

# Electrical safety measurement of the dialysis equipment

In case of major kidney deficiencies the kidneys functions are replaced artificially using a specialized apparatus (dialysis apparatus). The extracorporeal epuration is based on the transfer of the substances through one semi permeable membrane between the blood and the dialysis liquid which are circulated in the dialyzer. The dialysis liquid is prepared by the dialysis apparatus using concentrated active liquids and water for hemodialysis. The epuration of the blood takes place outside of the human body in the dialyzer, which is connected, to the dialysis apparatus and to the patient by an extracorporeal circuit.

Due to the composition of the dialysis liquid, which has conductive properties during hemodialysis, it is possible that electric current flows from or to the machine if a difference in electrical potential occurs. The major problem is that this may cause a health risk for the patient. During dialysis the patients are exposed to a permanent risk since their blood is circulated and filtered outside from their body, therefore it is very important to identify these risks for the patients and realize a permanent quality control to avoid these risks.

One of the quality and risk management methods can be the electrical safety test of the used device (dialysis apparatus in the presented situation). To realize the electrical safety test for dialysis apparatus the following electrical schema is presented, with MD as measurement device, as shown in Fig. 1. Using the presented testing circuit the following experimental results was obtained, as shown in Tab.

Tab. 1. Experimental results

Tested parameters	Limit values	Measured values	Observation
Isolation resistance	> 200 MW	300 MW	Test ok
Lake current to the ground	500 mA	106 mA	Test ok
Lake current to the frame	500 mA	106 mA	Test ok
Lake current to the patient	500 mA	93 mA	Test ok
Absorbed current	-----	186 mA	Test ok

## Conclusions:

The dialysis liquid is an electrical conductor so it can deliver accidental electrical currents from the dialysis apparatus to the patient, which may cause a health risk for the patient. Therefore, it is necessary to verify the electrical safety of the dialysis apparatus by the dialysis technicians with a specifically measurement instrument (electrical safety analyzer) using an adequate measurement circuit. It is recommended that after all technical interventions are added to the dialysis apparatus, a control test must be carried out on all its functions. This test is followed by the specifically disinfection procedures, which has the major objective to achieve adequate safety of the patient by the dialysis apparatus and the water treatment system. The greatest risk may occur when the patient also is connected to other electric devices with current leakage.

## Selected publications on the topic:

Ianosi Endre: Considerations about electrical safety in the dialysis process – Annals of 21thDAAAM World Symposium 2010, University of Zadar, 20-23 Oct. Zadar -HR, ISBN 978-3-901509-73-5, pp 915-916.

\*\*\* Standard IEC 60601-1-1: Medical electrical equipment-Part 1-1: General requirements for safety - Safety requirements for medical electrical systems

Ianosi Endre : Dialysis apparatus. Constructive elements and specific measurement methods(in romanian) - Ed. Politehnica Timișoara, 2003, ISBN 973-625-087-3.