SUMMARY

The aim of this paper is to make utilities aware of the need to ensure greater safety for the employees responsible for operating a variety of MV switchgear in different housings, by improving the man/machine interface.

The variety of existing or future models, each with its own operating method and sometimes with multiple interlocks, can lead to confusion on the part of the operators. Their usage is modified since the active parts are no longer visible. While the manufacturers’ operating instructions may be clear, the operators still need to receive prior training. In case of doubt it is necessary for the operator to read the instructions carefully. This reading is not compatible with the rapid actions, essential for network exploitation.

This paper recommends the introduction of individual instruction panels, in which the steps for each type of MV equipment in operation are shown schematically, modified as necessary for each item of equipment, with the same, standardised symbols being used by all manufacturers.

The instructions panel explain by use of pictures, the steps for making electrical installations safe, as defined in standard EN 50110-1, and the different operations to realise them, so as to make them more intelligible to operators.

Thus in addition to the harmonised synoptic block diagrams present in the cabins, already adopted in 1999 (CIRED 99), these instructions panels give the clear local instructions, so that the instruction manual does not have to be read long and carefully for each operation.

In order to harmonise the indications on the instruction panels of different manufacturers, and to make them easier to understand by the operating personnel, Electrabel imposes symbols and colors to be used. The result is given on the paper.

The use of instruction panels not only raises the efficiency with which the operations are carried out, but also improves the safety of personnel, other persons and equipment.

The main manufacturers active on the Belgian market have already begun to produce these panels. These are systematically supplied with the equipment ordered both by the utilities and by their customers.

Example of instruction panel for the switch and switch-fuses combination functions
ABSTRACT

The aim of this paper is to make utilities aware of the need to ensure greater safety for the employees responsible for operating a variety of MV switchgear in different housings, by improving the man/machine interface.

The article describes the options chosen for standardising the actions performed and the controls used during application of the five safety rules according to EN 50110-1, and during particular operations. Finally, by way of example, it presents a drawing, which applies the rules proposed for a typical installation.

INTRODUCTION

While the frequency of industrial accidents has been lowered by the greater use of metal- or insulating-enclosed MV equipments, and by the general use of clearly laid-out, harmonised synoptic block diagrams, the risk of operating errors has still not been completely eliminated.

The variety of existing or future models, each with its own operating method and sometimes with multiple interlocks, can lead to confusion on the part of the operators. Their usage is modified since the active parts are no longer visible. While the manufacturers’ operating instructions may be clear, the operators still need to receive prior training. In case of doubt it is necessary for the operator to read the instructions carefully. This reading is not compatible with the rapid actions, essential for network exploitation.

The harmonization of synoptic block diagrams proposed at CIRED 1999 was necessary but do not give notice of the procedure for making the equipment safe in accordance with EN 50110-1.

This paper proposes the introduction of individual instruction panels, in which the steps for each type of MV equipment in operation are shown schematically, modified as necessary for each item of equipment, with the same, standardised symbols being used by all manufacturers.

REPRESENTATION OF THE SAFETY RULES

The steps for making electrical installations safe, as defined in standard EN 50110-1, can be summarised and blocked out so as to make them more intelligible to operators.

Efficiency is a basic concern for any company, requiring the use of precise terms and concise instructions.
INDIVIDUAL INSTRUCTION PANEL

The most frequent causes of accidents or incidents in MV cabins are inattention or lack of concentration on the part of the operator, due to the great diversity of man/machine interfaces. These differ not only from one function to another but also between models from the same manufacturers, and alas even between successive versions of the same model. Thus in addition to the harmonised synoptic block diagrams present in the cabins, already adopted in 1999 (CIRED 99), clear instructions have to be displayed locally, otherwise the instruction manual has to be read long and carefully for each operation.

The main differences between the various man/machine interfaces concern:

- the accessories used for the different operations;
- the type and shape of the opening to introduce for these accessories;
- the position indicators;
- the locking devices;
- the direction of operation of the accessories;
- the particular operations (checking the phase correspondence, replacing fuses, carrying out measurements at the MV cable terminals, adjusting the trip settings for the safety relays, etc.).

Accordingly, for each of the steps in the safety rules, the instruction panel shows how the necessary operations have to be carried out, and in what order. Each step is indicated by the pictogram from the “5 Golden Rules” poster, in monochrome version.

Proposed principles

The panel only applies to the operations for taking the equipment out of operation and making it available for work to be carried out in safety.

Since Belgium is a multilingual country, the panel does not include any text apart from the manufacturer’s name and the model, in order to make it universal.

In principle, there should be a separate panel for each function. These are represented by the following letters:

- K = switch
- T = switch-fuses combination
- D = circuit breaker
- P = potential.

However, given the similarity in function between a switch (K) and switch-fuses combination (T), a single panel for both of these is justified, especially as these two functions are the most common.

The following are shown in blue:

- the actions of opening and closing the MV devices, showing their direction of movement, with the accessory to be manipulated shown in dotted lines in its initial position and in full lines in its final position;
- locking actions;
- the accessories that have been removed (fuses, access panel for the cable or fuse compartment, etc.);
- the symbol for visual check (eye and direction of look);
- the order of operations (numbered) for each stage of the making-safe.

The following are shown in yellow:

- the position indicators;
- the measuring or checking devices (position indicator, voltage presence tester, phase correspondence checker, or specific device for cable testing or current injection).

The panel “forbidden to be manipulated” is always shown in red.

When the panel giving access to the cable compartment is open, the compartment is drawn in perspective to show the available space to work in. In enclosed equipment, marking the accessible area is realised by removing the front access panel.

In the case of equipment where there is no separation between bays, conventional marking by means of panels or warning tape must be shown. In order to harmonise the indications on the instruction panels of different manufacturers, and to make them easier to understand by the operating personnel, obligatory symbols are used to represent the different testing devices for the procedures. These are shown in the examples at the end of the paper.

CONCLUSION

The use of instruction panels not only raises the efficiency with which the operations are carried out, but also improves the safety of personnel, other persons and equipment.

Since the Belgian market is very open and moreover multilingual, the main manufacturers have already begun to produce these panels. These are systematically supplied with the equipment ordered both by the utilities and by their customers.

PRACTICAL EXAMPLES

Here we have some examples of panels for different functions corresponding to the equipment shown in the photograph at the end of the paper.

Example of instruction panel for the switch and switch-fuses combination functions
Example of instruction panel for the circuit breaker function
Example of MV metal-enclosed equipment