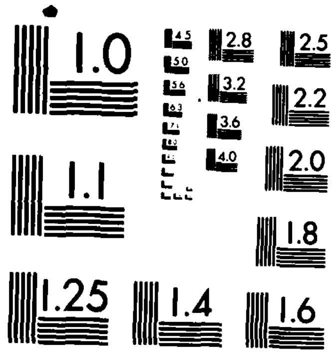
AD-A162 009 PROBLEMS OF THE STABILITY OF THE OUTPUT PARAMETERS OF SELF-EXCITED ELECTR (U) FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH Y G LELEKO 31 OCT 85 1/1

UNCLASSIFIED FTD-ID(RS)T-0254-85 F/G 10/2 NL

END
FILMED
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FTD-ID(RS)T-0254-85

AD-A162 009

FOREIGN TECHNOLOGY DIVISION

PROBLEMS OF THE STABILITY OF THE OUTPUT PARAMETERS OF SELF-EXCITED ELECTROSTATIC GENERATORS DURING PROLONGED CONTINUOUS OPERATION

by

Yu. G. Leleko

DTIC FILE COPY

DTIC ELECTE DEC 05 1985 S D E

Approved for public release;
distribution unlimited.

85 12 2 044

UNEDITED MACHINE TRANSLATION

FTD-ID(RS)T-0254-85 31 Oct 85

MICROFICHE NR: FTD-85-C-000998

PROBLEMS OF THE STABILITY OF THE OUTPUT PARAMETERS OF SELF-EXCITED ELECTROSTATIC GENERATORS DURING PROLONGED CONTINUOUS OPERATION

By: Yu. G. Leleko

English pages: 12

Source: Izvestiya Tomskogo Politekhnicheskogo Instituta imeni S.M. Kirova, Nr. 244, Tomsk 1972, pp. 24-27

Country of origin: USSR
This document is a machine translation.
Requester: FTD/TQTD
Approved for puplic release; distribution unlimited.

Accession For
NTIS GRA&I ☒
DTIC TAB ☐
Unannounced ☐
Justification
By
Distribution/
Availability Codes
Dist | Avail and/or Special
A-1

QUALITY INSPECTED 3

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL FOREIGN TEXT WITHOUT ANY ANALYTICAL OR EDITORIAL COMMENT. STATEMENTS OR THEORIES ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE AND DO NOT NECESSARILY REFLECT THE POSITION OR OPINION OF THE FOREIGN TECHNOLOGY DIVISION.

PREPARED BY:

TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WP-AFB, OHIO.

U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

Page 24.

PROBLEMS OF THE STABILITY OF THE OUTPUT PARAMETERS OF SELF-EXCITED ELECTROSTATIC GENERATORS DURING PROLONGED CONTINUOUS OPERATION.

Yu. G. Leleko.

(It is presented by the scientific seminar of the department of the theoretical bases of electrical engineering and by the department of RESG of NII [Scientific Research Institute] of YaF).

Small/miniature self-excited electrostatic generators (ESG), whose design concept and fundamental characteristics are described into [1, 2], is intended for continuous operation for several hours for active or capacitive load, whose value for this time is changed over wide limits. However, the results, described into [2], are obtained during the relatively short-term modes/conditions of the work of generator and give representation only about the maximum possibilities of generator.

In mode/conditions of continuous prolonged operation, fundamental characteristic, determining the possibility of practical use/application of self-excited generator, is stability of output parameters, i.e., degree of change in voltage/stress and current of load in dependence on operating time of generator.

Purpose of this work is explanation of degree of stability of output parameters in mode/conditions of continuous prolonged operation and reasons, which call their change, which will make it possible to refine recommendations regarding construction of self-excited ESG and to determine optimum mode of their operation.

For solving presented questions were carried out tests with several experimental models, into construction/design of which, described into [1], were introduced some insignificant changes. In particular, for decreasing the value of the induced charge on the transporters of supplementary rotor is reduced their length and is increased the depth of occurrence in the dielectric. At the same time the width of collector plates is increased to 2 mm, which is necessary for the more reliable work of brushes.

In experienced/tested generators for creation of uniform potential distribution on stator instead of glass cylinder was applied cylinder from epoxy compound, whose volumetric conductivity was compared with volumetric conductivity of glass. In this case the possibility of the machining of stator made it possible to establish/install uniform gap rotor-stator within the limits of 0.2-0.25 mm. During the tests all samples/specimens of generator were supplied with supplementary point-brush in the system of the supplementary rotor, with the aid of which output voltage/stress was stabilized in the limits either of 30 kV or 40 kV.

As working medium in experimental models were utilized hydrogen and nitrogen under pressure 6 atm(gage), which was monitored on manometer. The feed
of engine was realized both from the rectifier of a direct current of the type BCA-5 and from the storage batteries.

Page 25.

Generators tested under conditions, maximally approximating operating mode during industrial operation. In this case the values of the output parameters were removed/taken both with continuous operation for 10-12 hours with the subsequent cutoff/disconnection of generator and, without a change in the working conditions, by inclusion/connection after 14-12 hours and with continuous operation without the cutoffs/disconnections for several ten hours. The values of the output parameters were monitored with the aid of the kilovoltmeter C-100 and the microammeter M-194, and also by a chart-recording instrument of the type H-373-3. Since as the load of generator were utilized the effective resistance, whose value composed 16.6 GΩ and 41.4 GΩ, then was sufficient to monitor one of the output values - voltage/stress or current. Fig. 1 gives the results of the first tests of experimental models with different gases as the worker. Two generators worked continuously for 12 hours, after which they were disconnected and thoroughly were inspected (curves 2, 3). In this case one of the generators is controlled of the output voltage/stress 40 kV, by the second on 34 kV and both worked on the load resistance/resistors, equal to 16.6 GΩ. The generator, controlled on 40 kV, worked in the medium of hydrogen under the pressure 6 atm. and had the average parameters of engine $U_{дв} = 16$ V $I_{дв} = 75$ mA. The second generator worked in the nitrogen atmosphere under the pressure 6 atm. and $U_{дв} = 16$ V $I_{дв} = 75$ mA. Other two samples/specimens after cutoff/disconnection were not dismantled and after 12 hours again were included in the work. In this case the voltage/stress of load was restored to the values, with which occurred the cutoff/disconnection into first 1-2 min. Generators worked in the atmosphere hydrogen (curve 1) and nitrogen (curve 4) under the pressure 6 atm. on the resistance/resistor of load $R_н = 41.4$ GΩ. The voltage of supply of engine 16 V, current that consumed by engine under the load, amount on the average to on for the first generator 65 mA, for the second - 55 mA.

As given dependences have shown, average/mean value of output voltage of the generator grows/rises in first hours of work on the average by 10% of initial value and only after 10-12 hours of work ceases its increase/growth. The visual inspection of the parts of generator after 12 and 28-30 hours of work showed that in the system of supplementary rotor, especially in the region of the location of the supplementary point-brush, on the rotor and on the plates of collector/receptacle is a layer of dust, which was being formed, apparently, with friction of brushes against the compound of rotor. On the elements/cells of fundamental rotor also was observed the layer of dust, but in a considerably smaller quantity. As is known from literature data [3], the appearance of dust in the space of generator decreases its output parameters, but in the carried out tests this was not observed. For checking the obtained results the generators tested in the more continuous duties.

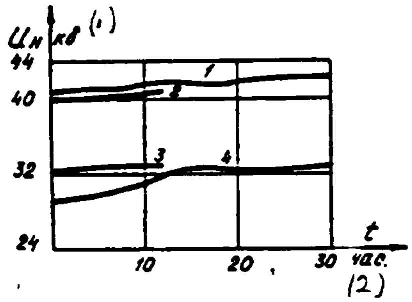


Fig. 1.

Key: (1). kV. (2). hour.

Page 26.

Fig. 2 and 3 as an example give the results of the tests of two samples/specimens of generators with parameters $U_н = 30$ kV, $U_{дв} = 16$ V, $I_{дв} = 65$ mA and $U_н = 40$ kV, $U_{дв} = 16$ V, $I_{дв} = 75$ mA, which worked in the atmosphere of hydrogen under the pressure 6 atm(gage) on resistive load $R_н$=41.4 GΩ. While conducting this set of experiments the part of the results was fixed/recorded with the aid of the recording microammeter, which made it possible to refine the oscillations/vibrations of voltage/stress and current at each moment of time.

As are shown given dependences, oscillations/vibrations of output voltage/stress relative to average/mean value, which were being fixed/recorded from readings/indications of kilovoltmeter, compose approximately/exemplarily ±3-4%. However, the average/mean value of output voltage/stress in all cases decreased within the time of tests for 30-40% from the initial value. In this case the rate of descent in the average/mean value of voltage/stress grows/rises with an increase in the number of hours of the work of generator. The maximum value of voltage/stress begins after 8-12 hours of work and subsequently it falls to the values, which compose only 60-70% of the initial. As showed tests, the stability of the output parameters at each moment of time is provided in limits of ±2%.

Thus, carried out tests showed that output parameters of generator, remaining in effect constant at each moment of time, with increase in number of hours of work decrease their average/mean values in comparison with initial ones. And only in the first hours of work the output parameters of generator grow/rise in the value.

Environmental factors, to which can be attributed value of resistor/resistance, on which works generator, pressure within housing of generator and chemical composition of gas, used as working medium, voltage of supply of engine, which affects speed of rotation of rotor, at presence of supplementary point-brush and constant pressure in housing of generator, virtually is not exerted effect on change in output parameters of generator. In connection with this it is possible to assume that on the stability of output voltage/stress has a considerable effect a change in the gas discharge in the commutating nodes and in the supplementary point-brush of generator. This change can be caused by a whole series of the reasons, fundamental from which, apparently, that follow:

1. Change in the geometry of electrodes under the effect of the discharges in the process of the work of generator. In this case is possible strengthening gaps/intervals in the process of "aging/training" of electrodes in the initial period of their work with the subsequent weakening due to the erosion under the effect of discharges with the continuous operation.

2. Becoming dusty of space of generator by dust from brush collector system.

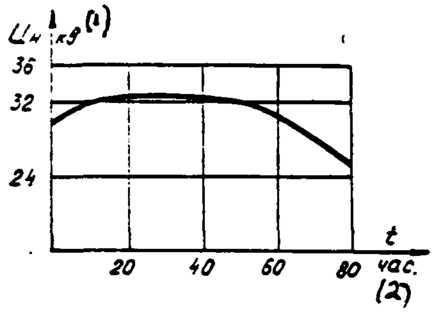


Fig. 2.

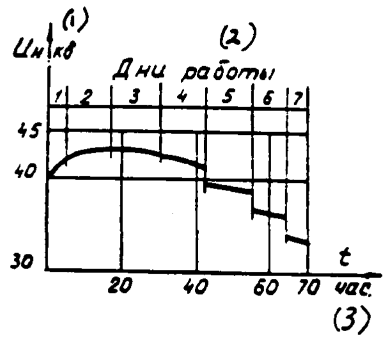


Fig. 3.

Fig. 2. Key: (1). kV. (2). hour.

Fig. 3. Key: (1). kV. (2). Days of work. (3). hour.

Page 27.

3. Appearance of decomposition products of material of rotor under effect of gas discharge in brush-collector system.

Observations of work of experimental models and visual inspection of fundamental elements/cells of generator after different hours of work confirm data of assumption about effect of instability of discharge on value of medium output voltage/stress. Thus, for example, visual inspection of the generator, which worked 180 hours in the atmosphere of hydrogen, showed that on the supplementary rotor along the outer side of collector plates is a layer of dust of dark gray color by the width of 1.5-2 mm. On the remaining part of the supplementary rotor weak dust content was noted. On the collar of supplementary rotor the dust of the same color is concentrated in essence around the the supplementary point-brush. From the side of fundamental rotor both on the collector/receptacle and on the adjacent parts of the stators - weak coating of dust of light grey color. Generator during this testing worked exactly 140 hours to the external effective resistance of load, equal to 16.6 GΩ. After this, the value of the load resistance/resistor was increased to 41.4 GΩ and generator worked 40 additional hours continuously, but a considerable increase in the voltage/stress, in comparison with the voltage/stress at the moment of cutoff/disconnection, did not occur. After the dismantling of generator and visual inspection all elements/cells of generator were rubbed through/wiped off by alcohol, generator was assembled and again launched in the work. The voltage/stress of load was raised to the initial values, i.e., to 40 kV and subsequently was repeated earlier obtained characteristic.

Thus, conducted investigations make it possible to draw conclusion that decrease in average/mean value of voltage in process of prolonged continuous work of generator proceeds due to becoming dusty of working volume of generator from brush-collector system, moreover in essence this occurs due to material of rotor, since brushes of generator after continuous operation virtually were not deformed and did not break down themselves. The formed dust is decomposed/expanded due to the ionizing processes in the brushes of generator and worsens/impairs the insulating properties of the working medium of generator. It is necessary to note that is most the intensely ionizing processes occur in the system of supplementary the rotor, which works in the most heavy duty both on the current and on the voltage/stress.

In connection with that outlined above for eliminating deficiencies/lacks indicated and, consequently, increase in number of hours of work of generator with nominal output parameters it is possible to recommend following changes in construction/design of generator:

1. To increase gap supplementary rotor-stator and to decrease the length of the transporters of supplementary rotor, which will lead to the decrease of the parameters, developed by supplementary rotor.

2. To change construction/design of collector/receptacle of supplementary rotor with the condition so that with friction of brush on larger path they would contact with plates of collector/receptacle, and commutation of transporters with brushes occurred within metallic surfaces.

3. At least around collector plates material of rotor must be thermoresistant and not be abraded with friction of brushes.

4. To improve ventilation system of supplementary rotor.

REFERENCES.

1. *В. В. Пацевич, Ю. Г. Лелеко.* Малогабаритный самовозбуждающийся ЭСГ. Изв. ТПИ, № 210. В печати.

2. *Ю. Г. Лелеко.* Вопросы исследования малогабаритного самовозбуждающегося электростатического генератора. Изв. ТПИ, № 232. В печати.

3. *Н. Ж. Фелиси.* «Электричество», № 1, 61, 1962.

END

FILMED

1-86

DTIC