ECOLOGICAL MEASURMENT-REPAIR VEHICLE FOR MAINTANANCE OF X/0.4 kV SUBSTATIONS

M. Radunović
O. Vidaković
PD for distribution of the electric power “Elektrovojvodina” d.o.o. Novi Sad
Electro distribution “Sombor”, Sombor
Serbia and Montenegro

SUMMARY

The mobile repair center for revision and maintenance of X/0.4 kV substations is the end of a project which begun with developing the independent device for voltage drop testing (IDVDT) which was presented at CIRED in the year 2000. in Herceg Novi. Mentioned device was developed as the phase one of this project. We have added the power invertors of 500 VA, the battery feeder of 12 V, the condensor device (NC) for protection function checking and the device for the substation oil check.

The advantage of this measuring vehicle compared to another with the same function is its ecological nature. All the solutions that we know of use diesel batteries as a power source for the measuring equipment. We use the standard 12 V battery with the bigger capacity. The equipment is placed in Yugo Florida pick-up.

Voltage fall measurement device possesses eight memory units which we can program in a different manner. Apart from 100 V current, DC for voltage fall measurement of 10 or 20 kV separators, we have also enabled for bimetal relay check. We memorize seven currents of different values and function times.

Invertors are used for feeding the NC devices which empty themselves into the spool while the protection and off-taster function check is on. If necessary, the dielectric penetrability of the substation oil can be checked at the spot. The vehicle is equipped with tools (drills, cutters) with small power, so that they can be powered by the built-in invertors.

Relays for the test cables of 25 meters have been made, and they are secured in transport. The inner installation has been made in a specific manner, so that all the devices can bee powered by the 220 VAC, weather from the invertors or from the feeding cable from the electric network, which enables refilling of the battery without having it removed from the vehicle.

Milan.Radunovic@so.ev.co.yu *025-24-399/231*

Measuring vehicle has been used and maintained by two workers who are capable to, in the short time, do all the necessary terrain measuring. When they come back, they plug in the feeding cable and regenerate the battery.

Key words: Mobile repair center, Substation, Ecology

INTRODUCTION

20/0.4 substations are used to conduct the electric power to the users. In our area, most of them are of the column-form, and have the separator from the high-voltage side, without the possibility of tree-pole malfunction adding-in (for the substations with less then 250 kVA, lately 400 kVA) and the low voltage drawer with the 0.4 kV substation field separators. Other substation either brick, tower-form or montage-concrete have 20 kV substation field separators with the electro magnet for turning off and the turning off system with a needle and the fuse. Low voltage drawers mainly have the separation device with protection. All the transformers are oil-type and have the Buholc relays and contact thermometers for currents greater than 160 kVA.

All the equipment underlay regular function checks and contact surface damage degree and also the eventual check of the oil dielectric penetrability. For this, the most appropriate are the mobile repair-measurement centers, which should enable all the necessary checks. Here, we will talk about a new solution with devices powered by a battery, unlike all other known to us, which use diesel-batteries. Our advantage is that we do not pollute the air make no noise.

PLANNED TESTS

On the 20 kV power separators, outflow and substation, the voltage drops are measured on the single-side current of 100 A. this way, we can determine the movement resistance and the quality of the contact surface, in order to act preventive. The continuity check of the protective current circles, the state check of the bimetal relay and the transformer field shutdown check by simulating all the protections and by the off-switch are performed. With mega om meter we check the isolation and the absorption score, and if need, the substation oil penetrability check is performed.

BUILT-IN EQUIPMENT

The measure vehicle must be operative for all the tasks on the 10 and 20/0.4 kV substations, either during maintenance and revision, or during damaging malfunctions and repairing the consequences. For this reason, together with standard electrician’s tools, we have some special tools for specific parts of the mobile equipment, minimum of spare parts and also:

-voltage fall measuring device

-invertors 500 VA

-battery feeder

-condensor device NC300

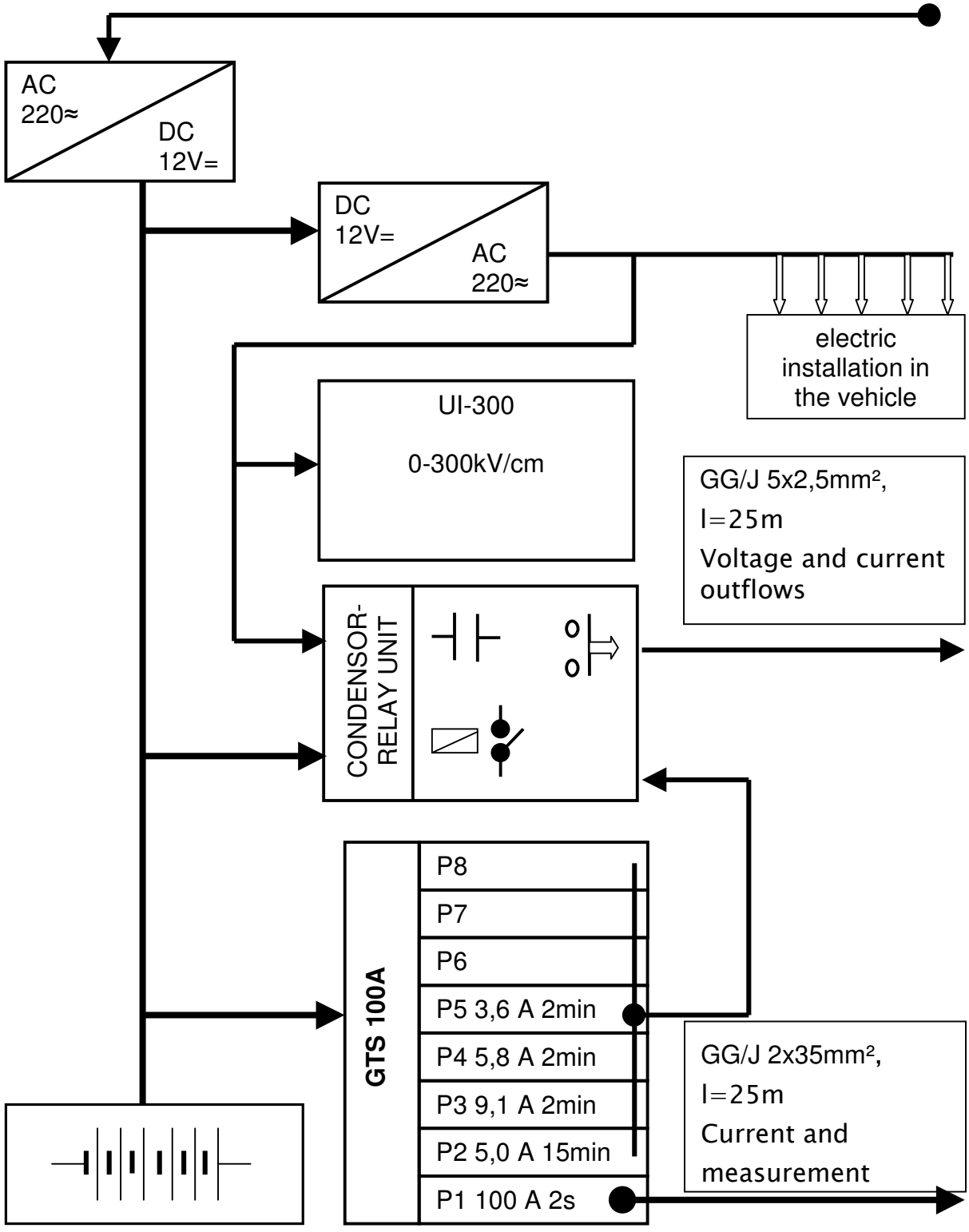
-static mega om meter

-the device for checking solidity of the substation oil

-battery 12 V, 96 Ah

Milan.Radunovic@so.ev.co.yu *025-24-399/231*

On the picture 1, a block scheme of the equipment built in the vehicle is shown.



Picture 1: The block scheme of the device

VOLTAGE FALL MEASURING DEVICE

The devce called GTS 300 has been develped on request of the Electrodistribution Sombor. It posesses eight memory units and can be programed on different current levels and function periods. The outgoing values are very precise, compaired to the entering. The current adjustment range is from 0 to 100 at the entering voltage from minimal 10 V and maximum 5 V on the outgoing. Feedin of the device and regulation of the test current is done with the starter led battery. On the display it shows the autgoing current and measured voltage. It has addings for the energetics and measurment.

In our measuring vehicle, we have fixed 25 meter cables. The instalation is built in and it is programed to measure voltage falls and bimetal relays check. It is used for revisions and remonting the 20/0.4 kV substations in voltageless state and checking the movable equipment on the 110/20 kV substations which mainly have home-like power, but the eqipment of the vehicle makes it suitable for this also.

Energy cables are connected by scissors on the separtor or switch poles and measuring cables which are schirmed worker can move as he wishes, so that can control movable and fixed contacts.

INVERTORS AND FEEDER

Invertors have power of 500 VA because we didn't want more batteries in the wehicle. It is powered from the same battery as GTS 100 A, and the outgoing voltage is powered through the substation oil solidity mesaurement device, the ploug and the condensor relay unit. In this unit comes the current from GTS 100 A device. From this point, voltage is linked behind the protection fuse on the low-voltage stations, current on the bimetal relay. The fuse gets turned off, so that the back-voltage on the transformer secondar and high voltage doesn't occur. This way, we are checking the bimetal protection, Buholc and overheating by simulation. The on-switch functionality is also being checked. Feeder has a fix connection for regenerating the battery, on the return from the terrain. It plougs in the ploug in the garage.

The inner look of the wehicle, and the wehicle itself is shown on picture 2.

Picture 2: Measurement-repair vehicle: inner look and wehicle itself

Milan.Radunovic@so.ev.co.yu 025-24-399/231

CONCLUSION

Mobile repair center for repair and revision of the substations is actively used in power distribution Sombor for four years. It enables train staff to do all the checks on transformers and movable equipment efectively and with high quaity an to perform all the necessary measures without any noise and polluting which diesel battery does. The possibility for memory build-up and reeding the data from terrain remains.

USED LITERATURE

1. M.Radunović, N. Pešalj, S. Stanković, CIRED 2000, “Independent device for voltage drop testing”,

2. S. Stanković,CIRED 2004, “Autonomous device for voltage drop measurement with memory extension for field work”,

Milan.Radunovic@so.ev.co.yu *025-24-399/231*