

IP Ratings in Practice — What IP54, IP65, IP66, IP67 and IP69K Really Promise

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Decoding the two IP digits honestly — dust versus water, jets versus immersion versus steam — why IP67 is not automatically better than IP66 outdoors, cable glands and caps as the real weak points, and stocked examples from sensors to controllers at each class.

The two digits

First digit = solids: 5 is dust-protected (ingress not fully prevented, no harmful deposit), 6 is dust-tight. Second digit = water, and the water scale is not cumulative in the way intuition suggests: 4 = splashes any direction; 5 = jets; 6 = powerful jets/heavy seas; 7 = temporary immersion (0.15–1 m, 30 min); 9K (per its own test) = high-pressure, high-temperature spray at close range. The catch engineers trip over: 7 is a static immersion test — a device can pass IP67 and fail IP66's dynamic jets, which is why washdown and deck equipment often specifies IP66 and 67 (or 69K), and why 'higher number = better' is only true within a test family.

Mapping classes to places

Class | Honest meaning | Stocked examples |

IP20 | Finger-safe, indoor panel | Contact blocks (ZBE5023), DIN electronics |

IP54 | Dust-protected, splash | Pressure switches (XMXA06, IP54) |

IP65 | Dust-tight, jets | Wall controllers (SmartCella IP65), limit switches |

IP66/IP67 | Heavy jets / immersion | Sensors and safety switches (XCSDMP, IP66, M12; M12 cordsets at IP67 — connector guide) |

IP69K | Close-range hot high-pressure washdown | Food-industry sensor/cordset classes (per listing) |

IP50 | Dust-protected only | Sensing bars (XUY420, IP50) — indoor conveyors |

The rating is a system property

An IP66 enclosure with a hand-tightened gland is an IP40 assembly. The weak points, in field order: cable glands (sized to the cable OD, torqued, with the sealing insert actually present), unused entries (plugged with rated plugs, not tape), connector caps (an unmated M12 is open — cap it), drain/breather choices (sealed boxes in cycling temperatures pump moisture: climate-matched breather or heater beats 'more sealing'), and lids (missing screws, perished gaskets). When specifying, carry the rating through: device, gland, cable, and the installer's torque wrench.

Environment beyond IP

IP says nothing about corrosion: a dust-tight zinc box still rusts at the coast — pair IP with material class (corrosion guide).

Nor temperature: freezer-room devices need their low-temp rating (the TF sensor versions in the inductive guide) regardless of IP.

Nor chemistry: washdown detergents attack seal elastomers — IP69K families specify the compatible chemistry.

UV and mechanical (IK) ratings complete outdoor specifications; protective covers for exposed instruments (light-curtain covers, ultrasonic covers) extend real-world life beyond what IP alone measures.

Specification habit that prevents warranty fights: write the IP class and the test family you actually need ('IP66/67', 'IP69K washdown side only'), name the gland standard, and photograph the finished penetrations at handover. Most 'IP failures' in service were installation decisions, and the photographs settle whose.

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