MATERIAL SELECTION

For material selection fluid type characteristic, pressure and working temperature shall be considered. **FCA** carries many years of experience with special materials such as duplex, superduplex, hastelloy, inconel, etc... Moreover standard forged or casted steels are daily work standard for our engineers. Other materials could be considered and provided on request according to customer specifications.

For internal parts such as cage or trim for globe valves, corrosion and wear resistant materials are considered in addition to pressure drop values and temperature working range specifications. Stainless steel materials are provided as standard, considering Stellite contribution for seat components, and hardened stainless steels as AISI 410 or AISI 420 for higher corrosion resistance.

The following table presents frequently used materials for **FCA** control valves, generally selected for severe service working applications:

MATERIAL	**CASTED** (ASTM)	**FORGED** (ASTM)
Carbon Steel	A216 Gr. WCB	A105
Stainless Steel	A351 Gr. CF8 / Gr. CF8M	A182 F316
Duplex Steel	A890 Gr. 4A	A182 F51
Superduplex Steel	A890 Gr. 5A / Gr. 6A	A182 F53 / F55
Inconel	-	Alloy 718

*Other materials on request.

ACTUATION DEVICES

Pneumatic, Hydraulic or electric signals (or a combination of electro-hydraulic devices) are commonly used for valve direct acting to create a modulating control action from an external control device.

As standard a Pneumatic Diaphragm actuator controls the plug position on globe valves by a signal loaded by the internal or external controller, providing a good linearity relationship between air pressure signal and valve travel. The force of the air signal is received into the actuator through a top port and distributed across the full area of the actuator's diaphragm. The diaphragm presses down on it's plate and the return spring, which then moves the valve stem and plug assembly downward to stroke the valve.

Electric actuators are motor driven devices that uses an electrical input signal to generate a motor shaft rotation. This rotation can be translated into a linear motion system (for linear controlled valves) which drives the valve stem and plug for flow modulation.

FCA has close cooperation with many world leader actuator manufactories and can offer a wide variety of interchangeable actuators:

· Electric motor.
· Pneumatic cylinder.
· Hydraulic cylinder.
· Electro-Hydraulic cylinder.
· Manually operated emergency systems.

FLOW COEFFICIENT VALUE

Control valve sizing and selection is based on a combination of theory and empirical data. The capacity, characteristic, rangeability and recovery are four important elements for selection of a control valve. **Cv** is known as flow coefficient value of a valve. This coefficient **Cv** is related to the flow and pressure conditions by the following basic liquid equation:

$$Cv=Q*(SG/\Delta P)^{1/2}$$

It is a relative measure of valves efficiency at allowing fluid flow. **Q** determines the flow rate (in gpm), **SG** reffers to fluid specific gravity and Presure drop is considered in psi. It describes the relationship between the pressure drop across the valve and the corresponding flow rate. In more practical terms, the flow coefficient **Cv** is the volume (in US gallons) of water at 60°F that will flow per minute through a valve with a pressure drop of 1 psi across the valve. This important parameter is critical for control valve sizing and gives the essence of valve performance.

The required **Cv** for a valve can thus be calculated based on flow and pressure working conditions. This **Cv** should then be matched to a suitable valve so that the required **Cv** falls between reasonable valve travel of the selected valve **Cv** capability. Maximum and minimum process flows has also to be taken into consideration while selecting the valve.

SIZING AND SELECTION ENGINEERING

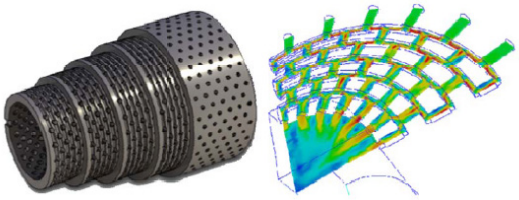
A control valve will perform satisfactory according to working conditions if it is sized correctly. For this sizing process the Cv shall be determined and also the required F_L, Flow velocities, Flow noise, appropiate actuator, etc... **FCA** Control valve specialists consider experimental and advanced software applications including computational fluid dynamics, together with their worldwide proven know-how, to analyze and select the appropiate valve accordingly. Selecting trims and configurations from an extended database with those and more determined parameters as:

- **FL: Liquid Pressure Recovery coefficient**, which is a dimensionless constant used to calculate pressure drop when the valve's liquid flow is choked.
- **Vena Contracta**: Where fluid's velocity is the highes and so on the fluid's pressure is the lowest.
- **Rangeability** of valve can be defined as the ratio of maximum to minimum flow over which good control can be achieved by using the valve.
- **Valve characteristic** is the relation between valve opening (valve travel) and flow through the valve.

Cavitation, flashing, choked flow, piping geometry, pressure drop ratio factors, actuator forces, noise, liquid properties and more important factors are also considered and performed by **FCA** team.

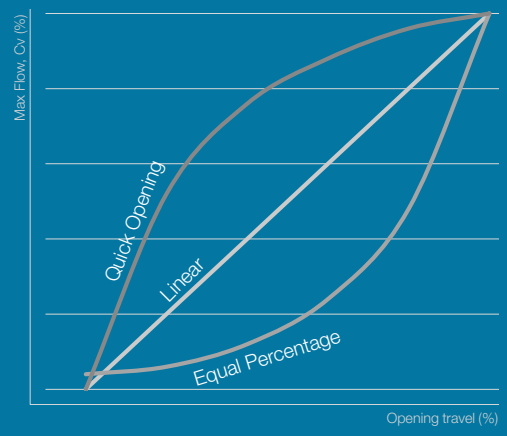
CAE ENGINEERING TOOLS

FCA uses specific softwares for control valve sizing calculation which are based on current industry standards and calculation methods, considering standards such as ISA-75.01.01, ISA-S75.02, ISA-RP75.23, etc... These tools can significantly reduce the time needed to accurately specify and configure the valve so that right solution can be implemented for the considered working conditions. **FCA** control valve engineering department assures efficiently optimized designs and provides reliable parameter definitions to reach the correct goal.



Construction and response to pressure drop for a fluid through multi-stage trim.

INHERENT FLOW CHARACTERISTIC



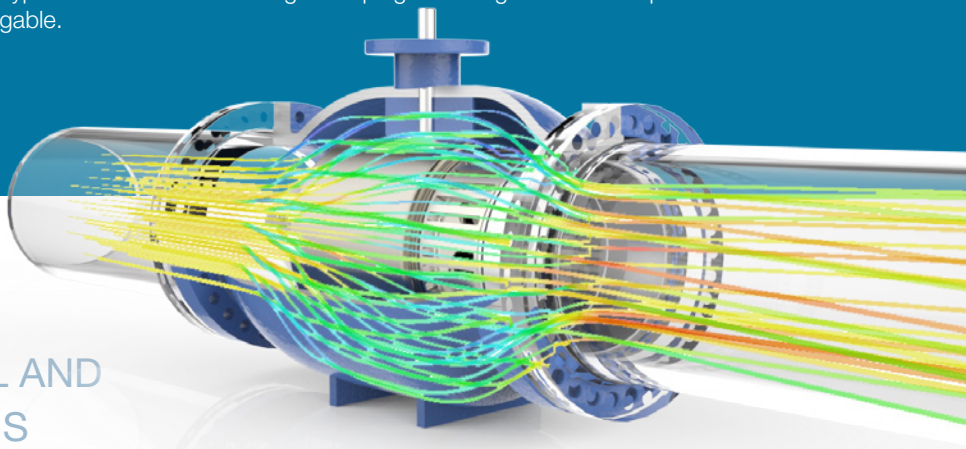
Linear flow characteristic curves have constant slope, therefore the linear gain is independent of travel. It produces equal changes in flow per unit of valve stroke regardless of plug position.

Quick opening characteristic can be provided by **FCA** to offer quick opening to establish significant flow with minimum travel. The gain of this characteristic is constant up to 70% of the rated flow and then decreases. generally used for on-off services, designed to produce maximum flow quickly.

For an inherent valve body gain directly proportional to flow equal percentage designs are available. Is the most commonly characteristic curve used in control processes.

Other characteristics such as modified linear or modified equal percentage result from specific valve trims accordingly designed to meet project working conditions.

FCA offers a wide range of trims structures and cage designs with unbalanced or balanced configurations to result in stronger vibration-proof closure performances. **FCA** valves can be converted from one trim type to another since all rings and plugs with a given size and pressure are completely interchangable.



FCA CAVITATION CONTROL AND NOISE-ATTENUATION TRIMS

Cavitation not only decreases flow capability through control valves, it may also cause material damage, excessive noise and high vibrations on body and its components.

Under severe working conditions Multi-hole and Multi-stage pressure cage structures are suitable for high temperature and high differential pressure control situations. **FCA** designs remarkably prevent the cavitation and reduces the noise providing to customer long service life valves.

DESIGN FEATURES

The **FCA** Control Valves are selected to fit application and piping requirements and to eliminate problems like cavitation, noise, erosion and vibrations by effectively control fluid parameters.

FCA trims are built for long-term and trouble-free service. The key features of a **FCA** Control Valve are the valve body, which is sized efficiently to meet operation pressure and flow requirements; the cage, which provides control for different fluid parameters; the body assembly, which includes the seat ring, bonnet, plug assembly, and bonnet spacer or balance cylinder (depending on valve model); the actuator assembly, which regulates the valve trim; and accessory components and controls selected to meet or exceed valve performance requirements.

FCA CONTROL SERVICE SOLUTIONS

Wide product range to meet application needs

CONTROL GLOBE VALVES - TG/TGM MODELS

The TG and TGM control valve model from FCA is a robust and heavy-section globe valve with a plug designed to accurately control the flow. It is a high performance valve with high flow capacity and a tight shut-off. It is designed for excellent flow control rangeability and its cast steel body is proportioned to withstand high pipe stresses without distortion. It accepts high pressure drops and mechanisms to prevent cavitation and noise are available.

To face a wide range of applications different structure and trim types are available, such as top-guided or cage-guided structures with multi-hole cage (TGM valve model) making the valve competent for severe working conditions, supporting pressures up to class 2500#. Balanced or unbalanced trims, single or double seated structures, soft or metal seats together with different bonnet type designs are available to meet customer special application needs. Linear, equal percentage or quick opening flow characteristic curves can be provided.

Sizes from DN50/2'' up to DN600/24'', although other sizes can be available under request.

PRESSURE RANGE

· ANSI CLASS 150#, 300#, 600#, 900#, 1500# and 2500#.

Other pressures on request.

TESTING

All FCA Control valve models have been hydrostatically tested.

NOMINAL PRESSURE (Kg/cm²)		150#	300#	600#	900#	1500#	2500#
TEST PRESSURE	Shell Test	31	80	159	238	396	660
	Seat Test	4	4	4	4	4	4

TECHNICAL SPECIFICATIONS

DESIGN AND MANUFACTURE	ANSI / ASME B16.34
FACE-TO-FACE	IEC 60534-3 / ISA 75.08 / ASME B16.10
FLANGE ENDS	ANSI / ASME B16.5 / B16.25 / B16.11
INSPECTION & TEST	IEC 60534-4 / ANSI-FCI 70-2-2006

APPLICATIONS

· Modulating services.
· High pressure drops.
· Continous working services.
· Severe working applications.
· Anti-Cavitation and noise attenuation.
· etc…

SECTORS

· Water pump stations.
· Mineral processing.
· Petrochemical plants.
· Oil & gas.
· etc...

FLOW COEFFICIENT TABLE - Standard Top guided Globe valve

SIZE		Rating Cv value									
		Valve openning travel %									
Valve	Seat	Equal Percentage Characteristic					Linear Characteristic				
		10	30	50	80	100	10	30	50	80	100
DN50 / 2''	1-1/4''	0.9	1.7	3.4	9.5	18.7	2.7	6.6	10.6	14.6	20.5
	1-1/2''	1.4	2.7	5.4	14.8	29.1	4.1	10.4	16.6	22.8	32.0
	2''	2.2	4.3	8.5	23.7	46.7	6.7	16.6	26.6	36.5	51.4
DN65 / 2-1/2''	1-1/2''	1.4	2.7	5.4	14.9	29.2	4.2	10.4	16.6	22.8	32.1
	2''	2.2	4.3	8.5	23.7	46.7	6.7	16.6	26.6	36.5	51.4
	2-1/2''	3.3	6.8	13.5	37.4	73.5	10.5	20.0	41.6	57.2	80.5
DN80 / 3''	2''	2.2	4.3	8.5	23.7	46.7	6.7	16.6	26.6	36.5	51.4
	2-1/2''	3.3	6.8	13.5	37.4	73.5	10.5	20.0	41.6	57.2	80.5
	3''	5.5	10.8	21.4	59.3	116.7	16.7	41.5	66.4	91.1	128.4
DN100 / 4''	2 -/2''	3.3	6.8	13.5	37.4	73.5	10.5	20.0	41.6	57.2	80.5
	3''	5.5	10.8	21.4	59.3	116.7	16.7	41.5	66.4	91.1	128.4
	4''	8.7	17.3	34.2	94.9	186.7	26.7	66.3	106.2	145.8	205.4
DN125 / 5''	3''	5.5	10.8	21.4	59.3	116.7	16.7	41.5	66.4	91.1	128.4
	4''	8.7	17.3	34.2	94.9	186.7	26.7	66.3	106.2	145.8	205.4
	5''	13.6	27.1	53.4	148.2	291.7	41.7	103.7	165.9	227.9	320.9
DN150 / 6''	4''	8.7	17.3	34.2	94.9	186.7	26.7	66.3	106.2	145.8	205.4
	5''	13.6	27.1	53.4	148.2	291.7	41.7	103.7	165.9	227.9	320.9
	6''	21.8	43.2	85.4	237.1	466.8	66.8	165.9	265.5	364.6	513.5
DN200 / 8''	5''	13.6	27.1	53.4	148.2	291.7	41.7	103.7	165.9	227.9	320.9
	6''	21.8	43.2	85.4	237.1	466.8	66.8	165.9	265.5	364.6	513.5
	8''	32.3	68.1	135.0	373.5	735.2	104.7	260.1	416.3	571.7	805.2
DN250 / 10''	10''	46.9	91.3	181.0	504.0	1000.0	144.0	356.0	569.0	783.0	1102.0
DN300 / 12''	12''	70.8	140.5	279.0	774.0	1521.0	220.0	543.0	868.0	1194.0	1680.0

NOT STANDARD DESIGNS

Special valve construction is important as they have to adapt to the needs of each installation. The different designs are aimed to solve specific process problems and optimize their performance.

For special control valve design and manufacture, valve and other equipment engineering projects are made according to each client specifications and working conditions, which gives FCA a high capacity of adaptation, necessary and highly valued by the industrial customers.

CE SECURITY MARKED

Following the CE norms, all valves equipped with automatic actuators are supplied with shields, which prevent any objects from being accidentally trapped or dragged.

ANTI-CORROSIVE TREATMENTS

As standard, iron or carbon steel components are painted with an anti-corrosive treatment, providing the necessary protection against corrosion and an excellent surface finish.

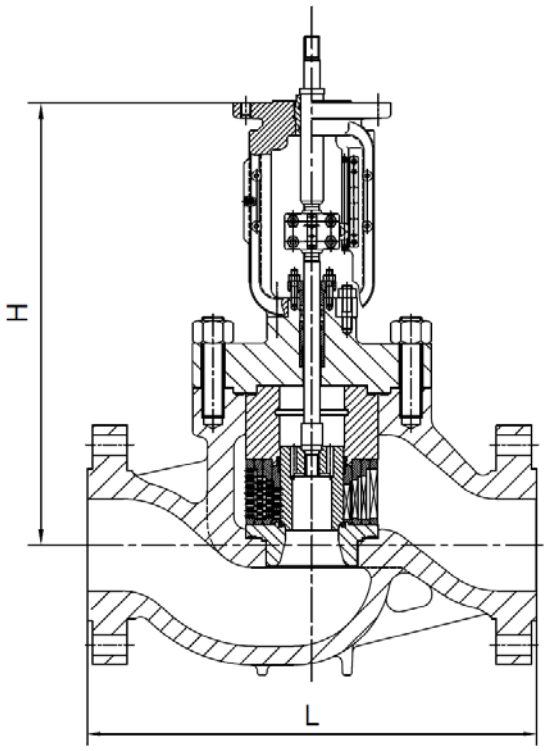
Painting consists of:

- Epoxy primer with excellent corrosive protection and adhesion on every type of metal.
- BLUE RAL-5019 painting.

Depending on the valve application, FCA offers special treatments for specific abrasive and corrosive solutions like hardening, valve or component protective coating, etc... More information on request.

CONTROL GLOBE VALVE GENERAL DIMENSIONS

Standard version available form DN50/2'' to DN600/24'', other sizes on request. Drawing according to multi-stage trim TGM globe valve.



ACCESORIES AND OPTIONS

- Other Structures and Trim types.
- Linear, equal percentage or modified characteristic curve.
- Anti-cavitation trim.
- Noise reduction trim.
- Balanced or not-balanced.
- FTO and FTC configurations.
- Standard or extended bonnet design.
- Air filters, Positioners, Solenoid valves, Limit switches, Regulators,
- Superior sizes.
- Wide range of actuation types.
- By-pass valves.

DN	SIZE	CLASS 150#				CLASS 300#				CLASS 600#			
		H mm	L - RF mm	L - RTJ mm	L - BW mm	H mm	L - RF mm	L - RTJ mm	L - BW mm	H mm	L - RF mm	L - RTJ mm	L - BW mm
50	2”	158	254	267	286	158	267	282	375	158	286	284	375
80	3”	210	298	311	337	210	318	333	460	218	337	340	460
100	4”	237	352	365	394	237	368	384	530	250	394	397	530
150	6”	318	451	464	508	318	473	489	768	327	508	511	768
200	8”	385	543	556	610	385	568	584	832	385	610	613	832
250	10”	395	673	686	752	395	708	724	991	398	752	755	991
300	12”	445	737	749	819	445	775	790	1130	455	819	822	1130
350	14”	515	889	902	1029	515	927	943	1257	535	972	975	1257
400	16”	520	1016	1029	1108	520	1057	1073	1422	543	1108	1111	1422

		CLASS 900#				CLASS 1500#				CLASS 2500#			
50	2”	210	375	375	375	210	375	375	375	210	400	400	400
80	3”	281	410	410	460	281	460	460	460	281	660	660	498
100	4”	342	511	511	530	342	530	530	530	342	737	737	575
150	6”	429	714	714	768	429	768	768	768	429	864	864	819
200	8”	492	914	914	832	492	972	972	832	492	1022	1022	1029
250	10”	513	991	991	991	513	1067	1067	991	513	1372	1372	1270
300	12”	587	1130	1130	1130	587	1219	1219	1130	587	1575	1575	1422
350	14”	615	1257	1257	1257	615	1257	1257	1257	-	-	-	-
400	16”	735	1422	1422	1422	735	1422	1422	1422	-	-	-	-

RF: Raised Face flanged ends. RTJ: Ring Joint Type flanged ends. BW: Butt-Welded ends.
Contact FCA for superior size valves up to 24''.