



Ottawa Police Service and the Submerged ZOLL AED Plus

Constable Rick Giroux of the Ottawa Police Service is assigned to the harbor patrol. His boat is outfitted with a ZOLL AED Plus™ automated external defibrillator (AED). He recalls a rather unique situation back in October that involved this AED.

“Our patrol boat was docked because of an impending hurricane,” said Giroux. “We had a pump going inside the boat to prevent it from sinking. Once the storm hit, however, the pump failed, and the boat took on water.”

As the boat filled with water, it flipped over and ripped the cleats right off the pier. Although the boat didn’t sink, all the equipment, including the AED Plus, was submerged for four hours.

After the hurricane, Giroux said that a Marine Patrol Officer removed the waterlogged AED, attempted to turn it on, and found that it worked fine. Giroux then brought it to the Biomedical Department of the Ottawa Paramedics Service, which took it out of service, despite the fact that it was still functioning. They sent the soaked AED to ZOLL Medical Corporation’s Technical Service Department for inspection.

ZOLL’s technical team performed extensive environmental and operational testing on the AED Plus, which proved the AED was fully functional. Without hesitation, ZOLL Technical Service recertified the AED Plus for use in the field.

The ZOLL AED Plus has been tested for particle and water ingress, and has received a rating of IP55. It has the highest rating of any AED available today.

At ZOLL, our claims for meeting these test specifications are conservative. The experience of the Ottawa Police Service shows that in some cases, the AED Plus can survive hours of complete submersion without any loss of functionality.

Ingress Protection

A worldwide standard has been established by the International Electrotechnical Commission (IEC) for comparing the ability of electronic devices to withstand exposure to dust and liquids. The IEC describes its mission to be

...the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies. These serve as a basis for national standardization and as references when drafting international tenders and contracts. Through its members, the IEC promotes international cooperation on all questions of electrotechnical standardization and related matters, such as the assessment of conformity to standards, in the fields of electricity, electronics and related technologies. [Quoted from the IEC web site.]

The ratings established by the IEC for resistance to particulate and liquid matter are called “Ingress Protection” or “IP” ratings, and are defined by IEC 60529, *Degrees of protection provided by enclosures ("IP" Code)*, for all IP Codes.

A full rating contains two digits, each of which can take a value of 1 through 6. The first measures the ability of the device to resist the ingress of foreign objects, or dust. The second measures the ability to resist the ingress of moisture. The first digit can have a value from 1 to 6, the second a value of 1 to 8. The higher the number, the better the protection. The lowest combined rating would be IP11; the highest would be IP68.



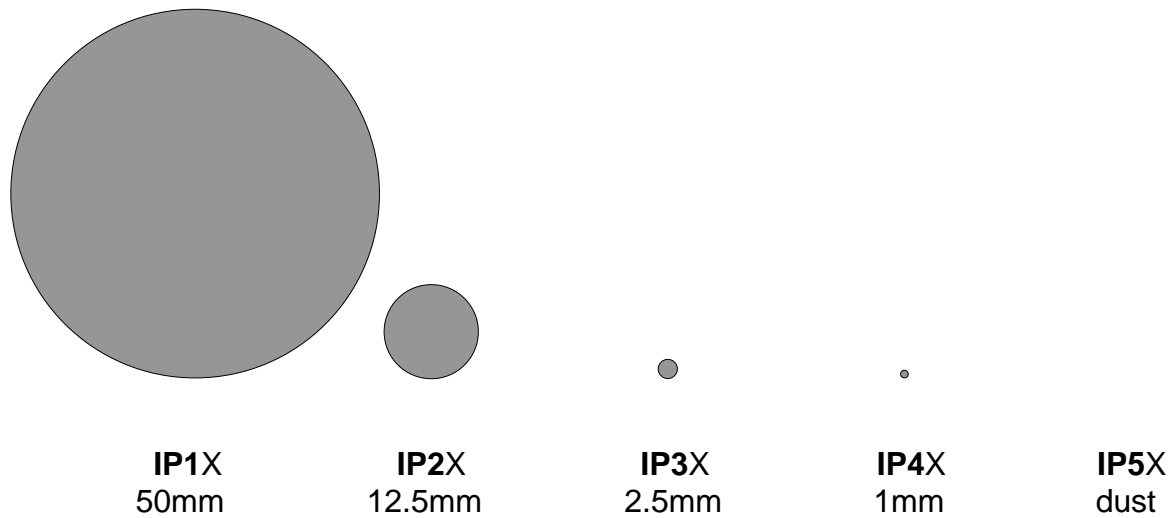
Where a device has not been rated for either dust or water, an “X” is substituted for the digit. Thus a device, like Med-ronic’s CR Plus, with a rating of IPX4, has not been tested and rated for its ability to resist dust, while its rating for moisture ingress is 4.

So what do the different digit values mean? The table below was developed by Underwriter’s Laboratory (UL) to explain the Ingress Protection code values, as specified in the IEC 60529 standard.

IP Ratings Explained by Underwriters Laboratories (UL)

1st Digit	Protection Against Foreign Objects	2nd Digit	Protection Against Moisture
0	Not protected	0	Not protected
1	Protected against objects greater than 50mm	1	Protected against dripping water
2	Protected against objects greater than 12mm	2	Protected against dripping water when tilted up to 15°N
3	Protected against objects greater than 2.5mm	3	Protected against spraying water
4	Protected against objects greater than 1.0mm	4	Protected against splashing water
5	Dust protected	5	Protected against water jets
6	Dust tight	6	Protected against heavy seas
		7	Protected against the effects of immersion
		8	Complete protection against submersion

To get some notion of how big the “foreign objects” being described in each of these ratings really are, the diagram below shows actual particle sizes.



This means that an AED like the Philips HeartStart OnSite, because it has a rating of IP21, is in danger of being compromised by a small pebble about ½ inch in diameter.

Only one other public access AED has as an IP rating for particulate matter at five: the Philips FR2+.

All other public access AEDs can be incapacitated by any foreign object smaller than the little 1 mm dot above. If there is any dust or spraying water present in your environment, and you don’t have an AED Plus, you’re running a risk that when you need your AED, it may not work. The table below lists the IP ratings of all of ZOLL’s competitors.

Ingress Protection Comparison

ZOLL AED Plus	Medtronic LIFEPAK CR Plus	Medtronic LIFEPAK 500	Philips HeartStart OnSite	Philips HeartStart FR2+	Cardiac Science Powerheart G3	Welch Allyn AED10
IP55	IPX4	IPX4	IP21	IP54	IP24	IP24