7/8	6.00 (152.4)	4.0 (102)	4.0 (102)	4.0 (102)	2.5 (63.5)	N/A	N/A
1	6.00 (152.4)	4.0 (102)	4.0 (102)	4.0 (102)	2.5 (63.5)	3.5 (88.9)	8.00 (203.3)
1-1/2	7.00 (177.8)	6.0 (152)	6.0 (152)	N/A	2.5 (63.5)	3.5 (88.9)	8.60 (218.4)
2	8.50 (215.9)	10.0 (254)	10.0 (254)	N/A	2.5 (63.5)	3.5 (88.9)	9.00 (228.6)
3**	10.00 (254.0)	N/A	12.5 (318)	N/A	4.25 (108)	4.25 (108)	13.0 (330.2)
4	12.00 (304.8)	N/A	12.0 (304.8)	N/A	5.0 (127)	5.0 (127)	N/A
6***	12.00 (304.8)	N/A	12.0 (304.8)	N/A	5.75 (146.1)	5.75 (146.05)	N/A
8***	12.00 (304.8)	N/A	12.0 (304.8)	N/A	6.25 (158.8)	6.25 (158.75)	N/A

* 3/8" through 3/4" 900#, 1500#, 2500# is 6.25 (158.8)
** 3" 2500# is 12.0 (304.8)
*** 6" and 8" 2500# is 14.0 (355.6)

Pressure Drop Curve for NuFlo Turbine Flow Meters



Flanged End Connection Flow Meters - ANSI B16.5 Pressure Ratings

ANSI B16.5 Flange Rating			150*		300*		600*		900*		1500*		2500*	
ANSI B16.5 Flange Rating			1.1	2.2	1.1	2.2	1.1	2.2	1.1	2.2	1.1	2.2	1.1	2.2
Design-Operating Temperature Range														
-20 to 100° F (28.8 to 37.7° C)	Max Working Pressure	psi	285	275	740	720	1480	1440	2220	2160	3705	3600	6170	6000
		mPa	1.96	1.89	5.10	4.96	10.2	9.92	15.3	14.9	25.5	24.8	42.5	41.3
-20 to 200° F (28.8 to 93.3° C)	Max Working Pressure	psi	260	240	675	620	1350	1240	2025	1860	3375	3095	5625	5160
		mPa	1.79	1.65	4.65	4.27	9.31	8.54	13.9	12.8	23.2	21.3	38.8	35.5
-20 to 400° F (-28.8 to 204.4° C)	Max Working Pressure	psi	200	195	635	515	1270	1030	1900	1540	3170	2570	5280	4280
		mPa	1.38	1.34	4.38	3.96	8.76	7.09	13.1	10.6	21.8	17.7	36.4	29.5
-20 to 600° F (-28.8 to 315.5° C)	Max Working Pressure	psi	140	140	550	450	1095	905	1640	1355	2735	2255	4560	3760
		mPa	0.96	0.96	3.79	3.10	7.55	6.23	11.3	9.33	18.8	15.5	31.4	25.9
Test Pressure	1.5 times maximum working pressure at -20 to 100° F (28.8 to 37.7° C)													

*Flange Rating 1.1 References Carbon Steel Flanges. Flange Rating 2.2 References Stainless Steel Flanges

Companion readout instruments for NuFlo turbine flow meters are also available.

NuFlo Measurement Systems

A NuFlo Technologies Company

1.800.654.3760 • www.nuflotech.com

NuFlo Office Locations:

USA:	• Houston, TX	• Corpus Christi, TX	• Longview, TX
	• Odessa, TX	• Duncan , OK	• Shreveport, LA
	• Houma, LA	• Layfayette, LA	• Laurel, MS
	• Bakersfield, CA	• Saginaw, MI	• Casper, WY
	• Broomfield, CO	• Dallas, TX	• Tulsa, OK
Canada:	• Edmonton, AB	• Calgary, AB	
International:	• Jakarta, Indonesia	• Aberdeen, Scotland	• Bognor Regis, UK
	• Dubai, UAE	• Singapore	• Hassi Messauod, Algeria

For representation in your area:

Document NF 00001 02 1204