**CENTRAL ELECTRICITY REGULATORY COMMISSION**
**NEW DELHI**

**Coram:**
**Dr. Pramod Deo, Chairperson**
**Shri S.Jayaraman, Member**
**Shri V.S.Verma, Member**
**Shri M.Deena Dayalan, Member**

**No.L-7/139(159)/2008** **Date of order: 22.4.2013**

**In the matter of**

Approval of amendments to the Detailed Procedure for relieving congestion in real time operation under Regulation 4 (2) of the Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009.

**ORDER**

The Commission notified the Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009 (hereinafter referred to as "Congestion Charge Regulations") which came into effect from 24.12.2009. The Commission vide its order dated 11.6.2010 approved the Detailed Procedure for relieving congestion in real time operation under regulation 4 (2) of the Congestion Charge Regulations.

2.. Power System Operation Corporation Limited (POSOCO)/National Load Despatch Centre (NLDC) in Petition No. 190/MP/2012 filed on 30.8.2012 submitted that in the wake of the grid disturbance on 30.7.2012 and 31.7.2012, an Enquiry Committee under Chairmanship of Chairman, CEA was appointed by the Government of India to inquire into the causes of grid disturbance and recommend remedial measures for future guidance. The Enquiry Committee has identified overdrawal as one of the causes of grid disturbance and has *inter-alia* made the following observations with regard to the Congestions Charges Regulations and the Detailed Procedure issued thereunder in the context of overdrawal:

> "5.2.3.2 ..The Committee has gone through relevant regulations of Central Commission. However, there is no provision which restrains NLDC from applying congestion charges. Further, para 5.4 of the 'Detailed procedure for relieving congestion in real time operation' prepared by NLDC and approved by Central Commission does not restrain NLDC from applying congestion charges in such situation but requires curtailment of transactions followed by revision of TTC. Thus, the procedure prepared under the provisions of a Regulation is not consistent with the Regulation. This aspect needs to be reviewed."

The Committee has made the following recommendations:

> "9.5.1 POSOCO should take up with Central Commission the issue of inconsistency between congestion regulation and the detailed procedure framed there under so that congestion due to forced outages and Unscheduled Interchange (UI) can be handled effectively."

3. POSOCO/NLDC has submitted that apart from above, a few other procedural issues have been observed as a result of which system operator is feeling constrained in applying of these regulations. POSOCO has proposed following changes in the 'Detailed Procedure ':

(a) In Clause 6.2 of the Detailed Procedure, congestion charge be applied on entities both upstream as well as downstream of congested corridor irrespective of frequency;

(b) Provision on non-imposition of congestion charge in case of forced outage vide clauses 5.4 and 5.5 of the Detailed Procedure be withdrawn; and

(c) Clauses 5.2.2 and 5.6 of the approved Detailed Procedure may be modified to remove ambiguity and Clause 5.3 of the Detailed Procedure may be modified to avoid delay in imposition of congestion charge.

4. The Commission disposed of the said petition with the following observations:

> *"We direct that the present petition be treated as a proposal of POSOCO for amendment of the Detailed Procedure and further direct the staff to examine the proposal and submit to the Commission for consideration in a time-bound manner POSOCO is permitted to submit further information as may be considered necessary in furtherance of the proposal."*

5. The changes suggested by POSOCO to the Detailed Procedure have been examined by the staff of the Commission in compliance with our directions as quoted above. Meanwhile, Central Electricity Authority brought out revised "Manual on Transmission Planning Criteria" in January, 2013 (hereinafter CEA Planning Criteria"). Subsequent thereto, POSOCO vide its letter dated 21.3.2013 has submitted the modified procedure incorporating more changes to align it with CEA planning criteria.

6. Certain changes in the formats of report have been also incorporated in the procedure on the basis of feedback received from the stakeholders during the intervening period.

7. After examination of the changes suggested by POSOCO in the light of the CEA Planning Criteria, we are of the view that calculation of the Total Transfer Capability in line with CEA Planning Criteria will be more objective and result in optimum utilization of the transfer capacity of the inter-State transmission lines. Accordingly, we approve the Revision 1 of the Detailed Procedures in exercise of our power under regulation 4(2) of the congestion charge regulations. The Detailed Procedure is enclosed as **Annexure** to this order.

8. We direct POSOCO to give wide publicity to the procedure for information of and compliance by all concerned and to explain the same to all the stakeholders in the next Operating Coordinating Committee of Regional Power Committees.

9. We also direct the POSOCO to operationalise the Detailed Procedure with immediate effect.

| sd/- | sd/- | sd/- | sd/- |
|---|---|---|---|
| **(M. Deena Dayalan)**<br>**Member** | **(V. S. Verma)**<br>**Member** | **(S. Jayaraman)**<br>**Member** | **(Dr. Pramod Deo)**<br>**Chairperson** |

**Annexure-I**

# Detailed Procedure for Relieving Congestion in Real Time Operation

**Prepared in compliance to Section 4(2) of The Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009**

**(Revision: 1 Dated: 25.4.2013)**

**National Load Despatch Centre**

**Real Time Congestion Management**
**Procedure**

## 1. Background

1.1. This Procedure is issued in compliance to Regulation 4(2) of the "Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009. All regional entities shall abide by this procedure.

1.2. This procedure will be implemented with effect from the date of approval by the Commission.

## 2. Transfer Capability

2.1. "Total Transfer Capability (TTC)" means the amount of electric power that can be transferred reliably over the inter-control area transmission system under a given set of operating conditions considering the effect of occurrence of the worst credible contingency.

2.2. "Transmission Reliability Margin (TRM)" means the amount of margin kept in the total transfer capability necessary to ensure that the interconnected transmission network is secure under a reasonable range of uncertainties in system conditions.

2.3. "Available Transfer Capability (ATC)" means the transfer capability of the inter-control area transmission system available for scheduling commercial transactions (through long term access, medium term open access and short term open access) in a specific direction, taking into account the network security. Mathematically ATC is the Total Transfer Capability less Transmission Reliability Margin.

2.4. TTC is dependent upon the network topology, point and quantum of injection/ drawal and power flows in other paths of the interconnected network as well as prevailing voltage profile in the network during the assessment period.

2.5. TTC is directional in nature and the transfer capability for import of power in a region or control area from another region or control area may be different from the transfer capability for export of power from that region or control area to the other region or control area.

2.6. Total Transfer Capability is time variant and there could be different figures for different time of the day/ month/ season/ year.

2.7. Transfer Capability shall be mentioned in MW.

## 3. Methodology for assessment of TTC, TRM and ATC

3.1. The methodology shall be in harmony with the detailed procedure of the Central Transmission Utility (CTU) prepared under the Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-State Transmission and related matters) Regulations, 2009 so as not to have different methodology for determination of TTC, TRM and ATC by the CTU in respect of long-term access and medium-term open access and NLDC/ RLDCs in respect of short-term open access.

3.2. TTC assessment is required for reliable system operation and to facilitate non discriminatory open access in transmission as per CERC regulations on Open Access and Power Markets.

3.3. TTC and TRM shall be assessed with the help of simulation studies carried out for a representative scenario to arrive at an initial or base case. Simulation studies may require setting up of a power system model and obtaining a power flow solution. The construction of an accurate base case power system model is a key step in the execution of a meaningful study.

3.4. **Power System model to be considered for simulation studies**

3.4.1. EHV transmission network shall be normally modeled down to 220 kV level with exceptions for generating units connected at 132 kV and for North Eastern Region, it shall be modeled down to 132 kV.

3.4.2. Normally all generating units greater than 50 MW and connected at 132 kV and above shall be modeled. Smaller generating units (particularly hydro units) may be lumped for study purposes.

3.4.3. Load shall be generally lumped at 220 kV or 132 kV, as the case may be Actual system data wherever available shall be used for power system modeling. In cases where data is not available, standard data as given in the CEA Manual on Transmission Planning Criteria shall be considered.

3.4.4. The requirements at clauses 3.3.1 to 3.3.3 are for use of data for RLDCs and NLDC. The SLDCs may consider lower voltage level and smaller units, if required.

3.5. Separate base cases calculating the export and import capability corresponding to both peak and off- peak load and generation with the likely scenario during the time frame for which transfer capability is to be assessed shall be used in the Simulation Studies for calculation of TTC and TRM of the required transmission corridors.

3.6. **Input Data for Base Case Preparation**

3.6.1. **Network Topology**: This shall be as per network data obtained from CTU and STUs. New transmission elements shall be considered only after the date of commissioning of that asset and duly considering their reliability during initial period.

3.6.2. **Unit Availability**: This shall be as per the maintenance schedule finalized by RPC. The new generating units expected to be available during the assessment period shall be considered only after commissioning of the new units and duly considering their reliability during initial period.

3.6.3. **Coal Fired Thermal Despatch**: This shall be as per the anticipated ex-bus generation of the thermal generating units arrived after deducting a normative auxiliary consumption as per the norms specified by Central Commission**.** and provisioning for partial outage based on experience of system operator from the installed capacity

3.6.4. **Gas/ Nuclear Despatch**: This shall be as per past trend of Plant Load Factor available with Central Electricity Authority (CEA) or as per past trend available at SLDCs/ RLDCs.

3.6.5. **Hydro Despatch**: This shall be as per the past trend available at RLDCs/ SLDCs. The day corresponding to the median value of daily consumption of the same month last year would be chosen. The current inflow pattern shall also be considered.

3.6.6. **Reactive power capability of generating units**: As per the generator capability curve or based on the assumption recommended in CEA's Manual on Transmission Planning Criteria.

3.6.7. **Nodal MW demand** : As per the anticipated load provided by SLDCs or Load Generation Balance Report (LGBR) prepared by CEA or past trend available at RLDCs/ NLDC.

3.6.8. **Nodal MVAR demand**: As per the anticipated power factor provided by SLDCs. In the absence of data from SLDCs, the load power factor at 220kV or 132 kV voltage levels shall be taken as 0.85 lag during peak load condition and 0.9 lag during light load condition except areas feeding predominantly agricultural loads where power factor can be taken as 0.75 and 0.85 for peak load and light load conditions as given in the CEA's Manual on Transmission Planning Criteria. This would be verified, post facto, with actual data, and if different, would be made more accurate for the future.

3.6.9. Permissible Normal and emergency limits for transmission elements shall be as defined in the (CEA Manual on Transmission Planning Criteria).

3.7. In case data from any of the sources mentioned above is unavailable or in case of additional data requirement, reasonable assumptions shall be made.

3.8. Total Transfer Capability between two areas would be assessed by increasing the load in the importing area and increasing the generation in the exporting area or vice versa till the constraints are hit for a credible contingency. The following credible contingencies shall be considered:

3.8.1. Outage of single transmission element (N-1) in the transmission corridor or connected system whose TTC is being determined as defined in IEGC

3.8.2. Outage of a largest unit in the importing control area Station.

3.9. During assessment of Total Transfer Capability it shall be ensured that the conditions specified in CEA Manual on Transmission Planning Criteria are met after credible n-1 and n-1-1 contingencies.

3.10. Assement of the Total Transfer Capability shall be in line with CEA's Manual on Transmission Planning Criteria (Relevant paragraphs 5 to 8.1 given as **Appendix-I**). Sailent points to be considered while assessing TTC shall be:

3.10.1. Violation of grid voltage operating range or

3.10.2. Violation of transmission element loading limit in n-1 contingency case or

3.10.3. Violation of emergency limit in the n-1 contingency case or

3.10.4 Stability under n-1-1 contingency of a temporary single phase to ground fault on a 765 kV line close to the bus or a permanent single phase to ground fault on a 400 kV line close to the bus

3.10.5 Angular difference of 30 degrees between adjacent buses under n-1 contingency.

3.11. Transmission Reliability Margin (TRM) shall be kept in the total transfer capability to ensure that the interconnected transmission network is secure under a reasonable range of uncertainties in system conditions. Computation of TRM for a region or control area or group of control areas would be based on the consideration of the following:

3.11.1. Two percent (2%) of the total anticipated peak demand met in MW of the control area/group of control area/region (to account for forecasting uncertainties)

3.11.2. Size of largest generating unit in the control area/ group of control area/ region

## 4. Procedure for declaration of TTC, TRM, ATC and anticipated Constraints

4.1. State Load Despatch Centre (SLDC) shall assess the Total Transfer Capability (TTC), Transmission Reliability Margin (TRM) and Available Transfer Capability (ATC) on its inter-State transmission corridor considering the meshed intra State corridors for exchange (import/ export) of power with inter-State Transmission System (ISTS). These figures along with the data considered for assessment of TTC would be forwarded to the respective RLDC for assessment of TTC at the regional level. The details of anticipated transmission constraints in the intra State system shall also be indicated separately.

4.2. Regional Load Despatch Centres shall assess TTC, TRM and ATC for the inter regional corridors at respective ends, intra regional corridors (group of control areas) and for individual control areas within the region (if required) for a period of three months in advance. During assessment of TTC, the RLDCs would duly consider the input provided by the SLDCs. The TTC, TRM and ATC figures for the inter-regional corridors, intra regional corridors (group of control areas) and for individual control areas within the region (if required) along with all the input data considered shall be forwarded to NLDC. The details of anticipated transmission constraints in the intra regional system shall also be indicated separately.

4.3. National Load Despatch Centre (NLDC) shall assess the TTC, TRM and ATC) of inter and intra-regional links/ Corridors respectively for three months in advance for each month up to the fourth month based on :

4.3.1. The inputs received from RLDCs

4.3.2. TTC/ TRM/ ATC notified/ considered by CTU for medium-term open access.

Sample format for declaration of TTC/TRM/ATC is enclosed as **Format-I**.

4.4. NLDC shall inform the TTC/ TRM/ ATC figures along with constraints observed in inter-regional/ intra-regional corridors to the RLDCs. These shall be put on the website of RLDCs as well as NLDC.

4.5. NLDC may revise the TTC, TRM and ATC due to change in system conditions (including commissioning of new transmission lines/ generation), vis-à-vis earlier anticipated system conditions which includes change in network topology or change in anticipated active or reactive generation or load, at any of the nodes in the study. Revisions may be done by NLDC based on its own observations or based on inputs received from SLDCs/ RLDCs. Revised TTC, TRM and, ATC shall be published on website of NLDC and RLDCs along with reasons thereof.

4.6 SLDCs / RLDCs / and NLDC shall designate Main and Alternate officers as “Reliability co-coordinator(s.).

## 5. Declaration of congestion in real-time

5.1. SLDCs/ RLDCs/ NLDC shall have a display available in their web-sites showing TTC, TRM, ATC declared in advance. Real time power flow in the corridor for which TTC has been declared shall be displayed alongside for comparison. The voltage of the important nodes in the grid downstream/ upstream of the corridor shall also be displayed. The format of the display is enclosed as **Format II**.

5.2. A corridor shall be considered congested under the following circumstances:

5.2.1. Grid voltage in the important nodes downstream/ upstream of the corridor is beyond the operating range specified in the IEGC and/or

5.2.2. The real time power flow along a corridor is such that n-1 criteria may not be satisfied.

5.2.3. One or more transmission lines in the corridor are loaded beyond the normal limit specified in CEA Manual on Transmission Planning Criteria.

5.3. Whenever actual flow on inter/ intra regional link/ corridor exceeds ATC and security criteria as mentioned in clause 5.2 above are violated RLDC, NLDC may issue a warning notice. In case SLDC observes congestion within the intra State grid it shall inform the respective RLDC which in turn shall inform the NLDC. The notice for congestion shall be communicated to all the Regional entities telephonically or through fax/ voice message/ e-mail and through postings on website and making the same available on the common screen at NLDC/ RLDCs/ SLDCs. The format of the notice is enclosed as Format III.

5.4 If the power flow on the corridor is as per the schedule, but the congestion has been caused by forced outages of a transmission line in the corridor, which occurs after the drawal schedule has been fixed, then open access transactions shall be curtailed in the priority given in the Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-State Transmission and related matters) Regulations, 2009 followed by revision of TTC, TRM and ATC.

5.5 If the power flow on the corridor is as per the schedule and the corridor is congested due to either of the circumstances mentioned in clauses 5.2.1 and 5.2.3 of this procedure then TTC, TRM and ATC shall be revised accordingly.

5.6 If violation of TTC limits persists for 2 time-blocks not counting the time-block in which warning notice was issued by RLDC and no affirmative action is taken by the defaulting agency, NLDC/ RLDC(s) shall issue a notice for application of congestion charge. This notice shall be communicated to all the concerned Regional entities telephonically or through fax message and through postings on website and the same shall also be made available at the common screen at NLDC/ RLDCs/ SLDCs. The format is enclosed as Format IV.

## 6. Applicability of Congestion Charge

6.1. Congestion Charge shall be applicable to Regional entities as per the CERC (Measures to relieve congestion in real time operation) Regulations and orders on rate of congestion charge as applicable from time to time.

6.2. Congestion charge would be levied for

a) over drawal or under-injection in the importing control area and

b) under drawal or over-injection in the exporting control area.

6.3. Congestion charges may also become applicable for an intra-regional corridor of one region, if the congestion is attributable to other regional entities of other region.

6.4. Congestion charge shall be applicable only after two time blocks from the time of issuing the notice, not counting the time block in which notice is issued.

6.5. Congestion charge shall be withdrawn after the power flow on the affected transmission link/ corridor has come down to the ATC and remains at this level for one time block. NLDC/ RLDC shall communicate to all concerned Regional entities telephonically or through fax message/ e-mail and through postings on website and making available the same on the common screen available at NLDC/ RLDCs/ SLDCs for lifting of congestion charge. The format of the notice is enclosed as **Format-V**.

## 7. Rate of Congestion Charge

7.1 The rate of congestion charge shall be as specified by the Commission from time to time, through an order.

## 8. Congestion Charge Accounting and Settlement

8.1. At the end of the operating day, NLDC/ RLDC shall indicate the times when notice for application of congestion charge was given along with the reasons of congestion. The format is enclosed as **Format-VI**. This format shall be available on the NLDC/ RLDCs websites.

8.2. Computation of congestion charge is a post facto event and shall be dictated by over –drawl/under-injection/under-drawl/over-injection in importing/exporting area.

8.3. ‘Congestion Charge account shall be settled on a weekly basis. This bank account shall be maintained and operated by RLDC in the same manner as the account for UI charges. The bank account details for congestion charge payment shall be intimated separately.

8.4. The statement of receipt and disbursal of congestion charge shall be issued by the Regional Power Committee Secretariat on weekly basis along with statement for Unscheduled Interchange charge.

8.5. The constituents required to pay congestion charge, shall pay the charges to the Congestion charge account within 10 days of issue of account and no cross adjustment with any other account would be allowed. Delay beyond 12 days after the issue of account for the short payment would attract a simple interest of 0.04% per day

8.6. RLDC shall release the amount to the Regional entities who have to receive congestion charge within three(3) working days after the receipt of the congestion charges.

8.7. The Commission will separately notify the procedure regarding the maintenance and operation of the funds accumulated out of the congestion charge.

8.8. RLDC shall submit a statement to the Commission on monthly basis, furnishing details of undisbursed amount.

8.9. The procedure shall be reviewed as and when required and shall be submitted to the Commission for approval.

## 9. Removal of Difficulties

9.1 In case of any difficulty in implementation of this procedure, this procedure shall be reviewed or revised by NLDC with the approval from the Commission.

**Format-I**
**(pdf format)**
**( csv format)**

**National /________Regional Load Despatch Centre**

**TOTAL TRANSFER CAPABILITY FOR** mmmm, yyyy

Issue Date: Issue Time: Revision No.

| Corridor/ Control Area | Date | Time Period | Total Transfer Capability (TTC) (MW) | Reliability Margin (RM) (MW) | Available Transfer Capability (ATC) (MW) | LTOA/ MTOA (MW) | Available Margin for STOA (MW) | Changes in TTC w.r.t. Last Revision | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

**Assumptions:**

**A. Load (MW)**

| Region / Entity Name | Peak Load | Off Peak Load |
|---|---|---|
| | | |
| | | |
| **Total** | | |

**B. Generation(MW)**

| | Thermal | | Hydro | |
|---|---|---|---|---|
| | Peak | Off Peak | Peak | Off Peak |
| ISGS | | | | |
| State | | | | |

**C. Major Transmission Line Outages**

| | Element | Voltage (kV) | Remarks |
|---|---|---|---|
| Central Sector | | | |
| | | | |
| State Sector | | | |

**D. Generation Outages**

| | Generating Unit | MW | Remarks |
|---|---|---|---|
| Central Sector | | | |
| | | | |
| State Sector | | | |
| | | | |

**E. HVDC Settings**

| Name | Setting (MW) |
|---|---|
| | |
| | |
| | |

**F. Constraints**

**G. Miscellaneous**

Note: Format may be changed as per requirement with prior approval of the Commission.

**Format II**

**National/_________Regional Load Despatch Centre**

**CONGESTION MONITORING DISPLAY**

**dd/mm/yyyy, hh:mm**

| Corridor/ Control Area | TTC (MW) | ATC (MW) | Actual (MW) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Note: Format may be changed as per requirement with prior approval of the Commission.

**Format III**

**National/_________Regional Load Despatch Centre**

**Notice Number: (NLDC/RLDC)/yyyy/mm/…. Date:** ***dd/mm/yy***
**Time of Issue:** ***hh:mm***

**To**

**WARNING NOTICE**

The actual transfer of electricity on following corridors has crossed the ATC.

| **Corridor/Control Area** | **ATC (MW)** | **Actual Flow (MW)** |
|---|---|---|
| | | |
| | | |

The following regional entities, which are downstream of the congested corridor, are advised to reduce their drawl/increase their generation to decongest the system:

**1.**
**…**
**m**.

The following reginal entities, which are upstream of te congested corridor are advised to
/ increase their drawl/reduce their generation to decongest the system:

**1.**
**…**
**n**.

**Shift Charge Manager**

This is a warning notice before levying of congestion charges and issued in accordance with the Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009

NLDC would send this notice to RLDC and RLDC would send this notice to regional entities

Note: Format may be changed as per requirement with prior approval of the Commission.

**Format IV**

**National/_________Regional Load Despatch Centre**

**Notice Number: (NLDC/RLDC)/yyyy/mm/….** **Date: *dd/mm/yy***
**Time of Issue: *hh:mm***

**To**

**NOTICE FOR APPLICATION OF CONGESTION CHARGE**

Congestion charge for Unscheduled Interchange (UI) energy as per CERC (Measures for relieving congestion) Regulations 2009 dated 22nd December 2009 would be applicable w.e.f time block no. ( hh:mm )of **dd/mm/yyyy.**

| Corridor/Control Area | TTC (MW) | Actual Flow (MW) |
|---|---|---|
| | | |
| | | |

Congestion charge would be applicable on the following regional entities, which are downstream of the congested corridor:
**1.**
**…**
**m**.

Congestion charge would be applicable on the following regional entities, which are upstream of the congested corridor:
**1.**
**…**
**n.**

**Shift Charge Manager**

Issued in accordance with the Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009

NLDC would send this notice to RLDC and RLDC would send this notice to regional entities

Note: Format may be changed as per requirement with prior approval of the Commission.

**Format V**

**National/_________Regional Load Despatch Centre**

**Notice Number: (NLDC/RLDC)/yyyy/mm/….     Date: *dd/mm/yy*   Time of Issue: *hh:mm***

**To**

**NOTICE FOR WITHDRAWAL OF CONGESTION CHARGE**

Congestion charge on Unscheduled Interchange (UI) energy that was applicable w.e.f **hh:mm of dd/mm/yyyy** vide **Notice Number**.... issued at hh:mm of dd/mm/yyyy would be lifted w.e.f **time block no**. (**hh:mm) of dd/mm/yyyy**.

**Shift Charge Manager**

Issued in accordance with the Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009

NLDC would send this notice to RLDC and RLDC would send this notice to regional entities

Note: Format may be changed as per requirement with prior approval of the Commission.

**Format VI**

**National/_________Regional Load Despatch Centre**

**STATEMENT ON NOTICE OF APPLICATION AND WITHDRAWAL OF CONGESTION CHARGE FOR**

**Date:** **Issued on:**

| **Application** | | **Withdrawal** | | **Downstream Regional Entities** | **Upstream Regional Entities** |
|---|---|---|---|---|---|
| **Time Block** | **Time** | **Time Block** | **Time** | | |
| 1 | 0000-0015 | | | | |
| 2 | 0015-0030 | | | | |
| 3 | 0030-0045 | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 96 | 2345-0000 | | | | |

Note: Format may be changed as per requirement with prior approval of the Commission.

**Annexure - II**

**Format for submission of details of Congestion Charge by NLDC for the month of**

(Rs. in Lakh)

| Sl. No. | Name of the RLDCs | Total Receipt of Congestion Charge | Total Disbursal of Congestion Charge | Undisbursed Amount in Congestion Charge Account |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**Extract of relevant clauses from Manual on Transmission Planning Criteria – January, 2013 Published by Central Electricity Authority**

## 5. Permissible normal and emergency limits

5.1 Normal thermal ratings and normal voltage limits represent equipment limits that can be sustained on continuous basis. Emergency thermal ratings and emergency voltage limits represent equipment limits that can be tolerated for a relatively short time which may be one hour to two hour depending on design of the equipment. The normal and emergency ratings to be used in this context are given below:

5.2 (a) The loading limit for a transmission line shall be its thermal loading limit. The thermal loading limit of a line is determined by design parameters based on ambient temperature, maximum permissible conductor temperature, wind speed, solar radiation, absorption coefficient, emissivity coefficient etc. In India, all the above factors and more particularly ambient temperatures in various parts of the country are different and vary considerably during various seasons of the year. However, during planning, the ambient temperature and other factors are assumed to be fixed, thereby permitting margins during operation. Generally, the ambient temperature may be taken as 45 deg Celsius; however, in some areas like hilly areas where ambient temperatures are less, the same may be taken. The maximum permissible thermal line loadings for different types of line configurations, employing various types of conductors, are given in Table-II of Annexure-V.

(b) Design of transmission lines with various types of conductors should be based on conductor temperature limit, right-of-way optimization, losses in the line, cost and reliability considerations etc.

(c) The loading limit for an inter-connecting transformer (ICT) shall be its name plate rating. However, during planning, a margin as specified in Paragraph: 13.2 and 13.3 shall be kept in the above lines/transformers loading limits.

(d) The emergency thermal limits for the purpose of planning shall be 110% of the normal thermal limits.

5.3 Voltage limits

a) The steady-state voltage limits are given below. However, at the planning stage a margin as specified at Paragraph: 13.4 may be kept in the voltage limits.

| **Voltages ($kV_{rms}$)** | | | | |
|---|---|---|---|---|
| | **Normal rating** | | **Emergency rating** | |
| **Nominal** | **Maximum** | **Minimum** | **Maximum** | **Minimum** |
| 765 | 800 | 728 | 800 | 713 |
| 400 | 420 | 380 | 420 | 372 |
| 230 | 245 | 207 | 245 | 202 |
| 220 | 245 | 198 | 245 | 194 |
| 132 | 145 | 122 | 145 | 119 |
| 110 | 123 | 99 | 123 | 97 |
| 66 | 72.5 | 60 | 72.5 | 59 |

**b) Temporary over voltage limits due to sudden load rejection:**

i) 800kV system 1.4 p.u. peak phase to neutral ( 653 kV = 1 p.u. )

ii) 420kV system 1.5 p.u. peak phase to neutral ( 343 kV = 1 p.u. )

iii) 245kV system 1.8 p.u. peak phase to neutral ( 200 kV = 1 p.u. )

iv) 145kV system 1.8 p.u. peak phase to neutral ( 118 kV = 1 p.u. )

v) 123kV system 1.8 p.u. peak phase to neutral ( 100 kV = 1 p.u. )

vi) 72.5kV system 1.9 p.u. peak phase to neutral ( 59 kV = 1 p.u.)

**c) Switching over voltage limits**

i) 800kV system 1.9 p.u. peak phase to neutral ( 653 kV = 1 p.u. )

ii) 420kV system 2.5 p.u. peak phase to neutral ( 343 kV = 1 p.u. )

## 6. Reliability criteria

### 6.1 Criteria for system with no contingency (‘N-0’)

a) The system shall be tested for all the load-generation scenarios as given in this document at Paragraph: 9 -11.

b) For the planning purpose all the equipments shall remain within their normal thermal loadings and voltage ratings.

c) The angular separation between adjacent buses shall not exceed 30 degree.

### 6.2 Criteria for single contingency (‘N-1’)

6.2.1 Steady-state :

a) All the equipments in the transmission system shall remain within their normal thermal and voltage ratings after a disturbance involving loss of any one of the following elements (called single contingency or ‘N-1’ condition), but without load shedding / rescheduling of generation:

- Outage of a 132kV or 110kV single circuit,
- Outage of a 220kV or 230kV single circuit,
- Outage of a 400kV single circuit,
- Outage of a 400kV single circuit with fixed series capacitor(FSC),
- Outage of an Inter-Connecting Transformer(ICT),
- Outage of a 765kV single circuit
- Outage of one pole of HVDC bipole.

b) The angular separation between adjacent buses under (‘N-1’) conditions shall not exceed 30 degree.

6.2.2 Transient-state :

Usually, perturbation causes a transient that is oscillatory in nature, but if the system is stable the oscillations will be damped. The system is said to be stable in which synchronous machines, when perturbed, will either return to their original state if there is no change in exchange of power or will acquire new state asymptotically without losing synchronism. The transmission system shall be stable after it is subjected to one of the following disturbances:

a) The system shall be able to survive a permanent three phase to ground fault on a 765kV line close to the bus to be cleared in 100 ms.

b) The system shall be able to survive a permanent single phase to ground fault on a 765kV line close to the bus. Accordingly, single pole opening (100 ms) of the faulted phase and unsuccessful re-closure (dead time 1 second) followed by 3-pole opening (100 ms) of the faulted line shall be considered.

c) The system shall be able to survive a permanent three phase to ground fault on a 400kV line close to the bus to be cleared in 100 ms.

d) The system shall be able to survive a permanent single phase to ground fault on a 400kV line close to the bus. Accordingly, single pole opening (100 ms) of the faulted phase and unsuccessful re-closure (dead time 1 second) followed by 3-pole opening (100 ms) of the faulted line shall be considered.

e) In case of 220kV / 132 kV networks, the system shall be able to survive a permanent three phase fault on one circuit, close to a bus, with a fault clearing time of 160 ms (8 cycles) assuming 3-pole opening.

f) The system shall be able to survive a fault in HVDC convertor station, resulting in permanent outage of one of the poles of HVDC Bipole.

g) Contingency of loss of generation: The system shall remain stable under the contingency of outage of single largest generating unit or a critical generating unit (choice of candidate critical generating unit is left to the transmission planner).

### 6.3 Criteria for second contingency ('N-1-1')

6.3.1 Under the scenario where a contingency as defined at Paragraph: 6.2 has already happened, the system may be subjected to one of the following subsequent contingencies (called 'N-1-1' condition):

a) The system shall be able to survive a temporary single phase to ground fault on a 765kV line close to the bus. Accordingly, single pole opening (100 ms) of the faulted phase and successful re-closure (dead time 1 second) shall be considered.

b) The system shall be able to survive a permanent single phase to ground fault on a 400kV line close to the bus. Accordingly, single pole opening (100 ms) of the faulted phase and unsuccessful re-closure (dead time 1 second) followed by 3-pole opening (100 ms) of the faulted line shall be considered.

c) In case of 220kV / 132kV networks, the system shall be able to survive a permanent three phase fault on one circuit, close to a bus, with a fault clearing time of 160 ms (8 cycles) assuming 3-pole opening.

6.3.2 (a) In the 'N-1-1' contingency condition as stated above, if there is a temporary fault, the system shall not loose the second element after clearing of fault but shall successfully survive the disturbance.

(b) In case of permanent fault, the system shall loose the second element as a result of fault clearing and thereafter, shall asymptotically reach to a new steady state without losing synchronism. In this new state the system parameters (i.e. voltages and line loadings) shall not exceed emergency limits, however, there may be requirement of load shedding / rescheduling of generation so as to bring system parameters within normal limits.

### 6.4 Criteria for generation radially connected with the grid

For the transmission system connecting generators or a group of generators radially with the grid, the following criteria shall apply:

6.4.1 The radial system shall meet 'N-1' reliability criteria as given at Paragraph: 6.2 for both the steady-state as well as transient-state.

6.4.2 For subsequent contingency i.e. 'N-1-1' (of Paragraph: 6.3) only temporary fault shall be considered for the radial system.

6.4.3 If the 'N-1-1' contingency is of permanent nature or any disturbance/contingency causes disconnection of such generator/group of generators from the main grid, the remaining main grid shall asymptotically reach to a new steady-state without losing synchronism after loss of generation. In this new state the system parameters shall not exceed emergency limits, however, there may be requirement of load shedding / rescheduling of generation so as to bring system parameters within normal limits.

## Criteria for simulation and studies

### 7. System studies for transmission planning

7.1 The system shall be planned based on one or more of the following power system studies, as per requirements:

i) Power Flow Studies

ii) Short Circuit Studies

iii) Stability Studies (including transient stability ** and voltage stability)

iv) EMTP studies (for switching / dynamic over-voltages, insulation coordination, etc)

(** Note : *The candidate lines, for which stability studies may be carried out, may be selected through results of load flow studies. Choice of candidate lines for transient stability studies are left to transmission planner. Generally, the lines for which the angular difference between its terminal buses is more than 20 degree after contingency of one circuit may be selected for performing stability studies.)*

### 8. Power system model for simulation studies

8.1 **Consideration of voltage level**

8.1.1 For the purpose of planning of the ISTS:

a) The transmission network may be modeled down to 220kV level with exception for North Eastern Region and parts of Uttrakhand, Himachal and Sikkim which may be modeled down to 132kV level.

b) The generating units that are stepped-up at 132kV or 110kV may be connected at the nearest 220kV bus through a 220/132 kV transformer for simulation purpose. The generating units smaller than 50 MW size within a plant may be lumped and modeled as a single unit, if total lumped installed capacity is less than 200 MW.

c) Load may be lumped at 220kV or 132kV/110kV, as the case may be.

8.1.2 For the purpose of planning of the Intra-STS System, the transmission network may be modeled down to 66kV level or up to the voltage level which is not in the jurisdiction of DISCOM. The STUs may also consider modeling smaller generating units, if required.

**<u>Table- II </u>(Thermal Loading Limits of Transmission Lines) Annexure-V**

**<u>( Referred in Para 5.2 of Manual on Transmission Planning Creteria0</u>**

Actual system data, wherever available, should be used. In cases where data is not available standard data given below can be assumed. Data for some new conductors which are equivalent to ACSR Zebra/Moose are also given in following tables:

| **Conductor type and dimension** | **Ambient Temperature (ºC)** | **AMPACITY FOR Maximum Conductor Temperature (ºC)** | |
|---|---|---|---|
| | | **65** | **75** |
| ACSR PANTHER 210 sq mm | 40<br>45<br>48<br>50 | 312<br>244<br>199 | 413<br>366<br>334<br>311 |

| **Thermal Loading Limits for ACSR Zebra equivalent Conductors** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Conductor Type (metallic area) and Dimension | Ambient Temperature (deg C) | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | 65 | 75 | 85 | 90 | 95 | 120 |
| ACSR Zebra (484 Sq.mm) Dia:28.62mm | 40 | 473 | 643 | 769 | NA | NA | NA |
| | 45 | 346 | 560 | 703 | NA | NA | NA |
| | 48 | 240 | 503 | 661 | NA | NA | NA |
| | 50 | 128 | 462 | 631 | NA | NA | NA |
| | | | | | | | |
| Conductor Type (metallic area) and Dimension | Ambient Temperature (deg C) | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | 65 | 75 | 85 | 90 | 95 | 120 |
| AAAC (479.00 sq mm) Dia:28.42 mm | 40 | 471 | 639 | 765 | 818 | 866 | NA |
| | 45 | 345 | 557 | 700 | 758 | 811 | NA |
| | 48 | 240 | 501 | 657 | 720 | 776 | NA |
| | 50 | 130 | 460 | 627 | 693 | 751 | NA |
| | | | | | | | |
| Conductor Type (metallic area) and Dimension | Ambient Temperature (deg C) | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | 65 | 75 | 85 | 90 | 95 | 120 |
| AL59 (383.00 sq mm) Dia:25.41 mm | 40 | 440 | 590 | 702 | 750 | 793 | NA |
| | 45 | 329 | 516 | 643 | 696 | 743 | NA |
| | 48 | 240 | 466 | 605 | 661 | 711 | NA |
| | 50 | 154 | 429 | 578 | 637 | 689 | NA |
| | | | | | | | |
| Conductor Type (metallic area) and Dimension | Ambient Temperature (deg C) | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | 85 | 95 | 120 | 150 | 175 | 200 |
| TACSR (462.63 sq mm) Dia:27.93mm | 40 | 730 | 826 | 1010 | 1173 | NA | NA |
| | 45 | 667 | 773 | 971 | 1142 | NA | NA |
| | 48 | 627 | 740 | 946 | 1124 | NA | NA |
| | 50 | 599 | 717 | 930 | 1111 | NA | NA |
| | | | | | | | |
| Conductor Type (metallic area) and Dimension | Ambient Temperature (deg C) | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | 85 | 95 | 120 | 150 | 175 | 200 |
| STACIR (419.39 sq mm) Dia:26.61mm | 40 | 701 | 793 | 969 | 1124 | 1228 | 1318 |
| | 45 | 642 | 743 | 931 | 1094 | 1203 | 1296 |
| | 48 | 604 | 711 | 908 | 1076 | 1188 | 1283 |
| | 50 | 577 | 689 | 892 | 1064 | 1177 | 1274 |
| | | | | | | | |

| Conductor Type (metallic area) and Dimension | Ambient Temperature (deg C) | AMPACITY FOR Maximum Conductor Temperature (deg C) | | | | | |
|---|---|---|---|---|---|---|---|
| | | **85** | **95** | **120** | **150** | **175** | **200** |
| **ACSS (413.69 sq mm) Dia:26.40mm** | 40 | 682 | 771 | 942 | 1093 | 1193 | 1281 |
| | 45 | 625 | 722 | 905 | 1064 | 1169 | 1260 |
| | 48 | 587 | 691 | 882 | 1046 | 1154 | 1247 |
| | 50 | 561 | 67 | 867 | 1035 | 1144 | 1238 |
| | | | | | | | |
| **Conductor Type (metallic area) and Dimension** | **Ambient Temperature (deg C)** | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | **85** | **95** | **120** | **150** | **175** | **200** |
| **ACCC (588.30 sq mm) Dia:28.14 mm** | 40 | 853 | 965 | 1182 | 1374 | 1502 | NA |
| | 45 | 780 | 904 | 1136 | 1338 | 1472 | NA |
| | 48 | 733 | 865 | 1107 | 1316 | 1453 | NA |
| | 50 | 700 | 837 | 1088 | 1301 | 1440 | NA |

## Thermal Loading Limits for ACSR Moose equivalent Conductors

| Conductor Type (metallic area) and Dimension | Ambient Temperature (deg C) | AMPACITY FOR Maximum Conductor Temperature (deg C) | | | | | |
|---|---|---|---|---|---|---|---|
| | | **65** | **75** | **85** | **95** | **120** | **150** |
| **ACSR Moose (597 Sq.mm) Dia:31.77mm** | 40 | 528 | 728 | 874 | **NA** | **NA** | **NA** |
| | 45 | 378 | 631 | 798 | **NA** | **NA** | **NA** |
| | 48 | 247 | 565 | 749 | **NA** | **NA** | **NA** |
| | 50 | 83 | 516 | 714 | **NA** | **NA** | **NA** |
| | | | | | | | |
| **Conductor Type (metallic area) and Dimension** | **Ambient Temperature (deg C)** | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | **65** | **75** | **85** | **90** | **95** | **120** |
| **AAAC (570.00 sq mm) Dia:31.05 mm** | 40 | 509 | 699 | 839 | 898 | 952 | NA |
| | 45 | 366 | 606 | 766 | 831 | 890 | NA |
| | 48 | 243 | 543 | 719 | 789 | 851 | NA |
| | 50 | 96 | 497 | 686 | 759 | 825 | NA |
| | | | | | | | |
| **Conductor Type (metallic area) and Dimension** | **Ambient Temperature (deg C)** | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | **65** | **75** | **85** | **95** | **120** | **150** |
| **AL59 (586.59 sq mm) Dia:31.50 mm** | 40 | 551 | 759 | 912 | 976 | 1035 | NA |
| | 45 | 395 | 658 | 832 | 904 | 968 | NA |
| | 48 | 260 | 589 | 781 | 857 | 926 | NA |
| | 50 | 94 | 539 | 745 | 825 | 896 | NA |

| Conductor Type (metallic area) and Dimension | Ambient Temperature (deg C) | AMPACITY FOR Maximum Conductor Temperature (deg C) | | | | | |
|---|---|---|---|---|---|---|---|
| | | **65** | **75** | **85** | **95** | **120** | **150** |
| **TACSR (596.90 sq mm) Dia:31.77mm** | 40 | 881 | 1001 | 1230 | 1433 | NA | NA |
| | 45 | 805 | 936 | 1182 | 1396 | NA | NA |
| | 48 | 755 | 895 | 1152 | 1372 | NA | NA |
| | 50 | 720 | 867 | 1132 | 1357 | NA | NA |
| **Conductor Type (metallic area) and Dimension** | **Ambient Temperature (deg C)** | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | **65** | **75** | **85** | **95** | **120** | **150** |
| **STACIR (483.85 sq mm) Dia:28.63 mm** | 40 | 772 | 874 | 1070 | 1244 | 1360 | 1461 |
| | 45 | 706 | 818 | 1028 | 1211 | 1333 | 1437 |
| | 48 | 663 | 783 | 1003 | 1191 | 1316 | 1423 |
| | 50 | 633 | 758 | 985 | 1178 | 1304 | 1413 |
| **Conductor Type (metallic area) and Dimension** | **Ambient Temperature (deg C)** | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | 65 | 75 | 85 | 95 | 120 | 150 |
| **ACSS (597 sq mm) Dia:31.77mm** | 40 | 902 | 1024 | 1258 | 1466 | 1606 | 1727 |
| | 45 | 823 | 957 | 1209 | 1428 | 1573 | 1699 |
| | 48 | 772 | 915 | 1178 | 1404 | 1554 | 1682 |
| | 50 | 736 | 886 | 1158 | 1388 | 1540 | 1670 |
| **Conductor Type (metallic area) and Dimension** | **Ambient Temperature (deg C)** | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | **65** | **75** | **85** | **95** | **120** | **150** |
| **ACCC ( 729.41 sq mm) Dia:31.55 mm** | 40 | 982 | 1115 | 1371 | 1599 | 1606 | NA |
| | 45 | 897 | 1043 | 1318 | 1557 | 1573 | NA |
| | 48 | 841 | 998 | 1284 | 1531 | 1554 | NA |
| | 50 | 802 | 966 | 1262 | 1514 | 1540 | NA |

## Thermal Loading Limits for Snowbird conductor

| ACSR SNOWBIRD | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Conductor Type and Dimension** | **Ambient Temperature (deg C)** | **AMPACITY FOR Maximum Conductor Temperature (deg C)** | | | | | |
| | | **65** | **75** | **85** | **95** | **120** | **150** |
| **ACSR Snowbird 552.23sq.mm Dia:30.57mm** | 40 | 529 | 726 | 870 | **NA** | **NA** | **NA** |
| | 45 | 382 | 630 | 795 | **NA** | **NA** | **NA** |
| | 48 | 256 | 565 | 746 | **NA** | **NA** | **NA** |
| | 50 | 110 | 517 | 712 | **NA** | **NA** | **NA** |

# Thermal Loading Limits for Bersimis equivalent conductors

| ACSR Bersimis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Conductor Type and Dimension | Ambient Temperature (deg C) | AMPACITY FOR Maximum Conductor Temperature (deg C) | | | | | |
| | | 65 | 75 | 85 | 95 | 120 | 150 |
| ACSR Bersimis 724.69sq.mm Dia:35.04 mm | 40 | 606 | 848 | 1024 | NA | NA | NA |
| | 45 | 423 | 732 | 933 | NA | NA | NA |
| | 48 | 256 | 653 | 874 | NA | NA | NA |
| | 50 | | 594 | 833 | NA | NA | NA |

| AAAC BERSIMIS | | | | | | | |
|---|---|---|---|---|---|---|---|
| Conductor Type and Dimension | Ambient Temperature (deg C) | AMPACITY FOR Maximum Conductor Temperature (deg C) | | | | | |
| | | 65 | 75 | 85 | 90 | 95 | 120 |
| AAAC Bersimis 766.86Sq.mm Dia:36 mm | 40 | 562 | 788 | 953 | 1022 | 1085 | NA |
| | 45 | 388 | 679 | 868 | 945 | 1014 | NA |
| | 48 | 228 | 605 | 813 | 896 | 969 | NA |
| | 50 | | 550 | 774 | 861 | 938 | NA |

# Thermal Loading Limits for Lapwing conductor

| ACSR LAPWING | | | | | | | |
|---|---|---|---|---|---|---|---|
| Conductor Type and Dimension | Ambient Temperature (deg C) | AMPACITY FOR Maximum Conductor Temperature (deg C) | | | | | |
| | | 65 | 75 | 85 | 95 | 120 | 150 |
| ACSR Lapwing 863.47Sq.mm Dia:38.22 mm | 40 | 635 | 899 | 1090 | NA | NA | NA |
| | 45 | 430 | 773 | 992 | NA | NA | NA |
| | 48 | 234 | 686 | 928 | NA | NA | NA |
| | 50 | | 622 | 883 | NA | NA | NA |

The above data has been calculated based on following assumptions:

Solar radiations = 1045 W/$m^2$.

Wind Speed = 2 km/hour

Absorption Coefficient = 0.8

Emissivity Coefficient = 0.45

Age > 1 year