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ELECTRICAL STANDARDS CODE

January 2019

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1 Introduction

1.1.1.1 This **electrical standards code** sets out the requirements for power supply quality associated with the transmission system. It should be read in conjunction with the grid code and is designed to set common requirements for all parties who are operating in competitive energy and ancillary service markets by setting conditions for non-discriminatory and transparent use of networks.

1.1.1.2 This **electrical standards code** establishes clear rules to be applied by the **transmission system operator** and by all **system users** to ensure that electricity generation, transmission and consumption can take place using the shared public electricity network.

1.1.1.3 This **electrical standards code** is prepared by the **TSMO** and approved by the **Energy Regulatory Office**. It lays down the conditions that have to be met by all parties in the circumstances covered by this code.

2 Glossary and Definitions

2.1.1.1 In this **electrical standards code**, the following definitions apply:

Term	Acronym	Definition
Connection		The interconnection of two systems in Kosovo.
Connection Agreement	CA	A bilateral agreement between a network operator and a user that details the conditions for connection to the transmission system.
Connection Point		The agreed point of supply established between a TSO and another user.
Customer		is a customer who is free to purchase electricity from the supplier of their choice as defined in the Law on Electricity
Energize		To apply voltage to an electrical installation by closing the final switch or inserting a cut-out fuse. Energized, energization etc shall be construed accordingly.
Energy Regulatory Office	ERO	Is the independent regulatory body established by the Law on the Energy Regulator .

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Term	Acronym	Definition
Force Majeure		An act or natural or social event, such as earthquakes, lightning, cyclones, floods, volcanic eruptions, fires or wars, armed conflicts, rebellion, terrorist or military acts, which prevent the licensee to comply with its obligations under the license, as well as other acts or events that are beyond the reasonable control and that did not happen as a fault of the licensee and the licensee has been unable to avoid such act or event through the exercise of will, effort, skill and his reasonable care;
Generating Unit		A single set of apparatus that generates electricity.
Producer		A natural or legal person generating electricity
Law on Energy		Is law nr. 05/L-081 approved by the Assembly of Kosovo.
Law on the Energy Regulator		Is law nr. 05/L-084 approved by the Assembly of Kosovo.
Law on Electricity		Is law nr. 05/L-085 approved by the Assembly of Kosovo.
Licence		An authorization issued by the Energy Regulatory Office that allows the holder to perform an activity in the energy sector for which a Licence is required according to its provisions dealing with the energy sector
Operational Codes Governance Committee	OCGC	The committee established in accordance with the provisions of the governance procedures for technical/operational codes to oversee the operation of technical and operational codes.
Party		Anyone who operates in the organized electricity market in Kosovo or provides services to enable the functioning of the market.
Point of Common Coupling	PCC	That point on the transmission system where the effect of the operation of equipment belonging to one system user is reflected in the quality of supply detected by another system user.
Regulator		Is the Energy Regulatory Office (ERO), the independent regulatory body established by the Law on the Energy Regulator .

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Term	Acronym	Definition
Rule on the Resolution of Complaints and Disputes in Energy Sector		Rules set by the Energy Regulatory Office in accordance with the Law on Energy Regulatory, which provide the basis for resolving disputes in the energy sector.
Rule on General Conditions of Energy Supply		A rule on general conditions of energy supply issued by the regulator in accordance with article 14.2.10 of the law on the energy regulator .
Rule on Governance Procedures for Technical/Operational Code		A rule on governance procedures for technical and operational codes issued by the regulator in accordance of the law on the energy regulator .
System User		Natural and legal persons supplying to, or supplied by a transmission or distribution system
Transmission		The transport of electricity through high-voltage systems and interconnected high voltage system with a view to its delivery to final customers or to the operators of distribution system,, but not including supply.
Transmission System Operator	TSO	A natural or legal person responsible for operating, ensuring the maintenance of and, if necessary, developing the transmission system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the transmission of electricity;
Transmission System	TS	The system comprising a combination of high voltage lines, substations and facilities, serving the transmission of electricity
ENTSO-E		Is the European Network of Transmission System Operators for Electricity
Energy Regulatory Office	ERO	Independent agency in energy sector, established by the Law on Energy Regulatory.

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2.1.1.2 In addition to special meanings contained in the Glossary and Definitions above, within this document certain words and phrases have the following meanings:

- References to the masculine shall include the feminine and references in the singular shall include references in the plural and *vice versa*,
- Where this **electrical standards code** specifies written information or written confirmation to be given, then any other suitable means of electronic transfer that enables the recipient to retain the information – such as electronic mail or FAX - fulfils this requirement,
- Except where explicitly stated otherwise all references to section shall be a reference to a section in this **electrical standards code**,
- Any reference to a law or regulation shall be a reference to that law or regulation applicable in Kosovo or, following the replacement of that law or regulation the new law or regulation from the date it comes into force.

3 Voltage Quality

3.1 Nominal Voltage Levels

3.1.1.1 The nominal voltage at transmission network terminations shall be 400 kV, 220 kV or 110 kV

3.2 Acceptable Deviation

3.2.1.1 In normal operating conditions, the limits of deviation from nominal voltage shall be:

- a) In 400 kV level – between 380 kV and 420 kV,
- b) In 220 kV level – between 198 kV and 242 kV, and
- c) In 110 kV level – between 99 kV and 121 kV.

3.2.1.2 In exceptional circumstances operating conditions, the limits of deviation from nominal voltage will be:

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- d) In 400kV level – between 360 kV and 440 kV,
- e) In 220kV level – between 189.2 kV and 250.8 kV, and
- f) In 110 kV level – between 90.2 kV and 129.8 kV.

3.2.1.3 At all times, the **TSO** shall maintain voltage levels on interconnecting circuits within the limits specified in the **ENTSO-E** Operation Handbook and as agreed within the control area that includes Kosovo. Voltage levels at interconnecting substations shall be agreed between the **TSO** and the adjoining **TSO** and kept as close to the agreed level as is possible.

3.2.1.4 In all supplying circuits of distribution substations and large consumers', voltage level at primary (HV) and secondary (LV) side must be kept at normal operated limits in compliance with requirements of the Grid Code, by using voltage regulators with regulation ability with the range +/- 10% at low voltage side.

4 Frequency

4.1 Nominal Frequency

4.1.1.1 The nominal frequency of the voltage sine wave it will be 50 Hz.

4.2 Acceptable Deviation

4.2.1.1 The **TSO** shall arrange for the provision of primary, secondary and tertiary control reserve to maintain system frequency as detailed in the Grid Code. The objective of the **TSO** will, as far as is reasonable, be to maintain nominal frequency within a tolerance band of ± 200 mHz.

4.2.1.2 In accordance with the **ENTSO-E** procedures for synchronously interconnected electricity transmission systems during normal operating conditions, the limits of deviation from nominal frequency shall be ± 800 mHz. If system frequency drops to 49 Hz, the **TSO** shall institute load shedding in compliance with the provisions of the **ENTSO-E** Operation Handbook.

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4.2.1.3 Where necessary to re-establish synchronous time control, the **TSO** shall be permitted to apply a frequency offset in accordance with the provisions of the **ENTSO-E** Operation Handbook. Such frequency offset shall not be considered to be a deviation from nominal frequency.

5 Effect of Disturbing Loads

5.1 Purpose

5.1.1.1 The connection of all loads to the electricity network will have a short term effect on the voltage waveform at the point of common coupling with those parts of the network providing connection for other **system users**. Since it is impossible to avoid changes to the voltage waveform, equipment intended for connection to public electricity systems must be designed to operate correctly over a reasonable range of disturbances. The purpose of this section of the code is to:

- a) Provide approvals for connection of certain types of loads without reference to the TSO,
- b) Establish limits of load disturbance for network planning purposes,
- c) Identify mechanisms to be applied in Kosovo for quantifying the acceptability of transmission system disturbances caused by disturbing loads,
- d) Establish the approach taken by the **TSO** in assessing the impact of disturbing loads on other **system users**.

5.1.1.2 In determining acceptable limits, the code relies on international practice and the limits found to be acceptable to most humans when disturbances affect the operation of tungsten filament lamps.

5.1.1.3 In determining the acceptability of a disturbing load for connection to its network, the **TSO** will only consider the impact of such a load on other **system users**. Since reducing the effect of disturbing loads on the operation of other equipment connected to the network may have a significant cost, it is considered that the limits of acceptability for the impact of disturbing loads operated by the same system user

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should be for that system user to determine. This allows a **system user** wishing to connect a disturbing load maximum freedom of choice in the cost/benefit analysis of the operation of its undertaking.

5.2 Application

5.2.1.1 This section of the code shall apply to all **system users** whose networks are directly connected to the **transmission system** operated by the **TSO**. Where a **system user** provides a mechanism for the network of another party to be connected to the network of the **TSO** through their own network, they shall assess the effect of disturbing loads connected to their network on the network of the **TSO** and ensure that the effect of such disturbing loads shall not (individually or in aggregate) exceed the limits specified in this code. **System users** who use their networks to provide connection to others are obliged to operate their networks in such a manner to ensure that the requirements of the CENELEC EN 50160 Standard are satisfied.

5.3 Basis of Applied Limits

5.3.1.1 Voltage fluctuations can be regarded as an envelope modulating the 50 Hz supply voltage wave, the envelope itself varying in a manner determined by the operation of connected loads. This envelope may be conceived as a separate fluctuating voltage which produces the subjective effect of flicker on human subjects and stress to electrical components. The limits have been set to allow maximum utilisation of the **transmission system** capacity to accept fluctuating loads without an excessive risk of failing to meet the electromagnetic compatibility requirements of IEC 61000 or of provoking complaints from **system users**.

5.4 Approval Arrangements

5.4.1.1 The arrangements for approval for connection of disturbing loads will follow a three stage approach:

- a) Stage 1: General approval for the connection of equipment without application or consideration by **TSO**,
- b) Stage 2: Approval at the planning stage after consideration by the **TSO**, and

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c) Stage 3: In exceptional circumstances, approval by the TSO following construction and site tests.

5.4.2 Stage 1 Approval

5.4.2.1 Certain equipment may be connected by a **system user** without reference to TSO. This includes equipment:

- d) [Compliant with the requirements of IEC 61000-3-3,
- e) [Electric motors up to 1500 kW normal output rating], and
- f) Manual arc welding equipment.

5.4.3 Stage 2 Approval

5.4.3.1 Following assessment by the TSO, any equipment that will cause a change in line voltage at the point of common coupling:

- a) Less than 3% where the interval between voltage changes is less than 10 minutes, or
- b) Less than 6% where the interval between voltage changes is equal to or greater than 10 minutes

will be approved for connection prior to construction.

5.4.4 Stage 3 Approval

5.4.4.1 In exceptional circumstances, particularly where the total effect on the transmission system of the combined operation of equipment that is electrically closely connected cannot be evaluated by other means, approval may be given by the TSO for the connection of disturbing loads where post construction tests carried out in accordance with IEC 61000-4 demonstrate that the continued operation of the equipment will result in voltage fluctuations and flicker within the limits of IEC 61000.

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5.4.5 Infrequent Disturbances

5.4.5.1 Where the starting of a continuous industrial process can cause system disturbances greater than would qualify for approval in terms of section 5.4.2 or section 5.4.3, agreement can be reached between the **system user**, the **TSO** and, if necessary, other **system users** that the continuous process may be started at times when the impact of any system disturbance on other **system users** will be limited because:

- a) the equipment they have connected to the system will be reduced,
- b) the **TSO** arranges that the voltage at the **PCC** is higher than normal, or
- c) the system impedance at the **PCC** is particularly low.

5.4.5.2 Where such agreement is reached, it shall be permissible for the voltage fluctuation caused by the **system user** to exceed the permitted values during the starting of a continuous process only, provided the fluctuation or the unusual conditions established by the **TSO** to allow the process to be started do not cause the voltage quality experienced by other system users to fall outside this limits specified in section 3.

6 Harmonic Distortion

6.1 Purpose of this Section of the Code

6.1.1.1 Satisfactory operation of the **transmission system** and the equipment of other system users is only possible where there is electromagnetic compatibility between equipment connected to the network. The purpose of this section of the code is to:

- a) Provide approvals for connection of certain types of non linear equipment without reference to the **TSO**,
- b) Establish permitted harmonic limits for network planning purposes,
- c) Establish the approach taken by the **TSO** in assessing the impact of non linear equipment on other **system users**.

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6.2 Application

6.2.1.1 This section of the code shall apply to all **system users** whose networks are directly connected to the **transmission system** operated by the **TSO**. Where a **system user** provides a mechanism for the network of another party to be connected to the network of the **TSO** through their own network, they shall assess the effect on the network of the **TSO** of non-linear loads and generating units that are connected to their network and ensure that the effect of such equipment shall not (individually or in aggregate) exceed the limits specified in this code. **System users** who use their networks to provide connection to others are obliged to operate their networks in such a manner to ensure that the requirements of the CENELEC EN 50160 Standard are satisfied.

6.3 System Planning Levels

6.3.1.1 Harmonic compatibility levels for equipment connected to public electricity supply networks are established in IEC 61000-2 at a value where correct operation of equipment is not guaranteed but where the probability of correct equipment operation is very high. As part of the general compatibility regime, IEC 61000-2 also establishes the principle that system planning levels should be lower than the compatibility level. The planning levels which are established in this code are based on IEC/TR 61000-3-6 and are:

- a) Total Harmonic Distortion – 3%
- b) Individual Harmonics on 400 kV and 220 kV Systems

Odd Harmonics (multiple of 3)		Even Harmonics		Odd Harmonics (not multiple of 3)	
Harmonic	Voltage (%)	Harmonic	Voltage (%)	Harmonic	Voltage (%)
3	[1.5]	2	[1.0]	5	[2.0]
9	[0.3]	4	[0.8]	7	[1.5]



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Odd Harmonics (multiple of 3)		Even Harmonics		Odd Harmonics (not multiple of 3)	
Harmonic	Voltage (%)	Harmonic	Voltage (%)	Harmonic	Voltage (%)
15	[0.3]	6	[0.5]	11	[1.0]
21	[0.2]	8	[0.4]	13	[1.0]
		12	[0.2]	19	[0.5]
		>12	[0.2]	23	[0.5]
			[25	[0.5]
				>25	[0.3]

c) Individual Harmonics on 110 kV System

Odd Harmonics (multiple of 3)		Even Harmonics		Odd Harmonics (not multiple of 3)	
Harmonic	Voltage (%)	Harmonic	Voltage (%)	Harmonic	Voltage (%)
3	[2.0]	2	[1.0]	5	[2.0]
9	[1.0]	4	[0.8]	7	[2.0]
15	[0.3]	6	[0.5]	11	[1.5]
21	[0.2]	8	[0.4]	13	[1.5]
>21	[0.2]	10	[0.4]	17	[1.0]
		12	[0.2]	19	[1.0]
		>12	[0.2]	23	[0.7]
				25	[0.7]
				>25	[0.5]

6.4 Approval Arrangements

6.4.1 Stage 1 Approval

6.4.1.1 Where a **system user** is connected to the network of the **TSO** but uses equipment at 35kV or below, certain equipment may be connected by the **system user** without reference to **TSO** provided the total and individual harmonic distortion at the point of common coupling does not exceed the values specified in section 6.3.1.1. This includes equipment:

- a) Compliant with the requirements of IEC 61000-3-3,

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- b) Single phase convertors or AC regulators designed to have negligible even harmonic emissions less than 5 kVA in aggregate,
- c) 6 pulse three phase convertors or AC regulators less than 15 kVA in aggregate,
- d) 12 pulse three phase convertors or AC regulators less than 50 kVA in aggregate, and
- e) Motors with thyristor drives where the normal output rating of the motor is less than 75 kW.

6.4.2 Stage 2 Approval

6.4.2.1 The TSO shall automatically approve connection of equipment where the **system user** can demonstrate that the total RMS harmonic current emissions of all equipment it is proposed should be connected in amperes per phase at the connection voltage will not exceed the values given in the table in Appendix A.

6.4.2.2 With the exception of the third and fifth harmonic, any two emission currents up to and including the nineteenth may exceed the limit values by 10%. For harmonics above the nineteenth, any four emission currents may exceed the specified values by up to 10%.

6.4.3 Stage 3 Approval

6.4.3.1 Where a **system user** proposes to connect non linear equipment to the network of the TSO and approval for the connection of this equipment cannot be granted in accordance with either section 6.4.1 or section 6.4.2, then a full assessment of the impact on the transmission system must be undertaken.

6.4.3.2 In undertaking this assessment, the characteristics of the non-linear equipment it is proposed to connect will be declared by the **system user** before the assessment is commenced and these characteristics will be used to complete the assessment.

6.4.3.3 The TSO shall provide the **system user** with details of the system harmonic impedance values at the PCC and either the TSO or the **system user** may calculate the effect of connecting the proposed non linear equipment by the **system user**.

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6.4.3.4 The **TSO** will measure the existing levels of harmonic distortion on the system and connection of the non linear equipment by the **system user** will be permissible if the sum of the existing harmonic distortion and the calculated effect of connecting the proposed non linear equipment do not cause either that total permitted harmonic distortion values or the permitted harmonic voltage planning levels to be exceeded.

6.4.4 Short Term Harmonic Distortion

6.4.4.1 Where thyristor drives associated with motors that are used as part of a continuous industrial process that does not cause frequent shocks to the motor drives and these motors have a larger normal output rating than would qualify for approval in terms of section 6.4.1.1 or section 6.4.3, agreement can be reached between the **system user**, the **TSO** and, if necessary, other **system users** that the continuous process may be started at times where either:

- a) the impact of any harmonic distortion on other **system users** will be limited because the equipment they have connected to the system will be reduced, or
- b) the system harmonic impedance values at the **PCC** are low.

6.4.4.2 Where such agreement is reached, it shall be permissible for the harmonic emissions of the **system user** to exceed the permitted values during the starting of a continuous process only.

7 Disputes Procedure

7.1.1.1 Disputes arising from the operation of this **electrical standards code** shall be dealt with in accordance with the **rule on the resolution of complaints and disputes in energy sector** approved by the **Energy Regulatory Office** as a means for resolving disputes arising between parties in the power market.

8 Management of the Electrical Standards Code

8.1.1.1 **Transmission system operator** is responsible for the administration of all technical codes for electricity including this **electrical standards code** and they are subject to the approval of the **Energy Regulatory Office** prior to their implementation.

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8.1.1.2 Revisions to this **electrical standards code** will be undertaken by the **operational codes governance committee** established in accordance with the **rule on governance procedures for technical/operational codes** approved by the **Energy Regulatory Office**. The **TSO** shall take responsibility for incorporating any amendments that are agreed by the **OCGC** and approved by the **Energy Regulatory Office** and will issue amended versions of the code as required.

8.2 Unforeseen Circumstances

8.2.1 In this Electrical Standards Code

8.2.1.1 If circumstances arise that the provisions of this **electrical standards code** could not reasonably have foreseen, the **TSO** shall, to the extent reasonably practicable in the circumstances, consult promptly with all affected **parties** and the **operational codes governance committee (OCGC)** in an effort to reach agreement as to what actions, if any, should be taken. If agreement between the **TSO** and those parties cannot be reached in the time available, the **TSO** acting as a **reasonable and prudent operator** shall determine what actions, if any, should be taken. The **TSO** shall notify the **parties** and the **Energy Regulatory Office** of its decision and the reasons for it as soon as practicable.

8.2.1.2 Whenever the **TSO** makes a decision, it shall do so having regard, wherever possible, to the views expressed by the other parties.

8.2.1.3 After the event the **TSO** shall promptly refer all such unforeseen circumstances and any such decisions to the **operational codes governance committee** for consideration in accordance with section 8.1.1.2

8.2.2 Affecting the ability of Parties to comply with this Code

8.2.2.1 Where a **party** is unable to comply with its obligations under this code for a **force majeure** event, it may send a notice to all affected **parties** and to the **Energy Regulatory Office** detailing the reasons for it being unable to meet its obligations, why it believes these reasons are a **force majeure** event and the time during which the **force majeure** event will last.

8.2.2.2 During the period of **force majeure**, the **party's** obligations shall be suspended.

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8.2.2.3 If any **party** believes that the declaration of **force majeure** is unreasonable, he may refer the matter to the **Energy Regulatory Office** for review and the decision of the **Energy Regulatory Office** shall be final. In the event that the **Energy Regulatory Office** determines that the reasons for non compliance were not a **force majeure** event, then the obligations of the **party** claiming **force majeure** will not be considered to have been suspended.



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Appendix A: Maximum Harmonic Current Emissions per System User in Amperes RMS per phase

Harmonic	110kV PCC	220kV PCC	400kV PCC	Harmonic	110kV PCC	220kV PCC	400kV PCC	Harmonic	110kV PCC	220kV PCC	400kV PCC	Harmonic	110kV PCC	220kV PCC	400kV PCC
2	[0.66]	[0.35]	[0.2]	15	[0.05]	[0.03]	[0.02]	28	[0.04]	[0.02]	[0.01]	41	[0.08]	[0.04]	[0.02]
3	[0.88]	[0.5]	[0.3]	16	[0.1]	[0.06]	[0.04]	29	[0.08]	[0.05]	[0.03]	42	[0.02]	[0.01]	[0.0]
4	[0.26]	[0.15]	[0.1]	17	[0.4]	[0.2]	[0.1]	30	[0.02]	[0.01]	[0.01]	43	[0.08]	[0.04]	[0.02]
5	[0.52]	[0.28]	[0.15]	18	[0.05]	[0.03]	[0.02]	31	[0.02]	[0.01]	[0.01]	44	[0.04]	[0.02]	[0.01]
6	[0.12]	[0.06]	[0.04]	19	[0.22]	[0.12]	[0.1]	32	[0.04]	[0.02]	[0.01]	45	[0.02]	[0.01]	[0.01]
7	[1.0]	[0.6]	[0.4]	20	[0.05]	[0.03]	[0.02]	33	[0.02]	[0.01]	[0.01]	46	[0.04]	[0.02]	[0.01]
8	[0.18]	[0.1]	[0.06]	21	[0.02]	[0.01]	[0.01]	34	[0.04]	[0.02]	[0.01]	47	[0.06]	[0.03]	[0.02]
9	[0.3]	[0.15]	[0.1]	22	[0.05]	[0.03]	[0.02]	35	[0.12]	[0.07]	[0.04]	48	[0.02]	[0.01]	[0.01]
10	[0.3]	[0.15]	[0.1]	23	[0.22]	[0.12]	[0.1]	36	[0.02]	[0.01]	[0.01]	49	[0.06]	[0.03]	[0.02]
11	[0.95]	[0.05]	[0.03]	24	[0.02]	[0.01]	[0.01]	37	[0.1]	[0.06]	[0.04]	50	[0.02]	[0.01]	[0.01]
12	[0.05]	[0.03]	[0.02]	25	[0.2]	[0.12]	[0.1]	38	[0.04]	[0.02]	[0.01]				
13	[0.8]	[0.05]	[0.03]	26	[0.1]	[0.06]	[0.04]	39	[0.02]	[0.01]	[0.01]				
14	[0.1]	[0.06]	[0.04]	27	[0.02]	[0.01]	[0.01]	40	[0.04]	[0.02]	[0.01]				

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