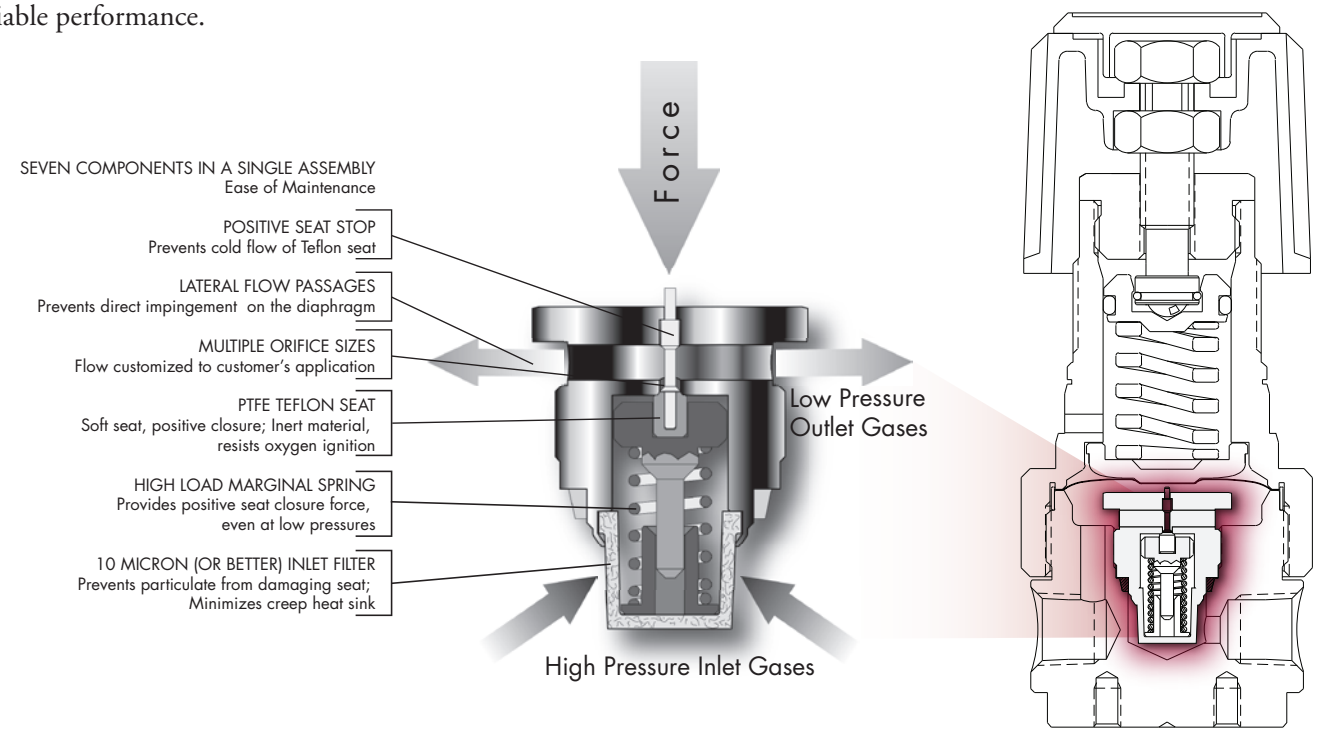
Capsule® Technology

To meet the rigorous requirements of end-users in the analytical, scientific, and electronics markets, CONCOA has developed a unique regulator seat assembly that incorporates the numerous individual parts of a standard regulator seat into a single component. This design allows the Capsule to be tested as a separate component prior to assembly into the regulator. The complete regulators are also 100% tested, giving the seat or "heart" of the device a double test. The result is longer life and reliable performance.



Lateral Flow Passages

Instead of impinging directly on the diaphragm, the gas enters the low pressure chamber through a side orifice of the Capsule. This smooth transition from high pressure to low pressure reduces the effects of gas surge on the diaphragm and minimizes regulator hum. In addition, the lateral flow passages induce a swirling effect which yields a completely swept internal cavity for complete purging.

Multiple Orifice Sizes

Each regulator has a specially designed Capsule to optimize regulator characteristics over a broad range of applications. However, there are applications requiring higher or lower flows than the standard Capsule can offer. By substituting a Capsule with a larger or smaller orifice, CONCOA can tailor the regulator to meet a specific requirement.

PTFE Seat

The standard seat material is high density PTFE. PTFE is an inert material which will not react with or contaminate any high purity gas. In addition, PTFE retains its sealing properties over a wider temperature range than most other seat materials. The inlet pressure rating of all CONCOA regulators with a PTFE seat is 3000 PSIG (210 BAR). With the optional PCTFE seated Capsule the pressure rating increases to 4500 PSIG (310 BAR).

High Load Marginal Spring

The purpose of the marginal spring is to close the seat independent of gas pressures. The innovative CONCOA Capsule utilizes a high force spring that assures a gas-tight seal under all conditions.

10 Micron Filter

Particles trapped between the seat and orifice prevent proper seat closure causing the regulator to fail. The Capsule incorporates a 10 micron filter which completely surrounds the seat components to prevent the entrance of these damaging particles, virtually eliminating the cause of such seat failures. In addition, this filter is very fine, and its large surface area is resistant to clogging and allows unrestricted flow. The 10 micron filter is a key factor in the long life and reliable performance of all CONCOA regulators. The Stainless Steel 10 Micron Mesh Capsule is patendted CONCOA technology.

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Table of Contents

Ordering CONCOA Regulators

In accordance with our philosophy of flexible design, CONCOA has developed a versatile modular manufacturing system to accommodate any individual requirement. With all the options CONCOA offers, listing discrete part numbers for each regulator series would be impossible. Therefore, we have created a part number matrix which allows you to design a regulator to meet the needs of any application.

Step One The first choice in completing the Part Number Matrix is selecting a particular regulator series. Determine which regulator series are compatible with the gases involved in the application by consulting the table which starts on the facing page. For further criteria, consider page 8 entitled Choosing a Regulator and finally the description of each regulator series in this catalog. If you are having problems deciding, feel free to call CONCOA for a recommendation. The regulator series number then becomes the first three digits of the part number.

Step Two Select the desired outlet pressure range from those available in the A column. The selection of an outlet pressure range automatically specifies the outlet pressure gauge which appears in the adjacent column. For example, a regulator with a 0-250 PSIG outlet pressure range will have a 0-400 PSIG pressure gauge installed.

Step Three Choose the inlet pressure gauge from those available in the B column. While the most common cylinder pressure is between 2200 PSIG and 2400 PSIG, several gases are stored in cylinders at other pressures. Choosing the inlet gauge with a range that most closely approximates the actual pressure range of the cylinder allows easy readability of cylinder contents. Please note that by indicating the 0-6000 PSIG inlet gauge, you are also selecting a special PCTFE Capsule® with a maximum inlet pressure of 4500 PSIG.

Step Four Indicate the outlet assembly desired from those available in the C column. Since there are a wide variety of tubing and piping systems in use, the matrix accommodates virtually any style of connection, eliminating the need for adapters and reducing potential leak paths. CONCOA also offers a choice of valve options for gas flow control.

Step Five Select an assembly option from those available in the D column. A bare body regulator is shipped without peripherals, with all ports open and unplugged. A standard assembly regulator comes completely assembled with all selected peripherals, ready for use; a Cleanroom regulator is completely assembled in a Class 10 environment. Finally, each regulator must pass a battery of rigorous operational tests and a Helium Leak Integrity check.

Step Six Specify an inlet connection. On all regulator series, CONCOA will provide any CGA, DIN 477, BS 341, or other standard connection provided it is recognized as safe for the materials of construction and pressure rating of the regulator. Consult your gas supplier for proper selection of the inlet connection. A "-000" at the end of the part number indicates no inlet connection (¼" female NPT).

Step Seven Choose an installed option from a range of protocol stations and purges. By ordering these options as a component of the part number, CONCOA can assure the appropriate materials, maximum pressure, and connections of the option chosen. See pages 26 through 29 for more information on Protocol Stations, and pages 115 and 116 for more information about purges.

For example, using the table below to order a 422 Series regulator with an outlet pressure range of 0-50 PSIG, a 0-4000 PSIG inlet pressure gauge, a diaphragm valve with a ¼" tube fitting, PSIG/kPa pressure gauges, and a CGA 580 connection for Nitrogen service, the part number would be 422-2331-580.

422	A		B	C	D	-Inlet	Options
Series 422	**Outlet Pressure**	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/ Gauges**	**Inlet Connections**	**Installed Options**
	1: 0-15*	30"-0-30 PSIG	0: None	0: ¼" FPT Port	0: Bare Body	000: ¼" FPT	A: Protocol Alarm Station (110V)
	2: 0-50	30"-0-100 PSIG	3: 0-4000 PSIG	1: ¼" MPT	1: Standard Assembly (PSIG/kPa Gauges)	TF2: ⅛" Tube	B: Protocol Alarm Station (220V)
	3: 0-100	30"-0-200 PSIG	5: 0-1000 PSIG	2: ¼" Tube Fitting	2: Standard Assembly (BAR/PSIG Gauges)	TF4: ¼" Tube	C: Protocol Switchover Station
	4: 0-250	0-400 PSIG	6: 0-300 PSIG	3: Diaphragm Valve ¼" Tube Fitting	4: Cleanroom Assembly (PSIG/kPa Gauges)	TF6: ⅜" Tube	D: Deep Purge
	5: 0-500	0-1000 PSIG	7: 0-400 PSIG	4: Diaphragm Valve ¼" MPT	5: Cleanroom Assembly (BAR/PSIG Gauges)	M06: 6mm Tube	G: Protocol Switchover Station with Alarm (110V)
	7: 0-150	30"-0-200 PSIG	8: 0-6000 PSIG*	5: Needle Valve ¼" MPT		CGA DIN 477 BS 341 and others available	H: Protocol Switchover Station with Alarm (220V)
	**Not available with 4500 PSIG maximum inlet pressure*		**Maximum inlet pressure 4500 PSIG (300 BAR) with PCTFE Seat Capsule*	6: ⅛" Tube Fitting			M: Protocol Station
				7: ⅜" Tube Fitting			S: SS Bonnet
				8: Diaphragm Valve ⅛" Tube Fitting			
				9: Diaphragm Valve ¼" FPT			
				A: ⅜" BSP Right Hand Fitting			
				M: 6mm Tube Fitting			
				S: Diaphragm Valve 6mm Tube Fitting			

Materials Compatibility

		Regulators							Flowmeters	
		100 Series	200 Series	300 Series		400 Series			500 Series	
Pure Gases	Formula	Brass	Plated Brass	Plated Brass	Stainless Steel	Aluminum	Brass	Stainless Steel	Plated Brass	Stainless Steel
Acetylene	C_2H_2									
Purified, 99.6%			•	•	•	•	•	•	•	•
Air										
Ultra Zero			•	•	•	•	•	•	•	•
Zero			•	•	•	•	•	•	•	•
Synthetic Compressed		•	•	•	•	•	•	•	•	•
Dry		•	•	•	•	•	•	•	•	•
Ammonia	NH_3									
Electronic, 99.999%								•		
Anhydrous, 99.99%					•	•		•		
Argon	Ar									
Research, 99.9995%								•		•
Ultra High Purity, 99.999%				•	•	•	•	•	•	•
Zero, 99.998%			•	•	•	•	•	•	•	•
Prepurified, 99.998%			•	•	•	•	•	•	•	•
High Purity, 99.99%		•	•	•	•	•	•	•	•	•
Arsine	AsH_3									
Electronic, 99.995%								•		
n-Butane	C_4H_{10}									
Research, 99.9%			•	•	•	•	•	•	•	•
CP 99.9%			•	•	•	•	•	•	•	•
Carbon Dioxide	CO_2									
Research, 99.998%				•	•	•	•	•		
Anaerobic, 99.99%			•	•	•	•	•	•		
Instrument, 99.99%			•	•	•	•	•	•		
Bone Dry, 99.9%			•	•	•	•	•	•		
Carbon Monoxide	CO									
Research, 99.99%				•	•		•	•	•	•
CP, 99.5%				•	•		•	•	•	•
Technical, 98.5%				•	•		•	•	•	•
Chlorine	Cl_2									
High Purity, 99.5%					•			•		
CP, 99.7%					•			•		
Ethane	C_2H_6									
Research, 99.96%			•	•	•	•	•	•	•	•
Technical, 97.5%			•	•	•	•	•	•	•	•
Ethylene	C_2H_4									
Research, 9.98%			•	•	•	•	•	•	•	•
CP, 99.5%			•	•	•	•	•	•	•	•
Technical, 98.5%			•	•	•	•	•	•	•	•
Helium	He									
Research, 99.9999%					•			•		•
Ultra High Purity, 99.999%				•	•	•	•	•	•	•
Zero, 99.995%			•	•	•	•	•	•	•	•
Hydrogen	H_2									
Research, 99.9999%					•			•		•
Ultra High Purity, 99.999%				•	•		•	•	•	•
Zero, 99.9%			•	•	•		•	•	•	•
Prepurified, 99.99%			•	•	•		•	•	•	•
Extra Dry, 99.95%			•	•	•		•	•	•	•

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	Regulators							Flowmeters	
	100 Series	200 Series	300 Series		400 Series			500 Series	
Pure Gases — Formula	Brass	Plated Brass	Plated Brass	Stainless Steel	Aluminum	Brass	Stainless Steel	Plated Brass	Stainless Steel
Hydrogen Chloride — HCl									
Electronic, 99.99%							•		•
Technical, 99%							•		•
Hydrogen Sulfide — H_2S									
CP, 99.5%					•		•		•
Isobutane — C_4H_{10}									
Research, 99.96%		•	•	•	•	•	•	•	•
CP, 99%		•	•	•	•	•	•	•	•
Krypton — Kr									
Research, 99.995%			•	•	•	•	•	•	•
Methane — CH_4									
Research, 99.99%		•	•	•	•	•	•	•	•
Ultra High Purity, 99.97%		•	•	•	•	•	•	•	•
CP, 99%		•	•	•	•	•	•	•	•
Technical, 98%		•	•	•	•	•	•	•	•
Commercial, 93%		•	•	•	•	•	•	•	•
Methyl Chloride — CH_3Cl									
CP, 99.5%				•			•		•
Neon — Ne									
Research, 99.999%			•	•	•	•	•	•	•
Purified, 99.99%		•	•	•	•	•	•	•	•
Nitric Oxide — NO_2									
CP, 99%				•			•		•
Nitrogen — N_2									
Research, 99.9995%				•			•		•
Ultra High Purity, 99.999%			•	•		•	•	•	•
Zero, 99.998%		•	•	•	•	•	•	•	•
Vehicle Emission		•	•	•	•	•	•	•	•
Prepurified, 99.998%		•	•	•	•	•	•	•	•
High Purity, 99.99%	•	•	•	•	•	•	•	•	•
Nitrous Oxide — N_2O									
Electronic, 99.99%		•	•	•	•	•	•	•	•
CP, 99%		•	•	•	•	•	•	•	•
Oxygen — O_2									
Research, 99.995%			•	•		•	•	•	•
Ultra High Purity, 99.993%			•	•		•	•	•	•
MOS, 99.995%			•	•		•	•	•	•
Zero, 99.6%		•	•	•		•	•	•	•
Extra Dry, 99.6%		•	•	•		•	•	•	•
Phosphine — PH_3									
Electronic, 99.995%							•		
Propane — C_3H_8									
Research, 99.99%		•	•	•	•	•	•	•	•
Instrument, 99.5%		•	•	•	•	•	•	•	•
CP, 99%		•	•	•	•	•	•	•	•
Silane — SiH_4									
VLSI							•		
CCD							•		
Semiconductor							•		
Sulfur Hexafluoride — SF_6									
CP, 99.8%		•	•	•	•	•	•	•	•
Xenon — Xe									
Research, 99.995%			•	•	•	•	•	•	•

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	Regulators							Flowmeters	
	100 Series	200 Series	300 Series		400 Series			500 Series	
Mixed Gases	Brass	Plated Brass	Plated Brass	Stainless Steel	Aluminum	Brass	Stainless Steel	Plated Brass	Stainless Steel
Ammonia									
in Argon				•			•		•
in Helium				•			•		•
in Hydrogen				•			•		•
in Nitrogen				•			•		•
Argon									
in Helium		•	•	•		•	•	•	•
in Hydrogen		•	•	•		•	•	•	•
in Nitrogen		•	•	•		•	•	•	•
in Oxygen		•	•	•		•	•	•	•
Carbon Dioxide									
in Air		•	•	•	•	•	•	•	•
in Argon		•	•	•	•	•	•	•	•
in Helium		•	•	•	•	•	•	•	•
in Hydrogen		•	•	•	•	•	•	•	•
in Nitrogen		•	•	•	•	•	•	•	•
in Oxygen		•	•	•	•	•	•	•	•
Chlorine									
in Argon				•			•		•
in Helium				•			•		•
in Nitrogen				•			•		•
Helium									
in Argon		•	•	•	•	•	•	•	•
in Hydrogen		•	•	•	•	•	•	•	•
in Nitrogen		•	•	•	•	•	•	•	•
in Oxygen		•	•	•	•	•	•	•	•
Hydrogen									
in Argon		•	•	•	•	•	•	•	•
in Carbon Monoxide		•	•	•	•	•	•	•	•
in Helium		•	•	•	•	•	•	•	•
in Nitrogen		•	•	•	•	•	•	•	•
Hydrogen Chloride									
in Argon							•		•
in Helium							•		•
in Nitrogen							•		•
in Oxygen							•		•
Methane									
in Air (Any Grade)		•	•	•	•	•	•	•	•
in Argon		•	•	•	•	•	•	•	•
in Helium		•	•	•	•	•	•	•	•
in Hydrogen		•	•	•	•	•	•	•	•
in Nitrogen		•	•	•	•	•	•	•	•
Nitric Oxide									
in Argon				•			•		•
in Helium				•			•		•
in Nitrogen				•			•		•
Nitrogen									
in Argon		•	•	•	•	•	•	•	•
in Helium		•	•	•	•	•	•	•	•
in Hydrogen		•	•	•	•	•	•	•	•
in Oxygen		•	•	•	•	•	•	•	•
Oxygen									
in Argon		•	•	•	•	•	•	•	•
in Helium		•	•	•	•	•	•	•	•
in Nitrogen		•	•	•	•	•	•	•	•

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How to Choose a Regulator

While all regulators can reduce pressure in a gas system, CONCOA high purity regulators conform to very exacting standards of pressure control. Below, we discuss some bases of comparison that can help you navigate this catalog and choose a regulator that best suits your needs. Of course, our Customer Service representatives would be happy to answer any further questions you may have about regulator design and operation.

Single Stage vs. Dual Stage

Single stage regulators reduce pressure in a single step to deliver a pressure within a specific range. Regulators designed in this way will show a slight variation in delivery pressure as the cylinder pressure falls during use. For this reason, single stage regulators are best suited for applications where a constant outlet pressure is not critical, where an operator can monitor and readjust pressure, or where inlet pressure is constant.

Dual stage regulators perform the same function as single stage regulators. However, delivery pressure remains constant as cylinder pressure decreases and greater accuracy in pressure control is maintained because the pressure reduction is performed in two steps. Dual stage regulators are recommended for applications requiring a constant outlet pressure over the life of a gas cylinder.

Helium Leak Integrity

Helium leak integrity is a measure of how well a regulator prevents gases from leaking into or out of a regulator body. The measured quantity is expressed as a flow rate such as 1×10^{-9} cc/sec He (1 billionth of a cc/sec). In this case, a Helium Leak integrity rating of 1×10^{-9} would indicate that the regulator would leak enough gas to fill a cubic centimeter every 33 years. If the rating were 1×10^{-3} the regulator would leak enough gas to fill a cubic centimeter in just 17 minutes.

Helium is used as the test gas because it is chemically inert, it is easy to detect, and it is an extremely small molecule able to pass through the smallest leak. The lower the helium leak specification, the better the regulator will be at preventing leaks into the atmosphere and at minimizing contamination from gases outside the body.

Materials of Construction

The materials of construction for a regulator should be based on the properties and purity of the gas. CONCOA manufactures regulators from brass, aluminum, and 316L stainless steel. Brass is compatible with most of the non-reactive gases. A choice of forged body or barstock construction is available. Forged body regulators are economical; however, their internal surface finishes are relatively rough as compared to barstock body regulators. Barstock body regulators have all wetted surfaces machined to a smooth finish which reduces the possibility of contamination. 316L stainless steel is highly corrosion resistant and is suitable for use with many of the highly corrosive gases in their anhydrous form. Aluminum is an economical lightweight alternative to stainless steel for many of the mildly corrosive gases. Refer to the compatibility charts on pages 5-7 or consult your gas supplier to determine suitable materials of construction.

Cylinder Connections

CONCOA manufactures cylinder connections which conform to all worldwide standards. In the US the Compressed Gas Association (CGA) has designated specific cylinder connections for each gas service and pressure rating. Refer to CGA publication V-1 for more information. A few of the international standards CONCOA provides include DIN 477, BS 341, JIS (Japan), and KS (Korea). Please note that a CGA connection limits the temperature range of a regulator to the guidelines of the connection.

Flow Charts

The flow charts on each catalog page are a graphical representation of test results which show the change in outlet pressure with varying flow rate. To use the chart, determine the maximum no-flow pressure permitted by your system. Locate this pressure on the vertical axis of the chart. If there is no curve for your specific condition, interpolate a curve. Follow the curve to the desired flow rate on the horizontal scale. Read horizontally to the left to determine the corresponding pressure drop. Because flow rate is dependent on inlet pressure, data is presented at full cylinder pressure (2000 PSIG), partially full (500 PSIG) and nearly empty (200 PSIG).

Diaphragms

The diaphragm is a sensing element crucial to the function of the regulator and the purity of gas delivery. Stainless steel diaphragms are corrosion resistant and have low leakage rate characteristics. Neoprene diaphragms may offer more sensitive pressure control, but do not offer the gas purity of stainless steel. Coating a neoprene diaphragm with Teflon® enhances gas purity greatly.

Specific Applications

While a single or dual stage regulator of the appropriate material will suffice in most gas service, some applications require specially designed regulators. For example in the 400 Series, the 455 Series regulators are specifically designed for use with highly corrosive gases and the 492 Series regulators can safely deliver gas at extremely high pressures. If you are unsure about your requirements, please contact CONCOA for assistance.

Ordering CONCOA Flowmeters

Step One The first choice in completing the Part Number Matrix is selecting a particular flowmeter series, depending on size and features desired. The flowmeter series number than becomes the first three digits of the part number.

Step Two The tube size from the A column and the float material from the B column are predicated entirely on flow conditions. The selection chart that accompanies the ordering information gives the flow rates of air at standard conditions (14.7 PSIA and 70°F). To determine flow rates for gases other than air at standard conditions, first decide the flow conditions including the specific gravity of the gas (see table), pressure, and temperature. Next, use the equations below to convert the flow rate of the gas desired in either scfh or ml/min (see page 128 for conversion information) to the equivalent flow capacity of air at standard conditions.

$$Q_{air} = K_{gas} \times Q_{gas}$$

$$K_{gas} = \sqrt{G \times \frac{T}{530} \times \frac{14.7}{P}}$$

Q_{air} = Equivalent flow capacity of air at standard conditions

Q_{gas} = Maximum flow of metered gas (in scfh or ml/min)

G = Specific gravity of metered gas (see table)

T = Absolute temperature (°F + 460) of metered gas at flow conditions

P = Absolute pressure (PSIG + 14.7) of metered gas at flow conditions

Gas	Specific Gravity
acetylene	0.9073
air	1.0000
ammonia	0.5963
argon	1.3796
butane	2.0854
carbon dioxide	1.5290
chlorine	2.4860
ethane	1.0493
ethylene	0.9749
helium	0.1380
hydrogen	0.0659
methane	0.5544
nitrogen	0.9672
nitrous oxide	1.5297
oxygen	1.1053
propane	1.5620
sulphur dioxide	2.2638

Using the equivalent air flow, select a tube size and float material from the selection chart. These two numbers, representing choices from the A column and the B column become the next two digits of the part number.

Step Three Choose the material from the options in the C column. Refer to the chart beginning on page 5 for material compatibility. A "0" indicates a tube and float without a frame, either as a replacement for the appropriate size frame or as a component of a multi-tube flowmeter.

Step Four Select a valve option from those available in the D column. A high accuracy valve provides better resolution than a standard valve. Finally, specify an end connection from those available in the XX column. These two digits, preceded by a dash, become the final two digits in the part number.

For example, using the table below to order a 65mm flowmeter with a maximum flow capacity equivalent to air at standard conditions of 280 ml/min (0.59 scfh), a 316 stainless steel frame, a standard valve, and a ¼" tube fitting connection, the part number would be 565-1421-01.

565	A	B	C	D	-XX
Series 565	**Tube Size** 1: 1 2: 2 3: 3 4: 4 5: 5 6: 6 7: 7 8: 8 9: 9	**Float Material** 1: Glass 2: Sapphire 3: 316 Stainless Steel 4: Carbolloy 5: Tantalum	**Material** 0: No frame (tube and float only) 1: Chrome-plated brass 2: 316 Stainless Steel	**Valve** 0: No valve 1: Standard Valve 2: High-accuracy Valve	**End Connection** 00: ⅛" FPT 01: ¼" Tube Fitting 02: ⅛" Tube Fitting 03: ¼" Hose Barb