

# Ingress Protection Case Study #2

## ZOLL® AED PRO® VS. LAKE GRAPEVINE

### Routine Boating Exercise Proves Anything But Routine



## The Story

Flower Mound Police Department and Fire and Emergency Services Department were conducting training exercises on Lake Grapevine near the Dallas/Ft. Worth area. The training involved a 22-ft boat both departments use to help maintain order on one of the busiest recreational lakes in the area.

One training maneuver is to reverse the boat at high speed. As a Flower Mound police sergeant undertook this maneuver, the boat began to take on water at the stern. Load distribution of the other passengers was inappropriate, resulting in the boat listing to the right side. As the water continued to spill over the stern, the list increased. Before it could be corrected, the boat capsized, sending all aboard into Lake Grapevine.

Officers on a nearby boat called for assistance. "I was meeting with the city manager when the call came in," said Scott Mitchell, Flower Mound's Assistant Fire Chief. "We responded to the scene in about 15 minutes. All parties were wearing floatation devices and escaped unscathed—unfortunately, I can't say the same for the equipment."

Grapevine Fire/Rescue towed the capsized boat to a marina. Five long hours later, a salvage crew finally righted the boat using air bags.

Chief Mitchell noted, "The good news was that some of the equipment was fastened down and in watertight cases. The bad news was that even though our new \$3,700 ZOLL AED Pro was fastened down, it wasn't in a watertight case and it was submerged for over five hours."

As a salvage crew member handed him the AED Pro's canvas bag, Lake Grapevine came pouring out of it. Chief Mitchell opened the case to find a waterlogged set of electrodes and emergency kit.

Fortunately, nothing indicated that water had gotten into the AED Pro itself. The AED Pro has been tested for particle and water ingress, and has a rating of IP55—the highest rating of any AED available today. "I fired it right up and it went into its self-check," said Chief Mitchell. "It presented itself as good to go. I was really quite impressed that the AED Pro worked as advertised."

Just to be safe, Chief Mitchell had the AED Pro sent back to ZOLL to have it evaluated by technical services. The AED Pro unit passed all tests and was released to go back into service.



# Ingress Protection



## Definition

A worldwide standard has been established by the International Electrotechnical Commission (IEC) for comparing the ability of electronic devices to withstand exposure to dust particles and water. 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.*

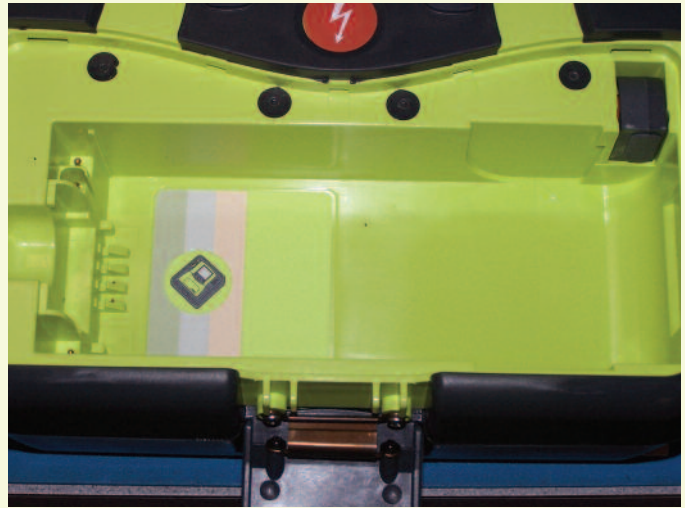
*[Quoted from the IEC website.]*

The ratings established by the IEC for resistance to particulates and water 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 Medtronic's CR Plus, with a rating of IPX4, has not been tested and rated for its ability to resist dust, while its rating for water 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.

First Digit	Protection Against Foreign Objects	Second 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



*Flower Mound's AED Pro in the ZOLL Tech Services Lab unopened.*



*Initial inspection of the battery well shows no signs of water damage.*



*Opening the device for the first time since it was submerged.*



*No water damage as the device is opened.*



*No water damage to the inner electronics.*



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