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AT&T Practices

Lighting for Network Equipment Buildings

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1 About this Document

1.1 Purpose

This practice discusses design and operating standards either addressed herein or made reference to for lighting systems within AT&T telecommunications equipment buildings. This standard is provided to aid the Building Engineer and their associates for planning illumination designs within new buildings, additions, or renovations that are intended to house network equipment meeting the requirements of AT&T 801-900-160, Issue 2, “AT&T Network Equipment Development Standards (NEDS) Generic Requirements”.

1.2 Reason for Reissue

This practice replaces the following AT&T practices.

760-230-130, Issue 3	Lighting in Network Equipment Buildings
730-230-130 Appendix 1, Issue 1	Emergency and Egress Lighting Systems in NSD Equipment Locations

1.3 How to Obtain a Copy of This Document

Use the document numerical identifier and issue number(i.e., 760-230-130 Issue 4) when ordering this practice.

External AT&T suppliers may obtain a copy of this document by accessing the AT&T Supplier Information web site (InfoSwap) at “http://infoswap.att.com” this site requires an id and password that can be obtain through AT&T Supplier Management.

For internal AT&T use an electronic copy of this manual may be obtained in a Portable Document Format (PDF) by accessing the NOE Document Management System (DMS) at “http://documents.ims.att.com”. Search for this document using the document numerical identifier.

1.5 How to Comment on This Document

To report errors or suggest changes to this document, contact the document owner. The name of the document owner can be obtained from the NOE DMS or MLDB via the NCS Home Page.

Any questions on the application of this document should be referred to the SME.

1.6 Scope

This practice is meant as guidance for any AT&T entity involved in designing and selecting lighting systems for use within AT&T spaces owned or leased. This practice specifies minimum quality levels for materials used for lighting luminaires, their installation and lamping.

2 Evaluating Illumination

Achieving a balanced system which includes the evaluation, selection and specification of lighting equipment to create effective lighting solutions must also address the interrelated issues of quality, cost, and flexibility.

2.1 Quality

The quality of the system not only applies to unit materials, sequence of assembly and disassembly and the method of installation, but also to such factors as the quality of illumination measured against initial cost, cost of operation and maintenance.

Visual comfort probability (VCP) is the rating system based on the degree of freedom from discomfort glare. This situation can be produced either by the direct glare from windows or luminaires, or by reflected glare from polished or glossy surfaces. The VCP shall be greater than 70% unless noted otherwise for a specific area.

Direct glare shall be minimized or eliminated by incorporating one or more of the following measures within the design:(a) remove the light from the field of view, (b) modify the light source to reduce or eliminate the direct light seen by the observer, and/or (c) reduce the brightness of the source.

Luminance ratios causing discomfort due to a high difference in luminance's within the visual spectrum (direct or reflected light/glare) must be avoided. Luminance values shall limit luminance ratios in footcandles to below five to one. (Max. to min.)

All fixtures, emergency lighting units and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the authorities having jurisdiction.

All lighting installations shall comply with the latest edition of NFPA 70. Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by Factory Mutual. All installations shall comply with visibility and luminance requirements for Egress/Exit as required by the latest edition NFPA 101, Life Safety Code.

2.2 Products

Wherever practical, fluorescent lamps should be used rather than incandescent lamps. Fluorescent lamps shall be T8 type, 3500K. The minimum Color Rendering Index (CRI) for fluorescent lamps shall be 80. Incandescent lamps shall be rated at 130 volts. Lighting fixtures for exterior or large storage facilities shall use metal halide lamps. Exterior lighting for security only shall use high-pressure sodium lamps. Do not use high-pressure sodium fixtures in areas where personnel will need to work. Approved lamp manufacturers are Osram/Sylvania, General Electric and Philips.

All fluorescent ballast shall be electronic type. Ballast shall be high frequency type, operating lamps at a frequency of between 20-30k Hz with no detectable flicker. Ballast shall be Class “P”, CSA certified and shall comply with FCC and Nema limits governing electromagnetic and radio frequency interference and shall not interfere with operation of other normal electrical equipment. Ballast shall withstand line transients as defined in ANSI/IEEE C62.41, Category A for normal and common modes. Ballast shall operate at an input frequency of 60 Hz and an input voltage of 10% rated voltage. Ballast that operates as a parallel circuit and shall allow remaining lamps to maintain full output if companion lamps fail. Ballast factor shall be between 0.87 and 1.1 and the ballast shall have an inrush peak no greater than 5 amps. Ballast shall meet the minimum requirements as follows: Power Factor = 0.95 minimum; Average Lamp Crest Factor = 1.8 maximum; Total Harmonic Distortion (THD) = 15% maximum; Ballast Current Third Harmonic Distortion content = 10% maximum. High power factor for all compact fluorescent lamps. Ballast manufacturer shall provide a 5-year warranty on parts and labor. Approved manufacturers are Magnetek, Universal, Advance and Motorola.

Emergency 48VDC fluorescent ballast shall be rapid start high frequency electronic, dual source AC and DC inverter ballast. Ballast shall operate in a single or dual lamp configuration. Ballast shall operate one lamp at approximately 70% level output. Approved manufacturers are Bodine, Side-Lite Emergi-Lite and Chloride.

All exit identification lights shall be dual voltage120/277V, with integral 48VDC inverter powered through a standby generator backed panel and the 48VDC DCO power plant. Illumination source shall be light emitting diodes (LED). Exit light shall be provided with 6" high stencil letters with red LED's. Exit light shall have universal mounting and universal directional chevrons. Housing shall be diecast aluminum. Approved manufacturers are LightGuard, Hubbell, Evenlite Inc. and Emergi-Lite.

At all workstations use fixture with parabolic aluminum louvers for combination of high efficiency, low brightness, low maintenance, and noise control. In all other areas use an acrylic prismatic lens fixture. Approved Lighting fixtures manufacturers are Daybrite, Lithonia, Metalux, Columbia and Lightolier. All other manufacturers shall be submitted for approval.

2.3 Costs

The design consultant shall specify all electrical and mechanical attributes such as the ballast type, wiring, flexible connectors, fusing, lamps, fixture size, finish, lens and louver type in order to obtain an initial cost. Consultant must specify competitive manufacturer models without allowing inferior substitution. Price comparisons should only address equivalently furnished equipment and lighting systems.

Special considerations of the system’s intended usage, energy consumption, initial, operating, lamp disposal and maintenance costs shall determine which system is the most economical and energy efficient within the a life-cycle evaluation.

2.4 Flexibility

The consultant/designer shall use the same fixture type as the main lighting luminaire as often as possible. In addition or renovations match existing luminaires. The consultant shall use the same lamp types for different lighting fixtures to reduce stocking requirements.

Flexible wiring systems shall be used when possible to minimize the time and expense of the initial installation and rearrangements caused by interior renovations.

2.5 Applications Aids

The consultant/designer shall provide computer-aided engineering reports calculating required lumens on all surfaces with time depreciation for either proposed or existing renovated systems. The consultant/designer shall provide construction drawings on AutoCad version 14 that shall delineate the complete lighting system layout with field-verified dimensions. Include all drawings, specifications and details with descriptive notes indicating seismic zone classification, fixture locations, mounting height, materials, finishes, typical and special conditions, fasteners, quantities, accessories, and other data to permit a full system evaluation. Submit the required number of drawing sets and performance specifications with product literature to AT&T Infrastructure Standards Group for review.

3 Surface Reflectance and Colors

The surface reflectance of ceilings, walls (including glass surfaces), floors, and equipment shall be treated as elements within the lighting design. Surface reflectance shall be maintained within 80 to 90 percent for ceilings, 50 to 70 percent for walls, and 10 to 20 percent for all floor types. The consultant/designer shall coordinate with the architect or interior designer prior to creating construction drawings.

At locations where work stations can be controlled, the lighting design consultant shall locate the general room light sources so that shadows, direct & veiling reflections, and light is not reflected from the task to the eye.

Use deep celled parabolic luminaires or luminaires designed for VDT environment in workstation areas for the general (ambient) lighting luminaires to eliminate the glare on computer screens. Select VDT luminaires that minimize brightness in the 55 or 65 to 90 degree zone. The average luminance in the lengthwise, crosswise and 45-degree vertical planes should not exceed:

850 cd/m2 (250fl) at 55 degrees from vertical.
350 cd/m2 (100fl) at 65 degrees from vertical.
175 cd/m2 (50fl) at 75 degrees or more from vertical.

In no case should the average luminance in the lengthwise, crosswise and 45-degree vertical planes exceed:

850 cd/m2 (250fl) at 65 degrees from vertical.
350 cd/m2 (100fl) at 75 degrees from vertical.

175 cd/m2 (50fl) at 85 degrees or more from vertical.

Select luminaires with shielding angles of a least 30 degrees in all directions. Select luminaires with high VCP's (minimum of 80, but preferably 90 or more). Design to a maximum maintained footcandeles on the horizontal work plane as indicated in Table A.

4 Measurement of Illumination

Refer to Chapter 11 "Illuminance Selection - Figure 11-1", IES Lighting Handbook, 8th edition for current recommended illuminance levels per activity, and the suggested minimum levels listed in Table A.

The levels shown in the table are in maintained footcandles on the task, and in the plane of the task (i.e., horizontal or vertical). General (ambient) lighting levels shall be reduced and controlled (switched) where increased illumination levels are required because of an individual location.

5 Energy Conservation

All designs shall comply with the US Government Energy Policy Act of 1992 (EPACT), Public Law #102-468. All designs shall meet the maximum watts per square foot allowed by the local Energy Code.

The total energy consumed by the interior lighting system shall be less than or equal to 1.7 watts per square foot.

No more than 0.2-watts/sq. ft. should be added in task lighting to the ambient lighting power requirement.

Lighting adjacent to window walls shall be switched separately from the general area lighting, and left off on bright days.

Refer to AT&T 760-260-200 "AT&T Energy Management Manual", Issue 1, Chapter 6 "Energy Cost Reduction Measures" Part 6-13 "Lighting" for assistance in implementing AT&T's energy policy.

Disposal of lamps and ballast shall conform to latest EPA regulations, specifically units with PCB's. Refer to the "Practical Guide to Ballast Disposal" 5 Th. edition, 1995 by Ful-Circle which includes Federal and State disposal regulations and AT&T 770-280- 700, "Inspection & Maintenance of Facility Lighting Systems", Issue 1 to maintain the lighting system through routine maintenance.

6 Facility Lighting Standards

6.1 General

Illumination levels for Network Equipment, Network Supportive (non-equipment) and other facility areas are listed in Table A.

In all areas, localized switching shall be provided to control area illumination to allow a lower intensity when the space is unoccupied.

Fluorescent or HID fixtures shall not be dimmed. Incandescent fixtures shall only be dimmed in conference room or areas as requested by the building engineer.

Special floor marking, fire extinguisher, first aid and fire alarm stations shall be illuminated providing positive identification without distortion indicating the presence of a hazard or a safety facility.

During commercial power interruption, or if a lighting feeder circuit is de-energized, the emergency power source shall be 48 volt DC unless otherwise directed by AT&T.

It is the consultants' responsibility to investigate all federal, state and local codes that shall apply to the renovated or new facility prior to the beginning of any work. These codes shall be indicated on the design documents that shall be “Issued for Permit”.

6.2 Network Equipment Areas

This section includes information on both slab and raised floor environments for 4ESS and 5ESS, DACs I-IV, Lightguide, NSDNet, SkyNet and STP equipment systems, etc., including the central office of the future (COOTF) space.

Slab environments: (Including areas with or without ceilings)

The equipment vendor is responsible for all network elements including the associated lighting layouts and specifications as installed by Lucent or other accredited vender. The luminaires used shall be designed to provide optimum vertical illumination. The luminaires shall be either equipment or frame mounted on the cross-aisle racks, or on other approved structures within the maintenance aisles. These fixtures, positioned parallel to the equipment frame lineups, shall generate 30 fc of horizontal lumens at one (1) foot above finished floor (AFF). The lighting fixtures shall be positioned within 3 1/2 feet of the end of equipment lineup. Provide one switch per aisle on end of the rack for lights within the maintenance aisle. All work provided by the equipment vendor shall comply with the NEC and Authority having jurisdiction.

When an equipment vendor provides demolition within a renovated space, they shall be responsible for demolition of all lighting equipment, wire and conduit back to the panel.

The design consultant shall provide a minimum of 15 fc in the base building design for general illumination. The design consultant shall provide dedicated lighting circuits terminating in junction boxes on the ceiling for connection by the equipment vendor.

Raised floor environments: (Including areas with or without ceilings)

The design/consultant is responsible for all the associated lighting layouts and specifications in the Network Equipment Areas. The lighting layout shall have the fixtures positioned perpendicular to the equipment frame lineups. The lighting fixtures shall be positioned within 3 1/2 feet of the end of equipment lineup. Provide illumination levels that are equal in both maintenance and wiring aisles. Throughout the area provide an

even maintained ambient light level of 30 fc of horizontal lumens at one (1) foot above the floor (AFF).

6.3 Network Supportive Areas

Network Supportive Areas are any area or point pertinent to the network and facility survival. These areas include Mini-Computer and Maintenance Operating Centers (MMOCs), Technology Control Centers (TCCs), and supportive Network Operating Centers (NOCs), which contain network supportive systems. These areas are locations of high personnel and computer interface with the network. These areas shall comply with the following:

- Provide minimum 50 fc of lumens at thirty (30) inches above the finished floor (AFF).
- Lighting fixtures in these areas shall be recessed fluorescent types.
- All lighting fixtures in these areas shall have glare control using reflectors that produce low brightness in the 60-90 degree zone (30 degree shielding).
- The VCP for these areas shall be 80% or higher.
- The consultant shall design the fixture layout in a pattern so that a minimum of one fixture is provided for each workstation located above the work surface unless the space is two or more stories.

6.4 Facility Supportive Areas

Any critical restoration point, space, area or room that house equipment to maintain both the facility and the network environment are considered facility supportive areas.

The facility supportive areas are the emergency operation center/mimic room, standby engine and switchgear operating control panel rooms, main building mechanical control room, spaces with HVAC control points, and the fire control panel room.

Provide 35 footcandles horizontal and 15 footcandles vertical with a minimum uniform lighting ratio of 6:1 under normal power conditions.

6.5 Administrative/Public Areas

Administrative areas:

Areas within network equipment facilities where people's activities are considered secondary to the network's function. Such areas include general office space, business offices, conference rooms, training rooms, locker rooms, cafeterias and lounges.

Public/general areas:

Areas that do not mechanically support the network or facility equipment. These areas include common areas and traffic circulation space (i.e. all points of entry and exit, lobby core areas, stairways, halls and corridors, shipping and receiving areas, rest rooms, janitorial closets, storage areas, etc.).

Refer to Table "A" for minimum illumination requirements.

6.6 Egress/Exit (E/E) Lighting Systems

Egress/exit lighting must be provided as required by local governmental authorities regardless of usage of a building area or space. This lighting must meet a minimum of one (1) fc at floor level for all egress paths.

Egress/exit lighting shall be mounted in accordance with industry standards per seismic zone classification as being separately supported from all suspended ceiling systems.

Egress/exit lighting fixtures shall be standard commercial luminaires.

Egress/exit lighting shall be placed within equipment environments that without light could cause individual disorientation and in all paths of egress indicating principal aisles and exits.

During normal facility lighting operation, the E/E lighting fixture shall be connected to a hot circuit from the building 48-volt DC DCO power plant and a standby engine AC source. The activation of the emergency lighting circuit shall be through an automatic transfer relay or switch within the fixture ballast activated by an AC power failure. The automatic transfer relay within the ballast shall be connected to a non-switched standby engine AC source. Local switches under normal conditions shall control the E/E lighting fixtures.

NOTE:

If the building engineer or the on site work force personnel will not allow connection to the building 48 volt DC plant, the fixtures shall be provided with internal battery inverters.

When using a battery inverter system the illumination depreciation of footcandle levels of the E/E lighting systems shall not decline below sixty per-cent (60%) of their initial level for ninety (90) minutes minimum.

Incandescent fixtures shall not be used as the E/E fixtures unless already existing. When incandescent fixtures are used as the E/E fixture the fixtures shall remain normally off and only light at full lumen capacity with DC power operation.

The lighting fixture shall luminate the lamps at full lumen capacity in AC mode and partial capacity (one of two or two of four lamps) when switched to DC operation.

The E/E luminaires shall operate until the standby power generator comes on-line or until commercial power is restored where general (ambient) area lighting resumes.

The DC plant servicing the 4ESS equipment shall not be used to power the E/E lighting system.

The DC plant (battery) capacity required to energize the lighting load shall be calculated on the basis of all E/E lights during a power failure. The hours of battery reserve available for these luminaires will be the same as those available for the telecommunications equipment, as coordinated with AT&T/COPs.

Provide appropriate E/E lumination beyond the exterior facade of the facility. The lighting consultant shall consult with governmental agencies as the Department of Health and Human Services, and the local fire marshal's office as applicable to the occupancy/usage of a given area within the facility.

Positioning of Fire alarm call points, fire fighting and first aid equipment shall be coordinated with the location of egress/exit lighting along the means of egress.

Egress/exit lighting as a "code required lighting," can also be considered as critical or referred to in-house as dedicated "facility safety" lighting receiving an in-house upgrade either by quantity of fixtures, and/or increased illumination output. The luminaires need to be strategically placed to satisfy both the local egress code and critical restoration requirements of the on-site personnel during power interruptions.

6.7 Facility Safety Lighting

Lighting for facility Safety is different from E/E lighting in that it involves ensuring proper uniform illumination (quality) at all times for safe working conditions, safe passage, and the identification of any hazards or obstructions, whether indoors or outdoors.

The illumination levels listed in this section are considered a lighting design guide that aids visual effectiveness to increase the probability that a person will avoid an accident or detect the potential cause of an accident and act to correct it. These values are not meant as an alternative or maintenance lighting level, and should only be considered as an element of the general (ambient) area lighting equation. In areas that do not have fixed lighting, or areas with minimal egress/exit lighting, local illumination shall be provided during occupancy by means of portable luminaires (i.e. under raised access floor systems).

Network Equipment Areas:

The E/E lighting shall be provided as indicated in Section 6.6 above. Additional fixtures shall be positioned to provide a minimum of 15fc at the switching, monitoring, and/or control locations, or a footcandle rating generated by one (1)-dedicated fixture of the same general area fixture type. Additional facility safety lighting requirements may be required to facilitate the restoration functions of operation, control, status verification of switch and breaker positions. Coordinate additional lighting requirements with the Central Office Planners (COPs).

Network Supportive Areas:

The E/E lighting shall be provided as indicated in Section 6.6 above. Additional fixtures shall be positioned at the control gauges/boards/panels etc. to provide a minimum of 15fc or a footcandle rating generated by one (1) dedicated fixture of the same general area fixture type.

Facility Supportive Areas:

The E/E lighting shall be provided as indicated in Section 6.6 above. Additional fixtures shall be positioned at either side of the standby engine plant and in front of the switchgear providing a minimum of 15fc or equal to one (1) standard general area luminaire. Non critical facility supportive areas such as electrical closets and rooms, miscellaneous HVAC rooms shall require standard egress/exit illumination and 5fc of safety lighting.

Administrative/public Areas:

The E/E lighting shall be provided as indicated in Section 6.6 above. No facility safety lighting shall be required for these areas.

Partitioned off areas: (i.e. open areas left vacant or planned for further retrofit)

The E/E lighting shall be provided as indicated in Section 6.6 above. No facility safety lighting shall be required for these areas.

At the discretion of equipment engineers, the COPs, and the on-site workforce, additional safety lighting or critical standby lighting maybe provided in the other equipment and supportive areas for added safety.

6.8 Exit Identification Lighting

The design/consultant shall provide layout and specifications for the location of exit identification fixtures.

The designer shall coordinate placement of units throughout the facility for a safe and orderly evacuation along the means of egress. The designer shall coordinate both telecommunication and facility equipment layouts. Provide additional unit if needed because of visual obstructions.

The designer shall field verify during construction, that regardless of the area's ownership or business entity responsible for equipment placement, that the local regulatory concerns have all been met.

All exit identification fixtures shall be continuously illuminated.

6.9 Exterior Lighting Systems

Lighting for safety is the main priority for company personnel and property. The designer must use simple and efficient (cost effective) outdoor lighting systems. Provide the minimum illumination levels for identifying potential areas of hazards such as obstacles, change in elevation and direction, and the facility's entry/exit points. Entry/exit points should be visible from any site location either by lighting or directional signs.

Nonessential specialty lighting such as architectural (i.e. building floodlighting), softscape (i.e. fountain, statute), landscape, flagpole, festoon lighting, should always be kept to a minimum.

Exterior security lighting shall be integrated into a complete security system which includes fences, locked gates, remote surveillance with a response element, and other exterior lighting layouts for parking areas and display lighting. The designer should only select the appropriate luminaire, lamp, mounting, mounting height, spacing, and pole type (if used) as required for the task per the local code, and the company's energy management policy.

Roadway/Parking area lighting shall accommodate the visual needs of night traffic (vehicular and pedestrian) expressed in amount of usage, pavement luminance, luminance uniformity and disability veiling glare produced by the system light sources. Provide an average maintained minimum of 0.5 footcandles for roadways with a max. to min ratio of 10:1 and average max. to min ratio of 6:1. For parking areas provide an average maintained minimum of 2 footcandles with a max. to min ratio of 12:1 and an average max. to min ratio of 3:1 with 6 footcandles at the entrances to buildings.

All circuits for exterior facility fixtures shall be equipped with programmable timers rather than photocells (except for egress/exit evacuation lighting) so that their on-off periods can be controlled.

All roadway and parking HID fixtures shall be individually fused.

Light pollution, light trespass, and temporary lighting are important issues to many communities, and should be considered when preparing an outdoor lighting design. Research local codes and provide documentation to AT&T.

7 Lighting Maintenance

AT&T 770-280-700 Issue 1, “Lighting Systems Inspection and Maintenance”, shall be consulted for company routines to help avoid lighting capital expenditure or costly interruptions.

8 References

Only the latest issue and/or edition of materials referenced herein shall apply.

AT&T Standards

- AT&T 154-001-050 “AT&T Power and Infrastructure Standard AC PWR-003 Inverter Power for Critical Network Elements”.
- AT&T 155-003-003 “Power Plant Emergency Test, Office Summary Report”.
- AT&T 760-260-200 “AT&T Energy Management Manual”.
- AT&T 760-610-205 “Fire Safety - Egress/Access Requirements”.
- AT&T 770-280-700 “Gen. Inspection/Maintenance of Facility Lighting Systems”.
- AT&T 801-900-160 “Development Standards (NEDS) Generic Requirements”.

Table A

Footcandles (fc)	Areas
30 fc	Network Equipment Areas
50 fc	Network Supportive Areas, Administrative Areas, General Office Spaces(Central Office, Employment Office, Business Office, Operator Units) Accounting, Computer, Distributing, and Drafting Rooms, Garage Repair Areas, Reprographics and Word Processing Areas, Libraries and Private Offices Training Areas
45 fc	Central Office Testboards, Conference Room, Kitchens, Operating Unit Key Shelf
35 fc	Facility Supportive Areas for Network Equipment
30 fc	Auditorium, Cafeteria, Telephone Equipment Areas
20 fc	Lounges and Waiting Rooms, Common Areas, Traffic Circulation Spaces
20 fc	Basements Boiler Rooms, Cable Vaults Corridors, Halls, Stairs, Exits, Lobbies and Foyers, Elevators and Elevator Machine Rooms, Locker and Rest Rooms, Mechanical Equipment Rooms Shipping/Receiving Areas, Standby Engine and Power Plant Rooms*, Switchgear Rooms*, Transformer Vaults*
10 fc	Janitors Closets, Storage Areas
2 fc	Personnel Entrances (Outdoor Illumination Level)
1 fc	Vehicle Entrances, Facility Egress/Exit Lighting

* These areas do not apply if the space is considered a Network Supportive Area for Network Equipment.