Appendix A – Tests conditions, PRPD and ultrasonic signals interpretation

The codes used in the tables are: “MOT” for Metal Object on Top, “MAB” Metal Object at the Bottom. The number sequence used in the Location/Distance label (“Loc/Dis”) are: Measurement number, location and distance. The Location can be “T” for top, “M” for middle and “B” for bottom. The letter “E-” indicates an electrical (PRPD) test and the “U-” an ultrasonic measurement. The PDs abbreviations are: “N” for normal, “NCP” for No Clear Pattern, “PC” for Loose Connection, “LPD” for Light Partial Discharge, “LC” for Light Corona, “LS” for Light Superficial, “C” for Corona and “S” for Superficial. “HSP”, “MSP” and “LSP” refer to Heavy Saline Pollution, Moderate Saline Pollution and Light Saline Pollution, respectively.

Table 1 – Sample size for each class

PRPD classification		**Ultrasound classification**	
Class	**Sample size**	**Class**	**Sample size**
Normal	120	Normal	242
NCP	57	LPD	16
PC	32	LC	10
LC	41	C	14
C	36	LS	18
LS	19	HSP	28
S	47	MSP	18
-	-	LSP	6

Table 2 – Test condition, PRPD and ultrasonic measurements for TPC 245 kV.

Nº	Condition	Type	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis
1	Normal 132.8 kV 29.9 ºC 91 %rh	Clean with corona ring	M1T16	M2M16	M3B16	M4T8	M5M8	M6B8
			E-NCP	E-N	E-N	E-N	E-N	E-NCP
			U-N	U-N	U-N	U-N	U-N	U-N
2	Normal 132.8 kV 29.4 ºC 93 %rh	Clean without corona ring	M1T8	M2M8	M3B8	M4T16	M5M16	M6B16
			E-LC	E-LC	E-LC	E-LC	E-LC	E-LC
			U-N	U-N	U-N	U-N	U-N	U-N
3	Corona 132.8 kV 29.4 ºC 93 %rh	MOT, without corona ring	M1T16	M2M16	M3B16	M4T8	M5M8	M6B8
			E-N	E-N	E-N	E-LC	E-LC	E-LC
			U-N	U-N	U-N	U-N	U-N	U-N
4	Corona 132.8 kV 30 ºC 83 %rh	MOT, open carrier wave circuit	M1T8	M2T8	M3T8	M4T8	M5T8	M6T8
			E-C	E-C	E-C	E-C	E-C	E-C
			U-C	U-C	U-C	U-C	U-C	U-C
5	Corona 132.8 kV 30 ºC 83 %rh	MOT, close carrier wave circuit	M1T8	M2T8	M3T8	M4T8	M5T8	M6T8
			E-NCP	E-NCP	E-NCP	E-NCP	E-NCP	E-NCP
			U-LPD	U-LPD	U-LPD	U-LPD	U-LPD	U-LPD
6	Normal 132.8 kV 30 ºC 83 %rh	MAB	M1T8	M2T8	M3B8	M4T10	M5T10	M6B10
			E-LC	E-LC	E-LC	E-LC	E-LC	E-LC
			U-N	U-N	U-N	U-N	U-N	U-N
7	Loose connection 132.8 kV 26 ºC 82 %rh	Loose connection between HV and IT	M1B10	M2M10	M3T10	M4B8	M5M8	M6T8
			E-PC	E-PC	E-PC	E-PC	E-PC	E-PC
			U-N	U-N	U-N	U-N	U-N	U-N
8	Pollution 132.8 kV 26 ºC 82 %rh	HSP ESDD~0.05	M1B8	M2M8	M3T8	M4B10	M5M10	M6T10
			E-S	E-S	E-S	E-S	E-S	E-S
			U-HSP	U-HSP	U-HSP	U-HSP	U-HSP	U-HSP
9	Pollution 132.8 kV 26 ºC 82 %rh	LSP ESDD~0.01	M1B10	M2M10	M3T10	M4B8	M5M8	M6T8
			E-LC	E-LC	E-LC	E-LC	E-LC	E-LC
			U-N	U-N	U-N	U-N	U-N	U-LC
10	Pollution 132.8 kV 26 ºC 82 %rh	MSP ESDD~0.02 5	M1B10	M2M10	M3T10	M4B8	M5M8	M6T8
			E-C	E-C	E-C	E-S	E-LS	E-LS
			U-N	U-MSP	U-N	U-MSP	U-LS	U-N

Table 3 – Test condition, PRPD and ultrasonic measurements for TC 245 kV.

Nº	Condition	Type	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis
11	Normal 132.8 kV 29.5 ºC 82 %rh	Deposit condition (dust) without corona ring	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-C	E-C	E-C	E-C	E-C	E-C
			U-C	U-N	U-N	U-C	U-C	U-C
12	Normal 132.8 kV 30 ºC 82 %rh	Deposit condition (dust) with corona ring	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
13	Normal 146 kV 27.7 ºC 93 %rh	Deposit condition (dust) with corona ring	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
14	Normal 132.8 kV 26.5 ºC 84 %rh	Clean with corona ring	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
15	Corona 132.8 kV 28.8 ºC 67%rh	MOT	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-LC	E-LC	E-LC	E-LC	E-LC	E-LC
			U-LC	U-N	U-N	U-LC	U-N	U-LC
16	Corona 146 kV 28.8 ºC 67 %rh	MOT	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-LC	E-LC	E-LC	E-LC	E-LC	E-LC
			U-LC	U-LC	U-LC	U-LC	U-N	U-N
17	Corona 132.8 kV 29.6 ºC 86 %rh	MAB	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-N	E-NCP	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
18	Corona 146 kV 28.6 ºC 86 %rh	MAB	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-N	E-NCP	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
19	Loose connection 132.8 kV 28.6 ºC 86 %rh	Loose connection between HV and IT	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-NCP	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
20	Loose connection 146 kV 28.6 ºC 86 %rh	Loose connection between HV and IT	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-NCP	E-NCP	E-N	E-NCP	E-NCP	E-NCP
			U-N	U-N	U-N	U-N	U-N	U-N
21	Normal 146 kV 29.5 ºC 87 %rh	Clean	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-NCP	E-NCP	E-NCP	E-NCP	E-NCP	E-NCP
			U-LPD	U-LPD	U-LPD	U-LPD	U-LPD	U-LPD
22	Pollution 132.6 kV 29.3 ºC 79 %rh	HSP ESDD~0.05	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-S	E-S	E-S	E-S	E-S	E-S
			U-HSP	U-HSP	U-HSP	U-HSP	U-HSP	U-HSP
23	Pollution 132.6 kV 28.5 ºC 84 %rh	LSP ESDD~0.01	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-C	E-LS	E-N	E-C	E-LS	E-C
			U-N	U-LS	U-N	U-LSP	U-LS	U-C

(Continued on next page)

Table 3 Continued – Test condition, PRPD and ultrasonic measurements for TC 245 kV.

Nº	Condition	Type	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis
24	Pollution 146 kV 28.6 ºC 84 %rh	LSP ESDD~0.01	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-C	E-C	E-LC	E-NCP	E-NCP	E-NCP
			U-LSP	U-LSP	U-LC	U-LPD	U-LPD	U-N
25	Pollution 136.2 kV 29 ºC 87 %rh	MSP ESDD~0.025	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-S	E-S	E-LS	E-S	E-S	E-LS
			U-MSP	U-MSP	U-LS	U-MSP	U-MSP	U-LS
26	Pollution 146 kV 29 ºC 87 %rh	MSP ESDD~0.025	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-S	E-S	E-LS	E-S	E-LS	E-N
			U-MSP	U-MSP	U-LS	U-MSP	U-MSP	U-N

Table 4 – Test condition, PRPD and ultrasonic measurements for TPI 145 kV.

Nº	Condition	Type	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis
27	Normal 79.7 kV 27 ºC 85 %rh	Deposit condition (dust)	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
28	Normal 88 kV 27 ºC 85 %rh	Deposit condition (dust)	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
29	Normal 79.7 kV 29.1 ºC 86 %rh	Clean	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
30	Normal 88 kV 28.6 ºC 86%rh	Clean	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
31	Corona 79.7 kV 29.7 ºC 84 %rh	MOT	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-PC	E-PC	E-PC	E-PC	E-PC	E-PC
			U-N	U-N	U-N	U-N	U-N	U-N
32	Corona 88 kV 29.7 ºC 84 %rh	MOT	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-PC	E-PC	E-PC	E-PC	E-PC	E-PC
			U-N	U-N	U-N	U-N	U-N	U-N
33	Corona 79.7 kV 28.8 ºC 84 %rh	MAB	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
34	Corona 88 kV 28.8 ºC 84 %rh	MAB	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
35	Loose connection 79.7 kV 29.5 ºC 87 %rh	Loose connection between HV and TI	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-NCP	E-NCP	E-NCP	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
36	Loose connection 88 kV 29.5 ºC 87 %rh	Loose connection between HV and TI	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
37	Pollution 79.7 kV 27 ºC 87 %rh	HSP ESDD~0.05	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-S	E-S	E-S	E-S	E-S	E-S
			U-N	U-HSP	U-HSP	U-HSP	U-HSP	U-HSP
38	Pollution 79.7 kV 30.8 ºC 88 %rh	MSP ESDD~0.025	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-C	E-S	E-S	E-S	E-S	E-LS
			U-N	U-MSP	U-MSP	U-MSP	U-MSP	U-LS
39	Pollution 88 kV 30.8 ºC 88 %rh	MSP ESDD~0.025	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-S	E-S	E-LS	E-S	E-C	E-LS
			U-MSP	U-MSP	U-LS	U-MSP	U-MSP	U-LS

(Continued on next page)

Table 4 Continued – Test condition, PRPD and ultrasonic measurements for TPI 145 kV.

Nº	Condition	Type	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis
40	Pollution 79.7 kV 29.7 ºC 93 %rh	LSP ESDD~0.01	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-S	E-LS	E-LS	E-LS	E-LC	E-NCP
			U-LSP	U-LS	U-LS	U-LS	U-LC	U-LPD
41	Pollution 88 kV 29.7 ºC 93 %rh	LSP ESDD~0.01	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-LS	E-LS	E-LS	E-S	E-C	E-NCP
			U-LS	U-LS	U-LS	U-LSP	U-LSP	U-LPD

Table 5 – Test condition, PRPD and ultrasonic measurements for TC 145 kV.

Nº	Condition	Type	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis
42	Normal 79.7 kV 30.8 ºC 61 %rh	Deposit condition (dust)	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
43	Normal 88 kV 32 ºC 63 %rh	Deposit condition (dust)	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-LC	E-LC	E-LC	E-LC	E-LC	E-LC
			U-N	U-N	U-N	U-N	U-N	U-N
44	Normal 79.7 kV 32 ºC 82 %rh	Clean	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
45	Normal 88 kV 30.8 ºC 72 %rh	Clean	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
46	Corona 79.7 kV 31.4 ºC 74 %rh	MOT	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-N	E-N	E-N	E-N	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
47	Corona 79.7 kV 33 ºC 63 %rh	MOT	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-C	E-C	E-C	E-C	E-C	E-C
			U-C	U-C	U-N	U-N	U-N	U-N
48	Corona 88 kV 33 ºC 63 %rh	MOT	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-C	E-C	E-C	E-C	E-C	E-C
			U-N	U-N	U-N	U-C	U-C	U-N
49	Loose connection 79.7 kV 31 ºC 67 %rh	Loose connection between HV and IT	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-PC	E-PC	E-PC	E-PC	E-PC	E-PC
			U-N	U-N	U-N	U-N	U-N	U-N
50	Loose connection 88 kV 30 ºC 71 %rh	Loose connection between HV and IT	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-PC	E-PC	E-PC	E-PC	E-PC	E-PC
			U-N	U-N	U-N	U-N	U-N	U-N
51	Normal 79.7 kV 32 ºC 68 %rh	MAB	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-NCP	E-NCP	E-NCP	E-NCP	E-NCP	E-NCP
			U-N	U-N	U-N	U-N	U-N	U-N
52	Normal 88 kV 32 ºC 68 %rh	MAB	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-NCP	E-NCP	E-NCP	E-NCP	E-NCP	E-NCP
			U-N	U-N	U-N	U-N	U-N	U-N
53	Pollution 79.7 kV 30 ºC 70 %rh	HSP ESDD~0.05	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-S	E-S	E-S	E-S	E-LS	E-S
			U-HSP	U-HSP	U-HSP	U-HSP	U-LS	U-HSP
54	Pollution 88 kV 30 ºC 70 %rh	HSP ESDD~0.05	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-S	E-S	E-S	E-S	E-S	E-S
			U-HSP	U-HSP	U-HSP	U-HSP	U-HSP	U-HSP

(Continued on next page)

Table 5 Continued – Test condition, PRPD and ultrasonic measurements for TC 145 kV.

Nº	Condition	Type	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis	Loc/Dis
55	Pollution 79.7 kV 31 ºC 79 %rh	LSP ESDD~0.025	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-NCP	E-NCP	E-NCP	E-NCP	E-NCP	E-NCP
			U-N	U-N	U-N	U-N	U-N	U-N
56	Pollution 88 kV 31 ºC 79 %rh	LSP ESDD~0.025	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-C	E-NCP	E-NCP	E-NCP	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N
57	Pollution 79.7 kV 29 ºC 79 %rh	MSP ESDD~0.037	M1T10	M2M10	M3B10	M4T8	M5M8	M6B8
			E-N	E-NCP	E-N	E-NCP	E-N	E-NCP
			U-N	U-N	U-N	U-N	U-N	U-N
58	Pollution 88 kV 30 ºC 75 %rh	MSP ESDD~0.037	M1T8	M2M8	M3B8	M4T10	M5M10	M6B10
			E-NCP	E-NCP	E-NCP	E-NCP	E-N	E-N
			U-N	U-N	U-N	U-N	U-N	U-N