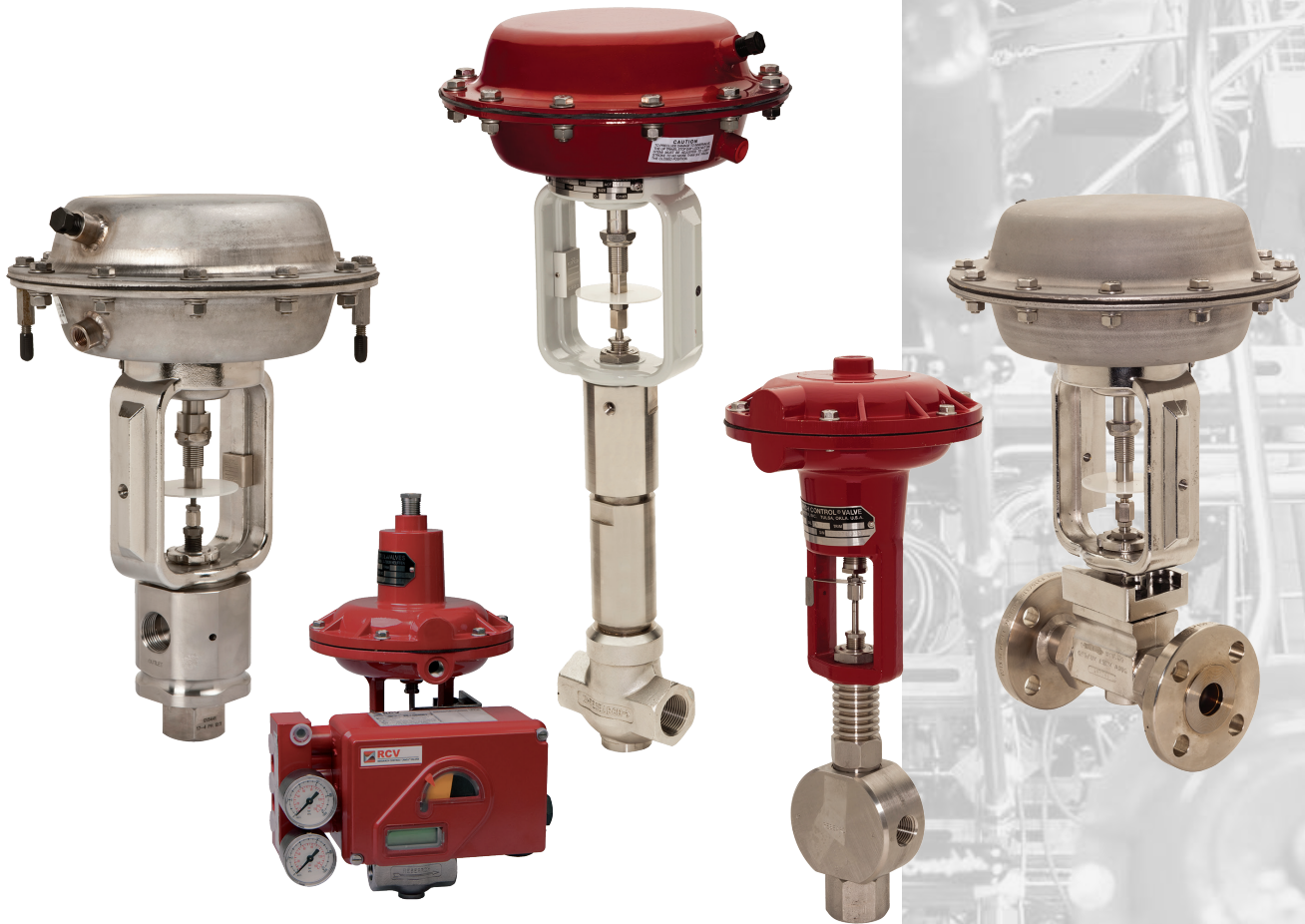


Valve Selection Overview



Research Control® Valves
Your Custom-Engineered Solution

Valve Selection Overview

When precision means everything.

Today's most challenging production and research processes demand precision.

And if your application requires critical control of liquid or gas flow, pressure or temperature, your choice of control valves is one of the most important decisions you'll make.

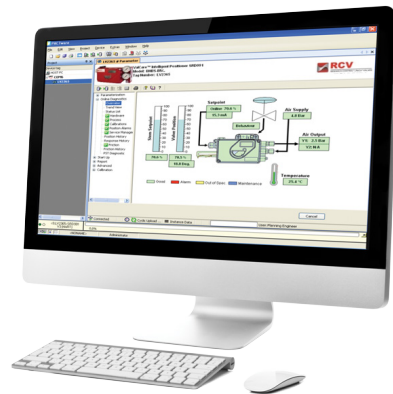
Processing plants, research facilities and government agencies worldwide rely on Research Control Valves from Badger Meter for repeatable performance – and durability. Built for applications two inches or smaller, our globe, angle and sanitary valves are integral components in systems ranging from petrochemical processing to pharmaceutical manufacturing.

When you choose Badger Meter Research Control Valves, you are assured a market leader in control valve technology – backed by more than 65 years of experience tailoring solutions for exacting field conditions.

Count on us to apply our expertise to create a highly engineered, feature-rich valve solution custom-designed to match your stringent parameters. When precision means everything -- when quality matters most -- choose Research Control Valves.

What is RCV?

- Engineered valve solutions
- Liquid and gas applications
- 1/4...2 inch globe and angle valves
- 1/2...2 inch sanitary valves
- Pressures – Full vacuum...60,000 psi
- Temperatures – -450...1500° F
- Stainless steel to exotic materials
- Standard and custom designs
- CV – 0.0000018...54



The FDT concept specifies a "frame application" with a uniform platform for software tools and provides the particular advantage of a simple, standardized and common implementation and engineering environment to integrate field devices into any FDT compliant control system.

It defines interfaces and mechanisms which provide a simple method of running a type of "printer driver" for field devices, the Device Type Manager (DTM).

Your Custom-Engineered Valve Solution

Step-By-Step

Feature-rich Badger Meter Research Control Valves are custom-designed to match your stringent parameters. To help ensure the right fit, we offer an extensive range of options – from unique valve alloys to custom-fit accessories. These selections can be combined in millions of ways to create a distinctive solution. This selection guide is designed to help you explore the possibilities between our combinations and your applications.

Start by taking a look at our portfolio – At-A-Glance. Then, review your options, step-by-step:

- Step 1: Valve Alloys
- Step 2: End Connections
- Step 3: Bonnet Selections
- Step 4: Guiding Options
- Step 5: Operating Temperature and Pressure Parameters
- Step 6: Packing Choices
- Step 7: Innervalue Trim Set Solutions
- Step 8: Custom-Fit Accessories
- Step 9: Product Definition, Pricing and Delivery



Valve Selection At-A-Glance

General Industrial and Research Applications

Your custom-engineered solution will be based on our product portfolio. Review our offerings here to help determine which type of valve will meet your requirements. Each valve can be made with most flange types and sizes, welded connections, NPT, or tube fittings.

Pictured below are selections for general industrial and research applications. The next page includes the process control and sanitary offerings.

Small Control Valves



Low Flow Control



Standard Flange



3-Way and
Diverting



Manual



Bellows



Exotic Alloys



Kynar

Cryogenic and High Temperature Valves



Standard
Fin



Extended
Fin



14" Extended
Bonnet



Cold Box
Extension

Valve Selection At-A-Glance

Process Control and Sanitary Applications

Listed below are selections for process control and sanitary applications.

High Pressure and Severe Service Valves



60,000 psi



40,000 psi



15,000



10,000 psi



Severe Service

Process Control Valves



9000



9000 Flange



9000 Extended
Bonnet



9000 3-Way and
Diverting



9100



9100 Extension

Sanitary Control Valves



SCV 85
Barstock



SCV 89
Investment Cast



SCV 95
Investment Cast

Valve Alloys

Step 1

Research Control Valve bodies and trims are manufactured from common products like 316 SS or Monel® to more exotic alloys like tantalum. Trims are normally supplied in the same material as the body, except where conditions require the use of other materials. Our technicians can help identify valve alloys that will complement your operation.

Options include:

Body Alloys

- 316/316L stainless steel*
- 304/304L stainless steel*
- 347 stainless steel
- Brass
- Bronze*
- Carbon steel*
- Monel*^e
- Alloy 20*^e
- Alloy B*^e
- Alloy C*^e
- Alloy G^e
- Inconel®*^e
- Titanium^e
- Tantalum^e
- Nickel^e
- Kynar®*^e
- Zirconium^e
- DIN 1.4581^e
- DIN 1.4571
- DIN 1.4539
- DIN 1.4404^e
- DIN 2.4819^e
- DIN 2.4617^e
- Aluminum^e
- Duplex stainless*^e
- Haynes® HR-120^e

Trim Alloys

- 316/316L stainless steel*
- 304/304L stainless steel*
- 347 stainless steel
- 316/Kel-F*
- 316/Teflon®*
- 316/Stellite®*
- Monel*
- Alloy 20*
- Alloy B*
- Alloy C*
- Hastelloy® C22*
- Inconel*
- Titanium
- Tantalum
- Nickel
- Kynar*
- Zirconium
- Duplex stainless*
- Stellite/304*
- Stellite/316*
- Stellite/416*
- Stellite/Alloy 20*
- Stellite/Alloy bronze*
- Stellite/Alloy B*
- Stellite/Alloy C*
- Stellite/Monel*

* Stocked for orders.

^e Alloy export control.

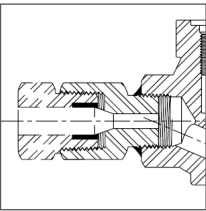


End Connections

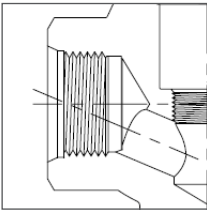
Step 2

End connections are dependent on a variety of factors such as pressure, temperature, size, or the frequency of removing the valve from the line. Our control valve end connections have single point threads to prevent galling and stripping.

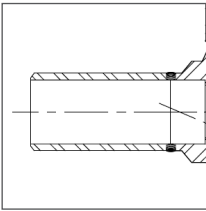
Selections include:



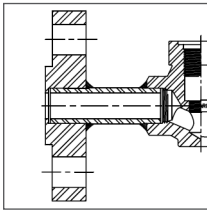
Autoclave Body



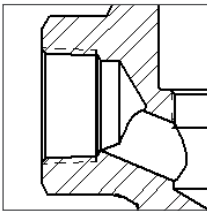
BSP-P (G)



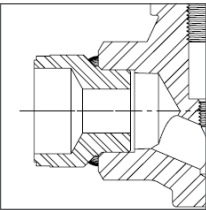
Butt Weld Body



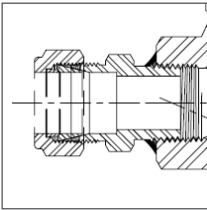
Flanged Body



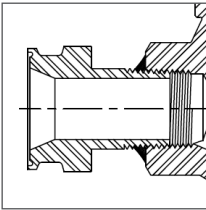
NPT Body



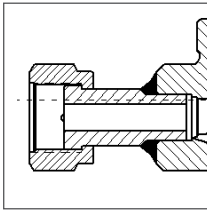
Socket Weld
Body



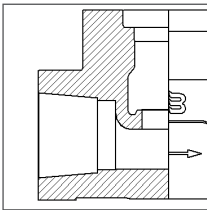
Swagelok Body



Triclamp Body



VCR and VCO
Body

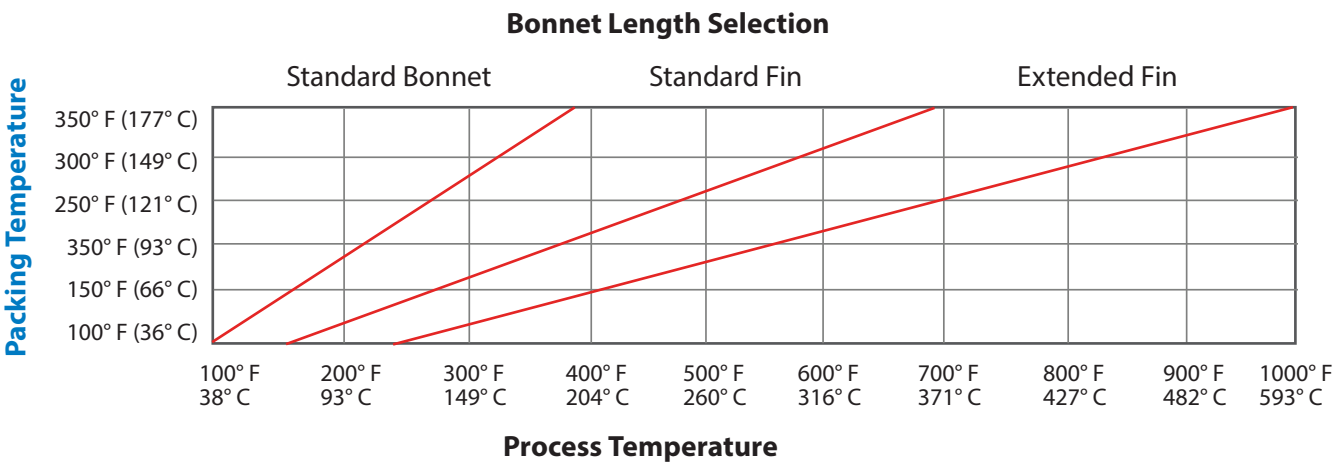


Wafer Body

Bonnet Selection

Step 3

Bonnet selection is a key element in specifying the correct control valve. Badger Meter offers a comprehensive selection of Research Control Valve bonnets to meet a wide range of requirements. Review the chart below. If your application is out of this range, please contact us. Depending on your specific requirements, we may be able to design a solution that can meet your needs.



Guiding Options

Step 4

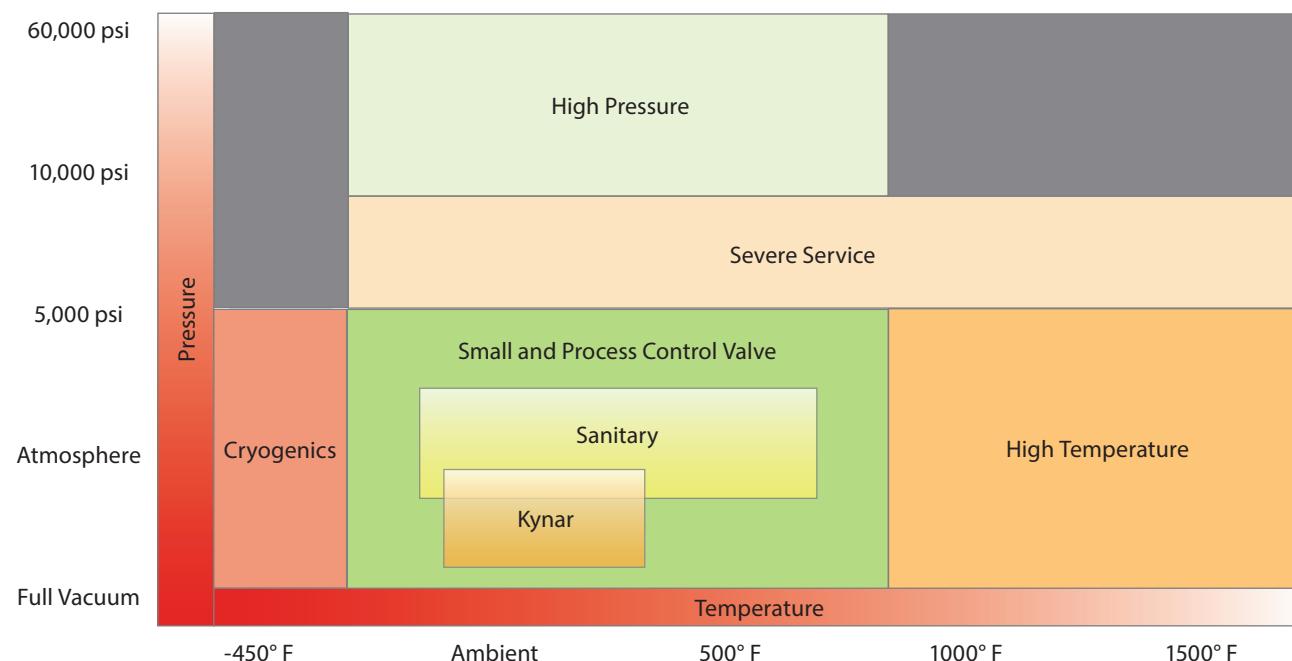
Badger Meter also provides a range of guiding options, including:

- **Top Guided** - A top guided innervalue is stem-guided at the packing. Some innervalue could be considered "seat-guided," due to the inherent close fit between the plug and seat.
- **Medium Guided** - A medium guided trim is guided at the packing and in the bonnet. The medium guided style was developed to provide a guide option for those wishing to use standard bonnets rather than heavy-duty versions. Medium guided trims, when available, will fit standard bonnets.
- **Heavy-Duty Guided** - The heavy-duty guided trim provides maximum resistance to actuator force and pressure induced vibration. The bonnet and trim will not interchange with the standard bonnet designs.

Operating Temperature and Pressure Range Parameters

Step 5

Temperature and pressure parameters are key considerations in bonnet, guiding and packing selection. Research Control Valves can meet pressure parameters from full vacuum to 60,000 psi. Operating temperatures range from extreme cold (-450° F) to extreme heat (1500° F).



Packing Choices

Step 6

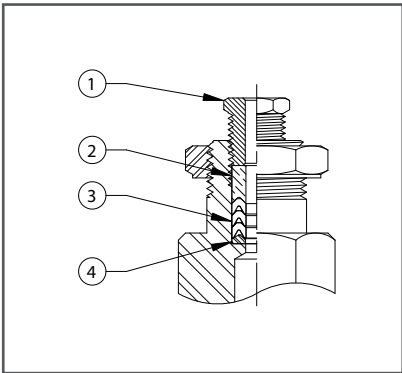
With today’s demanding applications and expanded regulations, leakage is not an option. Our packing choices are extensive – and reflect current industry needs. In addition to pressure and temperature parameters, there are many other factors to consider when customizing your packing configuration, including hysteresis, seal quality, maintenance and cycle life. If you have any questions regarding your application and its demands, contact us. We will help you select the correct solution.

Fugitive Emissions Control Packing (REK) - 0 ppm at 150 psi (leakage based on EPA Method 21)	<ul style="list-style-type: none">• Proven choice for critical applications where leakage is not an option• Twelve varieties of REK elastomer combinations are available including Kalrez, Zymaxx, Virgin PTFE, Moly/Glass filled PTFE and PFA, which provides a wide range of sealability
Single or Double PTFE Chevron Packing	<ul style="list-style-type: none">• Standard packing for Research Control Valves• Provides low friction and high chemical compatibility
Bellows packing	<ul style="list-style-type: none">• Provides a flexible, static seal, commonly used in critical situations:<ul style="list-style-type: none">• High Pressure (1500 psi), Low Pressure (580 psi), and Various Alloys (Alloy C, Monel and Inconel)
Grafoil® Packing	<ul style="list-style-type: none">• One of many high temperature options
Spring-Loaded Packing – Triple PTFE Chevron Packing	<ul style="list-style-type: none">• Combines Chevron packing and a stainless steel spring to provide a consistent live load
Customized Packing Solutions	<ul style="list-style-type: none">• Designed to meet your needs• Based on our experience with countless critical applications throughout the past 65 years

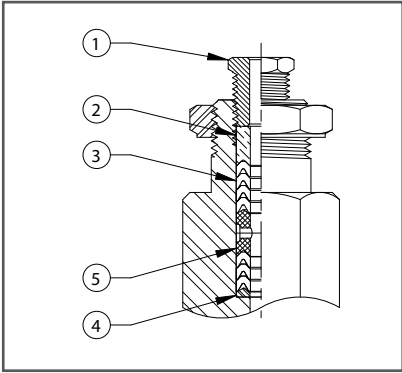
Port Options

Your Research Control Valves packing solution also includes leak detection and purge port options.

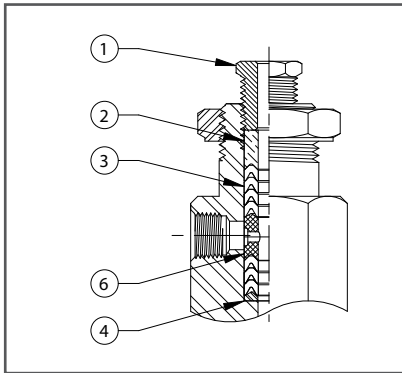
Single Packing



Double Packing



Double Packing with Purge Port



1. Packing Gland 2. Packing Follower 3. Packing CV Ring 4. Packing Adapter 5. Separator Ring 6. Lanem Ring

Innervolve Trim Set Solutions

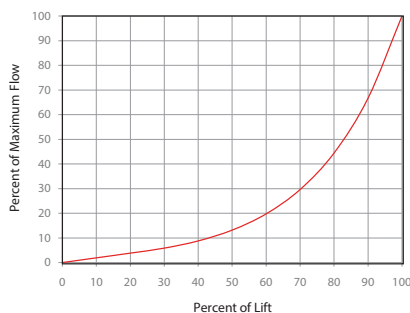
Step 7

Flow Characteristics

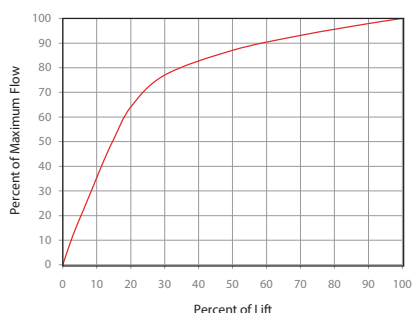
The innervolve represents the “heart” of the control valve and includes a single seat, profiled plug and a range of trim selections. Research Control Valve trim configurations are engineered for precise small and medium flow control (C_v from 0.0000018 to 54) and are designed to match the flow profiles of your system. Selecting the appropriate flow characteristics and trim size will enable your system to function within its design specifications. Trim configurations are available to match the flow characteristics below. Trim sizing guidelines are available on the following pages.

Trim Flow Characteristics Include:

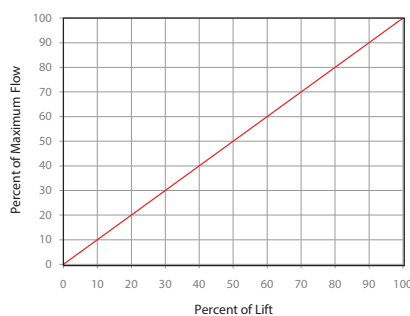
Equal Percentage



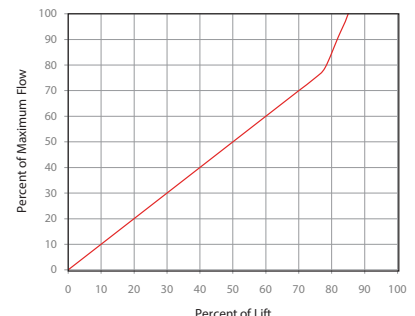
Quick Opening



Linear



Double Taper



Sizing Guidelines

Use the chart on the next page to help identify the best possible Research Control Valve trim size for your application and flow characteristics. For additional detail regarding rangeability, see the chart on page 14.

Note: Trims are interchangeable with valves of like configuration.

Soft Seat Trim Option:

Trim configurations also include soft seat trim options:

- Replaceable
- PTFE and Kel-F
- Available with all flow characteristics
- Available with all listed alloys

Innervolve Trim Set Solutions

Innervolve Chart: Research Control Valves

	Time Size	MaxCv	MaxKv	Rangeability Linear	Rangeability Equal %	Orifice	Port Area In ²	Flow Characteristics
1/4 in.	P18	0.0000018	0.000001548	15:1	NA	0.042	0.0014	L, DT
	P17	0.0000027	0.000002322	15:1	NA	0.042	0.0014	L, DT
	P16	0.000004	0.00000344	15:1	NA	0.042	0.0014	L, DT
	P15	0.000006	0.00000516	15:1	NA	0.042	0.0014	L, DT
	P14	0.00001	0.0000086	15:1	NA	0.042	0.0014	L, DT
	P13	0.000016	0.00001376	15:1	NA	0.042	0.0014	L, DT
	P12	0.000024	0.00002064	15:1	NA	0.042	0.0014	L, DT
	P11	0.000036	0.00003096	15:1	NA	0.042	0.0014	L, DT
	P10	0.00005	0.000043	15:1	NA	0.042	0.0014	L, DT
1/4 & 1/2 in.	P9	0.00008	0.0000688	15:1	NA	0.0625	0.0031	L, DT
	P8	0.00012	0.0001032	15:1	NA	0.0625	0.0031	L, DT
	P7	0.00018	0.0001548	15:1	NA	0.0625	0.0031	L, DT
	P6	0.00027	0.0002322	15:1	NA	0.0625	0.0031	L, DT
	P5	0.0004	0.000344	15:1	NA	0.0625	0.0031	L, DT
	P4	0.0006	0.000516	15:1	NA	0.0625	0.0031	L, DT
	P3	0.001	0.00086	15:1	NA	0.0625	0.0031	L, DT
	P2	0.0013	0.001118	15:1	NA	0.0625	0.0031	L, DT
	P1	0.002	0.00172	15:1	NA	0.0625	0.0031	L, DT
1/4, 1/2, 3/4 & 1 in.	O	0.003	0.00258	25:1	NA	0.086	0.0058	FT, L, QO, DT
	N	0.006	0.00516	25:1	NA	0.086	0.0058	FT, L, QO, DT
	M	0.01	0.0086	25:1	NA	0.086	0.0058	FT, L, QO, DT
	L	0.02	0.0172	25:1	NA	0.086	0.0058	FT, L, QO, DT
	K	0.03	0.0258	25:1	NA	0.086	0.005	FT, L, QO, DT
	J	0.05	0.043	30:1	40:1	0.156	0.0191	MEP, L, QO, DT
	I	0.08	0.0688	30:1	40:1	0.156	0.0191	MEP, L, QO, DT
	H	0.13	0.1118	30:1	40:1	0.156	0.0191	MEP, L, QO, DT
	G	0.2	0.172	30:1	40:1	0.156	0.0191	EP, L, QO, DT
1/2, 3/4 & 1 in.	F	0.32	0.2752	30:1	40:1	0.156	0.0191	EP, L, QO, DT
	E	0.5	0.43	40:1	50:1	0.25	0.0491	EP, L, QO, DT
	D	0.8	0.688	40:1	50:1	0.25	0.0491	EP, L, QO, DT
	C	1.25	1.075	40:1	50:1	0.281	0.0621	EP, L, QO, DT
	B	2	1.72	40:1	50:1	0.375	0.1105	EP, L, QO, DT
3/4 & 1 in.	A	2.5	2.15	40:1	50:1	0.375	0.1105	EP, L, QO, DT
	3	3	2.58	50:1	60:1	0.375	0.1105	EP, L, QO, DT
	3.5	3.5	3.01	50:1	60:1	0.5	0.197	EP, L, QO, DT
1 in.	4	4	3.44	50:1	60:1	0.5	0.197	EP, L, QO, DT
	4.5	4.5	3.87	50:1	60:1	0.5	0.197	EP, L, QO, DT
	5	5	4.3	50:1	60:1	0.625	0.307	EP, L, QO, DT
	6	6	5.16	50:1	60:1	0.625	0.307	EP, L, QO, DT

Innervolve Charts - Flow Characteristics Key

EP - Equal Percentage; QO - Quick Open; FT - Flow Trims; L - Linear; MEP - Modified Equal Percentage; DT - Double Taper

Innervolve Trim Set Solutions

Innervolve Chart: Model 9000 Process Control Valve

	Time Size	MaxCv	MaxKv	Rangeability Linear	Rangeability Equal %	Orifice	Port Area In ²	Flow Characteristics
1 in.	1	0.02	0.0172	50:1	60:1	0.086	0.02	EP, L, QO, DT
	2	0.05	0.043	50:1	60:1	0.156	0.02	EP, L, QO, DT
	3	0.1	0.086	50:1	60:1	0.156	0.02	EP, L, QO, DT
	4	0.2	0.172	50:1	60:1	0.156	0.02	EP, L, QO, DT
	5	0.5	0.43	50:1	60:1	0.156	0.02	EP, L, QO, DT
	6	1	0.86	50:1	60:1	0.5	0.2	EP, L, QO, DT
	7	2	1.72	50:1	60:1	0.5	0.2	EP, L, QO, DT
	8	5.3	4.558	50:1	60:1	0.5	0.2	EP, L, QO, DT
	9	8.3	7.138	50:1	60:1	0.812	0.52	EP, L, QO, DT
1-1/2 in.	19	4	3.44	50:1	60:1	0.625	0.31	EP, L, QO, DT
	20	7	6.02	50:1	60:1	0.625	0.31	EP, L, QO, DT
	21	11	9.46	50:1	60:1	0.812	0.52	EP, L, QO, DT
	22	15.5	13.33	50:1	60:1	1.25	1.23	EP, L, QO, DT
2 in.	27	7	6.02	50:1	60:1	0.625	0.31	EP, L, QO, DT
	28	15	12.9	50:1	60:1	0.812	0.52	EP, L, QO, DT
	29	21	18.06	50:1	60:1	1.125	1.0	EP, L, QO, DT
	30	25	21.5	50:1	60:1	1.5	1.77	EP, L, QO, DT

Innervolve Chart: Model 9100 Process Control Valve

	Time Size	MaxCv	MaxKv	Rangeability Linear	Rangeability Equal %	Orifice	Port Area In ²	Flow Characteristics
1/2, 3/4, & 1 in.	3	3.0	2.58	50:1	60:1	0.5	0.196	EP, L, QO, DT
	6	6.0	5.16	50:1	60:1	0.75	0.442	EP, L, QO, DT
3/4 in.	8	8.0	6.88	50:1	60:1	0.75	0.442	EP, L, QO, DT
	12	12.0	10.32	50:1	60:1	1.0	0.785	EP, L, QO, DT
1 in.	10	10.0	8.6	50:1	60:1	0.75	0.442	EP, L, QO, DT
	15	15.0	12.9	50:1	60:1	1.0	0.785	EP, L, QO, DT
1-1/4 in.	12	12.0	10.32	50:1	60:1	1.25	1.227	EP, L, QO, DT
	20	20.0	17.2	50:1	60:1	1.25	1.227	EP, L, QO, DT
	29	29.0	24.94	50:1	60:1	1.625	2.074	EP, L, QO, DT
1-1/2 in.	15	15.0	12.9	50:1	60:1	1.25	1.227	EP, L, QO, DT
	24	24.0	20.64	50:1	60:1	1.25	1.227	EP, L, QO, DT
	35	35.0	30.1	50:1	60:1	1.625	2.074	EP, L, QO, DT
2 in.	22	22.0	18.92	50:1	60:1	1.75	2.405	EP, L, QO, DT
	36	36.0	30.96	50:1	60:1	1.75	2.405	EP, L, QO, DT
	54	54.0	46.44	50:1	60:1	2.0	3.142	EP, QO
	56	56.0	48.27	50:1	60:1	2.0	3.142	L, QO, DT

Innervolve Trim Set Solutions

Innervolve Chart: Sanitary

	Time Size	MaxCv	MaxKv	Rangeability Linear	Rangeability Equal %	Orifice	Port Area In ²	Flow Characteristics
1/2, 3/4, 1 & 1-1/2 in.	J	0.05	0.043	30:1	40:1	0.156	0.02	EP, L, QO, DT
	I	0.8	0.0688	30:1	40:1	0.156	0.02	EP, L, QO, DT
	H	0.13	0.1118	30:1	40:1	0.156	0.02	EP, L, QO, DT
	G	0.2	0.172	30:1	40:1	0.156	0.02	EP, L, QO, DT
	F	0.32	0.2752	30:1	40:1	0.156	0.02	EP, L, QO, DT
	E	0.5	0.43	40:1	60:1	0.375	0.11	EP, L, QO, DT
	D	0.8	0.688	40:1	60:1	0.375	0.11	EP, L, QO, DT
	C	1.25	1.075	40:1	60:1	0.375	0.11	EP, L, QO, DT
	B	2	1.72	40:1	60:1	0.375	0.11	EP, L, QO, DT
	A	3	2.58	40:1	60:1	0.5	0.2	EP, L, QO, DT
3/4, 1 & 1-1/2 in.	4	4	3.44	40:1	60:1	0.5	0.2	EP, L, QO, DT
	5	5	4.3	40:1	60:1	0.5	0.2	EP, L, QO, DT
1 & 1-1/2 in.	6	6	5.16	40:1	60:1	0.75	0.44	EP, L, QO, DT
	8	8	6.88	40:1	60:1	0.75	0.44	EP, L, QO, DT
	10	10	8.6	40:1	60:1	0.75	0.44	EP, L, QO, DT
1-1/2 in.	15	15	12.9	40:1	60:1	1.0	0.79	EP, L, QO, DT
	20	20	17.2	40:1	60:1	1.0	0.79	EP, L, QO, DT
2 in.	25	25	21.5	50:1	60:1	1.859	2.71	EP, L
	33	33	28.38	50:1	60:1	1.859	2.71	EP, L
	40	40	34.4	50:1	60:1	1.859	2.71	EP, L
	50	50	43.1	50:1	60:0	1.9	2.8	EP, L
	70	70	60.34	50:1	60:0	1.9	2.8	EP, L

Innervolve Charts - Flow Characterisitcs Key

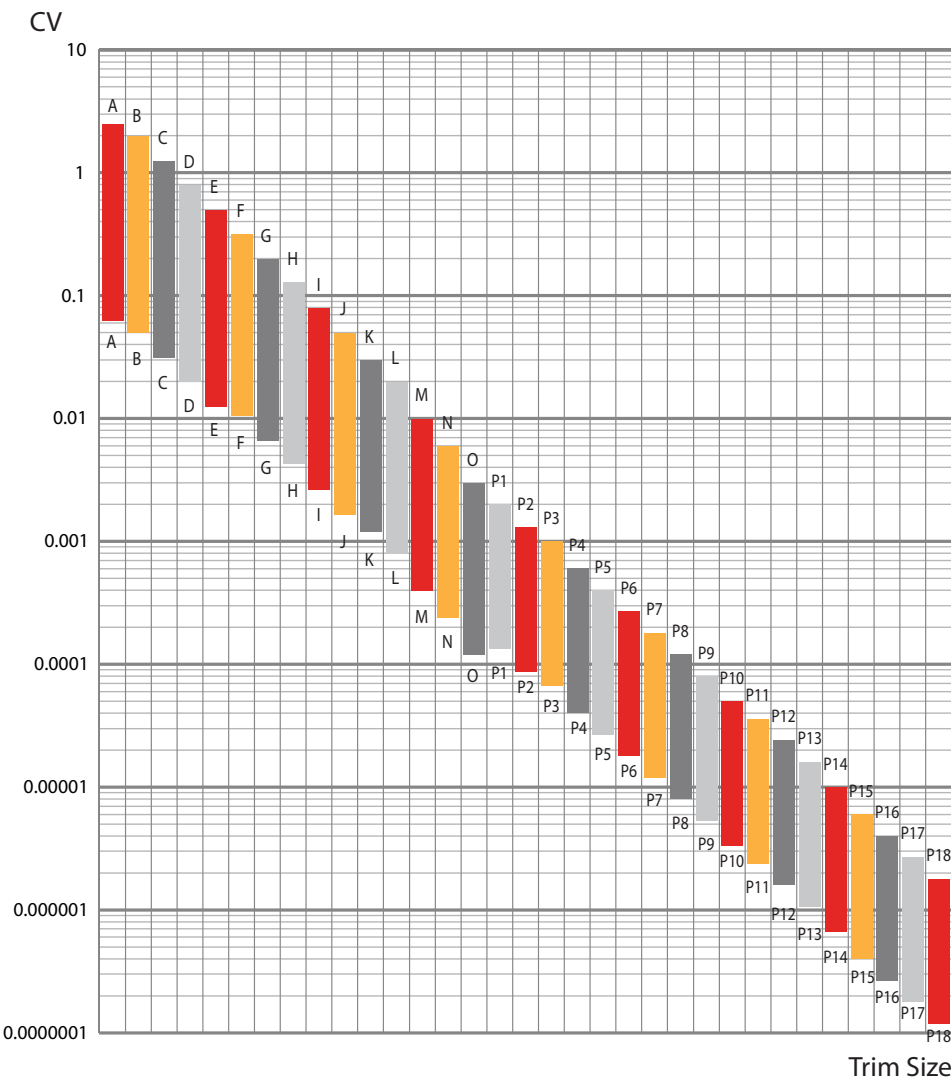
EP - Equal Percentage; QO - Quick Open; FT - Flow Trims; L - Linear; MEP - Modified Equal Percentage; DT - Double Taper

Innervolve Trim Set Solutions

Rangeability Considerations

Rangeability is another important consideration in trim configuration. Rangeability is the ratio of maximum to minimum controllable flows in a control valve. In other words, it is the range through which the desired flow characteristic is maintained. Rangeability answers the question: How low of a flow can the valve accurately control?

The chart below outlines rangeability for Research Control Valve linear trims by trim size.



Custom-Fit Accessories

Step 8

To help ensure your Research Control Valve functions at its full potential, choose from a variety of streamlined accessories, including:



Electric Actuators



SRD 991
(Digital IS Positioner)



SRD 960
(Digital XP Positioner)



Stainless Steel
Actuator



Handwheels



I/P Transducers

- Regulators
- Gauges
- Limit switches
- Filter
- Customized mounting kits
- Position transmitters
- Solenoids
- Steam jackets
- Custom tool kits

Product Definition, Pricing and Delivery

Step 9

While this selection guide provides general guidelines regarding how a Research Control Valve from Badger Meter can be engineered to meet your requirements, let us assist you to define your selection.

Our representatives will work with you to complete the specification process – and help ensure your valve meets your application requirements.

To begin the design and manufacturing process, take the next step. Contact us.

Valve Selection Overview

When precision means everything.

Customers around the world depend on Research Control Valves for precise, repeatable performance. When precision means everything, you can choose Research Control Valves with confidence.

Feature	Benefit
• MADE IN AMERICA	RCV is manufactured and assembled within the USA
• Over 70 years in the business	Vast experience and proven designs from simple to complex
• Incredible response times to signal due to size of actuator	Quicker adjustment to meet customers needs
Driving value with customized, turnkey solutions made in America for more than 65 years	
• Standard and unique alloys	Helps ensure chemical compatibility
• Engineered trim configurations	Provides greater installed rangeability
• Replaceable soft seat trims	Lowers maintenance costs
• Hand-lapped Stellite on Stellite trims	Enables tight shut-off for high pressures and temperatures
• Single point lathe-cut threads	Allows for better sealing and alignment – and less galling
• Stem surface finish (<10 AARH, 4-8 RMS)	Provides better sealing and low hysteresis
• In-field preload adjustment capability	Allows fine-tuning to upstream pressures
• REK packing	Reduces fugitive emissions – and helps drive environmental compliance
• High accessory compatibility	Accepts most fittings on the market
• Custom face-to-face dimensions	Fits systems with non-standard measurements
• Compact size	Provides a small footprint which can be mounted in any position
Meeting your needs worldwide	
• Global support network	Field service where you need it
• Onsite and factory training	Optimizes operation and maintenance in the field
• Factory repair center	Free estimates, factory authorized parts, and quick turnaround
• Hot Shot emergency delivery	Expedites shipping available up to next day
• Global certification	Documentation designed to preserve process integrity and meet regulatory requirements

Control. Manage. Optimize.

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