Principle of Operation

Liquid enters a precision-machined chamber containing a disc which nutates (wobbles). The position of the disc divides the chamber into compartments containing an exact volume. Liquid pressure drives the disc to wobble and a roller cam causes the nutating disc to make a complete cycle. The compartments are filled and emptied each cycle. The movements of the disc are transmitted by a gear train to a register/totalizer or pulse transmitter. Close clearances between the disc and chamber ensure minimum leakage for accurate and repeatable measurement of each volume cycle.

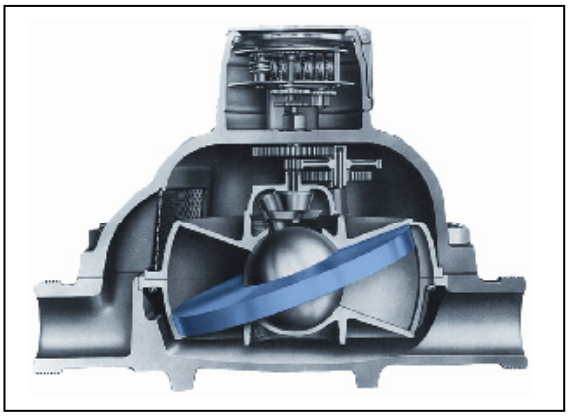


Figure 1

Figure 2. 1" Nutating Disc with R-25 transmitter

Figure 3. 1½" Nutating Disc with R-10 register

Figure 4. 1" Nutating Disc with R-31 register

Accessories

- Rate of flow indicators
- Totalizers
- Transmitters
- Batch controllers

Benefits

Exceptional Value	Eliminates upstream and downstream straight run piping requirements. Power not required for mechanical version.
Saves Space	Very compact size
Fluid Compatibility	Various materials of construction makes flowmeter compatible with broad range of fluids

Functional Specifications

Fluid Type	Liquid
Maximum Pressure	See Table 3
Fluid Temperature	See Table 3
Registration	U.S. gallons, lbs., Imperial gallons, Liters, etc.
Outputs	Mechanical totalizing, mechanical batching, electro-mechanical totalizing, electro-mechanical batching, and blind electronic pulse registers available.

Performance Specifications

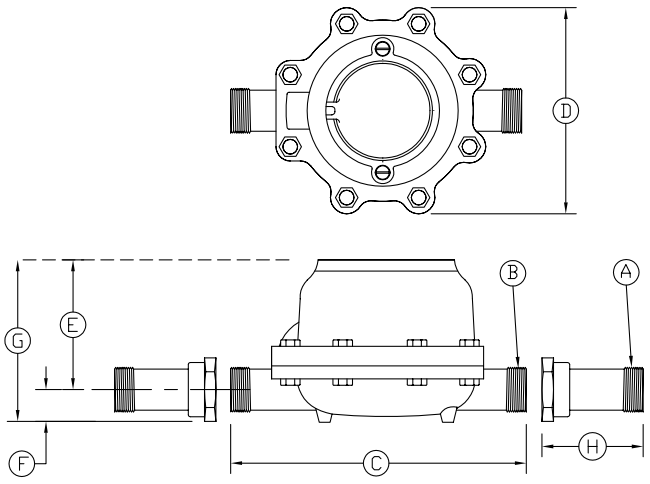
Accuracy	+ 1.5% of rate over flow ranges of Table 2 - std. + 0.5% of rate available (consult factory)
Repeatability	+ 0.25% of rate
Flow Turndown Ratio	See Table 2
Agency Approvals	UL and CSA, Class 1 Div 1 Group D, R22 only, Display and Totalizer available

Physical Specifications

Materials of Construction	See Table 3
Case	Bronze; 316 SS; or Epoxy coated Cast Iron or carbon steel
Chamber Material	Bronze; Ni-resist; or 316 SS
Disc	Ryton®
Ball	Ryton® or carbon
Gasket	Nitrile, Synthetic Fiber with Rubber Binder or TeflonT with 316 SS chamber
Gears	Bronze or 316 SS with 316 SS chamber
Register Housing	Plastic, Bronze, Aluminum
Connections & Mountings	See chart below for MNPT Connections
Mounting Position	Horizontal: Ensure meter remains full with register up.
Typical Straight Pipe Requirements	Upstream: none, Downstream: none
Process Connections	MNPT: Flange 3” and 4”. See Table 2.
Electrical Connection	Only for optional electronic transmitter

Physical Dimensions

DIM’s	Measurement	Meter Type					
		N075	N100	N125	N150	N200	N250
A	Threaded size on coupling (MNPT)	0.50	0.75	1.00	1.25	1.50	2.00
B	Threaded size on meter body (MNPT)	0.75	1.00	1.25	1.50	2.00	2.50
C	Overall length of meter	6.50	8.00	9.00	10.75	12.63	15.25
D	Overall width of meter	4.50	6.31	7.25	8.88	8.78	11.88
E	Height above pipe center	4.38	2.25	2.14	5.56	5.30	6.25
F	Depth below pipe center	0.88	2.34	2.73	1.25	1.63	1.88
G	Overall height of meter	5.25	4.59	4.88	6.81	6.93	8.13
H	Length of coupling	2.38	2.50	2.38	2.75	2.88	3.00



Sizing and Ordering Information

Please provide completed application data sheet, which can be downloaded from www.niagarameters.com.

1. Confirm fluid viscosity at process temperature. Select Group category from **Table 1** and Material from **Table 4.**
2. Confirm that the minimum and maximum flow ranges to maintain stated accuracy, for the Group category chosen, are within your requirements.
3. Move horizontally across the row of **Table 2** until you reach the desired case materials compatible with the process fluid. See **Table 4** for additional information.
4. Select line size identified from the column under your desired case material, **Table 2**.
5. Select materials of construction for case, chamber, disc and ball using **Table 3** and **Table 4**.
6. Confirm maximum pressure capability of meter at process temperature per **Table 3**. Confirm that pressure drop across the meter does not exceed your system requirements.
7. Select drive type from **Table 2**.
8. Select Register/Transmitter.
9. Specify Register/Transmitter units of measure (gallons, pounds, liters, etc.)

Flow Rate Group

Table 1

Group 1	Up to 30 SSU (.20 to 1.00 centipoise)
Group 2	31 to 450 SSU (1 to 90 centipoise)
Group 3	450 to 1,000 SSU (90 to 220 centipoise)
Group 4	1,000 to 5,000 SSU (220 to 1,100 centipoise)
Group 5	5,500 to 20,000 SSU (1,100 to 4,400 centipoise)
Group 6	20,000 to 50,000 SSU (4,400 to 11,000 centipoise)

Flow Ranges

Minimum and maximum flow rates in GPM to achieve accuracy

Table 2

Flow Rate Group (flow rates in GPM)						High Pressure Epoxy Coated Carbon Steel with Mechanical Drive	Epoxy Coated Cast Iron with Mechanical Drive	Bronze with Mechanical Drive	Bronze with Magnetic Drive	316 SS with Mechanical Drive
1	2	3	4	5	6					
0.75 - 5	0.5 - 7	0.2 - 5	0.2 - 5	0.2 - 3			0.75” MNPT	0.75” MNPT		
1 - 11	1 - 20	1 - 15	1 - 8	1 - 4		1” MNPT	1” MNPT	1” MNPT		1” MNPT
3 - 18	2 - 30	3 - 20	1 - 12	1 - 6	0.5 - 4		1.25” MNPT	1.25” MNPT		
5 - 30	3 - 50	5 - 30	2 - 15	1 - 8	1 - 5	1.5” Flg.	1.5” MNPT	1.5” MNPT		1.5” Flg.
7 - 35	5 - 100	7 - 50	2 - 35	2 - 20	1.5 - 10		2” MNPT	2” MNPT		
12 - 65	8 - 160	12 - 100	5 - 70	5 - 40	2 - 20	2.5” Flg.	2.5” MNPT			2.5” Flg.
18 - 100	8 - 240	15 - 125	9 - 80	9 - 45	4 - 25			3” G Flg.		
22 - 120	15 - 300	25 - 180	12 - 110	12 - 60	10 - 30			3” I Flg.		
35 - 185	20 - 400	30 - 250	16 - 190	16 - 100	14 - 50			4” Flg.		

Temperature & Pressure Ratings

Table 3

Case Material		**Bronze**									
Chamber Material		Bronze Standard									
Drive		Magnetic		Mechanical							
Size		0.75”		1”	1.5”	2”	3” G	3” I	4:		
Temperature & Pressure (in psi)	100°F	150		200	225	250	225	225	150		
	200°F	135		185	210	235	200	210	135		
	300°F	115		165	195	215	175	185	110		
	400°F	100		150	175	200	150	160	85		
End Connections		MNPT		MNPT	MNPT	MNPT	Flg.	Flg.	Flg.		
Case Material		**Epoxy Coated Cast Iron**									
Chamber Material		Bronze Standard						Ni-resist Optional	Stainless Steel Optional		
Size		0.75”	1”	1.25”	1.5”	2”	2.5”	1.25”	1”	1.5”	2.5”
Temperature & Pressure (in psi)	100°F	150	300	250	250	250	175	250	300	250	175
	200°F	135	285	235	235	235	160	235	285	235	160
	300°F	115	265	215	215	215	140	215	265	215	140
	400°F	100	250	200	200	200	125	200	250	200	125
End Connections		MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	
Case Material		**Epoxy Coated Cast Iron - High Pressure Ink Meter**									
Chamber Material		Bronze									
Size		1”									
Temperature & Pressure (in psi)	150°F	5000									
End Connections		MNPT									
Case Material		**High Pressure Epoxy Coated Carbon Steel**									
Chamber Material		Steel									
Size		1”	1.5”	2.5”							
Temperature & Pressure (in psi)	100°F	1440	720	720							
	200°F	1400	700	700							
	300°F	1365	680	680							
	400°F	1330	665	665							
End Connections		MNPT	Flg.	Flg.							
Case Material		**High Pressure Epoxy Coated Carbon Steel**									
Chamber Material		Steel									
Size		1”	1.5”	2.5”							
Temperature & Pressure (in psi)	100°F	150	150	150							
	200°F	130	130	130							
	300°F	115	115	115							
	400°F	100	100	100							
End Connections		MNPT	Flg.	Flg.							

Registers / Transmitters

Model	Description
R-10	Horizontal, mechanical, non-resettable total (Note 1)
R-11	Blind transmitter with dry contact closure (Note 2)
R-15A	Horizontal, mechanical, non-resettable total (Note 3)
R-15B	Horizontal, mechanical w/ transmitter, non-resettable total with contact closure (Note 3)
R-20	Vertical, mechanical non-resettable with 6” dial (Note 2)
R-22A	Vertical, mechanical totalizer and resettable totalizer (Note 2)
R-22B	Vertical, mechanical w/ transmitter, totalizer and resettable totalizer with contact closure (Note 2)
R-22C	Vertical, mechanical w/ transmitter, totalizer and resettable totalizer with digital pulse, explosion proof (Note 2)
R-25	Blind transmitter with digital pulse explosion proof (Note 1)
R-30A	Vertical, mechanical w/ transmitter, non-resettable total, 6” dial, contact closure at batch (Note 2)
R-30C	Vertical, mechanical w/ transmitter, non-resettable total, 6” dial, contact closure at zero point (Note 2)
R-30D	Vertical, mechanical w/ pulse transmitter, non-resettable total, 6” dial, contact closure per unit (Note 2)
R-31C	Vertical, mechanical w/ transmitter, non-resettable total, 6” dial, contact closure at zero, explosion proof (Note 2)
R-35	Mechanical batch controller with bronze or stainless steel valve (Note 4)

Note 1: Not available with 0.75” bronze case meters.
Note 2: Not available with 0.75” meters.
Note 3: Not available with 0.75” Teflon® coated cast iron case meters.
Note 4: Only available with 1” to 2” Epoxy coated cast iron case and bronze case flowmeters and 1 to 1.5” stainless steel case meters.

Pressure Drops

To find the pressure loss through a Niagara meter for a given application:

Pressure drop = (Step 1) X (Step 2)

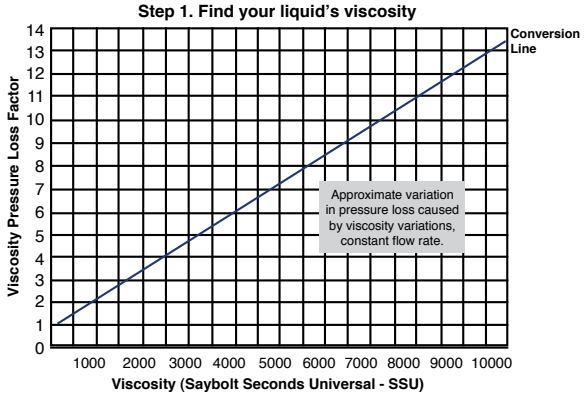
Step 1: Find your liquid’s viscosity (SSU value)** on the horizontal scale in the graph. Draw a vertical line up to the conversion line. From that point on the curve, draw a horizontal line over to the vertical scale.

Step 2: Locate the meter size in the first column of the nomograph* at right. Then locate the meter flow rate in the second column. Draw a straight line through these two points and over to the third column. This point at which your line intersects the third column is the pressure loss through the meter when measuring water. Multiply the resulting viscosity pressure loss factor by the pressure loss obtained in the nomograph.

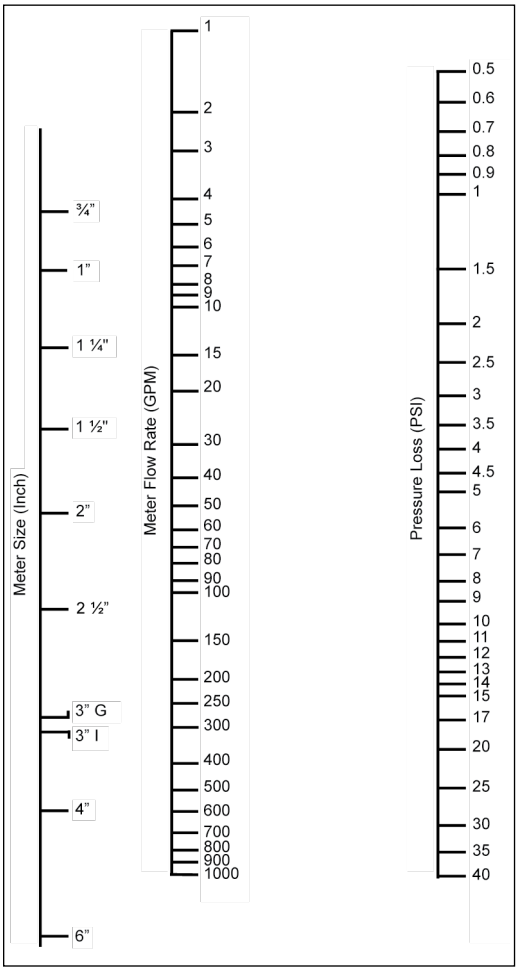
This value is the approximate pressure loss for your application.

* Based on average from test of stock Niagara meter when measuring water.
** Consult factory for liquids above 10,000 SSU.

Step 1. Find your liquid’s viscosity



Step 2. Locate the meter size



Material Selection Guide

Table 4.

R / C = Ryton / Carbon and R / R = Ryton / Ryton

Liquid	Flow Rate	Case	Chamber	Disc / Ball
Alcohol (ethyl/methyl)	1	Bronze	Bronze	R / C
Alcohol (denatured)	1	Bronze	Bronze	R / C
		Iron	Bronze	R / C
Animal Fat	3	Iron	Ni-resist	R / R
			SS	R / C
Asphalt (mastic) for sized 2.5" up	6	Iron	Bronze	R / R
Brine (sodium)	2	Iron	Bronze	R / R
Bunker C Oil	5	Iron	Bronze	R / R
Calcuim Chloride 30%	2	Iron	SS	R / C
Casein	2	Iron	Bronze	R / C
Caustic Soda	2	Iron	Ni-resist	R / R
			SS	R / C
Core Oil	3	Iron	Bronze	R / R
Corn Oil	3	Iron	Ni-resist	R / R
			SS	R / C
Corn Syrup	6	Iron	Bronze	R / R
Creosote	4	Bronze	Bronze	R / R
		Iron		
Cutting Oil	4	Bronze	Bronze	R / R
		Iron		
Emulsion Oil & Water	5	Bronze	Bronze	R / R
		Iron		
Ether	1	Iron	SS	R / C
Ethelyne Glycol	2	Iron	Bronze	R / R
Fish Oil	3	Iron	Bronze	R / R
Fish Soluables	2	Bronze	Bronze	R / R
		Iron		
Fuel Oil # 1 & 2	2	Iron	Bronze	R / R
Fuel Oil # 3 & 4	3			
Fuel Oil # 5 & 6	3			
Gasoline	1	Bronze	Bronze	R / C
		Iron	Bronze	R / C
Glue	6	Iron	Bronze	R / R
Glycerine	2	Bronze	Bronze	R / R
		Iron		
Grease	6	Iron	Bronze	R / R
Kerosene	1	Bronze	Bronze	R / R
		Iron		
Lacquer	3	Iron	Bronze	R / R
Lard (molten)	3	Iron	Ni-resist	R / R
			SS	R / C
Latex Solution	6	Iron	Bronze	R / R
Liquid Soap Solution	2	Iron	SS	R / C
Malt Syrup	3	Bronze	Bronze	R / R
Methyl Ethyl Ketone (MEK)	1	Iron	SS	R / C
Mineral Oil	2	Iron	Bronze	R / R
Mineral Spirits		Iron	Bronze	R / C
Molasses < 100° F	6	Iron	Bronze	R / R
Molasses > 100° F	5	Iron	Bronze	R / R
Monochlorobenzol	1	Bronze	Bronze	R / R
Naptha	1	Iron	Bronze	R / R
Oil (soluable cutting)	2	Iron	Bronze	R / R
Oleic Acid (red oil)	2	Iron	Ni-resist	R / R
			SS	R / C
Paracol Wax	3	Iron	Bronze	R / R
Paraffin (molten)	3	Iron	Bronze	R / R
Paint (oil base)	3	Iron	Bronze	R / R
Phenolic Resin	6	Iron	Bronze	R / R
Printing Ink	6	Iron	Bronze	R / R
Resin Emulsion	4	Iron	Bronze	R / R
Resin Polyester	3	Iron	Bronze	R / R
Resin Size	3	Bronze	Bronze	R / R
Rubber Cement	6	Iron	Bronze	R / R
Soap	2	Iron	Bronze	R / R
Soap (resin)	3	Iron	Bronze	R / R
Sodium Silicate	6	Bronze	Bronze	R / R
		Iron		
Stoddard Solvent	1	Iron	Bronze	R / R
Sugar Cane Juice	2	Bronze	Bronze	R / R
Sugar (liquid)	2	Bronze	Bronze	R / C
		Iron		
Thinners	1	Bronze	Bronze	R / C
		Iron		
Toluene	1	Bronze	Bronze	R / C
		Iron		
Turpentine	2	Iron	Bronze	R / C
Vanilla Extract	2	Iron	Bronze	R / R
Varsol	1	Iron	Bronze	R / C
Vegetable Fat or Oil	2	Iron	Ni-resist	R / R
			SS	R / C
Water < 100° F	2	Bronze	Bronze	R / R
		Iron		
Water 100° to 180° F	3	Bronze	Bronze	R / R
		Iron		
Water > 180° F	4	Bronze	Bronze	R / R
		Iron		
Water, Gas, Tar	4	Bronze	Bronze	R / R
		Iron		
Wax Emulsion	2	Iron	Bronze	R / R
Wax > 100° F	1	Iron	Bronze	R / R
Whey	2	Bronze	Bronze	R / R
		Iron		
Xylol (xylene)	1	Iron	Bronze	R / C

Bronze Case

Model # N ___ - ___ - ___ - ___ - ___

Line Size
- 075 ..... 0.75” (See Note 1)
- 100 ..... 1.0”
- 125 ..... 1.25”
- 150 ..... 1.5”
- 200 ..... 2.0”
- 250 ..... 2.5”
- 300 G ..... 3.0”
- 300 I ..... 3.0”
- 400 ..... 4.0”

Case Material and Mounting Connections
- BR N ..... Bronze MNPT (0.75” to 2.5”)
- BR F ..... Bronze 150# Flange (3.0” & 4.0”)

Chamber Material
- BR ..... Bronze

Disc & Ball
- 1 ..... Ryton®/Ryton®

Drive Type
- A ..... Magnetic (N075-BRN-BR1A only)
- E ..... Mechanical

Note 1: Only available in magnetic drive with R-15A or R-15B registers.

Epoxy Coated Cast Iron Case

Model # N ___ - ___ - ___ - ___ - ___

Line Size
- 075 ..... 0.75” (See Note 1)
- 100 ..... 1.0”
- 125 ..... 1.25”
- 150 ..... 1.5”
- 200 ..... 2.0”
- 250 ..... 2.5”

Case Material and Mounting Connections
- IR N ..... Iron (Epoxy Coated) MNPT

Chamber Material
- BR ..... Bronze
- NR ..... Ni-Resist (1.25” only)
- SS ..... Stainless Steel (1.0” only)
- SS ..... Stainless Steel (1.5” only)
- SS ..... Stainless Steel (2.5” only)

Disc & Ball
- 1 ..... Ryton®/Ryton®
- 2 ..... Ryton®/Carbon (Stainless Steel chamber only)

Drive Type
- E ..... Mechanical

Note 1: Only available with R-10 and R-25 registers

High Pressure Epoxy Coated Carbon Steel Case

Model # N ___ - ___ - ___ - ___ - ___

Line Size
- 100..... 1.0”
- 150..... 1.5”
- 250..... 2.5”

Case Material and Mounting Connections
- HC N..... Carbon Steel 1.0” only MNPT
- HI N ..... Iron “INK” 1.0” only MNPT
- HC F ..... Carbon Steel, 1.5” & 2.5” only 300# Flange

Chamber Material
- BR..... Bronze
- SS..... Stainless Steel

Disc & Ball
- 1..... Ryton®/Ryton®
- 2..... Ryton®Carbon (Stainless Steel chamber only)

Drive Type
- E ..... Mechanical

Stainless Steel Case

Model # N ___ - ___ - ___ - ___ - ___

Line Size
- 100..... 1.0”
- 150..... 1.5”
- 250..... 2.5”

Case Material and Mounting Connections
- SS N ..... Stainless Steel (1.0” & 1.5”) MNPT
- SS F..... Stainless Steel (2.5” only”) 150# Flange

Chamber Material
- SS ..... Stainless Steel

Disc & Ball
- 2..... Ryton®/Carbon

Drive Type
- E ..... Mechanical

150 Venture Boulevard • Spartanburg, SC 29306 • (864) 574-3327 • (800)778-9251 • Fax: (864)574-8063 • www.niagarameters.com • sales@niagarameters.com