

APPENDIX 8 : MAIN BUSBAR SIZING

8.1 MAIN BUSBAR

BUSBAR SIZING

The factors that must be taken into account in determining the size of busbars include:

a. Diversity factor :

Not all the loads supplied by a set of busbars are used at full rated load or at the same time. The diversity factor is the means to determine the maximum load current used to size the busbars. Standard IEC 61439-1 and 2 specifies the table below.

Number of Cicuits	Diversity Factor
2 - 3	0,9 (%90)
4 - 5	0,8(%80)
6 - 9	0,7(%70)
10 and more	0,6(%60)

For example:

Total equipment circuit : 2700A

Equipment quantity : 22 ---> Diversity factor : 0,6

Requiring main busbar circuit : $2700 \times 0,6 = 1620A$

b. Degree of IP Protection:

IP protection which means to protection against solid and liquid objects in the environment is a necessity for a switchboard to survive the functions for a long time period and to protect against short circuits and harmful chemicals can be cause corrosion. For that reason PDS switchboards are designed according to IP 53. This protection limits the air circulation inside the switchboard and effects heating operational temperature of busbars. In case of removing the metal filter and metal case the IP protection decreases to IP2X. Then the operational temperature of busbar can be decrease.

Additionally there is an another way to decrease operational temperature that using forced air with fan motors.

For see the technics please go on Thermal Management Instructions.

In the sheets of current - rated current (In) - according to busbar sizes are values where tested in 25°C ambience temperature without any air circulation limits so called nominal. In the following pages there will be selection tables for currents in different IP protection selections.

c. Ambient Temperature around the switchboard:

The maximum load current for a set of busbars is a function of the thermal environment.

The type and the size of the conductors must be determined in view of carrying the required currents taking into account the temperatures reached in the switchboard. These conductors are subjected to additional heat rise caused by the flowing current (joule effect) and the connected devices.

The temperatures reached by the conductors and the insulating materials, etc. must not exceed the maximum temperatures for which the products were designed. PDS busbars are sized to operate without any particular constraints for the assemblies in switchboards operating under normal environmental conditions.

IEC 61439-1 permits higher overtemperature limits than 105 K, the absolute busbar temperature at an ambient temperature of 35°C and 105K over temperature limitis 140°C. Temperature 140°C is significantly below the thermal softening of copper material.

In the selection tables in below calculation of over temperature limits 105°C as a limit of PDS according to permissible temperature limits on insulated materials which is inside the IEC 61439-1 limit.

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		Permissible current (A) at maximum 105°C Bare Busbar Temperature up to 60 Hz (E-Cu F30)								
Type of Busbar	Nominal(In) 25°C +30K	Air Ventilation	IP Protection	Average Ambient Temperature around the Switchboard						
				20°C	25°C	30°C	35°C	40°C	45°C	50°C
40/10x2	1350A	Forced Air	IP2X	2640	2640	2640	2640	2500	2400	2270
		Standard	IP2X	2150	2050	1970	1900	1770	1680	1590
		Forced Air	IP53	2440	2440	2440	2440	2300	2220	-
		Standard	IP53	1940	1850	1790	1720	1620	1550	-
50/10x2	1620A	Forced Air	IP2X	3260	3260	3260	3260	3100	2960	2800
		Standard	IP2X	2400	2310	2220	2140	1930	1810	1690
		Forced Air	IP53	2920	2920	2920	2920	2800	2650	-
		Standard	IP53	2170	2070	2000	1920	1740	1610	-
60/10x2	1860A	Forced Air	IP2X	3340	3340	3340	3340	3200	3040	2870
		Standard	IP2X	2600	2490	2390	2300	2170	2030	1900
		Forced Air	IP53	2940	2940	2940	2940	2800	2670	-
		Standard	IP53	2330	2220	2140	2060	1870	1720	-
80/10x2	2300A	Forced Air	IP2X	4160	4160	4160	4160	3900	3780	3570
		Standard	IP2X	3210	3060	2950	2840	2660	2500	2330
		Forced Air	IP53	3720	3720	3720	3720	3500	3380	-
		Standard	IP53	2900	2760	2660	2560	2330	2160	-

		Permissible current (A) at maximum 105°C Bare Busbar Temperature up to 60 Hz (E-Cu F30)								
Type of Busbar	Nominal(In) 25°C +30K	Air Ventilation	IP Protection	Average Ambient Temperature around the Switchboard						
				20°C	25°C	30°C	35°C	40°C	45°C	50°C
40/10x2	1350A	Forced Air	IP2X	2000	2000	2000	2000	1910	1820	1710
		Standard	IP2X	1590	1540	1500	1430	1350	1300	1220
		Forced Air	IP 53	1820	1820	1820	1820	1730	1650	-
		Standard	IP53	1440	1400	1360	1300	1240	1180	-
50/10x2	1620A	Forced Air	IP2X	2990	2990	2990	2990	2850	2720	2570
		Standard	IP2X	2400	2310	2220	2140	1930	1810	1690
		Forced Air	IP 53	2680	2680	2680	2680	2560	2440	-
		Standard	IP53	2170	2070	2000	1920	1740	1610	-
60/10x2	1860A	Forced Air	IP2X	3340	3340	3340	3340	3200	3040	2870
		Standard	IP2X	2600	2490	2390	2300	2170	2030	1900
		Forced Air	IP 53	2940	2940	2940	2940	2800	2670	-
		Standard	IP53	2330	2220	2140	2060	1870	1720	-
80/10x2	2300A	Forced Air	IP2X	3700	3700	3700	3700	3530	3360	3180
		Standard	IP2X	2940	2850	2760	2640	2520	2400	2250
		Forced Air	IP 53	3360	3360	3360	3360	3200	3060	-
		Standard	IP53	2650	2580	2520	2400	2280	2170	-

! NOTE: Tin plated busbar currents are the same as bare busbars. The tables can be use also in tin plated copper applications.

! NOTE: The tables show the currents on phases (L1,L2,L3). Sizing of Neutral , PEN or PE bars partner have to follow the instructions in section C 3: EQUIPOTENTIALITY and ELECTRICAL CONTINUTY instruction pages.

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Type of Busbar	Nominal(In) 25°C +30K	Permissible current (A) at maximum 105°C Bare Busbar Temperature up to 60 Hz (E-Cu F30)								
		Air Ventilation	IP Protection	Maximum Ambient Temperature around the Switchboard						
				20°C	25°C	30°C	35°C	40°C	45°C	50°C
40 / 10 x 4	2500A	Forced Air	IP2X	3440	3440	3440	3440	3300	3130	2950
		Standard	IP2X	2950	2860	2780	2650	2530	2400	2270
		Forced Air	IP 53	3020	3020	3020	3020	2850	2750	-
		Standard	IP53	2780	2700	2620	2500	2380	2270	-
50 / 10 x 4	3000A	Forced Air	IP2X	4040	4040	4040	4040	3800	3670	3470
		Standard	IP2X	3170	3080	2990	2850	2720	2590	2450
		Forced Air	IP 53	3500	3500	3500	3500	3300	3180	-
		Standard	IP53	2850	2810	2700	2600	2480	2350	-
60 / 10 x 4	3400A	Forced Air	IP2X	4220	4220	4220	4220	4000	3840	3620
		Standard	IP2X	3450	3350	3250	3100	2950	2820	2650
		Forced Air	IP 53	3580	3580	3580	3580	3400	3250	-
		Standard	IP53	3230	3140	3050	2900	2770	2640	-
80 / 10 x 4	4000A	Forced Air	IP2X	4800	4800	4800	4800	4580	4370	4120
		Standard	IP2X	3880	3700	3570	3440	3090	2940	2780
		Forced Air	IP 53	4280	4280	4280	4280	4080	3890	-
		Standard	IP53	3450	3300	3180	3060	2850	2710	-

! NOTE: Tin plated busbar currents are the same as bare busbars. The tables can be use also in tin plated copper applications.

! NOTE: The tables show the currents on phases (L1,L2,L3) - 3 Poles - or with Neutral/PEN bar. -4 Poles-