OAKTON® TECH TIPS

NEC, IP and NEMA/IEC Ratings

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National Electrical Code (NEC) Ratings

Hazardous Classifications:

CLASS I:
Areas in which flammable gases or vapors may be present in the air in sufficient quantities to be explosive

Group A: Atmospheres containing acetylene

Group B: Atmospheres such as butadiene, ethylene oxide, propylene oxide, acrolein, or hydrogen (or gases or vapors equivalent in hazard to hydrogen, such as manufactured gas)

Group C: Atmospheres such as cyclopropane, ethyl ether, ethylene, or gas or vapors of equivalent hazard

Group D: Atmospheres such as acetone, alcohol, ammonia, benzene, benzol, butane, gasoline, hexane, lacquer solvent vapors, naphtha, natural gas, propane, or gas or vapors of equivalent hazard

CLASS II:
Areas made hazardous by the presence of combustible dust

Group E: Atmospheres containing combustible
1) metal dusts, regardless of resistivity
2) dust of similarly hazardous characteristics having a resistivity less than 100 kΩ-cm
3) electrically conductive dusts

Group F: Atmospheres containing combustible
1) carbon black, charcoal, or coke dusts having more than 8% total volatile material
2) dusts so sensitized that they present an explosion hazard, and dusts having a resistivity greater than 100 Ω-cm but less than or equal to 1 x 108 Ω-cm

Group G: Atmospheres containing combustible
1) dust having resistivity equal to or greater than 100 kΩ-cm
2) electrically nonconductive dusts

CLASS III:
Areas made hazardous by the presence of easily ignitable fibers or dust, but which are not likely to be in suspension in the air in quan- tities that are sufficient to ignite

Division 1: Atmospheres where hazardous concentrations exist continuously, intermittently, or periodically under normal operating conditions

Division 2: Atmospheres where hazardous concentrations exist only in case of accidental rupture or breakdown of equipment

Explosion-proof:
Enclosures or housings are designed to withstand internal explosions and prevent the spread of fire to the outside.

Intrinsically-safe:
Systems designed in which electrical energy in the circuits is not present at levels that would ignite a flammable mixture of a gas and air.

International Protection (IP) Ratings

The IP rating system provides a means of classifying the degrees of protection from solid objects and liquids afforded by electrical equipment and enclosures. The system is recognized in most European countries and is set out in a number of British and European standards.These include: Classification of Degrees of Protection Provided by Enclosures, BS (British Standards) 5490:1977; IEC (International Electrotechnical Commission) 529:1976. Specifications for Degrees of Protection of Enclosures of Switchgear and Control Gear for voltages up to and including 1000 VAC and 1200 VDC, BS 5420:1977; and IEC 144:1963.

First number

Protection against solid objects

0 no protection

1 protected against solid objects up to 50 mm (e.g. accidental touch by hands)

5 protected against dust-limited to ingress (no harmful deposits)

6 totally protected against dust

Second number

Protection against liquids

0 no protection

1 protected against vertically falling drops of water (e.g. condensation)

2 protected against direct sprays of water up to 15° from the vertical

4 protected against water sprayed from all directions—limited ingress permitted

6 protected against strong jets of water—limited ingress permitted (e.g. for use on ship decks)

7 protected against the effects of immersion between 15 cm and 1m

NEMA/IEC Enclosure Ratings

NEMA enclosure type no.	NEMA definition	IEC enclosure class
1	General-purpose. Protects against dust, light, and indirect splashing but is not dust-tight; primarily prevents contact with live parts; used indoors and under normal atmospheric conditions.	IP10
2	Drip-tight. Similar to Type 1 but with addition of drip shields; used where condensation may be severe (as in cooling rooms and laundries). (as in cooling rooms and laundries).	IP11
3 and 3S	Weather-resistant. Protects against weather hazards such as rain and sleet; used outdoors on ship docks, in construction work, and in tunnels and subways	IP54
3R	Intended for outdoor use. Provides a degree of protection against falling rain and ice formation. Meets rod entry, rain, external icing, and rust-resistance design tests.	IP14
4 and 4X	Watertight (weatherproof). Must exclude at least 65 GPM of water from 1-in. nozzle delivered from a distance not less than 10 ft for 5 min. Used outdoors on ship docks, in dairies, and in breweries.	IP56
5	Dust-tight. Provided with gaskets or equivalent to exclude dust; used in steel mills and cement plants.	IP52
6 and 6P	Submersible. Design depends on specified conditions of pressure and time; submersible in water; used in quarries, mines, and manholes.	IP67
7	Hazardous. For indoor use in Class I, Groups A, B, C, and D environments as defined in the NEC.	—
8	Hazardous. For indoor and outdoor use in locations classified as Class I, Groups A, B, C, and D as defined in the NEC.	—
9	Hazardous. For indoor and outdoor use in locations classified as Class II, Groups E, F, or G as defined in the NEC.	—
10	MSHA. Meets the requirements of the Mine Safety and Health Administration, 30 CFR Part 18 (1978).	—
11	General-purpose. Protects against the corrosive effects of liquids and gases. Meets drip and corrosion-resistance tests.	—
12 and 12K	General-purpose. Intended for indoor use, provides some protection against dust, falling dirt, and dripping noncorrosive liquids. Meets drip, dust, and rust resistance tests.	IP52
13	General-purpose. Primarily used to provide protection against dust, spraying of water, oil, and noncorrosive coolants. Meets oil exclusion and rust resistance design tests.	IP54