Current-Limiting Fuse Selection for Medium Voltage Capacitors

Introduction

Metal-Enclosed Capacitor Banks and Harmonic Filter Banks utilize current limiting fuses, sometimes called Silver-Sand Fuses, for their protection. Current limiting fuses (as opposed to expulsion fuses) are required and are utilized, as they do not emit ionized gases during operation. Ionized gases are undesirable because they can cause bushing and insulator flashovers that result in additional damage.

This document provides information on the selection of Medium Voltage Current Limiting Fuses for the protection of Single-Phase Wye-Connected Capacitors utilized in Metal Enclosed Capacitor Banks.

Background

When selecting current limiting fuses for the protection of Single-Phase Wye-Connected Capacitors it is important to account for, and to consider the following:

- Maximum continuous current the fuse will see during normal operation. Factors such as capacitor tolerances, harmonic currents, system operating voltage, and blown fuses within a bank can all lead to higher than normal operating current.
- Inrush and outrush currents associated with capacitor bank energization.

Based on the above information it is important that the design engineer select a fuse that is small enough (or sensitive enough) to prevent case rupture, yet large enough to prevent spurious or false fuse operation due to normal operating conditions.

Fuse Selection Table

Table 1 below shows the recommended current-limiting fuse voltage and current rating for industry standard capacitors. The table should only be used for guidance and is based upon the following assumptions:

- The current limiting fuse type is full range
- The capacitor neutral voltage will not significantly shift away from 0-Volts
- The ambient temperature within the enclosure does not exceed 25 Degrees Celsius
- The capacitor is operated at its voltage rating

Depending upon the fuse manufacturer, temperature derating may be required. The following table does not account for temperature derating. For banks in which the neutral voltage can shift away from 0 volts, the fuse voltage should be equal to the system line-to-line voltage. Such applications typically involve small ungrounded banks and harmonic filter banks.

Table 1 - Current Limiting Fuse Selection Table For Single Phase Wye-Connected Capacitor Banks

2400 Volt Capacitors — 4200 Volts Line to Line System Voltage

KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	2400	20.8	4.3	35
100	2400	41.7	4.3	65
150	2400	62.5	4.3	100
200	2400	83.3	4.3	130

2770 Volt Capacitors — 4800 Volts Line to Line System Voltage

KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	2770	18.1	4.3	35
100	2770	36.1	4.3	65
150	2770	54.2	4.3	100
200	2770	72.2	4.3	130

4160 Volt Capacitors — 7200 Volts Line to Line System Voltage

KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	4160	12.0	4.3	18
100	4160	24.0	4.3	40
150	4160	36.1	4.3	65
200	4160	48.1	4.3	75

4800 Volt Capacitors — 8300 Volts Line to Line System Voltage

KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	4800	10.4	5.5	18
100	4800	20.8	5.5	30
150	4800	31.3	5.5	50
200	4800	41.7	5.5	65
300	4800	62.5	5.5	100
400	4800	83.3	5.5	130

6640 Volt Capacitors — 11480 Volts Line to Line System Voltage

KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	6640	7.5	8.3	12
100	6640	15.1	8.3	25
150	6640	22.6	8.3	40
200	6640	30.1	8.3	50
300	6640	45.2	8.3	80
400	6640	60.2	8.3	100
500	6640	75.3	8.3	125

7200 Volt Capacitors		12470 Volts Line to Line System Voltage		
KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	7200	6.9	8.3	12
100	7200	13.9	8.3	25
150	7200	20.8	8.3	40
200	7200	27.8	8.3	40
300	7200	41.7	8.3	65
400	7200	55.6	8.3	100
500	7200	69.4	8.3	125

7620 Volt Capacitors		13200 Volts Line to Line System Voltage		
KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	7620	6.6	8.3	10
100	7620	13.1	8.3	20
150	7620	19.7	8.3	30
200	7620	26.2	8.3	40
300	7620	39.4	8.3	65
400	7620	52.5	8.3	80
500	7620	65.6	8.3	100

7960 Volt Capacitors		13800 Volts Line to Line System Voltage		
KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	7960	6.3	8.3	10
100	7960	12.6	8.3	20
150	7960	18.8	8.3	30
200	7960	25.1	8.3	40
300	7960	37.7	8.3	65
400	7960	50.3	8.3	80
500	7960	62.8	8.3	100

8320 Volt Capacitors		14400 Volts Line to Line System Voltage		
KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	8320	6.0	15.5	10
100	8320	12.0	15.5	12
150	8320	18.0	15.5	30
200	8320	24.0	15.5	40
300	8320	36.1	15.5	65
400	8320	48.1	15.5	80
500	8320	60.1	15.5	100

9540 Volt Capacitors		16500 Volts Line to Line System Voltage		
KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	9540	5.2	15.5	8
100	9540	10.5	15.5	18
150	9540	15.7	15.5	25
200	9540	21.0	15.5	40
300	9540	31.4	15.5	50
400	9540	41.9	15.5	65
500	9540	52.4	15.5	80

9960 Volt Capacitors		17230 Volts Line to Line System Voltage		
KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	9960	5.0	15.5	8
100	9960	10.0	15.5	18
150	9960	15.1	15.5	25
200	9960	20.1	15.5	30
300	9960	30.1	15.5	50
400	9960	40.2	15.5	65
500	9960	50.2	15.5	80

11400 Volt Capacitors		19800 Volts Line to Line System Voltage		
KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	11400	4.4	15.5	8
100	11400	8.8	15.5	18
150	11400	13.2	15.5	20
200	11400	17.5	15.5	30
300	11400	26.3	15.5	40
400	11400	35.1	15.5	65
500	11400	43.9	15.5	65

15125 Volt Capacitors		26166 Volts Line to Line System Voltage		
KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	15125	3.3	15.5	8
100	15125	6.6	15.5	10
150	15125	9.9	15.5	18
200	15125	13.2	15.5	20
300	15125	19.8	15.5	30
400	15125	26.4	15.5	40
500	15125	33.1	15.5	50

19920 Volt Capacitors		34500 Volts Line to Line System Voltage		
KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	19920	2.5	23	6
100	19920	5.0	23	8
150	19920	7.5	23	12
200	19920	10.0	23	18
300	19920	15.1	23	25
400	19920	20.1	23	30
500	19920	25.1	23	40

20800 Volt Capacitors		35980 Volts Line to Line System Voltage		
KVAR	Voltage (Volts)	Rated Amps	Recommended Fuse Voltage (KV)	Recommended Fuse Size
50	20800	2.4	23	6
100	20800	4.8	23	8
150	20800	7.2	23	12
200	20800	9.6	23	18
300	20800	14.4	23	25
400	20800	19.2	23	30
500	20800	24.0	23	40

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