Научно-технический центр
Единой энергетической системы

ПОЛИТЕХ
Санкт-Петербургский
политехнический университет
Петра Великого

INFLUENCE OF PARAMETERS OF LARGE TURBOGENERATORS ON SHORT CIRCUIT CURRENTS AND TORQUES

2024 ElCon

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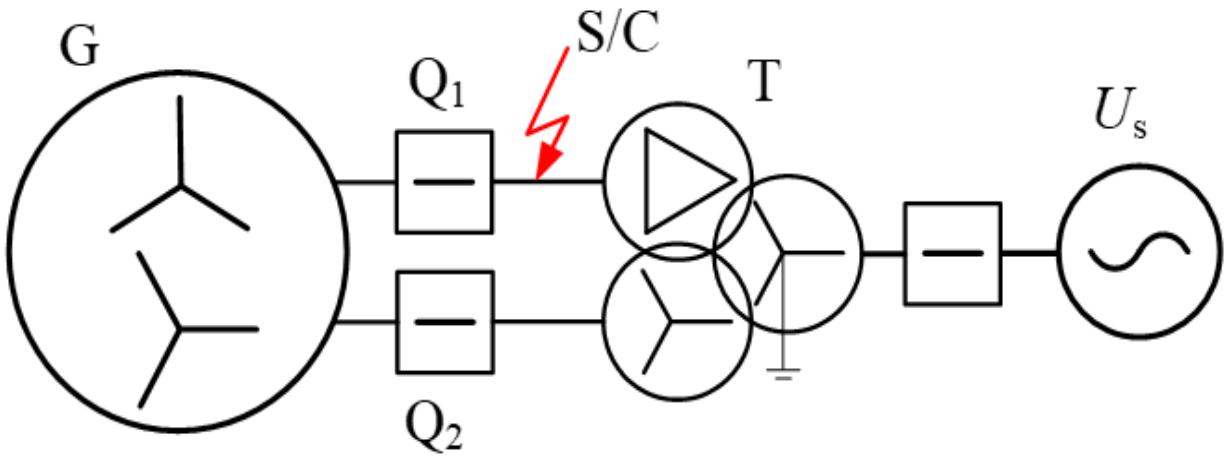
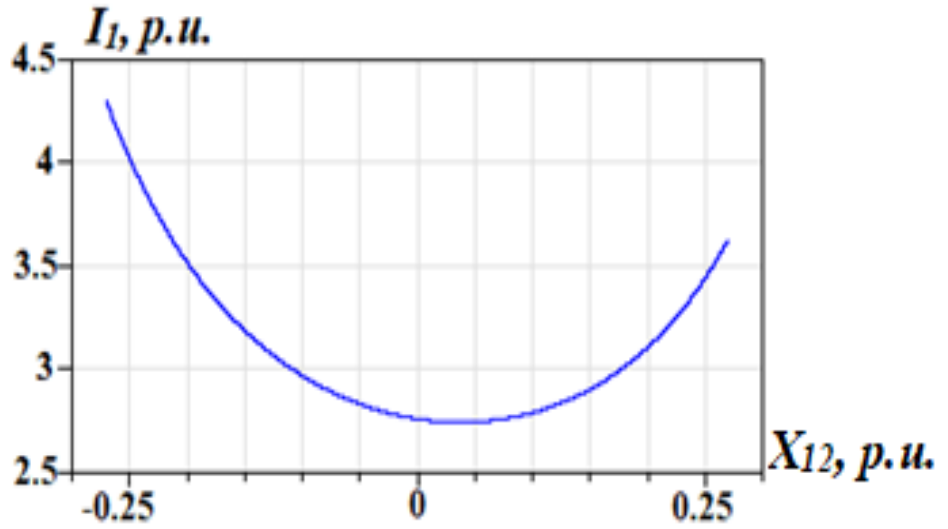
Connection diagram of the T3V-1200-2 generator to the network





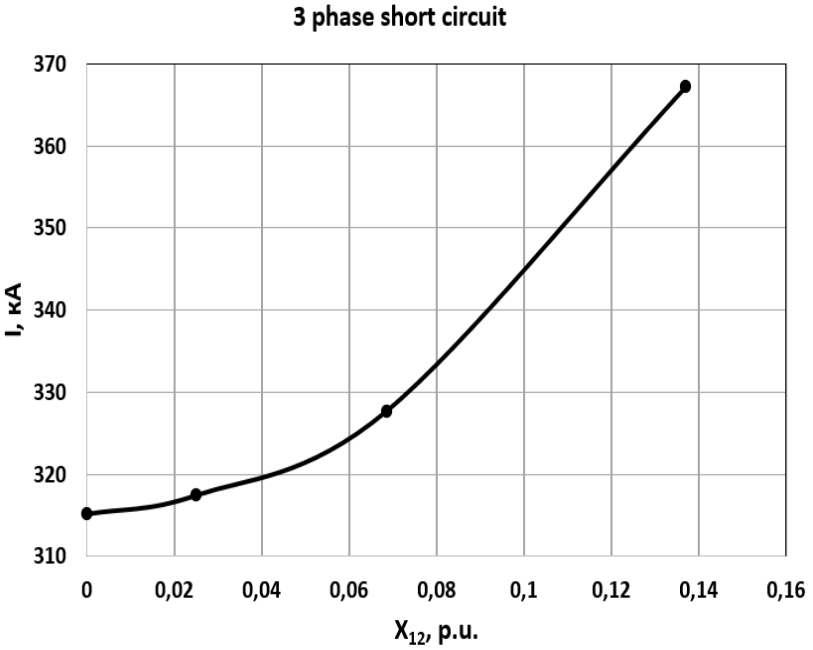
Dependence of the short-circuit current at the terminals in one of the generator windings on the mutual reactance along the leakage paths between three-phase systems

Main parameters of the demonstration model

№	Name of the parameter	Designation	Units	T3V-1200-2A	TVV-1200-2
1	Synchronous reactance in the direct axis	Xd	p.u.	2,275	2,44
2	Leakage reactance of the stator winding	Xs	p.u.	0,232	0,315
3	Mutual reactance between two three-phase systems by leakage flux	X12	p.u.	0,137	0,102
4	Leakage reactance of the excitation winding	Xsr	p.u.	0,123	0,1225

Short circuits of T3V-1200-2A in idle mode

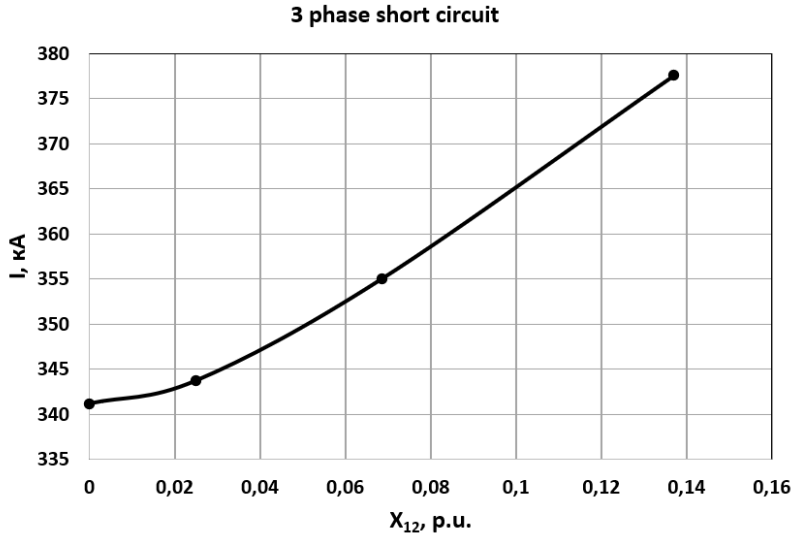
X_{12}, p.u.	Type of accident	I_s, kA	$I_{s/c}/I_{system}$, kA	$I_{winding2}$, кА	T_{e1}, p.u.	T_{e2}, p.u.
0	Three-phase s/c on one of the three-phase systems	315,16	587/ 271,84	32,54	3,55	-0,49
	Two-phase s/c transitioning to three-phase s/c	346,16	643,86/ 297,7	39,5	4,451	-0,6078
0,025	Three-phase s/c on one of the three-phase systems	317,46	586,56/ 269,08	37,66	3,568	-0,426
	Two-phase s/c transitioning to three-phase s/c	348,06	642,06/ 294	90,2	4,45	-0,5256
0,0685	Three-phase s/c on one of the three-phase systems	327,7	591,07/ 263,02	48,72	3,65	-0,4185
	Two-phase s/c transitioning to three-phase s/c	357,52	643,86/ 286,34	33,04	4,492	-0,51
0,137	Three-phase s/c on one of the three-phase systems	367,2	619/ 251,8	77,6	4,165	-0,97
	Two-phase s/c transitioning to three-phase s/c	432,2	727,2/ 295	90,2	5,88	-1,35



Dependence of the short circuit current amplitude value at three-phase short circuit on the mutual reactance along the leakage paths between three-phase systems (T3V-1200-2A, idle mode)

Short circuit of T3V-1200-2A in rated load mode

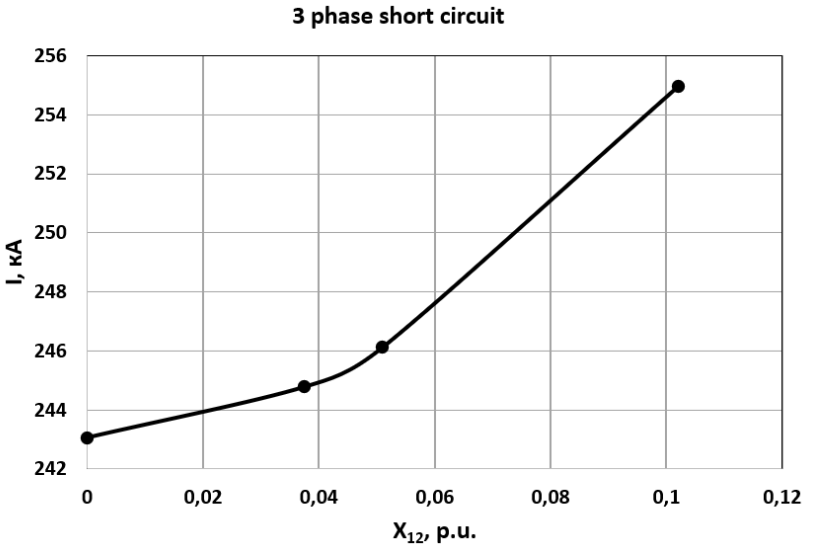
X_{12}, p.u.	Type of accident	I_s, kA	$I_{s/c}/I_{system}$, kA	$I_{winding\ 2}$, кА	T_{e1}, p.u.	T_{e2}, p.u.
0	Three-phase s/c on one of the three-phase systems	341,2	612,28/ 271,08	115	4,192	1,798
	Two-phase s/c transitioning to three-phase s/c	401,88	723,26/ 321,38	114,96	5,935	1,959
0,025	Three-phase s/c on one of the three-phase systems	343,76	610,92/ 267,16	117,6	4,214	1,765
	Two-phase s/c transitioning to three-phase s/c	404,5	721/ 316,5	119,48	5,951	1,966
0,0685	Three-phase s/c on one of the three-phase systems	355,04	615,44/ 260,4	120,46	4,312	1,65
	Two-phase s/c transitioning to three-phase s/c	415,96	723,72/ 307,76	127,1	6,028	1,922
0,137	Three-phase s/c on one of the three-phase systems	377,6	617,2/ 239,6	86,6	4,7	-0,52
	Two-phase s/c transitioning to three-phase s/c	446,6	731/ 284,4	99,6	6,73	-0,91



Dependence of the short circuit current amplitude value at three-phase short circuit on the mutual reactance along the leakage paths between three-phase systems (T3V-1200-2A, rated load mode)

Short circuits of TVV-1200-2 in idle mode

X_{12}, p.u.	Type of accident	I_s, kA	$I_{s/c}/I_{system}$, kA	$I_{winding\ 2}$, кА	T_{e1}, p.u.	T_{e2}, p.u.
0	Three-phase s/c on one of the three-phase systems	243,06	516,16/ 273,1	27,08	2,725	-0,4383
	Two-phase s/c transitioning to three-phase s/c	266,42	564,44/ 298,02	32,48	3,391	-0,5389
0,0375	Three-phase s/c on one of the three-phase systems	244,78	514,36/ 269,58	30,1	2,746	-0,339
	Two-phase s/c transitioning to three-phase s/c	268,14	562,64/ 294,5	34,36	3,41	-0,4157
0,051	Three-phase s/c on one of the three-phase systems	246,12	514,8/ 268,68	31,96	2,762	-0,3204
	Two-phase s/c transitioning to three-phase s/c	269,54	562,64/ 293,1	36,1	3,427	-0,4131
0,102	Three-phase s/c on one of the three-phase systems	254,96	518,88/ 263,92	40,58	2,867	-0,4056
	Two-phase s/c transitioning to three-phase s/c	279,1	567,14/ 288,04	44,42	3,548	-0,4722



Dependence of the short circuit current amplitude value at three-phase short circuit on the mutual reactance along the leakage paths between three-phase systems (TVV-1200-2, idle mode).

Conclusion

1. A significant effect of the difference in the electromagnetic parameters of a hydrogen-water-cooled generator and a water-water-cooled generator on currents and torques during short circuits.
2. The influence of the inductive mutual reactance along the leakage paths between the three-phase stator windings is quite noticeable. A decrease in the value of this reactance, all other things being equal, leads to a decrease in short-circuit currents.
3. With an increase of the mutual resistance between the three-phase stator windings along the paths of the leakage flows, the current of simultaneous (six-phase) closure decreases compared to the current when closing at the terminals of one of the three-phase systems. Considering that short circuits on the high voltage side (equivalent to six-phase short circuits) are undoubtedly more frequent than short circuits on the generator voltage current line, this factor should be attributed to favorable.

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Thank you for your attention!

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