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CHAPTER 1

HISTORY OF WIRING INSTALLATION

There have been requirements for safe electrical wiring as far back as 1876 and, in 1882, the Society of Telegraph Engineers and Electricians, later to become the Institution of Electrical Engineers (IEE - now part of the IET), published the 'Rules and Regulations for the Prevention of Fire Risks arising from Electric Lighting'. This first incarnation of the IEE Wiring Regulations was just a simple four-page document. It was from these small beginnings that the idea of an inspection body with teeth to protect the general public from the dangers associated with electricity use was born.

Up to1923, there was guidance in the form of the IEE Wiring Regulations (such as they were), but no guarantee that these were being followed, and no unanimity as to whether compulsion would be valuable. It was eventually decided that the most effective way of improving domestic wiring safety standards, and getting rid of unsound contractors, would be to form a voluntary body.

The National Register of Electrical Installation Contractors (NREIC) was the result, and its objectives were to enable the public to identify competent contractors, to improve the efficiency and status of contractors, and to establish a register of such contractors, although requirements were not strict.

By 1929, the NREIC had a mere 202 contractors on its register, though this number did grow significantly and, by 1937, the new Electricity Supply Regulations gave suppliers the power to inspect electrical installations - now much more numerous - before connection to the public supply to ensure that they were safe, though the only statutory requirement was an insulation test.

During the early 1950s, the electricity supply industry had begun taking increased interest in installation issues, even - at one stage - proposing replacing the IEE Wiring Regulations with a 'Code of Minimum Wiring Practice'. This was opposed by contractors, the ECA, the British Electrical & Allied Manufacturers' Association (BEAMA), BSI and the IEE, and the proposal was eventually dropped. The happy result was a proposal for a more effective inspection body - the NICEIC, which was eventually formed in 1956.
Agreement had been reached some time before on the necessity for setting up the NICEIC, but difficulties of principle caused actual formation to take six long years. The delay, however, had a major advantage in that the 13th Edition of the Wiring Regulations, introduced around 1955/56, was suitably worded for enforcement, together with non-mandatory recommendations for good practise.

A decade later, in October 1966, E.J. Sutton (NICEIC Director from 1966 - 71) talked about the forthcoming 14th Edition of the Wiring Regulations to A.S.E.E. members.
To enable electrical contractors to learn about the new Regulations as early as possible, the NICEIC published a 'Contractors' Handbook' about them. There was now huge discussion among contractors, the technical press, and the various bodies such as the NICEIC, about the forthcoming 14th Edition - and much controversy too. E. J. Sutton was busy on the topic, writing many articles on the effects of the 14th Edition. Modifications were announced in early 1969, and were analysed by the NICEIC.

In February 1977, amid mounting concern over the forthcoming 15th Edition, NICEIC Chief Engineer Tom Howell helped put contractors' fears at ease by saying that the forthcoming 15th Edition would 'not lead to radical changes'. This did not stop contractors' worries. With the proposed launch of the 15th Edition in spring 1981 - more huge controversy ensued, with many articles, news and views being aired in the trade press.

A major issue was that of mainland European influence, as the 15th Edition was based in layout on the IEC Wiring Regulations.

The NICEIC, ECA and the then ECA of Scotland held a series of joint 15th Edition introductory meetings across the country. However, it was felt that there were still issues to be resolved, and the Council recommended in January 1981 that electrical installations should NOT be specified to the 15th Edition until the beginning of 1982.

The NICEIC, along with other bodies, held a series of seminars on the topic throughout September and October of 1981. A late 1981 edition of Electrical Times fretted that the 15th Edition was 'beyond the ken of ordinary contractors', so clearly, more education and clarifications were required. Yet, despite approval for the 15th Edition in 1982, the relevant Secretaries of State saw no difficulty in concurrent operation of the 14th and 15th Editions for a transitional period, until the end of 1984. Confusion reigned and, while 'Megohm' in Electrical Times claimed that the 15th Edition was a 'green light for cowboys', the NICEIC acceded to a request from the Secretaries of State for England and Scotland to delay implementation until January 1985.

In the event, it was the question of how to accommodate the stringent IEC voltage requirements that delayed the 15th Edition for three years.
1983 Colin Kinloch's (Technical Officer, later Assistant Director - Technical, then Director) long career at the NICEIC came to an end, as he retired, but not before airing his views before he went. Among other things, he commented that he still didn't know just how many contractors were then working to the 15th Edition, but said 'it forced people to think'.
Soon after, regarding the then forthcoming the 16th Edition, the NICEIC made an announcement concerning the electrical test instruments that Approved Contractors were required to have.

However, the Council also announced at its AGM that is would amend its Memorandum of Association to include reference to standards of electrical installation safety and practice additional to the IEE Wiring Regulations.
This would allow the National Inspection Board to invoke specific European and International standards as required.
In December 1992, it was announced that implementation of the 16th Edition of the IEE Wiring Regulations would come into effect from 1st January 1993.
The NICEIC provided its usual service, including meetings and publications, to Approved Contractors to ensure that they were a fully conversant with the implications of the new Edition as possible, prior to its implementation.

1.1 TODAY:

Now that the 17th Edition of the IEE Wiring Regulations are planned to come into force in 2008, and the Draft for Public Comment (DPC) has been and gone, the UK electrical industry will have to wait to see what changes are finally published, but the rationale is mainly to do with harmonisation of the document with European standards.

However, nobody yet knows what will be in the final version of the 17th Edition, due in 2008. Very recently, a trusted source has told Voltimum that more substantial changes have now been made which may - we emphasise the 'may' - have a very significant impact on the way electrical installers and contractors carry out their business, but for the moment we will have to wait and see. For that reason, this VoltiBULLETIN brings you only articles about what will definitely be in the 17th Edition, and certainly not all those changes that may be in the final document. We also bring you related news and those training courses being advertised for the introduction of the 17th Edition. Just click on the items in the rest of this VoltiBULLETIN. We can also see more by clicking on Wiring safety codes are intended to protect people and buildings from electrical shock and fire hazards.

Regulations may be established by city, county, provincial/state or national legislation, sometimes by adopting in amended form a model code produced by a technical standards-setting organization, or by a national standard electrical code.

Electrical codes arose in the 1880s with the commercial introduction of electrical power. Many conflicting standards existed for the selection of wire sizes and other design rules for electrical installations.

The first electrical codes in the United States originated in New York in 1881 to regulate installations of electric lighting. Since 1897 the U.S. National Fire Protection Association, a private nonprofit association formed by insurance companies, has published the National Electrical Code (NEC). States, counties or cities often include the NEC in their local building codes by reference along with local differences. The NEC is modified every three years. It is a consensus code considering suggestions from interested parties. The proposals are studied by committees of engineers, tradesmen, manufacturer representatives, fire fighters, and other invitees.

Since 1927, the Canadian Standards Association has produced the Canadian Safety Standard for Electrical Installations',' which is the basis for provincial electrical codes.
Although these two national standards deal with the same physical phenomena and broadly similar objectives, they differ occasionally in technical detail. As part of the NAFTA program, U.S. and Canadian standards are slowly converging toward each other, in a process known as harmonization.

In European countries, an attempt has been made to harmonize national wiring standards in an IEC standard, IEC 60364 Electrical Installations for Buildings. Hence national standards follow an identical system of sections and chapters. However, this standard is not written in such language that it can readily be adapted as a national wiring code. Neither is it designed for field use by electrical tradesmen and inspectors for testing compliance with national wiring standards. National codes, such as the NEC or CSA C22.2, exemplify the common objectives of IEC 60364, and provide rules in a form that allows for guidance of those installing and inspecting electrical systems.

The 2006 edition of the Canadian electrical code references IEC 60364 and states that the code addresses the fundamental principles of electrical protection in Section 131. The Canadian code reprints Chapter 13 of IEC 60364 and it is interesting to note that there are no numerical criteria listed in that chapter whereby the adequacy of any electrical installation can be assessed.

DKE - the German Commission for Electrical, Electronic and Information Technologies of DIN and VDE - is the German organisation responsible for the promulgation of electrical standards and safety specifications. DIN VDE 0100 is the German wiring regulations document harmonised with IEC 60364.

In the United Kingdom wiring installations are regulated by the IET Requirements for Electrical Installations: IET Wiring Regulations, BS 7671: 2001, which are harmonised with IEC 60364. The previous edition (16th) was replaced by the current 17th Edition in January 2008. The 17th edition includes new sections for microgeneration and solar photovoltaic systems.[citation needed] The first edition was published in 1882.

AS/NZS 3000 is an Australian/New Zealand standard, commonly known as the "wiring rules," that specifies the requirements for the selection and installation of electrical equipment and the design and testing of such installations. The standard is a mandatory standard in both New Zealand and Australia; therefore, all electrical work covered by the standard must comply.

HISTORY OF WIRING

Materials for wiring interior electrical systems in buildings vary depending on:

Intended use and amount of power demand on the circuit

Type of occupancy and size of the building

National and local regulations

1.2 ENVIRONMENT IN WHICH THE WIRING MUST OPERATE

Wiring systems in a single family home or duplex, for example, are simple, with relatively low power requirements, infrequent changes to the building structure and layout, usually with dry, moderate temperature, and noncorrosive environmental conditions. In a light commercial environment, more frequent wiring changes can be expected, large apparatus may be installed, and special conditions of heat or moisture may apply. Heavy industries have more demanding wiring requirements, such as very large currents and higher voltages, frequent changes of equipment layout, corrosive, or wet or explosive atmospheres.

1.3 EARLY WIRING METHODS

The very first interior power wiring systems used conductors that were bare or covered with cloth, which were secured by staples to the framing of the building or on running boards. Where conductors went through walls, they were protected with cloth tape. Splices were done similarly to telegraph connections, and soldered for security. Underground conductors were insulated with wrappings of cloth tape soaked in pitch, and laid in wooden troughs which were then buried. Such wiring systems were unsatisfactory because of the danger of electrocution and fire and the high labor cost for such installations.

1.4 KNOB AND TUBE

The earliest standardized method of wiring in buildings, in common use in North America from about 1880 to the 1930s, was knob and tube (K&T) wiring: single conductors were run through cavities between the structural members in walls and ceilings, with ceramic tubes forming protective channels through joists and ceramic knobs attached to the structural members to provide air between the wire and the lumber and to support the wires. Since air was free to circulate over the wires, smaller conductors could be used than required in cables. By arranging wires on opposite sides of building structural members, some protection was afforded against short-circuits that can be caused by driving a nail into both conductors simultaneously. By the 1940s, the labor cost of installing two conductors rather than one cable resulted in a decline in new knob-and-tube installations.

1.5 METAL-SHEATHED WIRES

In the United Kingdom, an early form of insulated cable [1] introduced in 1896 consisted of two impregnated-paper-insulated conductors in an overall lead sheath. Joints were soldered, and special fittings were used for lamp holders and switches. These cables were similar to underground telegraph and telephone cables of the time. Paper-insulated cables proved unsuitable for interior wiring installations because very careful workmanship was required on the lead sheaths to ensure moisture did not affect the insulation.

A later system invented in 1908 in the UK employed vulcanized-rubber insulated wire enclosed in a strip metal sheath. The metal sheath was bonded to each metal wiring device to ensure continuity.

1.6 OTHER HISTORICAL WIRING METHODS

Other methods of securing wiring that are now obsolete include:
Re-use of existing gas pipes for electric lighting. Insulated conductors were pulled into the pipes feeding gas lamps.

Wood moldings with grooves cut for single conductor wires. These were eventually prohibited in North American electrical codes by the 1930s, but may still be permitted in other regions.

The first polymer-insulated cables for building wiring were introduced in 1922. These were two or more solid copper wires, with rubber insulation, woven cotton cloth over each conductor for protection of the insulation, with an overall woven jacket, usually impregnated with tar as a protection from moisture. Waxed paper was used as a filler and separator.
Rubber-insulated cables become brittle over time because of exposure to oxygen, so they must be handled with care, and should be replaced during renovations. When switches, outlets or light fixtures are replaced, the mere act of tightening connections may cause insulation to flake off the conductors. Rubber was hard to separate from bare copper, so copper was tinned, causing slightly more resistance.

About 1950, PVC insulation and jackets were introduced, especially for residential wiring. About the same time, single conductors with a thinner PVC insulation and a thin nylon jacket became common.

Aluminium wire was common in North American residential wiring from the late 1960s to mid 1970s, because of the rising cost of copper. Because of its greater resistivity, aluminium wiring requires larger conductors than with copper. For instance, instead of 14 AWG (American wire gauge) for most lighting circuits, aluminium wiring would typically be 12 AWG on a typical 15 amp circuit, though local building codes may vary.

Aluminium conductors were originally used with wiring devices intended for copper wires. This can cause defective connections unless all devices (breakers, switches, receptacles, splice connectors (i.e., wire nuts), etc.) were designed to address problems with junctions between dissimilar metals, oxidization on metal surfaces and mechanical effects that occur as different metals expand at different rates with increases in temperature.

Because of improper design and installation, some junctions to wiring devices overheated under heavy current load and caused fires. Revised standards for wiring devices (such as the CO/ALR "copper-aluminum-revised" designation) were developed to reduce these problems.

Aluminium conductors are still used for power distribution and large feeder circuits because they cost less than copper wiring, especially in the large sizes needed for heavy current loads. Aluminum conductors must be installed with compatible connectors.

The simplest form of cable is comprised of two insulated conductors twisted together to form a unit; such unjacketed cables with two or three conductors are used for low-voltage signal and control applications such as doorbell wiring.
In North American practice, an overhead cable from a transformer on a power pole to a residential electrical service consists of three twisted (triplexed) wires, often with one being a bare neutral and the other two being insulated for the line voltage.

Modern wiring materials Modern nonmetallic sheathed cables (NMC), like (U.S. and Canadian) Type NM, consist of two to four thermoplastic insulated wires and a bare wire for grounding (bonding) surrounded by a flexible plastic jacket. Many call this "Romex (tm)" cable since it was the first of its type, by Rome Cable. (The trade name is owned by Southwire as of 2006.)

Rubber-like synthetic polymer insulation is used in industrial cables and power cables installed underground because of its superior moisture resistance.

CHAPTER 2

CABLES

Cable is one or more wires or optical fibers bound together, typically in a common protective jacket or sheath. The individual wires or fibers inside the jacket may be covered or insulated. Combination cables may contain both electrical wires and optical fibers. Electrical wire is usually copper because of its excellent Electrical cables may be made flexible by stranding the wires. In this process, smaller individual wires are twisted or braided together to produce larger wires that are more flexible than solid wires of similar size. Bunching small wires before concentric stranding adds the most flexibility. A thin coat of a specific material (usually tin-which improves the solderability of the bunch-, but it could be silver, gold and another materials and of course the wire can be unplated - with no coating material) on the individual wires provides lubrication for longest life. Tight lays during stranding makes the cable extensible (CBA - as in telephone handset cords).
Bundling the conductors and eliminating multi-layers ensures a uniform bend radius across each conductor. Pulling and compressing forces balance one another around the high-tensile center cord that provides the necessary inner stability. As a result the cable core remains stable even under maximum bending stress.
Cables can be securely fastened and organized, such as using cable trees with the aid of cable ties or cable lacing. Continuous-flex or flexible cables used in moving applications within cable carriers can be secured using strain relief devices or cable ties.
onductivity, but aluminum is sometimes used because it costs less

2.1 HISTORY

In the 19th century and early 20th century, cable was often insulated using cloth, rubber and even paper. Plastic materials are generally used today, except for high reliability power cables. There are four types of plastic insulation used in telecommunications cables today: solid, cellular, foam skin and skin-foam-skin.

The leading global producers of wire and cable include (in no particular order): Canare, Draka, General Cable, Belden, Nexans, India, igus, Sumitomo Electric Industries, Furukawa Electric, Hitachi Cable, Southwire, Marmon Group, LS Cable, Leoni, Fujikura, Tyco, Prysmian, Lapp, Wonderful Hi-Tech, Walsin Lihwa and Wilms Group, and Jainson Cables - India.

2.2 CABLE TYPE

Basic cable types are as follows:
Basic cable
Coaxial cable
Multicore cable (consist of more than one wire and is covered by cable jacket)
Optical fiber cable
Ribbon cable
Single cable (from time to time this name is used for wire)

2.3 ADVANTAGE

they are good conductors,cheap and available every where

2.4 DISADVANTAGE

copper corrode easily and should be layered with Lacquer to help conserve the concluding

CHAPTER 3

PROJECT RULES

In our project ;current lines 0.4 mm - 0.5 mm the low current lines 0.2 mm – 0.3 mm the armatures , switches , sockets , etc ... and the symbols of electrical devices 0.2 mm

Have to bea.Because ıt ıs rule of the draving of ıllumination.

The power calculating and the electrical installation Project have to be suitable to the rules of "TÜRK TESİSAT STANDARTLARI BAYINDIRLIK BAKANLIĞI ELEKTRİK TEKNİK ŞARTNAMESİ".

IN THE APPLİCATİON SWİTCHES,SOCKETS,LAMPS FUSE BOX have to be some hıgh from ground.

These highs have to be;

Devices ;	distance from ground ;
Switches	.... 150 cm
Sockets	.... 40 cm
Wall lamps	.... 190 cm
Conduit boxes	.... 220 cm
Fuse box line	.... 200 cm

These devices have to put 35 cm far from door case and have to put 60 cm. far from window case. Nowadays improved cable channel and connecting devices with sockets have to put shorter then 40 cm high on the ground and wall.

In floor plans, power line plans lines and at the outlet the number of cable, crosscut and models with pipe model and its sizes are showed.

The power lines and the electric cable lines have to be numerated and this numbers are repeated a long the power lines and electric cable lines , the power lines are showed square , the electric cable lines are showed by circle.
At the wet ground (toilets and bathroom) using the conduit box, switches, and the sockets are not permutated. The conduit box, switches and the sockets have to put to outside this place.

When we want to put a socket inside of the bathroom it is useful to use a special water leak proof socket.The electric meter have to put a place where without damp , without dust , harmful heating changing weather like this and have to put a place that the competent can find and make control easily without asking the person who live .

In houses every subscriber can put the electric meter outside the own door, over the wall in the well hole, inside the covered parts or a ground where well weather coming dry and suitable places. The electric meter can putted to the first enter in the places like shops, bureau, Office, etc... where the manager to see fit.

By the practise in the apartments the electric meter are putted to the ground floor in the electric meter panel.

The electric meter which has to be putted the dusted places and open area must putt the electric meter panel which made from galvanized iron. The illumination line and socket line have to separate electric cable lines have to be numbered according to the exit and secondary panel (the numbers putted in circle).

The illumination and socket cable lines are protected by the circuit breaker. The short circuit current of the circuit breakers has to be at least 3 KA. The voltage loss has to calculate for the longest and the highest line.

We can not draw a line surrounding of chimneys or columns at the Project. The switches, sockets, have to be put to a different place from chimneys and columns. We can not put on joist or columns or near the joist or columns switches or sockets.

The electrical meter have to put to an enter of well hole in a box which have to be made from galvanization sheet. At drawing the electrical installation projects and at the practise the lamp lines and the socket lines have to be different. It can be connecting to the lamp line at most nine (8) lamps for the socket line it can be connecting at most seven (6) sockets.

But only the washing machine, dishwasher, and oven must have a along line and the power are different from the others.

CHAPTER 4

THE CONTROL OF VOLTAGE LOSS

Voltage loss in a wire is synonymous to pressure loss in a pipe. Electric current flows in a wire, just like water in a pipe, and creates a loss. The loss is a function of:

The diameter of the wire - The smaller the diameter, the larger the loss.

The length of the wire - The longer the wire, the larger the loss.

The type of metal used in the wire - The higher the resistance, the larger the loss.

Copper and Aluminum wires are the most common types, with copper having the lower resistance.

4.1 VOLTAGE LOSS DETECTOR

A detector for indicating loss of voltage on a monitored conductor includes first and second serially connected capacitors, and a rectifier circuit which derives operating power from the monitored conductor to charge the capacitors in the presence of voltage on the conductor.

A forward-biased diode connected across the second capacitor limits the voltage developed across the second capacitor during charging to a relatively low level. Upon loss of voltage a portion of the charge in the first capacitor is transferred to the second capacitor, causing the voltage across the second capacitor to reverse polarity and progressively increase.

This causes an enhanced field effect transistor connected across the capacitor to become conductive and discharge the first capacitor through a relay or other indicating device to provide a control effect indicative of voltage loss.

Voltage loss is the electrical phenomena that reduces the voltage that travels through a conductor.
Input voltage, for example, of 120 volts into a specific wire conductor may be significantly reduced by the time it reaches the opposite end of the wire based on the load being controlled and the length of the wire run. Voltage loss can be explained as the resistance of a conductor to current flow.
This means that because of voltage loss, the operating voltage of equipment is reduced and could have a negative effect on the operation of the equipment. Voltage loss can cause equipment
such as motors and ballasts to overheat. The end result is shorter equipment life. More sensitive electronic equipment such as computers or even copy machines may in fact shut

down due to voltage loss.
How do we overcome this problem? Increasing the gauge of the wire will typically reduce the effects of voltage loss. The load being controlled and the length of the wire run are still a factor.
As is the case with most electrical equipment, occupancy sensors must operate within a certain
voltage range. The table on the following page will simplify wire gauge selection and is intended to limit voltage drop of 24 VDC to no more than 10%. When using this chart remember that to calculate the correct wire gauge you must take the actual distance of the wire
run and double it (since this is the distance from the power supply to the sensors and then back to the relay). The wire lengths in the chart include this calculation. We recommend a minimum of 22 AWG.

CHAPTER 5

LIGHTING

Lighting includes both artificial light sources such as lamps and natural illumination of interiors from daylight. Lighting represents a major component of energy consumption, accounting for a significant part of all energy consumed worldwide.

Artificial lighting is most commonly provided today by electric lights, but gas lighting, candles or oil lamps were used in the past, and still are used in certain situations. Proper lighting can enhance task performance or aesthetics, while there can be energy wastage and adverse health effects of lighting. Indoor lighting is a form of fixture or furnishing, and a key part of interior design. Lighting can also be an intrinsic component of landscaping.

5.1 FIXTURES

Main article: Light fixture

Lighting fixtures come in a wide variety of styles for various functions. Some are very plain and functional, while some are pieces of art in themselves. Nearly any material can be used, so long as it can tolerate the heat and is in keeping with safety codes.

Proper selection of fixtures is complicated by the requirement to minimize the veiling reflections off printed material. Since the exact orientation of printed material may not be closed controlled, a visual comfort probability can be calculated for a given set of lighting fixtures.

5.2 TYPES

Lighting is classified by intended use as general, localized, or task lighting, depending largely on the distribution of the light produced by the fixture.

Task lighting is mainly functional and is usually the most concentrated, for purposes such as reading or inspection of materials. For example, reading poor-quality reproductions may require task lighting levels up to 1500 lux (150 footcandles), and some inspection tasks or surgical procedures require even higher levels.

Accent lighting is mainly decorative, intended to highlight pictures, plants, or other elements of interior design or landscaping.

General lighting fills in between the two and is intended for general illumination of an area. Indoors, this would be a basic lamp on a table or floor, or a fixture on the ceiling. Outdoors, general lighting for a parking lot may be as low as 10-20 lux (1-2 footcandles) since pedestrians and motorists already used to the dark will need little light for crossing the area.

5.3 METHODS

Downlighting is most common, with fixtures on or recessed in the ceiling casting light downward. This tends to be the most used method, used in both offices and homes. Although it is easy to design it has dramatic problems with glare and excess energy consumption due to large number of fittings.

Uplighting is less common, often used to bounce indirect light off the ceiling and back down. It is commonly used in lighting applications that require minimal glare and uniform general illuminance levels.
Uplighting (indirect) uses a diffuse surface to reflect light in a space and can minimize disabling glare on computer displays and other dark glossy surfaces. It gives a more uniform presentation of the light output in operation.

Front lighting is also quite common, but tends to make the subject look flat as its casts almost no visible shadows. Lighting from the side is the less common, as it tends to produce glare near eye level. Backlighting either around or through an object is mainly for accent.
Forms of Lighting include alcove lighting, which like most other uplighting is indirect. This is often done with fluorescent lighting or rope light, or occasionally with neon lighting. It is a form of backlighting.

Soffit or close to wall lighting can be general or a decorative wall-wash, sometimes used to bring out texture (like stucco or plaster) on a wall, though this may also show its defects as well. The effect depends heavily on the exact type of lighting source used.

Recessed lighting (often called "pot lights" in Canada, "can lights" or 'high hats" in the U.S.) is popular, with fixtures mounted into the ceiling structure so as to appear flush with it. These downlights can use narrow beam spotlights, or wider-angle floodlights, both of which are bulbs having their own reflectors. There are also downlights with internal reflectors designed to accept common 'A' lamps (light bulbs) which are generally less costly than reflector lamps. Downlights can be incandescent, fluorescent, HID (high intensity discharge) or LED, though only reflector incandescent or HID lamps are available in spot configuration.

Track lighting, invented by Lightolier, was popular at one point because it was much easier to install than recessed lighting, and individual fixtures are decorative and can be easily aimed at a wall. It has regained some popularity recently in low-voltage tracks, which often look nothing like their predecessors because they do not have the safety issues that line-voltage systems have, and are therefore less bulky and more ornamental in themselves.

A master transformer feeds all of the fixtures on the track or rod with 12 or 24 volts, instead of each light fixture having its own line-to-low voltage transformer. There are traditional spots and floods, as well as other small hanging fixtures. A modified version of this is cable lighting, where lights are hung from or clipped to bare metal cables under tension.

A sconce is a wall-mounted fixture, particularly one that shines up and sometimes down as well. A torchiere is an uplight intended for ambient lighting. It is typically a floor lamp but may be wall-mounted like a sconce.

The portable or table lamp is probably the most common fixture, found in many homes and offices. The standard lamp and shade that sits on a table is general lighting, while the desk lamp is considered task lighting. Magnifier lamps are also task lighting.

The illuminated ceiling was once popular in the 1960s and 1970s but fell out of favor after the 1980s. This uses diffuser panels hung like a suspended ceiling below fluorescent lights, and is considered general lighting. Other forms include neon, which is not usually intended to illuminate anything else, but to actually be an artwork in itself. This would probably fall under accent lighting, though in a dark nightclub it could be considered general lighting. Underwater accent lighting is also used for koi ponds, fountains, swimming pools and the like.

In a movie theater each step in the aisles is usually marked with a row of small lights, for convenience and safety when the film has started, hence the other lights are off. Traditionally made up of small low wattage, low voltage lamps in a track or translucent tube, these are rapidly being replaced with LED based versions.

5.4 VEHICLE USE

Vehicles typically include headlights and tail lights. Headlights are white or yellow lights placed in the front of the vehicle, designed to illuminate the upcoming road and to make the vehicle more visible. Tail lights are always red and are placed in the rear to quickly alert other drivers about the vehicle's direction of travel. The white portion of the tail light is the back-up lamp, which when lit, is used to indicate that the vehicle's transmission has been placed in the reverse gear, warning anyone behind the vehicle that it is moving backwards, or about to do so.

In addition to lighting for useful purposes, and early 1970s, manufacturers would sometimes backlight their logos and or other translucent panelling. In the 1990s, a popular trend was to customize vehicles with neon lighting, especially underneath the body of a car. In the 2000s, neon lighting is increasingly yielding to digital vehicle lighting, in which bright LEDs are placed on the car and operated by a computer which can be customized and programmed to display a range of changing patterns and colors, a technology borrowed from Christmas lights.

5.5 LAMPS

Commonly called 'light bulbs', lamps are the removable and replaceable portion of a luminaire which converts electrical energy to both visible and non-visible electromagnetic energy. Specialists who work with lighting, carefully avoid energetic units for measuring of the light output of sources of light. For example, instead of watt per steradian, the special unit candela is used: 1 candela=(1/683) W/steradian. Common characteristics used to evaluate lamp quality include efficiency measured in lumens per watt, typical lamp life measured in hours, and Color Rendering Index on a scale of 0 to 100. Cost of replacement lamps is also an important factor in any design.[1]

Lighting design as it applies to the built environment, also known as 'architectural lighting design', is both a science and an art. Comprehensive lighting design requires consideration of the amount of functional light provided, the energy consumed, as well as the aesthetic impact supplied by the lighting system.

Some buildings, like surgical centers and sports facilities, are primarily concerned with providing the appropriate amount of light for the associated task. Some buildings, like warehouses and office buildings, are primarily concerned with saving money through the energy efficiency of the lighting system. Other buildings, like casinos and theatres, are primarily concerned with enhancing the appearance and emotional impact of architecture through lighting systems. Therefore, it is important that the sciences of light production and luminaire photometrics are balanced with the artistic application of light as a medium in our built environment. These electrical lighting systems should also consider the impacts of, and ideally be integrated with, daylighting systems.

Factors involved in lighting design are essentially the same as those discussed above in energy conservation analysis.

Mathematical modeling is normally used for complex lighting design, whereas, for simple configurations, tables and simple hand calculations can be used. Based on the positions and mounting heights of the fixtures, and their photometric characteristics, the proposed lighting layout can be checked for uniformity and quantity of illumination.

For larger projects or those with irregular floor plans, lighting design software can be used. Each fixture has its location entered, and the reflectance of walls, ceiling, and floors can be entered. The computer program will then produce a set of contour charts overlaid on the project floor plan, showing the light level to be expected at the working height. More advanced programs can include the effect of light from windows or skylights, allowing further optimization of the operating cost of the lighting installation.

The Zonal Cavity Method is used as a basis for both hand, tabulated, and computer calculations. This method uses the reflectance coefficients of room surfaces to model the contribution to useful illumination at the working level of the room due to light reflected from the walls and the ceiling. Simplified photometric values are usually given by fixture manufacturers for use in this method.

Computer modelling of outdoor flood lighting usually proceeds directly from photometric data. The total lighting power of a lamp is divided into small solid angular regions. Each region is extended to the surface which is to be lit and the area calculated, giving the light power per unit of area. Where multiple lamps are used to illuminate the same area, each one's contribution is summed. Again the tabulated light levels (in lux or foot-candles) can be presented as contour lines of constant lighting value, overlaid on the project plan drawing. Hand calculations might only be required at a few points, but computer calculations allow a better estimate of the uniformity and lighting level.

Practical lighting design must take into account the gradual decrease in light levels from each lamp owing to lamp aging, lamp burnout, and dirt accumulation on fixture and lamp surfaces. Empirically-established depreciation factors are listed in lighting design handbooks.

5.6 ENERGY CONSUMPTION

Artificial lighting consumes a significant part of all electrical energy consumed worldwide. In homes and offices from 20 to 50 percent of total energy consumed is due to lighting.[2] Most importantly, for some buildings over 90 percent of lighting energy consumed can be an unnecessary expense through over-illumination.[2] The cost of that lighting can be substantial. A single 100 W light bulb used just 6 hours a day can cost over $25 per year to use (.12/kWh). Thus lighting represents a critical component of energy use today, especially in large office buildings where there are many alternatives for energy utilization in lighting. There are several strategies available to minimize energy requirements in any building:
Specification of illumination requirements for each given use area.

Analysis of lighting quality to insure that adverse components of lighting (for example, glare or incorrect color spectrum) are not biasing the design.

Integration of space planning and interior architecture (including choice of interior surfaces and room geometries) to lighting design.

Design of time of day use that does not expendunnecessary energy. Selection of fixture and lamp types that reflect best available technology for energy conservation.

Training of building occupants to utilize lighting equipment in most efficient manner. Maintenance of lighting systems to minimize energy wastage.

Use of natural light - some big box stores are being built (Ca 2006 on) with numerous plastic bubble skylights, in many cases completely obviating the need for interior artificial lighting for many hours of the day.

5.7 HEALTH EFFECTS

Main articles: Full-spectrum light and Over-illumination

It is valuable to provide the correct light intensity and color spectrum for each task or environment. Otherwise, energy not only could be wasted but over-illumination can lead to adverse health and psychological effects.

Specification of illumination requirements is the basic concept of deciding how much illumination is required for a given task. Clearly, much less light is required to illuminate a hallway or bathroom compared to that needed for a word processing work station. Prior to 1970 (and too often even today), a lighting engineer would simply apply the same level of illumination design to all parts of the building without considering usage. Generally speaking, the energy expended is proportional to the design illumination level.

For example, a lighting level of 80 footcandles might be chosen for a work environment involving meeting rooms and conferences, whereas a level of 40 footcandles could be selected for building hallways. If the hallway standard simply emulates the conference room needs, then twice the amount of energy will be consumed as is needed for hallways. Unfortunately, most of the lighting standards even today have been specified by industrial groups who manufacture and sell lighting, so that a historical commercial bias exists in designing most building lighting, especially for office and industrial settings. Beyond the energy factors being considered, it is important not to over-design illumination, lest adverse health effects such as headache frequency, stress, and increased blood pressure be induced by the higher lighting levels. In addition, glare or excess light can decrease worker efficiency.

Analysis of lighting quality particularly emphasizes use of natural lighting, but also considers spectral content if artificial light is to be used. Not only will greater reliance on natural light reduce energy consumption, but will favorably impact human health and performance. For example, it is clear that student test scores are improved for children who learn in the presence of greater natural light.[citation needed] Artificial night-lighting has been associated with irregular menstrual cycles.[citation needed]

5.8 ENVIRONMENTAL ISSUES

Kerosene and Whale Oil Lamps

In 1849, Dr. Abraham Gesner, a Canadian geologist, devised a method where kerosene could be distilled from petroleum. Earlier coal-gas methods had been used for lighting since the 1820s, but they were expensive. Gesner's kerosene was cheap, easy to produce, could be burned in existing lamps, and did not produce an offensive odor as did most whale oil. It could be stored indefinitely, unlike whale oil, which would eventually spoil.

The American petroleum boom began in the 1850s. By the end of the decade there were 30 kerosene plants operating in the United States. The cheaper, more efficient fuel began to drive whale oil out of the market. John D. Rockefeller was most responsible for the commercial success of kerosene.

He set up a network of kerosene distilleries which would later become Standard Oil, thus completely abolishing the need for Whale Oil lamps.

5.9 COMPACT FLORESCENT LAMPS

Compact fluorescent lamps (aka 'CFLs') use less power to supply the same amount of light as an incandescent lamp. Due to the ability to reduce electric consumption, many organizations have undertaken measures to encourage the adoption of CFLs.

Some electric utilities and local governments have subsidized CFLs or provided them free to customers as a means of reducing electric demand. For a given light output, CFLs use between one fifth and one quarter of the power of an equivalent incandescent lamp. One of the simplest and quickest ways for a household or business to become more energy efficient is to adopt CFLs as the main lamp source, as suggested by the Alliance for Climate Protection

CHAPTER 6

SWITCHES, SOCKETS AND BUTTONS

6.1 SWITCH

Electrical switches. Top, left to right: circuit breaker, mercury switch, wafer switch, DIP switch, surface mount switch, reed switch. Bottom, left to right: wall switch (U.S. style), miniature toggle switch, in-line switch, push-button switch, rocker switch, microswitch.

A switch is a mechanical device used to connect and disconnect a circuit at will. Switches cover a wide range of types, from subminiature up to industrial plant switching megawatts of power on high voltage distribution lines.

In applications where multiple switching options are required (e.g., a telephone service), mechanical switches have long been replaced by electronic switching devices which can be automated and intelligently controlled.

The prototypical model is perhaps a mechanical device (for example a railroad switch) which can be disconnected from one course and connected to another.

The switch is referred to as a "gate" when abstracted to mathematical form. In the philosophy of logic, operational arguments are represented as logic gates. The use of electronic gates to function as a system of logical gates is the fundamental basis for the computer—i.e. a computer is a system of electronic switches which function as logical
A simple electrical switch
A simple semiconductor switch is a transistor.

6.2 CONTACTS

In the simplest case, a switch has two pieces of metal called contacts that touch to make a circuit, and separate to break the circuit.

The contact material is chosen for its resistance to corrosion, because most metals form insulating oxides that would prevent the switch from working. Contact materials are also chosen on the basis of electrical conductivity, hardness (resistance to abrasive wear), mechanical strength, low cost and low toxicity[1].
Sometimes the contacts are plated with noble metals. They may be designed to wipe against each other to clean off any contamination. Nonmetallic conductors, such as conductive plastic, are sometimes used.

6.3 SINGLE KEY

This switch can on and off a lamp or lamps only from one place. These switches are use usually in kitchen, toilets, room etc…

6.4 COMMUTATOR

These switches are used usually for a wall lamp, drawing room. This switch can on and off two different lamp or lamps from one place at the same time or different time.

6.5 VAEVIEN

This switch can on and off a lamp or lamps of the same time from different place. These switches are used usually in the balcony which has two doors or in the kitchen which have two doors.

6.6 WELL HOLE SWITCHES

These switches can on and off the lamp or lamps more than two (2) different place at the same time. These switches are used at the stair.

6.7 SOCKET:

Sockets are very important in our life because we need sockets in our home or in our work. To operate electrical devices sockets that we use have to be made to TS _ 40

Sockets are in two groups for a safety.
1 – Normal sockets
2 - Ground sockets

6.8 BUTTONS:

The switches from ground	150 cm
The sockets from ground	40 cm
The wall lamp from ground	190 cm
The conduit box from ground	220 cm
The fuse box from the ground	200 cm

CHAPTER 7

EARTHING

In electricity supply systems, an earthing system defines the electrical potential of the conductors relative to that of the Earth's conductive surface. The choice of earthing system has implications for the safety and electromagnetic compatibility of the power supply. Note that regulations for earthing (grounding) systems vary considerably between different countries.

A protective earth (PE) connection ensures that all exposed conductive surfaces are at the same electrical potential as the surface of the Earth, to avoid the risk of electrical shock if a person touches a device in which an insulation fault has occurred. It ensures that in the case of an insulation fault (a "short circuit"), a very high current flows, which will trigger an overcurrent protection device (fuse, circuit breaker) that disconnects the power supply.

A functional earth connection serves a purpose other than providing protection against electrical shock. In contrast to a protective earth connection, a functional earth connection may carry a current during the normal operation of a device. Functional earth connections may be required by devices such as surge suppression and electromagnetic-compatibility filters, some types of antennas and various measurement instruments. Generally the protective earth is also used as a functional earth, though this requires care in some situations.
In household wiring

There are two main approaches to the problem of how to disconnect power when a live wire comes into contact with metalwork attached to the earthing system: One way is to get the resistance through the fault path and back to the supply very low by having a metallic connection from the earth back to the supply transformer (a TN system). Then when a fault happens a very high current will flow rapidly blowing a fuse (or tripping a circuit breaker).
The second approach, where such a direct connection is not used (a TT system), the resistance of the fault path back to the supply is too high for the branch circuit overcurrent protection to operate (blow a fuse or trip a circuit breaker). In such case a residual current detector is installed to detect the current leaking to ground and interrupt the circuit.

7.1 SAFETY

In TN, an insulation fault is very likely to lead to a high short-circuit current that will trigger an overcurrent circuit-breaker or fuse and disconnect the L conductors. With TT systems, the earth fault loop impedance can be too high to do this, or too high to do it quickly, so an RCD (or formerly ELCB) is usually employed. The provision of RCD or ELCB to ensure safe disconnection makes these installations EEBAD (Earthed Equipotential Bonding and Automatic Disconnection).

Many 1950s and earlier earlier TT installations inthe UK may lack this important safety feature. Non-EEBAD installations are capable of the whole installation CPC (Circuit Protective Conductor) remaining live for extended periods under fault conditions, which is a real danger.

In TN-S and TT systems (and in TN-C-S beyond the point of the split), a residual-current device can be used as an additional protection. In the absence of any insulation fault in the consumer device, the equation IL1+IL2+IL3+IN = 0 holds, and an RCD can disconnect the supply as soon as this sum reaches a threshold (typically 10-500 mA). An insulation fault between either L or N and PE will trigger an RCD with high probability.

In IT and TN-C networks, residual current devices are far less likely to detect an insulation fault. In a TN-C system, they would also be very vulnerable to unwanted triggering from contact between earth conductors of circuits on different RCDs or with real ground, thus making their use impracticable. Also, RCDs usually isolate the neutral core. Since it is unsafe to do this in a TN-C system, RCDs on TN-C should be wired to only interrupt the live conductor.

In single-ended single-phase systems where the Earth and neutral are combined (TN-C, and the part of TN-C-S systems which uses a combined neutral and earth core), if there is a contact problem in the PEN conductor, then all parts of the earthing system beyond the break will rise to the potential of the L conductor.

In an unbalanced multi-phase system, the potential of the earthing system will move towards that of the most loaded live conductor. Therefore, TN-C connections must not go across plug/socket connections or flexible cables, where there is a higher probability of contact problems than with fixed wiring. There is also a risk if a cable is damaged, which can be mitigated by the use of concentric cable construction and/or multiple earth electrodes. Due to the (small) risks of the lost neutral, use of TN-C-S supplies is banned for caravans and boats in the UK, and it is often recommended to make outdoor wiring TT with a separate earth electrode.
In IT systems, a single insulation fault is unlikely to cause dangerous currents to flow through a human body in contact with earth, because no low-impedance circuit exists for such a current to flow.

However, a first insulation fault can effectively turn an IT system into a TN system, and then a second insulation fault can lead to dangerous body currents. Worse, in a multi-phase system, if one of the live conductors made contact with earth, it would cause the other phase cores to rise to the phase-phase voltage relative to earth rather than the phase-neutral voltage. IT systems also experience larger transient overvoltages than other systems.

In TN-C and TN-C-S systems, any connection between the combined neutral-and-earth core and the body of the earth could end up carrying significant current under normal conditions, and could carry even more under a broken neutral situation. Therefore, main equipotential bonding conductors must be sized with this in mind; use of TN-C-S is inadvisable in situations such as petrol stations, where there is a combination of lots of buried metalwork and explosive gases.

In TN-C and TN-C-S systems, any break in the combined neutral-and-earth core which didn't also affect the live conductor could theoretically result in exposed metalwork rising to near "live" potential!

7.2 APPLICATION EXAMPLES

Most modern homes in Europe have a TN-C-S earthing system. The combined neutral and earth occurs between the nearest transformer substation and the service cut out (the fuse

before the meter). After this, separate earth and neutral cores are used in all the internal wiring.
Older urban and suburban homes in the UK tend to have TN-S supplies, with the earth connection delivered through the lead sheath of the underground lead-and-paper cable.
Some older homes, especially those built before the invention of residual-current circuit breakers and wired home area networks, use an in-house TN-C arrangement. This is no longer recommended practice.

Laboratory rooms, medical facilities, construction sites, repair workshops, mobile electrical installations, and other environments that are supplied via engine-generators where there is an increased risk of insulation faults, often use an IT earthing arrangement supplied from isolation transformers. To mitigate the two-fault issues with IT systems, the isolation transformers shoulsupply only a small number of loads each and/or should be protected with an insulation monitoring device (generally used only by medical or military IT systems, because of cost).

In remote areas, where the cost of an additional PE conductor outweighs the cost of a local earth connection, TT networks are commonly used in some countries, especially in older properties. TT supplies to individual properties are also seen in mostly TN-C-S systems where an individual property is considered unsuitable for TN-C-S supply (e.g. petrol stations).

In Australia, the TN-C-S system is in use; however, the wiring rules currently state that, in addition, each customer must provide a separate connection to earth via both a water pipe bond (if metallic water pipes enter the consumer's premises) and a dedicated earth electrode. In older installations, it is not uncommon to find only the water pipe bond, and it is allowed to remain as such, but the additional earth electrode must be installed if any upgrade work is done. The protective earth and neutral conductors are combined until the consumer's neutral link (located on the customer's side of the electricity meter's neutral connection) - beyond this point, the protective earth and neutral conductors are separate.
The earth is made up of materials that is electrically conductive.

A fault current will flow to 'earth' through the live conductor, provided it is earthed . This is to prevent a potentially live conductor from rising above the safe level . All exposed metal parts of an electrical installation or electrical appliance must be earthed .

7.3 The main objectives of the earthing are to :

1) Provide an alternative path for the fault current to flow so that it will not endanger the user
2) Ensure that all exposed conductive parts do not reach a dangerous potential

3) Maintain the voltage at any part of an electrical system at a known value so as to prevent over current or excessive voltage on the appliances or equipment .

7.4 The qualities of a good earthing system are :

1) Must be of low electrical resistance

2) Must be of good corrosion resistance

3) Must be able to dissipate high fault current repeatedly

CALCULATİONS

FOR A-1

$h_2 = 3 - (0.85+0.0) = 2.15$ *meter*

$$K_{index} = \frac{(A * B)}{(A + B) * h_2} = \frac{(4 * 3)}{(3 + 4) * 2.15} \cong 0.797 \cong$$

$\eta = 0.36 \Rightarrow$ *FROM TABLE*

$d = 1.25$

$$\phi_T = \frac{E * S * d}{\eta} = \frac{50 * 3 * 4 * 1.25}{0.51} = 1470 \text{ lumen.}$$

$$N = \frac{\phi_T}{\phi_L} = \frac{1470}{1400} \cong 1.05 \text{ lambs [Z=1]}$$

We choose 1 lambs.

We use 1 lamps under 30 m^2.

PAR22 HalogenA	60	1400	E27

FOR A-2

h_2=3 - (0.85+0.0) = 2.15 meter

$$K_{index}=\frac{(A*B)}{(A+B)*h_2}=\frac{(7*7)}{(7+7)*2.15}\cong 1.627\cong$$

η =0.45 $\Rightarrow$ *FROM TABLE*

d= 1.25

$$\phi_T=\frac{E*S*d}{\eta}=\frac{50*7*7*1.25}{0.45}=6805 lumen.$$

$$N=\frac{\phi_T}{\phi_L}=\frac{6805}{2800}\cong 2.43 \text{ lambs } [\ Z=1]$$

We choose 2 lambs after 30m^2.

PAR 38 SP 60w	60w	2800	E27

FOR A-3

h_2=3 - (0.85+0.0) = 2.15 meter

$$K_{index}=\frac{(A*B)}{(A+B)*h_2}=\frac{(3*2)}{(2+3)*2.15}\cong 0.55\cong$$

η =0.24 $\Rightarrow$ *FROM TABLE*

d= 1.25

$$\phi_T=\frac{E*S*d}{\eta}=\frac{50*2*3*1.25}{0.24}=1562 lumen.$$

$$N=\frac{\phi_T}{\phi_L}=\frac{1562}{740}\cong 2.01 \text{ lambs } [\ Z=1]$$

We choose 2 lambs

40 watt 750 lümen QR 112/*24

FOR A-4

h_2=3 - (0.85+0.0) = 2.15 meter

$$K_{index}=\frac{(A*B)}{(A+B)*h_2}=\frac{(7*26)}{(26+7)*2.15}\cong 2.3\cong$$

η =0.56 $\Rightarrow$ *FROM TABLE*

d= 1.25

$$\phi_T=\frac{E*S*d}{\eta}=\frac{75*26*7*1.25}{0.56}=32568lumen.$$

$$N=\frac{\phi_T}{\phi_L}=\frac{30768}{740}\cong 43.9\ lambs\ \ [\ Z=1]$$

We choose 44 lambs

40 watt 750 lümen QR 112/*24

A-5

$h_2 = 3 - (0.85+0.0) = 2.15$ *meter*

$$K_{index} = \frac{(A * B)}{(A + B) * h_2} = \frac{(3 * 18)}{(18 + 3) * 2.15} \cong 1.19 \cong$$

$\eta = 0.41 \Rightarrow$ *FROM TABLE*

d= 1.25

$$\phi_T = \frac{E * S * d}{\eta} = \frac{150 * 18 * 3 * 1.25}{0.41} \cong 22865 lumen.$$

$$N = \frac{\phi_T}{\phi_L} = \frac{22865}{2800} \cong 8.1 \text{ lambs } [\ Z=1]$$

We choose 8 lambs

CONCULUTİON

Before we started our project first we find a building's architectural. And before starting our drawing we calculated the illumination of the project. And we know that some mistakes big causes.

For these reason DR. ÖZGÜR ÖZERDEM checks our projects step by step and correct our mistakes.

If electrical calculation had got some mistakes it causes fires or some people may die for these reasons. For example if we make wrong calculation some parts of the buildings, hotel or etc... Wire may not carry so much current it may cause fire or if wires are big it losses big voltages in the system or if we make wrong calculation of the ground, people can die.

The electrical installation project bases we have to make certain calculations. While we are calculating we base the TSE (TURKISH STANDART INSTITUTE).

Our project helps us to take information about how we make calculation and what rules obey and the importance of grounding for human life, we learned the rules of drawing and calculate a project, before starting the ELECTRİCAL AND ELECTRONIC ENGINEERING.

COST OF PROJECT

*There are 407 lambs are used ın oour project

1 lamb ıs 195 ytl

407*195=79.365.000

*2 air condition lıne ıs used

1 aır conditıion 208.000ytl

2*208.000=506.000

*3 washıng lıne machıne used

1washıng machıne 327.000ytl

3*327=981.000ytl

*9tv lıne used

1tv lıne 90*9=810.000ytl

*gorund part for hotel and hause sıde. Base ıs 2.700.000

2.700.000*9=24.300.000

*dıstrıbutıon board (3*8) ıs 1.262.000 ytl

35*1.262.000=44.170.000ytl

*ground cable ıs(3*12+70) ıs 195 ytl

*cable cost ıs not dıerect measure nearly; 60.980.000ytl

TOTAL= 215.704.000 YTL

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