Summary

Installing AMI equipment on pole MV/LV substations with the live working technology is an interesting alternative to the performance of such work with voltage disconnected. No additional expenditures are necessary, because it is based on existing live working technologies applied in MV overhead lines with a lift and an insulation arm as well as the live working technology applied in LV distribution equipment. This technology will certainly improve the SAIDI index significantly; however, in order to get even better effects in this regard, an insulated shunt has to be designed that makes it possible to shunt the LV cable bridge of a MV/LV pole substation for the period of its disconnection from transformer terminals.

REFERENCES
Technical Reports:

Papers from Conference Proceedings (Published):

Webpages:

Polish electricians individual 2nd grade equipment to protect against the thermal hazards of electric arc according to PN-EN 61482

Indywidualne wyposażenie polskich monterów-elektryków w odzież 2 kl. ochrony przed zagrożeniami termicznymi spowodowanymi łukiem elektrycznym zgodnie z normą PN-EN 61482

Statistics of electric hazards

For many years the Association of Polish Electricians is deeply involved in issues related to safe operation of electric and power equipment and systems, including safety of both professional personnel and regular users.

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2) Bogumil Dudek (e-mail: bogumil.dudek@wp.pl).
installation of electric equipment and systems or improper operation of the same.

Figures related to the number of fatalities due to electric shocks and the number of fires in various buildings in Poland are collected, structured, and analyzed by the Institute of Building Technologies (ITB) on the basis of information received annually from such organizations as the Central Statistical Office (GUS), State Labour Inspection (PIP) and the Headquarter of State Fire Brigades.

The completed analyzes demonstrate that the annual number of fatalities due to electric shock per one million of people in Poland dropped down from 9.5 over the years from 1980 to 1985 to 3.8 for the time period 2000-2011 with the trend to further reduction during subsequent years. However, the number of fatalities associated with electric shocks still remains in Poland by two or three times higher than in other countries of European Union.

The statistics of fatalities at work caused by electric shocks in Poland from 2001 to 2011 is outlined in the Table 1.

However, there are still too many such accidents and it is indispensable to further eliminate them or mitigate their consequences, in particular with regard to professional personnel who deal with operation of electric equipment.

Safety of equipment users is a separate category of activities where Polish representative of the Association of Polish Electricians (SEP) are deeply involved in efforts of numerous initiatives with other organizations as the Central Statistical Office (GUS), State Labour Inspection (PIP) and the Headquarter of State Fire Brigades.

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Use of preventive means and measures intended to protect against thermal effect of electric arc flash

Various Committees of the Association of Polish Electricians are concerned with safety of personnel employed at companies that deal with professional electric power engineering. For such people various technical means are developed to enable execution of jobs with live equipment, whilst training programs for them benefit from achievements of behavioral psychology and are in line with guidelines and manuals issued by Electric Section of International Social Security Association (ISSA) that collaborates with the Central Institute for Labour Protection – National Research Institute (CIOP-PIB). It is expected that benefiting from the most advanced foreign experience shall enable more efficient collaboration and bring together all electric professionals who are keen on activities for sake of common safety and improvement of labour standards.

The safety measures intended to improve protection of personnel health and life were discussed during the ICOLIM’2011 conference in Croatia [2], [3], [4]. The paper [2] presented by Polish delegates covered also the issues of furnishing the professional personnel in Poland with protective means suitable for 1st grade protection against thermal effects of thermal arc flash. Further efforts in improvement of those protective means brought fruits in participation of a Polish representative in the editorial board that has prepared the second issue of the ISSA guideline [1] devoted to examination of personal protective equipment of both first and second class of protection and providing references to corresponding American and European investigations.

Lack of personal protective equipment meeting requirements of the second protection grade and suitable for electric professionals triggered many research studies and measurements that have led to development of a helmet that protects both faces and heads of working personnel. The analysis covered several types of safeguarding shields and finally an option was selected that meets criteria of thermal protection, which is illustrated in attached pictures.

Table 1

<table>
<thead>
<tr>
<th>Years</th>
<th>Number of fatalities at work caused by electric shocks</th>
<th>Percentage of the total at work fatalities, %</th>
<th>Percentage of the total fatalities associated with electric shocks, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>21</td>
<td>3.8</td>
<td>11.8</td>
</tr>
<tr>
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<td>3.4</td>
<td>10.8</td>
</tr>
<tr>
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<td>20</td>
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<tr>
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<td>10</td>
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<tr>
<td>2011</td>
<td>27</td>
<td>3.3</td>
<td>20.3</td>
</tr>
</tbody>
</table>

Development of requirements to helmets with regard to protection against thermal effect of thermal arc flash was directed by the following standards:

• EN 397:2012 „Industrial safety helmets”
• EN 50365:2002 „Electrically insulating helmets for use on low voltage installations”
• EN 166:2001 „Personal eye-protection – Specification”
• GS-ET-29:2011-05 „Supplementary requirements for the testing and certification of face shields for electrical works”.

The investigations were carried out for several types of face shields that were subjected to tests according to requirements of the GS-ET-29 code and included so called box test that for the equipment of the second protection grade imposes the resistance to the impact of 423 kJ/m2 and immunity to the short fault current of 7 kA and duration of 0.5 sec. The plans for the 1st quarter of 2014 foresee tests according to the American standard ASTM F2178 with the aim to determine the Arc Thermal Performance Value (ATPV) coefficient.

Hence, one can say that a helmet with a face shield that meets requirements of the second protection grade is already available.
Live working PPE – arc flash safety helmet; the results Fig.1-6

- **Fig. 1.** Box Test method

- **Fig. 2.** ATPV test method

- **Fig. 3.** Differences in testing method ATPV and Box Test

- **Fig. 4.** The first helmet design for test of resistance to electric arc (2 class) – result: test was failed (readout from 4 calorimeters should be below the Stoll curve)

- **Fig. 5.** The second helmet design for test of resistance to electric arc (2 class) - changing cover the neck – result: test was failed

- **Fig. 6.** The third helmet design for test of resistance to electric arc (2 class) – new design cover the neck – result: test was passed
REFERENCES

[1] ISSA Guideline for the selection of personal protective equipment when expose to the thermal effects of an electric fault arc, 2nd Edition 2011


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Concept of installation of cable terminations on 110-400 kV live line poles

Koncepcja montażu pod napięciem głowic kablowych końcowych na słupach linii 110-400 kV

Introduction

Modernization and reconstruction projects of overhead lines, ranging between 110 and 400 kV, are related to intensive expansion of infrastructure in our country in recent years. It applies in particular to construction of roads, railroads, sports and cultural facilities, including highways, sports stadiums, which leads to installation of cables on various lengths of sections, which frequently enter dense built-up areas of urban agglomerations. Expanded infrastructure, formal-legal regulations cause difficulties to acquire land for overhead lines. Therefore, despite higher costs, projects involve installation of 110-400kV cable lines more often than in the past [1],[6],[7]. The most frequent projects involve construction of 110kV cable lines, which cost is nearly twice as high as overhead lines. Installation of cable lines requires high quality installation works, including terminations on line poles and support structures of stations.

In order to avoid inconvenient outages, electrical companies conduct concept works in order to install heads on live lines. These works are described in this report. It discusses the principles of occupational safety and the risk involved in this type of works.

What to build – overhead or cable lines?

At first glance, cable line looks better than overhead line. However, collecting opinions about environmental impact of the line is not that unequivocal. In addition, high cost of line construction plays an important role as well. It is reflected in the cost of electricity, for which consumers want to pay as little as possible. Equally important are formal and technical aspects due to the growing density of infrastructure. Despite the fact that the number of overhead lines will continue to dominate, cable lines will be built more often. Their installation frequently faces problems related to performance of works with uninterrupted power supply to consumers or cutting the time of outages to minimum. Without live-line working technology, effectiveness of these works would be very low.