Nordel

Operational Performance Specifications for small Thermal Power Units

Amendment no. 1 1995

Recommendation by NORDEL

Operational Performance Specifications for Smaller Thermal Power Units[1]

Abstract

The operational performance specifications of NORDEL for thermal power units above 200 MW were adopted in 1975 and revised in 1982 and in 1995.

There is an increasing interest in establishing small thermal power units in several countries. As the systematic importance of the small plants are increased by it, specifications for the small plants have been prepared starting with the adopted recommendation.

Basic idea

The large plants constitute the foundation of the power supply structure. Therefore, heavy demands are made on the technical and operational properties of the plants. The plants are constructed in the simplest and cheapest possible way while meeting the requirements. In the small power plants, the main stress is laid on a simple, reliable and cheap constructional layout. It is acceptable that they are neutral concerning maintenance of systems operation, but they cannot be allowed to aggravate an already existing, strenous operational situation. The specifications should be considered minimum demands.

Classification

It has been decided to divide all the thermal power plats into three main groups:

- above 100 MW[2]
- from 25 MW to 100 MW
- below 25 MW

The latter group is further divided up into categories according to manning and possibilities of remote control.

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[1] This 1995 edition of Amendment No. 1 is identical to the 1990 edition except that clause references have been changed according to the changes in the 1995 revision of Operational Performance Specifications for Thermal Power Units larger than 100 MW.

[2] Now included in above mentioned 1995 revision.

Recommendation

- NORDEL recommends that the sphere of application for *Operation performance Specifications for Smaller Thermal Power Units* be extended so that the specifications apply to all new thermal power units. For units below 100 MW demands are mitigated, as described in Appendix 1 of 1990.

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1. Introduction

The operational performance specifications of NORDEL for thermal power stations above 200 MW were adopted in 1975 and revised in 1982 and 1995. In 1995 200 MW was changed to 100 MW.

There is an increasing interest in establishing small thermal power units in several countries. As the systematic importance of the small plants is increased by it, specifications for the small plants have been prepared starting with the adopted recommendation.

Basic idea

The large plants constitute the foundation of the power supply structure. Therefore, heavy demands are made on the technical and operational properties of the stations. The plants are constructed in the simplest and cheapest possible way while meering the requirements. In the small power plants, the main stress is laid on a simple, reliable and cheap constructional layout. It is acceptable that they are neutral concerning maintenance of systems operation, but they cannot be allowed to aggravate an already existing, strenous operational situation. The specifications should be considered minimum demands.

2. Classification of thermal power stations

It has been decided to divide the thermal power stations into three main groups according to size, delimited by 25 MW and 100 MW.

Small thermal power stations (below 25 MW)

The smallest thermal power stations up to approx. 25 MW electricity effect are supposed to be connected to the distribution network or regional networks with voltages up to approx. 70 kV.

They can be devided into the following categories:

Categori 1 (up to approx. 1 MW)
Normally, there is no supervision or command facility from the operations station. Operations only take place according to elaborated running schedules.

Categori 2 (from 1 to approx. 10 MW)
Normally, the plant is part-time manned. The power production is shown in the control room of the network operations. No command facility via remote control is available. Normally, operations take place according to previously elaborated running schedules.

Categori 3 (from 10 to approx. 25 MW)
The plant is either full-time manned or tele-controlled. The power production is shown in the control room of the network operations. It is possible to command "max. generation of power" or "min. generation of power". By these commands the largest range of regulation should be understood considering the required heat production or possibilities of heat accumulation under the circumstances. During normal operations, production takes place according to the elaborated running schedules.

Medium-sized and larger thermal power stations
(above 25 MW and below 100 MW)
Medium-sized and larger thermal power stations from 25 to 100 MW are presumed connected to voltages from approx. 40 kV to 300 kV.

The plant is either full-time manned or tele-controlled. The power production is shown in the control room of the network operations. It is possible to command "max. generation of power" or "min. generation of power". By these commands the largest range of regulation should be understood considering the required heat production or possibilities of heat accumulation under the cirsumstances. During normal operations, production takes place according to the elaborated running schedules.

Large thermal power stations (above 100 MW)
The stations are connected to voltages from approx. 100 kV to 400 kV. Operations take place fully manned or via remote control and the production of power is determined by the operations station based on considerations of economy and performance reliability.

3. Specifications

The specifications should be considered minimum requirements. If local conditions bring about bette properties, or if better properties can be obtained without extensive additional costs or complications, this alternative should be chosen. As an example of local special demands the possibility of island operation in a ratio controlled system during an operational disturbance of long duration can be mentioned.

In the following, reference is made to the NORDEL Operational Performance Specifications for Thermal Power Units larger than 100 MW, revised 1995 (abbreviated N-DSV 95). In principle, these specifications apply to all new plants.

3.1 Specifications for plants below 200 MW and above 100 MW

N-DSV 95 applies to all new plants above 100 MW.

3.2 Specifications for plants below 100 MW and above 25 MW

The following deviations from N-DSV 95 can be accepted:

§ 1.1: All the small power stations should observe this regulation irrespective of the type of primary fuel.

§ 1.2: Efforts should be made to observe this regulation, but observance is not demanded.

§ 1.3: Must be observed.

§ 2.1 and 2.2: Must be observed.

§ 2.3: Is not required observed according to the above-mentioned considerations.

§ 3.2, 3.3 and 3.1: Must be observed.

§ 3.4 and 3.5: Only apply to nuclear power stations.

§ 4.1, 4.2: Must be observed.

§ 4.3, 4.4 and 4.5, 4.6: Are not relevant to small power stations.

§ 5: A voltage profile as shown in enclosure 1, figure 1, in the transmission network or in the regional distribution network should not be allowed to cause cutting-out of power stations.

Deviations of frequency and voltage within the hatched area on enclosure 1, figure 2, should not be allowed to cause cutting-out of power stations. A reduction of the active production by up to 20% is acceptable. The power stations should be able to tolerate frequencies up to 53 Hz.

§ 6: Is not required observed according to the above-mentioned considerations. A quick start-up after cutting-out is desirable but is not demanded generally.

Regarding the starting times the following directions can be given:

After release	30 min.
After an outage time of 10 h	90 min.
After an outage time of 30 to 50 h	120 min.

As for unmanned plants another 120 minutes may pass before the guard can attain to the power station.

It should be possible to start up and fully load gas turbine plants within 30 minutes even after a long outage time. It should be mentioned that the power which is at disposal after 15 minutes in the natioal systems can be calculated as part of the fast reserve, according to *Reserve demands in the NORDEL System* of 19.05.1988.

§ 7, 8 and 9 are not required

By way of comparison the requirements on small as well as large plants are shown on enclosure 1.

3.3 Specifications for plants below 25 MW

To these plants it applies that the requirements which it is reasonable to demand complied with depend on the mode of operation, manning and type of fuel. In order to meet this, the power stations are divided into three categories, cf. section 2.

Categori 1 (< 1 MW)
In the main, locally conditioned requirements are made. However, the power stations should be capable for short periods of time of tolerating frequencies in the range from 47.5 Hz to 53 Hz.

For plants of the 2nd and 3rd category (1 MW - 25 MW) the following deviations from N-DSV 95 are acceptable:

§ 1.1: All the power stations of the 3rd category should observe this regulation irrespective of the type of fuel.

§ 1.2: Efforts should be made to observe this regulation, but observance is not demanded.

§ 1.3: Should be observed.

§ 2.1 and 2.2: Must be observed for the 3rd category (In case of solid fuel fired plants observance may be difficult. No requirements made on the 2nd category).

§ 2.3: Is not required observed according to the above-mentioned considerations.

§ 3.2, 3.3 and 3.1: Must be observed for the 3rd category (no requirements made on the 2nd category).

§ 3.4 and 3.5: Only apply to nuclear power stations.

§ 4.1, 4.2: Must be observed.

§ 4.3, 4.4 and 4.5, 4.6: Are not relevant to small power stations.

§ 5: A voltage profile as shown in enclosure 1, figure 1, in the transmission network or in the regional distribution network should not be allowed to cause cutting-out of power stations.

Deviations of frequency and voltage within the hatched area on enclosure 1, figure 2, should not be allowed to cause cutting-out of power stations. A reduction of the active production by up to 20% is acceptable. For solid fuel fired plants of the 2nd category it may be difficult to comply with the requirement in the range from 47.5 - 49 Hz. The power stations should be able to tolerate frequencies up to 53 Hz.

§ 6: Is not required observed according to the above-mentioned considerations. But a quick start-up after cutting-out is desirable.

Gas turbine plants and gas motor do. should be able to start automatically with the alternative of remote operation when the voltage is stable after a network fault causing cutting-out of the plant.

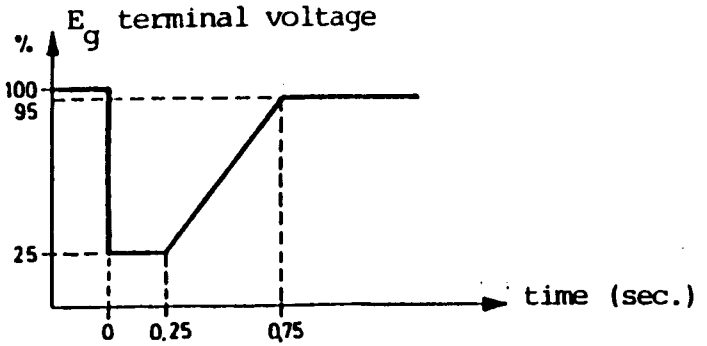
For solid fuel fired plants of the 2nd category no requirements are made.

§ 7, 8 and 9 are not required

By way of comparison the requirements on small as well as large plants are shown on enclosure 1.

UNITS ABOVE 100 MW

Dimensioning voltage profile
for network faults



UNITS BELOW 100 MW

Dimensioning voltage profile
for network faults

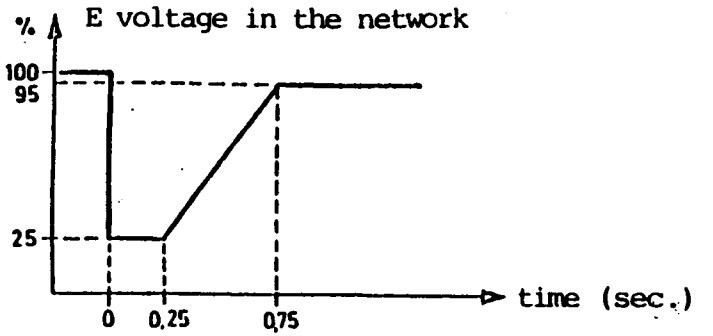
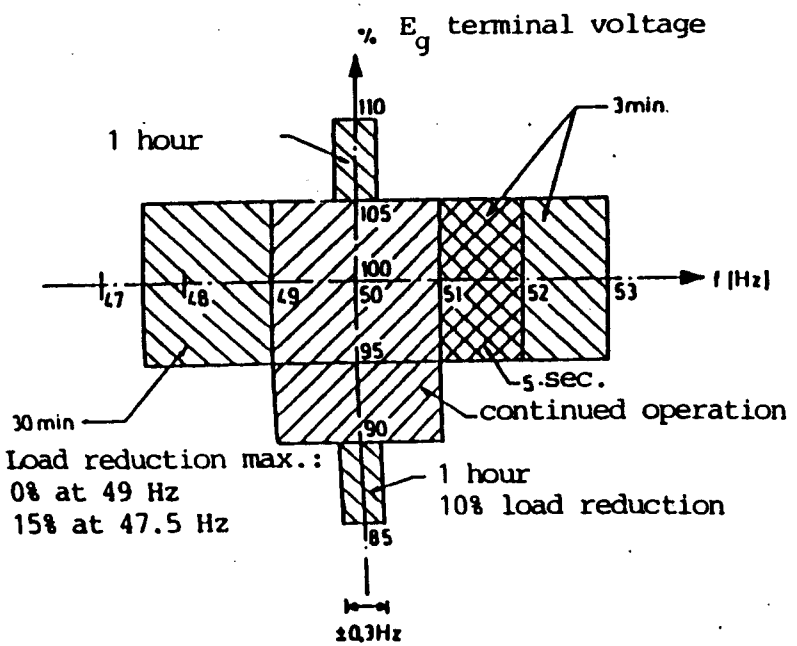


Figure 1



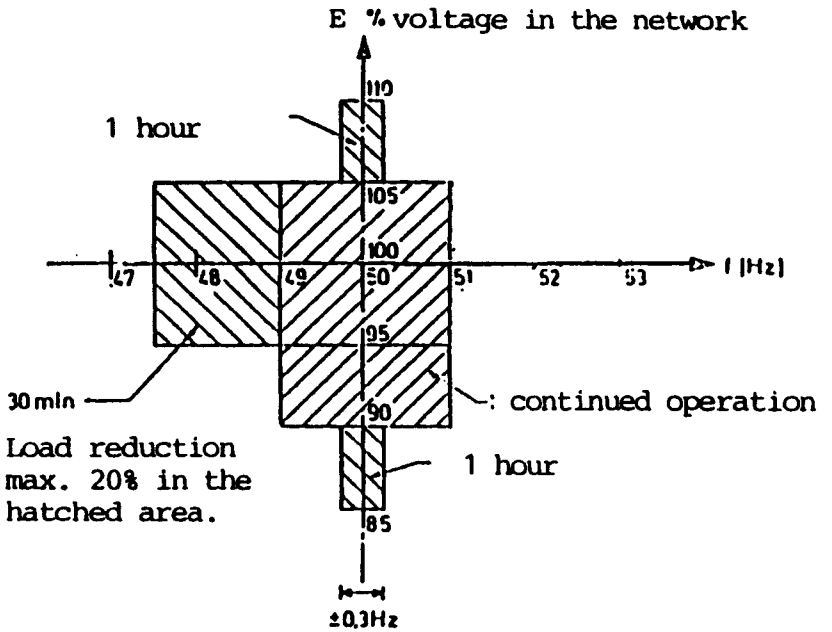


Figure 2

Recommendations concerning frequency and voltage from The Thermal Power Committee of NORDEL