Table D.1. Definitions of Tabulated Generator Unit Data

GENERATOR		
Unit no.		Arbitrary reference number
Rated MVA		Machine-rated MVA; base MVA for impedances
Rated kV		Machine-rated terminal voltage in kV; base kV for impedances
Rated PF		Machine-rated power factor
SCR	(1)	Machine short circuit ratio
x''_d	pu	Unsaturated d axis subtransient reactance
x'_d	pu	Unsaturated d axis transient reactance
x_d	pu	Unsaturated d axis synchronous reactance
x''_q	pu	Unsaturated q axis subtransient reactance
x'_q	pu	Unsaturated q axis transient reactance
x_q	pu	Unsaturated q axis synchronous reactance
r_a	pu	Armature resistance
x_ℓ or x_p	pu	Leakage or Potier reactance
r_2	pu	Negative-sequence resistance
x_2	pu	Negative-sequence reactance
x_0	pu	Zero-sequence reactance
τ''_d	s	d axis subtransient short circuit time constant
τ'_d	s	d axis transient short circuit time constant
τ''_{d0}	s	d axis subtransient open circuit time constant
τ'_{d0}	s	d axis transient open circuit time constant
τ''_q	s	q axis subtransient short circuit time constant
τ'_q	s	q axis transient short circuit time constant
τ''_{q0}	s	q axis subtransient open circuit time constant
τ'_{q0}	s	q axis transient open circuit time constant
τ_a	s	Armature time constant
W_R	MW·s	Kinetic energy of turbine + generator at rated speed in MJ or MW·s
r_F	Ω	Machine field resistance in Ω
$S_{G1.0}$	(2)	Machine saturation at 1.0 pu voltage in pu
$S_{G1.2}$	(2)	Machine saturation at 1.2 pu voltage in pu
E_{FDFL}	(2)	Machine full load excitation in pu
D	(3)	Machine load damping coefficient

EXCITER		
VR Type	(4)	Excitation system type
Name		Excitation system name
RR	(4)	Exciter response ratio (formerly ASA response)
τ_R	s	Regulator input filter time constant
K_A	pu	Regulator gain (continuous acting regulator) or fast raise-lower contact setting (rheostatic regulator)
τ_A or τ_{A1}	s	Regulator time constant (#1)
τ_{A2}	s	Regulator time constant (#2)

EXCITER (*continued*)		
$V_{R\max}$	pu (4)	Maximum regulator output, starting at full load field voltage
$V_{R\min}$	pu (4)	Minimum regulator output, starting at full load field voltage
K_E	pu	Exciter self-excitation at full load field voltage
τ_E	s	Exciter time constant
$S_{E.75\max}$	(5)	Rotating exciter saturation at 0.75 ceiling voltage, or K_I for SCPT exciter
$S_{E\max}$	(5)	Rotating exciter saturation at ceiling voltage, or K_p for SCPT exciter
A_{EX}	(5)	Derived saturation constant for rotating exciters
B_{EX}	(5)	Derived saturation constant for rotating exciters
$E_{FD\max}$	pu (5)	Maximum field voltage or ceiling voltage, pu
$E_{FD\min}$	pu	Minimum field voltage
K_F	pu	Regulator stabilizing circuit gain
τ_F or τ_{F1}	s	Regulator stabilizing circuit time constant (#1)
τ_{F2}	s	Regulator stabilizing circuit time constant (#2)

TURBINE-GOVERNOR		
GOV	(6)	Governor type: G = general, C = cross-compound, H = hydraulic
R	(6)	Turbine steady-state regulation setting or droop
$P_{\max}$	MW	Maximum turbine output in MW
τ_1	s	Control time constant (governor delay) or governor response time (type H)
τ_2	s	Hydro reset time constant (type G) or pilot valve time (type H)
τ_3	s	Servo time constant (type G or C), or hydro gate time constant (type G) or dashpot time constant (type H)
τ_4	s	Steam valve bowl time constant (zero for type G hydrogovernor) or ($\tau_W/2$ for type H)
τ_5	s	Steam reheat time constant or 1/2 hydro water starting time constant (type C or G) or minimum gate velocity in MW/s (type H)
F	(6)	pu shaft output ahead of reheater or −2.0 for hydro units (types C or G), or maximum gate velocity in MW/s (type H)

STABILIZER		
PSS	(7)	PSS feedback: F = frequency, S = speed, P = accelerating power
K_{QV}	(7)	PSS voltage gain, pu
K_{QS}	(7)	PSS speed gain, pu
τ_Q	s	PSS reset time constant
τ'_{Q1}	s	First lead time constant
τ_{Q1}	s	First lag time constant
τ'_{Q2}	s	Second lead time constant
τ_{Q2}	s	Second lag time constant
τ'_{Q3}	s	Third lead time constant
τ_{Q3}	s	Third lag time constant
$V_{S\lim}$	pu	PSS output limit setting, pu

Table D.2. Typical Data for Hydro (*H*) Units

GENERATOR										
Unit no.		*H*1	*H*2	*H*3	*H*4	*H*5	*H*6	*H*7	*H*8	*H*9
Rated MVA		9.00	17.50	25.00	35.00	40.00	54.00	65.79	75.00	86.00
Rated kV		6.90	7.33	13.20	13.80	13.80	13.80	13.80	13.80	13.80
Rated PF		0.90	0.80	0.95	0.90	0.90	0.90	0.95	0.95	0.90
SCR	(1)	1.250	...	2.280	1.167	1.180	1.18	1.175	2.36	1.18
x''_d	pu	0.329	0.330	0.310	0.235	0.288	0.340	0.240	0.140	0.258
x'_d	pu	0.408	...	...	0.260	0.318	0.380	0.260	0.174	0.320
x_d	pu	0.911	1.070	1.020	1.000	0.990	1.130	0.900	0.495	1.050
x''_q	pu	...	...	...	0.264	0.306	0.340	...	0.135	0.306
x'_q	pu	0.580	0.660	0.650	0.620	0.615	0.680	0.540	...	0.670
x_q	pu	0.580	0.660	0.650	0.620	0.615	0.680	0.540	0.331	0.670
r_a	pu	...	0.003	0.0032	0.004	0.0029	0.0049	0.0022	0.0041	0.0062
x_ℓ or x_p	pu	...	0.310	0.924	0.170	0.224	0.2100	...	0.120	0.140
r_2	pu	...	0.030	0.030	0.040	...	...	0.014	...	0.060
x_2	pu	...	0.490	0.460	0.270	0.297	0.340	0.260	0.130	0.312
x_0	pu	...	0.200	0.150	0.090	0.125	0.180	0.130	0.074	0.130
τ''_d	s	...	0.035	0.035	0.035	...	...	...	...	0.044
τ'_d	s	...	1.670	2.190	2.300	1.700	3.000	1.600	1.850	2.020
τ''_{d0}	s	...	...	...	...	...	...	...	...	0.051
τ'_{d0}	s	4.200	5.400	7.200	7.100	5.300	8.500	5.500	8.400	4.000
τ''_q	s	...	0.035	0.035	0.035	...	...	...	...	0.017
τ'_q	s	...	0.835	1.100	1.150	...	...	...	...	...
τ''_{q0}	s	...	...	...	...	...	...	...	...	0.033
τ'_{q0}	s	...	...	...	...	...	...	...	...	...
τ_a	s	0.1800	...	...	...	...	...	...	...	0.286
W_R	MW-s	23.50	117.00	183.00	254.00	107.90	168.00	176.00	524.00	233.00
r_F	Ω	...	...	...	...	0.269	0.301	0.199	0.155	0.332
$S_{G1.0}$	(2)	0.160	0.064	0.064	0.064	0.194	0.3127	0.1827	0.170	0.245
$S_{G1.2}$	(2)	0.446	1.018	1.018	1.018	0.685	0.7375	0.507	0.440	0.770
E_{FDFL}	(2)	2.080	2.130	2.130	2.130	2.030	2.320	1.904	1.460	2.320
D	(3)	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
EXCITER										
VR type	(4)	*E*	*E*	*E*	*E*	*A*	*A*	*A*	*A*	*A*
Name		RHEO	AJ23	GFA4	WMA	NA108	REGULUX	WMA	NA108	NA143
RR	(4)	0.88	0.5	0.5	0.5	0.5	0.5	1.85	0.5	0.5
τ_R	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
K_A	pu	0.050	0.050	0.050	0.050	65.200	25.000	37.300	180.000	242.000
τ_A or τ_{A1}	s	20.000	20.000	20.000	20.000	0.200	0.200	0.120	1.000	0.060
τ_{A2}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.000
$V_{R\max}$	pu (4)	4.320	5.940	4.390	5.940	2.607	1.000	1.410	3.000	5.320
$V_{R\min}$	pu (4)	0.000	1.210	0.000	1.210	−2.607	−1.000	−1.410	−3.000	−5.320
K_E	pu	1.000	1.000	1.000	1.000	−0.111	−0.057	−0.137	−0.150	−0.1219
τ_E	s	2.019	0.760	1.970	0.760	1.930	0.646	0.560	2.000	2.700
$S_{E.75\max}$	(5)	0.099	0.220	0.096	0.220	0.176	0.0885	0.328	0.623	0.450
$S_{E\max}$	(5)	0.385	0.950	0.375	0.950	0.610	0.3480	0.687	1.327	1.500
A_{EX}	(5)	0.0017	0.0027	0.0016	0.0027	0.0042	0.0015	0.0357	0.0645	0.0121
B_{EX}	(5)	1.7412	1.9185	1.7059	1.9185	0.9488	1.5738	1.1507	1.1861	1.3566
$E_{FD\max}$	pu (5)	3.120	3.050	3.195	3.050	5.240	3.480	2.570	2.550	3.550
$E_{FD\min}$	pu	0.000	1.210	0.000	1.210	−5.240	−3.480	−2.570	−2.550	−3.550
K_F	pu	0.000	0.000	0.000	0.000	0.120	0.103	0.055	0.150	0.100
τ_F or τ_{F1}	s	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
τ_{F2}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table D.2 *(continued)*

TURBINE-GOVERNOR										
GOV	(6)	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*
R	(6)	0.050	0.050	0.050	0.050	0.056	0.050	0.050	0.050	0.050
P_{max}	MW	8.60	14.00	23.80	40.00	40.00	52.50	65.50	90.00	86.00
τ_1	s	48.440	16.000	16.000	16.000	0.000	0.000	25.600	20.000	12.000
τ_2	s	4.634	2.400	2.400	2.400	0.000	0.000	2.800	4.000	3.000
τ_3	s	0.000	0.920	0.920	0.920	0.500	0.000	0.500	0.500	0.500
τ_4	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
τ_5	s	0.579	0.300	0.300	0.300	0.430	0.785	0.350	0.850	1.545
F	(6)	−2.000	−2.000	−2.000	−2.000	−2.000	−2.000	−2.000	−2.000	−2.000
STABILIZER										
PSS	(7)	...	...	...	...	...	...	*F*	*F*	*F*
K_{QV}	(7)	...	...	...	...	...	...	0.000	0.000	0.000
K_{QS}	(7)	...	...	...	...	...	...	1.000	4.000	3.150
τ_Q	s	...	...	...	...	...	...	30.000	30.000	10.000
τ'_{Q1}	s	...	...	...	...	...	...	0.500	0.700	0.758
τ_{Q1}	s	...	...	...	...	...	...	0.030	0.100	0.020
τ'_{Q2}	s	...	...	...	...	...	...	0.500	0.700	0.758
τ_{Q2}	s	...	...	...	...	...	...	0.030	0.050	0.020
τ'_{Q3}	s	...	...	...	...	...	...	0.000	0.000	0.000
τ_{Q3}	s	...	...	...	...	...	...	0.000	0.000	0.000
V_{slim}	pu	...	...	...	...	...	...	0.100	0.100	0.095

Table D.2. *(cont.)*

Table D.2 *(continued)*

GENERATOR										
Unit no.		*H*10	*H*11	*H*12	*H*13	*H*14	*H*15	*H*16	*H*17	*H*18
Rated MVA		100.10	115.00	125.00	131.00	145.00	158.00	231.60	250.00	615.00
Rated kV		13.80	12.50	13.80	13.80	14.40	13.80	13.80	18.00	15.00
Rated PF		0.90	0.85	0.90	0.90	0.90	0.90	0.95	0.85	0.975
SCR	(1)	1.20	1.05	1.155	1.12	1.20	...	1.175	1.050	...
x''_d	pu	0.280	0.250	0.205	0.330	0.273	0.220	0.245	0.155	0.230
x'_d	pu	0.314	0.315	0.300	0.360	0.312	0.300	0.302	0.195	0.2995
x_d	pu	1.014	1.060	1.050	1.010	0.953	0.920	0.930	0.995	0.8979
x''_q	pu	0.375	0.287	0.221	0.330	0.402	0.290	0.270	0.143	0.2847
x'_q	pu	0.770	0.610	0.686	0.570	0.573	0.510	...	0.568	0.646
x_q	pu	0.770	0.610	0.686	0.570	0.573	0.510	0.690	0.568	0.646
r_a	pu	0.0049	0.0024	0.0023	0.004	...	0.002	0.0021	0.0014	...
x_ℓ or x_p	pu	0.163	0.147	0.218	0.170	0.280	0.130	0.340	0.160	0.2396
r_2	pu	...	0.027	0.008	...	...	0.045	...	...	...
x_2	pu	0.326	0.269	0.211	0.330	...	0.255	0.258	...	...
x_0	pu	...	0.161	0.150	0.150	...	0.120	0.135	...	...
τ''_d	s	0.035	...	...	0.030	...	0.024	0.020	...	...
τ'_d	s	1.810	2.260	1.940	2.700	...	1.600	3.300	...	...
τ''_{d0}	s	0.039	0.040	...	0.030	0.041	0.029	0.030	...	...
τ'_{d0}	s	6.550	8.680	6.170	7.600	7.070	5.200	8.000	9.200	7.400
τ''_q	s	...	...	...	0.030	...	0.028	0.020	...	...
τ'_q	s	...	...	...	...	...	...	...	...	...
τ''_{q0}	s	0.071	0.080	...	0.040	0.071	0.034	0.060	...	...
τ'_{q0}	s	...	...	...	...	...	...	...	...	...
τ_a	s	0.278	0.330	...	0.180	...	0.360	0.200	...	...
W_R	MW·s	312.00	439.00	392.09	458.40	469.00	502.00	786.00	1603.00	3166.00
r_F	Ω	0.332	0.156	0.379	0.182	...	0.206	0.181	...	...
$S_{G1.0}$	(2)	0.219	0.178	0.200	0.113	0.220	0.1642	0.120	0.0769	0.180
$S_{G1.2}$	(2)	0.734	0.592	0.612	0.478	0.725	0.438	0.400	0.282	0.330
E_{FDFL}	(2)	2.229	2.200	2.220	1.950	2.230	1.990	1.850	1.88	...
D	(3)	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
EXCITER										
VR type	(4)	*A*	*A*	*A*	*G*	*A*	*A*	*A*	*A*	*J*
Name		WMA	WMA	NA143A	SCR	WMA	NA143	SIEMEN	ASEA	...
RR	(4)	1.0	1.5	1.5	0.5	1.0	0.5	1.0	1.0	...
τ_R	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
K_A	pu	400.000	276.000	54.000	272.000	400.000	17.800	50.000	100.000	200.000
τ_A or τ_{A1}	s	0.050	0.060	0.105	0.020	0.050	0.200	0.060	0.020	0.020
τ_{A2}	s	0.000	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.000
$V_{R\max}$	pu (4)	4.120	1.960	3.850	2.730	4.120	0.710	1.000	5.990	7.320
$V_{R\min}$	pu (4)	−4.120	−1.960	−3.850	−2.730	−4.120	−0.710	−1.000	−5.990	0.000
K_E	pu	−0.243	−0.184	−0.062	1.000	−0.243	−0.295	−0.080	−0.020	1.000
τ_E	s	0.950	1.290	0.732	0.000	0.950	0.535	0.405	0.100	0.000
$S_{E.75\max}$	(5)	0.484	0.270	0.410	0.000	0.480	0.333	0.200	0.127	0.000
$S_{E\max}$	(5)	1.308	0.560	1.131	0.000	1.310	0.533	0.407	0.300	0.000
A_{EX}	(5)	0.0245	0.0303	0.0195	0.000	0.0236	0.0812	0.0237	0.0096	0.000
B_{EX}	(5)	1.0276	0.5612	1.1274	0.000	1.0377	0.6303	0.9227	1.1461	0.000
$E_{FD\max}$	pu (5)	3.870	5.200	3.600	2.730	3.870	2.985	3.080	3.000	7.320
$E_{FD\min}$	pu	−3.870	−5.200	−3.600	0.000	−3.870	−2.985	−3.080	−3.000	0.000
K_F	pu	0.040	0.0317	0.140	0.0043	0.040	0.120	0.0648	0.000	0.010
τ_F or τ_{F1}	s	1.000	0.480	1.000	0.060	1.000	1.000	1.000	0.000	1.000
τ_{F2}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table D.2 *(continued)*

TURBINE-GOVERNOR										
GOV	(6)	G	G	G	G	G	G	G	G	G
R	(6)	0.030	0.051	0.050	0.050	0.038	0.050	0.050	0.050	0.050
P_{max}	MW	133.00	115.00	171.00	120.00	160.00	155.00	267.00	250.00	603.30
τ_1	s	52.100	...	31.00	27.500	65.300	...	124.470	30.000	36.000
τ_2	s	4.800	...	4.120	3.240	6.200	...	8.590	3.500	6.000
τ_3	s	0.500	...	0.393	0.500	0.500	...	0.250	0.520	0.000
τ_4	s	0.000	...	0.000	0.000	0.000	...	0.000	0.000	0.000
τ_5	s	0.498	...	0.515	0.520	0.650	...	0.740	0.415	0.900
F	(6)	−2.000	−2.000	−2.000	−2.000	−2.000	−2.000	−2.000	−2.000	−2.000
STABILIZER										
PSS	(7)	F	F	F	...	...	...	F	F	F
K_{QV}	(7)	0.000	0.000	0.000	...	...	...	0.000	0.000	0.000
K_{QS}	(7)	1.000	0.300	8.000	...	...	...	4.000	10.000	5.000
τ_Q	s	10.000	10.000	30.000	...	...	...	55.000	15.000	10.000
τ'_{Q1}	s	0.700	0.431	0.600	...	...	...	1.000	0.000	0.380
τ_{Q1}	s	0.020	0.020	0.100	...	...	...	0.020	0.053	0.020
τ'_{Q2}	s	0.700	0.431	0.600	...	...	...	1.000	0.000	0.380
τ_{Q2}	s	0.020	0.020	0.040	...	...	...	0.020	0.053	0.020
τ'_{Q3}	s	0.000	0.000	0.000	...	...	...	0.000	0.000	0.000
τ_{Q3}	s	0.000	0.000	0.000	...	...	...	0.000	0.000	0.000
V_{slim}	pu	0.050	0.100	0.100	...	...	...	0.090	0.050	0.050

Table D.3. Typical Data for Fossil Steam (F) Units

GENERATOR												
Unit no.		*F*1	*F*2	*F*3	*F*4	*F*5	*F*6	*F*7	*F*8	*F*9	*F*10	*F*11
Rated MVA		25.00	35.29	51.20	75.00	100.00	125.00	147.10	160.00	192.00	233.00	270.00
Rated kV		13.80	13.80	13.80	13.80	13.80	15.50	15.50	15.00	18.00	20.00	18.00
Rated PF		0.80	0.85	0.80	0.80	0.80	0.85	0.85	0.85	0.85	0.85	0.85
SCR	(1)	0.80	0.80	0.90	1.00	0.90	0.90	0.64	0.64	0.64	0.64	0.6854
x''_d	pu	0.120	0.118	0.105	0.130	0.145	0.134	0.216	0.185	0.171	0.249	0.185
x'_d	pu	0.232	0.231	0.209	0.185	0.220	0.174	0.299	0.245	0.232	0.324	0.256
x_d	pu	1.250	1.400	1.270	1.050	1.180	1.220	1.537	1.700	1.651	1.569	1.700
x''_q	pu	0.120	...	0.116	0.130	0.145	0.134	0.216	0.185	0.171	0.248	0.147
x'_q	pu	0.715	...	0.850	0.360	0.380	0.250	0.976	0.380	0.380	0.918	0.245
x_q	pu	1.220	1.372	1.240	0.980	1.050	1.160	1.520	1.640	1.590	1.548	1.620
r_a	pu	0.0014	...	...	0.0031	0.0035	0.004	0.0034	0.0031	0.0026	0.0016	0.0016
x_ℓ or x_p	pu	0.134	...	0.108	0.070	0.075	0.078	0.133	0.110	0.102	0.204	0.155
r_2	pu	0.0082	...	...	0.016	0.020	0.017	0.0284	0.016	0.023	...	...
x_2	pu	0.120	0.118	0.105	0.085	0.095	0.134	0.216	0.115	0.171	0.248	0.140
x_0	pu	0.0215	0.077	0.116	0.070	0.065	...	0.093	0.100	...	0.143	0.060
τ''_d	s	0.035	...	...	...	...	0.023	0.035	...	0.023	0.350	0.027
τ'_d	s	0.882	...	0.882	...	...	1.280	...	...	0.829	0.950	0.620
τ''_{d0}	s	0.059	...	...	0.038	0.042	0.033	0.0484	0.033	0.033	0.0437	...
τ'_{d0}	s	4.750	5.500	6.600	6.100	5.900	8.970	4.300	5.900	5.900	5.140	4.800
τ''_q	s	0.035	...	...	...	...	0.023	0.0072	...	0.023	...	...
τ'_q	s	...	...	...	...	...	0.640	...	...	0.415	...	...
τ''_{q0}	s	0.210	...	...	0.099	0.092	0.070	0.218	0.076	0.078	0.141	...
τ'_{q0}	s	1.500	...	...	0.300	0.300	0.500	1.500	0.540	0.535	1.500	0.500
τ_a	s	0.177	...	...	0.140	0.140	0.390	0.470	0.240	0.254	0.420	0.297
W_R	MW·s	125.40	154.90	260.00	464.00	498.50	596.00	431.00	634.00	634.00	960.50	1115.00
r_F	Ω	0.375	...	0.295	0.290	0.215	...	...	0.370	...	...	0.166
$S_{G1.0}$	(2)	0.279	0.210	0.2067	0.100	0.0933	0.1026	0.057	0.1251	0.105	0.0987	0.125
$S_{G1.2}$	(2)	0.886	0.805	0.724	0.3928	0.4044	0.4320	0.364	0.7419	0.477	0.303	0.450
E_{FDFL}	(2)	2.500	3.000	2.310	2.120	2.292	2.220	2.670	2.680	2.640	2.580	2.300
D	(3)	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
EXCITER												
VR type		*E*	*A*	*A*	*E*	*A*	*A*	*A*	*A*	*A*	*C*	*A*
Name	(4)	BJ30	NA143A	WMA	GFA4	NA101	NA101	WMA	NA101	NA101	BRLS	BBC
RR	(4)	0.50	0.50	1.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
τ_R	s	0.000	0.000	0.000	0.000	0.060	0.060	0.000	0.060	0.060	0.000	0.000
K_A	pu	0.050	57.140	400.000	0.050	25.000	25.000	175.000	25.000	25.000	250.000	30.000
τ_A or τ_{A1}	s	20.000	0.050	0.050	20.000	0.200	0.200	0.050	0.200	0.200	0.060	0.400

τ_{A2}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$V_{R\max}$	pu (4)	6.812	1.000	0.6130	4.380	1.000	1.000	3.120	1.000	1.000	4.420	4.590
$V_{R\min}$	pu (4)	1.395	−1.000	−0.6130	0.000	−1.000	−1.000	−3.120	−1.000	−1.000	−4.420	−4.590
K_E	pu	1.000	−0.0445	−0.0769	1.000	−0.0582	−0.0601	−0.170	−0.0497	−0.0505	1.000	−0.020
τ_E	s	0.700	0.500	1.370	1.980	0.6544	0.6758	0.952	0.560	0.5685	0.613	0.560
$S_{E.75\max}$	(5)	0.414	0.0684	0.1120	0.0967	0.0895	0.0924	0.220	0.0765	0.0778	0.010	0.730
$S_{E\max}$	(5)	0.908	0.2667	0.2254	0.3774	0.349	0.3604	0.950	0.2985	0.303	0.270	1.350
A_{EX}	(5)	0.0392	0.0012	0.0137	0.0016	0.0015	0.0016	0.0027	0.0013	0.0013	0.000	0.1154
B_{EX}	(5)	0.8807	1.2096	0.6774	1.7128	1.5833	1.6349	1.4628	1.3547	1.3733	3.7884	0.7128
$E_{FD\max}$	pu (5)	3.567	4.500	4.130	3.180	3.438	3.330	4.000	4.020	3.960	3.480	3.450
$E_{FD\min}$	pu	1.417	−4.500	−4.130	0.000	−3.438	−3.330	−4.000	−4.020	−3.960	0.000	−3.450
K_F	pu	0.000	0.080	0.040	0.000	0.105	0.108	0.030	0.0896	0.091	0.053	0.050
τ_F or τ_{F1}	s	0.000	1.000	1.000	0.000	0.350	0.350	1.000	0.350	0.350	0.330	1.300
τ_{F2}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TURBINE GOVERNOR												
GOV	(6)	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*
R	(6)	0.050	0.050	0.078	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
$P_{\max}$	MW	22.50	36.10	53.00	75.00	105.00	132.00	121.00	142.30	175.00	210.00	230.00
τ_1	s	0.200	0.200	0.200	0.090	0.090	0.083	0.200	0.100	0.083	0.150	0.100
τ_2	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
τ_3	s	0.300	0.300	0.300	0.200	0.200	0.200	0.300	0.200	0.200	0.100	0.259
τ_4	s	0.090	0.200	0.090	0.300	0.300	0.050	0.090	0.050	0.050	0.300	0.100
τ_5	s	0.000	0.000	0.000	0.000	0.000	5.000	10.000	8.000	8.000	10.000	10.000
F	(6)	1.000	1.000	1.000	1.000	1.000	0.280	0.250	0.300	0.271	0.237	0.272
STABILIZER												
PSS	(7)	...	...	*F*	...	...	...	...	...	*S*	...	...
K_{QV}	(7)	...	...	0.000	...	...	...	...	...	0.000	...	...
K_{QS}	(7)	...	...	0.700	...	...	...	...	...	15.000	...	...
τ_Q	s	...	...	10.000	...	...	...	...	...	10.000	...	...
τ'_{Q1}	s	...	...	0.300	...	...	...	...	...	1.000	...	...
τ_{Q1}	s	...	...	0.020	...	...	...	...	...	0.020	...	...
τ'_{Q2}	s	...	...	0.300	...	...	...	...	...	0.750	...	...
τ_{Q2}	s	...	...	0.020	...	...	...	...	...	0.020	...	...
τ'_{Q3}	s	...	...	0.000	...	...	...	...	...	0.000	...	...
τ_{Q3}	s	...	...	0.000	...	...	...	...	...	0.000	...	...
V_{slim}	pu	...	...	0.100	...	...	...	...	...	0.050	...	...

Table D.3 *(continued)*

GENERATOR											
Unit no.		F12	F13	F14	F15	F16	F17	F18	F19	F20	F21
Rated MVA		330.00	384.00	410.00	448.00	512.00	552.00	590.00	835.00	896.00	911.00
Rated kV		20.00	24.00	24.00	22.00	24.00	24.00	22.00	20.00	26.00	26.00
Rated PF		0.90	0.85	0.90	0.85	0.90	0.90	0.95	0.90	0.90	0.90
SCR	(1)	0.580	0.580	0.580	0.580	0.580	0.580	0.500	0.500	0.52	0.64
x''_d	pu	...	0.260	0.2284	0.205	0.200	0.198	0.215	0.339	0.180	0.193
x'_d	pu	0.317	0.324	0.2738	0.265	0.270	0.258	0.280	0.413	0.220	0.266
x_d	pu	1.950	1.798	1.7668	1.670	1.700	1.780	2.110	2.183	1.790	2.040
x''_q	pu	...	0.255	0.2239	0.205	...	0.172	0.215	0.332	...	0.191
x'_q	pu	1.120	1.051	1.0104	0.460	0.470	0.247	0.490	1.285	0.400	0.262
x_q	pu	1.920	1.778	1.7469	1.600	1.650	1.770	2.020	2.157	1.715	1.960
r_a	pu	...	0.0014	0.0019	0.0043	0.004	0.0047	0.0046	0.0019	0.001	0.001
x_ℓ or x_p	pu	0.199	0.1930	0.1834	0.150	0.160	...	0.155	0.246	0.135	0.154
r_2	pu	...	0.0054	...	0.023	...	0.013	0.026	...	0.019	...
x_2	pu	...	0.2374	0.2261	0.175	...	0.167	0.215	0.309	0.135	0.192
x_0	pu	...	0.1320	0.1346	0.140	...	0.112	0.150	0.174	0.130	0.105
τ''_d	s	...	0.035	...	0.023	...	0.030	0.0225	...	0.035	...
τ'_d	s	...	0.159	...	1.070	...	0.550	...	...	0.596	...
τ''_{d0}	s	...	0.042	0.042	0.032	...	...	0.032	0.041	0.032	...
τ'_{d0}	s	6.000	5.210	5.432	3.700	3.800	3.650	4.200	5.690	4.300	6.000
τ''_q	s	...	0.035	...	...	...	...	0.0225	...	0.035	...
τ'_q	s	...	0.581	...	...	...	...	...	...	0.298	...
τ''_{q0}	s	...	0.042	0.158	0.060	...	...	0.062	0.144	...	...
τ'_{q0}	s	1.500	1.500	1.500	0.470	0.480	1.230	0.565	1.500	...	0.900
τ_a	s	...	0.450	...	0.150	...	...	0.140	...	0.160	...
W_R	MW-s	992.00	1006.50	1518.70	1190.00	1347.20	3010.00	1368.00	2206.40	2625.00	2265.00
r_F	Ω	...	0.1245	...	0.1357	...	0.0711	0.1094	...	...	...
$S_{G1.0}$	(2)	0.082	0.162	0.2632	0.0910	0.090	0.111	0.079	0.134	0.090	0.340
$S_{G1.2}$	(2)	0.290	0.508	0.5351	0.400	0.400	0.518	0.349	0.617	0.402	1.120
E_{FDFL}	(2)	...	3.053	2.7895	2.870	2.700	3.000	2.980	3.670	3.330	3.670
D	(3)	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
EXCITER											
VR type		A	C	C	A	G	A	G	C	G	A
Name	(4)	WMA	BRLS	BRLS	NA143A	ALTHYREX	BBC	ALTHYREX	WTA	ALTHYREX	BBC
RR	(4)	0.50	0.50	0.50	0.50	1.50	0.50	3.50	2.00	2.50	0.50
τ_R	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
K_A	pu	400.000	400.000	400.000	50.000	200.000	30.000	200.000	400.000	250.000	50.000
τ_A or τ_{A1}	s	0.050	0.020	0.020	0.060	0.3950	0.400	0.3575	0.020	0.200	0.060
τ_{A2}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

V_{Rmax}	pu (4)	3.810	8.130	5.270	1.000	3.840	5.990	5.730	18.300	5.150	1.000
V_{Rmin}	pu (4)	−3.810	−8.130	−5.270	−1.000	−3.840	−5.990	−5.730	−18.300	−5.150	−1.000
K_E	pu	−0.170	1.000	1.000	−0.0465	1.000	−0.020	1.000	1.000	1.000	−0.0393
τ_E	s	0.950	0.812	0.920	0.520	0.000	0.560	0.000	0.942	0.000	0.440
$S_{E.75max}$	(5)	0.220	0.459	0.435	0.071	0.000	0.730	0.000	0.813	0.000	0.064
S_{Emax}	(5)	0.950	0.656	0.600	0.278	0.000	1.350	0.000	2.670	0.000	0.235
A_{EX}	(5)	0.0027	0.1572	0.1658	0.0012	0.000	0.1154	0.000	0.023	0.000	0.0013
B_{EX}	(5)	0.3857	0.2909	0.3910	1.2639	0.000	0.5465	0.000	0.9475	0.000	1.1562
E_{FDmax}	pu (5)	4.890	4.910	3.290	4.320	3.840	4.500	5.730	5.020	5.150	4.500
E_{FDmin}	pu	−4.890	0.000	0.000	−4.320	−3.840	−4.500	−5.730	0.000	−5.150	−4.500
K_F	pu	0.040	0.060	0.030	0.0832	0.0635	0.050	0.0529	0.030	0.036	0.070
τ_F or τ_{F1}	s	1.000	1.000	1.000	1.000	1.000	1.300	1.000	1.000	1.000	1.000
τ_{F2}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TURBINE GOVERNOR											
GOV	(6)	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*
R	(6)	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
P_{max}	MW	347.00	360.00	367.00	390.00	460.00	497.00	553.00	766.29	810.00	820.00
τ_1	s	0.100	0.220	0.180	0.100	0.150	0.100	0.080	0.180	0.100	0.100
τ_2	s	0.000	0.000	0.000	0.000	0.050	0.000	0.000	0.030	0.000	0.000
τ_3	s	0.400	0.200	0.040	0.300	0.300	0.300	0.150	0.200	0.200	0.200
τ_4	s	0.050	0.250	0.250	0.050	0.260	0.100	0.050	0.000	0.100	0.100
τ_5	s	8.000	8.000	8.000	10.000	8.000	10.000	10.000	8.000	8.720	8.720
F	(6)	0.250	0.270	0.267	0.250	0.270	0.300	0.280	0.300	0.300	0.300
STABILIZER											
PSS	(7)	...	...	...	*S*	*S*	...	*S*	*F*	*S*	...
K_{QV}	(7)	...	...	...	0.000	0.000	...	0.000	0.000	0.000	...
K_{QS}	(7)	...	...	...	4.000	26.000	...	24.400	0.400	24.000	...
τ_Q	s	...	...	...	10.000	3.000	...	3.000	10.000	10.000	...
τ'_{Q1}	s	...	...	...	0.230	0.150	...	0.150	0.650	0.200	...
τ_{Q1}	s	...	...	...	0.020	0.050	...	0.050	0.020	0.060	...
τ'_{Q2}	s	...	...	...	0.230	0.150	...	0.150	0.650	0.150	...
τ_{Q2}	s	...	...	...	0.020	0.050	...	0.050	0.020	0.020	...
τ'_{Q3}	s	...	...	...	0.000	0.000	...	0.000	0.000	0.000	...
τ_{Q3}	s	...	...	...	0.000	0.000	...	0.000	0.000	0.000	...
V_{slim}	pu	...	...	...	0.100	0.050	...	0.050	0.100	0.050	...

Table D.4. Typical Data for Cross-Compound Fossil Steam (*CF*) Units

GENERATOR											
Unit no.		*CF1-HP*	*CF1-LP*	*CF2-HP*	*CF2-LP*	*CF3-HP*	*CF3-LP*	*CF4-HP*	*CF4-LP*	*CF5-HP*	*CF5-LP*
Rated MVA		128.00	128.00	192.00	192.00	278.30	221.70	445.00	375.00	483.00	426.00
Rated kV		13.80	13.80	18.00	18.00	20.00	20.00	22.00	22.00	22.00	22.00
Rated PF		0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
SCR	(1)	0.64	0.64	0.64	0.64	0.58	0.58	0.64	0.64	0.604	0.645
x''_d	pu	0.171	0.250	0.225	0.225	0.231	0.252	0.205	0.180	0.220	0.205
x'_d	pu	0.232	0.369	0.315	0.315	0.311	0.380	0.260	0.250	0.285	0.285
x_d	pu	1.680	1.660	1.670	1.670	1.675	1.581	1.650	1.500	1.800	1.750
x''_q	pu	0.171	0.250	0.224	0.224	0.229	0.248	0.205	0.181	0.220	0.205
x'_q	pu	0.320	0.565	0.958	0.958	0.979	0.955	0.460	0.440	0.490	0.485
x_q	pu	1.610	1.590	1.640	1.640	1.648	1.531	1.590	1.400	1.720	1.580
r_a	pu	0.0024	0.003	0.0036	0.0036	0.0043	0.0039	0.0043	0.0045	0.0027	0.0036
x_ℓ or x_p	pu	0.095	0.140	0.186	0.186	0.304	0.291	0.150	0.140	0.160	0.155
r_2	pu	0.026	0.020	0.028	0.028	0.029	0.028	0.022	0.022	0.025	0.025
x_2	pu	0.171	0.250	0.224	0.224	0.229	0.249	0.175	0.145	0.220	0.205
x_0	pu	...	...	0.101	0.101	...	...	0.140	0.135	0.150	0.150
τ''_d	s	0.023	0.023	...	...	0.023	0.023	0.020	0.020	0.023	0.023
τ'_d	s	0.815	1.130	0.820	0.820	1.000	1.292	...	...	0.586	1.360
τ''_{d0}	s	0.034	0.037	0.043	0.043	0.047	0.053	0.032	0.036	0.032	0.035
τ'_{d0}	s	5.890	5.100	5.000	5.000	5.400	5.390	4.800	8.000	3.700	8.400
τ''_q	s	0.023	0.023	...	...	0.023	0.023	0.020	0.020	0.023	0.023
τ'_q	s	0.410	0.570	...	...	0.500	0.650	...	...	0.293	0.680
τ''_{q0}	s	0.080	0.070	0.150	0.150	0.150	0.135	0.060	0.070	0.060	0.070
τ'_{q0}	s	0.600	0.326	1.500	1.500	1.500	1.500	0.470	0.410	0.480	0.460
τ_a	s	0.171	0.205	0.390	0.390	0.390	0.330	0.150	0.110	0.150	0.110
W_R	MW·s	305.00	787.00	596.70	650.70	464.00	1418.00	639.50	3383.50	633.00	2539.00
r_F	Ω	...	...	0.141	0.141	...	...	0.1357	0.3958	0.1259	0.343
$S_{G1.0}$	(2)	0.121	0.1122	0.0982	0.0982	0.1249	0.0905	0.0926	0.1333	0.0866	0.177
$S_{G1.2}$	(2)	0.610	0.433	0.4161	0.4161	0.500	0.345	0.4139	0.5555	0.410	0.532
E_{FDFL}	(2)	2.640	2.640	2.840	2.840	2.570	2.500	2.730	2.560	2.900	2.915
D	(3)	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
EXCITER											
VR type		*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*G*	*G*
Name	(4)	NA101	NA101	WMA	WMA	WMA	WMA	NA143A	NA143A	ALTHYREX	ALTHYREX
RR	(4)	0.50	0.50	0.50	0.50	0.50	0.50	2.00	2.00	2.50	2.50
τ_R	s	0.060	0.060	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
K_A	pu	25.000	25.000	275.000	275.000	245.000	245.000	592.000	312.000	250.000	250.000

τ_A or τ_{A1}	s	0.200	0.200	0.060	0.060	0.050	0.050	0.053	0.050	0.140	0.060
τ_{A2}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$V_{R\max}$	pu (4)	1.000	1.000	0.984	0.984	2.780	2.780	13.050	10.770	5.150	4.910
$V_{R\min}$	pu (4)	−1.000	−1.000	−0.984	−0.984	−2.780	−2.780	−13.050	−10.770	−5.150	−4.910
K_E	pu	−0.051	−0.051	−0.0667	−0.0667	−0.170	−0.170	−0.591	−0.4035	1.000	1.000
τ_E	s	0.5685	0.5685	1.230	1.230	1.370	1.370	0.512	1.080	0.000	0.000
$S_{E.75\max}$	(5)	0.0778	0.0778	0.1688	0.1688	0.220	0.220	1.094	0.647	0.000	0.000
$S_{E\max}$	(5)	0.3035	0.3035	0.2978	0.2978	0.950	0.950	3.048	2.545	0.000	0.000
A_{EX}	(5)	0.0013	0.0013	0.0307	0.0307	0.0027	0.0027	0.0506	0.0106	0.000	0.000
B_{EX}	(5)	1.3750	1.3750	0.5331	0.5331	1.639	1.639	0.7719	1.0891	0.000	0.000
$E_{FD\max}$	pu (5)	3.960	3.960	4.260	4.260	3.570	3.570	5.310	5.030	5.150	4.910
$E_{FD\min}$	pu	−3.960	−3.960	−4.260	−4.260	−3.570	−3.570	−5.310	−5.030	−5.150	−4.910
K_F	pu	0.091	0.091	0.033	0.033	0.040	0.040	0.070	0.090	0.062	0.025
τ_F or τ_{F1}	s	0.350	0.350	0.330	0.330	1.000	1.000	1.880	2.250	1.000	1.000
τ_{F2}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TURBINE GOVERNOR											
GOV	(6)	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*
R	(6)	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
$P_{\max}$	MW	107.50	107.50	172.50	172.50	267.00	213.00	411.00	339.00	436.00	382.00
τ_1	s	0.100	0.100	0.100	0.100	0.250	0.250	0.100	0.100	0.100	0.100
τ_2	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
τ_3	s	0.150	0.150	0.150	0.150	0.000	0.000	0.200	0.200	0.300	0.300
τ_4	s	0.300	0.300	0.300	0.300	0.050	0.300	0.100	0.100	0.050	0.050
τ_5	s	10.000	10.000	4.160	4.160	12.000	12.000	8.720	8.720	14.000	14.000
F	(6)	0.606	0.000	0.560	0.000	0.549	0.000	0.540	0.000	0.580	0.000
STABILIZER											
PSS	(7)	*S*	*S*	*F*	*F*	*S*	*S*	*F*	*F*	*S*	*S*
K_{QV}	(7)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
K_{QS}	(7)	12.000	8.000	0.600	0.600	10.000	10.000	1.170	1.170	24.000	24.000
τ_Q	s	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
τ'_{Q1}	s	1.000	1.000	0.490	0.455	0.250	0.700	0.265	0.640	0.200	0.200
τ_{Q1}	s	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.050	0.070
τ'_{Q2}	s	0.750	0.250	0.490	0.455	0.400	0.450	0.265	0.640	0.200	0.300
τ_{Q2}	s	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
τ'_{Q3}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
τ_{Q3}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$V_{s\lim}$	pu	0.050	0.050	0.080	0.080	0.050	0.050	0.060	0.080	0.050	0.050

Table D.5. Typical Data for Nuclear Steam (*N*) Units

GENERATOR									
Unit no.		*N*1	*N*2	*N*3	*N*4	*N*5	*N*6	*N*7	*N*8
Rated MVA		76.80	245.5	500.00	920.35	1070.00	1280.00	1300.00	1340.00
Rated kV		13.8	14.4	18.00	18.00	22.00	22.00	25.00	25.00
Rated PF		0.85	0.85	0.90	0.90	0.90	0.95	0.90	0.90
SCR	(1)	0.650	0.640	0.580	0.607	0.500	0.500	0.480	0.480
x''_d	pu	0.190	0.210	0.283	0.275	0.312	0.237	0.315	0.281
x'_d	pu	0.320	0.320	0.444	0.355	0.467	0.358	0.467	0.346
x_d	pu	1.660	1.710	1.782	1.790	1.933	2.020	2.129	1.693
x''_q	pu	0.120	0.210	0.277	0.275	...	0.237	0.308	0.281
x'_q	pu	0.470	0.510	1.201	0.570	1.144	0.565	1.270	0.991
x_q	pu	1.580	1.630	1.739	1.660	1.743	1.860	2.074	1.636
r_a	pu	...	0.0032	0.0041	0.0048	0.360	0.0019	0.0029	0.0021
x_ℓ or x_p	pu	0.150	0.125	0.275	0.215	...	0.205	0.251	0.228
r_2	pu	...	0.025	0.029	0.028	...	0.029	...	...
x_2	pu	0.125	0.160	0.280	0.230	0.284	0.215	...	0.228
x_0	pu	0.450	0.110	...	0.195	...	0.195	...	...
τ''_d	s	...	0.230	0.035	...	...	...	...	...
τ'_d	s	...	...	1.512	...	...	...	...	...
τ''_{d0}	s	0.032	0.038	0.055	0.032	...	0.034	0.052	0.043
τ'_{d0}	s	4.780	7.100	6.070	7.900	6.660	9.100	6.120	6.580
τ''_q	s	...	...	0.035	...	...	...	...	...
τ'_q	s	...	...	0.756	...	...	...	...	...
τ''_{q0}	s	...	0.073	0.152	0.055	...	0.059	0.144	0.124
τ'_{q0}	s	...	0.380	1.500	0.41	...	0.460	1.500	1.500
τ_a	s	...	0.210	0.310	0.19	...	0.180	...	...
W_R	MW·s	281.70	1136.00	1990.00	3464.00	3312.00	4690.00	4580.00	4698.00
r_F	Ω	...	0.217	...	0.0901	...	0.0979	0.0576	0.0576
$S_{G1.0}$	(2)	0.0857	0.1309	0.0900	0.0816	...	0.0779	0.0714	0.0769
$S_{G1.2}$	(2)	0.3244	0.5331	0.3520	0.3933	...	0.3055	0.3100	0.4100
E_{FDFL}	(2)	2.587	2.730	2.710	2.870	...	2.945	3.340	2.708
D	(3)	2.000	...	2.000	...	2.000	2.000	2.000	2.000
EXCITER									
VR type		*A*	*A*	*A*	*A*	*C*	*A*	*C*	*C*
Name	(4)	NA101	NA101	WMA	NA143	BRLS	EA210	BRLS	BRLS
RR	(4)	0.50	0.50	0.50	0.50	2.00	1.50	2.23	2.00
τ_R	s	0.060	0.060	0.000	0.000	0.000	0.000	0.000	0.000
K_A	pu	25.000	25.000	256.000	25.000	400.000	50.000	400.000	400.000
τ_A or τ_{A1}	s	0.200	0.200	0.050	0.200	0.020	0.020	0.020	0.020
τ_{A2}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$V_{R\max}$	pu (4)	1.000	1.000	2.858	1.000	10.650	1.000	6.960	6.020
$V_{R\min}$	pu (4)	−1.000	−1.000	−2.858	−1.000	−10.650	−1.000	−6.960	−6.020
K_E	pu	−0.0516	−0.0489	−0.170	−0.0464	1.000	−0.0244	1.000	1.000
τ_E	s	0.579	0.550	2.150	0.522	1.000	0.1455	0.015	0.015
$S_{E.75\max}$	(5)	0.0794	0.0752	0.2200	0.0714	0.375	0.0863	0.3400	0.3900
$S_{E\max}$	(5)	0.3093	0.2932	0.9500	0.2784	1.220	0.2148	0.5600	0.5630
A_{EX}	(5)	0.0013	0.0016	0.0027	0.0016	...	0.0056	0.0761	0.1296
B_{EX}	(5)	1.4015	1.6120	1.5966	1.5330	...	0.6818	0.4475	0.3814
$E_{FD\max}$	pu (5)	3.881	4.090	3.665	4.310	4.800	5.350	4.460	3.850
$E_{FD\min}$	pu	−3.881	−4.090	−3.665	−4.310	0.000	0.000	0.000	0.000
K_F	pu	0.093	0.088	0.040	0.084	0.060	0.0233	0.040	0.040
τ_F or τ_{F1}	s	0.350	0.350	1.000	1.000	1.000	0.7750	0.050	0.050
τ_{F2}	s	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table D.5. *(continued)*

TURBINE GOVERNOR									
GOV	(6)	*G*	*G*	*G*	*G*	*G*	*G*	*G*	*G*
R	(6)	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
P_{max}	MW	65.00	208.675	450.00	790.18	951.00	1216.00	1090.00	1205.00
τ_1	s	...	...	0.250	...	0.180	0.150	0.180	0.180
τ_2	s	...	...	0.000	...	0.030	0.000	0.000	0.000
τ_3	s	...	...	0.000	...	0.100	0.210	0.040	0.040
τ_4	s	...	...	0.300	...	0.200	0.814	0.200	0.200
τ_5	s	...	...	5.000	...	6.280	2.460	5.000	5.000
F	(6)	...	...	0.320	...	0.330	0.340	0.300	0.300
STABILIZER									
PSS	(7)	*S*	...	...	...	*F*	*S*	*F*	*F*
K_{QV}	(7)	0.000	...	...	...	0.000	0.000	0.000	0.000
K_{QS}	(7)	0.200	...	...	...	10.000	1.530	20.000	20.000
τ_Q	s	10.000	...	...	...	10.000	3.000	10.000	10.000
τ'_{Q1}	s	1.330	...	...	...	0.080	0.150	0.300	0.300
τ_{Q1}	s	0.020	...	...	...	0.020	0.050	0.020	0.020
τ'_{Q2}	s	1.330	...	...	...	0.080	0.150	0.000	0.000
τ_{Q2}	s	0.020	...	...	...	0.020	0.050	0.000	0.000
τ'_{Q3}	s	0.000	...	...	...	0.000	0.000	0.000	0.000
τ_{Q3}	s	0.000	...	...	...	0.000	0.000	0.000	0.000
V_{slim}	pu	0.100	...	...	...	0.100	0.100	0.100	0.100

Table D.6. Typical Data for Synchronous Condensor (*SC*) Units

GENERATOR						
Unit no.		*SC*1	*SC*2	*SC*3	*SC*4	*SC*5
Rated MVA		25.00	40.00	50.00	60.00	75.00
Rated kV		13.80	13.80	12.70	13.80	13.80
Rated PF		0.00	0.00	0.00	0.00	0.00
SCR	(1)	...	0.558	1.004	0.477	0.800
x_d''	pu	0.2035	0.231	0.141	0.257	0.170
x_d'	pu	0.304	0.343	0.244	0.385	0.320
x_d	pu	1.769	2.373	1.083	2.476	1.560
x_q''	pu	0.199	...	0.170	0.261	0.200
x_q'	pu	0.5795	1.172	0.720	1.180	1.000
x_q	pu	0.855	1.172	0.720	1.180	1.000
r_a	pu	0.0025	...	0.006	0.0024	0.0017
x_ℓ or x_p	pu	0.1045	0.132	...	0.146	0.0987
r_2	pu	0.0071	...	0.160	...	0.180
x_2	pu	0.177	...	...	0.225	0.185
x_0	pu	0.115	...	0.058	0.165	0.128
τ_d''	s	...	0.035	0.041	0.035	0.041
τ_d'	s	...	...	0.858	...	3.230
τ_{d0}''	s	0.0525	0.058	0.050	0.058	0.039
τ_{d0}'	s	8.000	11.600	6.000	12.350	16.000
τ_q''	s	...	...	...	...	0.0473
τ_q'	s	...	...	...	...	...
τ_{q0}''	s	0.0151	0.201	...	0.188	0.235
τ_{q0}'	s	...	...	0.150	...	...
τ_a	s	...	0.159	0.200	0.290	0.288
W_R	MW·s	30.00	60.80	105.00	60.60	89.98
r_F	Ω	0.4407	...	0.0631	0.274	0.279
$S_{G1.0}$	(2)	0.304	0.295	0.0873	0.180	0.150
$S_{G1.2}$	(2)	0.666	0.776	0.310	0.708	0.500
E_{FDFL}	(2)	3.560	4.180	2.338	4.224	3.730
D	(3)	...	...	...	...	...
EXCITER						
VR type		*A*	*A*	*A*	*A*	*A*
Name	(4)	WMA	WMA	...	WMA	NA143
RR	(4)	0.50	1.00	3.85	1.00	2.00
τ_R	s	0.000	0.000	0.000	0.000	0.000
K_A	pu	400.000	400.000	200.000	400.000	18.000
τ_A or τ_{A1}	s	0.050	0.050	0.050	0.050	0.200
τ_{A2}	s	0.000	0.000	0.000	0.000	0.000
$V_{R\max}$	pu (4)	4.407	6.630	11.540	5.850	1.000
$V_{R\min}$	pu (4)	−4.407	−6.630	−11.540	−5.850	−1.000
K_E	pu	−0.170	−0.170	−0.170	−0.170	−0.0138
τ_E	s	0.950	0.950	1.000	0.950	0.0669
$S_{E.75\max}$	(5)	0.220	0.220	0.220	0.220	0.0634
$S_{E\max}$	(5)	0.950	0.950	0.950	0.950	0.1512
A_{EX}	(5)	0.0027	0.0027	0.0027	0.0027	0.0047
B_{EX}	(5)	1.0356	0.6884	0.3956	0.7802	0.4782
$E_{FD\max}$	pu (5)	5.650	8.500	14.790	7.500	7.270
$E_{FD\min}$	pu	−5.650	−8.500	−14.790	−7.500	−7.270
K_F	pu	0.040	0.040	0.070	0.040	0.0153
τ_F or τ_{F1}	s	1.000	1.000	1.000	1.000	1.000
τ_{F2}	s	0.000	0.000	0.000	0.000	0.000

Table D.7. Typical Data for Combustion Turbine (CT) Units

GENERATOR			
Unit no.		CT1	CT2
Rated MVA		20.65	62.50
Rated kV		13.80	13.80
Rated PF		0.85	0.85
SCR	(1)	0.580	0.580
x''_d	pu	0.155	0.102
x'_d	pu	0.225	0.159
x_d	pu	1.850	1.640
x''_q	pu	...	0.100
x'_q	pu	...	0.306
x_q	pu	1.740	1.575
r_a	pu	...	0.034
x_ℓ or x_p	pu	...	0.113
r_2	pu	...	0.352
x_2	pu	...	0.102
x_0	pu	...	0.051
τ''_d	s	...	0.035
τ'_d	s	...	0.730
τ''_{d0}	s	...	0.054
τ'_{d0}	s	4.610	7.500
τ''_q	s	...	0.035
τ'_q	s	...	0.188
τ''_{q0}	s	...	0.107
τ'_{q0}	s	...	1.500
τ_a	s	...	0.350
W_R	MW·s	183.30	713.50
r_F	Ω	...	0.261
$S_{G1.0}$	(2)	...	0.0870
$S_{G1.2}$	(2)	...	0.2681
E_{FDFL}	(2)	2.640	2.4348
D	(3)	...	2.000

EXCITER			
VR type		*D*	*C*
Name	(4)	SCPT	BRLS
RR	(4)	...	0.50
τ_R	s	0.000	0.000
K_A	pu	120.000	400.000
τ_A or τ_{A1}	s	0.050	0.020
τ_{A2}	s	0.000	0.000
$V_{R\max}$	pu (4)	1.200	7.300
$V_{R\min}$	pu (4)	−1.200	−7.300
K_E	pu	1.000	1.000
τ_E	s	0.500	0.253
$S_{E.75\max}$	(5)	...	0.500
$S_{E\max}$	(5)	...	0.860
A_{EX}	(5)	...	0.0983
B_{EX}	(5)	...	0.2972
$E_{FD\max}$	pu (5)	...	7.300
$E_{FD\min}$	pu	...	0.000
K_F	pu	0.020	0.030
τ_F or τ_{F1}	s	0.461	1.000
τ_{F2}	s	...	0.000
K_P		1.19	
K_I		2.32	

TURBINE GOVERNOR				
GOV	(6)	*G*		*G*
R	(6)	0.050		0.040
$P_{\max}$	MW	17.55		82.00
τ_1	s	0.000		0.500
τ_2	s	0.000		1.250
τ_3	s	Fuel: Oil 0.025	Gas 0.100	0.700
τ_4	s	0.000	0.000	0.700
τ_5	s	0.025	0.100	0.000
F	(6)	0.5	0.0	1.000

Table D.8. Typical 60-Hz Transmission Line Data

Line-to-line voltage (kV)	Conductors per phase @ 18 in. spacing	ACSR Conductor area (or diam) kCM (in.)	Flat phase spacing (ft)	Geometric mean distance (ft)	60-Hz inductive reactance Ω/mi			60-Hz capacitive reactance MΩ·mi			Surge impedance z_0 (Ω)	Surge impedance loading (MVA)
					x_a	x_d	$x_a + x_d$	x'_a	x'_d	$x'_a + x'_d$		
69	1	226.8	12	15.1	0.465	0.3294	0.7944	0.1074	0.0805	0.1879	386.4	12
115	1	336.4	14	17.6	0.451	0.3480	0.7990	0.1039	0.0851	0.1890	388.6	34
138	1	397.5	16	20.1	0.441	0.3641	0.8051	0.1015	0.0890	0.1905	391.6	49
161	1	477.0	18	22.7	0.430	0.3789	0.8089	0.0988	0.0926	0.1914	393.5	66
230	1	556.5	22	27.7	0.420	0.4030	0.8230	0.0965	0.0985	0.1950	400.6	132
345	1	(1.750)	28	35.3	0.3336	0.4325	0.7761	0.0777	0.1057	0.1834	374.8	318
345	2	(1.246)	28	35.3	0.1677	0.4325	0.6002	0.0379	0.1057	0.1436	293.6	405
500	1	(2.500)	38	47.9	0.2922	0.4694	0.7616	0.0671	0.1147	0.1818	372.1	672
500	2	(1.602)	38	47.9	0.1529	0.4694	0.6223	0.0341	0.1147	0.1488	304.3	822
500	3	(1.165)	38	47.9	0.0988	0.4694	0.5682	0.0219	0.1147	0.1366	278.6	897
500	4	(0.914)	38	47.9	0.0584	0.4694	0.5278	0.0126	0.1147	0.1273	259.2	965
735	3	(1.750)	56	70.6	0.0784	0.5166	0.5950	0.0179	0.1263	0.1442	292.9	1844
735	4	(1.382)	56	70.6	0.0456	0.5166	0.5622	0.0096	0.1263	0.1359	276.4	1955