ISA-RP16.1,2,3-1959

Approved October 30, 1959

Recommended Practice

Terminology, Dimensions and Safety Practices for Indicating Variable Area Meters (Rotameters)

RP16.1 Glass Tube
RP16.2 Metal Tube
RP16.3 Extension-Type Glass Tube

ISA-RP16.1,2,3 — Terminology, Dimensions and Safety Practices for Indicating Variable Area Meters (Rotameters) Glass Tube, Metal Tube, Extension Type Glass Tube

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ISA
67 Alexander Drive
P.O. Box 12277
Research Triangle Park, North Carolina 27709

Preface

This Recommended Practice has been prepared as a part of the service of ISA toward a goal of uniformity in the field of instrumentation. To be of real value this report should not be static, but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms and asks that they be addressed to the Standards and Practices Board Secretary, ISA, 67 Alexander Drive, P.O. Box 12277, Research Triangle Park, North Carolina 27709, e-mail: standards@isa.org.

This report was prepared by the Committee on Variable Area Meters 8D-RP16.

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The assistance of those who aided in the preparation of this Recommended Practice by answering questionnaires, offering suggestions, and in other ways is gratefully acknowledged.

Contents

1 Purpose

The Recommended Practice is intended to (a) establish uniformity of connection dimensions to permit interchangeability of one manufacturer's meters with another manufacturer's meters of the same size, (b) provide a common ground of understanding of the terminology, use and component parts and accuracies of these meters, and (c) to provide a reference for the safe working pressures of these meters.

2 History and development

The need for this Recommended Practice was established by a survey of instrument users sent out in September, 1954 to about two hundred and fifty meter users and manufacturers. The answers indicated a need for uniform practice in several portions of the variable area meter fields. These are: (a) connection dimensions, (b) terminology, (c) safety practices, (d) maintenance methods, (e) calibration procedures, and (f) installation practices.

In August, 1955, this summary was reviewed with the Main Recommended Practices Committee, who felt that the first three considerations should be investigated by a manufacturers organization and presented the problem to SAMA. SAMA declined to undertake this activity on the basis that they did not represent the majority of manufacturers of variable area meters. In September, 1956, the Main Recommended Practices Committee suggested that a subcommittee be formed on which the major manufacturers of this type of equipment would be represented. Early in 1957, this committee was formed including representatives of three major manufacturers.

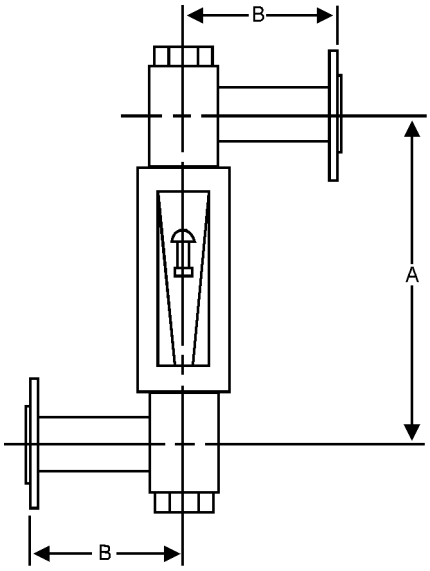
In the September 8, 1957 Recommended Practices Committee (RPC) meeting, RP 16.1 and RP 16.2 were approved for release as tentative and both were issued in March, 1958. In the September 14, 1958 RPC meeting, RP 16.3 was approved for release as tentative with the recommendation that all be combined into one publication to reduce duplication of information.

3 Scope

This Recommended Practice combines RP 16.1 - 10" (250 millimeter) scale length glass tube indicating variable area meters (rotameters) with horizontal inlet and outlet, either flanged or screwed construction; RP 16.2 - 5" (125 millimeter) scale length metal tube indicating variable area meters (rotameters) with bottom inlet and horizonal outlet of flanged construction; and RP 16.3 - 5" (125 millimeter) scale length glass tube extension type variable area meters (rotameters) with horizontal inlet and outlet, either flanged or screwed construction. Additional auxiliary functions of the extension such as indication, pneumatic or electrical transmission, alarm, local recording, etc., is included in RP 16.4.

4 Uniform connection dimensions

The uniform piping dimensions listed on the following page are to permit interchangeability of meters and simplified piping designs. Dimensions are established as whole dimensions or nominal fractions for easy piping detail. No dimension "B" is included for screwed meter connections, but center to center of inlet and outlet "A" dimension applies for screwed meters as well.

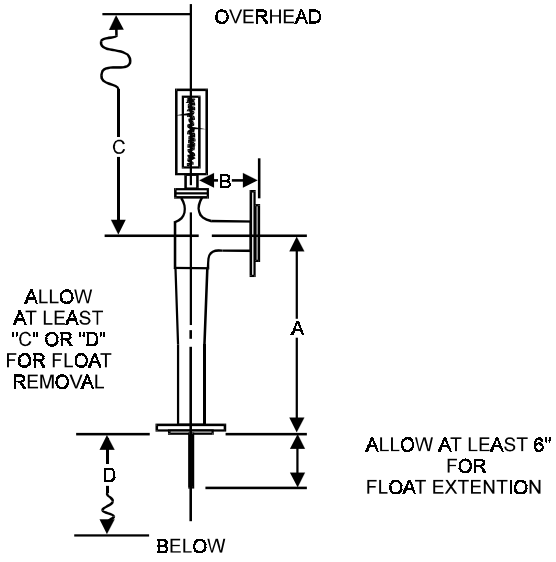


Connection Pipe Size	Center to Center Inlet to Outlet "A"	Center to Face of Flange Face "B"	
		150# RF	300# RF
1/2"	16 1/2"	3 1/2"	4"
3/4"	17 1/2"	4"	4 1/2"
1"	17 1/2"	4"	4 1/2"
1 1/2"	20 1/2"	5"	5 1/2"
2"	21"	5"	5 1/2"
3"	24"	6"	7"
4"	28"	6"	7"

NOTE: Dimensions are for 1/16" raised face flanges.

Safe working pressure are obtained by reference to 6.1, and not from nominal flange rating.

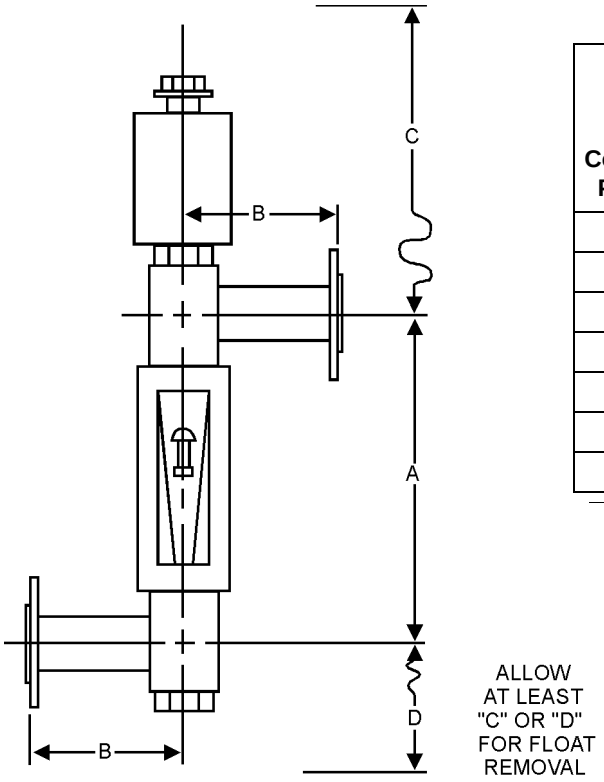
Figure 16.1



Connection Size Inches	Face Inlet to Center Outlet "A"	Center Meter to Face Outlet "B"		Clearance for Float Removal	
		150# RF	300# RF	"C"	"D"
1"	12 1/2"	3 1/2"	4"	47"	30"
1 1/2"	14 1/2"	4"	4 1/2"	51"	30"
2"	15 1/2"	4 1/2"	5"	51"	30"
3"	18"	5 1/2"	6"	64"	33"
4"	24"	6 1/2"	—	70"	39"

NOTE: Dimension"B" in all cases is equal to dimension of ASA standard tee (centerline of run to face of side outlet.) Therefore, ASA standard tees can be used at inlet to produce a side inlet, side outlet construction. Dimensions are for 1/16" raised face flanges.

Figure 16.2



Connection Pipe Size	Center to Center Inlet to Outlet "A"	Center to Face of Flange Face "B"		Clear-ance for Float Removal	
		150# RF	300# RF	"C"	"D"
1/2"	11 1/2"	3 1/2"	4"	48"	37"
3/4"	12 1/2"	4"	4 1/2"	48"	37"
1"	12 1/2"	4"	4 1/2"	48"	37"
1 1/2"	15 1/2"	5"	5 1/2"	48"	39"
2"	16"	5"	5 1/2"	50"	40"
3"	19"	6"	7"	55"	51"
4"	23"	6"	7"	60"	53"

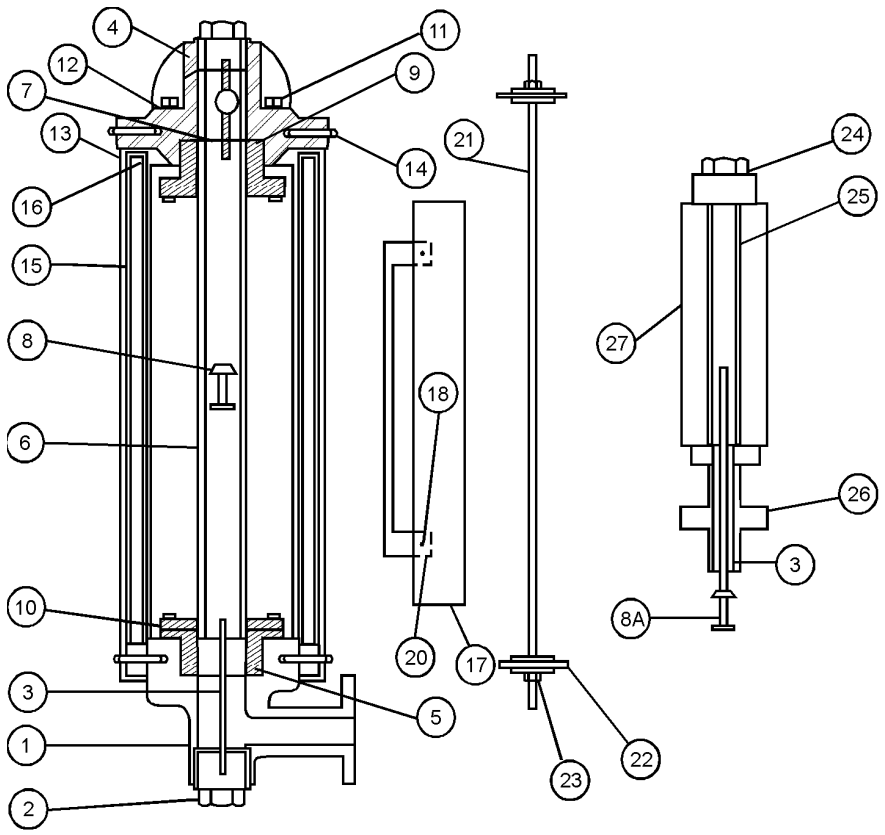
NOTE: Dimensions are for 1/16" raised face flanges

Safe working pressures are obtained by reference to 6.1, and not from nominal flange rating.

Figure 16.3

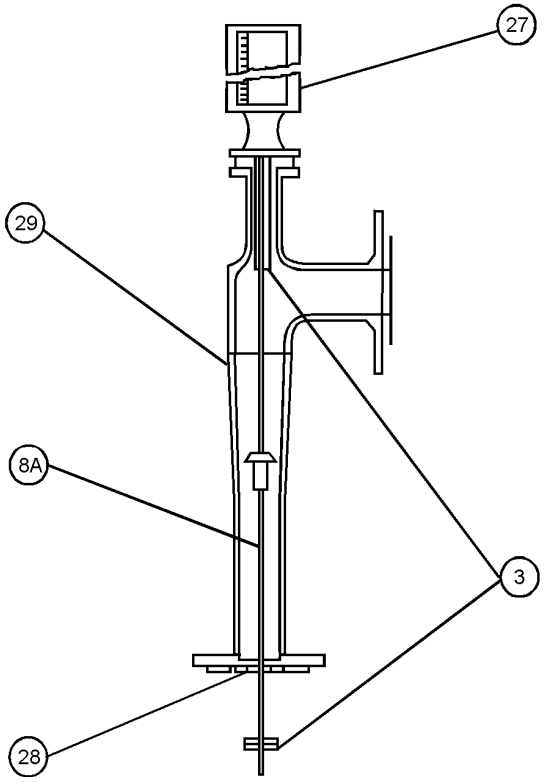
5 Uniform nomenclature

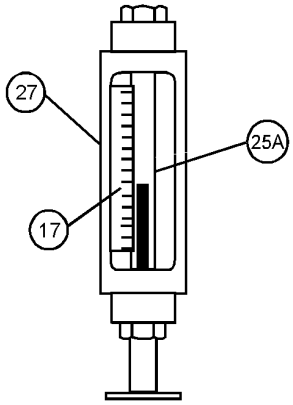
5.1 Listed below is a tabulation of standard terminology for component parts of the glass and metal tube meters. This portion of the Recommended Practice is intended to standardize the component terms used by each meter manufacturer (and by users) when advertising and when specifying spare parts.



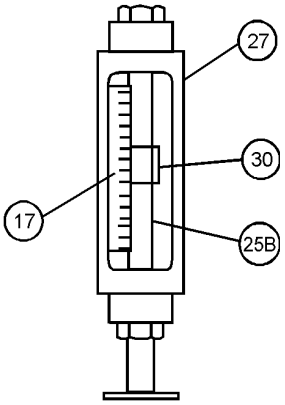
ROTAMETER PARTS LIST

1. End Fitting
2. End Plug
3. Float Stop
4. Plug Gaskets
5. Tube Seat Gasket
6. Metering Tube
7. Packing
8. Metering Float
8A. Extension Type Metering Float
9. Glands
10. Gland Follower
11. Gland Bolts
12. Side Panel Assembly
13. Cover
14. Cover Screws
15. Window Glass
16. Window Gasket
17. Scale
18. Scale Holder Screw
19. Scale Holder Nut
20. Scale Holder
21. Guide Rod
22. Guide Rod Cartridge
23. Guide Rod Nut
24. Vent Plug or Purge Connection
25. Extension Tube
25A. Glass Extension Tube
25B. Metal Extension Tube
26. Extension Adapter
27. Extension Housing
28. Float Guide Spider
29. Meter Body
30. Indicating Follower





GLASS TUBE
INDICATING HEAD



METAL TUBE
INDICATING HEAD

5.2 Uniform terminology concerning meter accuracy — A Code System is presented herewith to establish an exact expression for Meter accuracy at specified operating conditions. Through the use of this Code System, in Specifications by both Manufacturers and Users, it is expected that there should be no misunderstanding between accuracy of maximum scale reading and accuracy of instantaneous flow reading, the limits of the scale at which the accuracy is expected, and, of course, the accuracy (maximum error) desired.

	% Accuracy specified	% Referred to*	Lower limit (% of scale) of specified accuracy
Example 1:	1	S	10

Meter specified to have accuracy of plus or minus 1% of maximum scale from 100 down to 10% of scale reading.

As written, would then be 1-S-10

Example 2:	2	R	20

Meter specified to have accuracy of plus or minus 2% of instantaneous reading from 100 down to 20% of scale reading.

As written, would then be 2-R-20.

***NOTE:** S = full scale; R = instantaneous reading

5.3 Uniform tube nomenclature — A Code System is presented to permit specifying and defining specific meter tubes.

	Manufacturer (Initials)	Inlet bore size	(Diameter Ratio-1) X 100	Tube style**	Tube length
Example 1:	F & P	1½”	27	G	10

This is a Fischer and Porter, 10”, beaded guide, glass tube, 1½” size, with a 1.27 outlet to inlet diameter ratio.

As written, would then be F&P - 1½-27-G-10.

Example 2:	S & K	2”	35	P	10

This is a Schutte and Koerting, 10”, plain glass tube, 2” inlet size, with 1.35 outlet to inlet diameter ratio.

As written, would then be S&K - 2-35-P-10.

Example 3:	BR	3”	40	M	5

This is a Brooks Rotameter Company, 5” long metal tube, 3” inlet size, with 1.40 outlet to inlet diameter ratio.

As written, would then be BR - 3-40-M-5.

***NOTE:** G = guided glass; P = plain glass; M = metal.

Please note that tube codes are included for meters not covered in the scope of this Recommended Practice. The code will apply to tubes for all styles of meters.

6 Recommended safe working pressures

6.1 Recommended safe working pressures of borosilicate glass tubes

Listed below are the safe working pressures recommended by this Practice. To use meters above these pressures is considered unsafe because of the possibility of glass breakage. Particular conditions, not listed below, should be checked with the individual manufacturer.

Nominal Tube Inlet Bore	Max. Working Pressure (PSIG) Up to 200 Deg. F.	Pressure Reduction Above 200°F. PSI/Deg. F.	Max. Temp. Degrees F.
1/16” or 1/8”	550	0.75	400
1/4”	450	0.75	400
3/8”	350	0.75	400
1/2”	300	0.75	400
3/4”	240	0.60	400
1”	200	0.45	400
1 1/2”	130	0.33	400
2”	100	0.25	400
3”	70	0.15	300
4”	50	0.10	300

1) Maximum working pressure ratings are for non-shock conditions. (No water hammer)

2) Recommended test pressure (static) should be 1.5 times safe working pressure.

3) Above pressure ratings apply to rib, fluted, or plain tapered tubes.

4) Maximum safe working pressures for glass tubes above 200°F. to be calculated using the pressure reduction given in table above.

5) Up to the maximum temperatures listed above, Borosilicate glass tubes are resistant to thermal shock.

6) All glass tube meters should be adequately shielded with safety glass on the reading side and amply vented on sides, back, or bottom.

6.2 Recommended safe working pressures of metal tubes

These meters are suitable for operation on pressures up to that limited by the weights of the standard ASA flange connections. These metal tube meters can be tested in conformance with ASA Standard Flange Test Procedures. For specific further information, check either the Piping Code or the manufacturers.

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ISA
Attn: Standards Department
67 Alexander Drive
P.O. Box 12277
Research Triangle Park, NC 27709

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