Bhopal, Dated: 17th November 2005

No.2752/MPERC/2005. In exercise of the powers conferred by sections 181 (1) and 181 (2) (za) read with section 57 (1), 57 (2) and 86 (1) (i) of the Electricity Act, 2003 (36 of 2003) enacted by the parliament, the Madhya Pradesh Electricity Regulatory Commission makes the MPERC (Transmission Performance Standards) Regulations, 2004 (Revision 1, 2005)

MADHYA PRADESH ELECTRICITY REGULATORY COMMISSION (TRANSMISSION PERFORMANCE STANDARDS) REGULATIONS, 2004 (Revision 1, 2005) (No.RG-9 (I) of 2005)

1: SHORT TITLE AND COMMENCEMENT

1.1 These Regulations may be called "Madhya Pradesh Electricity Regulatory Commission (Transmission Performance Standards) Regulations, 2004" (Revision 1, 2005).

1.2 These Regulations shall be applicable to State Transmission Utility/ Transmission Licensee in the state of Madhya Pradesh.

1.3 These regulations extend to the whole of the State of Madhya Pradesh.

1.4 These Revised regulations shall remain in force w.e.f..23-07-2004 i.e. the date of publication of MPERC (Transmission Performance Standards) Regulations, 2004 published vide Notification No. 1932/MPERC/2004 in the official Gazette of Madhya Pradesh.

2: DEFINITIONS

2.1 In these standards, unless the context otherwise requires:

(a) "Act" means the Electricity Act 2003 (Central Act No. 36 of 2003);

(b) "Commission" means Madhya Pradesh Electricity Regulatory Commission;

(c) "Consumer" means any person who is supplied with electricity by the licensee and includes any person whose premises are for the time being connected for the purpose of receiving electricity from the licensee, persons who have applied for an electricity connection, persons whose supply is not yet connected even after due notice to avail connection or whose electricity supply has been disconnected. A consumer is -

(i) 'Low Tension Consumer (LT Consumer)' if he obtains supply from the licensee at low or medium voltage.

(ii) 'High Tension Consumer (HT Consumer)' if he obtains supply from the licensee at High Voltage.

(iii) 'Extra High Tension Consumer (EHT Consumer)' if he obtains supply from the licensee at Extra High Voltage.

(d) "Distribution Code" means the Madhya Pradesh Electricity Distribution Code specified by the Commission for Distribution Licensees in the State of Madhya Pradesh;

(e) “Distribution Licensee” means a Licensee authorised to operate and maintain a distribution system for supplying electricity to the consumers in his area of supply;

(f) “Distribution System” means the system of wires and associated facilities between the delivery points on the transmission lines or the generating station connection and the point of connection to the installation of the consumers;

(g) "EHV/EHT" means Extra High Voltage/Extra High Tension (voltage level above 33,000 volts);

(h) "Electricity Supply Code" means the Madhya Pradesh Electricity Supply Code, 2004 approved by the Commission;

(i) "Generating Company" means any company or body corporate or association or body of individuals, whether incorporated or not, or artificial juridical person, which owns or operates or maintains a generating station

(j) "Grid Code" means the set of principles and guidelines prepared in accordance with the terms of Section 86 (1) (h) of the Electricity Act 2003;

(k) "HV/HT" means High Voltage/High Tension (voltage level above 650 volts but does not exceed 33,000 volts);

(l) “IEGC” means the Indian Electricity Grid Code approved by Central Electricity Regulatory Commission (CERC) and shall include any Grid Code specified by Central Commission under clause (h) of sub-section (1) of section 79 of the Act;

(m) "Licensee" means a person who has been granted a license by the Commission under the Act and include MPSEB and any of its successor entity under the provisions of section 131 of the Act;

(n) "LT" means Low Tension (voltage does not exceed 650 volts under normal condition);

(o) “MPPTCL” means Madhya Pradesh Power Transmission Company Limited registered under the Companies Act, 1956;

(p) “MPSEB” means the Madhya Pradesh State Electricity Board constituted under section 5 of the Electricity (Supply) Act, 1948 by State Government of Madhya Pradesh and functioning before commencement of the Act. The term MPSEB includes any of its successor entities created pursuant to section 131 of the Act;

(q) “PGCIL” means Power Grid Corporation of India Limited, a Central Transmission Utility notified under sub-section (1) of section 38 of the Act;

(r) "MP Act" means The Madhya Pradesh Vidyut Sudhar Adhiniyam 2000;

(s) “Rules” means the Indian Electricity Rules, 1956 and/or any other rules made under Act;

(t) “SLDC” means the centre established under sub-section (2) of section 31 of the Act and includes State Load Despatch Centre already functioning in the State

having its control room at Jabalpur, an apex body to ensure integrated operations of the power system in the state;

(u) "State Transmission System" means the system of EHV electric lines and electrical equipment operated and/or maintained by State Transmission Utility and/or any Transmission Licensee for the purpose of the transmission of electricity among generating stations, external interconnections, distribution systems and any other user connected to it;

(v) "State Transmission Utility" means the Board or Government Company specified as such by the State Government under sub-section (1) of section 39 of the Act;

(w) "User" means a person, including Generating Stations within MP, Transmission Licensees or Distribution Licensees within MP and open access customer who use the State Transmission System and who must comply with the provisions of the Grid Code;

(x) "WREB" means Western Regional Electricity Board;

(y) "WRLDC" means Western Regional Load Despatch Centre established under sub-section (1) of section 27 of Act.

2.2 Words and expressions used but not defined herein shall have meaning assigned to them in Electricity Act 2003, Indian Electricity Grid Code, Madhya Pradesh Electricity Grid Code and Indian Electricity Rules, 1956.

3: OBJECTIVE

3.1 These standards lay down the guidelines to maintain critical grid parameters within the permissible limits. They shall serve as guidelines for State Transmission Utility (STU)/Transmission Licensee to operate State Transmission System for providing an efficient, reliable, coordinated and economical system of electricity supply and transmission. The objectives of these performance standards are:

(a) To ensure that the grid performance meets a minimum standard which is essential for the Users' system demand and proper equipment functions

(b) To enable the Users to design their systems and equipment to suit the electrical environment that they operate in.

(c) To enhance the quality standards of the State Transmission System in order to move towards standard stipulated in or established under the authority of National and State Acts and Rules in the short term and gradually moving towards international standards in the long term.

4: LEGAL PROVISIONS

4.1 The Commission in pursuance to provisions of section 57 read with section 86 (1) (i) of the Act is specifying these standards for State Transmission Utility /Transmission Licensee in the State of Madhya Pradesh. The Standards of Performance specified herein are intended to serve as guidelines for State Transmission Utility /Transmission Licensee to operate the State Transmission system for providing quality, continuity and reliability of services.

4.2 Section 57 (1) of the Act stipulates that the Commission after consultation with Licensees and persons likely to be affected shall specify standards of performance of a Licensee or a class of Licensees.

4.3 The sub-section (2) of section 57 provides that if a Licensee fails to meet the standards specified under sub-section (1), without prejudice to any penalty, which may be imposed, or prosecution be initiated, he shall be liable to pay such compensation to a person affected as may be determined by the Appropriate Commission;

Provided that before determination of compensation, the concerned Licensee shall be given reasonable opportunity of being heard.

4.4 Under the provisions of section 86(1) (i) the Commission is required to specify and enforce standards with respect to quality, continuity and reliability of services by the Licensees.

4.5 Section 59 of the Act provides the information with respect to level of performance. This has been covered in these regulations as Reporting Requirement (Refer Clause 7). This covers quarterly report on performance standards and publication of Annual Report under section 59 (2) of the Act.

4.6 Failure to meet performance standards and payment of compensation to affected party has been covered under Compliance of Regulations. The penal and prosecution provision are as per section 142 of the Act.

4.7 The Commission, therefore, issues these Standards of performance of Transmission Licensee(s) as the regulation under sections 181 (1) and 181 (2) (za) of the Act.

5: PERFORMANCE STANDARDS

5.1 The Transmission performance standards fall under two categories:

(a) Category A - Those performance standards, where the provision of sub-section (2) of the section 57 is applicable for failure to meet the standards specified.

(b) Category B - Those performance standards, which are desirable to provide quality, continuity and reliability of services by the Licensees, which the Commission specifies in discharge of its function, but however not attract the provision of sub-section (2) of the section 57 relating to compensation to the persons affected.

5.2 Following standards fall under Category A as mandatory standards:

(a) Voltage Variation

(b) Frequency Variation

(c) Safety Standards

These are statutory standards to be complied with by the Licensee as per Electricity Rules 1956. The new Rules under section 53 of Act are to be issued by the CEA in consultation with State Government. These standards shall be revised after new Rules under Act come into effect.

5.3 Category B standards have been specified with the object of providing quality, continuity and reliability of services to the consumers under section 86 (1) (i) of the Act. The Commission has fixed the time bound schedule for compliance of specified standards relating to each of the parameters mentioned in Section 5.4 below:

5.4 Following standards have been specified under Category B as desirable achievements:

(a) System Availability
(b) Feeder Availability
(c) Transformer Availability
(d) Voltage Unbalance
(e) Neutral Voltage Displacement (NVD)
(f) Voltage Variation Index (VVI)
(g) Frequency Variation Index (FVI)
(h) Harmonics in Supply Voltage
(i) System Adequacy
(j) System Security

6: PHASING OF IMPLEMENTATION

6.1 Due to non-preparedness of Licensee, the performance standards established herein shall be implemented in phased manner in the stages as per following table:

Stage	Time Period	Category	Performance Parameters	Remark
Immediate Stage	Applicable w.e.f. 23-07-2004 i.e from the date of first notification	**A**	Voltage Variation Frequency Variation Safety Standards	Mandatory Standards
Preliminary Stage – For Two Years	From 23-07-2004 i.e from the date of first notification to 22-07-2006	**B**	System Availability, Feeder Availability, Transformer Availability, Voltage Unbalance, Neutral Voltage Displacement, Voltage Variation Index, Frequency Variation Index, System Adequacy	Standards specified at level 1 to be achieved
Transition Stage – For Three Years	From 23-07-2006 to 22-07-2009	**B**	System Availability, Feeder Availability, Transformer Availability, Voltage Unbalance, Neutral Voltage Displacement, Voltage Variation Index, Frequency Variation Index, System Adequacy System Security	Standards specified at level 2 to be achieved
Final Stage	From 23-07-	**B**	System Availability, Feeder Availability,	Standards specified at

	2009 onwards		Transformer Availability, Voltage Unbalance, Neutral Voltage Displacement, Voltage Variation Index, Frequency Variation Index, Harmonic in Supply Voltage System Adequacy System Security	level 3 to be achieved

6.2 In all cases, where standards, for example Electricity Rules 1956, are specified by appropriate authorities, such standards shall be applicable from the preliminary stage itself.

7: PARAMETERS OF PERFORMANCE STANDARDS

Category A Standards

7.1 Those performance parameters, where the provision of sub-section (2) of the section 57 is applicable for failure to meet the standards specified. The standards of performance are Conditions of License to be complied with by the Licensee.

7.2 The Commission specifies following standards under Category A:

(a) Voltage Variation:

(i) Voltage Variation is defined as the deviation of the root-mean-square (RMS) value of the voltage from its nominal value, expressed in terms of percent. Voltage Variation may be either of short duration not exceeding one minute or long duration for a time greater than one minute.

(ii) For the purpose of these standards, the sustained variation in steady state voltage exceeding one minute duration shall be considered. The specified permissible limits of sustained voltage variation shall not apply in the cases where the circumstances are reasonably beyond the control of State Transmission Utility /Transmission Licensee e.g. major break-downs, grid failures, accidents, system distress conditions etc.

(iii) State Transmission Utility /Transmission Licensee shall make all possible efforts to ensure that the grid voltages remain within the following voltage levels at all EHT sub-stations of its Transmission System:

Voltage (kV rms)					
Nominal Voltage (kV)	**Maximum**		**Minimum**		**Reference**
	Limit (%)	**Value (kV)**	**Limit (%)**	**Value (kV)**	
400	+5	420.00	-10	360.00	IEGC

Voltage (kV rms)					
	Maximum		Minimum		
220	+10	245.00	-10	198.00	IEGC
132	+10	145.20	-10	118.80	IEGC
66	+10	72.60	-10	59.40	IE Rules
33	+6	34.98	-9	30.03	IE Rules
11	+6	11.66	-9	10.01	IE Rules

(iv) The compliance of above standards is subjected to following conditions:

1- Voltage is maintained by PGCIL at Transmission Licensee/ State Transmission Utility interfaces as per IEGC limits
2- Discoms drawal at a minimum power factor of 0.95 lagging

3- Loading of all lines limited to the Surge Impedance Loading (SIL) in normal conditions

(v) The compliance shall be reported as per Annexure – 1A to 1F

(b) Frequency Variation:

(i) State Transmission System shall always operate as an integral part of the Western grid. However, frequency management is the joint responsibility of all constituents of the Western grid. State Transmission Utility /Transmission Licensee shall be responsible for complying with the provisions of IEGC. Further State Transmission Utility /Transmission Licensee shall fulfill its responsibility to keep the frequency within following specified ranges:

Target Range (As per IEGC)	**Variation (%)**	**Value (Hz)**
Upper Limit	+1%	50.5 Hz
Lower Limit	-2%	49.0 Hz
Statutory Acceptable Limit (As per IE Rules, 1956)	**Variation (%)**	**Value (Hz)**
Upper Limit	+3%	51.5 Hz
Lower Limit	-3%	48.5 Hz

Frequency range for the extreme conditions from System Security point of view shall be as prescribed by WRLDC/WREB from time to time.

(ii) The compliance shall be reported as per Annexure – 2.

(c) Safety Standards:

(i) State Transmission Utility /Transmission Licensee shall observe the general safety requirements as laid down in IE Rules, 1956 for construction, installation, protection, operation and maintenance of electric supply lines and apparatus.

(ii) Following important sections of IE Rules 1956, but not limited to, shall be referred for detailed safety standards:

1-	Section 29 to 46	-	General safety requirements
2-	Section 74 to 81	-	Support Standards and Safety Clearances
3-	Section 87 to 88	-	Line crossing and Guarding
4-	Section 90	-	Earthing
5-	Section 91	-	Safety and protective devices
6-	Section 92	-	Protection against lightning
7-	Section 93	-	Unused overhead lines

(iii) State Transmission Utility /Transmission Licensee shall designate suitable persons as designated officers as specified in Grid Code for coordination of safety procedures before work is taken up, during work, and after work is completed till the concerned system component is energized, both inside its own Transmission System and across a control boundary between State Transmission Utility's/Transmission licensee's Transmission System and that of any user.

(iv) State Transmission Utility / Transmission Licensee shall develop its own Operation and Maintenance Manual (including Safety Regulations) taking into consideration the safety requirements for the construction, operation and maintenance of electrical plants and electric lines as may be specified by the Central Electricity Authority under Clause (c) of section 73 of the Act.

(v) A consolidated report on the compliance of each clause of section 7.2(c)ii of this regulation shall be submitted to the Commission in the proforma enclosed at Annexure – 3.

Category B Standards

7.3 These are the desirable performance standards with respect to providing quality, continuity and reliability of services by the Licensees but do not attract the provision of sub-section (2) of the section 57 of the Act for the present. These are intended to provide expected level of performance after preliminary stage to provide quality, continuity and reliability of services to the consumers and for each violation of Standard, Licensee will need to bring out the reasons for examination and analysis by the Commission on case to case basis.

7.4 The Commission specifies following standards under Category B:

(a) System Availability:

1. Procedure for calculation of Transmission System Availability

Transmission System Availability shall be calculated separately for each voltage level. The transmission elements shall be grouped into following categories for the purpose of calculation of availability of Transmission Systems :

i) AC transmission lines: Each circuit of AC transmission line shall be considered as one element.
ii) Inter-Connecting Transformers (ICTs): Each ICT bank (three single phase transformer together) shall form one element.
iii) Static VAR Compensator (SVC): SVC along with SVC transformer shall form one element. However, 50% credit to inductive and 50% to capacitive rating shall be given.
iv) Switched Bus Reactor: Each switched Bus Reactor shall be considered as one element.

2. The Availability of AC Transmission system shall be calculated as under:

% System Availability for AC system

$$= \frac{o \times AV_o + p \times AV_p + q \times AV_q + r \times AV_r}{o + p + q + r} \times 100$$

Where

o	is	Total number of AC lines.
AV_o	is	Availability of o number of AC lines (As defined in 8b).
p	is	Total number of switched bus reactors .
AV_p	is	Availability of p number of switched bus reactors.
q	is	Total number of ICTs.
AV_q	is	Availability of q number of ICTs (As defined in 8c).
r	is	Total number of SVCs.
AV_r	is	Availability of r number of SVCs.

3. The weightage factor for each category of transmission elements shall be as under:

(a) For each circuit of AC line – For intra-State transmission lines -Surge Impedance Loading for Uncompensated line (SIL) multiplied by Circuit Km. For inter-State transmission lines - Surge Impedance Loading for Uncompensated line (SIL) multiplied by 50% of total line length in Circuit Km.
SIL rating for various voltage level and conductor configuration is given in **Appendix-A**. However, for the voltage levels and/or conductor configurations not listed in Appendix-A, appropriate SIL based on technical considerations may be used for availability calculation under intimation to long-term transmission customers.
(b) For switched Bus reactor – The rated MVAR capacity
(c) For each ICT bank – The rated MVA capacity.
(d) For SVC – The rated MVAR capacity (inductive & capacitive).

4. The availability for each category of transmission elements shall be calculated based on the weightage factor, total hours under consideration and non-available hours for each element of that category. The formulae for calculation of Availability of each category of the Transmission elements are as per **Appendix-B.**

5. The transmission elements under outage due to following reasons not attributable to the transmission licensee shall be deemed to be available:

   i) Shut down of transmission elements availed by other agency/agencies for maintenance or construction of their transmission system.
   ii) Manual tripping of line due to over voltage and manual tripping of switched bus reactor as per the directions of RLDC / SLDC.

6. Outage time of transmission elements for the following contingencies shall be excluded from the total time of the element under period of consideration.

   i) Outage of elements due to acts of God and force majeure events beyond the control of the transmission licensee.

   ii) Outage caused by grid incident/disturbance not attributable to the transmission licensee, e.g. faults in substation or bays owned by other agency causing outage of the transmission licensee's elements, tripping of lines, ICTs, etc. due to grid disturbance. However, if the element is not restored on receipt of direction from RLDC / SLDC while normalising the system following grid incident/disturbance within reasonable time, the element will be considered not available for whole period of outage and outage time shall be attributable to the transmission licensee

7. The System Availability shall be as given below:

Preliminary Stage – Level 1	95.0%
Transition Stage – Level 2	97.0%
Final Stage – Level 3	98.0%

8. The compliance shall be reported as per Annexure - 4:

(b) Feeder Availability:

The feeder availability gives the % of time during which the feeder remained available for transmission. Feeder Availability shall be calculated based on following formula:

$$AV_o(\text{Availability of } o \text{ no. of AC lines}) = \sum_{i=1}^{o} \frac{Wi(Ti - T_{NA}i)}{Ti} \Big/ \sum_{i=1}^{o} Wi$$

Where Wi = Weightage factor for i^{th} transmission line (As defined in clause 7.4(a)3(a))

Ti = The total hours of ith AC line block during the period under consideration (excluding time period for outages not attributable to transmission licensee for reasons given in Para 6 of the procedure)

$T_{NA}i$ = The non-availability hours (excluding the time period for outages not attributable to transmission licensee taken as deemed availability as per Para 5 of the procedure) for ith AC line

The Feeder Availability shall be as given below

Preliminary Stage – Level 1	95.0%
Transition Stage – Level 2	97.0%
Final Stage – Level 3	98.0%

The compliance shall be reported as Annexure - 5:

(c) Transformer Availability:

The transformer availability expressed in % is the measure of the extent of power transmission capacity remained available from a transformer. Transformer Availability shall be calculated based on following formula:

$$AV_q(\text{Availability of } q \text{ no. of ICTs}) = \sum_{K=1}^{q} \frac{Wk(Tk - T_{NA}k)}{Tk} \Big/ \sum_{k=1}^{q} Wk$$

Where Wk = Weightage factor for k^{th} ICT (As defined in clause 7.4(a)3(c))

Tk = The total hours of k^{th} ICT block during the period under consideration (excluding time period for outages not attributable to transmission licensee for reasons given in Para 6 of the procedure)

$T_{NA}k$ = The non-availability hours (excluding the time period for outages not attributable to transmission licensee taken as deemed availability as per Para 5 of the procedure) for k^{th} ICT

The Transformer Availability shall be as given below

Preliminary Stage – Level 1	95.0%
Transition Stage – Level 2	97.0%

Final Stage – Level 3	98.0%

The compliance shall be reported as Annexure – 6.

(d) Voltage Unbalance:

The phase voltages of a 3-phase supply should be of equal in magnitude and phase angle. The loads on each phase should be balanced. Deviations will result in decreased efficiency, negative torque, vibrations and overheating. Severe unbalance could lead to malfunctioning of some equipment. Some types of loads like X-ray machine, electric traction, induction & arc furnace may induce unbalance in the supply voltages.

$$\% \text{ Voltage Unbalance} = \frac{\text{Max Deviation from Mean of \{VRY, VYB, VBR\}} \times 100}{\text{Mean of \{VRY, VYB, VBR\}}}$$

Subject to Distribution Licensee observing the Grid Code Connection Conditions in this regard, the voltage unbalance shall not exceed the values given below:

Voltage Level	Limit of voltage unbalance	Implementation Stage
220kV and Above	2%	Preliminary Stage - Level 1
132kV	3%	Transition Stage - Level 2
33kV and 11kV buses in EHV Sub-station	3%	Transition Stage - Level 2

The above limit for Voltage unbalance at the interconnection point with Distribution System is subject to Distribution Licensee maintaining current unbalance between phases within limit of 3% applied for all feeders of one voltage class emanating from a sub-station including railway traction etc. measured at 3 sub-stations in a row.

The Voltage unbalance shall be measured at sub-stations provided with measuring instruments having accuracy class within 1% limit.

The compliance shall be reported as Annexure – 7.

(e) Neutral Voltage Displacement (NVD) (Level 1):

(i) Unbalance in loads on three phases cause shifting of neutral from earth potential. Neutral displacement is applicable for transformers with 'Star Point' solidly grounded. Under "solidly" grounded conditions, the potential of neutral should be equal to earth i.e. zero. But in actual conditions, the earthing of the star point is imperfect and so the star to ground offers small resistance. This results in flow of negative sequence currents (because $IR + IY + IB \neq 0$) through neutral to ground. The neutral therefore shifts from earth potential.

(ii) Unbalance voltages and displacement of neutral will result in decreased efficiency, negative torque, leakage currents, vibrations and overheating. Severe unbalance and neutral displacement could lead to malfunctioning of some equipment. Some types of loads like X-ray machines, electric traction, induction and arc furnace may induce

unbalance in the supply voltages and shift the voltage of neutral from earth potential.

(iii) The neutral voltage displacement is determined by measuring the current flowing through the neutral to earth. Therefore, the State Transmission Utility /Transmission Licensee shall ensure that the current through neutral will not be greater than 2% of the full load current of transformer at normal conditions. This performance standard shall be achieved for following category of transformers:

1- Star point of all EHT Transformers having 33kV on low voltage side
2- Star point of all EHT Transformers having 11kV on low voltage side

(iv) The compliance shall be reported as Annexure – 8.

(f) Voltage Variation Index (VVI):

(i) Voltage Variation Index representing the degree of voltage variation from nominal value (in %) over a specified period of time shall be computed separately by the State Transmission Utility /Transmission Licensee for higher than nominal system voltage and lower than nominal system voltage as per the following formula:

$$VVI = \frac{100}{Vs} \times \text{Square Root of } \frac{\sum_{i=1}^{N} (Vi - Vs)^2}{N}$$

Where,
Vi = RMS value of measured voltage (in kV) at ith hour in the period for which VVI is computed
Vs = RMS value of the nominal system voltage i.e. 400kV, 220kV and 132kV etc. as may be applicable at the interconnection point
N = Number of hourly measurements over the specified period of time
The data from defective metering or any abnormal data shall be discarded from calculations. The VVI shall be computed on monthly basis:

Preliminary Stage – Level 1	No mandatory requirement	
Transition Stage – Level 2	<=6%	To be achieved for more than 90% of buses
Final Stage – Level 3	<=4%	To be achieved for more than 90% of buses

The compliance shall be submitted as Annexure – 9.

(g) Frequency Variation Index (FVI):

A performance index representing the degree of frequency variation from nominal value of 50.00 Hz over a specified period of time:

$$\sum_{i=1}^{N} (fi - 50)^2$$

$$FVI = 10 \times \frac{\sum_{i=1}^{N} (f_i - 50)^2}{N}$$

Where,

fi = Actual frequency in Hz at ith time period

N = Number of measurements over the specified period of time

State Transmission Utility /Transmission Licensee shall observe the IEGC stipulations for Frequency Variation Index as and when implemented in the Western Region. Maintaining of FVI is a joint responsibility of all Constituents of Western Grid.

Preliminary Stage – Level 1	<= 2.0%
Transition Stage – Level 2	<= 2.0%
Final Stage – Level 3	<= 2.0%

The compliance shall be submitted as Annexure – 10.

(h) Harmonics in Supply Voltage (Level 3):

Many loads in power system produce current and voltages at frequencies in multiple of the fundamental frequency. These multiple frequency voltage and currents are called Harmonics and their ratio to the fundamental frequency is called harmonic order. Harmonics affect system operation and life of the equipments. Harmonics of odd order are more undesirable. Especially in Industrial sub-stations the effect of harmonics are more severe. Some types of loads like Induction & Arc Furnace, electromagnetic equipment such as X-ray machines etc. may produce harmonics in supply voltages. Distribution Licensees shall ensure that the loads connected at the interconnection points with State Transmission Utility /Transmission Licensee not induce any harmonic voltage and distort the supply waveform. Subject to Distribution Licensees observing the Grid Code Connection Conditions in this regard, State Transmission Utility /Transmission Licensee shall monitor the voltage harmonic levels at the supply points to the Users (Distribution Licensees, Generating companies and EHV consumer) and other strategic locations on the transmission system.

Harmonic contents of the supply voltage is indicated by the following indices:

$$VTHD = \sqrt{\sum_{i=1}^{40} \frac{Vi^2}{V_1^2}} x100\%$$

$$VIHD = \frac{Vi}{V_1} x100\%$$

Where,

Vi : ith harmonic of voltage

V1 : Fundamental frequency (50 Hz) voltage

VTHD : Voltage total harmonic distortion

VIHD : Voltage distortion of ith harmonic

Harmonic measurement shall confirm to IEC Std. 1000-4-7 or IEEE Std. 519. The Total Harmonic Distortion (THD) in voltage waveform determined in accordance with IEC Std. 1000-4-7 shall not exceed 1% at the interconnection point of EHV system. The measurement should be taken at 10 minutes interval and shall last for 1 week per site. State Transmission Utility /Transmission Licensee shall measure the THD at strategic such interconnection points which it consider prone to harmonic voltage generation at regular interval of 12 months.

State Transmission Utility /Transmission Licensee shall intimate the programme to Generating Companies or Licensee as the case may be at least seven (7) days in advance and their representative may be present during such measurements. State Transmission Utility /Transmission Licensee will compile a list of all metering points, which are prone to harmonic generation for taking remedial measures.

The compliance shall be reported as Annexure – 11.

(i) System Adequacy:

System adequacy is the ability of the electric system to receive the generated power or supply the aggregate electrical demand and energy requirements of their consumers at all times, taking into account scheduled and reasonably expected unscheduled outage of system elements.

Adequacy of the power system is usually measured in terms of Loss Of Load Probability (LOLP). LOLP is the probability of transmission system capacity not being able to meet system load. LOLP can also be expressed as Loss Of Load Expectation (LOLE) in hours per year. This measure does not consider the amount or duration of the capacity shortfall. State Transmission Utility /Transmission Licensee is expected to achieve LOLE hours in percentage as under:

Implementation Stage	**Nos. of hours in year when system demand can be fully met subject to generation availability (A)**	**Nos. of hours in year when system demand can not fully met even with generation availability (B = 8760 - A)**	**Loss Of Load Expectation (LOLE) in % of hours (C= B x 100/8760)**
Preliminary Stage	7008	1752	20.00%
Transition Stage	8000	696	8.68%
Final Stage	8664	96	1.00%

The compliance shall be reported as Annexure 12.

(j) System Security:

Security is the ability of the electric system to withstand sudden disturbance such as electric short circuits or unanticipated loss of system element. Refer Clause 6 of "Manual on Transmission Planning Criteria" by CEA for details on system security criteria.

The State Transmission System shall be designed for a security level of "n-1" i.e. to withstand a single contingency with little negative effect. This means the most severe fault or tripping of any generator or transformer or line should not result in instability of the system, overloading lines and/or transformers for more than 15 minutes, voltage drop of more than 10% when the system import is increased by 20%. State Transmission Utility /Transmission Licensee shall maintain the system security level of "n-1" (single contingency) plus spinning reserve margin for Steady State Operation.

Implementation Stage	**System Security Level of "n-1" (Single Contingency) plus spinning reserve margin of:**
Preliminary Stage – Level 1	No mandatory requirement
Transition Stage – Level 2	0.5% of system peak load
Final Stage – Level 3	1% of system peak load

The compliance shall be reported as Annexure - 13:

8: REPORTING REQUIREMENT AND COMPLIANCE

8.1 Quarterly Report

State Transmission Utility /Transmission Licensee shall furnish to the Commission a quarterly report in formats prescribed for each performance parameter (Annexure – 1 to Annexure -13) and the summary in the format prescribed at Annexure 14, within 45 days of end of the quarter on actual performance vis-à-vis the performance standards laid down in these standards. The quarterly report shall contain all parameters irrespective whether such parameters are applicable during current quarter or not. The State Transmission Utility /Transmission Licensee shall maintain the base data like Log Sheet, Complaint Registers and Interruption Register etc. at sub-station level for compilation of quarterly reports. The base data at sub-station level may be subject to Commission's scrutiny as may be necessary.

8.2 For the purpose of this Regulation, a quarter would mean as follows:

(a) Quarter 1: April to June
(b) Quarter 2: July to September
(c) Quarter 3: October to December
(d) Quarter 4: January to March

8.3 The Commission may, from time to time, modify the contents of the regulation/formats or add new regulation/formats for additional information.

8.4 In addition to the hard copies the information shall necessarily be submitted in such electronic form through compact disks, floppy discs or e-mail etc.

8.5 Compliance

(a) Consequent to failure of State Transmission Utility /Transmission Licensee to meet overall performance standards, the affected Utility/Consumers shall be entitled to seek relief/compensation for any loss/damage suffered by them from State Transmission Utility /Transmission Licensee, as may be determined by the Commission.

(b) Further the State Transmission Utility /Transmission Licensee are subject to such fines/penalty and charges, which the Commission may impose as provided in the Act and regulations made there under.

(c) Commission at its own discretion may require the State Transmission Utility /Transmission Licensee to furnish a report on actual performance levels maintained against the standards specified by the Commission with its Petitions for Annual Revenue Requirement (ARR) and Tariff Determination and which shall be subject to public hearing for tariff setting by the Commission.

9: MISCELLANEOUS

Annual Review of Performance Standard

9.1 The Commission in consultation with State Transmission Utility /Transmission **LICENSEE SHALL REVIEW THE PERFORMANCE STANDARDS FOR TRANSMISSION SYSTEM AS SPECIFIED ABOVE ANNUALLY IN THE MONTH OF MAY EVERY YEAR.**

Use of the Information

9.2 The Commission shall have the right to use the information submitted by State Transmission Utility /Transmission Licensee as it deems fit including publishing it or placing it on the Commission's website and/ or directing the State Transmission Utility /Transmission Licensee to display the information in the licensee's website.

Power to Amend

9.3 The Commission may, at any time add, vary, alter, modify or amend any provisions of these regulations.

Repeal and Savings

9.4 The Regulation namely "MPERC (Transmission Performance Standards) Regulations, 2004" published vide Notification No. 1932/MPERC/2004 in the Gazette dated 23/07/2004 and read with all amendments thereto, as applicable to the subject matter of this regulation is hereby superceded.

9.5 Nothing in these Regulations shall be deemed to limit or otherwise affect the inherent power of the Commission to make such orders as may be necessary to meet the ends of justice or to prevent abuses of the process of the Commission.

9.6 Nothing in these Regulations shall bar the Commission from adopting in conformity with the provisions of the Act a procedure, which is at variance with any of the provisions of these Regulations, if the Commission, in view of the special circumstances of a matter or class of matters and for reasons to be recorded in writing, deems it necessary or expedient for dealing with such a matter or class of matters.

9.7 Nothing in these Regulations shall, expressly or impliedly, bar the Commission dealing with any matter or exercising any power under the Act for which no Regulations have been framed, and the Commission may deal with such matters, powers and functions in a manner it thinks fit.

Exemption

9.8 The Commission may relax adherence to specific performance standard during Force Majeure conditions such as war, mutiny, civil commotion, riot, flood, cyclone, storm, lightening, earthquake, grid failure, and strike/curfew, lockout, fire affecting the State Transmission Utility's/ Transmission Licensee's installations and operation activities.

9.9 Commission under specific circumstances may also relax provisions of regulations in general or in specific cases for the period specified in its order.

By Order of the Commission

ASHOK SHARMA, Dy. Secy.

Appendix - A

SURGE IMPEDANCE LOADING (SIL) OF AC LINES

S.No.	Line voltage (kv)	Conductor Configuration	SIL (MW)
1	765	Quad Bersimis	2250
2	400	Quad Bersimis	691
3	400	Twin Moose	515
4	400	Twin AAAC	425
5	400	Quad Zebra	647
6	400	Quad AAAC	646
7	400	Tripple Snowbird	605
8	400	ACKC(500/26)	556
9	400	Twin ACAR	557
10	220	Twin Zebra	175
11	220	Single Zebra	132
12	132	Single Panther	50
13	66	Single Dog	10

Appendix - B

Formulae for calculation of Availability of each category of transmission elements

$$AV_o\text{(Availability of } o \text{ no. of AC lines)} = \sum_{i=1}^{o} \frac{Wi(Ti - T_{NA}i)}{Ti} \Big/ \sum_{i=1}^{o} Wi$$

$$\Big/ \sum_{i=1}^{q} q$$

AV_q(Availability of q no. of ICTs) $= \sum_{K=1} \frac{Wk(Tk - T_{NA}k)}{Tk} \Big/ \sum_{k=1} Wk$

AV_r(Availability of r no. of SVCs) $= \left[\sum_{l=1} 0.5\frac{W_l l\,(T_l l - T_{NA} l)}{T_l l} + \sum_{l=1} 0.5\, W_C l\,\frac{(T_C l - {}_{AC} l)}{T_C l} \right] \Big/ \left[\sum_{l=1} 0.5 W_l l + \sum_{l=1} 0.5\, W_C l \right]$

AV_p(Availability of p no. of Switched Bus reactors) $= \sum_{m=1} \frac{Wm(Tm - T_{NA}m)}{Tm} \Big/ \sum_{m=1} Wm$

Where Wi = Weightage factor for i^{th} transmission line = Surge Impedance Loading for Uncompensated line (SIL) multiplied by Circuit KMs

Wk = Weightage factor for k^{th} ICT = The rate MVA Capacity

$W_l l$ & $W_C l$ = Weightage factors for inductive & capacitive operation of l^{th} SVC = The rated MVAR Capacity (inductive & capactive)

Wm = Weightage factor for m^{th} bus reactor = The rated MVAR capacity.

Ti, Tk, $T_l l$, $T_C l$, -&Tm Total hours of i^{th} AC line, k^{th} ICT, l^{th} SVC (Inductive Operation), l^{th} SVC (Capacitive Operation) & m^{th} Switched Bus Reactor block during the period under consideration (excluding time period for outages not attributable to transmission licensee for reasons given in Para 6 in clause 7.4(a))

$T_{NA}i$, $T_{NA}k$ - $T_{NA}l$, & $T_{NAC}l$, The non-availability hours (excluding the time period for outages not attributable to transmission licensee taken as deemed availability as per Para 5 in clause 7.4(a)) for i^{th} AC line, k^{th} ICT , l^{th} SVC (Inductive Operation), l^{th} SVC (Capacitive Operation) & m^{th} Switched Bus Reactor block .

****

Annexure – 1A

Voltage Variation Performance Achieved During the Quarter Ending _____

Voltage – 400KV Bus at EHV Substations

Standard Limits - Maximum +5% or 420KV & Minimum -10% or 360KV

Sl. No.	Name Of Substation	Max. Voltage Actually Achieved		Min. Voltage Actually Achieved	
		%	KV	%	KV
1.					

2.					
|					
|					
N					

Annexure – 1B

Voltage Variation Performance Achieved During the Quarter Ending _____

Voltage – 220KV Bus at EHV Substations

Standard Limits - Maximum +10% or 245KV & Minimum -10% or 198KV

Sl. No.	Name Of Substation	Max. Voltage Actually Achieved		Min. Voltage Actually Achieved	
		%	KV	%	KV
1.					
2.					
|					
|					
N					

Annexure – 1C

Voltage Variation Performance Achieved During the Quarter Ending _____

Voltage – 132KV Bus At EHV Substations

Standard Limits - Maximum +10% or 145.20KV & Minimum -10% or 118.80KV

Sl. No.	Name Of Substation	Max. Voltage Actually Achieved		Min. Voltage Actually Achieved	
		%	KV	%	KV

1.					
2.					
|					
|					
N					

Annexure – 1D

Voltage Variation Performance Achieved During the Quarter Ending _____

Voltage – 66 KV Bus at EHV Substations

Standard Limits - Maximum +10% or 72.60KV & Minimum -10% or 59.40KV

Sl. No.	Name Of Substation	Max. Voltage Actually Achieved		Min. Voltage Actually Achieved	
		%	KV	%	KV
1.					
2.					
|					
|					
N					

Annexure – 1E

Voltage Variation Performance Achieved During the Quarter Ending _____

Voltage –33 KV Bus At EHV Substation

Standard Limits - Maximum +6% or 34.98 KV & Minimum -9% or 30.3KV

Sl. No.	Name Of Substation	Max. Voltage Actually Achieved		Min. Voltage Actually Achieved	
		%	KV	%	KV

1.					
2.					
|					
|					
N					

Annexure – 1F

Voltage Variation Performance Achieved During the Quarter Ending _____

Voltage –11 KV Bus At EHV Substation

Standard Limits - Maximum +6% or 11.66 KV & Minimum -9% or 10.01KV

Sl. No.	**Name Of Substation**	**Max. Voltage Actually Achieved**		**Min. Voltage Actually Achieved**	
		%	**KV**	**%**	**KV**
1.					
2.					
|					
|					
N					

Annexure - 2

Frequency Variation Performance Achieved During the Quarter Ending _____

Standard Frequency – 50 Htz

Standard Limits:

Target Range : Maximum +1% or 50.5 Htz and Minimum -2% 49.0 Htz

Statutory Acceptable Range : Maximum +3% or 51.5 Htz and Minimum -3% 48.5 Htz

Sl. No.	**Frequency Range**	**Duration in %age of Time**
1	**Above 50.5 Htz**	

2	From 50.2 to 50.5 Htz	
3	From 49.8 to 50.2 Htz	
4	From 49.5 to 49.8 Htz	
5	From 49.0 to 49.5 Htz	
6	From 48.5 to 49.0 Htz	
7	Below 48.5 Htz	

Annexure – 3

Confirmation Report On Security Standards For the Quarter Ending _____

Sl. No.	Section of IE Rule 1956	With Regard to	Whether Complied	Reason for Deviation, if any
1	Section 29 to 46	General Safety Requirements		
2	Section 74 to 81	Supports Standards and Safety Clearances		
3	Section 87 to 88	Line Crossing and Guarding		
4	Section 90	Earthing		
5	Section 91	Safety and Protective Devices		
6	Section 92	Protection Against Lightening		
7	Section 93	Unused Overhead Lines		

Annexure – 4

System Availability Achieved During the Quarter Ending _____

Standard Limits:

Preliminary Stage – 95.0%

Transition Stage - 97.0%

Final Stage - 98.0%

Present Stage	System Voltage	Actual Achieved
Preliminary Stage	400 KV	
	220 KV	
	132 KV	
	Over All	

Note: Detailed Calculation shall also be provided

Annexure – 5

Feeder Availability Achieved During the Quarter Ending _____

(Only For the Transmission Lines Falling Below the Standard Limits)

Standard Limits:

Preliminary Stage – 95.0%

Transition Stage - 97.0%

Final Stage - 98.0%

Present Stage	Voltage	Name Of Transmission Line	Actual Achieved
Preliminary Stage	**400 KV**	1	
		2	
		|	
		N	
	220 KV	1	
		2	
		|	
		N	
	132 KV	1	
		2	
		|	
		N	

Annexure – 6

Transformer Availability Achieved During the Quarter Ending _____

(Only For the Transformer Falling Below the Standard Limits)

Standard Limits:

Preliminary Stage – 95.0%

Transition Stage - 97.0%

Final Stage - 98.0%

Present Stage	Voltage	Name Of Substation	Actual Achieved
Preliminary Stage	**400 KV**	1	
		2	
		|	
		N	
	220 KV	1	
		2	
		|	
		N	
	132 KV	1	

		2	
		|	
		N	

Annexure – 7

Voltage Unbalance recorded During the Quarter Ending _____

(Only For the Transformer Falling Below the Standard Limits)

Standard Limits:

Preliminary Stage – For 200KV and Above - 2%

Transition Stage - For 132 KV - 3%

Transition Stage - For 33 KV & 11KV Buses in EHV Substations - 3%

Present Stage	Voltage	Name of Substation	Actual Achieved
Preliminary	220kV and Above	1.	
		2.	
		|	
		|	
		N	

Annexure – 8

Neutral Voltage Displacement recorded During the Quarter Ending _____

(Only For the Substations Falling Below the Standard Limits)

Standard Limits:

Preliminary Stage – 2% of Full Load Current of Transformer in Normal Conditions

Transition Stage - 2% of Full Load Current of Transformer in Normal Conditions

Final Stage - 2% of Full Load Current of Transformer in Normal Conditions

Present Stage	Name of Substation	Actual Achieved
Preliminary	1.	
	2.	
	|	
	|	
	N	

Annexure - 9

Voltage Variation Index achieved during the quarter ending _____

Standard Limits:

Preliminary Stage – Standard VVI No mandatory requirement.

Transition Stage - Standard VVI <= 6

Final Stage - Standard VVI <= 4

Present Stage	Voltage Level	Actual Achieved For 90% buses
Preliminary Stage	400KV	
	220KV	
	132KV	

Annexure – 10

Frequency Variation Index achieved during the quarter ending _____

Standard Limits:

Preliminary Stage – Standard FVI <= 2.0

Transition Stage - Standard FVI <= 1.0

Final Stage - Standard FVI <= 0.5

Present Stage	Actual Achieved
Preliminary Stage	

Annexure – 11

Harmonics in Supply Voltage recorded during the quarter ending _____
(Only for those substations where Harmonics in supply voltage are recorded)

Standard Limits:

Preliminary Stage – No mandatory requirement

Transition Stage - No mandatory requirement

Final Stage - 1%

Present Stage	Name of Substation	Actual Percentage obtained
Preliminary Stage	1	
	2	
	3	
	|	
	|	
	N	

Annexure - 12

System Adequacy achieved during the quarter ending _____

Standard Limits:

Preliminary Stage – 20%

Transition Stage - 8.68%

Final Stage - 1%

Present Stage	Actual Achieved	
	Nos. of hours in year when system demand can be fully met subject to generation availability	Loss Of Load Expectation (LOLE) in % of hours
Preliminary		

Annexure - 13

System Security Level achieved during the quarter ending _____

Standard Limits:

Preliminary Stage – No Mandatory Requirement
Transition Stage - 0.5 % of System Peak Load
Final Stage - 1.0 % of System Peak Load

Present Stage	**Actual System Security Level Achieved**
Preliminary	

Annexure -14

CHECK LIST ON TRANSMISSION PERFORMANCE STANDARDS

Report for quarter ending:……Date of submission:……

Clause Reference	Name of Parameter	Whether Report Submitted	Reason for Non submission
7.2(a)	Voltage Variation		
7.2(b)	Frequency Variation		
7.2(c)	Safety Standards		
7.4(a)	System Availability		
7.4(b)	Feeder Availability		
7.4(c)	Transformer Availability		
7.4(d)	Voltage Unbalance		
7.4(e)	Neutral Voltage Displacement		
7.4(f)	Voltage Variation Index		
7.4(g)	Frequency Variation Index		
7.4(h)	Harmonics in Supply Voltage		
7.4(i)	System Adequacy		
7.4(j)	System Security		

Note:

1. The State Transmission Utility shall maintain the base data like Log Sheet, Complaint Registers and Interruption Register etc. at sub-station level.
2. For compilation of quarterly report at circle level base data of sub-stations shall be used.
3. The consolidated report for whole State Transmission Utility /Transmission Licensee shall be based on circle-wise compilation.
4. The circle-wise compilation and base data at sub-station level may be subject to Commission scrutiny as may be necessary.

Name of Reporting Officer:

Designation: