Application Paper **AP03407003E**

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XT IEC power control—high altitude

Rating requirements for use in high altitude applications

Electrical switchgear is often installed in applications exceeding 3280 ft (1000 m). Due to the lower air density and heat transfer capacity at elevated altitudes, the physical properties such as dielectric strength and the load capacity of the switchgear, conductors, and motors, as well as the tripping characteristics of thermal relays and timer units, must be modified to reflect these changes due to altitude.

It is suggested that for elevations above 6562 ft (2000 m) the operational voltage (U_N) be derated according to Paschen's Law. Additionally, it is recommended that the rated thermal current (I_N) also be reduced to compensate for the lower air density for cooling in accordance with the chart provided.

Example: A mining company in Peru wishes to purchase a rotary manual motor protector (MMP) for a 380 V, 10 kW motor that is rated for 25 A. This application is located 11,482 ft (3500 m) above sea level. This would imply that the motor is actually rated for 22 A after derating motor output power by a factor of 0.88 according to the chart below. Because the rated current of the device must be derated by a factor of 0.87, the standard rating of the device must equal the motor rating divided by this factor or 25.3 A before derating. The XTPR032BC1 product would meet this customer's need for the application. Caution regarding motor derating should be used, as motors can be purchased that require no derating.

The ***XT*** product line has been developed in accordance with IEC Standard EN 60947-1. This application note is written to assist users in complying with EN 60947-1 Annex B Paragraph B.1.2 regarding altitude above 2000 meters. Annex B states, "If the conditions for operation in service and the application differ from those given in this standard, the user shall state the deviations from the standard conditions and consult the manufacturer regarding the suitability of equipment use under such conditions."

Table 1. High altitude applications—rating requirements

Altitude	Dielectric strength	Rated operating voltage	Switching capacity	Tripping current and rated current	Cable cross-section		Motor output
ft (m) ①	U_i ②	U_N ③	I_s and P_1 ④	I and I_N ⑤	A_i ⑥	A_a ⑦	P_N ⑧
>3280 (1000)	1	1	0.97	0.98	1	1	0.98
>6562 (2000)	0.9	0.9	0.91	0.92	0.99	0.94	0.94
>9843 (3000)	0.8	0.8	0.86	0.87	0.96	0.89	0.88
>13,123 (4000)	0.72	0.72	0.81	0.82	0.9	0.83	0.81

① ft (m) = Feet (meters)

② U_i = Rated insulation voltage

③ U_N = Rated voltage

④ I_s and P_1 = Control current and power

⑤ I and I_N = Tripping current and rated current

⑥ A_i = Indoor cable derating

⑦ A_a = Outdoor cable derating

⑧ P_N = Motor power rating

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