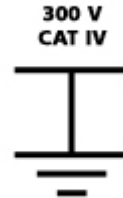


CATIV Instrument rating
Application note

Why is the CAT rating important?

The CAT (Category) rating of a test instrument defines where in the electrical supply chain the instrument can be safely used. This is usually printed on the instrument across the test connections and appears as CAT II,

CAT III or CAT IV. CAT I is generally no longer used, as it has no practical application.



What is a CAT rating?

The CAT rating defines the level of transient (spike or surge) the instrument has been designed to withstand. These transients vary in size and duration depending on the source of the transient. A transient may be several kV in amplitude but its duration is typically very short, maybe only 50 microseconds.

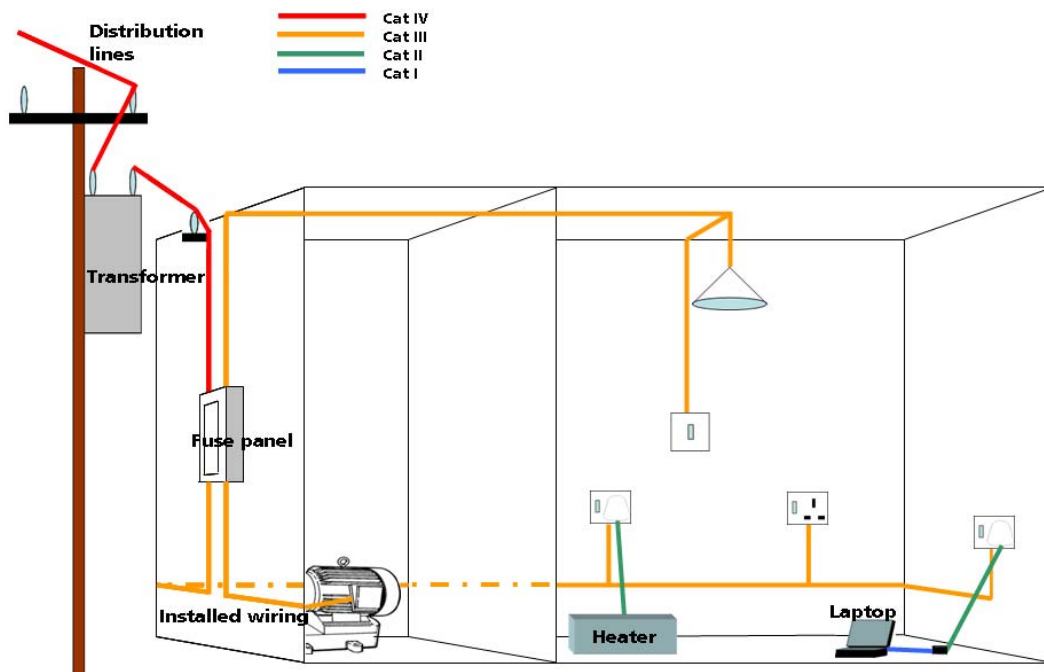
for a few milliseconds, creating a big bang, possibly causing burns, fire or explosion. Instruments designed with the correct category rating have sufficient clearance between critical parts to prevent an arc from creating the initial breakdown when a transient occurs.

On its own the transient will cause little damage. However, when it occurs on top of the normal mains sinusoidal supply voltage it can start an arc (short circuit), which continues until the end of the cycle. The transient riding on a high-energy supply is more dangerous than a transient on an isolated cable as it can deliver larger currents when a fault occurs (a spike on steroids if you like). In the case of a CAT IV system the available short circuit current can be in excess of 1000 amps. This generates hundreds of kilowatts of heat in a small space

IEC61010 defines the design requirements for instruments that declare a specific category rating and specifies both the electrical and physical requirements. Recently companies, especially electrical distribution companies, have stipulated all electrical test instrumentation to be rated CAT IV. This is a result of injuries sustained by engineers using inappropriately rated instruments on the supply. This is being applied to insulation testers as well as Loop impedance testers.

Where are CAT IV applications found?

The electrical supply can be broken down into categories from CAT I to CAT IV as shown



The picture shows the transmission lines (overhead or underground) as Category IV because the energy available from the supply and size of a transient is much higher near to the transformer. Test equipment suitable for use in this environment need to be rated to CAT IV. By the time the voltage goes through the fuse panel into the house, the circuit impedance is higher and transients are damped, reducing the available energy in the transient. The ability of the test instrument to withstand this surge is less stringent, hence a Category III rating.

The further down the supply you progress the lower the protection a test instrument has to provide. At the socket or lighting outlet the circuit is rated CAT II and items such as photocopiers, televisions etc can be considered as CAT I environments. Most electricians' testers will be rated to CAT II, or the better ones to CAT III. These instruments **are not designed to be used** on the higher energy CAT IV circuits.

However in reality this does occur.

Who will want CAT IV?

Electrical Utilities: -

As already mentioned, the electrical utilities are now specifying CAT IV instruments in an attempt to reduce risk to their operators and consequent liability, where instruments get used both inside and outside the building. This applies to insulation testers as well as LIVE testers, as the capability to measure supply voltage exists on a voltage measurement range, as well as accidental connection to live circuits whilst in other test modes.

Any engineer: -

Working outside the premise, either on overhead or underground LV supplies, will be working in a CAT IV environment, and should be working with suitably rated instruments.

Some basic statistics:

Small transients (a few hundred volts) occur on supply systems most days of the year.

Large transients (5 to 10 kV) do not occur very often.

However, they are unpredictable, using a correctly rated instrument the chances of a dangerous

breakdown are something like one in a million for every hour connected to the supply. Using a tester rated one category less increases the chances of an accident by a factor of about 30. This means that if 100 engineers are using instruments with wrong category ratings and they connect to live systems for one hour every day, 200 days a year, a dangerous situation is likely to occur once every 18 months!

The **MFT1700 series multifunction installation testers** are rated for use in **CAT IV** applications as well as **CAT III** and **CAT II** applications. This is indicated on the instrument terminal connection label by the symbol shown at the top of this document.