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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 15543-2008

Replacing GB/T 15543-1995

Power quality - Three-phase voltage unbalance

电能质量 三相电压不平衡

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Standardization Administration of the PRC

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Foreword

This Standard replaces GB/T 15543-1995 "Quality of Electric Energy Supply - Admissible Three-phase Voltage Unbalance Factor". Compared with GB/T 15543-1995, main contents revised in this Standard are as follows: - Application scope of this Standard is revised; clearly define that "Instant and temporal unbalance factor problems are not applicable to this Standard". - Relevant content on Zero-sequence Unbalance Factor of Low-voltage Distribution System Low-voltage Distribution System is added; all "unbalance factors" of the previous standard are replaced by "negative-sequence unbalance factors". - "Measurement and Evaluating of Unbalance Factors" in the appendix of previous standard is upgraded to main text of this Standard; and adjustment is made on measuring time and measuring method. For unbalance factors caused by fluctuating load, the measuring time is 24h; measuring time interval of each unbalance factor is 1min. For the common coupling point of the system, the measuring time is adjusted to 1 week; measurement interval of each unbalance factor is the integral multiple of 1 min. - Because measuring method becomes part of the new standard content, the name of this Standard is changed; "Admissible Three-phase Voltage Unbalance Factor" is changed to "Three-phase Voltage Unbalance". At the same time, adjustment is made to the English translation of "power quality", which maintains consistency with the power quality used in other standards. - content of "Normative References" is added; and terms are expanded. - Clearly specify that three-phase unbalance factor is the unbalance factor of the fundamental-wave component. - Adjust the content of "Unbalance Factor Calculation" in the appendix. Appendix A is informative. This Standard was proposed by and shall be under the jurisdiction of National Technical Committee on Voltages, Current Ratings and Frequencies of Standardization Administration of China. Drafting organizations of this Standard. Wuhan Guoce Science and Technology Co., Ltd, China Electric Power Research Institute, China Productivity Center for Machinery, Wuhan High Voltage Institute of State Grid, China Railway Siyuan Survey and Design Group Co., Ltd, Wuhan Iron and Steel (Group) Corp., and Harbin Research Institute

of Electrical Instruments. Chief drafting staffs of this Standard. Hou Tiexin, Bu Zhengliang, Lin Haixue, Liu Xun, Li Shusen, Huang Zuping, Zou Jiaping, Zhang Jianping, Mei Guihua, and Li Zhaoyang. Participating drafting staffs of this Standard. Jing Deyan, Gu Wen, Zeng Youtian, Wu Mingli, Wang Wei, Lin Xiang Nin, and Wu Lijun. The previous edition replaced by this Standard is. - GB/T 15543-1995. Power Quality - Three-phase Voltage Unbalance

1 Scope

China's national standard for three-phase voltage unbalance - the third of the power quality family alongside GB/T 12325 on voltage deviation and GB/T 12326 on fluctuation and flicker. It specifies the limits of the three-phase voltage unbalance in the power system, together with the methods of calculation, measurement and evaluation. Unbalance is the condition in which the three phase voltages are not equal in magnitude or not exactly 120 degrees apart, and it arises from unbalanced load: a large single-phase load such as an electric railway traction supply, an arc furnace, or simply an accumulation of single-phase domestic and commercial connections that do not distribute evenly across the phases. What makes it worth regulating is what it does to three-phase motors, which are most of the connected load in industry. An unbalanced supply produces a negative sequence component, and that component drives a current in the rotor at nearly twice supply frequency - so a small voltage unbalance produces a much larger current unbalance and a disproportionate heating of the machine. A few per cent of voltage unbalance can cost a motor a large part of its life, and nothing on the machine indicates why. The standard therefore sets the limits at the point of common coupling in terms of the negative sequence component, together with the method of calculating it, the measurement and the evaluation period and probability - since unbalance varies continuously - and the way the permitted emission is allocated to an individual unbalanced customer, which is what a railway traction supply or a furnace has to be designed against. Issued on 18 June 2008 and in force since 1 May 2009, it replaces GB/T 15543-1995.

This Standard specifies limits, calculation, measurement and evaluation methods of three-phase voltage unbalance. This Standard is applicable to, AC power system of which the nominal frequency is 50Hz is operated in normal mode, voltage unbalance at common coupling point caused by negative-sequence fundamental-wave component; and voltage unbalance at common coupling point caused by zero-sequence fundamental-wave component of the low-voltage system. Voltage permissible unbalance factor and permissible value of negative-sequence current of rated condition of electrical equipment shall still be specified by the various standards, for example, rotating motors shall meet the requirements in GB 755. Instantaneous and momentary unbalance problem are not applicable to this Standard.

2 Normative References

The following documents contain provisions which, through reference in this Standard, constitute provisions of this Standard. For dated reference, subsequent amendments (excluding corrigendum) or revisions of these publications do not apply. However, parties who enter in agreement based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. For undated references, the latest edition of the normative document is applicable to this Standard.

GB/T 156-2007 Standard Voltage (IEC 60038.2002, MOD)

GB/T 12325 Power Quality - Deviation of Supply Voltage

3 Terms and Definitions

The following terms and definitions apply to this Standard.

3.1 Voltage unbalance Three-phase voltage is different in amplitude or (and) the phase difference is not 120°, or both.

3.2 Unbalance factor It refers to the unbalanced degree of three-phase in the three-phase power system. It is represented by square mean root value percentage BETWEEN voltage, current negative-sequence fundamental-wave component or zero-sequence fundamental-wave component AND positive-sequence fundamental-wave component. Voltage, current negative-sequence unbalance factor and zero-sequence unbalance factor are respectively represented by 2U, 0U, 12 and 10.

3.3 Positive-sequence component It is the component of the positive-sequence symmetric system, after the electric quantity of the unbalanced three-phase system is decomposed according to the symmetrical component method.

3.4 Negative-sequence component It is the component of the negative-sequence symmetric system, after the electric quantity of the unbalanced three-phase system is decomposed according to the symmetrical component method.

4 Voltage Unbalance Factor Limit

4.1 Voltage unbalance factor limit for common coupling point of the electric power systems is. If the power grid is normally operated, unbalance factor of the negative-sequence voltage shall be less than or equal to 2%; the temporary negative-sequence voltage unbalance factor shall not be more than 4%.

5 Conversion of Permissible Values of Voltage Unbalance Factors Caused by User

Permissible values of voltage unbalance factors usually, in accordance with the normal

minimum short circuit capacity of the coupling points, can be converted into the corresponding negative-sequence current value, and be used as the basis of analysis or measurement & calculation.

6 Measurement and Evaluating of Unbalance Factors

6.1 Measurement conditions Measurement shall be carried out when the electric power system is normally operated in the minimum mode (or smaller mode), and the unbalanced load is under normal condition and continuously operation. And ensure that the maximum work cycle of the unbalanced load is included.

6.2 Measurement time For common coupling point of the electric power system, duration time of measurement is 1 week (168h); measurement interval of each unbalance factor can be integral multiples of 1min.

6.3 Measurement evaluating For common coupling point of the electric power system, the probability of 95% of 10 min square-mean-root of the supply voltage negative-sequence unbalance factor measured value shall not be larger than 2%; and the maximum value of all measured values shall be less than or equal to 4%.