



### Identification of PARS Station Class Surge Arresters

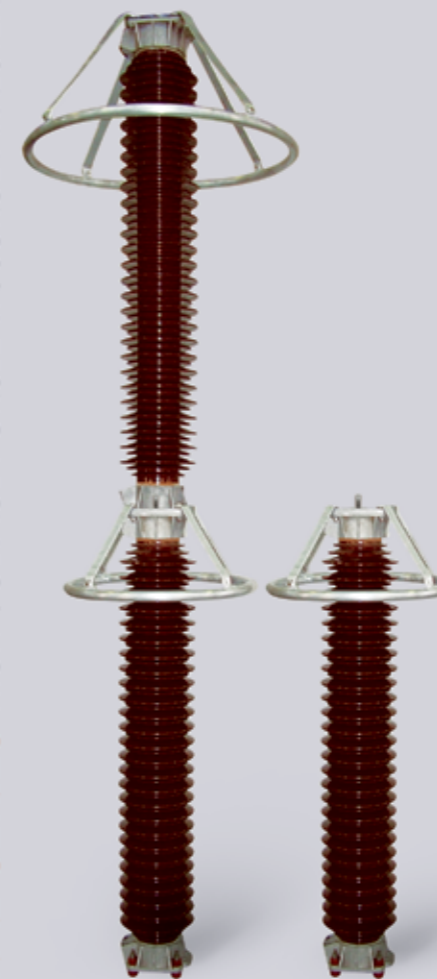
#### PA E 2 360 - 4 B 4 2

PA	E	2	360	4	B	4	2		
PARS Arrester	Porcelain Type	Arrester Type*	Rated Voltage kV	ZnO Block Size		Line Discharge Class		Number of Units	
		2		1	D48mm: $I_{2ms}=500$	2	LD 2	1	1 Unit
		3		2	D58mm: $I_{2ms}=850$	3	LD 3	2	2 Units
				3	D64mm: $I_{2ms}=1000$	4	LD 4	3	3 Units
				4	D70mm: $I_{2ms}=1200$	5	LD 5		
				5	D74mm: $I_{2ms}=1300$				
	6	D78mm: $I_{2ms}=1500$							

\*Table 1

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**PAE SERIES HIGH VOLTAGE PORCELAIN SURGE ARRESTER**



**PARS Electrical Transmission Equipment Co.**  
**PARS ARRESTER**

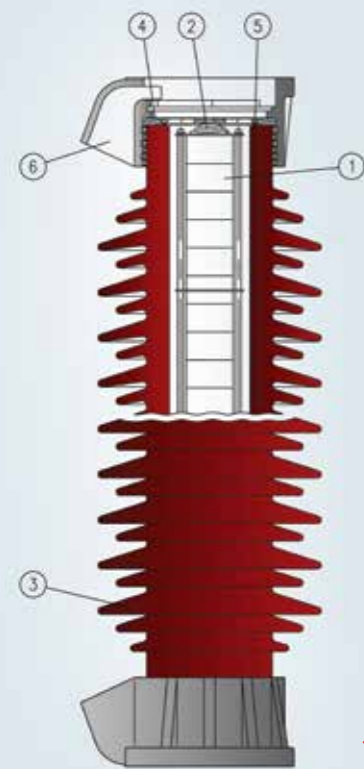
# PARS ARRESTER

## INTRODUCTION OF PAE SURGE ARRESTERS

▷ When reliability of high voltage application comes up, experience gets the main role. After production of variety of Medium voltage and high voltage surge arresters for more than 10 years, we could support the utility in improving the system reliability. The cost-effectiveness of our arresters is underscored by uncompromising quality ensuring the long service life and reliability of each application.

The PAE series have been designed based on ZnO type surge arresters with porcelain insulators. The arresters are used to protect the insulation of equipment in electrical high voltage substations against internal and external over voltages. PAEs have been designed to meet the requirement of a wide range of common installation environments, from mountain cold climate to the heat of the desert and dampness of tropical climates. These arresters consist of two main types of PAE2 and PAE3. Basically we can procure the PAE2 up to 420 kV adequate for networks up to 550 kV, and the PAE3 up to 150kV which is adequate for networks up to 170 kV.

## Structure



△ Cross-section of a unit

▷ PAE arresters comprise a metal-oxide resistor stack (1) with non-linear voltage-current characteristics. The resistor stack is clamped between the flanges by means of strong pressure spring (2). The flanges are produced from a light metal alloy which is resistant to open air and seawater, and are cemented to the porcelain housing (3). This connection procedure ensures optimal power transmission between flanges and porcelain and allows high permissible mechanical forces acting on the top section. The flanges enclose also the sealing arrangement. The corrosion resistant pressure relief diaphragm (4) and weather and ozone resistant synthetic rubber seals (5) with carefully selected material combinations are the sealing system parts. This arrangement ensures that housing is leak proof for many years. Each unit of arrester is equipped with very quick opening pressure relief diaphragm and gas venting nozzle (6) at both ends. In the extremely rare event of an arrester failure, these diaphragms are opened at the pressure which is only a fraction of the porcelain housing strength. In this case the ionized gas flows out through the venting nozzle. Since the venting nozzle at two ends are directed towards each other, the arc continues burning outside of housing until the short-circuit current is switched off. This system ensures relieving the internal pressure and preventing a violent shattering of the insulator.

## Mechanical Strength

The Mechanical strength of the housing i.e. the maximum withstands moment is defined in accordance with IEC 60099-4. Thus the breaking moment is generally more than 120% of the specified value. The insulating base matches the strength of the housing. The maximum continuous moment should be limited to 40% of the maximum withstand moment in accordance with above standards.

The maximum permissible dynamic service load (MPDSL) is calculated as maximum withstands moment divided by the distance between the base of the arrester and the center of the terminal load. In the same case the permissible static service load (PSSL) or cantilever load is calculated as maximum continuous moment divided by the distance between the base of the arrester and the center of the terminal load.



### ► Selection of Arrester code

Selection of appropriate arrester code consists of following steps:

- Selection of arrester type
- Selection of ZnO block specification like as rated voltage, line discharge class, nominal discharge current and energy absorption capability
- Selection of Arrester housing (insulator)

### ► PAE Arrester Types:

The PAE arresters consisting of two main types of PAE2 and PAE3 as following rated specification:

Table 1

		PAE2	PAE3
Maximum Nominal System Voltage (Un)	kV	550	170
Maximum Rated Voltage (Ur)	kV	420	150
Maximum Nominal Discharge Current (In)	kA	20	10
Maximum Line Discharge Class		5	3
Maximum Energy Absorption Capability	kJ/kVr	13	8
Maximum Long Duration Current Impulse	A	1500	850
Rated short Circuit Current	kA	63	40
Maximum permissible service load	N.m	13000	6000

In order to select the ZnO block characteristic use following tables:

Table 2

### Arrester Coding: PAE3 \*\*\*- 1 \*21

Nominal Discharge Current: 10 kA 8/20 μS

Line Discharge Class: 2

Energy Absorption Capability: 5 kJ/kV ur

Long Duration Current Impulse: 500 A 2000 μS

Maximum Value of Residual Voltage @ Specified Discharge Current

Rated Voltage [kV]	MCOV [kV]	8/20 μS			30/60 μS			1/4 μS
		5 kA	10 kA	20 kA	0.5 kA	1 kA	2 kA	10 kA
20	16	53	56	63	44	45	48	59
24	19	63	67	76	52	54	57	71
30	24	79	84	95	65	68	71	89
36	29	95	101	114	79	82	86	107
45	36	118	126	142	98	102	107	133
60	48	158	168	190	131	136	143	178
66	53	174	185	209	144	150	157	196
75	60	197	210	237	164	170	179	222
96	77	253	269	304	210	218	229	285
108	86	284	302	342	236	245	257	320
120	96	316	336	380	262	272	286	356
150	120	395	420	475	327	340	357	445

**Table 3**  
**Arrester Coding: PAE3 \*\*\* - 1 \* 31**

Nominal Discharge Current: 10 kA 8/20 µA  
Energy Absorption capability: 6 kJ/kV Ur  
Line Discharge Class: 3  
Long Duration Current Impulse: 500 A 2000 µS

Rated Voltage [kV]	MCOV [kV]	Maximum Value of Residual Voltage @ Specified Discharge Current							
		8/20 µS			30/60 µS			1/4 µS	
		5 kA	10 kA	20 kA	0.5 kA	1 kA	2 kA	10 kA	
20	16	59	63	71	49	51	54	67	
24	19	71	76	86	59	61	64	80	
30	24	89	95	107	74	77	80	100	
36	29	107	113	128	89	92	97	120	
45	36	133	142	160	111	115	121	150	
60	48	178	189	214	148	153	161	200	
66	53	196	208	235	163	168	177	220	
75	60	222	236	267	185	191	201	250	
96	77	285	302	342	237	245	258	320	
108	86	320	340	385	266	275	290	360	
120	96	356	378	428	296	306	322	400	
150	120	445	473	535	370	383	402	500	

**Table 4**  
**Arrester Coding: PAE2 / PAE3 \*\*\* - 2 \* 3 \***

Nominal Discharge Current: 10 kA 8/20 µA  
Energy Absorption capability: 8 kJ/kV Ur  
Line Discharge Class: 3  
Long Duration Current Impulse: 850 A 2000 µS

Rated Voltage [kV]	MCOV [kV]	Maximum Value of Residual Voltage @ Specified Discharge Current							
		8/20 µS				30/60 µS			1/4 µS
		5 kA	10 kA	20 kA	40 kA	0.5 kA	1 kA	2 kA	10 kA
20	16	46	49	55	61	39	41	43	52
24	19	55	59	66	73	47	49	51	62
30	24	69	73	82	92	59	61	64	78
36	29	83	88	99	110	71	73	77	93
45	36	104	110	123	138	88	92	96	117
60	48	138	147	165	184	118	122	128	156
66	53	152	162	181	202	129	134	141	171
75	60	173	184	206	230	147	153	160	195
96	77	221	235	263	294	188	195	205	249
108	86	249	264	296	330	212	220	230	280
120	96	276	294	329	367	235	244	256	312
150 *	120	345	367	411	459	294	305	320	389
168	134	387	411	461	514	329	342	358	436
180	144	415	441	494	551	353	366	384	467
198	158	456	485	543	606	388	403	422	514
228	182	525	558	625	698	447	464	486	592
245	196	564	600	672	750	480	499	522	636
288	230	663	705	790	881	564	586	614	748
336	269	774	823	921	1028	658	684	716	872
345	276	795	845	946	1056	676	702	735	896
360	288	829	882	987	1102	705	733	767	935
396	317	912	970	1086	1212	776	806	844	1028

\* For arrester type PAE3, maximum available rated voltage is 150 kV

**Table 5**  
**Arrester Coding: PAE2 \*\*\* - 4 \* 4 \***

Nominal Discharge Current: 20 kA 8/20 µA  
Energy Absorption capability: 10 kJ/kV Ur  
Line Discharge Class: 4  
Long Duration Current Impulse: 1200 A 2000 µS

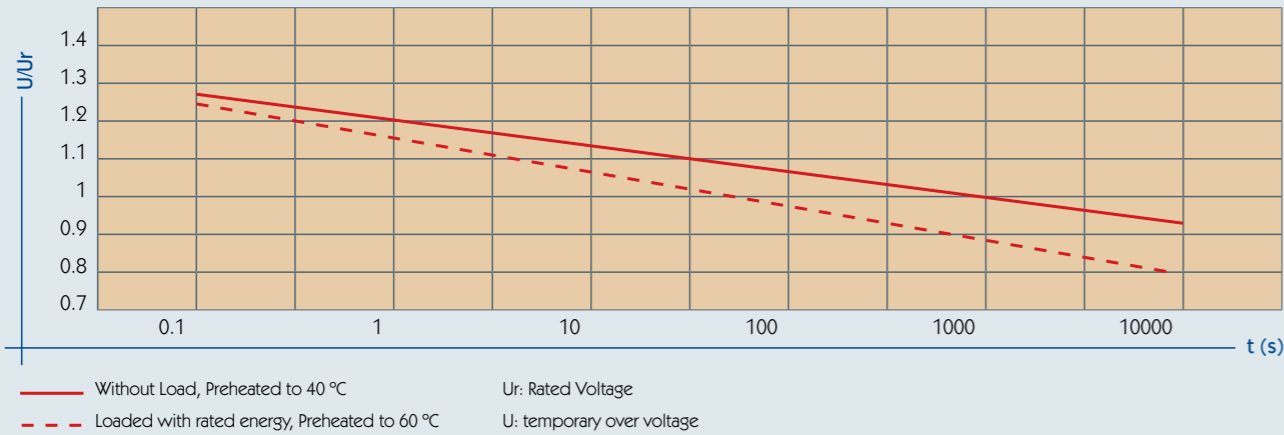
Rated Voltage [kV]	MCOV [kV]	Maximum Value of Residual Voltage @ Specified Discharge Current								
		8/20 µS				30/60 µS			1/4 µS	
		5 kA	10 kA	20 kA	40 kA	0.5 kA	1 kA	2 kA	10 kA	20 kA
20	16	45	48	53	59	39	40	42	51	57
24	19	54	58	64	71	47	48	51	61	68
30	24	68	72	80	89	58	60	63	76	85
36	29	81	86	96	106	70	72	76	92	102
45	36	101	108	120	133	87	91	95	114	127
60	48	135	144	160	177	116	121	127	153	170
66	53	149	158	176	195	128	133	139	168	186
75	60	169	180	200	221	146	151	158	191	212
96	77	216	230	256	283	186	193	203	244	271
108	86	244	259	288	319	210	217	228	275	305
120	96	271	288	320	354	233	242	253	305	339
150	120	338	360	399	443	291	302	317	382	424
168	134	379	403	447	496	326	338	355	427	475
180	144	406	432	479	531	349	362	380	458	509
198	158	446	475	527	584	384	399	418	504	559
228	182	514	547	607	673	443	459	481	580	644
245	196	552	588	652	723	476	493	517	623	692
288	230	649	691	767	850	559	580	608	733	814
336	269	758	806	895	992	652	677	709	855	949
345	276	778	828	919	1018	670	695	728	878	975
360	288	812	864	959	1063	699	725	760	916	1017
396	317	893	950	1055	1169	769	797	836	1007	1119

**Table 6**  
**Arrester Coding: PAE2 \*\*\* - 6 \* 5 \***

Nominal Discharge Current: 20 kA 8/20 µA  
Energy Absorption Capability: 12 kJ/kV Ur  
Line Discharge Class: 5  
Long Duration Current Impulse: 1500 A 2000 µS

Rated Voltage [kV]	MCOV [kV]	Maximum Value of Residual Voltage @ Specified Discharge Current								
		8/20 µS				30/60 µS			1/4 µS	
		5 kA	10 kA	20 kA	40 kA	0.5 kA	1 kA	2 kA	10 kA	20 kA
20	16	43	46	51	57	37	39	40	49	54
24	19	52	55	61	68	45	46	48	59	65
30	24	65	69	77	85	56	58	60	73	81
36	29	78	83	92	102	67	70	72	88	97
45	36	97	104	115	127	84	87	90	110	122
60	48	130	138	153	170	112	116	120	146	162
66	53	143	152	168	187	123	128	133	161	178
75	60	162	173	191	212	140	145	151	183	203
96	77	207	221	245	272	179	186	193	234	259
108	86	233	248	276	306	201	209	217	263	292
120	96	259	276	306	340	224	232	241	293	324
150	120	324	345	383	425	279	290	301	366	405
168	134	363	386	429	475	313	325	337	410	454
180	144	389	414	459	509	335	348	361	439	486
198	158	428	455	505	560	369	383	398	483	535
228	182	493	524	582	645	425	441	458	556	616
245	196	529	564	625	693	456	474	492	597	662
288	230	622	662	735	815	537	557	578	702	778
336	269	726	773	857	951	626	649	675	819	907
345	276	746	794	880	976	643	667	693	841	932
360	288	778	828	919	1019	671	696	723	878	972
396	317	856	911	1011	1121	738	765	795	965	1069

► **Temporary over voltage (TOV) diagram of PAE Arresters (Power frequency voltage versus time characteristic)**

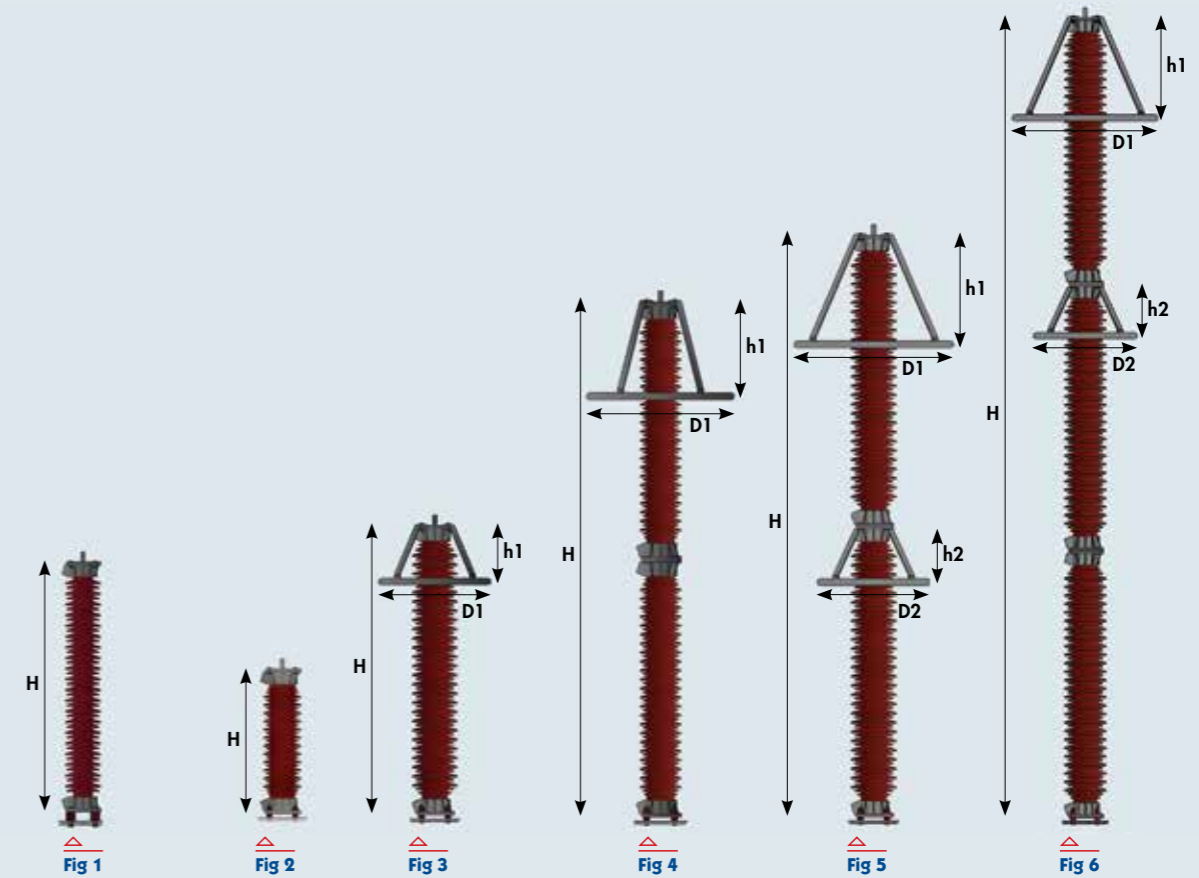


**Table 7 TECHNICAL INFORMATION OF PAE3 ARRESTER HOUSING**

Housing Code	Height [mm]	Creep. dist. [mm]	Power Frequency with-stand Voltage [kV]		Lighting Impulse Withstand Voltage [kV]	Top Mechanical Load [N]		Fig
			Dry	Wet		MPDSL	PSSL	
D	690	1200	150	120	300	8650	3450	1
C	1040	2530	250	200	470	5750	2300	1
B	1460	3900	370	300	700	4100	1600	1
A	1660	4600	420	320	800	3600	1400	1

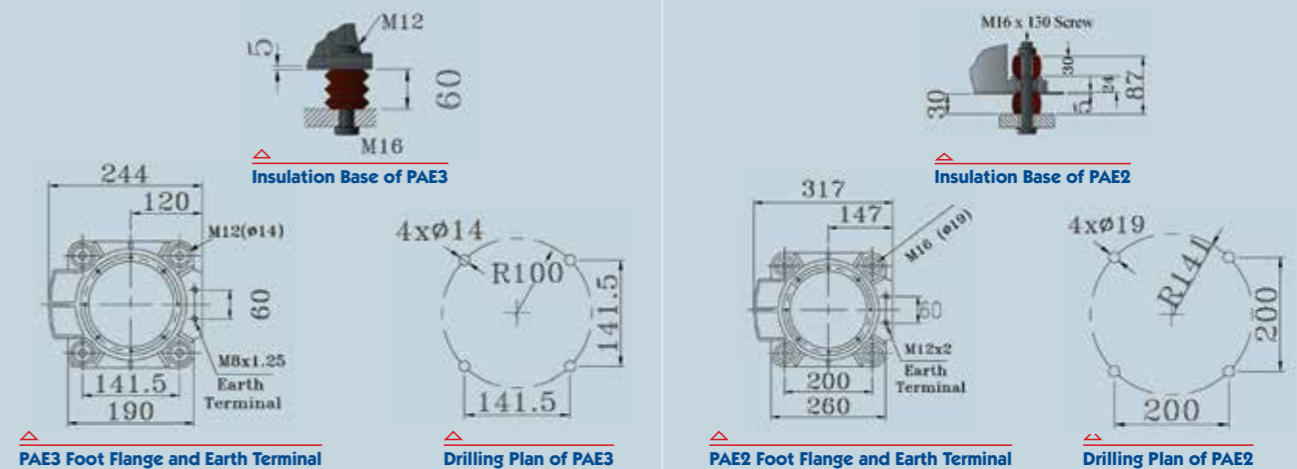
**Table 8 TECHNICAL INFORMATION OF PAE2 ARRESTER HOUSING**

Housing Code	Height [mm]	Creep. dist. [mm]	Power Frequency Withstand Voltage [kV]		Lighting Impulse Withstand Voltage [kV]	Switching Impulse Withstand Voltage [kV]		Top Mechanical Load [N]		Diameter of Grading Ring [mm]		Hight of Grading Ring [mm]		Fig
			Dry	Wet		Dry	Wet	MPDSL	PSSL	D1	D2	h1	h2	
F	797	1250	140	130	325	260	170	16,300	6500	....	...	....	....	2
E	1184	2350	264	210	550	420	320	10,500	4200	....	....	....	....	2
D	1885	4520	420	360	800	720	590	6850	2750	....	....	....	....	2
C	2205	5400	420	360	850	780	640	5850	2300	850	....	400	....	3
B	2205	6550	420	360	850	780	640	5850	2300	850	....	400	....	3
A	2205	7650	420	360	850	780	640	5850	2300	850	....	400	....	3
D+D	3770	9050	650	540	1050	950	900	3400	1350	1250	....	800	....	4
C+C	4410	10800	720	680	1425	1200	1050	2900	1150	1250	850	800	400	5
B+B	4410	13100	720	680	1425	1200	1050	2900	1150	1250	850	800	400	5
A+A	4410	15,300	720	680	1425	1200	1050	2900	1150	1250	850	800	400	5
D+D+D	5655	13,600	800	750	1750	1175	1100	2250	900	1250	850	800	400	6



**Installation & Grounding of PAE3 Type**

**Installation & Grounding of PAE2 Types**



**High Voltage Terminals of both Type arresters**

