

# Toughened Glass Insulators

## Introduction

For many customers and applications, toughened glass provides the highest level of performance and long-term security for high voltage insulation. MacLean is pleased to be able to provide our customers toughened glass insulators from stock held at our South Carolina factory. The products have service experience dating back to 1957 with installations in a broad range of operating conditions with more than 300 utilities worldwide at voltages from 15 to 1150kV AC and up to 800kV DC. Insulators are manufactured in two factory locations to insure steady supply and sufficient capacity for even the largest projects. Both plants utilize the same manufacturing process and the same automated 'Waltek' equipment for the toughening process with an annual output of more than 14 million pieces.

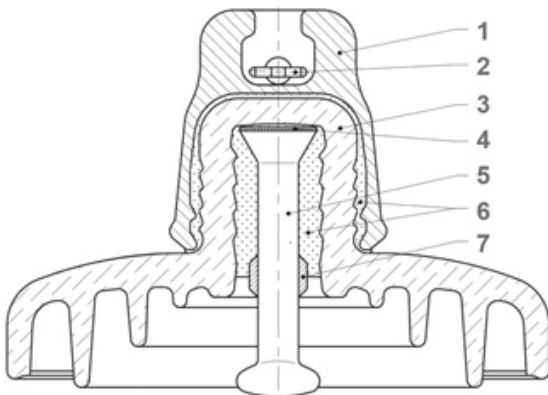
The products have been subjected to testing in the factory laboratories and international independent test centers to confirm the customer's requirements and national standards. The toughened glass insulators are tested per ANSI, IEC, CSA and GOST. Toughened glass has many inherent characteristics that makes it especially suitable for HV, EHV and DC applications:

- Unlike porcelain or non-ceramic materials, toughened glass insulating material never ages.
- The binary status (all or none) of TG is desirable for line maintenance. In the event of electrical or mechanical damage, the shell collapses allowing maintenance personnel to easily identify faults visually from the ground without any special instruments or tools
- TG has 4 times the mechanical impact strength dictated by ANSI (90in/lb) compared to porcelain, which reduces losses due to shell damage during construction and handling
- Even with the insulating shell absent, the toughened glass stub is guaranteed to retain its mechanical strength, eliminating the chance of line drop due to insulator separation
- All units are subjected to routine mechanical proof load AND 4 minute electrical flashover test prior to shipment, so the M&E integrity is guaranteed on every unit shipped.

The current designs are based on 50-year-old operating experience in the field of insulation at the important high-voltage objects in harsh environmental conditions:

- Standard and FOG profile
- Ultra-FOG glass insulator profiles
- Silicone Coated
- DC insulators

## Zinc Sleeves

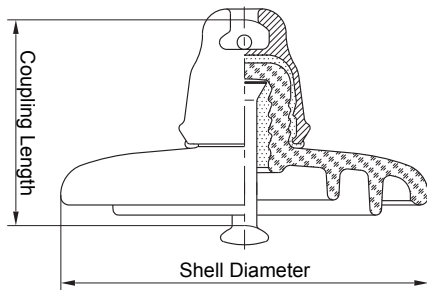


### MacLean Toughened Glass Design Details

1. Cap – Cast Iron / Hot Dip Galvanized
2. Locking Device – Stainless Steel Cotter Pin
3. Toughened Glass Shell
4. Gasket – Interlaying Material
5. Pin – Forged Steel / Hot Dip Galvanized
6. Alumina Cement
7. Zinc Sleeve – Supplied standard on all MG Insulators

Insulator Markings – permanent markings, as required by ANSI, are marked both on the Cap and Shell of the insulators. Markings include MPS logo, M&E Rating, ANSI Class, Plant MFG ID and Date Code.

## Standard Shell Profile



### Features

- Certified to ANSI C29.2B Standard / CSA / IEC
- Zinc Sleeve Standard on all MG Insulators
- Hot Cured Alumina Cement
- 400 in-lbs Mechanical Impact Strength
- Standard Pack = 6 Units / Wirebound Crate
- Silicone Coated Insulators Available

Catalog Number		MG523Z	MG525Z	MG528Z	MG5211Z	MG300Z	MG400Z
ANSI Class		52-3	52-5	52-8	52-11	IEC-24	IEC-28
Coupling Type		B	J	K	K		
<b>MECHANICAL</b>							
Min. Mechanical Failing Load	lbs	20,000	30,000	40,000	50,000	67,400	90,000
	kN	100	136	180	222	300	400
Proof Routine Test Mech. Load	lbs	10,000	15,000	20,000	25,000	33,700	45,000
	kN	45	68	90	111	150	200
<b>DIMENSIONS</b>							
Shell Diameter	in / mm	10.0 / 255	10.0 / 255	11.0 / 280	11.0 / 280	12.6 / 320	14.2 / 360
Coupling Length	in / mm	5.75 / 146	5.75 / 146	5.75 / 146	6.14 / 156	7.7 / 195	8.1 / 205
Leakage Distance	in / mm	12.6 / 320	12.6 / 320	15.2 / 385	16.9 / 428	19.1 / 485	21.7 / 550
<b>ELECTRICAL</b>							
Dry Flashover	kV	80	80	80	80	95	105
Wet Flashover	kV	50	50	50	50	55	60
CIFO +	kV	125	125	125	140	145	155
CIFO -	kV	130	130	130	140	145	155
Puncture Voltage	kV	130	130	130	130	130	130
RIV Test Voltage	kV	10	10	10	10	10	10
Max. RIV at 1 MHz	µV	50	50	50	50	50	50
<b>PACKAGING</b>							
Weight / 1	lbs	8.8	9.3	13.6	17.4	25.4	35.7
# Units / Wirebound	Qty	6	6	6	6	6	6
Weight / Wirebound	lbs	57	60	86	110	158	216
# Units / Pallet	Qty	96	96	54	54	54	54
Weight / Pallet	lbs	962	1010	824	1040	1472	1644
Bulk Pack "-SC"	Qty	210	210	144	120	—	—
Weight / Bulk Pack	lbs	1900	2000	2000	2550	—	—

### Notes:

- 1) For Bulk Pack option, add suffix "-SC" to the catalog number [MG525Z-SC]
- 2) For Silicone Coated option, add suffix "-SIL" to the catalog number [MG525Z-SIL]

# Toughened Glass Insulators

## Flashover for 52-3, 52-5, and 52-8

Number of insulators in the string	Connection Length		Power frequency flashover voltage, kV		Critical impulse flashover voltage, kV	
	Inch	mm	dry	wet	Positive	Negative
2	11.50	292	145	90	220	225
3	17.25	438	205	130	315	320
4	23.00	584	270	170	410	420
5	28.75	730	325	215	500	510
6	34.50	876	380	255	595	605
7	40.25	1022	435	295	670	695
8	46.00	1168	485	335	760	780
9	51.75	1314	540	375	845	860
10	57.50	1461	590	415	930	945
11	63.25	1607	640	455	1015	1025
12	69.00	1753	690	490	1105	1105
13	74.75	1899	735	525	1185	1190
14	80.50	2045	785	565	1265	1275
15	86.25	2191	830	600	1345	1360
16	92.00	2337	875	635	1425	1440
17	97.75	2483	920	670	1505	1530
18	103.50	2629	965	705	1585	1615
19	109.25	2775	1010	740	1665	1700
20	115.00	2921	1050	775	1745	1785
21	120.75	3067	1100	810	1825	1870
22	126.50	3213	1135	845	1905	1955
23	132.25	3359	1180	880	1985	2040
24	138.00	3505	1220	915	2065	2125
25	143.75	3651	1260	950	2145	2210
26	149.50	3797	1300	985	2220	2295
27	155.25	3943	1340	1015	2300	2380
28	161.00	4089	1380	1045	2375	2465
29	166.75	4235	1425	1080	2455	2550
30	172.50	4382	1460	1110	2530	2635

**Notes:**

- Flashover voltages are based on the tests according to ANSI C 29.1.
- Characteristics are given for the strings without screens and arcing horns.
- Dry power frequency flashover voltage  $\pm 5\%$
- Wet power frequency flashover voltage  $\pm 10\%$
- Critical impulse flashover voltage  $\pm 8\%$

## Flashover for 52-11

Number of insulators in the string	Connection Length		Power frequency flashover voltage, kV		Critical impulse flashover voltage, kV	
	Inch	mm	dry	wet	Positive	Negative
2	12.28	312	145	90	220	225
3	18.43	468	205	130	315	320
4	24.57	624	270	170	410	420
5	30.71	780	345	225	520	530
6	36.85	936	400	275	615	625
7	42.99	1092	455	315	690	715
8	49.13	1248	510	360	765	815
9	55.28	1404	570	405	920	925
10	61.42	1560	640	455	1015	1025
11	67.56	1716	690	490	1105	1105
12	73.70	1872	735	525	1185	1190
13	79.84	2028	785	565	1265	1275
14	85.98	2184	830	600	1345	1360
15	92.13	2340	875	635	1425	1440
16	98.27	2496	920	670	1505	1530
17	104.41	2652	965	705	1585	1615
18	110.55	2808	1010	740	1665	1700
19	116.69	2964	1050	775	1745	1785
20	122.83	3120	1100	810	1825	1870
21	128.98	3276	1135	845	1905	1955
22	135.12	3432	1180	880	1985	2040
23	141.26	3588	1220	915	2065	2125
24	147.40	3744	1260	950	2145	2210
25	153.54	3900	1300	985	2220	2295
26	159.69	4056	1340	1015	2300	2380
27	165.83	4212	1380	1045	2375	2465
28	171.97	4368	1425	1080	2455	2550
29	178.11	4524	1460	1110	2530	2635
30	184.25	4680	1495	1140	2605	2720

**Notes:**

- Flashover voltages are based on the tests according to ANSI C 29.1.
- Characteristics are given for the strings without screens and arcing horns.
- Dry power frequency flashover voltage  $\pm 5\%$
- Wet power frequency flashover voltage  $\pm 10\%$
- Critical impulse flashover voltage  $\pm 8\%$