



FLOW & CONTROL SYSTEM PRIVATE LTD

**Catalogue:
By-Pass Rotameters: FCSBPR Series**

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Read this Manual Before Installation

This manual contains essential information about Magnetic liquid level indicators. Please read all instructions carefully and follow the steps given in order.

Manual Conventions

This manual uses specific styles and symbols to share technical details, supporting information, and safety guidance. General explanations are written in plain text, while special notices are highlighted as Notes, Cautions, and Warnings.

- **Notes:** Provide additional information or clarification about an operating step. Notes are meant to assist understanding and do not normally include actions.
- **⚠ Caution:** Indicate conditions that could cause minor injury, equipment damage, or reduce system integrity. Cautions also highlight unsafe practices or the need for special tools, materials, or protective gear.
- **Warnings:** Identify serious hazards that could lead to major injury or death. A warning signals an immediate danger if proper precautions are not taken.

Safety Instructions

- Always follow standard safety practices when working with electrical equipment, especially high-voltage systems. Disconnect power before touching or servicing any components.

⚠ Warning: Explosion risk — do not connect or disconnect any device unless power is turned off or the area is verified to be non-hazardous.

Low Voltage Directive:

This product is intended for Installation Category II, Pollution Degree 2. Any use beyond manufacturer instructions may reduce the equipment's safety and protection.

Warranty

All Flow & Control System mechanical level controls carry a three-year warranty, and electronic level controls carry an eighteen-month warranty from the date of factory shipment. If a unit fails within the warranty period and inspection confirms a manufacturing defect, Flow & Control System will repair or replace it free of charge, excluding transportation costs.

The company is not responsible for misapplication, labour costs, or any direct or indirect damages arising from installation or use. No other warranties apply unless specified in writing for certain products.

Quality Assurance

Flow & Control System maintains a rigorous quality management system to ensure consistent product and service excellence. The company's corporate quality assurance program is ISO 9001 certified, demonstrating compliance with recognized international standards and a commitment to total customer satisfaction.

Copyright Notice

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Product specifications are valid as of the publication date and may change without prior notice. Flow & Control System reserves the right to modify product designs or manuals at any time and does not guarantee complete accuracy of the information provided herein.



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By-Pass Rotameter: FCSBPR Series

Introduction:

Designed for measuring low flow rates up to **50 NB**, this instrument is suitable for pipelines. It is available in multiple material options and can be supplied with **impulse piping, carrier ring, or as a rotameter with flow indicator**. The design complies with **ISO 5167 / BS 1042** standards.

Working Principle:

This is an **inline rotameter with a glass tube or metal tube** installed in a bypass line. Unlike a standard rotameter, an **orifice plate** is installed at the inlet. The pressure difference created across the orifice is equivalent to the pressure drop across the main line orifice.

The **float movement** inside the rotameter indicates the flow rate, which is read directly on the scale. Any change in flow, controlled by throttling or opening the valve, results in a corresponding change in float position.

Available Sizes: 50 NB to 450 NB **Flow Ranges: Water:** 22 to 800 m³/hr at ambient temp & **Air:** 0.1 to 300 Nm³/hr at NTP

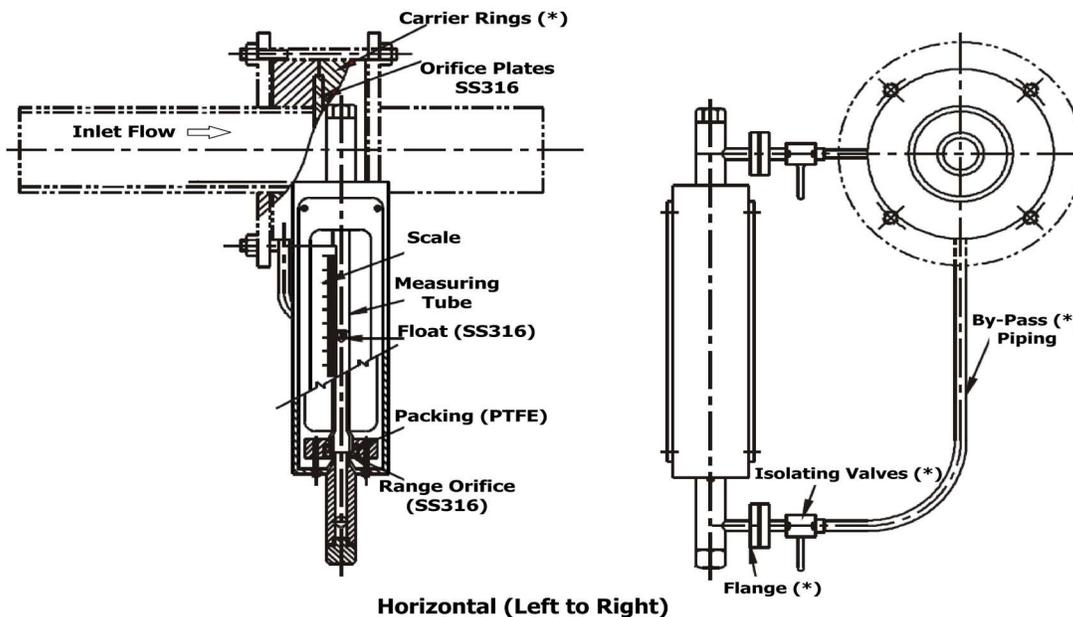
Accuracy: ±2% of Full-Scale Deflection (FSD)

Accessories: Isolating valves & High and low flow alarms



By-Pass Rotameter FCSBPR Series: With Orifice Plate & Carrier Ring:

Figure A





Specifications:

| Components | MOC |
|-------------------|---|
| Item | Bypass Rotameter with Orifice Plate & Carrier Ring |
| Measuring tube | Borosilicate Glass |
| Float | SS 316 / Aluminum / PVC / PTFE |
| Carrier Ring | P.P / M.S / S.S 304 / S.S 304L / S.S 316 / S.S 316L |
| Orifice Plate | SS 316 / SS 316L / Hastelloy C |
| Gland Packing | Neoprene / PTFE / Silicon |
| Impulse Piping | C.S / P.P / S.S 304 / S.S 304L / S.S 316 / S.S 316L |
| Isolation Valve | P.P / S.S 304 / S.S 304L / S.S 316 / S.S 316L |
| End Connection | Drilled as per ASA 150# RF / BS / DIN |
| Direction of Flow | Horizontal (Left to Right & Vice versa) / Vertical Upward / Vertical Downward |
| Rated Pressure | 10 Kg/cm ² |
| Downstream Length | 5D |
| Upstream Length | 10D |
| Accuracy | ±2% OF F.S.D. |

Standard Ranges:

| NB | Flow Rate of Water in M3/hr | Flow Rate of Air in Nm3/hr |
|-----|-----------------------------|----------------------------|
| 50 | | |
| 80 | 20 | 600 |
| 100 | 36 | 1100 |
| 125 | 80 | 2500 |
| 150 | 125 | 3800 |
| 200 | 150 | 4600 |
| 250 | 320 | 9900 |
| 300 | 550 | 17000 |
| | 800 | 25000 |



Installation & Maintenance Manual: Bypass Rotameter FCSBPR Series

Caution:

Please read this instruction manual carefully before installing the rotameter. Failure to follow the instructions may result in serious personal injury and/or damage to the rotameter. The manufacturer shall not be held responsible for any damage or injury arising from improper installation or use.

Unpacking:

Unpack the rotameter carefully. The float inside the metal tube is secured in one position during transit to prevent damage. Before installing the instrument in the pipeline, ensure that the float is released and free to move. Also, check the float retainer at the top of the tube. If it has become loose during transportation, it must be properly tightened before installation.

Details of Components Used in a By-Pass Rotameter:

Mainline Orifice:

The mainline orifice is installed in the process line to generate a differential pressure. This differential pressure varies with the flow rate through the main line and is used to determine the flow by measuring the pressure drop across the orifice plate.

By-Pass Rotameter:

The by-pass rotameter is an in-line rotameter (glass tube or metal tube) installed in a by-pass line. It differs from a standard rotameter by the inclusion of a range orifice at the inlet. This range orifice is designed so that the differential pressure across the by-pass line matches the differential pressure across the mainline orifice. With this arrangement, the rotameter functions as a manometer, indicating the mainline flow rate.

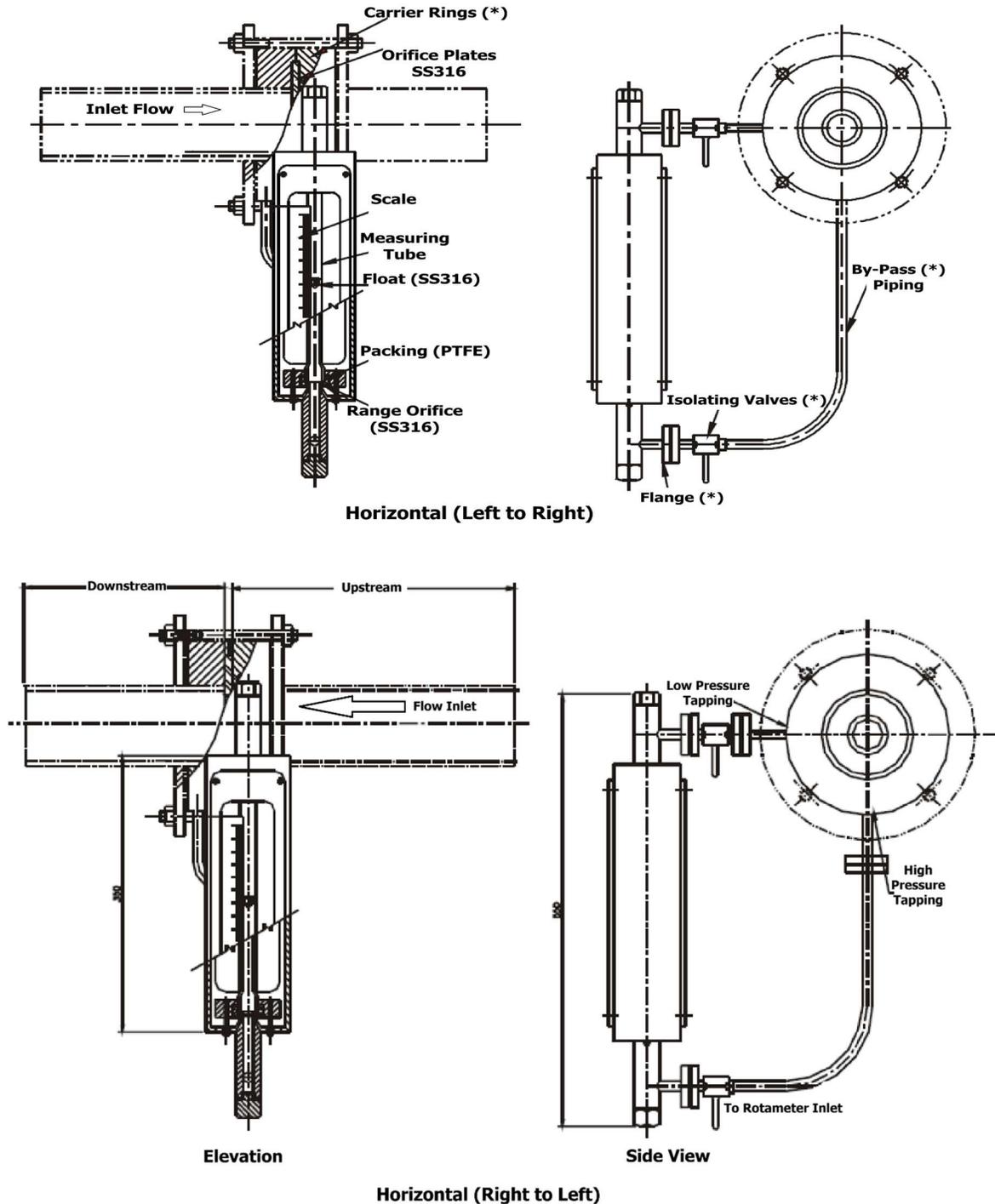
By-Pass Piping:

The by-pass piping connects the upstream pressure tap of the main line to the rotameter inlet and the downstream tap to the rotameter outlet. Isolation valves provided in the by-pass line allow maintenance of the rotameter without shutting down the main process.

Mounting Options:

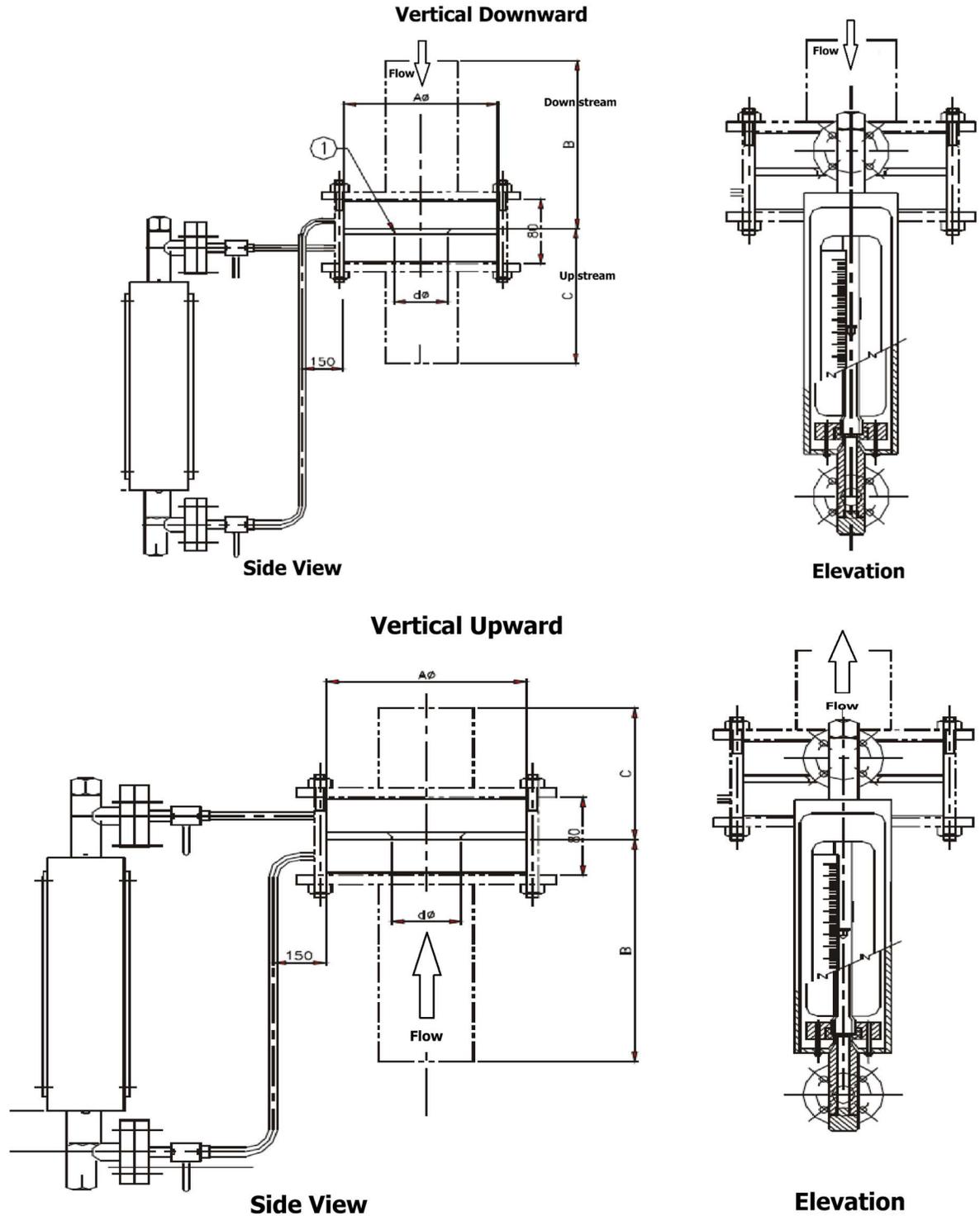
By-Pass Rotameter FCSBPR Series: With Orifice Plate & Carrier Ring: FCSBPR

Figure A





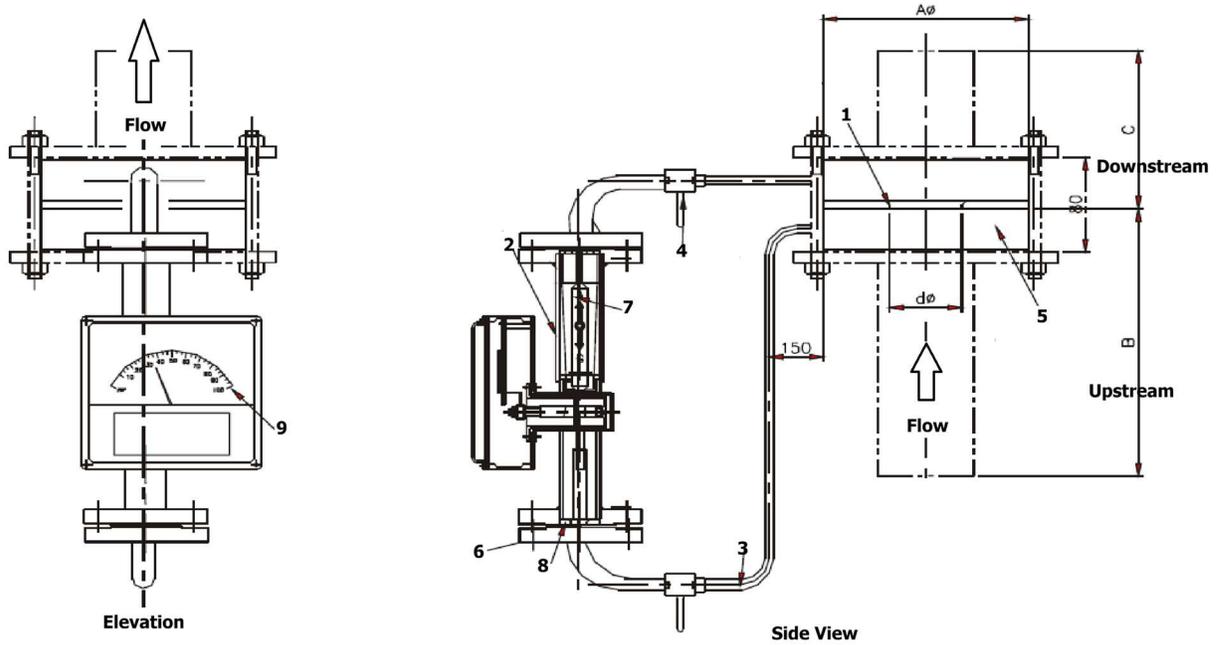
By-Pass Rotameter FCSBPR Series: FCSBPRVD/VU



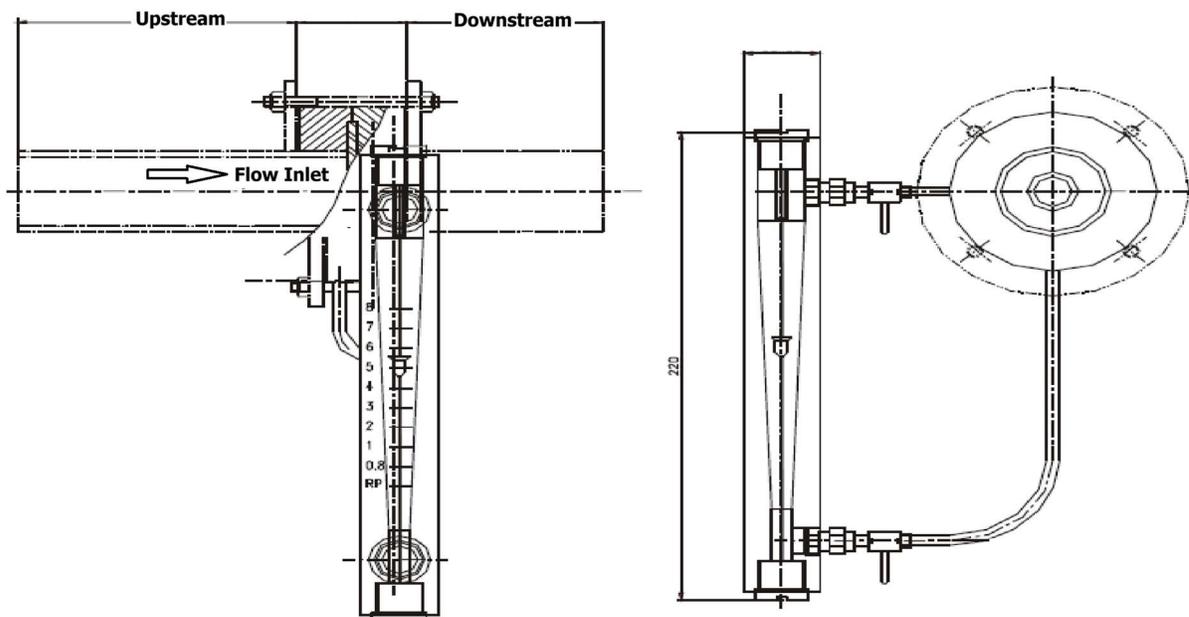


By-Pass Rotameter FCSBPR Series:

By-pass Rotameter with Metal Tube Rotameter as Flow Indicator

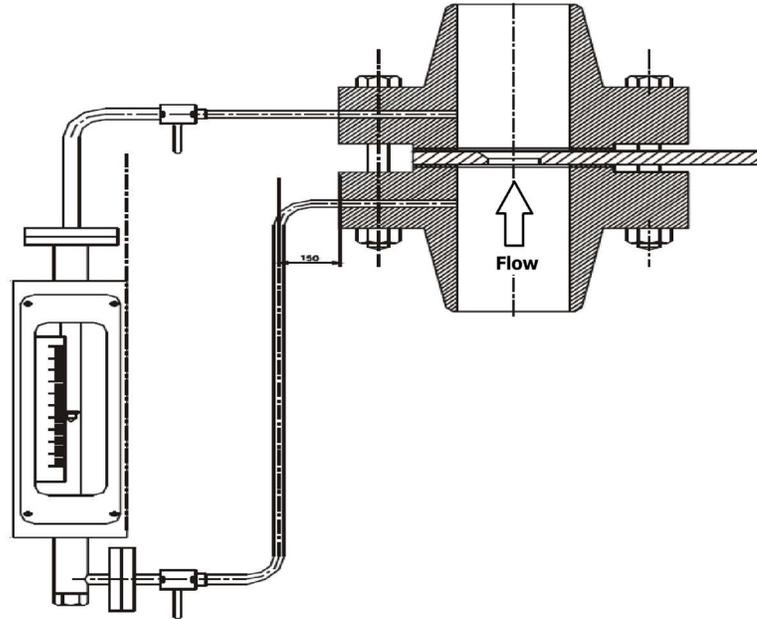


By-pass Rotameter with Acrylic Body Rotameter as Flow Indicator



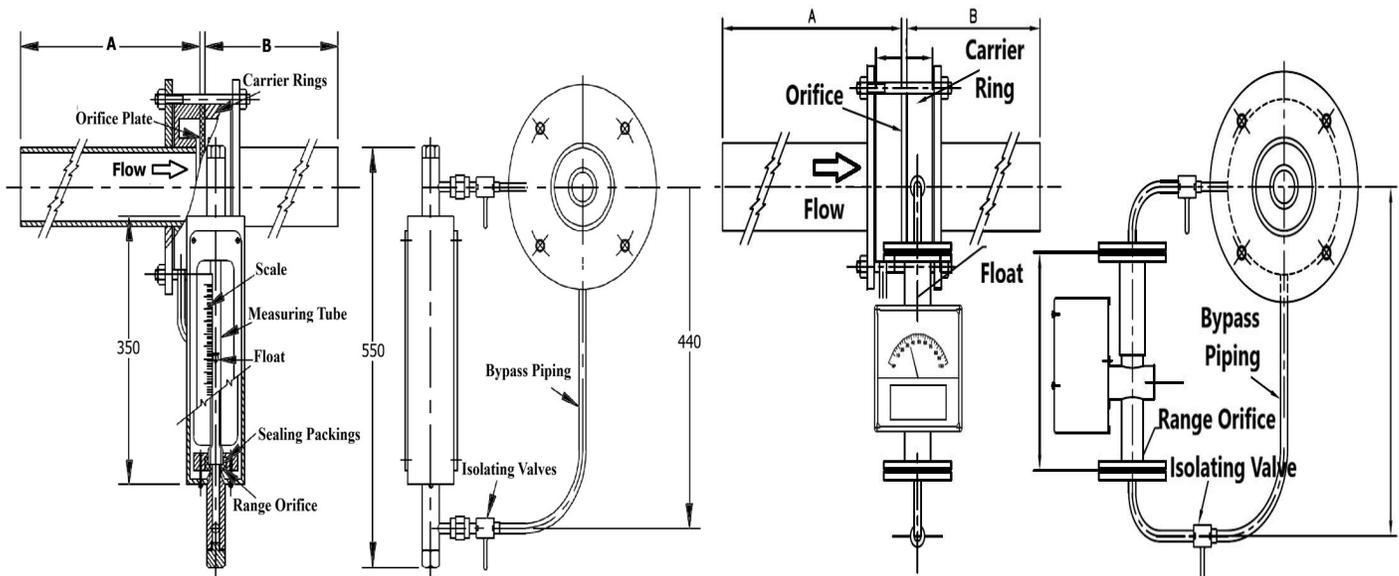
By-Pass Rotameter FCSBPR Series:

Bypass Rotameter with Weld Neck Flange Assembly



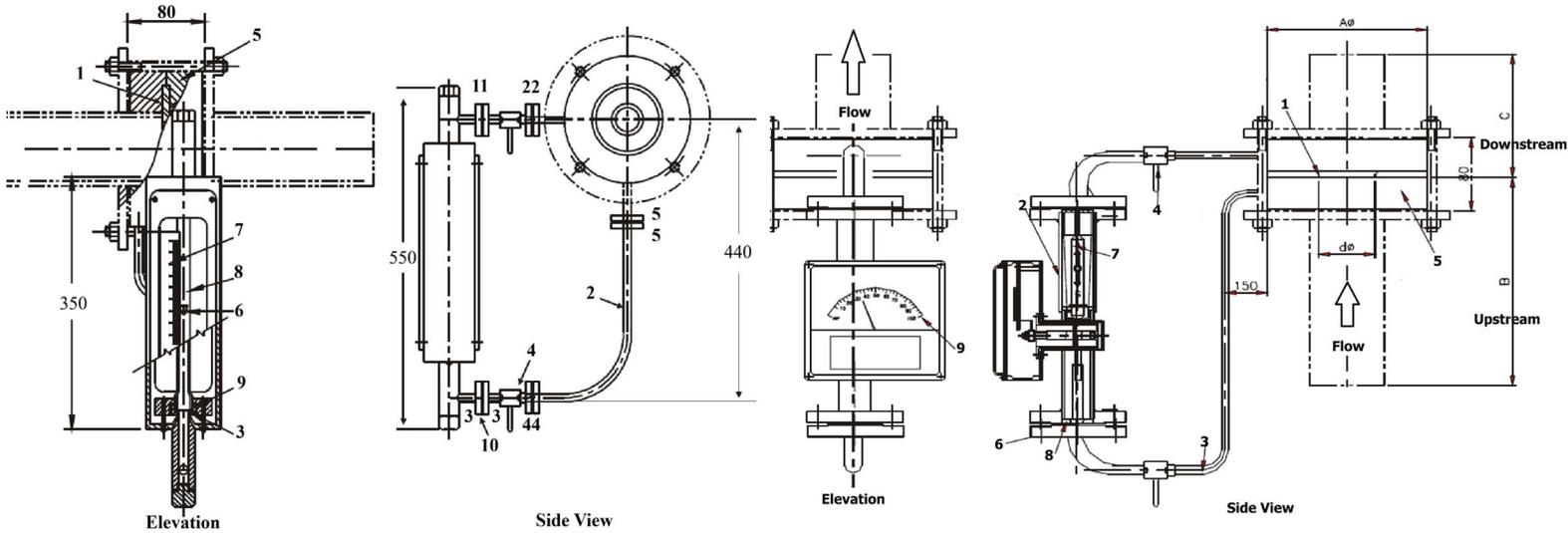
Pressure Tapping: Differential pressure across the orifice plate can be measured using 3 tapping methods.

1. Corner Tapping (Carrier Ring Type): Pressure is taken from openings located at the corners of the orifice plate through slots in the carrier ring. The typical installation of a bypass rotameter with a carrier ring for a horizontal pipeline is shown below.



2. Flange Tapping:

This tapping method is simple to manufacture, as the pressure taps are drilled directly into the orifice flange at a fixed distance of **25 mm** from the orifice plate face. It removes the need to maintain a specific tapping distance on the main line. Installation details of the bypass rotameter with flange tapping for a horizontal pipeline are shown below.

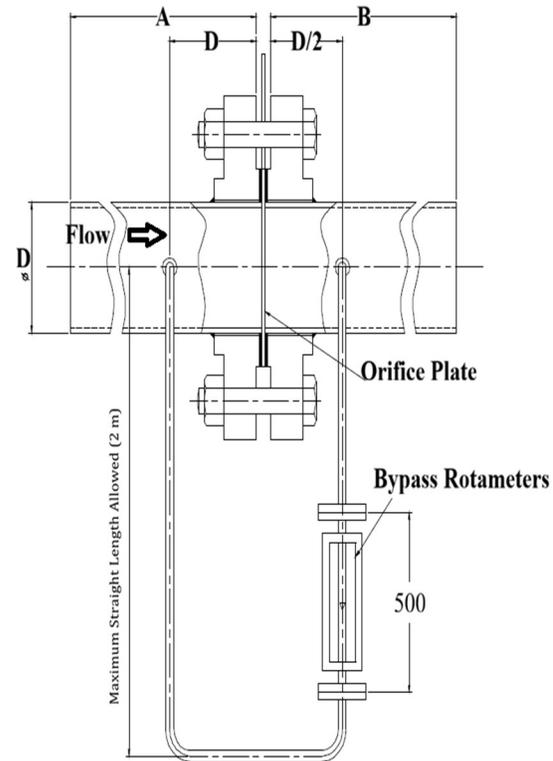


3. D and D/2 Tapping Arrangement: The installation of the FCS bypass rotameter with D and D/2 tapping is shown below. The upstream pressure tap is located at a distance of D from the orifice plate face, while the downstream tap is positioned at D/2, where D represents the internal diameter of the pipeline. The FCS bypass rotameter is designed to measure fluid flow in pipelines of 2 inches diameter and above. The orifice plate is installed in the main line, while a bypass line incorporating the rotameter with a range orifice is connected to the pressure tapping points. When the orifice, bypass piping, and rotameter are installed in accordance with BS standards and the recommended instructions, the system provides flow measurement accuracy within $\pm 2\%$ of maximum flow.

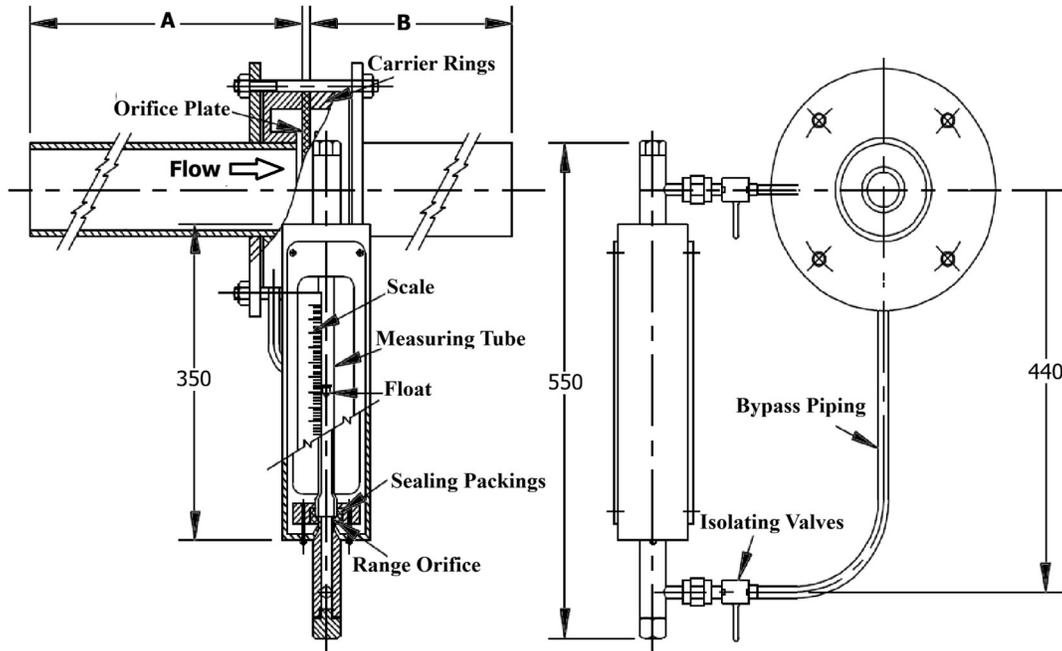
The bypass rotameter is supplied fully assembled.

Summary:

The installation of the bypass rotameter with **D** and **D/2** tapping is shown below. The upstream pressure tap is located at a distance of **D** from the orifice plate face, while the downstream tap is positioned at **D/2**, where **D** represents the internal diameter of the pipeline.



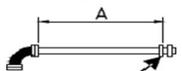
Flange Tapping: D and D/2 Tapping Arrangement:



Fittings before straight line

Single 90° bend or tee

Piping Layout



Two or more bends in different plane



Two or more bends in same plane



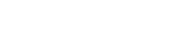
Reducers or expanders



Globe valve (fully open)



Gate valve (fully open)



Minimum downstream straight length required

Diameter Ratio (B)

| | 0.20 | 0.25 | 0.30 | 0.35 | 0.40 | 0.45 | 0.45 | 0.50 | 0.55 | 0.65 | 0.70 | 0.75 | 0.80 |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Single 90° bend or tee | 10 | 10 | 10 | 12 | 14 | 14 | 14 | 16 | 18 | 22 | 28 | 36 | 46 |
| Two or more bends in different plane | 14 | 14 | 16 | 16 | 18 | 18 | 20 | 22 | 26 | 32 | 36 | 42 | 50 |
| Two or more bends in same plane | 34 | 34 | 34 | 36 | 36 | 38 | 40 | 44 | 48 | 54 | 62 | 70 | 80 |
| Reducers or expanders | 16 | 16 | 16 | 16 | 16 | 18 | 20 | 20 | 22 | 24 | 26 | 28 | 30 |
| Globe valve (fully open) | 18 | 18 | 18 | 18 | 20 | 20 | 22 | 24 | 26 | 28 | 32 | 36 | 44 |
| Gate valve (fully open) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 14 | 14 | 16 | 20 | 24 | 30 |
| Minimum downstream straight length required | 4 | 4 | 5 | 5 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 |

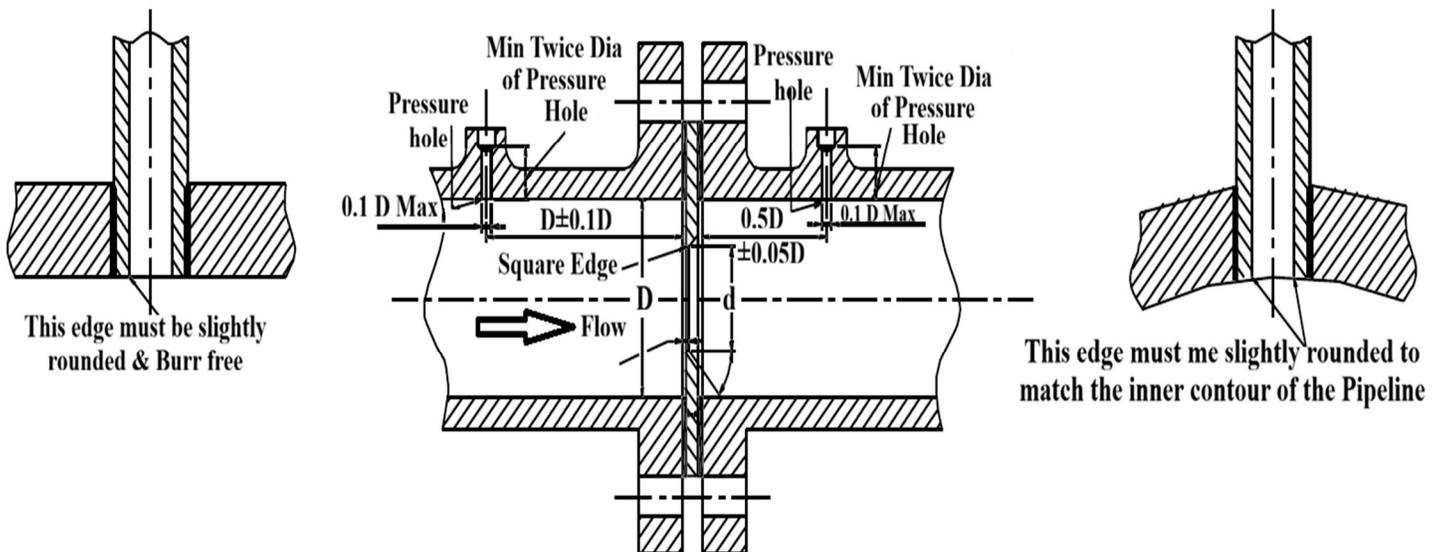
Straight Length Criteria:

All straight length values are expressed in terms of **pipe diameters 'D'** $\beta=d/D$
 Where: **d** = Internal diameter of the orifice & **D** = Internal diameter of the pipe

Installation Notes:

1. Ensure the instrument is not damaged during transportation. Remove the end plugs and the plastic locking rod used to secure the float during transit.
2. Fluid flow in a pipeline develops a defined flow profile. Disturbances caused by valves, elbows, tees, or bends can introduce turbulence and affect measurement accuracy. Therefore, the recommended **straight pipe lengths upstream and downstream** must be maintained as specified.
3. The centerline of the orifice plate and the pipeline shall be perfectly aligned. The bevel of the orifice plate must face the downstream side.
4. The pipeline shall be clean and flushed using a temporary or dummy section before installing the rotameter.
5. The fluid shall be filtered and free from suspended particles.
6. The rotameter must be installed in a true vertical position. A maximum inclination of $\pm 2^\circ$ is permissible.
7. For orifice plates with D and D/2 tapping, the scope of supply includes the orifice plate and a vertical, flanged bypass rotameter used as an indicator. Bypass piping shall be provided by the user and kept as short as possible with a minimum number of fittings. If isolating valves are required, ball valves are recommended to minimise pressure loss. For pressure tapping details, refer below.
8. The user-provided pump shall be capable of overcoming the pressure loss across the orifice while maintaining the required system pressure.
9. Ensure that the R.P. line marked on the detachable scale aligns with the red line on the glass tube.
10. Bring the rotameter into operation gradually to prevent sudden movement of the float, which could damage the measuring tube. It is recommended that the flow-control valve be installed on the downstream side.
11. Maintenance instructions for the rotameter are provided in a separate manual supplied with the instrument.

Orifice Plate With D & D/2 Tappings





Trouble Shooting- Error Causes:

| Category | Observation / Condition | Possible Causes |
|----------|---|--|
| A | Positive Error in Flow Rate | <ol style="list-style-type: none">1. Deposition of foreign material in the orifice plate bore2. Insufficient upstream straight pipe length3. Incorrect location of pressure tapping4. Deposits on the inner surface of the glass or metal measuring tube |
| B | Negative Error in Flow Rate | <ol style="list-style-type: none">1. Deposition of foreign material on the upstream face of the orifice plate2. Orifice plate installed in reverse direction3. Operating pressure insufficient to overcome the differential pressure across the orifice4. Excessive pressure loss in the bypass piping due to needle valves or excessive fittings5. Presence of internally projecting rivet heads on flanges where the orifice plate is mounted6. Insufficient downstream straight pipe length7. Orifice plate bore calculated using incorrect pipe internal diameter8. Incorrect location of pressure tapping9. Deposition within the range orifice of the bypass rotameter |
| C | Float of Bypass Rotameter Stuck at Bottom | <ol style="list-style-type: none">1. Float jammed due to particles present in the fluid2. Flow rate below the minimum value indicated on the scale3. Presence of air bubbles in the impulse piping |



Data required to submit the Quotation:

- Product Code
- Name of the Liquid
- Operating Temperature
- Operating Pressure
- Operating Density
- Center to Center Distance
- Operating Specific Gravity
- Connection Details
- Material Of Construction
- Accessories
- Nozzle Size

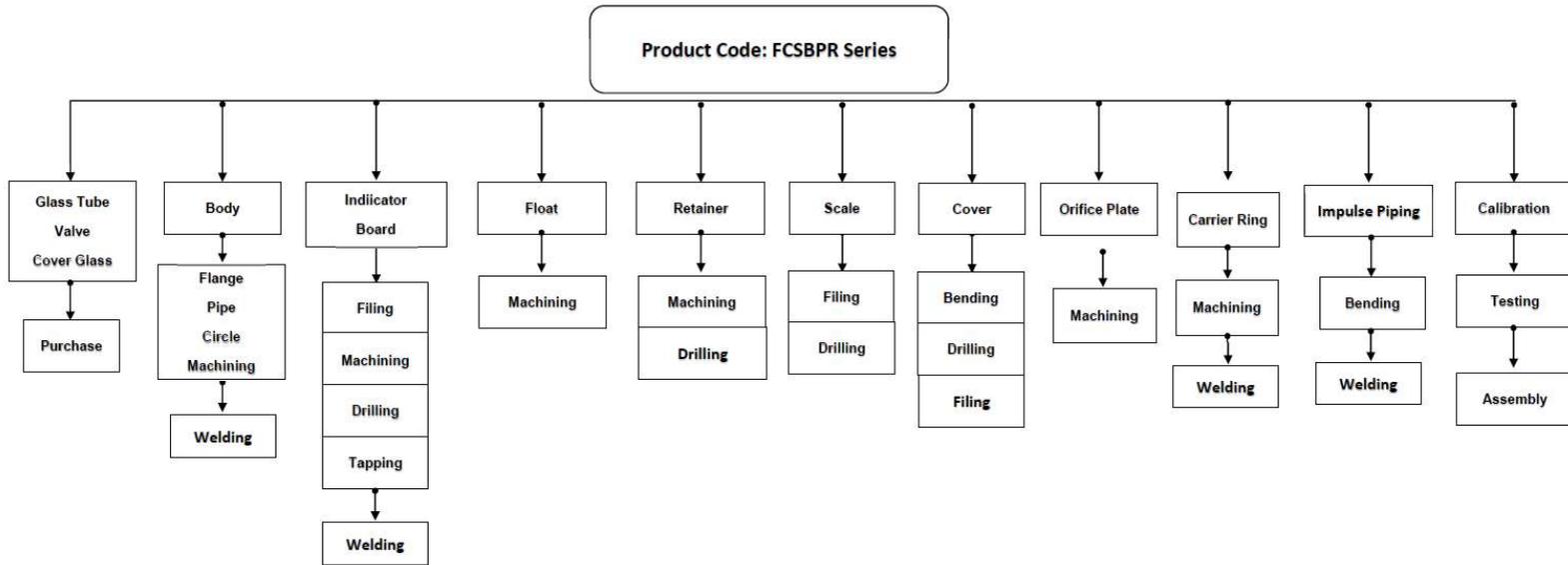


Quality Assurance Plan: Bypass Rotameter

| Quality Assurance Plan: Bypass Rotameter | | | | | | | | | | | | | |
|---|-------------------------------------|---|-------------------------------|------------------|--|-------------------------------------|-------|---|---|-----------------|--|--|---|
| No. | Component | Check Characteristic | Type of Check | Quantum of Check | Reference Standard Documents/Acceptance Norms | Format of Records | Scope | | | Remarks(if any) | | | |
| | | | | | | | M | C | W | | | | |
| A. Materials | | | | | | | | | | | | | |
| 1 | Pipe, Rod, Carrier Ring, Ball-Valve | Surface finish & Dimensions | Visual Dimensional & Chemical | 100% | As per requirement given in P.O. approved Drawings, & given Std. Specification | Goods Receipt Note & Mfr.'s Lab T.C | ✓ | | | | | | |
| 2 | Pipe, Rod, Flange, Ball-Valve | Chemical Properties | Visual Dimensional & Chemical | Random | | | | | ✓ | C | | | |
| 3 | Angle, Cover | Surface finish & Dimensions | Visual Dimensional & Chemical | 100% | | | | | | | | | |
| B. BOUGHT OUT / JOB WORK | | | | | | | | | | | | | |
| 1 | Glass Tube & Glass Cover | Surface finish & Dimensions | Visual & Dimensional | Random | From Approved Vendor. | Goods Receipt Note | ✓ | | | C | | | |
| 2 | Fasteners, gasket etc. | | | | | | | | | | | | |
| C. IN PROCESS | | | | | | | | | | | | | |
| 1 | Machining | Dimension | Measurement | 100% | As per Approved Drawing Of Mfr. | Internal Inspection Report | ✓ | | | C | | | |
| 2 | Welding | Welding Quality | Visual | | | | | | | | | | |
| 3 | Assembly | Dimensions & conformity orientation | Visual & Dimensional | | | | | | | ✓ | | | C |
| 4 | Testing | Leak Tightness | Hydro Test | | | | | | | ✓ | | | C |
| 5 | Calibration | w.r.t. Master Calibrator | Calibration | | | | | No leak at rated pressure for 20 min. Calibration as per ISA RP-16.6 | | ✓ | | | C |
| 6 | Painting & Cleaning | Surface finish | Visual | | | | | AS per P.O. & approved Drawing Of Mfg. | | ✓ | | | C |
| 7 | Final Inspection | Final finish & Appearance Completeness of supply with spares & accessories | Visual | | | | | • Good Finish • As per P.O. & App. Drawing | | ✓ | | | C |
| <p>Legends: -M: Manufacturer, -P: Perform, -V: Verify, -W: Witness -C: Customer, -M: Manufacturer, -P: Perform, -V: Verify, -W: Witness -Performance Test Procedure: -Performance Test: M-100%, C-10%</p> <p>*Testing 100% by M/s Flow & Control (P) Ltd. and Client may witness randomly as agreed upon.</p> | | | | | | | | | | | | | |
| <p>Prepared By: (QC Engineer) Approved By: (Technical Head)</p> <p>Remarks:</p> | | | | | | | | | | | | | |



Process Flow Chart: Bypass Rotameter



Reviewed & Approved By: Technical Head

Remarks:



Assured Quality & Less Service Cost

Service Policy

Owners may return any Flow & Control System instrument or component for rebuilding or replacement. Returns must be shipped prepaid. The company will repair or replace the gauge free of charge, excluding transportation costs, provided that, if:

- **Returned within the warranty period; and**
- **The factory inspection finds the cause of the claim to be covered under the warranty.**

If the issue arises from conditions beyond our control or is not covered under warranty, charges for labour and replacement parts will apply. In certain cases, it may be necessary to ship replacement parts or a new instrument before the original is returned.

To arrange this, please provide the model and serial numbers of the instrument to be replaced. Credit for returned materials will be determined based on warranty applicability. Claims for misapplication, labour, or consequential damages will not be accepted.

Return Material Procedure

To ensure efficient processing of returned materials, a Return Material Authorization (RMA) number must be obtained from the factory before shipment. This can be arranged through your local Flow & Control System representative or by contacting the factory directly. Please provide the following information:

- | | | |
|-----------------------------|-----------------------------------|-------------------------|
| 1. Company Name | 2. Description of Material | 3. Serial Number |
| 4. Reason for Return | 5. Application | |

Units previously used in a process must be thoroughly cleaned in accordance with Occupational Safety and Health Administration (OSHA) standards before return. A Material Safety Data Sheet (MSDS) must accompany any unit exposed to process media. All returns must be shipped prepaid, and all replacements will be dispatched F.O.B. factory.



**Our Footprints in India and Across the Globe,
“Trusted by leading organizations in Energy, Oil & Gas, Power & Process Industries”.**



COCHIN SHIPYARD LTD



राष्ट्रीय केविकल्स एंड फर्टिलाइजर्स लिमिटेड
Rashtriya Chemicals and Fertilizers Limited



Manufacturing Units:

MIDDLE EAST

Flow & Control System Private Ltd.
INTERNATIONAL SOLUTIONS 4 INDUSTRIAL SERVICES

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