High-Performance Metal Oxide Varistors by Xi'an Tian Gong Electric (TGE)

Product Catalogue

Partner with TGE for High-Performance MOV Solutions

Xi'an Tiangong Electric (TGE) is your reliable partner for advanced Metal Oxide Varistors tailored to surge arrester applications across all voltage levels — from distribution networks to ultra-high-voltage systems.

We invite surge arrester manufacturers and engineering teams to contact us directly for:

- Product inquiries and quotations
- Tailored MOV solutions for specific applications
- Technical consultations and support

Our commercial and technical teams are ready to assist you with quick response times and in-depth expertise.

Contact Information

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LinkedIn	Xi'an Tiangong Electric Co., Ltd.
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Scan to Visit Our Website

40 Years of Expertise

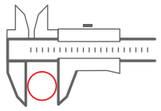
Global Leader in MOV Manufacturing

Customized Solutions for Surge Arrester Manufacturers

COMPANY OVERVIEW

Xi'an Tian Gong Electric (TGE) stands as a recognized global expert in the manufacturing of Metal Oxide Varistors (MOVs), renowned for delivering exceptional quality and innovation to major surge arrester manufacturers worldwide. Since its founding in 2002, TGE has dedicated nearly four decades to the research and development of MOV technology, earning a stellar reputation among customers across Europe, the USA, China and beyond.

With a comprehensive portfolio of MOV diameters ranging from 30mm to 136mm, TGE serves a wide range of applications and voltage classes, making it a trusted partner for surge arrester manufacturers globally. TGE's enduring commitment to product excellence and customer satisfaction has solidified its position as a pioneer in the industry.



30 MM ~ 136 MM

With a comprehensive portfolio of MOV diameters ranging from 30mm to 136mm

200 + Million Pieces

More than 200 million TGE MOVs have been successfully deployed in power grid systems across various countries worldwide.

TGE

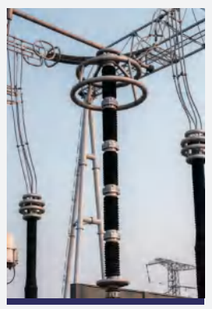
Key achievements include

TGE brings unmatched expertise to the MOV manufacturing industry, with over 20 years of experience producing high-performance MOVs. The company continuously drives innovation through its dedicated R&D team, optimizing formulas and manufacturing processes to meet the evolving demands of modern power systems.

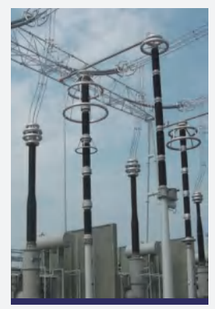
Key achievements include

- 30+ patents and the development of over 100 MOV types, showcasing TGE's ability to adapt to diverse customer requirements.
- A reputation for stable and reliable product performance, often regarded as superior to competitors in both quality and longevity.
- Pioneering innovation in MOV technology, including the successful R&D of glass-glazed MOVs, DC MOVs, and green MOV manufacturing methods.
- Tailored solutions to meet specific customer needs, offering customized product design, development, and production services.
- Active participation in industry standards, as a member of the IEC TC37 working group for surge arrester and SPD specifications, contributing to the development of IEC 60099-4 for metal-oxide surge arresters.
- International certification and field performance, with TGE MOVs certified by KEMA and UL.
- TGE MOVs are successfully deployed in Ultra-High-Voltage power systems in China.

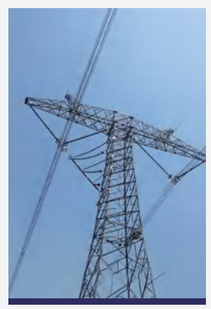
TGE MOVs Used in Key Projects of China's Ultra-High Voltage (UHV)



1000kV UHA AC
Station Arrester
MOV Model: D136



1000kV UHV AC
Station Arrester
MOV Model: D120



±800kV UHV DC
Line Arrester
MOV Model: D105

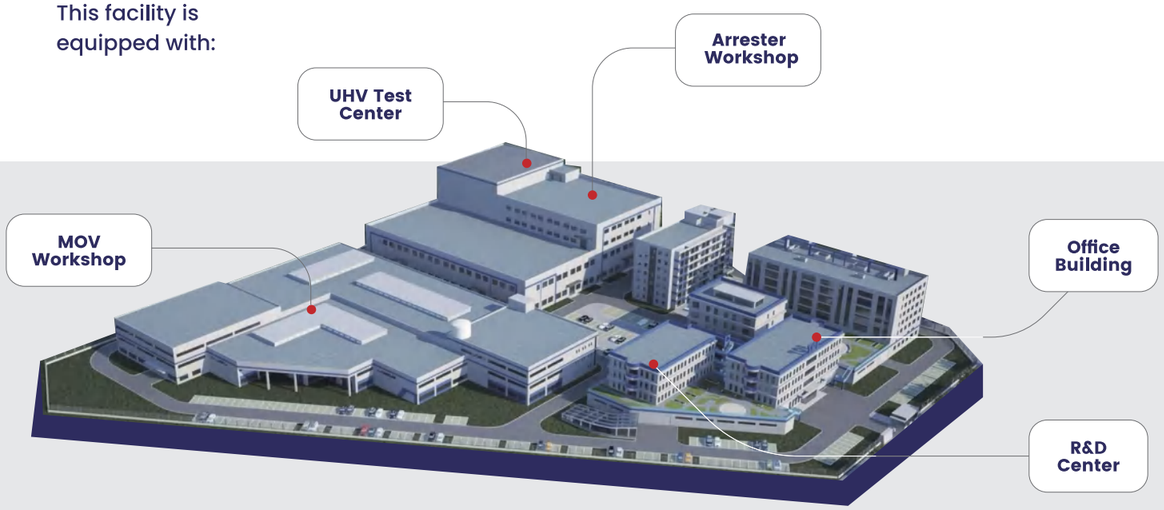
±800kV UHV DC
Converter Station Arrester
MOV Model: D115

MANUFACTURING CAPABILITIES

In 2024, TGE inaugurated its state-of-the-art 70,000 m² factory, making it one of the largest MOV manufacturing facilities in the world.

70,000 m²
factory

This facility is equipped with:



* State-of-the-art 70,000 m² factory inaugurated in 2024
MOA : Metal Oxide Arresters

450 T
A monthly production capacity of 450 tons, translating to 24 million MOV pieces with an average diameter of 42mm.

11
11 custom-designed tunnel furnaces, purpose-built to ensure precise temperature control, uniform heating, and stable sintering processes, with a capacity of 450 tons per month.

TGE's highly automated production lines are complemented by stringent quality control measures and cutting-edge technology to ensure the consistent delivery of safe, reliable, and sustainable products.

TGE

Outstanding development of a 36mm diameter MOV to successfully complete IEC/IEEE design tests, meeting DH (Distribution High) requirements. All tests were passed on the first attempt, and the final KEMA certification report was obtained.

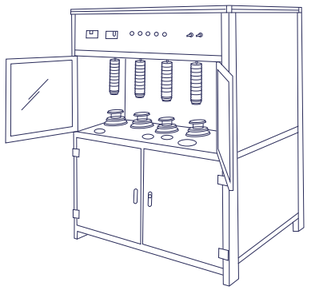
INNOVATION IN MOVS

Innovation lies at the heart of TGE's operations

2,000 m²
R&D Center

The company's 2,000 m² R&D Center is a hub for advanced material research and technology development.

Peak	200kA	100kA	65kA
Waveform	4/10μs	8/20μs	2/20μs



TGE is equipped with one of the most powerful multi-function impulse current generators, capable of performing full scale testing such as 200kA tests for MOVs below 10kV DC (4/10μs waveform), 100kA tests for 8/20μs waveform, and 65kA tests for 2/20μs waveform.

These advanced testing capabilities meet the requirements of IEC and IEEE standards, ensuring that every MOV block performs to the highest global benchmarks.

Differentiating Factors

TGE distinguishes itself in several key ways:

Comprehensive MOV Capabilities
Expertise in manufacturing all types of MOV blocks, including those for **UHV GIS, HVDC systems**, and other specialized applications.

Global Reach and Partnerships
TGE's MOVs are found in every corner of the globe, thanks to its strong partnerships with leading surge arrester manufacturers.

Advanced Glass Coating Expertise
Mastery of challenging manufacturing processes, such as **glass coating**, ensures **long-term performance stability** under extreme environmental conditions.

Commitment to Customer Success
TGE's unique company culture fosters close collaboration with clients and strategic partners, ensuring that solutions are tailored to meet specific requirements.

Global Presence

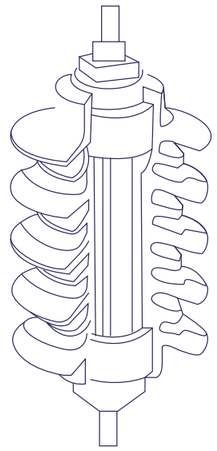
TGE is proud to say that its MOV products are integrated into power systems across the world, providing reliable surge protection and enabling the safe, efficient operation of modern energy infrastructure.

INTRODUCTION TO MOV CATEGORIES

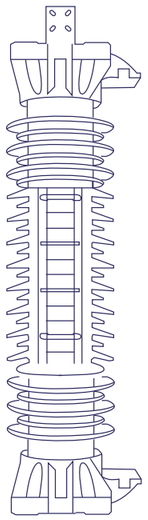
TGE offers a comprehensive range of MOVs designed to meet the specific requirements of various surge arrester applications. Each application demands unique features, and TGE ensures that its MOV design, composition, and manufacturing processes align with the distinct needs of surge arresters. This portfolio covers a wide system voltage range from 3kV to 1100kV, with MOV diameters spanning 30mm to 136mm, making TGE a versatile and reliable partner for surge arrester manufacturers.

MOV Blocks for Distribution Class Arresters (Medium Voltage)

Range	30mm to 48mm diameter (D30 series to D48 series).
Standards	Fulfill IEC 60099-4 (DL, DM, DH) and IEEE C62.11 (LD, ND, HD).
Features	The design of distribution network surge arresters must optimize both electrical and economic performance, even with limited dimensions. This means not only meeting the required electrical performance but also enabling cost reductions through a more compact arrester design.



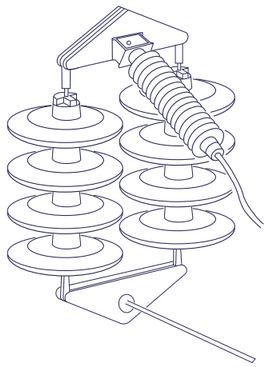
Distribution Class Arresters are highly exposed to lightning surges due to their typical installation in sensitive points on overhead distribution lines, such as pole-mounted transformers and riser poles. To ensure long-term robustness and reliability, these arresters are rigorously verified for their ability to endure 20 instances of 8/20 µs repetitive charge transfers (Qrs ratings) without any degradation in electrical performance.



MOV Blocks for Station Class Arresters (High Voltage)

Range	41mm to 115mm diameter (D41 series to D115 series).
Standards	Fulfill IEC 60099-4 (SL, SM, SH) and IEEE C62.11 (Intermediate and Station Energy Class).
Features	The design of surge arresters for transmission networks must achieve an optimal balance between electrical performance, energy absorption capability, and cost-effectiveness. As the backbone of the electrical infrastructure, the reliability of transmission networks is paramount and cannot be compromised.

Station Class Arresters are typically less exposed to lightning surges due to their installation at the ends of transmission lines, within substations. IEC and IEEE classifications primarily focus on the ability of surge arresters to handle switching surges. While Qrs ratings (at 2-4 ms) are expected, a critical verification for ensuring thermal stability and long-term performance is the ability to absorb multiple energy injections (Wth rating) under extreme conditions. The arrester must effectively dissipate the energy and maintain stability without any degradation in electrical performance.



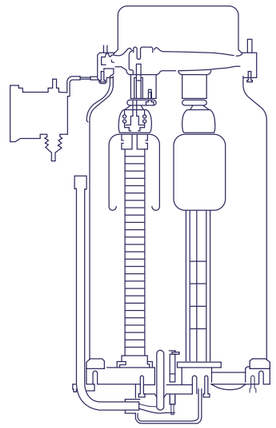
MOV Blocks for Line Surge Arresters (Overhead Lines)

Range	32mm to 115mm diameter (D32 series to D115 series).
Standards	Fulfill IEC 60099-4, IEC 60099-8 and upcoming IEC/IEEE 60099-11 for Line Surge Arresters (LSAs).
Features	Line Surge Arresters (LSAs) cover a wide range of system voltages and are available in two main designs: Externally Gapped Line Arresters (EGLA) and Non-Gapped Line Arresters (NGLA). TGE's comprehensive portfolio of MOVs meets the diverse technical and commercial demands of LSA applications, ensuring reliable performance under varying conditions.

LSAs are designed to handle lightning discharges and prevent lightning-related outages on overhead lines, making them highly exposed to lightning surges. According to the upcoming IEC/IEEE 60099-11 standard, a critical verification for ensuring robustness and long-term performance is the ability to endure 20 instances of 2/20 µs repetitive charge transfers (Qrs ratings at 200-230 µs) without degradation in electrical performance. These 20 lightning discharges represent a worst-case scenario over the service life of an LSA.

High Gradient MOV Blocks for GIS Arresters (Gas Insulated Switchgears)

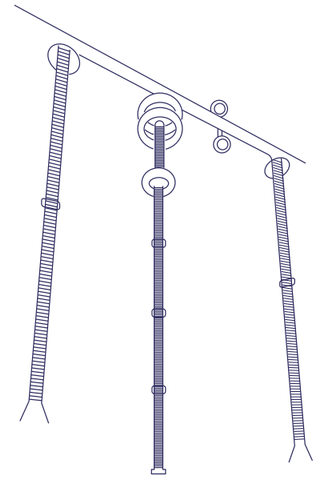
Range	60mm to 115mm diameter (D60 series to D115 series).
Standards	Fulfill IEC 60099-4 (SL, SM, SH) and IEEE C62.11 (Intermediate and Station Energy Class).
Features	The voltage range for Gas Insulated Surge Arresters is generally comparable to that of Station Class Arresters but is tailored specifically for gas-insulated applications. MOV's High Gradient can reach up to 400V/mm.



High-gradient MOVs are characterized by a high reference voltage per unit thickness, enabling the design of more compact surge arresters by reducing the number of MOV Blocks required. The field strength of an MOV is determined by the number of boundary layers per unit height. By minimizing the grain size, the number of boundary layers increases, enhancing field strength. This is achieved through material composition adjustments and optimization of the sintering process.
Key advantages of high-gradient MOVs include improved protection performance (lower residual voltages) and significantly reduced arrester dimensions, particularly in length. A critical verification for ensuring long-term stability and performance is the Thermal Energy Rating (Wth), which evaluates the arrester's ability to withstand and dissipate energy under demanding conditions.

MOV Blocks for DC Arresters (HVDC Systems and Other DC Applications)

Range	70mm to 115mm diameter (D70 series to D115 series)
Standards	Compliant with IEC 60099-9, the standard for HVDC Surge Arresters, these devices address the unique requirements of "Metal-oxide surge arresters without gaps for HVDC converter stations." This relatively recent standard introduces new challenges tailored to the specific demands of HVDC systems.



Due to the unique characteristics of DC systems and their integration into converter stations, HVDC Surge Arresters require specialized considerations, particularly in the design and optimization of MOV technology. Lower protection levels contribute to cost reductions in converter stations by minimizing the number of thyristor valves required.

HVDC systems generate complex waveforms that include a mix of AC and DC components. MOVs for HVDC Surge Arresters must effectively manage these waveforms, with particular focus on the steepness of voltage changes and the peak continuous operating voltage (PCOV). Long-term stability under DC stress and the capability to handle varying polarities demand rigorous testing. This includes simulating polarity reversals and ensuring power loss stability over extended periods, ensuring reliable performance in demanding conditions.

TECHNICAL SPECIFICATIONS

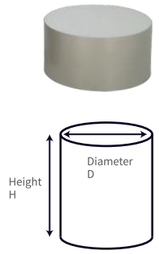
The technical parameters presented in this catalog represent commonly used specifications, with only one rated voltage (Ur) retained. The tables below provide typical heights for each specific diameter. For inquiries about other height requirements, **please feel free to contact us.**

All MOVs tested at TGE have an ageing test factor (Kct) ≤1 and have passed two long-duration current impulse tests.

*Classes according to IEC and IEEE are provided as references only, based on experience. Surge arrester manufacturers must conduct rigorous type tests on their surge arrester designs to fully meet the requirements.

MOV Blocks for Distribution Class Arresters (Medium Voltage)

Designation	D30	D32	D33	D34	D36	D41	D42	D45	D48
IEC Class*	DL	DM	DM	DM	DH	DH	DH+	DH+	DH+
IEEE Class*	LD	ND	ND	ND	HD	HD	HD+	HD+	HD+
Nominal discharge current, In (kA)	5	5 10	5	5	10	10	10	10	10
Repetitive charge transfer rating, Qrs (8/20μs in C)	0.2	0.3	0.4	0.4	0.4	0.5	0.5 0.6	0.6	0.6
4/10μs high current (kA)	65	65	65	65	100	100	100	100	100
Long duration impulse 2ms (A)	150	200	250	250	350	500	500 600	600	600 800



Specification	Suggested rated voltage	Diameter D	Height H	Gradient	Reference voltage, $U_{ref.1mA.DC}$	Reference current, $I_{ref.AC}$	Reference voltage, $U_{ref.AC}$	Residual voltage, U_{res}
	kV(≤)	mm	mm	V/mm	kV (r.m.s)	mA	kV(r.m.s)	kV(peak)
D30H29	0.38Ures	30±0.6	29±0.3	230	6.67±0.35	1	4.74±0.24	11.67±0.61
D30H29	0.38Ures	30±0.6	29±0.3	240	6.96±0.30	1	4.95±0.20	12.18±0.53
D30H27.5	0.38Ures	30±0.6	27.5±0.3	230	6.33±0.30	1	4.50±0.20	11.07±0.53
D32H22	0.38Ures	32±0.6	22±0.3	240	5.35±0.30	1	3.78±0.20	9.26±0.53
D32H29	0.38Ures	32±0.6	29±0.3	250	7.33±0.30	1	5.18±0.20	12.68±0.53
D32H36	0.38Ures	32±0.6	36±0.3	250	9.07±0.40	1	6.41±0.26	15.69±0.70
D32H29.4	0.38Ures	32±0.6	29.4±0.3	240	7.13±0.35	1	5.04±0.24	12.33±0.62
D32H39.2	0.38Ures	32±0.6	39.2±0.3	230	9.07±0.45	1	6.41±0.30	15.69±0.79
D33H19.5	0.38Ures	34±0.6	19.5±0.3	230	4.49±0.30	1	3.17±0.20	7.76±0.53
D33H22	0.38Ures	34±0.6	22±0.3	225	4.95±0.30	1	3.50±0.20	8.56±0.53
D33H29.5	0.38Ures	34±0.6	29.5±0.3	230	6.79±0.30	1	4.80±0.20	11.74±0.52
D33H32.9	0.38Ures	34±0.6	32.9±0.3	240	7.90±0.35	1	5.58±0.24	13.66±0.62

Specification	Suggested rated voltage	Diameter D	Height H	Gradient	Reference voltage, $U_{ref.1mA.DC}$	Reference current, $I_{ref.AC}$	Reference voltage, $U_{ref.AC}$	Residual voltage, U_{res}
	kV(≤)	mm	mm	V/mm	kV(r.m.s)	mA	kV(r.m.s)	kV(peak)
D33H33	0.39Ures	34±0.6	33±0.3	220	7.24±0.35	1	5.25±0.24	12.53±0.62
D33H36	0.39Ures	34±0.6	36±0.3	220	7.85±0.35	1	5.73±0.20	13.58±0.7
D34H25	0.40Ures	34±0.6	25±0.3	245	6.13±0.30	1	4.42±0.20	10.48±0.52
D34H34	0.40Ures	34±0.6	34±0.3	250	8.50±0.40	1	6.12±0.28	14.45±0.55
D36H18.3	0.39Ures	36±0.7	18.3±0.3	235	4.30±0.30	2	3.09±0.20	7.78±0.55
D36H20.7	0.37Ures	36±0.7	20.7±0.3	235	4.86±0.30	2	3.49±0.20	8.8±0.55
D36H27.5	0.37Ures	36±0.7	27.5±0.3	235	6.46±0.30	2	4.64±0.20	11.7±0.55
D36H30.5	0.37Ures	36±0.7	30.5±0.3	235	7.17±0.35	2	5.14±0.24	12.97±0.64
D36H31	0.37Ures	36±0.7	31±0.3	235	7.29±0.35	2	5.23±0.24	13.19±0.64
D36H34.5	0.37Ures	36±0.7	34.5±0.3	235	8.11±0.40	2	5.82±0.28	14.67±0.74
D36H36.4	0.37Ures	36±0.7	36.4±0.3	235	8.55±0.45	2	6.14±0.30	15.48±0.83
D41H22	0.38Ures	41±0.8	22±0.3	250	5.48±0.30	3	3.88±0.20	9.70±0.54
D41H29	0.38Ures	41±0.8	29±0.3	250	7.29±0.30	3	5.16±0.20	12.9±0.54
D41H36	0.38Ures	41±0.8	36±0.3	250	9.05±0.40	3	6.40±0.28	16.02±0.72
D41H40	0.38Ures	41±0.8	40±0.3	250	10.0±0.40	3	7.15±0.28	17.7±0.72
D42H18.5	0.37Ures	42±0.8	18.5±0.3	235	4.35±0.30	3	3.07±0.20	7.7±0.54
D42H19.5	0.37Ures	42±0.8	19.5±0.3	220	4.29±0.30	3	3.03±0.20	7.59±0.54
D42H20.5	0.38Ures	42±0.8	20.5±0.3	220	4.51±0.30	3	3.19±0.20	7.98±0.54
D42H22	0.38Ures	42±0.8	22±0.3	220	4.91±0.30	3	3.47±0.20	8.68±0.54
D42H23.5	0.38Ures	42±0.8	23.5±0.3	220	5.17±0.30	3	3.66±0.20	9.15±0.54
D42H24	0.37Ures	42±0.8	24±0.3	225	5.40±0.30	3	3.73±0.20	9.56±0.54
D42H26.4	0.38Ures	42±0.8	26.4±0.3	250	6.60±0.30	3	4.67±0.20	11.55±0.54
D42H29	0.38Ures	42±0.8	29±0.3	220	6.41±0.30	3	4.57±0.20	11.35±0.63
D42H29.4	0.38Ures	42±0.8	29.4±0.3	250	7.35±0.35	3	5.20±0.24	12.86±0.63
D42H35	0.38Ures	42±0.8	35±0.3	235	8.23±0.40	3	5.82±0.28	14.48±0.72
D42H36	0.38Ures	42±0.8	36±0.3	220	7.95±0.35	3	5.68±0.24	14.07±0.72
D45H20	0.38Ures	45±1	20±0.3	230	4.60±0.30	3	3.25±0.20	8.05±0.53
D45H30	0.39Ures	45±1	30±0.3	230	6.90±0.35	3	4.88±0.24	12.01±0.62
D45H26.3	0.39Ures	45±1	26.3±0.3	260	6.84±0.35	3	4.84±0.24	11.76±0.62
D48H35	0.40Ures	48±1	35±0.3	245	8.58±0.40	3	6.31±0.28	14.84±0.70
D48H35.4	0.40Ures	48±1	35.4±0.3	220	7.79±0.40	3	5.45±0.28	13.47±0.70

MOV Blocks for Station Class Arresters (High Voltage)

Designation	D48	D50	D52	D55	D60	D62	D64	D70	D78	D85	D105
IEC Class*	SL	SL	SL	SL SM	SM	SM	SM SH	SH	SH+	SH+	SH+
IEEE Class*	Station C	Station C/D	Station D	Station D	Station D	Station D/E	Station E	Station E/F	Station F/G	Station F/G	Station H
Nominal discharge current, In (kA)	10	10	10	10	10	10	10 20	20	20	20	20
Repetitive charge transfer rating, Qrs (2ms in C)	1.2 1.4	1.5	1.6	1.8	2.0	2.4	2.4	3.0	4.0	4.4	5.0
4/10μs high current (kA)	100	100	100	100	100	100	100	100	100	100	100
Long duration impulse 2ms (A)	600 700	800	800	900	1000	1200	1200	1500	2000	2200	2500

Specification	Suggested rated voltage	Diameter D	Height H	Gradient	Reference voltage, $U_{ref.1mA.DC}$	Reference current, $I_{ref.AC}$	Reference voltage, $U_{ref.AC}$	Residual voltage, U_{res}
	kV (≤)	mm	mm	V/mm	kV(r.m.s)	mA	kV(r.m.s)	kV(peak)
D48H9.4	0.38Ures	48±1	9.4±0.3	220	2.07±0.30	3	1.45±0.20	3.58±0.53
D48H26.3	0.40Ures	48±1	26.3±0.3	260	6.84±0.35	3	4.79±0.24	11.7±0.62
D48H32.7	0.40Ures	48±1	32.7±0.3	260	8.50±0.35	3	5.95±0.24	14.54±0.62
D48H34	0.40Ures	48±1	34±0.3	230	7.82±0.40	3	5.48±0.28	13.53±0.70
D48H35	0.40Ures	48±1	35±0.3	245	8.58±0.40	3	6.31±0.28	14.84±0.70
D48H35.4	0.40Ures	48±1	35.4±0.3	220	7.79±0.40	3	5.45±0.28	13.47±0.70
D50H23.5	0.40Ures	50±1	23.5±0.3	220	5.17±0.30	3	3.62±0.20	8.84±0.52
D50H24	0.40Ures	50±1	24±0.3	245	5.93±0.30	3	4.15±0.20	10.14±0.52
D50H29	0.41Ures	50±1	29±0.3	220	6.41±0.30	3	4.57±0.20	10.96±0.61
D50H36	0.43Ures	50±1	36±0.3	220	7.88±0.35	3	5.92±0.24	13.47±0.70
D50H41	0.41Ures	50±1	41±0.3	230	9.40±0.45	3	6.75±0.30	16.07±0.78
D52H24	0.40Ures	52±1	24±0.3	238	5.71±0.25	3	4.04±0.18	9.77±0.45
D55H22.5	0.41Ures	55±1	22.5±0.3	220	4.95±0.30	3	3.47±0.20	8.32±0.51
D60H9.4	0.39Ures	60±1	9.4±0.3	220	2.07±0.30	3	1.43±0.20	3.47±0.51
D60H22.5	0.41Ures	60±1	22.5±0.3	225	5.06±0.30	3	3.51±0.20	8.45±0.51
D60H23.5	0.41Ures	60±1	23.5±0.3	220	5.17±0.30	3	3.58±0.20	8.69±0.51
D60H35.4	0.41Ures	60±1	35.4±0.3	220	7.79±0.45	3	5.40±0.30	13.08±0.77
D62H23.7	0.45Ures	62.25±1	23.7±0.3	210	4.88±0.30	3	3.62±0.20	8.1±0.51
D62H35.3	0.43Ures	62.25±1	35.3±0.3	205	7.12±0.40	3	5.06±0.30	11.82±0.68
D62H41.6	0.43Ures	62.25±1	41.6±0.3	190	7.88±0.45	3	5.59±0.30	13.08±0.77
D64H9.4	0.39Ures	64.5±1	9.4±0.3	215	2.04±0.30	3	1.41±0.20	3.47±0.52
D64H35.4	0.41Ures	64.5±1	35.4±0.3	215	7.68±0.40	3	5.38±0.28	12.75±0.68
D70H9.4	0.41Ures	70±1	9.4±0.3	220	2.07±0.30	5	1.46±0.20	3.41±0.50
D70H35.4	0.43Ures	70±1	35.4±0.3	220	7.79±0.40	5	5.58±0.28	12.85±0.67
D71H22.5	0.43Ures	70±1	22.5±0.3	220	4.95±0.30	5	3.50±0.20	8.17±0.50
D78H22.5	0.39Ures	78±1	22.5±0.3	205	4.61±0.30	5	3.26±0.20	8.21±0.54
D78H35.4	0.43Ures	78±1	35.4±0.5	215	7.61±0.40	5	5.38±0.28	12.41±0.66
D78H35.4B	0.44Ures	78±1	35.4±0.3	235	8.32±0.40	5	5.91±0.28	13.39±0.66
D85H24	0.44Ures	86±1	24±0.3	240	5.76±0.30	5	4.07±0.20	9.27±0.49
D105H22.5	0.46Ures	105±1.5	22.5±0.3	210	4.73±0.30	5	3.41±0.20	7.42±0.48

MOV Blocks for Line Surge Arresters (Overhead Lines)

Designation	D33	D34	D36	D41	D42	D45	D48	D50	D52	D55	D60	D62	D64	D70	D78
IEC Class*	DM	DM	DH	DH	DH+	DH+	SL	SL	SL	SL SM	SM	SM	SM SH	SH	SH+
IEEE Class*	Y1	Y1	Y2	Y2	Y2	Y3	Y3	Y3	Y3	Y3	Y3	Y3	Y4	Y4	Y4
Upcoming IEC/IEEE class* (60099-11)	L1	L1	L2	L3	L3	L3	L4	L4	L4	L5	L5	L5	L5 L6	L6	L6
Lightning classifying current impulse 2/20, I_{pl} (kA)	5	5	10	10	10	10	15	15	15	15	15	15	15 20	20	20
High current impulse withstand 2/20 (kA)	10	10	25	25	25	25	30	30	30	30	40	40	40	40	40
Repetitive charge transfer rating, Qrs (200-230μs in C)	0.2	0.2	0.3	0.4	0.4	0.4	0.6	0.6	0.6	0.6	0.8	0.8	1.0	1.2	1.6
Long duration impulse 2ms (A)	250	250	350	500	500 600	600	600 700	800	800	900	1000	1200	1200	1500	2000

Specification	Diameter D	Height H	Gradient	Reference voltage, $U_{ref.1mA.DC}$	Reference current, $I_{ref.AC}$	Reference voltage, $U_{ref.AC}$	Residual voltage, U_{res}
	mm	mm	V/mm	kV(r.m.s)	mA	kV(r.m.s)	kV(peak)
D32H22	32±0.6	22±0.3	240	5.35±0.30	1	3.78±0.20	9.26±0.53
D33H32.9	34±0.6	32.9±0.3	240	7.90±0.35	1	5.58±0.24	13.66±0.62
D33H33	34±0.6	33±0.3	220	7.24±0.35	1	5.25±0.24	12.53±0.62
D33H36	34±0.6	36±0.3	220	7.85±0.35	1	5.73±0.20	13.58±0.7
D36H18.3	36±0.7	18.3±0.3	235	4.30±0.30	2	3.09±0.20	7.78±0.55
D36H20.7	36±0.7	20.7±0.3	235	4.86±0.30	2	3.49±0.20	8.8±0.55
D36H27.5	36±0.7	27.5±0.3	235	6.46±0.30	2	4.64±0.20	11.7±0.55
D36H30.5	36±0.7	30.5±0.3	235	7.17±0.35	2	5.14±0.24	12.97±0.64
D36H31	36±0.7	31±0.3	235	7.29±0.35	2	5.23±0.24	13.19±0.64
D36H34.5	36±0.7	34.5±0.3	235	8.11±0.40	2	5.82±0.28	14.67±0.74
D36H36.4	36±0.7	36.4±0.3	235	8.55±0.45	2	6.14±0.30	15.48±0.83
D41H22	41±0.8	22±0.3	250	5.48±0.30	3	3.88±0.20	9.70±0.54
D41H29	41±0.8	29±0.3	250	7.29±0.30	3	5.16±0.20	12.9±0.54
D41H36	41±0.8	36±0.3	250	9.05±0.40	3	6.40±0.28	16.02±0.72
D42H22	42±0.8	22±0.3	220	4.91±0.30	3	3.47±0.20	8.68±0.54
D42H24	42±0.8	24±0.3	225	5.40±0.30	3	3.73±0.20	9.56±0.54
D42H26.4	42±0.8	26.4±0.3	250	6.60±0.30	3	4.67±0.20	11.55±0.54
D42H29	42±0.8	29±0.3	220	6.41±0.30	3	4.57±0.20	11.35±0.63
D42H29.4	42±0.8	29.4±0.3	250	7.35±0.35	3	5.20±0.24	12.86±0.63
D42H35	42±0.8	35±0.3	235	8.23±0.40	3	5.82±0.28	14.48±0.72
D42H36	42±0.8	36±0.3	220	7.95±0.35	3	5.68±0.24	14.07±0.72
D45H20	45±1	20±0.3	230	4.60±0.30	3	3.25±0.20	8.05±0.53
D45H30	45±1	30±0.3	230	6.90±0.35	3	4.88±0.24	12.01±0.62
D48H9.4	48±1	9.4±0.3	220	2.07±0.30	3	1.45±0.20	3.58±0.53
D48H34	48±1	34±0.3	230	7.82±0.40	3	5.48±0.28	13.53±0.70
D48H35	48±1	35±0.3	245	8.58±0.40	3	6.31±0.28	14.84±0.70
D48H35.4	48±1	35.4±0.3	220	7.79±0.40	3	5.45±0.28	13.47±0.70
D50H24	50±1	24±0.3	245	5.93±0.30	3	4.15±0.20	10.14±0.52
D50H29	50±1	29±0.3	220	6.41±0.30	3	4.57±0.20	10.96±0.61
D50H36	50±1	36±0.3	220	7.88±0.35	3	5.92±0.24	13.47±0.70

Specification	Diameter D	Height H	Gradient	Reference voltage, $U_{ref.1mA.DC}$	Reference current, $I_{ref.AC}$	Reference voltage, $U_{ref.AC}$	Residual voltage, U_{res}
	mm	mm	V/mm	kV(r.m.s)	mA	kV(r.m.s)	kV(peak)
D52H24	52±1	24±0.3	238	5.71±0.25	3	4.04±0.18	9.77±0.45
D55H22.5	55±1	22.5±0.3	220	4.95±0.30	3	3.47±0.20	8.32±0.51
D60H9.4	60±1	9.4±0.3	220	2.07±0.30	3	1.43±0.20	3.47±0.51
D60H22.5	60±1	22.5±0.3	225	5.06±0.30	3	3.51±0.20	8.45±0.51
D60H23.5	60±1	23.5±0.3	220	5.17±0.30	3	3.58±0.20	8.69±0.51
D60H35.4	60±1	35.4±0.3	220	7.79±0.45	3	5.40±0.30	13.08±0.77
D62H23.7	62.25±1	23.7±0.3	210	4.88±0.30	3	3.62±0.20	8.1±0.51
D62H35.3	62.25±1	35.3±0.3	205	7.12±0.40	3	5.06±0.30	11.82±0.68
D62H41.6	62.25±1	41.6±0.3	190	7.88±0.45	3	5.59±0.30	13.08±0.77
D64H9.4	64.5±1	9.4±0.3	215	2.04±0.30	3	1.41±0.20	3.47±0.52
D64H35.4	64.5±1	35.4±0.3	215	7.68±0.40	3	5.38±0.28	12.75±0.68
D70H9.4	70±1	9.4±0.3	220	2.07±0.30	5	1.46±0.20	3.41±0.50
D70H35.4	70±1	35.4±0.3	220	7.79±0.40	5	5.58±0.28	12.85±0.67
D70H22.5	70±1	22.5±0.3	220	4.95±0.30	5	3.50±0.20	8.17±0.50
D78H22.5	78±1	22.5±0.3	205	4.61±0.30	5	3.26±0.20	8.21±0.54
D78H35.4	78±1	35.4±0.5	215	7.61±0.40	5	5.38±0.28	12.41±0.66
D78H35.4B	78±1	35.4±0.3	235	8.32±0.40	5	5.91±0.28	13.39±0.66

In practice, MOV blocks above D78 are rarely used for LSA applications outside China, though they can be applied in specific cases involving hollow-core polymer designs, typically above 800 kV.

High Gradient MOV Blocks for GIS Arresters (Gas Insulated Switchgears)

Designation	D60	D70	D85	D99	D115
IEC Class*	SL	SL	SM	SH	SH+
IEEE Class*	Station C	Station C/D	Station D	Station E/F	Station F/G
Nominal discharge current, In (kA)	10	10	10	20	20
Repetitive charge transfer rating, Qrs (2ms in C)	1.2	1.6	2.4	3.0	4.0
4/10μs high current (kA)	100	100	100	100	100
Long duration impulse 2ms (A)	600	800	1200	1500	2000

Specification	Diameter D	Height H	Gradient	Reference voltage, $U_{ref.1mA.DC}$	Reference current, $I_{ref.AC}$	Reference voltage, $U_{ref.AC}$	Residual voltage, U_{res}
	mm	mm	V/mm	kV(r.m.s)	mA	kV(r.m.s)	kV(peak)
D60H22.5HG	60±1	22.5±0.3	350	7.88±0.45	5	5.62±0.30	13.40±0.78
D70H21.4HG	70±1	21.4±0.3	370	7.92±0.45	5	5.60±0.30	12.59±0.74
D70H22.5HG	70±1	22.5±0.3	330	7.43±0.45	5	5.33±0.30	11.89±0.75
D85H21.4HG	86±1	21.4±0.3	370	7.91±0.45	5	5.75±0.30	12.12±0.72
D99H21.4HG	99±1	21.4±0.3	360	7.70±0.45	5	5.30±0.30	11.60±0.72
D108H24HG	108±1	24.0±1	360	8.64±0.45	5	5.90±0.30	14.68±0.72
D115H21.4HG	115±1.5	21.4±0.3	360	7.70±0.45	10	5.35±0.30	11.55±0.73

MOV Blocks for DC Arresters (HVDC Systems and Other DC Applications)

Designation	D71	D78	D99	D105
IEC Class*	SH	SH+	SH+	SH+
IEEE Class*	Station E/F	Station F/G	Station G/H	Station H
Nominal discharge current, In (kA)	20	20	20	20
Repetitive charge transfer rating, Qrs (2ms in C)	3.0	4.0	4.0	5.0
4/10μs high current (kA)	100	100	100	100
Long duration impulse 2ms (A)	1500	2000	2000	2500

Specification	Diameter D	Height H	Gradient	Reference voltage, $U_{ref.1mA.DC}$	Reference current, $I_{ref.AC}$	Reference voltage, $U_{ref.AC}$	Residual voltage, U_{res}
	mm	mm	V/mm	kV(r.m.s)	mA	kV(r.m.s)	kV(peak)
D71H22.5DC	71±1	22.5±0.3	220	4.95±0.30	5	3.57±0.20	8.17±0.50
D78H22.5DC	78±1	22.5±0.3	205	4.61±0.30	5	3.26±0.20	8.21±0.54
D78H35.4DC	78±1	35.4±0.3	213	7.55±0.45	5	5.40±0.30	12.45±0.8
D99H22.5DC	99±1	22.5±0.3	220	4.95±0.30	5	3.57±0.20	8.42±0.50
D105H22.5DC	105±1.5	22.5±0.3	210	4.73±0.30	5	3.41±0.20	7.42±0.48

MANUFACTURING PROCESS

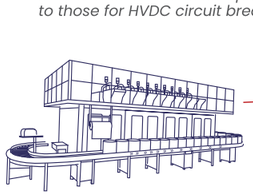
TGE's manufacturing process for MOVs reflects a commitment to excellence through innovation, precision, and stringent quality control. By combining advanced technology with deep expertise, TGE ensures that every MOVs meets the highest industry standards. Below, we outline the seven key steps in TGE's MOV production process, highlighting the unique techniques and practices that set TGE apart.

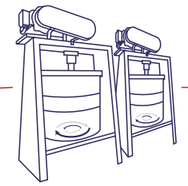
MOV MANUFACTURING FLOWCHART

1 Weighing and Mixing

Customization: *Additives are tailored to specific product requirements. For example, MOVs for AC distribution systems have different constituents compared to those for HVDC circuit breakers.*

Output: *A slurry is formed by blending the materials with organic solvents and binders, setting the foundation for consistent electrical performance.*





Additive Materials Procurement

Additive Materials Mixing

Additive Preparation

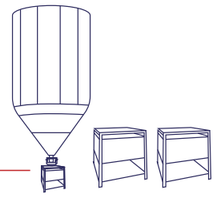
Zinc Oxide Raw Materials

Process: *The process begins with the precise weighing and mixing of raw materials. Zinc oxide (ZnO), the primary constituent, comprises about 90% of the MOV's mass, while oxide additives fine-tune characteristics like non-linear V-I behavior, grain growth, and electrical stability.*

- Main Ingredient Analysis
- Average Particle Size
- Impurity Content of Raw Material
- Moisture Content Measurement
- Organic Binders
- Deionized Water Preparation
- Conductivity

2 Dehumidification or Spray Drying

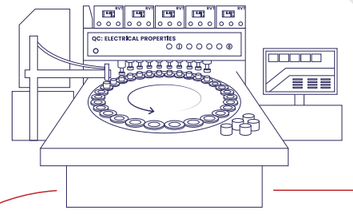
Process: *The slurry is injected into modern spray dryers to remove moisture, yielding granulated powder. The quality of this oxidized granulation powder is critical for determining the MOV's electrical properties.*



Slurry Manufacturing / Granulation Process (Key Step)

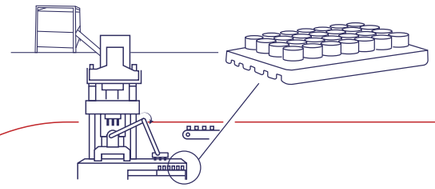
- Particles Size Analysis
- Bulk Density Measurement
- Moisture Content Measurement

Output: *High-quality granulation powder ready for forming.*



3 Pressing or Forming

Process: *The granulated powder is pressed into preliminary blocks shapes through dry pressing. This visually significant step gives the MOV its basic structure.*



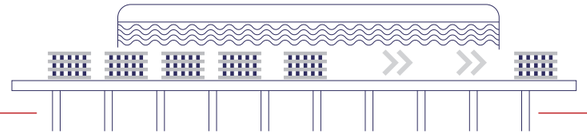
MOV Blocks Forming

- Density
- Height

Output: *Preliminary MOV Blocks with precise dimensions.*

4 Pyrolyzing and Sintering

Key Feature: *TGE's furnaces are designed for precise temperature control and rapid cooling curves, ensuring uniformity and stability.*



MOV Blocks Pre-Sintering (Pyrolyzing)

Process:
Pyrolyzing: Organic solvents and binders are removed at high temperatures, leaving a "green block."
Sintering: Blocks are heated up to 1050°C in custom-designed tunnel furnaces, forming grains and grain boundaries that define the MOV's electrical performance.

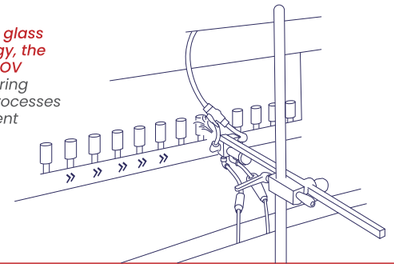
MOV Final Sintering (Special Process)

- Voltage
- Shrinkage Ratio
- Leakage Current

Output: *Finished MOV Blocks that shrink by approximately 17% in volume during the process.*

5 Passivation or Coating

Key Expertise:
TGE specializes in glass coating technology, the cutting edge of MOV passivation, *requiring highly sensitive processes to ensure consistent quality.*



MOV Blocks Glass Coating Spraying

- Visual Inspection

Process: *A passivation layer is applied to the lateral surface of the MOV. This step is vital for : Protecting the MOV from environmental factors like moisture and contamination. Enhancing its flashover resistance.*

Output: *Fully coated MOV Blocks with enhanced durability.*

MOV Blocks Polishing (Grinding)

- Height
- Flatness
- Perpendicularity
- Visual Inspection

MOV Blocks Cleaning

- Cleanliness

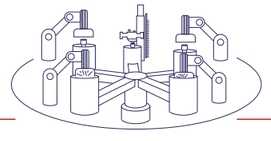
MOV Blocks Aluminum Spraying

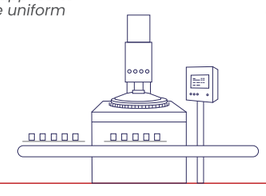
- Adhesion
- Aluminum or Not

Output: *MOV Blocks ready for integration into the surge arrester stacks.*

6 Surface Preparation and Electrode Application

Process: *Surfaces are ground flat using a water-assisted grinding machine to remove residual coating material and ensure evenness.*
Aluminum electrodes *(~0.1mm thick) are applied to create a conductive surface, ensuring the uniform distribution of energy across the MOV.*





MOV Blocks Per-Piece Routine Testing

- 100% Electrical Performance Testing

Process: *Comprehensive electrical tests are conducted to verify MOV characteristics, including reference voltage and residual voltage performance.*
Routine test such as the long-duration current impulses test ensure grain and boundary properties meet specifications.

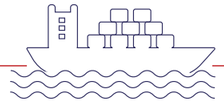
Quality Tracking: *Rejection rates are closely monitored to maintain high production standards.*

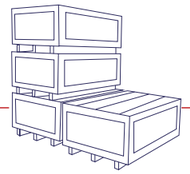
MOV Blocks Testing

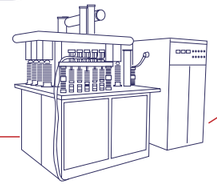
- U_{1mA} Test
- Long Duration Impulse Testing
- High Current Impulse
- Aging Test

Output: *MOV Blocks that meet all performance and reliability requirements.*

7 Final Verification and Testing







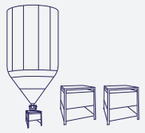
Packaging & Storage

Shipping

Key Distinctions in TGE's Manufacturing Process

High-Quality Materials

Rigorous inspection of zinc oxide and other inputs.

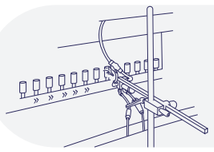


Advanced Granulation Technology

Automated control for precise particle size and temperature.

Custom-Designed Furnaces

Tailored for optimal sintering and cooling conditions.



Expert Glass Coating

Cutting-edge passivation for environmental resistance.

Comprehensive Testing

100% rigorous routine tests, complemented by in-process sampling.

By adhering to this precise and controlled manufacturing process, TGE delivers MOV Blocks that meet the stringent requirements of surge arrester manufacturers, ensuring reliability and long-term performance in a wide range of applications.

COMPETITIVE ADVANTAGE

TGE distinguishes itself as a leader in the global MOV industry by delivering unmatched quality, innovation, and reliability. Our expertise, advanced manufacturing capabilities, and commitment to rigorous quality control ensure long-term value and confidence in every product.

Criteria	TGE (Xi'an Tiangong Electric)
Long-term Value	A perfect balance of cost-effectiveness and high-performance longevity, ensuring quality and reliability without compromise.
Stable Quality	Low rejection rates achieved through rigorous quality control and highly reliable production processes.
Advanced Testing	Comprehensive in-house impulse testing up to 200kA (4/10μs), 100kA (8/20μs), and 65kA (2/20μs), fully meeting IEC and IEEE standards.
Glass Coating Expertise	Cutting-edge glass coating technology ensures long-term stability and environmental resistance.
Customization Capabilities	Tailored MOV designs for specialized applications, including HVDC and GIS, with fast turnaround for custom solutions.
Compliance with Standards	Full compliance with IEC, IEEE, and GB standards, including the latest requirements such as IEC 60099-9 for HVDC and the upcoming IEC/IEEE 60099-11 for Line Surge Arresters.
Production Capacity	High-capacity manufacturing with 450 tons/month and 24 million pieces/month, ensuring reliable global supply.
R&D Innovation	A state-of-the-art 11,000 m² R&D center, backed by 30+ patents and continuous advancements in MOV formulas and manufacturing processes.
Energy Efficiency & Sustainability	Advanced waste heat recovery systems contribute to energy conservation and environmental protection.
Partnerships and Market Reach	Strong global presence and trusted partnerships with leading surge arrester manufacturers worldwide.
Customer Support	A dedicated technical support team providing application-specific guidance and assistance.

ADDRESSING CUSTOMER NEEDS

Critical Factors Impacting Surge Arrester Manufacturers

01

Type Test Failures

Surge arrester manufacturers invest heavily in international IEC/IEEE type tests to validate the quality and performance of their products. A significant pain point arises when a type test fails due to:

- Inconsistent MOV quality.
- Instabilities in production processes that affect electrical characteristics. These failures lead to high costs, delays, and reputational damage.

02

Long-Term Stability Issues

Over time, stability in MOVs may degrade, causing surge arresters to fail during acceptance tests conducted by key end clients. Such failures not only damage customer trust but can also jeopardize critical business relationships.

03

Integration Challenges in Complex Designs

Surge arresters are built using complex and sensitive designs to seal MOV stacks. Low-quality MOVs can:

- Cause routine test failures (e.g., partial discharge or lightning impulse residual voltage tests).
- Disrupt manufacturing processes, leading to high rejection rates and production delays.

TGE's Support and Solutions

01 Unmatched Quality and Consistency

Stable Production Processes: TGE places a strong emphasis on granulation and firing, the two most critical steps in MOV production. These processes are tightly monitored by a dedicated technical team to ensure consistency and prevent deviations that could affect stability or performance.

Rigorous Testing: Each MOV undergoes 100% routine testing for characteristics such as residual voltage and long-duration impulse performance, ensuring that every block meets stringent quality requirements.

02 Focus on Long-Term Stability

TGE's MOVs are designed to maintain their electrical and mechanical stability over time, reducing the risk of failures during acceptance tests or field operations.

Rapid Response to Deviations: If any performance deviations are detected during production, TGE promptly investigates and implements corrective actions to safeguard stability.

03 Reliability in Complex Designs

Precision Manufacturing: TGE's fully automated processes ensure MOVs with high dimensional accuracy and performance reliability, enabling seamless integration into sensitive surge arrester designs.

Advanced Coating Techniques: TGE's expertise in glass coating technology ensures long-term resistance to environmental factors, enhancing overall arrester performance.

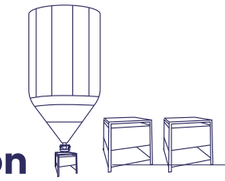
04 Minimizing Customer Risks

By ensuring consistent quality and performance, TGE helps manufacturers pass type tests on the first attempt, avoiding costly retests.

Stable MOV production reduces rejection rates during surge arrester manufacturing, ensuring smoother operations and higher efficiency.

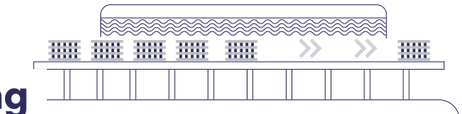
Customer visit symbolizing strong relationships with customers and transparency in the manufacturing process.

Special Focus on Production Stability



Granulation

Advanced granulation technology ensures precise control over particle size, internal temperature, and component uniformity, which directly impact MOV performance.



Firing

Custom-designed furnaces with controlled temperature profiles and cooling curves guarantee the formation of stable grains and grain boundaries, critical for MOV reliability.

TGE's commitment to production stability is unparalleled. The granulation and firing processes are meticulously controlled to achieve consistent performance across batches.

TGE's proactive approach includes:

Real-time monitoring of production processes by a team of highly skilled technicians.

Immediate investigation and resolution of any performance deviations.

Continuous improvement through the implementation of beneficial changes identified during production.

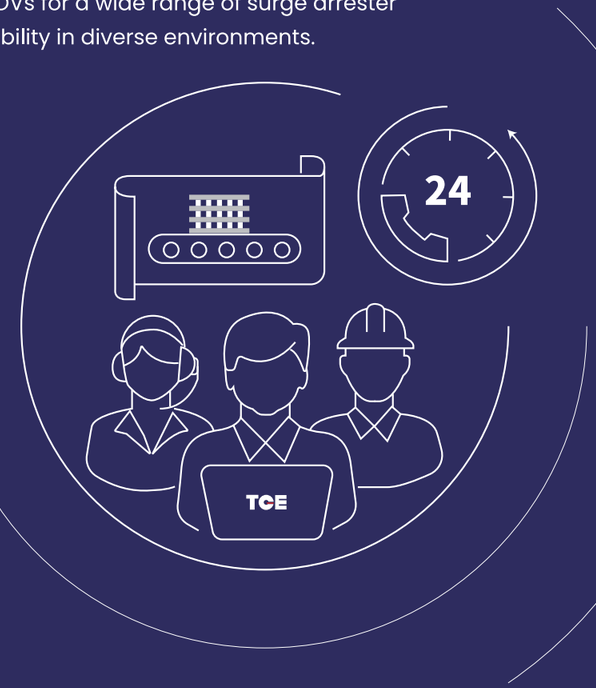
450 T

Custom-designed furnaces with a total capacity of 450 tons per month

CUSTOMIZATION AND FLEXIBILITY

TGE takes pride in its ability to provide tailored solutions for surge arrester manufacturers, offering unmatched flexibility to meet unique customer requirements. TGE specializes in designing and manufacturing customized MOVs for a wide range of surge arrester applications, ensuring compatibility and reliability in diverse environments.

Tailored Solutions for Surge Arrester Manufacturers



Direct Consultation

Customers can contact TGE with specific technical parameters or requirements, and our team of experts will recommend the most suitable MOV solution within 24 hours.

Existing Options or Customization

- Customers may choose from TGE's extensive portfolio of existing MOVs with proven performance.
- For unique applications, TGE can customize MOV formulas and manufacturing processes to achieve desired specifications, such as exceptionally high current performance up to 200kA.

Batch-Specific Customization

If customer demand meets the required batch size, TGE can adjust while maintaining consistent quality:

- The MOV formula for specific energy or voltage performance.
- The manufacturing process to achieve unique dimensional or electrical characteristics.

TESTING AND COMPLIANCE

TGE

highest standards of quality

QA
QUALITY ASSURANCE

QC
QUALITY CONTROL

meets or surpasses standards

IEC 60099

IEEE C62.11

GB
STANDARDS

At TGE, we ensure that every MOV Block is produced to the highest standards of quality, reliability, and compliance. Through rigorous quality assurance (QA) and quality control (QC) measures, TGE eliminates uncertainty and instills confidence in every surge arrester manufacturer. Our testing protocols and advanced facilities exceed industry expectations, guaranteeing that each MOV meets or surpasses the stringent requirements of IEC 60099 series, IEEE C62.11, and GB standards.

Rigorous Testing Protocols

Routine Tests

Performed on 100% of MOV Blocks to ensure grain properties and electrical performance meet design specifications such as :

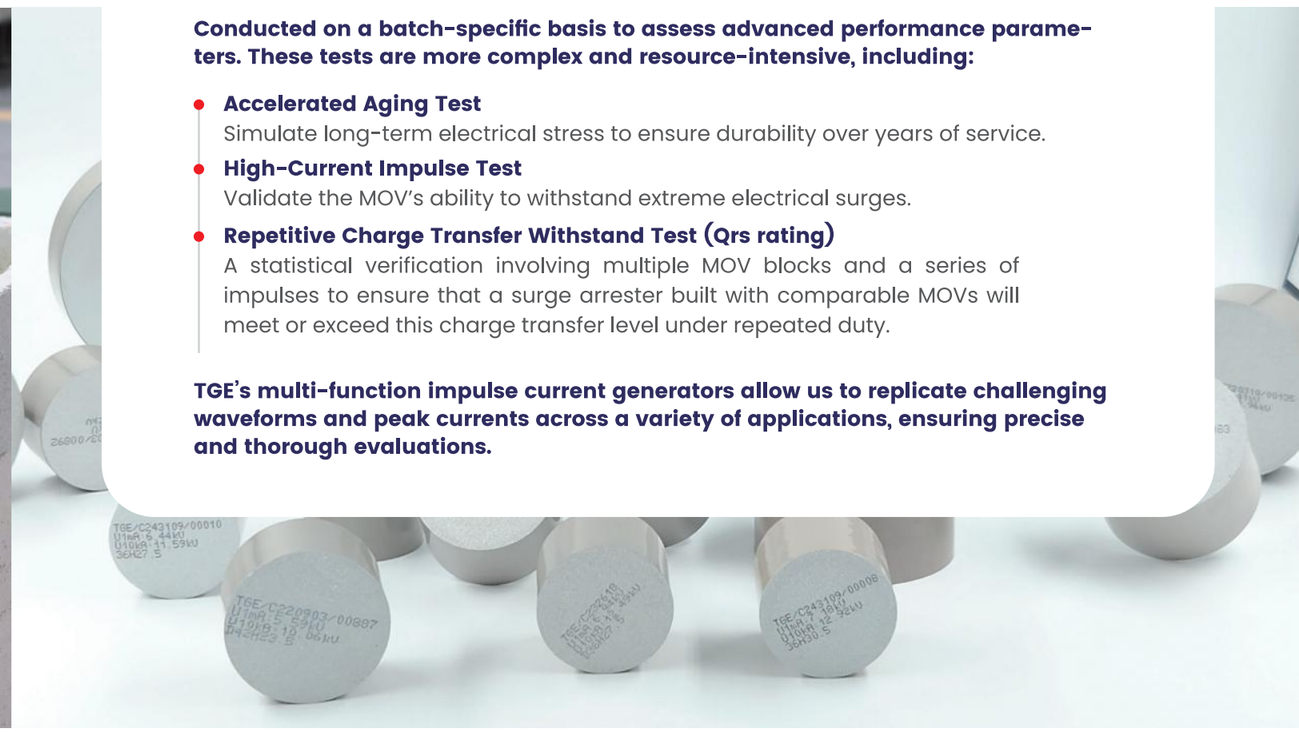
- **Long-Duration Impulse Test**
  Validates the MOV's ability to handle energy injections.
- **Residual Voltage Test**
  Confirms the protection level of each blocks, ensuring consistency and conformity with customer requirements.
- **Reference Voltage Test**
  Verify the gradient and operational voltage rating of each MOV under a predefined reference current.

Sampling Tests

Conducted on a batch-specific basis to assess advanced performance parameters. These tests are more complex and resource-intensive, including:

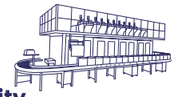
- **Accelerated Aging Test**
  Simulate long-term electrical stress to ensure durability over years of service.
- **High-Current Impulse Test**
  Validate the MOV's ability to withstand extreme electrical surges.
- **Repetitive Charge Transfer Withstand Test (Qrs rating)**
  A statistical verification involving multiple MOV blocks and a series of impulses to ensure that a surge arrester built with comparable MOVs will meet or exceed this charge transfer level under repeated duty.

TGE's multi-function impulse current generators allow us to replicate challenging waveforms and peak currents across a variety of applications, ensuring precise and thorough evaluations.



Key Highlights of TGE's Manufacturing and Testing Excellence

TGE's manufacturing process is underpinned by comprehensive and continuous quality control, integrating advanced technologies and proven methodologies at every stage:

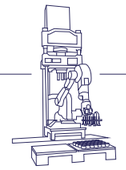


01
High-Quality Raw Materials

Stringent incoming inspections ensure the purity and consistency of zinc oxide and additive materials used in production. This rigorous control guarantees optimal electrical characteristics in the final MOV Blocks.

02
Advanced Granulation Towers

Precise control over particle size, internal temperature, and component uniformity ensures consistent performance across all MOV batches. Granulation quality directly impacts the electrical properties and longevity of MOV Blocks.

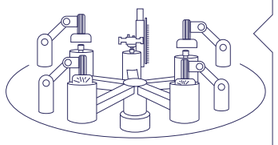


03
Fully automatic molding process

The molding process adopts advanced molding technology and an automated production system. Through automatic loading, pressing and unloading by mechanical hands, the entire process is operated without human intervention. The high uniformity granular powder is molded in precise molds and combined with online density and height dual detection to ensure precise and consistent dimensions of the raw materials. This process has significant advantages such as high molding accuracy, fast production efficiency, and strong batch stability, providing a high-quality and standardized molding foundation for subsequent sintering.

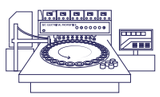
04
Automated Aluminium Process

Automated electrode application ensures uniformity and high conductivity, critical for energy distribution across MOV surfaces.



05
Automated intelligent sintering production line

The entire process is carried out by automated mechanical arms, combined with TGE custom-made kilns for precise temperature control. This ensures uniform formation of the clay body, creates excellent crystal grains and boundary structures, and guarantees stable electrical performance of MOV.



06
Rigorous Routine Testing

Every MOV Blocks undergoes rigorous electrical and energy withstand tests, ensuring conformity with design specifications and long-term operational reliability.

07
Comprehensive Sampling Tests

Critical tests like high-current impulses and accelerated aging are conducted on selected batches using full-scale test facilities, replicating real-world stress conditions.

R&D Test Center

Power Frequency Withstand Voltage Test Equipment

Partial Discharge Laboratory

Highly versatile and robust multi-function impulse current generator

TGE'S R&D ECOSYSTEM:
Independent Innovation and Collaborative Strategy

Organizational & Collaborative Structure

TGE leads a comprehensive R&D ecosystem that integrates the strengths of academic institutions, certification bodies, and industry partners. As the leading unit of this multi-tiered alliance, TGE collaborates with:

Universities and Research Institutes specializing in material science and electrical engineering

Certification bodies such as Xi'an High Voltage Apparatus Research Institute (**XIHARI**) and China Electric Power Research Institute (**CEPRI**).

Key Industrial Partners, including raw material suppliers and component manufacturers

This collaborative framework ensures a dynamic exchange of knowledge and resources, enabling a continuous feedback loop between research, industrial application, and product validation.

Strategic Focus Areas

Driven by both internal innovation and strategic partnerships, TGE's R&D efforts target three critical areas essential to MOV technology:

01 Advanced Material Formulations

02 Optimization of MOV Manufacturing Processes

03 Integration of Smart Manufacturing Equipment

These areas reflect TGE's long-term commitment to process excellence, cost efficiency, and product reliability.

Research Summary & Technical Findings

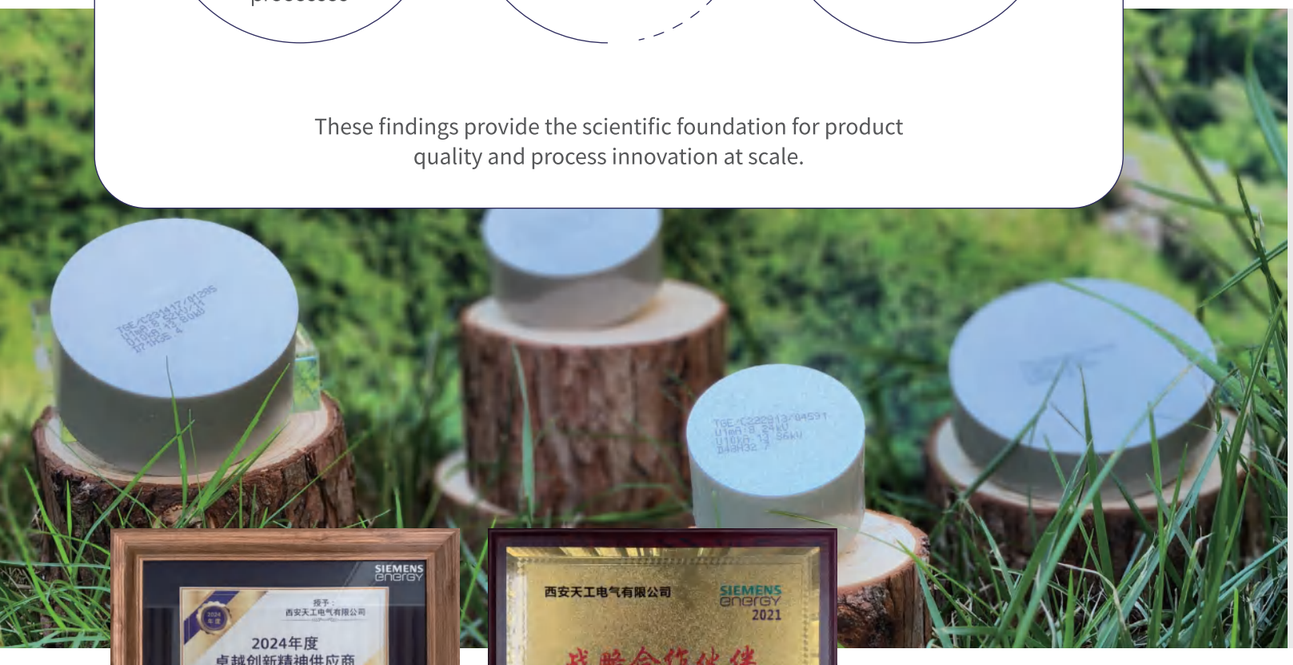
A notable outcome of TGE's R&D program is the development of high-performance MOVs through advanced control of granulated powder properties. Research shows that the powder used in MOV production exhibits a monodisperse Particle Size Distribution (PSD) with Gaussian characteristics, indicating highly uniform particle morphology. This level of control plays a vital role in:

01
Improving the stability and consistency of manufacturing processes

02
Enhancing electrical performance under demanding conditions

03
Ensuring long-term reliability of the final product

These findings provide the scientific foundation for product quality and process innovation at scale.



2024 Outstanding Innovative Spirit Supplier

2021 Strategic Partner

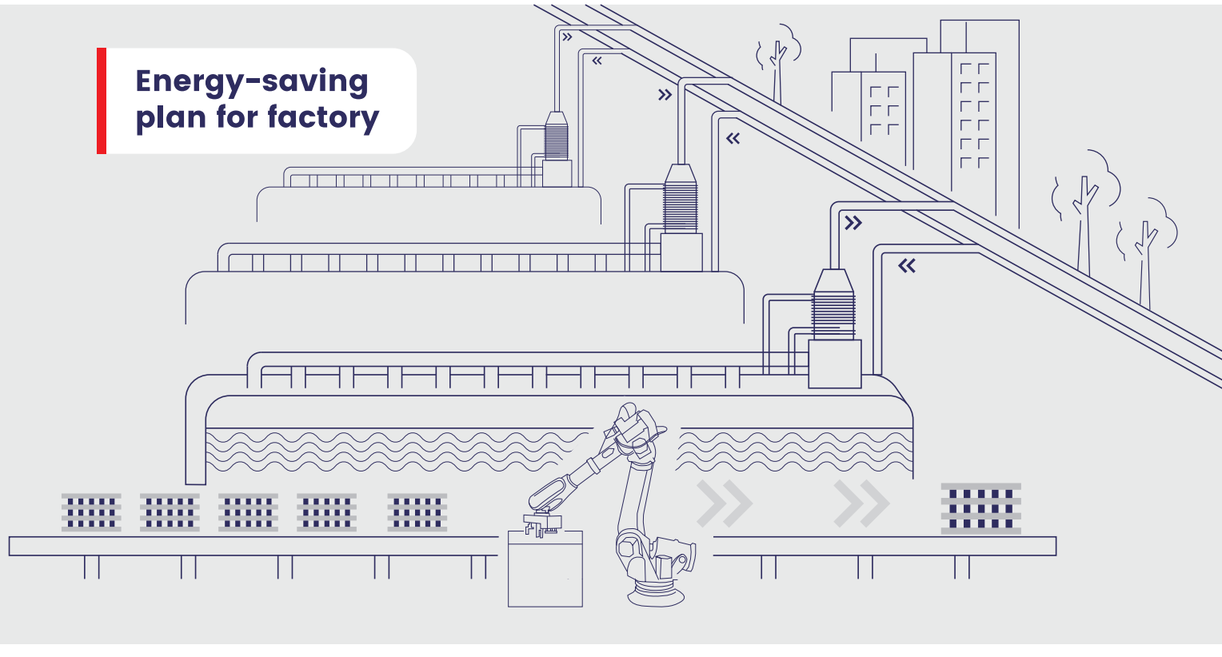
Innovative Sustainability

TGE's new manufacturing facility embodies the company's commitment to sustainable industrial development by integrating advanced environmental standards with innovative engineering practices. Designed to meet the latest sustainability regulations, the facility not only optimizes energy use but also minimizes its ecological footprint across the full production lifecycle.

A key highlight of the factory's energy conservation approach is the reuse of waste heat generated by tunnel furnaces, which is efficiently captured and repurposed to supply hot water throughout the site—a solution that reduces overall energy consumption and enhances thermal efficiency. This practical integration of energy recovery systems reflects TGE's broader philosophy of environmental responsibility through technical innovation.

Beyond infrastructure, TGE continues to lead in the development of high-performance, eco-conscious MOVs, emphasizing low-emission processes, smart resource utilization, and sustainable product design. By aligning product performance goals with environmentally friendly manufacturing, TGE sets a benchmark for sustainable innovation in the power protection industry.

Energy-saving plan for factory



Waste Heat Recovery Units Installed on Tunnel Furnaces for Energy Reuse