

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.

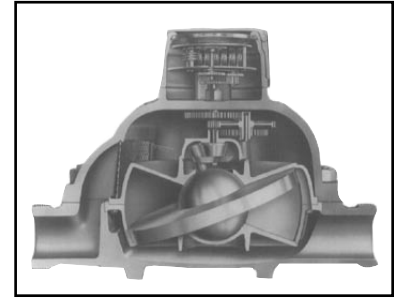


Figure 1



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



Figure 3. 1" 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

Technical Information

Functional Specifications

Fluid Types	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. See Registers section beginning on page 44.

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 Display and Totalizer Available

Physical Specifications

Materials of Construction (see Table 3)	
Case	Bronze or Teflon® coated Cast Iron
Chamber Material	Bronze, Ni-resist, or 316 SS
Disc	Ryton®
Ball	Ryton® or carbon
Seal	Nitrile or Teflon® with 316 SS chamber
Gears	Bronze or 316 SS with 316 SS chamber
Register Housing	Plastic, Bronze, Aluminum - See section beginning on page 44
Connections & Mountings	
Mounting Position	Horizontal Ensure meter remains full with register up.
Typical Straight Pipe Requirements	Upstream 0 x D Downstream 0 x D
Process Connections	MNPT
Electrical Connection	Only for optional electronic transmitter

Flow Rate Group

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)

Table 1

Flow Ranges

Minimum and maximum flow rates in gpm to achieve accuracy

Flow Rate Group (flow rates in GPM)						High Pressure Teflon® Coated Cast Iron with Magnetic Drive	Teflon® Coated Cast Iron with Mechanical Drive	Bronze with Mechanical Drive	Bronze with Magnetic Drive
1	2	3	4	5	6				
0.75 - 5	0.5 - 7	0.2 - 5	0.2 - 5	0.2 - 3			¾" MNPT	¾" MNPT	¾" MNPT
1 - 11	1 - 20	1 - 15	1 - 8	1 - 4		1" MNPT ³	1" MNPT ³	1" MNPT	
3 - 18	2 - 30	3 - 20	1 - 12	1 - 6	0.5 - 4		1 ¼" MNPT ²		
5 - 30	3 - 50	5 - 30	2 - 15	1 - 8	1 - 5		1 ½" MNPT ³	1 ½" MNPT	
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 ½" MNPT		

Table 2

Bronze - Case Material											
Chamber Materials		Bronze Standard									
Drive		Magnetic			Mechanical						
Size		¾"	1"	1 ¼"	1 ½"	2"	2 ½"	1 ¼"	1"	1 ½"	
Temp. & Pressure (in psi)	100° F	150	300	250	250	250	175	250	300	250	
	200° F	135	285	235	235	235	160	235	285	235	
	300° F	115	265	215	215	215	140	215	265	215	
	400° F	100	250	200	200	200	125	200	250	200	
End Connections		MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	
Teflon® Coated Cast Iron - Case Material											
Chamber Materials		Bronze Standard						Ni-resist (opt.)		Stainless steel(opt.)	
Size		¾"	1"	1 ¼"	1 ½"	2"	2 ½"	1 ¼"	1"	1 ½"	
Temp. & Pressure (in psi)	100° F	150	300	250	250	250	175	250	300	250	
	200° F	135	285	235	235	235	160	235	285	235	
	300° F	115	265	215	215	215	140	215	265	215	
	400° F	100	250	200	200	200	125	200	250	200	
End Connections		MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	MNPT	
Teflon® Coated Cast Iron - Case Material High Pressure Ink Meter											
Chamber Materials		Bronze									
Size		1"									
Temp. & Pressure (in psi)	150° F	5000									
		Standard w/R-38 register									
End Connections		MNPT									

Table 3

Ordering Information

Please provide completed application data sheet (found at www.aaliant.com) to allow us to confirm selection.

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

	Model #	N			
Line Size 075 0.75" 100 1.0" 125 1.25" 150 1.5" 200 2.0" 250 2.5"					
Case Material and Mounting Connections BR N Bronze MNPT (0.75" & 1.0") BR N Bronze MNPT (1.5" & 2.0") HI N Teflon® coated cast iron HP ink MNPT (1" only) IR N Teflon® coated cast iron MNPT					
Chamber Material BR Bronze - Standard on all meters SS Stainless Steel - opt. on Teflon® coated cast iron case (1") NR Ni-Resist - (1.25 " only) SS Stainless Steel - opt. on Teflon® coated cast iron case (1.5")					
Disc and Ball 1 Ryton®/Ryton® 2 Ryton®/Carbon (required with stainless steel chamber)					
Drive Type A Magnetic; ¾" bronze and high pressure Iron (HI) only E Mechanical					

Registers/Transmitters

Flowmeter Case Material	Teflon [®] Coated Cast Iron						Bronze			
	.75"	1.0"	1.25"	1.5"	2.0"	2.5"	0.75"	1.0"	1.5"	2.0"
Flowmeter Size										
R-10 Horizontal, mechanical, non-resettable total	▪	▪	▪	▪	▪	▪		▪	▪	▪
R-11 Blind transmitter with dry contact closure		▪	▪	▪	▪	▪		▪	▪	▪
R-15A Horizontal, mechanical, non-resettable total		▪	▪	▪	▪	▪	▪	▪	▪	▪
R-15B Horizontal, mechanical w/ transmitter, non-resettable total with contact closure		▪	▪	▪	▪	▪	▪	▪	▪	▪
R-20 Vertical, mechanical non-resettable with 6" dial		▪	▪	▪	▪	▪	▪	▪	▪	▪
R-22A Vertical, mechanical totalizer and resettable totalizer		▪	▪	▪	▪	▪	▪	▪	▪	▪
R-22B Vertical, mechanical w/ transmitter, totalizer and resettable totalizer with contact closure		▪	▪	▪	▪	▪		▪	▪	▪
R-22C Vertical, mechanical w/ transmitter, totalizer and resettable totalizer with digital pulse, explosion proof		▪	▪	▪	▪	▪		▪	▪	▪
R-25 Blind transmitter with digital pulse explosion proof	▪	▪	▪	▪	▪	▪		▪	▪	▪
R-30A Vertical, mechanical w/ transmitter, non-resettable total, 6" dial, contact closure at batch		▪	▪	▪	▪	▪		▪	▪	▪
R-30C Vertical, mechanical w/ transmitter, non-resettable total, 6" dial, contact closure at zero point		▪	▪	▪	▪	▪		▪	▪	▪
R-30D Vertical, mechanical w/ pulse transmitter, non-resettable total, 6" dial, contact closure per unit		▪	▪	▪	▪	▪		▪	▪	▪
R-31C Vertical, mechanical w/ transmitter, non-resettable total, 6" dial, contact closure at zero, explosion proof		▪	▪	▪	▪	▪		▪	▪	▪
R-35 Mechanical batch controller with valve										
▪ R-35 with bronze valve		▪		▪	▪			▪	▪	▪
▪ R-35 with stainless steel valve		▪		▪	▪			▪	▪	▪

Table 4

Pressure Drops

To find the pressure loss through a Niagara meter for a given application use the formula below.

$$\text{Pressure drop} = (\text{Step 1}) \times (\text{Step 2})$$

Step 1. Find your liquid's viscosity (SSU value)** on the horizontal scale in the graph (Fig.1). 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 factor 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.

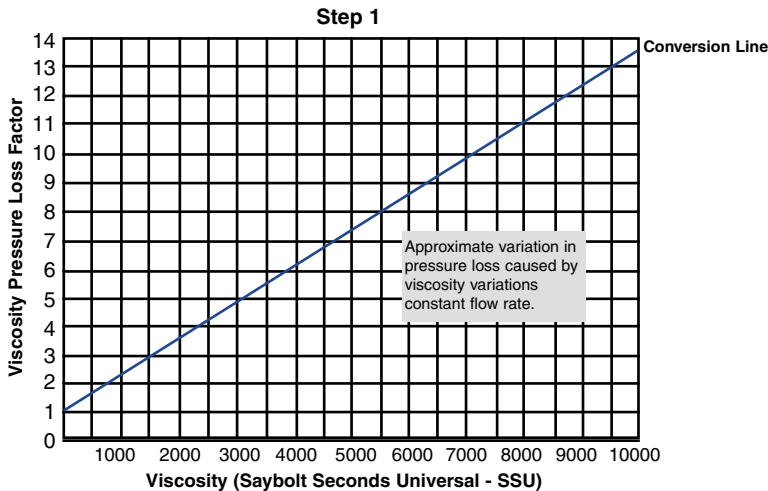
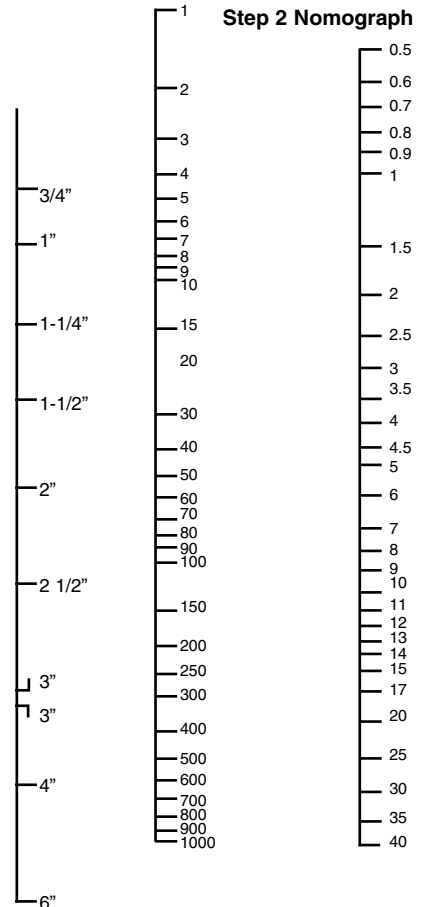


Figure 5



Material Selection Guide

Liquid	Flow rate group	Case material	Chamber material	Disc/ball material
Alcohol (ethyl/methyl)	1	bronze	bronze	ryton/carbon
Alcohol (denatured)	1	bronze	bronze	ryton/carbon
Animal fat	3	iron	ni-resist SS	ryton/ryton ryton/carbon
Asphalt (mastic) for sizes 2½" up	6	iron	bronze	ryton/ryton
Brine (sodium)	2	bronze	bronze	ryton/ryton
Bunker C oil	5	iron	bronze	ryton/ryton
Buttermilk (cattle feed)	2	bronze	bronze	ryton/ryton
Calcium chloride 30%	2	iron	SS	ryton/carbon
Casein	2	iron	bronze	ryton/carbon
Caustic soda	2	iron	ni-resist SS	ryton/ryton ryton/carbon
Core oil	3	iron	bronze	ryton/ryton
Corn oil	3	iron	ni-resist SS	ryton/ryton ryton/carbon
Corn syrup	6	iron	bronze	ryton/ryton
Creosote	4	bronze	bronze	ryton/ryton
Cutting oil	4	bronze	bronze	ryton/ryton
DDT solution	1	iron	bronze	ryton/carbon
Emulsion oil & water	5	bronze	bronze	ryton/ryton ryton/ryton
Ether	1	iron	SS	ryton/carbon
Ethylene glycol	2	iron	bronze	ryton/ryton
Fish oil	3	iron	bronze	ryton/ryton
Fish solubles	2	bronze	bronze	ryton/ryton
Fuel oil #1 & 2	2	iron	bronze	ryton/ryton
Fuel oil #3 & 4	3	iron	bronze	ryton/ryton
Fuel oil #5 & 6	4	iron	bronze	ryton/ryton
Gasoline	1	bronze	bronze	ryton/carbon
Glue	6	iron	bronze	ryton/ryton
Glycerine	2	bronze	bronze	ryton/ryton
Grease	2	iron	bronze	ryton/ryton
Kerosene	1	bronze	bronze	ryton/ryton
Lacquer	3	iron	bronze	ryton/ryton
Lard (molten)	3	iron	ni-resist SS	ryton/ryton ryton/carbon
Latex solution	6	iron	bronze	ryton/ryton
Liquid soap solution	2	iron	SS	ryton/carbon
Malt syrup	3	bronze	bronze	ryton/ryton
Methyl ethyl ketone (MEK)	1	iron	SS	ryton/carbon

Liquid	Flow rate group	Case material	Chamber material	Disc/ball material
Mineral oil	2	iron	bronze	ryton/ryton
Mineral spirits	1	iron	bronze	ryton/carbon
Molasses (cold)	6	iron	bronze	ryton/ryton
Molasses (hot)	5	iron	bronze	ryton/ryton
Monochlorobenzol	1	bronze	bronze	ryton/ryton
Naptha	1	iron	bronze	ryton/ryton
Oil (soluble cutting)	2	iron	bronze	ryton/ryton
Oleic acid (red oil)	2	iron	ni-resist SS	ryton/ryton ryton/carbon
Paracol wax	3	iron	bronze	ryton/ryton
Paraffin (molten)	3	iron	bronze	ryton/ryton
Paint (oil base)	3	iron	bronze	ryton/ryton
Phenolic resin	6	iron	bronze	ryton/ryton
Printing ink	6	iron	bronze	ryton/ryton
Resin emulsion	4	iron	bronze	ryton/ryton
Resin polyester	3	iron	bronze	ryton/ryton
Resin size	3	bronze	bronze	ryton/ryton
Rubber cement	6	iron	bronze	ryton/ryton
Soap	2	iron	bronze	ryton/ryton
Soap (resin)	3	iron	bronze	ryton/ryton
Sodium silicate	6	bronze	bronze	ryton/ryton
Stoddard solvent	6	iron	bronze	ryton/ryton
Sugar cane juice	1	iron	bronze	ryton/carbon
Sugar (liquid)	2	bronze	bronze	ryton/ryton
Thinners	2	iron	bronze	ryton/ryton
Toluene	1	bronze	bronze	ryton/carbon
Trichlorethylene	1	iron	bronze	ryton/carbon
Turpentine	2	iron	bronze	ryton/carbon
Vanilla extract	2	iron	©bronze	ryton/ryton
Varsol	1	iron	bronze	ryton/carbon
Vegetable fat or oil	2	iron	ni-resist SS	ryton/ryton ryton/carbon
Water 100o F	2	bronze	bronze	ryton/ryton
Water 100 to 180o F	2	iron	bronze	ryton/ryton
Water 180o F & above	3	bronze	bronze	ryton/ryton
Water, gas, tar	4	iron	bronze	ryton/ryton
Wax emulsion	4	bronze	bronze	ryton/ryton
Wax (hot)	2	iron	bronze	ryton/ryton
Whey	1	bronze	bronze	ryton/ryton
Xylol (xylene)	2	iron	bronze	ryton/ryton

Table 5