WEAR-RESISTANT

FINE CONTROL

Fujikin

CORROSION-RESISTANT

FINE CERAMIC MINI-CONTROL VALVES

ACCURACY

PERFORMANCE

FULLY CERAMIC

Fujikin

Since 1930, Fujikin has led the industry with uniquely innovative, problem-solving solutions to the demanding environments typically encountered in today's industry. The need for an ultra-fine throttling valve that is both wear-resistant and corrosion-resistant has led to the development of our fully ceramic Mini-Control Valve. In 1975, Fujikin ceramic valves were introduced to the manufacturing industry, and have since become the most dependable and maintenance-free ceramic valves in the world. This product superiority has enabled Fujikin to become the standard by which all other valves are measured against.

Fujik

Why choose a Fujikin Mini-Control Valve?

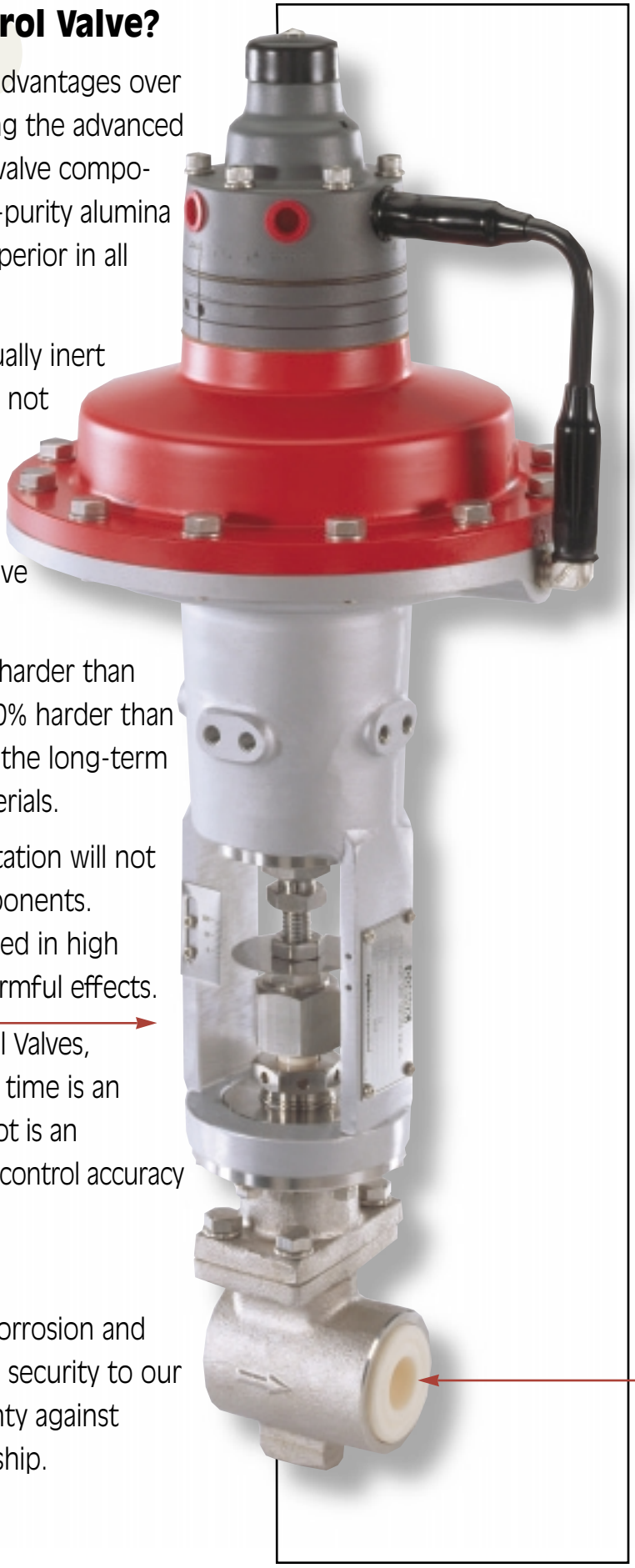
Fujikin Mini-Control Valves offer significant advantages over conventional severe-service valves by utilizing the advanced properties of technical ceramics. All wetted valve components are manufactured of solid 99.5% high-purity alumina ceramic, which guarantees a valve that is superior in all respects, including resistance to:

- **Corrosion.** 99.5% alumina ceramic is virtually inert to organic and inorganic chemicals. They do not interact with, nor contaminate the process media. They are physically and chemically stable against most acids and alkalis, and offer years of service with little or no corrosive degradation.

- **Abrasion.** 99.5% alumina ceramic is 43% harder than zirconia, 140% harder than porcelain, and 730% harder than stainless steel, which offers an indication of the long-term wear-resistance properties of our valve materials.

- **Cavitation.** Even severe, continuous cavitation will not degrade or damage our ceramic valve components. Therefore, the Mini-Control Valve may be used in high differential-pressure applications with no harmful effects.

- **Ultra-Precise Control.** For all Mini-Control Valves, backlash/stiction is less than 0.2%, response time is an ultra-quick 0.1 second average, and overshoot is an impressive 0% – yielding unprecedented fluid control accuracy in a fully-ceramic valve.



2-Year Warranty

By utilizing a ceramic material that is both corrosion and abrasion-resistant, we offer an extra level of security to our customers by offering up to a 2-year warranty against corrosion, abrasion, and/or faulty workmanship.

To meet the most stringent requirements mandated by the needs of modern industry, we offer additional ceramic materials for use in our valve components – with each possessing unique characteristics. Alumina ceramics are by far the most widely used ceramic materials, and are commercially offered in varying purities – from a porous 76% refractory material to an inert 99.9% grade. Although low-purity alumina is a relatively low cost alternative, important properties such as hardness and corrosion-resistance are drastically reduced when compared to other ceramics and higher alumina-content grades. Zirconia, silicon carbide and silicon nitride each possess a variety of unique characteristics and are all available for use in Fujikin ceramic valves.

99.5% Alumina. 99.5% alumina is the standard ceramic material utilized in all Fujikin ceramic valves. In addition to its extreme corrosion resistance and high hardness factor, alumina is also not subject to radioactive degradation, making it an ideal material for a wide variety of aggressive applications. It remains stable at extremely high temperatures, and may even be used for services exceeding 1,000°F.

99.9% Alumina. This high-grade alumina is one of the purest forms of alumina available. It has a finer particle size, is more homogenous, and has less binding material than the 99.5% alumina. As a result, the corrosion and abrasion resistance properties are dramatically increased, making this ceramic an ideal choice for the most severe services.

Silicon Nitride. Silicon nitride exceeds other ceramics with a remarkably high thermal shock resistance and high strength properties at elevated temperatures. Originally developed for components in internal combustion engines, turbines, and diesel glow plugs, it is also available as an optional ceramic material in Fujikin valves. It is so stable at high temperatures that it can be used with molten metals.

Silicon Carbide. Silicon carbide is only next to diamond and boron carbide in hardness, and 95% harder than our standard alumina. It exhibits high thermal conductivity, high thermal-shock resistance, and strength durability at extreme temperatures. Silicon carbide has the highest corrosion resistance of all fine ceramic materials, and is also one of the few that is resistant to HF, making this material the ceramic of last resort.

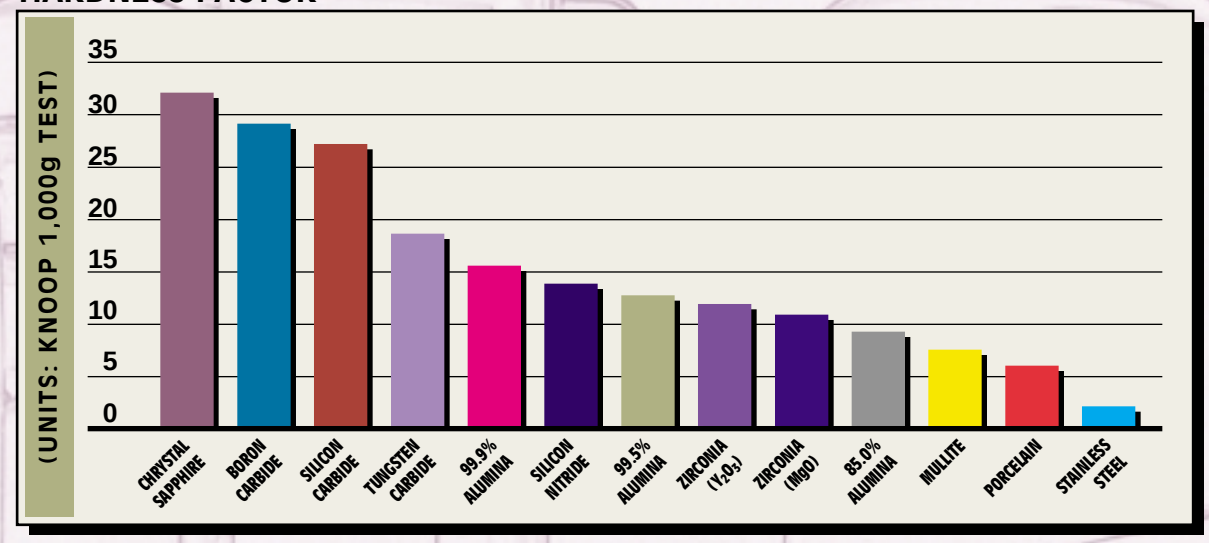
Performance Characteristics
Materials available in Fujikin valves with their respective characteristics

	99.5% ALUMINA (Al_2O_3)	99.9% ALUMINA (Al_2O_3)	SILICON CARBIDE (SiC)	SILICON NITRIDE (Si_3N_4)	ZIRCONIA (ZrO_2)
COLOR	WHITE	IVORY	BLACK	CHARCOAL	LIGHT GRAY
BULK DENSITY (g/cc)	3.8	3.97	3.2	3.2	5.5
FLEXURAL STRENGTH (MPa)	379	552	552	906	620
ELASTIC MODULUS (GPa)	372	386	400	311	200
STIFFNESS/WEIGHT (GPa/g/cc)	96	97	129	94	35
COMPRESSIVE STRENGTH (MPa)	2620	3792	–	–	1750
FRACTURE TOUGHNESS ($MPa \cdot m^{1/2}$. NOTCHED BEAM TEST)	4-5	4-5	3	6	11
MAXIMUM USE TEMPERATURE (°C)	1750	1900	1650	1200	500

Zirconia. Zirconia has the highest strength and toughness at room temperature of all engineered ceramics. However, zirconia is less corrosion resistant and more susceptible to impingement and rubbing wear, and is therefore used primarily for high torque and/or high pressure applications.

All Fujikin valve components are manufactured and tested to the strictest quality assurance procedures, assuring the end-user a product that is flawless in its craftsmanship.

HARDNESS FACTOR



THERMAL SHOCK RESISTANCE FOR FUJIKIN VALVES

(IMMERSION TEST, QUENCHING IN 20°C WATER)

	99.5% ALUMINA (Al_2O_3)	99.9% ALUMINA (Al_2O_3)	SILICON CARBIDE (SiC)	ZERCONIA (ZrO_2)	SILICON NITRIDE (Si_3N_4)
THERMAL SHOCK RESISTANCE (°C)	50	50	75	87	200

CHEMICAL DURABILITY COMPARISON CHART

(UNITS: WEIGHT LOSS; mg/cm²/day)

MEDIA	TEMP	99.5% Al_2O_3	99.9% Al_2O_3	ZrO_2	SiC	Si_3N_4	SS304	SS316	HC®	STELLITE® #6	STELLITE® #12
20% HCl	60°C	A	A	A	A	B	C	C	B	C	C
20% HCl	95°C	A	A	A	A	C	–	–	C	C	C
90% H_2SO_4	60°C	A	A	A	A	A	C	C	B	B	C
90% H_2SO_4	95°C	A	A	A	A	B	C	C	C	–	–
60% H_3PO_4	60°C	A	A	A	A	C	C	C	A	B	A
60% H_3PO_4	95°C	A	A	A	A	C	C	C	A	C	C
10% HF	60°C	B	B	C	A	A	C	C	B	C	C
46% HF	95°C	C	C	C	A	C	–	–	C	–	–
60% HNO_3	60°C	A	A	A	A	C	A	A	C	A	A
60% HNO_3	95°C	B	A	A	A	C	B	B	C	B	C
30% NaOH	60°C	B	A	A	A	B	A	A	A	C	A
30% NaOH	95°C	B	A	B	A	C	A	B	A	–	B

A = < 0.1 mmg/cm²/day — Negligible or no corrosion, and recommended for this service
B = 0.1 ≈ 0.3 mmg/cm²/day — Little or slight corrosion; Use with annual inspection
C = > 0.3 mmg/cm²/day — Significant corrosion, and not recommended for valve use
– = Test not completed due to violent corrosion

The data in the above charts were obtained under controlled test conditions, and actual valve characteristics and performance may increase or decrease depending upon actual installation conditions.

Fujikin's Most Accurate Ceramic Control Valve

EnTech™ verification has determined that backlash/stiction of any standard Mini-Control Valve is less than 0.2% – making it the most accurate fully-ceramic control valve available. Additionally, the response time is an average 0.1 second with absolutely no overshoot, allowing the Mini-Control Valve to respond quickly, precisely, and consistently – crucial to accurate flow control.

The Fujikin ceramic Mini-Control Valve is available in a wide variety of equal-percent characteristic trims to accurately control processes which require Cv's from as low as 0.018 up to 50.00. With up to 9 different equal-percent characteristic trims per line size, selection of the best-suited trim will assure a wide throttling range to precisely adjust and meter fluid flow.

TRIM SIZES

SIZE	AVAILABLE Cv VALUES								
1/2"	5	3.5	2.5	1.5	1.0	0.7	0.5	0.35	
3/4"	7	5	3.5	2.5	1.5	1.0	0.7	0.5	0.35
1"	17	11	7	5	3				
1 1/2"	35	25	15	7					
2"	50	35	25	15					

The allowable seat leakage of the Mini-Control is between 1 x 10^{-3} to 1 x 10^{-4} of the maximum rated Cv of the valve. This shut-off is effectively achieved by consistently manufacturing high-tolerance polished sealing surfaces between the valve's ceramic stem and the ceramic body. This hard-seated design is not vulnerable to media wear and gouging, and will consistently yield tight shut-off beyond the approved warranty period and for the life of the valve.

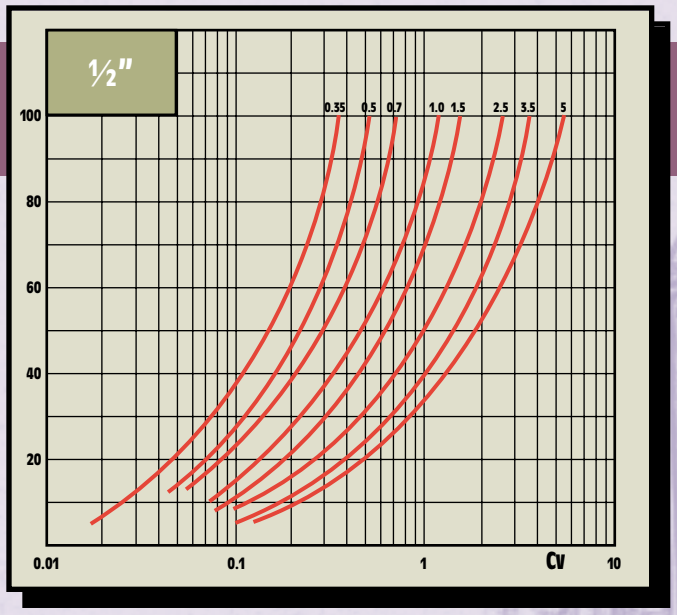
Downstream pipe wear is virtually eliminated due to superior valve design. The ceramic stem controls in a vertical up-and-down motion against the control port positioned perpendicular to the piping. Abrasive media controlled in this fashion will always travel parallel to the piping, and will not be diverted against the piping as is common with rotary valves.

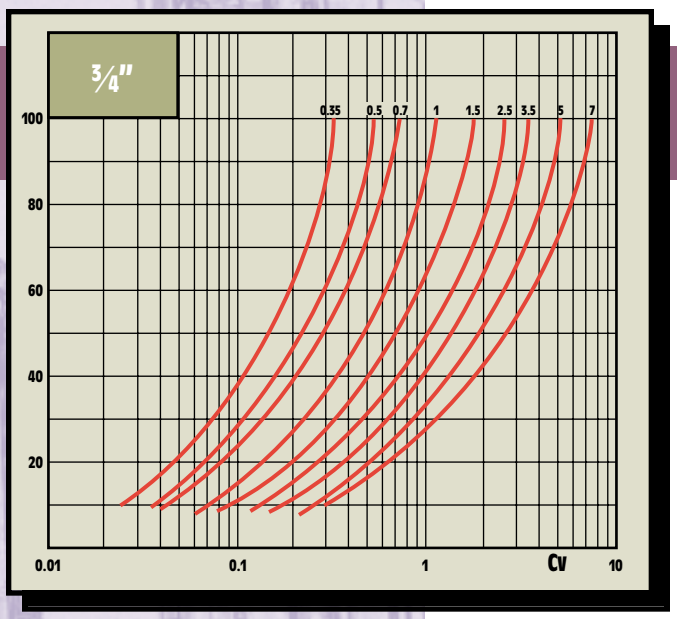
The table above lists the standard trims available in the Mini-Control Valve. If a non-standard Cv is required to match a particularly fine control range, Fujikin may specially manufacture one to suit.

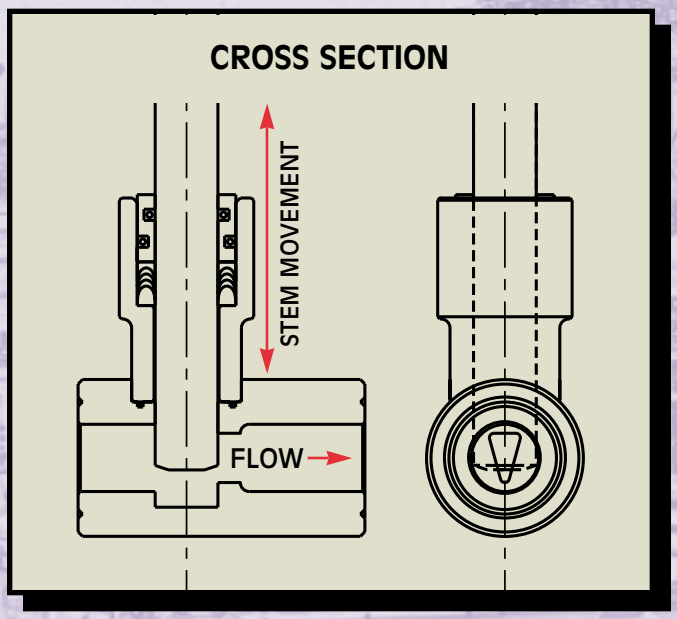
ACCURATE

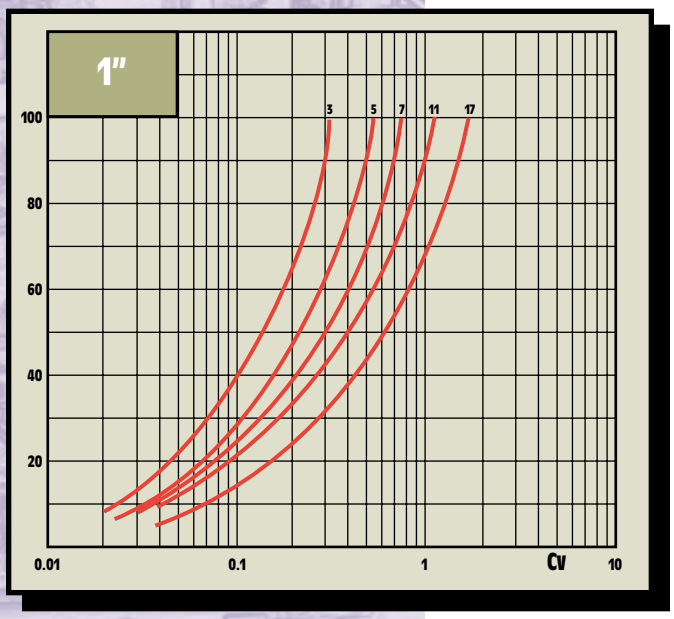
Cv-0.018

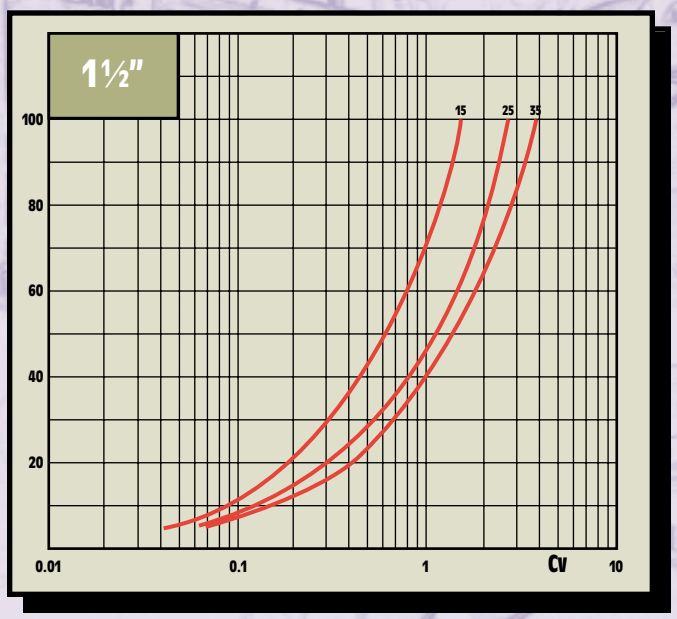
TOLERANCE

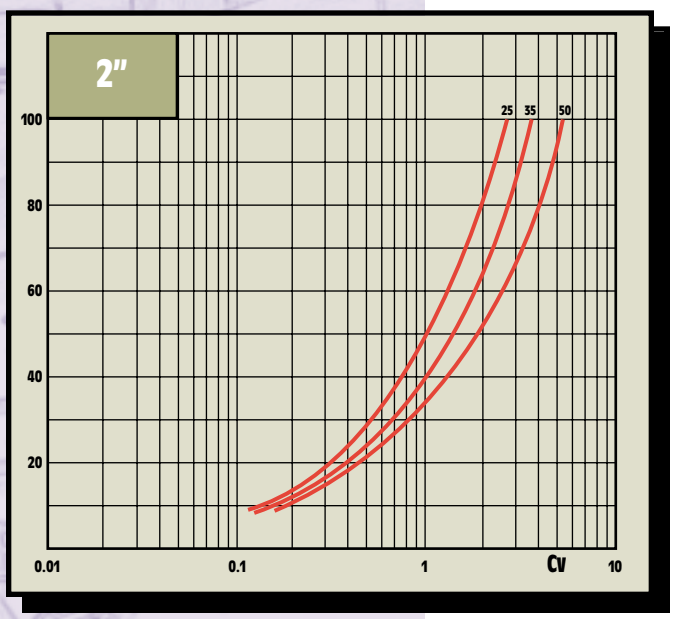

½"
100
80
60
40
20
0.35
0.5
0.7
1.0
1.5
2.5
3.5
5
0.01
0.1
1
Cv
10


¾"
100
80
60
40
20
0.35
0.5
0.7
1
1.5
2.5
3.5
5
7
0.01
0.1
1
Cv
10


CROSS SECTION
STEM MOVEMENT
FLOW


1"
100
80
60
40
20
3
5
7
11
17
0.01
0.1
1
Cv
10


1½"
100
80
60
40
20
15
25
35
0.01
0.1
1
Cv
10


2"
100
80
60
40
20
25
35
50
0.01
0.1
1
Cv
10

Exploded view of ceramic Mini-Control Valve

1-Solid Ceramic Body...
is offered in a wide variety of trim sizes to assure precise process control with maximum rangeability. Simple design allows an effortless means of maintaining the valve with minimal down-time.

2-Stainless Steel Housing...
encloses the ceramic body and packing components to provide a durable and corrosion-resistant protective housing.

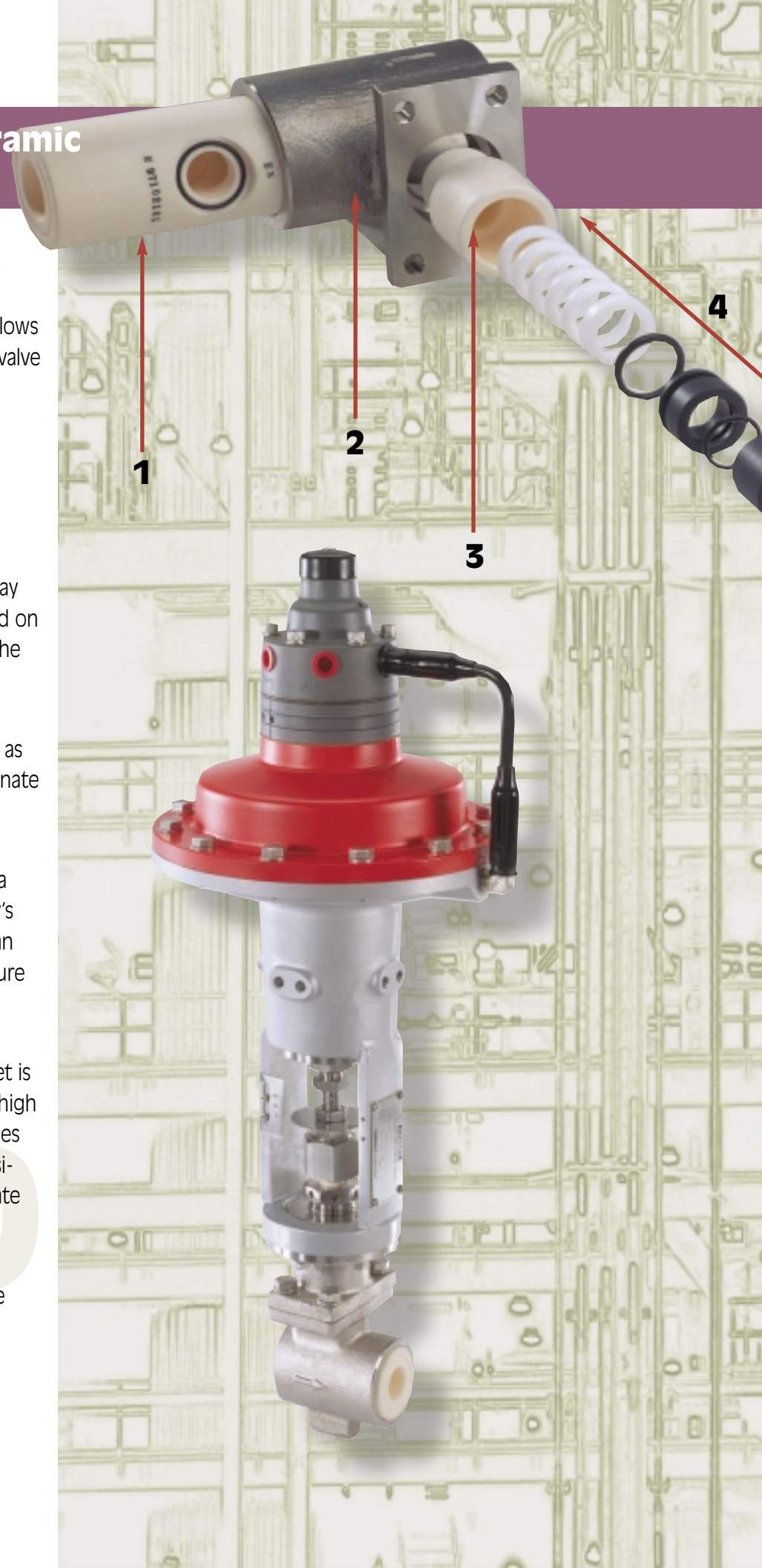
3-Ceramic Stuffing Box...
is also inert to corrosion, and cleans away any media that might have accumulated on the ceramic stem, thereby protecting the packing against gouging.

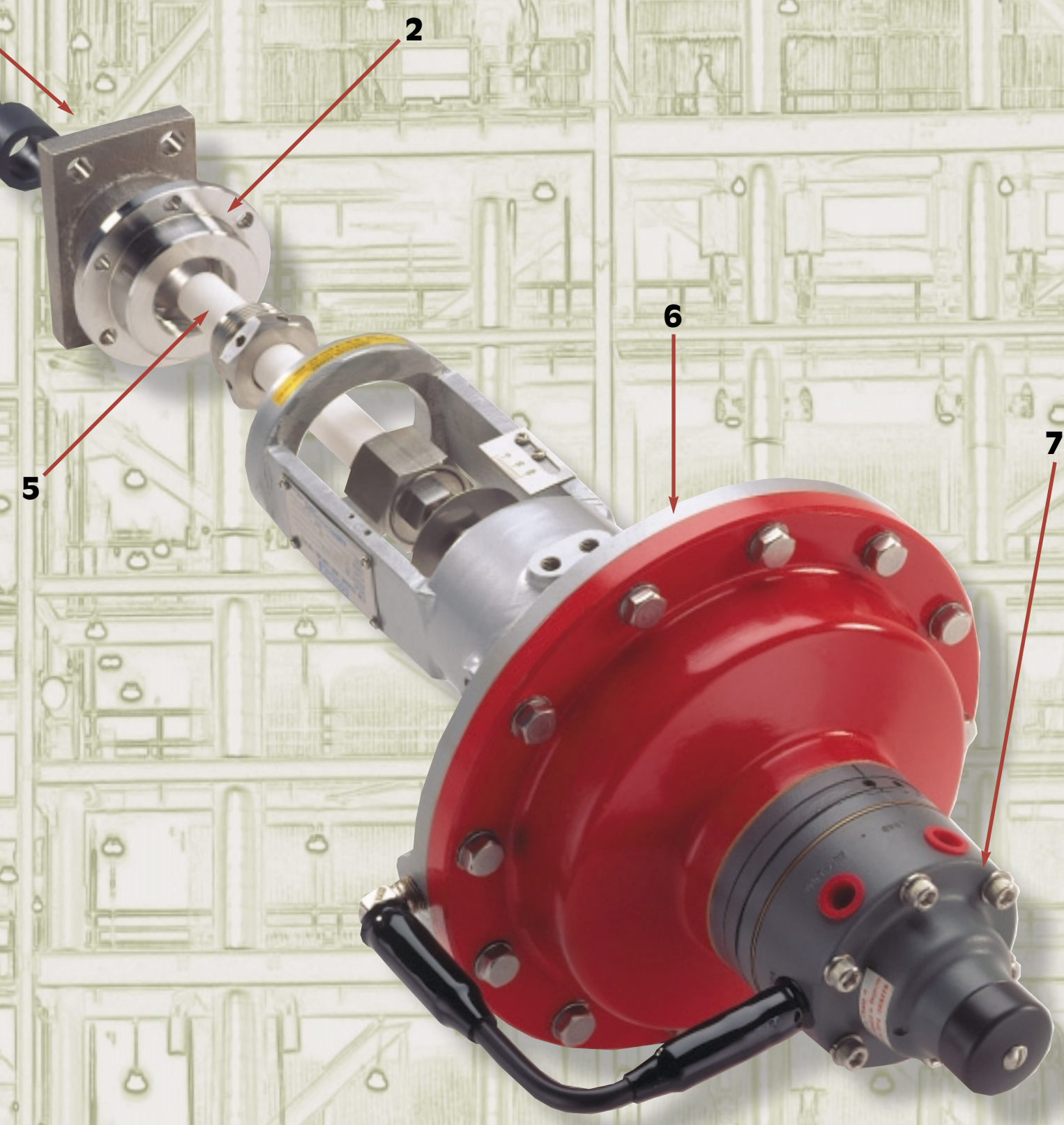
4-Dual Seal...
is accomplished by providing V-Packing as well as inner and outer O-Rings to eliminate any possibility of leakage.

5-Ceramic Stem...
is polished to a mirror surface to form a tight, Class IV shut-off against the body's downstream seat, as well as providing an effective packing sealing surface to assure zero media leakage.

6-Diaphragm Actuator...
requires only 35 psig compressed air, yet is strong enough to operate the valve at high pressures. Extremely sensitive to changes in air pressure, it provides excellent positioning characteristics critical for accurate control.

7-Integral Positioner...
is top-mounted to accurately adjust the valve's position. The lack of linkage kits enables the positioner to position in response to even a minute change in control signal.




2
5
6
7

Product Identification Number

Please use this part number when making inquiries.

AD R -C M II -2 2 F -E11 -SiC -HT

- **AD** – Air Actuated Diaphragm Actuator
- **R** – **(Bank)= Air To Close, Fail Open**; **R= Air To Open, Fail Close**
- **-C** – Ceramic Valve Components
- **M** – Mini-Control Series
- **II** – Cosmix® Valve
- **-2** – **1= FNPT End-Connections (Adapter)**; **2= ANSI 150# / ANSI 300# Wafer**
- **2** – 20 kg/cm² Maximum Operating Pressure
- **F** – **D** ½" Size; **E** ¾" Size; **F** 1" Size; **H** 1½" Size; **I** 2" Size
- **-E11** – Specify Valve Trim
- **-SiC** – **[Blank]** – 99.5% Alumina Ceramic Components (Standard); **99.9** – 99.9% Alumina Ceramic Components; **SiC** – Silicon Carbide Ceramic Components; **Si_3N_4** – Silicon Nitride Ceramic Components; **ZIR** – Zirconia Ceramic Components
- **-HT** – **HT** High-Temperature; **SP** Special/Non-Standard Option

Replacement Parts

All original factory replacement parts are manufactured to the strictest of quality procedures. Extremely high tolerances are kept, and therefore 100% of parts are interchangeable eliminating the need for matched components. Fujikin maintains an extensive inventory of all replacement parts for the Mini-Control Valves. Spares can usually be shipped the same day, thus minimizing unscheduled downtime and eliminating the need for local stocking of parts.

Fujikin 2-Year Warranty

In order to assure every Fujikin valve provides the longest possible service, our technical staff will review each process and recommend the proper valve size and trim. Additionally, each service is cross-referenced with our extensive chemical compatibility database and 25 years of installation expertise. As a result, Fujikin is able to warranty the Mini-Control Valves against corrosion, abrasion, and/or faulty workmanship for up to 2-years in service. Should the valve not perform as intended, we will immediately provide free replacement parts or repair the valve in our facility at no cost to the end-user.

The Fujikin warranty is our assurance to you, that each and every Fujikin valve is manufactured to the highest quality standards, and will provide years of maintenance-free service in the most aggressive conditions.

Operating Parameters

SIZE RANGE

½" to 2"

MAXIMUM OPERATING TEMPERATURES

Standard Configuration	200°C (392°F)
High-Temperature Configuration	600°C (1,112°F)

MAXIMUM INSTANTANEOUS TEMPERATURE DIFFERENTIAL

Alumina	50°C (122°F)
Zirconia	87°C (188°F)
Silicon Carbide	75°C (167°F)
Silicon Nitride	200°C (392°F)

Higher instantaneous temperature differentials may be accomplished with the use of heat-tracing devices.

MAXIMUM OPERATING PRESSURE

Standard Configuration	20 kg/cm^2 (285 psi)
High-Pressure Configuration	40 kg/cm^2 (570 psi)

All models capable of handling the full differential pressure

MAXIMUM ALLOWABLE LEAKAGE

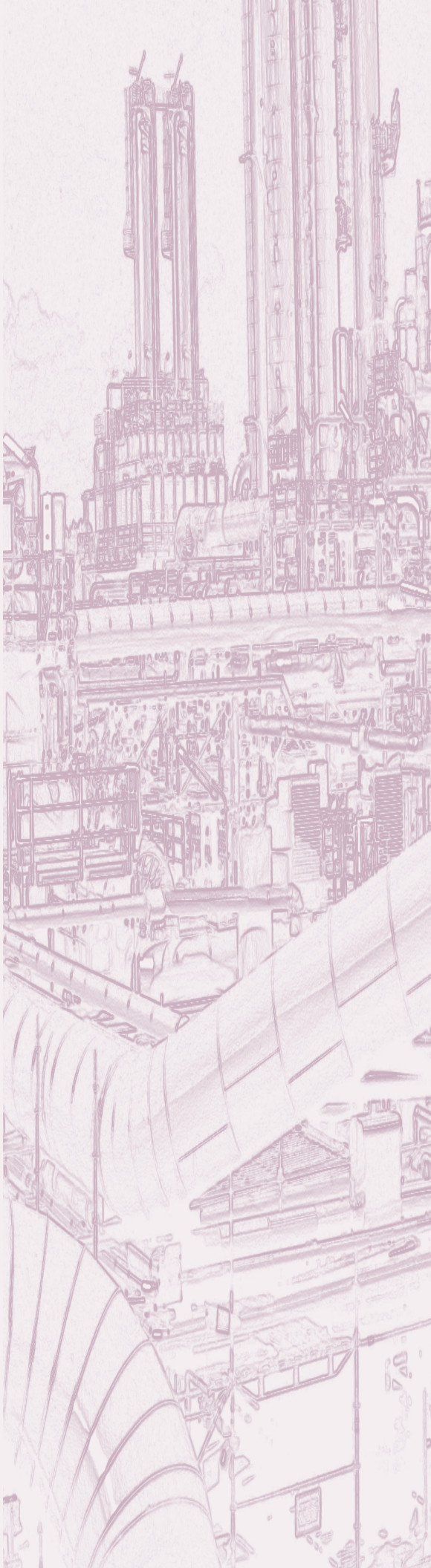
Between 0.0001 and 0.00001 of valve Cv.

PERFORMANCE

Backlash/stiction	Less than 0.2%
Deadtime	0.1 Second Average
Overshoot	0%

EnTech

Complete conformance to EnTech™ Valve Dynamic Specification V2.1



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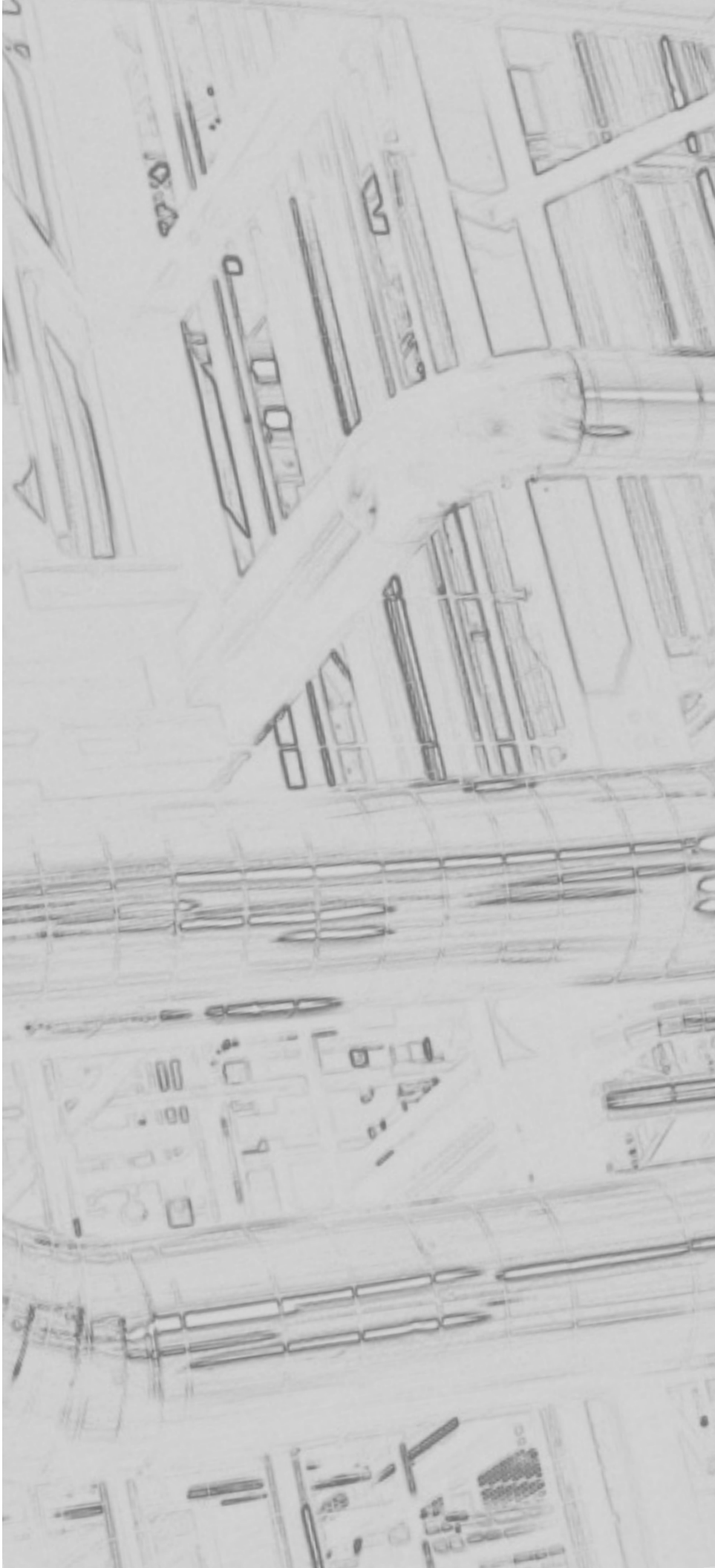

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