# ASPECTS REGARDING THE DIAGNOSTICATION OF THE MEDIUM VOLTAGE AFFERENT TO THE COLLECTOR BARS OF THE POWER SUPPLY SYSTEM OF OWN SERVICE CONSUMERS OF AN ENERGY GROUP WITH THE POWER OF 330 MW

**Popescu Cristinel, "***Constantin Brâncuși" University of Târgu Jiu, Romania*

**ABSTRACT**: *The paper aims to highlight the importance of the collector bar systems in maintaining the quality parameters of the electricity distributed to the medium voltage consumers entering the technological flow of a 330 MW power plant from a thermoelectric power plant. To this end, the paper presents the way of connecting the own services consumers at the transformer of the general services in the start-up phase, respectively at the transformer of own services, following the parallel introduction of a 330 MW power group, with Energy National System.*

**KEY WORDS:** *collector bars, power group, own services, general services, electrical transformer, insulation condition*.

## 1. INTRODUCTION

Collector bar systems that are part of the electrical plant configuration in a power plant are of major importance in maintaining quality parameters, among which are very important the safety of operation and the continuity in the supply of electricity to own services consumers of energy groups of 330 MW.

Starting from the fact that the majority of the consumers of own services related to a 330 MW energy group are in the category of vital consumers, it is obvious that their electricity supply must be carried out in compliance with all the quality parameters regulated by the norms in force.

The collector bar systems associated with a thermoelectric plant can be divided into two categories[1]:

- a busbar system, called main busbar system, which assures the transfer of electricity through a general power service transformer with a power of 40 MVA and a 110/6 kV transformation ratio to its own service consumers entering in the technological flow of an energy group with a power of 330 MW;
- a busbar system that assures the transfer of electricity through an electric transformer with a power of 40 MVA and the transformation ratio of 24/6 kV to the consumers of its own services entering the technological flow diagram of an energy group with the power of 330 MW;

## 2. THE WAY OF SUPPLYING CUSTOMERS OF THEIR OWN SERVICES FROM COLLECTOR BARS SYSTEMS

As mentioned in the introductory part of the paper, the supply of self-service customers in the configuration of the technological flow scheme of a 330 MW power group can be synthesized in two variants. Figure 1 presents the monofilament power scheme for own service customers from the own services transformer of the energy power group [1].

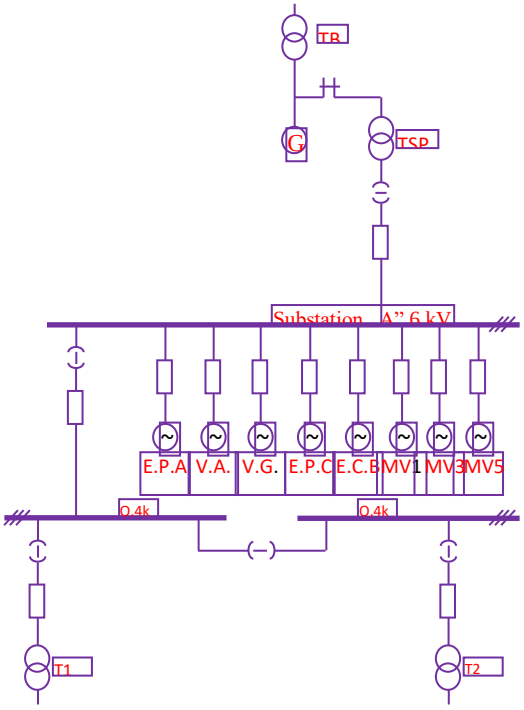


Figure 1.The monofilament electric power scheme of the own services consumers from own services transformer of energy system.

Figure 2 shows the monofilament power scheme of own services customers from the general service transformer (TSG) and from the own services transformer (TSP) of the energy group [1].

As can be seen from Figure 2, the medium voltage busbar system from which the energy service users of an energy group feed themselves can be powered by both, the own services transformer and the general service transformer.

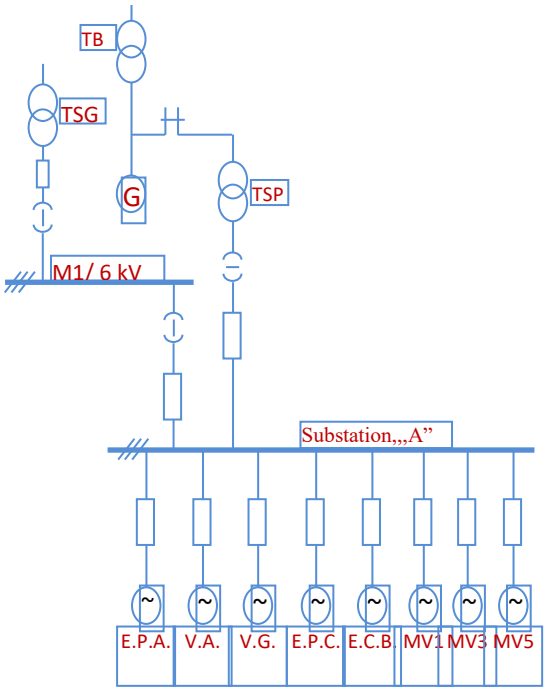


Figure 2. The monofilament electric power scheme of the own services consumers from the own services energy system transformer

The power supply from the general service transformer of the consumers is made in the start-up phase, and after starting the energy group and entering it in parallel with the National Power System, through the switching apparatus, the electricity supply of the consumers of own services is transferred from own service transformer.

## 3. DIAGNOSIS OF MEDIUM VOLTAGE BUSBARS RELATED TO THE SYSTEM OF SUPPLYING THE OWN SERVICES CONSUMERS

Considering the major importance of busbar systems in powering the medium voltage consumers of a 330 MW power group, it is necessary to monitor some

reference parameters for the insulation status of these systems. The parameters reflecting the state of the medium voltage busbar systems are[2]:

- insulation resistance;
- insulation with industrial frequency voltage for 1 minute;
- checking the minimum insulation and protection distances;
- tightness test of the capped bars;
- checking the screw connections of the current paths and the earthing connections of the enclosed bar bodies;
- verification of isolated condenser passes;
- the measurement of the contact ohmic resistance at the joint of the collector bars and at the deviations from the collector bars;
- verifying the existence of closed metal contours formed from the carcasses of the collector bundles together with the support rack.

Measurement of insulation resistance at collector bar systems is achieved by means of inductors at a voltage of at least 2500 V continuous current on current revisions, capital repairs and commissioning. The minimum permissible value of insulation resistance is 100 MΩ [2].

After the verification of the isolation state of the medium voltage busbar systems, the sample with industrial frequency voltage can be applied for 1 min. This check is carried out at the commissioning of the collector bar systems, or at the following repairs due to the occurrence of some regimes. Since the collector bar systems support insufflation passages of congestion type, the increased voltage test addresses the behavior of these insulating passages (insulators), in the sense that within 1 minute, no overflows should occur. The test voltage values are given in relation to the rated voltage and are shown in Table 1 for organic insulators, respectively in Table 2 for insulators of inorganic material (ceramic) [2].

Table 1

| ***Crt no.*** | ***Nominal voltage [kV]*** | ***Industrial frequency test voltage [kV]*** |
|---|---|---|
| 1. | 3,3 | 10 |
| 2. | 7,2 | 20 |
| 3. | 12 | 28 |
| 4. | 17,5 | 38 |
| 5. | 24 | 50 |

Table 2

| ***Crt no.*** | ***Nominal voltage [kV]*** | ***Industrial frequency test voltage [kV]*** |
|---|---|---|
| 1. | 3,3 | 21 |
| 2. | 7,2 | 27 |
| 3. | 12 | 35 |
| 4. | 17,5 | 45 |
| 5. | 24 | 55 |

Verification of minimum insulation and protective distances for busbar systems is performed when commissioning or changes occur in the configuration of the busbar systems in service. The reference values for these distances are shown in Table 3 [3-5].

Table 3

| Crt. no. | ***Symbol and calculation relation*** | ***Rated installation voltage [kV]*** | | | |
|---|---|---|---|---|---|
| | | **(3)** | **6** | **10** | **(15)20** |
| | | ***Minimal distance (mm)*** | | | |
| 1. | $A_0$ | 65 | 90 | 120 | 180 |
| 2. | A  1,1 $A_0$ | 70 | 100 | 130 | 200 |

| | | | | | |
|---|---|---|---|---|---|
| 3. | $A_2 = A_0$ (ext.)/2 ($A_2 \leq$ A) | 70 | 100 | 100 | 150 |
| 4. | $B_1 = A_0 + 30$ | 100 | 120 | 150 | 210 |
| 5. | $B_2 = A_0+100$ | 170 | 190 | 220 | 280 |
| 6. | $B_3 = A_0 +750$ | 820 | 840 | 870 | 930 |
| 7. | $C = A_0 +2300$ (min. 2600) | 2600 | 2600 | 2600 | 2600 |
| 8. | $E = A_0 + 600$ | 670 | 690 | 720 | 780 |
| 9. | h | 4500 | 4500 | 4500 | 4750 |

where:

A- the minimum air-to-air separation distances between the conductor parts under voltage ension of different phases

$A_0$ - the minimum air-to-air separation distances between the conductor parts under voltage of different phases and the earth-related elements

$B_1$, $B_2$ sau $B_3$ - the distances between the conductive parts, under voltage or isolated from the ground, of the installation and the definitive protection enclosures.

C-the distances between the elements of the system under voltage or isolated from the ground and the level of the floor.

The measurement of the contact resistance at the joint of the collector busbar connections and at the deviation of the collector bars is carried out on the basis of current repairs, technical revisions and commissioning, by the DC volt-amperemeter method at a value of 100 A [2-5].

The ohmic resistance must not exceed with 20% the ohmic resistance of a continuous portion of the same length [2-5].

## CONCLUSIONS

The following conclusions can be drawn from the aspects that were presented before:

1. Medium voltage collection systems are the vital electrical equipment for the proper operation of the service facilities of own services customers for a 330 MW power group.
2. In order to prevent the occurrence of defects in the medium voltage busbar systems, it is necessary to check and diagnose preventively during commissioning, technical revisions and current repairs.
3. Prophylactic checks on medium voltage busbar systems aim at continuous monitoring which purpose is the developing of a centralized database, which highlights the evolution over time of the operating state of these equipment and may prevent, on the basis of the interpretation of the reference values, the occurrence of emergency regimes.

## REFERENCES

[1] Instrucțiuni de exploatare a unui grup energetic cu puterea de 330 MW

[2] PE116/94- Normativ de încercări şi măsurători la echipamente şi instalaţii electrice

[3] STAS 6390-55- Suporturi izolante pentru instalaţii electrice. Condiţii generale.

[4] STAS 6391/1;2-86- Treceri pentru tensiuni alternative peste 100 V

[5] PE 101/85 - Normativ pentru construcţia instalaţiilor electrice de conexiuni şi transformare cu tensiuni pentru 1 kV.