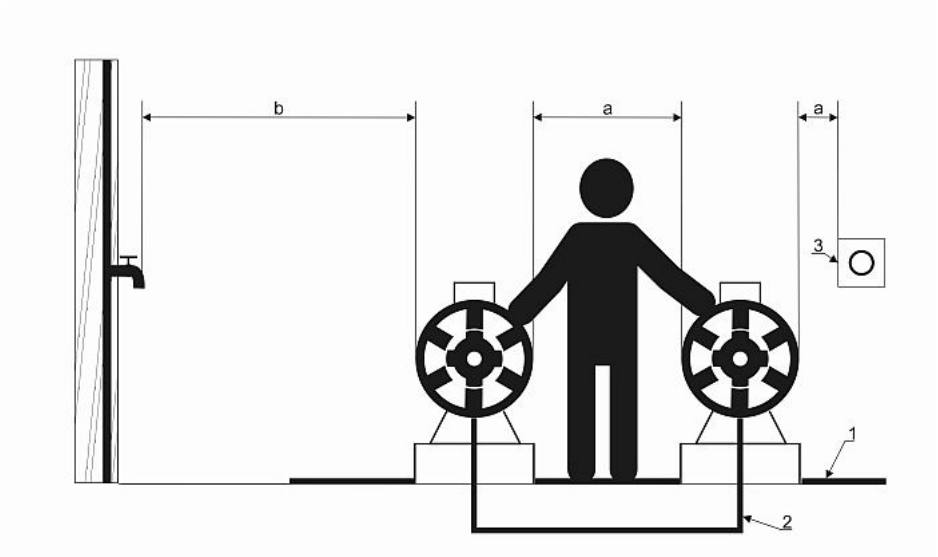
Properly performed acceptance and periodic tests of electrical installations, where protection against electrical shock is based on test stand insulation, require a report on floor and wall resistance/impedance measurements. Bearing in mind accepted rules and technical knowledge, an experienced tester will need special tools, i.e. PRS-1 [1] resistance test probe and MIC insulation resistance meter. Our three-way PRS-1 [1] test probe, in the shape of an equilateral triangle, has been made in accordance with the requirements contained in HD 60364-6 and EN 1081 standards. The test probe legs are made with a suitable rubber grade ensuring a leg volume resistance of R < 5 kΩ and hardness within 50 to 70 IRHD. Such a design, with the required probe pressure, ensures approx. 900 mm2 of contact area with the tested surface.

[2]

Fig.1 PRS-1 test probe.

Effective insulation of test stands.
Effective protection ensured by the reduction of floor and wall conductivity should provide such operating conditions so that the worker is not exposed to the risk of contact with potentials other than the potential of defective equipment, i.e. hazardous electrical shock currents.



[3]

Fig. 2. Insulated test stand where: 1- insulated pathway, 2- potential equalization conductor,

3- insulating shield, a≤2m – distance between items reached from the test stand,
b>2m – distance to items that are outside the reach of test stand.

Such a solution is based on the insulation of the test stand from the ground and equalizing the potentials of conductive parts (using non-earthed equipotential bonding) which are not a part of the electrical circuit to supply the test stand (fig-2).

If external conductive parts can be reached from the test stand within a distance

< 2 m, insulating shields with at least a 2 kV electrical rating should be provided.

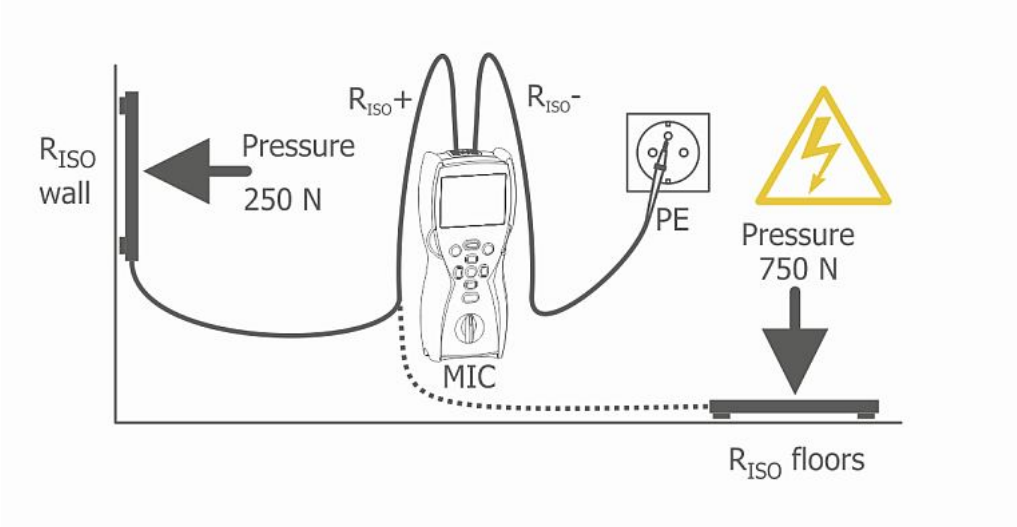
This condition can be precisely verified with a MIC-2510 insulation resistance meter, which allows adjustments of the measuring voltage within a range of 50-2500 V in 10 V steps. The use of a barrier made with conductive materials requires it to be insulated from the ground and accessible conductive parts. If floor and/or wall insulation is missing or ineffective, the electrical shock current can reach:

$$I_R = \frac{Un}{Rc + Rp.} = \frac{230[V]}{1000\Omega + 2000\Omega} = 76mA$$

where: Rc- human body resistance, Rp- floor resistance.

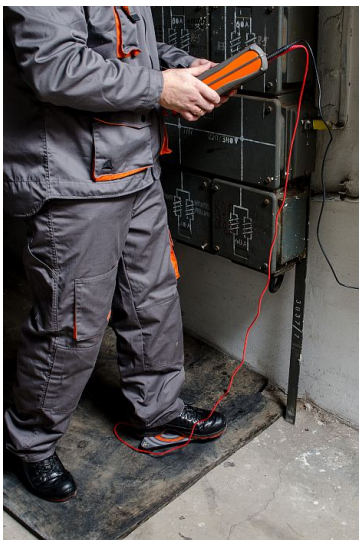
If floor resistance is higher, e.g. >50 kΩ, the electrical shock current is reduced to < 10mA, which is the threshold of current self-release, i.e. current for which it is still possible to overcome the muscular contraction and forcing the fingers apart.

Professional attitude
Assessment of the effectiveness of the described solution recommends (see HD 60364-4-41) resistance measurements on floors and walls, for which the resistance/impedance in any measuring point should not be lower than 50 kΩ at 500 V of the test voltage for the nominal system voltage of up to 500 V and 100 kΩ at 1000 V of the test voltage for the nominal system voltage higher than 500 V. Resistance measurements should be made at three various points of the floor and wall in the tested room. At least one of these measurements, both for the floor and the wall, should be made at a distance of up to 1m from external conductive parts, e.g.: radiators or water taps, while other measurements should be made at greater distances. When using the MIC-10 [4] tester and PRS-1 [1] test probe, the user can check surface resistance 60 s after applying the test voltage. If the measured resistance at every point is lower than the values indicated above, the floors and walls are considered as external conductive parts for the purpose of the electrical shock protection.



[5]

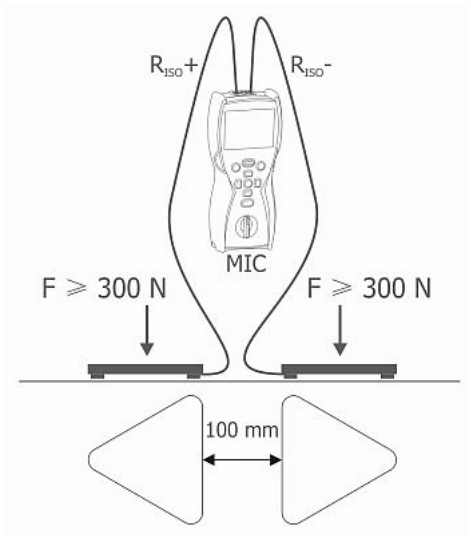
[6]



[7]

Fig. 3. Resistance measurement on floor or wall with the PE conductor in use.

Considering the fact that contaminated surfaces have an influence on the measurement results, it is necessary to remember that the floor should be cleaned with a cleaning solution (ethanol or isopropanol recommended) before testing. Besides the floor and wall resistance/impedance measurements, the PRS-1 [1] probe also allows the user to check the volume resistance of insulating materials (e.g. linings) and the surface resistance in a two-electrode configuration. The tester, using two PRS-1 [1] probes, can easily and quickly determine the surface resistance based on the guidelines included in EN 1081. (Fig. 4 or photographs).

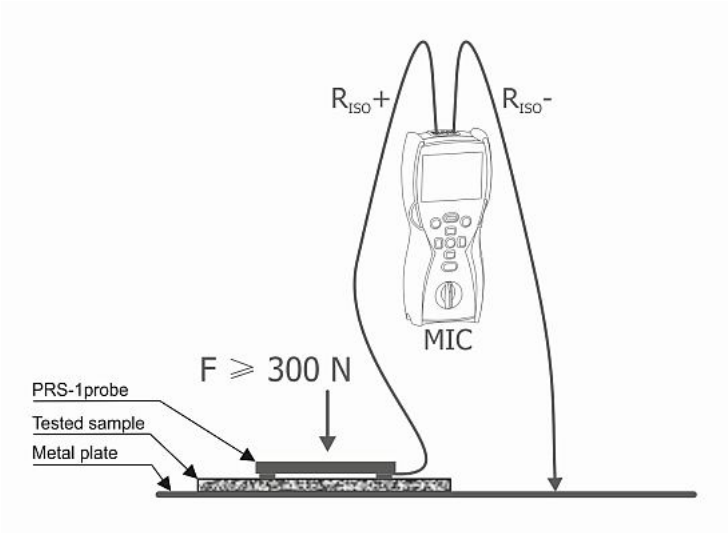


[8]

[9]

Fig. 4. Surface resistance measurements using two PRS-1 test probes.

In accordance with the mentioned standard, the PRS-1 [1] test probe can also be used to determine the volume resistance by placing a sample (for example a resilient lining) between the PRS-1 electrode and a metal plate. However, the pressure exerted on the probe electrode must be equal to the force F≥ 300 N. If an even load is applied to the electrode, correct measurements will ensue.



[10]

When performing measurements with the use of Sonel brand instruments, the user can be sure that the tests which are performed represent the actual quality and physical parameters of the tested surfaces, which directly