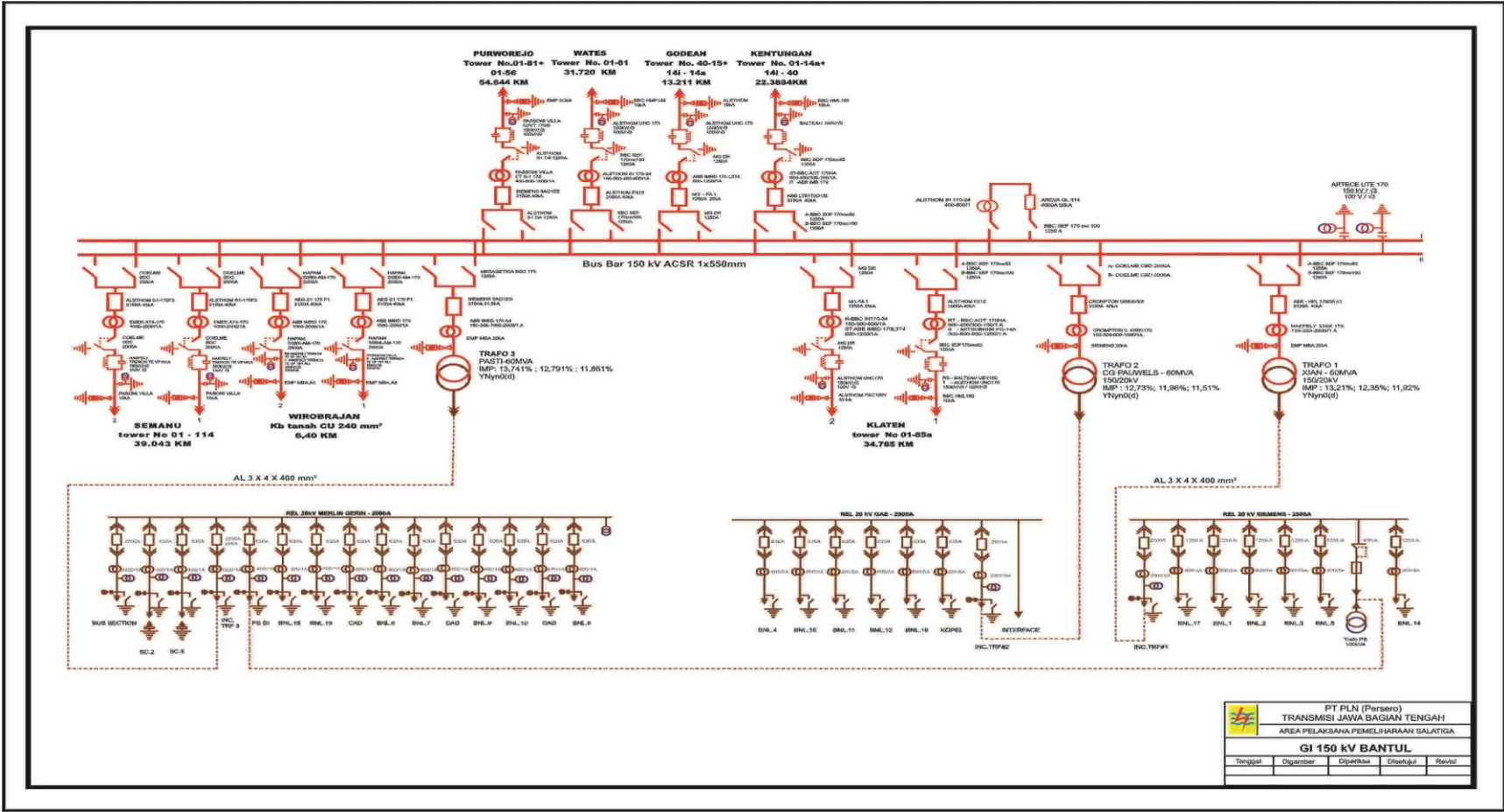


# LAMPIRAN

SLD (Single Line Diagram) Gardu Induk Bantul 150 kV



2. Jarak Bebas Minimum Horizontal dari Sumbu Vertikal Menara/Tiang pada SUTT, SUTET, dan SUTTAS

Tabel b.

Jarak Bebas Minimum Horizontal dari Sumbu Vertikal Menara/Tiang pada SUTT, SUTET, dan SUTTAS


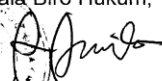
No.	Saluran Udara	Jarak dari Sumbu Vertikal Menara/Tiang ke Konduktor	Jarak Horizontal Akibat Ayunan Konduktor	Jarak Bebas <i>Impuls</i> Petir (untuk SUTT dan SUTTAS) atau Jarak Bebas <i>Impuls Switsing</i> (untuk SUTET)	Total $L + H + I$	Pembulatan
		$L$ (m)	$H$ (m)	$I$ (m)	(m)	(m)
1.	SUTT 66 kV Tiang Baja	1,80	1,37	0,63	3,80	4,00
2.	SUTT 66 kV Tiang Beton	1,80	0,68	0,63	3,11	4,00
3.	SUTT 66 kV Menara	3,00	2,74	0,63	6,37	7,00
4.	SUTT 150 kV Tiang Baja	2,25	2,05	1,50	5,80	6,00
5.	SUTT 150 kV Tiang Beton	2,25	0,86	1,50	4,61	5,00
6.	SUTT 150 kV Menara	4,20	3,76	1,50	9,46	10,00
7.	SUTET 275 kV Sirkuit Ganda	5,80	5,13	1,80	12,73	13,00
8.	SUTET 500 kV Sirkuit Tunggal	12,00	6,16	3,10	21,26	22,00
9.	SUTET 500 kV Sirkuit Ganda	7,30	6,16	3,10	16,56	17,00
10.	SUTTAS 250 kV	7,40	4,30	1,70	13,40	14,00
11.	SUTTAS 500 kV	9,00	5,30	3,30	17,60	18,00

MENTERI ENERGI DAN SUMBER DAYA MINERAL  
REPUBLIK INDONESIA,

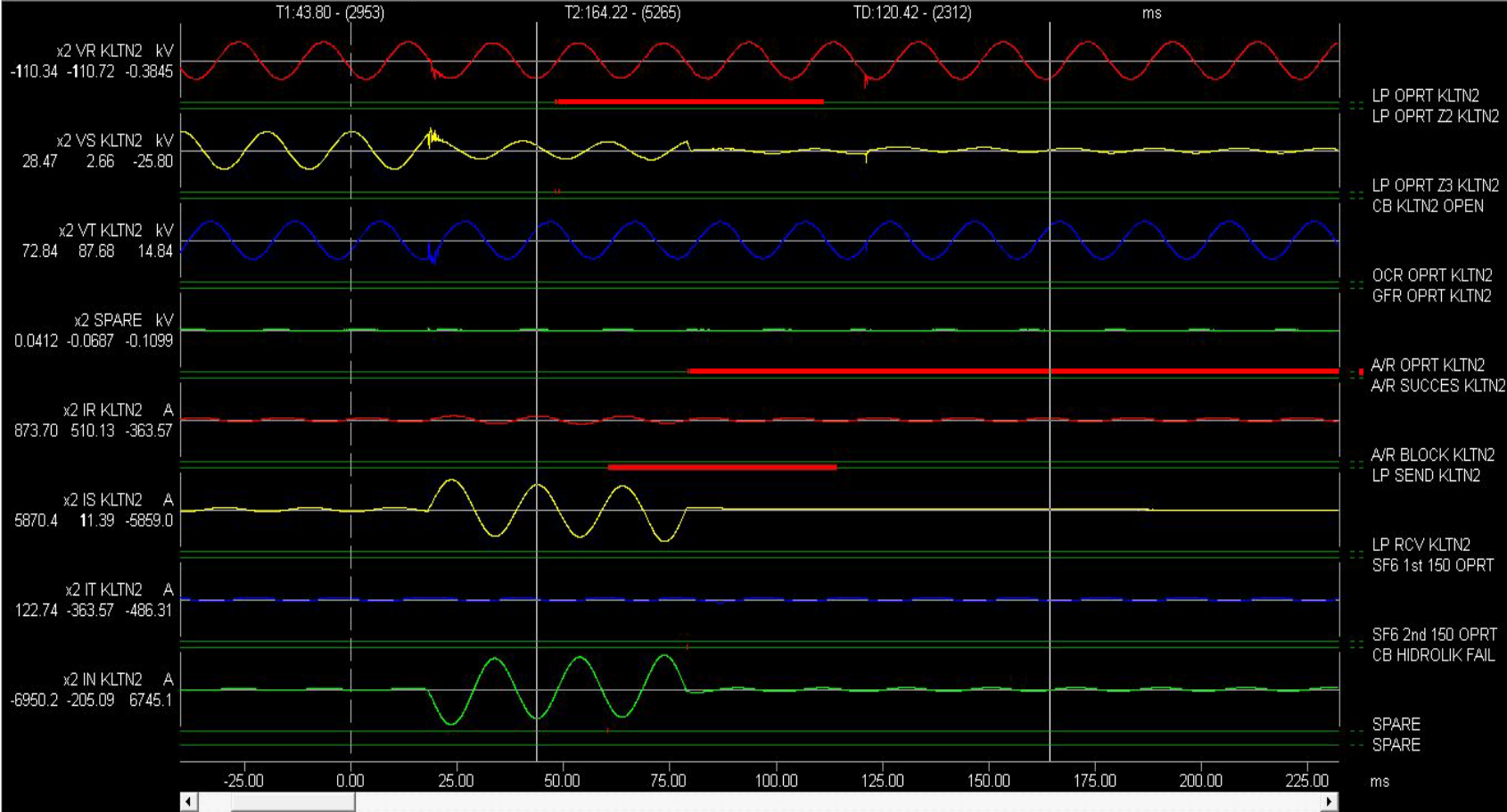
ttd.

SUDIRMAN SAID

Salinan sesuai dengan aslinya  
KEMENTERIAN ENERGI DAN SUMBER DAYA MINERAL  
Kepala Biro Hukum,

  
  
Susyanto

DFR (Digital Fault Recorder) Gardu Induk Bantul - Klaten 2



# ACSR ACSR

## Aluminium Conductor Galvanized Steel Reinforced

Standard Specification : SPLN 41-7 : 1981



### Technical Properties

Size	Number / Diameter of Wire		Calculated Cross Section Area		Approx. Overall Diameter	Approx. Weight of Conductor	Calculated Breaking Load	DC Resistance at 20 °C Max.	Current Carrying Capacity *	Standard Length per Reel
	Al	GSW	Al	GSW						
mm <sup>2</sup>	No. / mm	No. / mm	mm <sup>2</sup>	mm <sup>2</sup>	mm	kg/km	kN	Ohm/km	A	m
16/2.5	6 / 1.80	1 / 1.80	15.3	2.5	5.40	62	6.0	1.879	109	2,000
25/4	6 / 2.25	1 / 2.25	23.9	4.0	6.75	96	9.2	1.203	144	2,000
35/6	6 / 2.70	1 / 2.70	34.4	5.7	8.10	139	12.7	0.8353	182	2,000
44/32	14 / 2.00	7 / 2.40	44.0	31.7	11.20	248	43.0	0.6533	225	2,000
50/8	6 / 3.20	1 / 3.20	48.3	8.0	9.60	195	17.1	0.5946	226	2,000
50/30	12 / 2.33	7 / 2.33	51.2	29.8	11.65	375	43.8	0.5644	245	2,000
70/12	26 / 1.85	7 / 1.44	69.9	11.4	11.72	282	26.8	0.4130	287	2,000
95/15	26 / 2.15	7 / 1.67	94.4	15.3	13.61	380	35.8	0.3053	348	2,000
95/55	12 / 3.20	7 / 3.20	96.5	56.3	16.00	707	79.4	0.2992	368	2,000
105/75	14 / 3.10	19 / 2.25	105.7	75.5	17.45	594	108.5	0.2719	395	2,000
120/20	26 / 2.44	7 / 1.90	121.6	19.8	15.46	491	45.7	0.2374	409	2,000
120/70	12 / 3.60	7 / 3.60	122.1	71.3	18.00	895	100.0	0.2364	428	2,000
125/30	30 / 2.33	7 / 2.33	127.9	29.8	16.31	587	57.6	0.2259	425	2,000
150/25	26 / 2.70	7 / 2.10	148.9	24.2	17.10	601	55.3	0.1939	465	2,000
170/40	30 / 2.70	7 / 2.70	171.8	40.1	18.90	788	76.8	0.1682	514	2,000
185/30	26 / 3.00	7 / 2.33	183.8	29.8	18.99	741	66.2	0.1571	533	2,000
210/35	26 / 3.20	7 / 2.49	209.1	34.1	20.27	844	74.9	0.1380	579	2,000
210/50	30 / 3.00	7 / 3.00	212.1	49.5	21.00	973	93.9	0.1363	588	2,000
230/30	24 / 3.50	7 / 2.33	230.9	29.8	20.99	870	73.1	0.1249	614	2,000
240/40	26 / 3.45	7 / 2.68	243.1	39.5	21.84	980	86.4	0.1183	638	2,000
265/35	24 / 3.74	7 / 2.49	263.7	34.1	22.43	994	83.1	0.1094	669	2,000
300/50	26 / 3.88	7 / 3.00	307.4	49.5	24.52	1,236	107.0	0.09390	736	2,000
305/40	54 / 2.68	7 / 2.68	304.6	39.5	24.12	1,151	99.4	0.09490	733	2,000
340/30	48 / 3.00	7 / 2.33	339.3	29.8	24.99	1,169	92.9	0.08539	780	2,000
360/50	54 / 3.00	7 / 3.00	381.7	49.5	27.00	1,442	123.1	0.07573	846	2,000
385/33	48 / 3.20	7 / 2.49	386.0	34.1	26.67	1,331	104.8	0.07432	851	2,000
435/55	54 / 3.20	7 / 3.20	434.3	56.3	28.80	1,640	136.5	0.06656	918	2,000
430/40	43 / 3.45	7 / 2.68	402.0	39.5	28.74	1,417	120.8	0.07207	883	2,000

\* Note : Ambient temperature : 35° C Conductivity of Al : 61% IACS  
 wind velocity : 0.6 m/sec Solar absorption coefficient : 0.5  
 Continuous operating temperature of conductor : 80° C Emissivity with respect to black body : 0.6

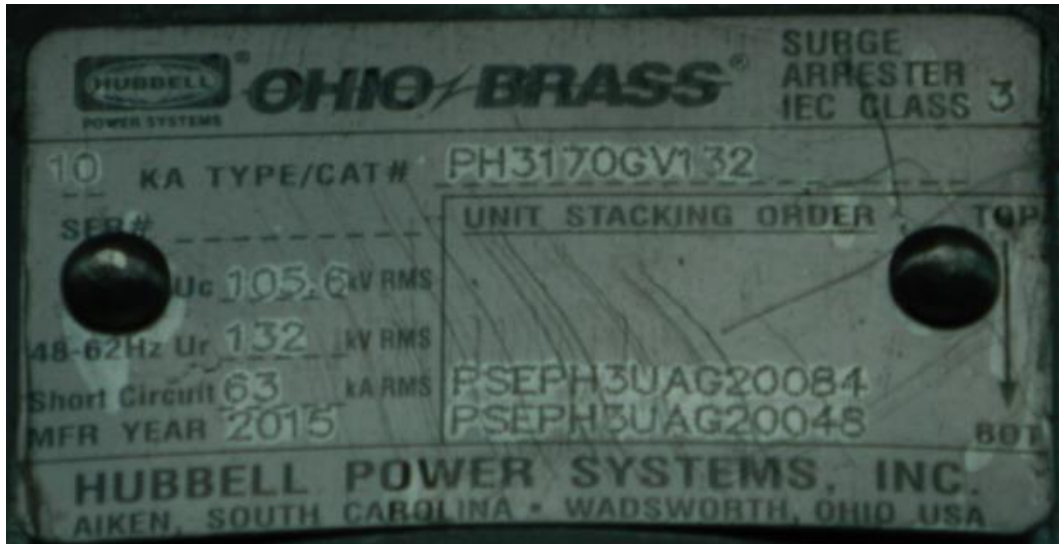
## Technical Properties

Size	Number / Diameter of Wire		Calculated Cross Section Area		Approx. Overall Diameter	Approx. Weight of Conductor	Calculated Breaking Load	DC Resistance at 20 °C Max.	Current Carrying Capacity *	Standard Length per Reel
	Al	GSW	Al	GSW						
mm <sup>2</sup>	No. / mm	No. / mm	mm <sup>2</sup>	mm <sup>2</sup>	mm	kg/km	kN	Ohm/km	A	m
490/65	54 / 3.40	7 / 3.40	490.3	63.6	30.60	1,852	153.1	0.05896	991	2,000
493/35	43 / 3.74	7 / 3.48	472.4	66.6	32.88	1,824	121.8	0.06133	994	2,000
510/45	43 / 3.69	7 / 2.63	459.8	38.0	30.03	1,565	136.7	0.06300	955	2,000
550/70	54 / 3.60	7 / 3.60	549.7	71.3	32.40	2,076	170.6	0.05259	1,065	2,000
560/50	48 / 3.86	7 / 3.00	561.7	49.5	32.16	1,936	149.0	0.05158	1,072	2,000
570/40	45 / 4.82	7 / 2.68	821.1	39.5	36.96	2,572	136.2	0.03528	1,332	1,000
650/45	45 / 4.30	7 / 2.87	653.5	45.3	34.41	2,156	155.5	0.04420	1,176	2,000
680/83	64 / 4.00	19 / 3.40	804.2	172.5	41.00	3,230	206.3	0.03620	1,172	1,000
1043/45	72 / 4.30	7 / 2.43	1045.6	32.5	41.69	3,142	217.6	0.02831	1,521	1,000

\* Note : Ambient temperature : 35° C Conductivity of Al : 61% IACS  
 Wind velocity : 0.6 m/sec Solar absorbtion coefficient : 0.5  
 Continuous operating temperature of conductor : 80° C Emissivity with respect to black body : 0.6

Spesifikasi (*Namplate*) arrester pada transformator di Gardu Induk Bantul 150 kV

1. Arrester OHIO BRASS (Transformator I)



2. Arrester SIEMENS (Transformator II)



Tabel Karakteristik Arrester OHIO BRASS (Trasformator I) Gardu Induk Bantul 150 kV

204-24



PH3 Protective Characteristics

Ur kV	Uc kV	Temporary Over-Voltage Withstand at indicated duration			Max 36/90 Switching Impulse Residual Voltage at indicated current				Max 8/20 Lightning Impulse Residual Voltage at indicated current					
		1s kVrms	10s kVrms	100s kVrms	0.25kA kV	0.5kA kV	1kA kV	2kA kV	1.5kA kV	3kA kV	5kA kV	10kA kV	20kA kV	40kA kV
24	19.2	26	24	23	45	46	48	50	50	52	54	58	63	71
27	21.6	29	27	26	51	52	54	57	56	58	61	65	71	81
30	24.0	33	31	29	56	58	60	63	62	65	68	72	78	89
33	26.4	36	34	32	62	63	66	69	68	71	74	79	86	98
36	28.8	39	37	34	68	69	72	75	74	77	81	87	94	107
39	31.2	42	40	37	73	75	78	81	80	84	88	94	102	116
42	33.6	46	43	40	79	81	84	88	87	90	95	101	110	125
48	38.4	52	49	46	90	92	95	100	99	103	108	115	125	142
51	40.8	55	52	49	95	97	101	106	105	109	114	122	132	151
54	43.2	59	55	52	102	104	108	113	112	116	122	130	141	161
60	48.0	65	61	57	112	115	119	125	124	129	135	144	156	178
66	52.8	72	67	63	123	126	131	137	136	141	148	158	171	195
72	57.6	78	73	69	135	138	143	150	148	154	162	173	188	214
75	60.0	82	76	72	140	143	149	156	154	161	168	180	195	222
78	62.4	85	79	75	146	149	155	162	160	167	175	187	203	231
81	64.8	88	82	78	151	154	161	168	166	173	181	194	210	240
84	67.2	91	86	80	157	160	167	174	172	179	188	201	218	248
90	72.0	98	92	86	168	172	179	187	185	193	202	216	234	267
96	76.8	104	98	92	179	183	190	199	197	205	215	230	249	284
108	86.4	118	110	103	202	206	214	225	222	231	242	259	280	320
120	96.0	131	122	115	223	228	238	249	246	256	268	287	311	354
132	105.6	144	134	126	246	251	262	274	271	282	295	316	342	390
138	110.4	150	140	132	257	262	273	286	283	294	308	330	357	407
144	115.2	157	147	138	269	274	285	299	295	308	322	345	373	426
162	129.6	176	165	155	302	308	321	336	332	346	362	388	420	479
168	134.4	183	171	161	313	319	333	348	344	358	375	402	435	496
180	144.0	196	183	172	335	342	357	373	369	384	402	431	466	532
192	153.6	209	195	184	358	365	380	398	394	410	429	460	498	568
198	158.4	215	202	190	369	376	392	411	406	422	442	474	513	585
216	172.8	235	220	207	402	410	428	448	443	461	482	517	559	638
228	182.4	248	232	218	425	433	451	473	467	486	509	546	591	674
240	192.0	261	244	230	446	456	475	497	491	511	535	574	621	708
258	206.4	281	263	247	480	490	510	534	528	550	576	617	667	761
264	211.2	287	269	253	492	502	523	547	541	563	590	632	684	780
276	220.8	300	281	264	513	524	546	571	565	588	616	660	714	814
288	230.4	313	293	276	536	547	570	596	590	614	643	689	745	850
312	249.6	339	318	299	580	592	617	646	638	664	696	746	807	920
330	264.0	359	336	316	614	626	652	683	675	703	736	789	853	973
336	268.8	366	342	322	625	638	665	696	688	716	750	804	870	992
360	288.0	392	366	345	669	683	712	745	737	767	803	861	931	1062
372	297.6	405	379	356	692	706	736	770	761	793	830	890	963	1098
378	302.4	411	385	362	703	717	747	782	773	805	843	904	978	1115
390	312.0	424	397	374	725	740	771	808	798	831	870	933	1009	1151
396	316.8	431	403	379	736	751	783	820	810	843	883	947	1024	1168
420	336.0	457	428	402	781	797	831	870	860	895	937	1005	1087	1240



Tabel Karakteristik Arrester SIEMENS (Trasformator II) Gardu Induk Bantul 150 kV

## Rating and Specifications

Station Class – Silicone Rubber Housed Arrester, Type 3EL2

Electrical Characteristics													Arrester order number
Duty cycle voltage	MCOV	TOV Capability <sup>(1)</sup>	Protective level										
			Maximum discharge voltage										
			FOW <sup>(2)</sup>		for 8/20 μs					for 45/90 μs			
[kV]	[kV]	for 0.1 s [kV]	[kV cr]	1.5 kA [kV cr]	3 kA [kV cr]	5 kA [kV cr]	10 kA [kV cr]	20 kA [kV cr]	40 kA [kV cr]	250 A [kV cr]	500 A [kV cr]		
9	7.65	11.9	24.2	19.0	19.8	20.7	22.0	24.5	27.8	17.2	17.6	3EL2 009-2PC31-4NH5	
10	8.4	13.1	26.4	20.7	21.6	22.6	24.0	26.7	30.3	18.8	19.2	3EL2 010-2PC31-4NH5	
12	10.2	15.9	31.9	25.0	26.1	27.3	29.0	32.2	36.6	22.7	23.2	3EL2 012-2PC31-4NH5	
15	12.7	19.8	39.6	31.0	32.4	33.9	36.0	40.0	45.4	28.1	28.8	3EL2 015-2PC31-4NH5	
18	15.3	23.9	47.3	37.0	38.7	40.5	43.0	47.8	54.2	33.6	34.4	3EL2 018-2PC31-4NH5	
21	17.0	26.5	55.0	43.0	45.0	47.0	50.0	55.5	63.0	39.0	40.0	3EL2 021-2PC31-4NH5	
24	19.5	30.4	63.8	49.9	52.2	54.6	58.0	64.4	73.1	45.3	46.4	3EL2 024-2PC31-4NH5	
27	22	34.3	71.5	55.9	58.5	61.1	65.0	72.2	81.9	50.7	52.0	3EL2 027-2PC31-4NH5	
30	24.4	38.1	79.2	62.0	64.8	67.7	72.0	80.0	90.8	56.2	57.6	3EL2 030-2PC31-4NH5	
36	29.0	45.2	94.6	74.0	77.4	80.9	86.0	95.5	108	67.1	68.8	3EL2 036-2PF31-4NH5	
39	31.5	49.1	103	80.9	84.6	88.4	94.0	104	119	73.4	75.2	3EL2 039-2PF31-4NH5	
45	36.5	56.9	119	92.9	97.2	102	108	120	136	84.3	86.4	3EL2 045-2PF31-4NH5	
48	39	60.8	127	99	104	108	115	128	145	89.7	92.0	3EL2 048-2PF31-4NH5	
54	42	65.5	143	112	117	122	130	144	164	101	104	3EL2 054-2PF31-4NH5	
60	48	74.9	158	124	130	135	144	160	182	112	115	3EL2 060-2PF31-4NH5	
72	57	88.9	190	149	156	163	173	192	218	135	138	3EL2 072-2PJ31-4NH5	
90	70	109	238	186	194	203	216	240	272	169	173	3EL2 090-2PJ31-4NH5	
96	76	119	253	198	207	216	230	255	290	179	184	3EL2 096-2PJ31-4NH5	
108	84	131	285	223	233	244	259	288	326	202	207	3EL2 108-2PM31-4NH5	
111	88	137	293	229	239	250	266	295	335	208	213	3EL2 111-2PM31-4NH5	
120	98	153	317	248	259	271	288	320	363	225	230	3EL2 120-2PM31-4NH5	
132	106	165	349	273	285	298	317	352	400	247	254	3EL2 132-2PQ32-4NH5	
144	115	179	381	298	311	325	346	384	436	270	277	3EL2 144-2PQ32-4NH5	
168	131	204	443	347	363	379	403	447	508	314	322	3EL2 168-2PJ32-4NH5	
172	140	218	454	355	372	388	413	459	520	322	330	3EL2 172-2PJ32-4NH5	
180	144	225	475	372	389	406	432	480	544	337	346	3EL2 180-2PJ32-4NH5	
192	152	237	507	397	415	433	461	512	581	360	369	3EL2 192-2PJ32-4NH5	
228	180	281	602	471	492	514	547	607	689	427	438	3EL2 228-2PW32-4NH5	
240	190	296	634	495	518	542	576	639	726	449	461	3EL2 240-2PW32-4NH5	
258	209	326	652	516	534	558	593	652	712	469	480	3EL2 258-3PW42-4NH5	
264	212	331	668	528	546	571	607	668	728	480	492	3EL2 264-3PW42-4NH5	
276	220	343	699	553	572	597	635	699	762	502	514	3EL2 276-3PW42-4NH5	
288	230	359	728	576	596	622	662	728	794	523	536	3EL2 288-3PM42-4NH5	
294	235	367	744	588	608	636	676	744	811	534	548	3EL2 294-3PM42-4NH5	

Table 2: Station Class – Silicone Rubber Housed Arrester Type 3EL2

Tabel Karakteristik Arrester MBA (Trasformator III) Gardu Induk Bantul  
150 kV

**Station Class**  
**Porcelain Surge Arresters MBA**

**Protective Characteristics**

Product Code	Rating voltage kV	Max cont. operating voltage (COV) kV	Temporary over-voltage capability for 1 sec (TOV) kV	Max residual voltage kV crest with current wave										Steep current residual voltage*
				Switching surge 30/60 µS					Lightning current 8/20 µS					
				125A kV crest	250A kV crest	500A kV crest	1000A kV crest	2000A kV crest	5kA kV crest	10kA kV crest	20kA kV crest	40kA kV crest	10kA kV crest	
MBA03L2E1E1	3.0	2.40	3.42	7.33	7.53	7.79	8.09	8.49	8.72	9.27	10.0	12.5	9.87	11.8
MBA06L2E1M1	6.0	4.80	6.85	12.2	12.5	13.0	13.5	14.1	15.4	16.6	18.2	20.8	17.8	19.8
MBA012L2E1M1	12	9.60	13.7	24.4	25.1	25.9	27.0	28.3	30.8	33.1	36.5	41.5	35.5	39.3
MBA015L2E1M1	15	12.0	17.1	29.3	30.1	31.1	32.4	33.9	37.0	39.7	43.8	49.8	42.6	47.1
MBA018L2E1M1	18	14.4	20.5	36.6	37.6	38.9	40.5	42.4	46.2	49.7	54.7	62.3	53.3	58.9
MBA021L2E1M1	21	16.8	24.0	41.5	42.7	44.1	45.9	48.1	52.4	56.3	62.0	70.6	60.4	66.8
MBA024L2E1M1	24	19.2	27.4	48.8	50.2	51.9	54.0	56.6	61.6	66.2	73.0	83.0	71.1	78.5
MBA127L2E1M1	27	21.6	30.8	53.7	55.2	57.1	59.3	62.2	67.8	72.8	80.3	91.3	78.2	86.4
MBA130L2E1M1	30	24.0	34.2	58.6	60.2	62.3	64.7	67.9	73.9	79.4	87.6	99.6	85.3	94.3
MBA136L2E1M1	36	28.8	41.1	70.8	72.8	75.2	78.2	82.0	89.3	96.0	106	120	103	114
MBA139L2E1M1	39	31.2	44.5	78.2	80.3	83.0	86.3	90.5	98.6	106	117	133	114	126
MBA251L2E1M1	51	40.8	58.2	100	103	106	111	116	126	136	150	170	146	161
MBA260L2E1M1	60	48.0	68.5	117	120	125	129	136	148	159	175	199	171	189
MBA275L2E1M1	75	60.0	85.6	147	151	156	162	170	185	199	219	249	213	236
MBA360L2E1M1	60	48.0	68.4	117	120	125	129	136	148	159	175	199	171	189
MBA396L2E1M1	96	76.8	110	188	193	200	208	218	237	255	281	320	274	302
MBA3108L2E1M1	108	86.4	123	212	218	226	235	246	268	288	317	361	309	342
MBA3120L2E1M1	120	96.0	137	234	241	249	259	272	296	318	350	399	341	377
MBA3126L2E1M1	126	101	144	247	253	262	272	286	311	334	369	419	359	397
MBA3132L2E1M1	132	106	151	259	266	275	286	300	327	351	387	440	377	416
MBA4150L2E1M1	150	120	171	293	301	311	324	339	370	397	438	498	426	471
MBA31150L2E1M1	150	120	171	293	301	311	324	339	370	397	438	498	426	471
MBA32150L2E1M1	150	120	171	293	301	311	324	339	370	397	438	498	426	471
MBA33150L2E1M1	150	120	171	293	301	311	324	339	370	397	438	498	426	471
MBA40120L2E1M1	120	96.0	137	234	241	249	259	272	296	318	350	399	341	377
MBA41120L2E1M1	120	96.0	137	234	241	249	259	272	296	318	350	399	341	377
MBA40150L2E1M1	150	120	171	293	301	311	324	339	370	397	438	498	426	471

\* Residual voltage correction factor as per IEC recommendation 10kV/10kA/m