

DOI: <https://doi.org/10.15407/techned2017.04.048>

AN IMPACT OF CHANGES IN THE INDUCTANCE OF DISTRIBUTION NETWORK ON THE MODES AND PARAMETERS OF EQUIPMENT OF THYRISTOR COMPENSATOR OF REACTIVE POWER

Journal	Tekhnichna elektrodynamika
Publisher	Institute of Electrodynamics National Academy of Sciences of Ukraine
ISSN	1607-7970 (print), 2218-1903 (online)
Issue	No 4, 2017 (July/August)
Pages	48 – 54

Authors

Chyzhenko O.I., Trach I.V.

Institute of Electrodynamics National Academy of Sciences of Ukraine,
pr. Peremohy, 56, Kyiv, 03057, Ukraine,
e-mail: alivchizh@ukr.net, igor.trach@ied.org.ua

Abstract

An impact of technology changes of inductive resistance of electrical network can be observed on the characteristics and parameters of the bridge thyristor compensator of reactive power established in it to maintain proper values of $\cos\varphi$. It is determined that with the increase of this resistance, a maximum value of reactive power generated into the network by thyristor compensator of reactive power, also increases, whereas a depth of reactive power control narrows. Thus, when increasing inductive resistance of the network by 25%, the depth of reactive power control, calculated value of which is x_a for the constant parameter, will be reduced almost by half. To improve the quality of input current of thyristor compensator of

reactive power (aka line current), i.e. to reduce its harmonic distortion to the values lower than 5%, it is proposed to decrease the reactor inductance, which is connected between capacitor bank and thyristor bridge, during the process of on-load changing. These changes are carried out step-wise by switching the taps of reactors' windings using additional thyristors. Thus, when the depth of reactive power control is 50% and the input LC circuit of thyristor compensator of reactive power is tuned to quadruple frequency (with respect to the mains power frequency), the number of taps that is needed is two. When inductive resistance of the network increases, the frequency of LC circuit setup decreases, which leads to the reduction of taps until their complete absence. When tuning the input circuit of thyristor compensator of reactive power to quadruple frequency, it is possible to connect inductive-thyristor part of the controller directly to the capacitor banks installed in the network without any interference into their equipment. This results in a smooth control of reactive power in the network of capacitor unit with a fixed power. References 13, figures 2, tables 3.

Key words: inductive resistance, thyristor compensator of reactive power, quality of input current, harmonic distortion, depth of reactive power control.

Received: 20.10.2016
Accepted: 20.04.2017
Published: 15.06.2017

References

1. Volkov I.V., Chyzhenko A.I. Method of Smooth Regulation of the Reactive Power with Correction of Quality of input Current of Thyristor Compensators of the Reactive Power. *Elektronnoe modelirovanie*. 2012. Vol. 34. No 2. Pp.77 – 84. (Rus)
2. Volkov I.V., Chyzhenko A.I., Kurilo I.A. Three-phase thyristor-reactor inverter AC voltag. *Pra*

tsi Instytutu Elektrodynamiky Natsionalnoi Akademii Nauk Ukrainy

. 2010. No 26. Pp. 90 – 94. (Rus)

3. Volkov I.V., Lypkivsky K.O., Chyzhenko O.I. Method of smooth regulation of alternating voltage on the active-inductive load. Patent of Ukraine No 48865 A MKI 7 H 02 P 13/30, H 02 M5/10, 2002.

4. Nesterovych V.V. The requirements for device for measuring the frequency characteristics of electrical networks / University Science 2015: Abstracts of the International scientific and engineering. conf. Pryazovskyi State Technical University.-18-19 may 2015. Mariupol. (Rus)

5. Chizhenko A.I., Trach I.V. The analysis of electromagnetic processes in the system of the electric network – thyristor compensator of reactive power in standby smooth control of reactive power. Assessing the impact of the bridge options thyristor compensator of reactive power on its EMC network. *Pratsi Instytutu Elektrodynamiky Natsionalnoi Akademii Nauk Ukrainy*. 2016. No 45. Pp. 20 –29. (Rus)

6. Chyzhenko A.I., Trach I.V. A method of improving the quality of the current in the system network – controlled bridge thyristor compensator of reactive power. *Pratsi Instytutu Elektrodynamiky Natsionalnoi Akademii Nauk Ukrainy*. 2017. No 46. Pp. 22 – 30. (Rus)

7. General purpose oil power transformers 35 kV and including. Specifications. –State Committee for Standardization and Certification Ukraine.

8. IEEE Std519-2014. Recommended Practice and Requirements for Harmonic Control in Electric Power Systems/ Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, Piscataway, NJ 08854, <http://standards.ieee.org>

9. Felipe G. Duque, Leonardo W. de Oliveira. Allocation of capacitor banks in distribution systems through a modified monkey search optimization technique. *Electrical Power and Energy Systems* . 2015. Vol. 73. Pp. 420–432.

10. Mykhalskyi V.M., Sobolev V.M., Chopyk V.V., Polishchuk S.Y., Shapoval I.A. Matrix converter control strategy maximizing reactive power transfer. Proceeding of the International Conference on *Intelligent Energy and Power Systems* (IEPS), Kyiv, Ukraine. June 02–06, 2014. Pp. 26–31. DOI: <https://doi.org/10.1109/IEPS.2014.6874193>

11. Pravin Sonawane. Optimal capacitor placement and sizing for enhancement of distribution system reliability and power quality using PSO. International Conference for *Convergence of Technology* (I2CT). 2014. Pp. 1.–7. DOI: <https://doi.org/10.1109/I2CT.2014.7092338>

12. Sayyad Nojavan, Mehdi Jalali, Kazem Zare. Optimal allocation of capacitors in radial/mesh distribution systems using mixed integer nonlinear programming approach . *Electric Power Systems Research* . 2014. Vol. 107. Pp. 53–124. DOI: <https://doi.org/10.1016/j.epsr.2013.09.019>

13. K.L.Sireesha, K.Bhushana Kumar. Power Quality Improvement in Distribution System Using D-STATCOM. *IJEAR*. 2014. Vol. 4. Issue Spl–1. Pp.58–62.

[PDF](#)