SPINK CONTROLS®

CE-2424

JAS-ANZ

An ISO 9001:2015
Certified Company

DIGITAL VARIABLE AREA FLOWMETER (ROTAMETER)

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OPERATOR'S MANUAL

MODEL: R 300/D SERIES

Contents:

Caution

The customer is advised to follow the installation and operating instruction carefully non adherence to which may cause serious personal injury and damage to the Flowmeter for which the manufacture will not be responsible.

WARNING

Digital Metal Tube Rotameter is designed for operation up to the maximum operating pressures and temperatures as specified here in. Over Pressure and temperature cause damage to instrument, so before installation please go through the operational & instruction Manual. Please go through the handling & storage instruction when flow meter is not in use.

Section 1: Handling & Storage Instruction

1.1 Unpacking

Care should be taken when opening the box containing the Flowmeter, any markings or warnings shown on the parcel should be observed prior to opening. The following steps should then be taken:

- Unpack the Flowmeter in a dry area.
- The Flowmeter should be handled with care and not left in an area where it chances of physical damages to instrument.
- If using a knife to remove packaging care should be taken not to damage the Flowmeter.
- The Flowmeter package and contents should be checked for completeness against the delivery note supplied and any missing items reported immediately.
- The Flowmeter package and contents should be checked for signs of damage during transport and any problems report immediately.
- The vendor accepts no responsibility for damage or injury caused during the unpacking of the instrumentation supplied.

1.2 Storage and preservation condition:

- Cable gland holes must be closed to avoid any moister enter could lead to create problem in electronic circuit.
- Storage must away from water and harsh environmental conditions,
- In a way as to avoid damage, cover the flanges by Protective Coating or tape.

Section 2: INTRODUCTION

R 300/D Model series is origin of metal tube Rotameter; it works on the principle of variable Area. Applicable for any Liquids and Gases flow measurements, it has digital read outs with local indication without need for auxiliary power.

Specialty:

- Local Indication without the need for auxiliary power.
- Minimum Pressure loss.
- Accurate measurement even at higher flow (150 m^3/hr).
- Suitable for low flow (8 LPH).
- Default inbuilt transmitter of 4 – 20 mA (Loop power) 24 VDC supply.
- No movement assembly thus reduces the maintenance.

Section 3: OPERATIONS

3.1 Principle of Operation:

It operates on the principle of Variable Area; when a fluid or gas flow through a taper tube containing a float, a pressure difference of P1 and P2 is created between the upper and lower side of the float. The float moves upwards by a force obtained by multiplying the pressure differential by the maximum cross-sectional area of the float. Due to the nature of the taper tube as the float moves upwards, the fluid passing area increases as a result of which the differential pressure decreases. The upward movement of float stops when the dead load is dynamically balanced by the differential pressure. The tapering of the metering tube is so designed that the vertical movement of the float becomes linearly proportional to the rate of flow and the scale is provided to read the position of the float, thus bringing birth to the flow indication.

Based on Bernoulli's theorem, the principle mentioned above can be theoretically expressed as follows.

3.2 Flow Formula:

$$Q = CA\sqrt{\frac{2gV}{Af}\left(\frac{\partial\rho - \gamma}{\gamma}\right)}$$

Where
Q = Volumetric flow rate.
C = Flow coefficient.
A = Fluid passing Area.
g = gravimetric acceleration.
V = Volume of float.
Af = Maximum pressure receiving area of float.
ρ = Float density.
γ = Fluid density.

3.3 Mechanism and Digital readout:

By a magnetic coupling the inner float movement through a series of linkage of linkages and counter weight, the float and the taper tube combination determines the flow rate. The inner float magnetic field is detected by the sensitive magnetic field detection sensor; enable us to show the Digital readout.

Section 4: TECHNICAL SPECIFICATION

TECHNICAL SPECIFICATION

Accuracy	:	+/- 1.5% of FSR.
Rangeability	:	10:1
Repeatability	:	+/- 0.25% of FSR
Temperature Rating	:	-50 to 120 °C.
Pressure Rating	:	80 kg/cm2
Flow Direction	:	Bottom to Top
End connection	:	Flanged to suit customer's requirement.
Wetted Part	:	To suitable specific liquid or gases.
Mounting position	:	Vertical.
Indication	:	Digital flow rate
Transmission	:	2 wire loop powered
Enclosure	:	Flameproof / Weatherproof.
Power supply	:	9 VDC Battery

MAXIMUM FLOW AND PRESSURE LOSS

LINE SIZE NB	20° C WATER FLOW m3/hr	0° C 1 atm AIR FLOW Nm3/hr	APPROX PRESSURE LOSS MM WC
15	0.2 - 1.2	6 - 3 5	200 - 225
20	0.4 - 2.0	8 - 6 0	220 - 230
25	1 - 5	30 - 1 5 0	200 - 270
40	2.5 - 10	70 - 3 0 0	200 - 250
50	3.5 - 17	100 - 50 0	225 - 280
85	6 - 30	200 - 9 0 0	225 - 240
80	10 - 45	300 - 12 0 0	225 - 280
100	20 - 100	600 - 30 0 0	350 - 850
125	30 - 120	900 - 4 0 0 0	300 - 850
150	30 - 150	900 - 4 5 0 0	350 - 950

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4.2 Ordering Model specifications:

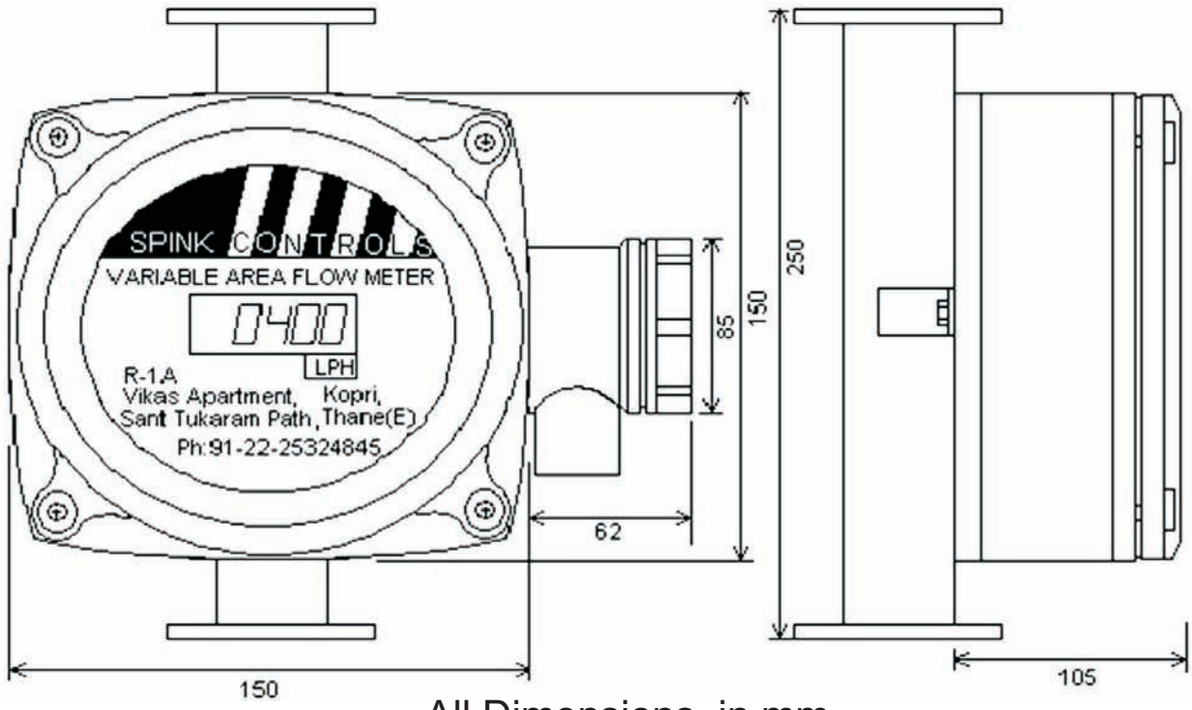
Basic Model R – 300/D with local Indicator

R-300/D	001	F	A	1	WL	CC1	AL	J
Base Model								
Battery Operated / 24 VDC loop powered 4 – 20 mA	**001**							
Totaliser with Loop powered	**002**							
230 VAC & 4 – 20 mA output	**003**							
Totaliser & Batch Controller – 230 VAC	**004**							
High & Low switch	**005**							
Process Connection								
Flanged		**F**						
Screwed		**S**						
Tri-clover		**TC**						
Hose		**H**						
Special on request (Please specify)		**SC**						
Float Material								
SS 316			**A**					
SS 316 L			**B**					
SS 304			**C**					
PTFE			**D**					
PP			**E**					
Material of Construction – Body & Process connection								
SS 316				**1**				
SS 316L				**2**				
SS 304				**3**				
Poly Propylene				**4**				
Special on request (Please specify)				**5**				
Lining Material								
PTFE					**PT**			
Without Lining					**WL**			
Flange to Flange Distance								
250 mm						**CC1**		
300 mm						**CC2**		
400 mm						**CC3**		
500 mm						**CC4**		
Enclosure Confirmed to								
Di-Cast Aluminium - Ex d IIB T4 IP 67							**AL**	
Stainless Steel 304 - Ex d IIA & IIB T6 IP 66							**SS304**	
Stainless Steel 316 - Ex d IIA & IIB T6 IP 66							**SS316**	
Other							**OTH**	
Additional								
Jacketed								**J**
Remote Totaliser								**RT**

4.3 Indicator Housing Dimension & Power supply connections:

Figure: 01

Dimensional Drawing

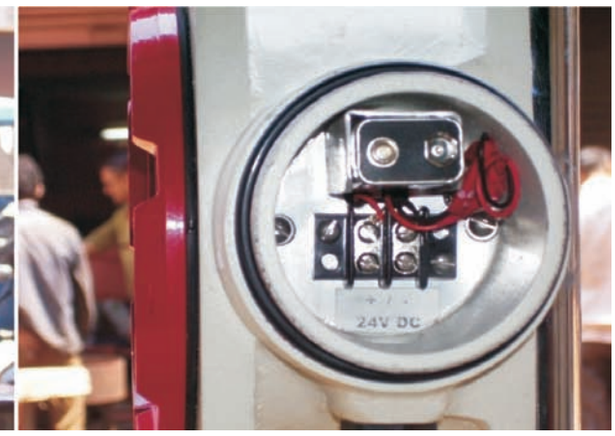


All Dimensions in mm

Figure: 02

9 VDC Battery connection.

Figure: 03



24 VDC Supply connecting Terminal
For 4 – 20 mA output signal.

For Model: R300/D0001

Section 5: PROGRAMMING OF MICROPROCESSOR BASED CONTROLLER

The variable Area flow meter with Batch controller uses the Microcontroller Based single set point ON/OFF controller.
This flow meter has the 16 digit X 4 lines LCD display to indicate the **FLOW RATE, BATCH SETTING, BATCH FILLED AND TOTALISER, DENSITY CORRECTION.**
The flow meter has four keys the **"SET", "INC", "SHIFT", and "SAVE/EXIT"**

SET	BUTTON FOR PROGRAMMING
INC	INCREMENT THE PARAMETER VALUE
SHIFT	TO SHIFT THE PARAMETER VALUE
SAVE/EXIT	TO SAVE AND EXIT FROM THE PROGRAMMER.

When you start the flow meter initially all the parameters are displayed on the screen.

"BATCH SET"
Press **"SET"** the display shows "**SET BATCH". "0000"**
You can set the batch by using "INC" and "SHIFT" buttons. Once the required batch is set press "EXIT/SAVE" button to save and exit from the program.

"PASSWORD"
Press "SET" the displays shows the **"ENTER PASSWORD" "0000".**The instrument password is **"8642".**You can change the pass word by using **"INC"** and **"SHIFT"** buttons. Once the required password is changed press **"EXIT/SAVE"** button to save and exit from the program.
Only batch set can be programmed without the password.

"SET DENSITY"
The flow meter is calibrated with water; you can change the density between 0.6 to 1.5 Press "SET" the display shows the "**SET DENSITY"**; initially the display shows the density **"1.00".**You can change the density by using **"INC" and "SHIFT"** buttons. Once the required density is changed press **"EXIT/SAVE"** button to save and exit from the program.

"**SET TOTALISER"**
The display show **"SET TOTALISER"** initially displays shows **"00000000".** You can set the totaliser by using **"INC" and "SHIFT"** buttons.
e.g., If you set the totaliser to **"00005000".** When the flow meter starts the totaliser will count above the 5000. If you set the totaliser to **"00000000"** it starts from **"00000000".** Once the totaliser is set press **"EXIT/SAVE"** button to save and exit from the program. "**Press SET**" The display shows "**Enter Password2**". This is for the factory setting. Do not disturb.

"BATCH RESET"
If you press the **"SHIFT"** key in the normal mode the batch will be reset to **"0000"**

"SAVE/EXIT" This is used to save the changes made and also it **STARTS/STOPS** the batch.

In the set mode this key will save the changes made.

In the normal mode (Once the Batch is set) it **STARTS/STOPS** the batch

All the parameters are stored in a nonvolatile memory and are not disturbed even in a power off condition.

"**HIGH/LOW SWITCH SETTINGS"**
Press **"SET"** key, the Display will show **01** that means the low flow setting / 02 for high flow setting. You can change the value by **"INC & SHIFT"** Keys.

Note: In this Model there is no Transmitter.

Section: 6 CALIBRATIONS & TESTING

After manufacturing the flow meter is then inspected by QC department for Hydrostatic and Temperature testing. And calibration procedure followed.

Method: GRAVIMETRIC CALIBRATION OF FLOWMETER

A Flowmeter can be calibrated gravimetrically by weighing the quantity of liquid collected in a vessel. The vessel is weighed and the weight (in air) of the fluid collected is noted.

For any gas & liquid the water equivalent is calculated from the operating data's of pressure, temperature, density and viscosity by computer using special software developed by SPINK CONTROLS.

The instrument is calibrated by using water at various flow rates by measuring volume of water collected in a known time. For this purpose we use various calibrated tanks ad stop watch having an accuracy of 0.01.

Detailed Calibration & Test Report is attached along with Material when it is dispatched.

Section: 7 INSTALLATIONS

Note: Physical Inspection should be done after receiving Material, its condition, whether it got damaged or not which may be occurred by mishandling during transit. If any damage observed immediately contact our service department. Read the Instruction given in section 1.1 & 1.2

Installation should be done by experts.

The mechanical electrical installation, start up and maintenance of the instrument should only be carried out by trained who have been authorized to perform these task by the systems operated. The technician must have read and understood this operating instruction and fallow its instruction

7.1 If it seems OK u can follow the installation guideline.

- The float in the Flowmeter is located at one place to avoid damage during transit.
- Unpack the ends make the float free and check the float retainer at the top, if it is loose tighten it.
- The Flowmeter is to be mounted vertically with inlet at bottom and outlet at the top. Fig. 4
- The vertical line should always be checked with a plumb-bob and a maximum of 1 deg is allowed from the vertical position. If the Flowmeter is not installed correctly there will be operational difficulty and its accuracy will be affected.
- A minimum 10D upstream and 5D downstream straight lengths should be maintained at installation location. Where D is the Pipe Diameter.
- For case of maintenance, please install isolating valves at the inlet and outlet of Flowmeter and also on the bypass line. See Fig. 4
- Connect the battery before installation

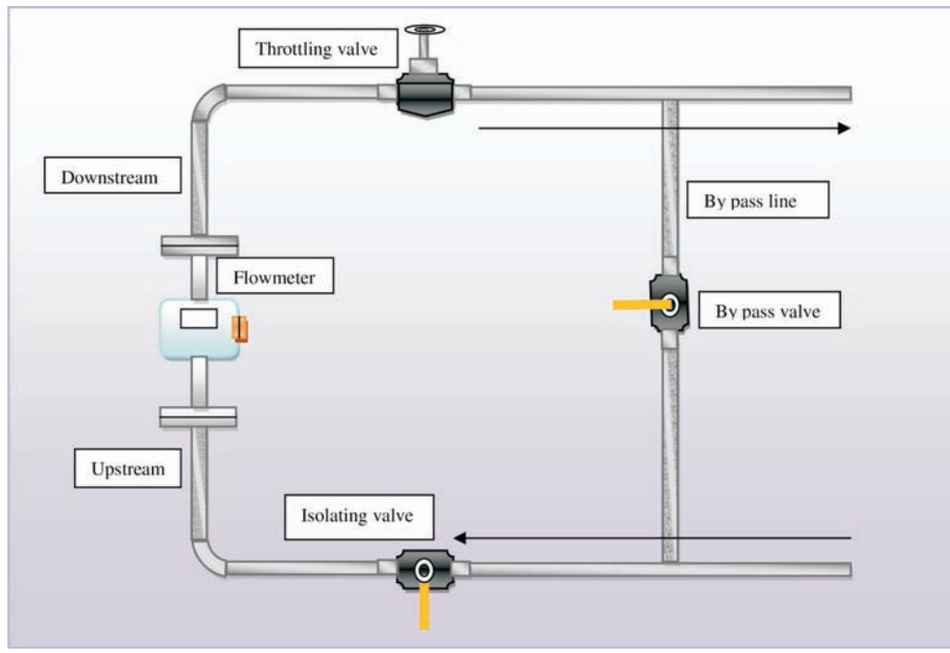


Figure: 04 Installation of Flowmeter

7.2 Following Points Are Important for flow meter installation.

1. A straight pipe section of approximately should be maintained, if any, will effectively stabilize readings.

2. **Strainer:** Generally the strainer is not indispensable required, if there is a possibility that dust may enter, however, maintenance will be easier if the strainer is provided.

3. **Bypass piping:** From the viewpoint of safety, is recommendable to provide a by pass piping.

4. **Manipulating Valve:** Slowly manipulate the flow regulator valve while reading the flow indicator. Staring and stopping the pump with the valve fully opened will cause the flow to collide hard with the upper and lower parts. This may result in damage to the flow meter.
   Especially while the pump is stopped, air is liable to stay in piping. This residual air will make the shock all the greater.

5. Provide a flow regulator valve on the outlet side where valves are provided just before and after the flow meter. Do not fail to open the inlet valve fully. In the case of gas particular, the meter will have an internal pressure varying with the flow rate and pressure compensation will be required from time to time, if the flow is regulated with the valve on the inlet side.
   The meter internal pressure can be easily kept constant when the flow is regulated on the outlet side, though dependent upon the upstream piping conditions.

7.3 Electrical connections

Figure: 02, Show the **9 VDC** Battery connections.
Figure: 03, as per customer Requirement flow meter has inbuilt **4 – 20 mA** transmitting signal, power supply **24 VDC**. See fig. 05

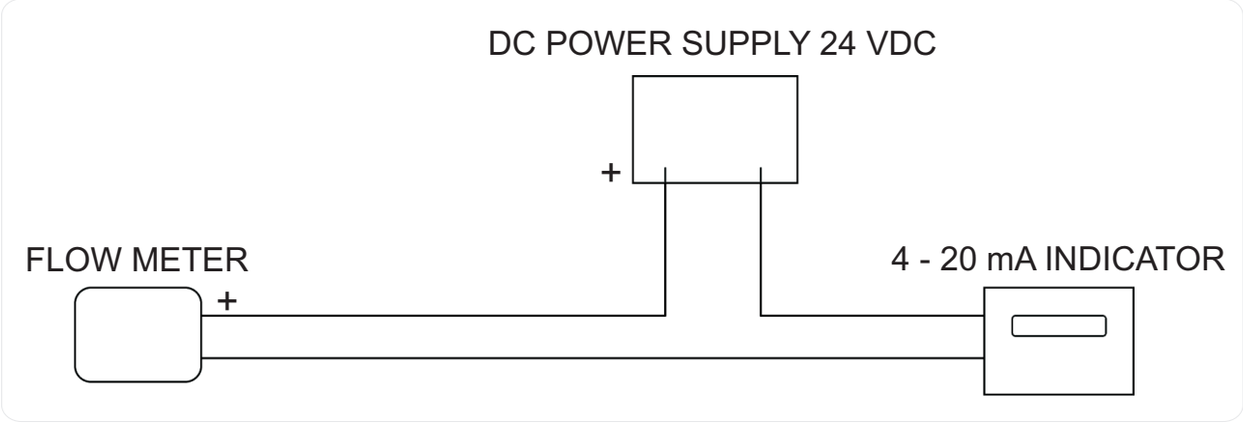
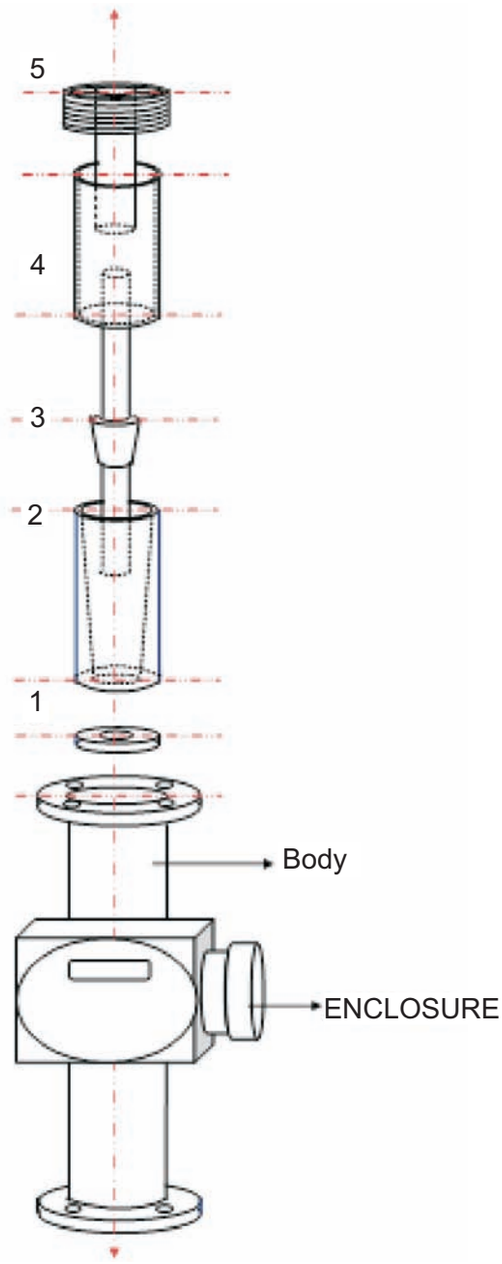


Figure: 05

Section 8 Constructions, Maintenance & Trouble shoots

8.1 Internal assembly of Flowmeter applicable for low flow.



Part No	Name
1	Strainer
2	Taper Metering Tube
3	Float
4	Stopper
5	Float Guide

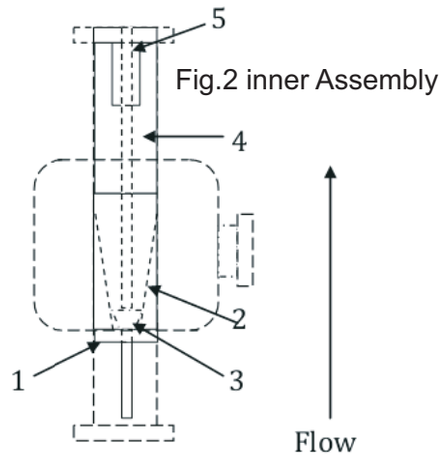


Fig.2 inner Assembly

Fig.6 Dismantling & assembling internal part

Note: Figures are not to scale

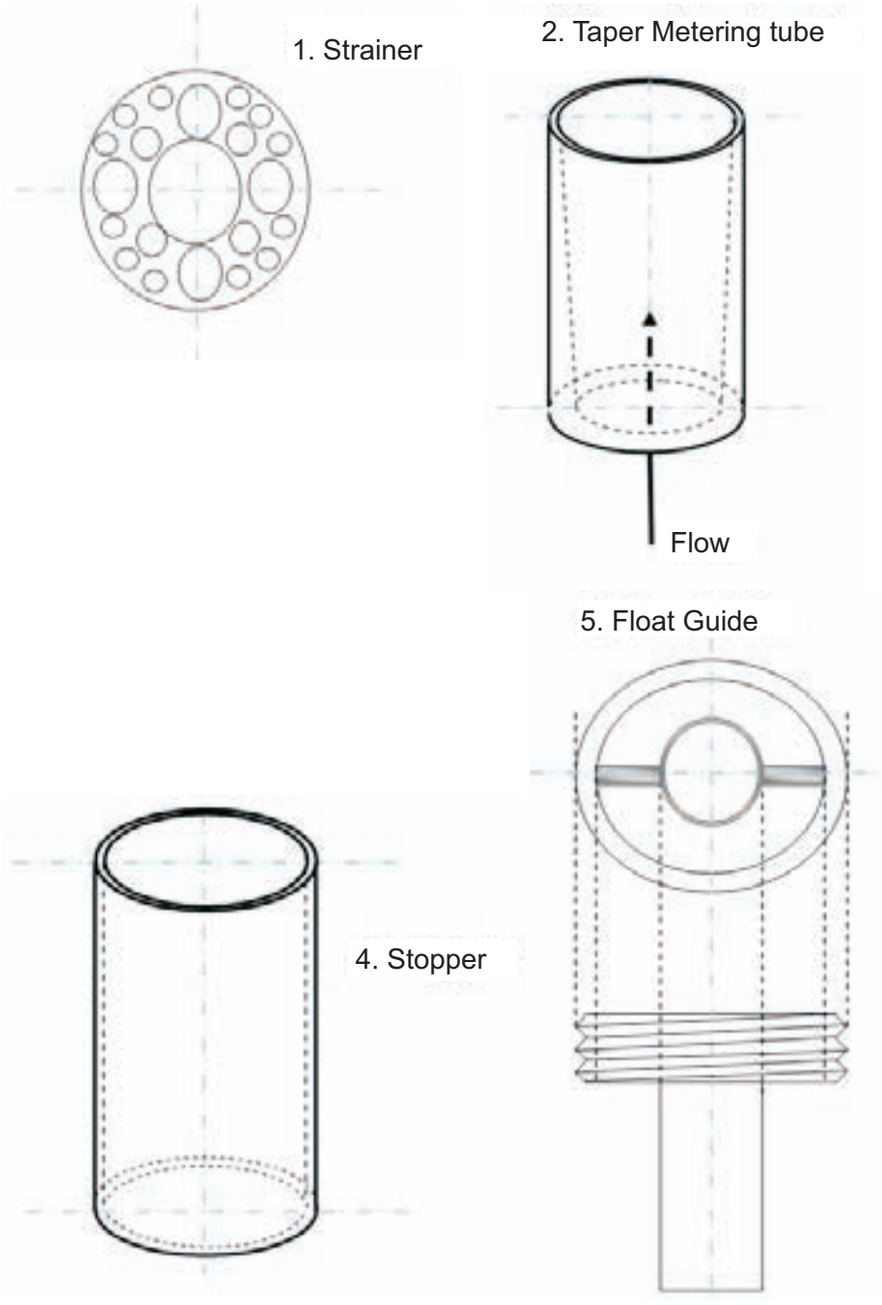
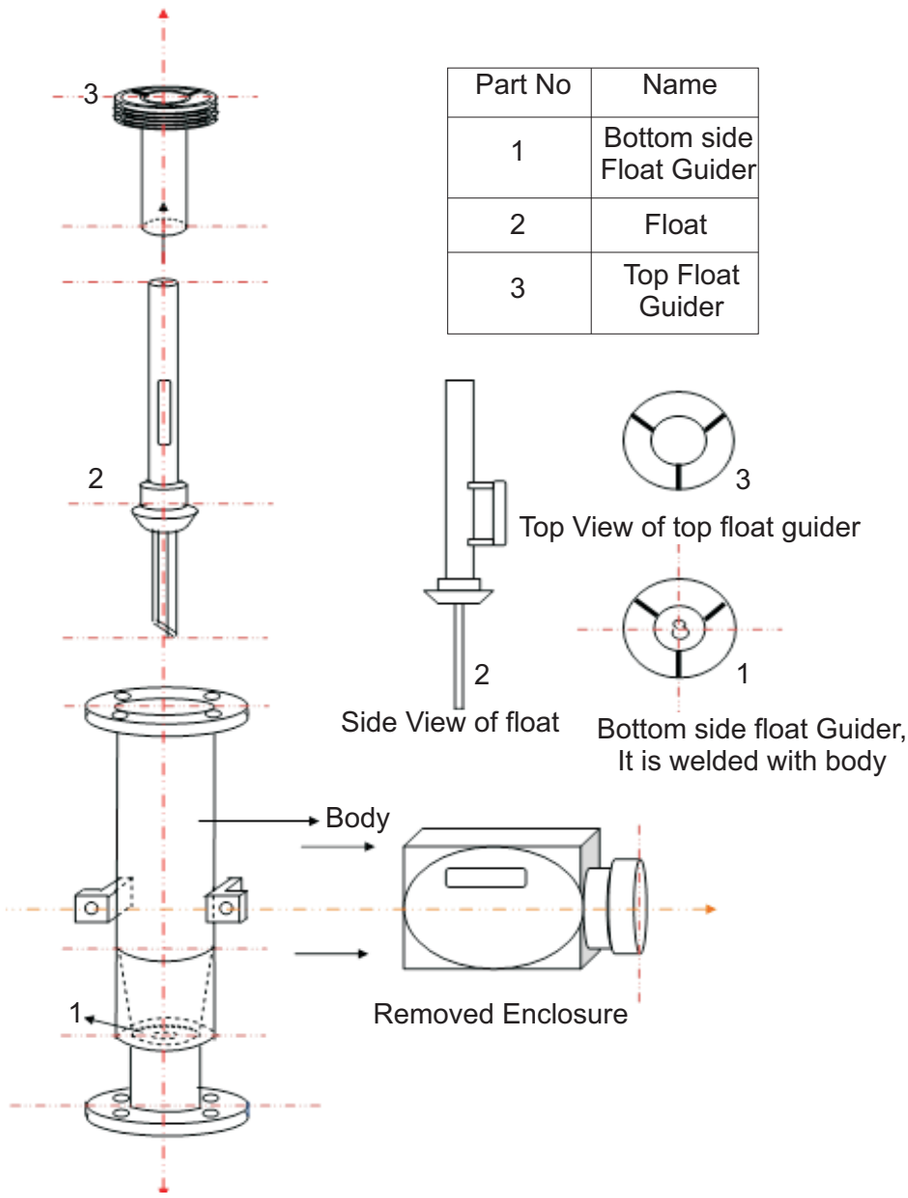


Fig.7 Each Parts Diagrams

NOTE: All Figures are not to scale.

8.2 Digital Variable area Flowmeter (high flow) internal assembly.



Part No	Name
1	Bottom side Float Guider
2	Float
3	Top Float Guider

Figure 08 Dismantling & assembling of internal part.

Note: figures are not to scale

8.3 Maintenance & Troubleshoots.

Since it has no moving part except float, so it is almost zero maintenance, periodic cleaning or flushing the metering tube should be done to remove any foreign particles which may be clogged in between the metering tube which may leads to parts damage. If strainer provided at inlet side of meter then it should be cleaned weekly.

Avoid using Flowmeter in excess pressure and temperature as specified for meter's long durability.

While dismantling please go through the fig. 6, 7, 8 & assemble accordingly to avoid any non working of Flowmeter.

For any functioning setting error Refer to section 5 of this manual for settings.

Fault Observed	Reason	Trouble shoots
Reading shows high/low flow rate than specified	Check operating condition	Contact Spink Controls
Flowmeter shows correct reading but stuck	Float is damaged or corroded	Replace float in case of gases
Flowmeter shows correct reading but starts showing higher reading after sometime	Scaling / deposition of foreign particles on the inside of the metering tube or on the float or both	Clean the Flowmeter metering & float
Fluctuation of float	Wrong operating pressure	Maintain operating pressure as prescribed for the design