
 NAVFAC IGS-16510 (APRIL 2004)

 Superseding
 Preparing Activity: LANTNAVFACENGCOM IGS-16510 (OCTOBER 2002)

ITALIAN GUIDE SPECIFICATIONS

Use for ITALIAN projects only

Latest changes indicated by CHG tags.

SECTION 16510

INTERIOR LIGHTING
04/04

NOTE: This guide specification is issued by the Atlantic Division, Naval Facilities Engineering Command for regional use in Italy.

NOTE: This guide specification covers requirements for interior lighting installations. Requirements for materials and procedures for special or unusual design should be added as necessary to fit specific projects.

NOTE: In compliance with Executive Order 12902 and FAR section 23.704 which directs federal agencies to purchase products in the upper 25 percent of energy efficiency, the following products specified in this section meet or exceed the U.S. Department of Energy, Federal Energy Management Program (DOE/FEMP) Product Energy Efficiency Recommendations (PEER) for the Recommended energy efficiency levels. It is the Navy's intent to meet the minimum U.S. energy goals for all DOD projects located in Europe.

- FEMP LT-1 (1998) How to Buy Energy-Efficient Fluorescent Tube Lamps
- FEMP LT-2 (1998) How to Buy Energy-Efficient Fluorescent Ballasts
- FEMP LT-3 (1998) How to Buy Energy-Efficient Fluorescent Luminaires
- FEMP LT-4 (1998) How to Buy Energy-Efficient

Exit Signs

- FEMP LT-5 (1999) How to Buy Energy-Efficient Compact Fluorescent Light Bulbs
- FEMP LT-6 (1999) How to Buy Energy-Efficient Industrial HID Luminaires
- FEMP LT-7 (2000) How to Buy Energy-Efficient Commercial Downlight Luminaires
- FEMP LT-8 (2000; Draft) How to Select Lighting Controls For Offices and Public Buildings

Be aware that PEER is based on certain cost-effectiveness assumptions. Where energy prices and hours of use differ from those assumed in the PEER, recalculate cost effectiveness using the ratios given in the PEER.

For additional information on PEER, contact FEMP at 800-363-3732. To view the latest information about buying energy efficient products on-line go to the FEMP home page at: <http://www.eren.doe.gov/femp/procurements>.

NOTE: Provide lighting fixture schedule and lighting fixture details on the drawings. The following information shall be shown:

1. Type, style, mounting, and lamp arrangement
2. Location of fixtures
3. Wattage, voltage, and frequency rating required
4. Type of reflector, diffuser required
5. Glass/plastic lens
6. Accessories required, such as photocell, time switches, sensors, and auxiliary lamps
7. Mounting height above floor or grade to bottom of fixture
8. Where wire for humid areas, rods, or straps are used (if more than one type of hanger is used)
9. Reflecting or nonreflecting surface finish

10. Shielding required

11. Provide a detail for each lighting fixture type. Establish a level of quality from three (or at least two) manufacturers. Provide specific information to the typical detail defined on similar LANTDIV lighting fixture plates. Example: define housing requirements, material thickness, ballast information, photometric data, define specific manufacturer's options that are required or desired, and so forth.

12. Occupancy sensor location, mounting, and sensor detection type.

NOTE: Demolition work that involves disposal of fluorescent and HID lamps and ballasts will require the use of Section 13286, "Handling of Lighting Ballasts and Lamps Containing PCBs and Mercury".

NOTE: Comments and suggestion on this specification are welcome and should be directed to the technical proponent of the specification. A listing of the technical proponents, including their organization designation and telephone number, is on the Internet.

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Maximize the use of European technical/construction standards. Do not reference Italian standards that duplicate an available European standard. However, the designer is responsible for determining if there are any specific Italian standards that must be referenced, and for consulting with the project's Activity to determine their requirements and standards.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the

basic designation only.

EUROPEAN COMMUNITY QUALITY MARKS (CE)

NOTE: CE (European Community) is a European quality marking system indicating that the equipment or product conforms to EEC (European Economic Community) standards concerning quality of safety and health and conforms with all the Italian technical standards in force. All products (Electrical, Mechanical and Electronic Equipment and similar items) that are marked CE conform to the standards and Laws enforced in Europe. In Italy, the CE marking is a mandatory requirement and must be shown on all applicable equipment and products attesting to the conformity with the EEC standards.

CE European Quality Mark

EUROPEAN COMMITTEE FOR STANDARDIZATION (EN)

- EN 10088-1 (1995) Stainless Steels, Part 1. List of Stainless Steels
- EN 10218-1 (1994) Steel Wire and Wire Products - General, Part 1: Test Methods
- EN 10244-2 (2001) Steel Wire and Wire Products - Non-ferrous Metallic Coatings on Steel Wire, Part 2: Zinc or Zinc Alloy Coatings

ITALIAN ELECTROTECHNICAL COMMITTEE STANDARDS (CEI)

NOTE: A CEI Norm is an Italian technical normative for electrical systems recognized by Italian Law, submitted by a private organization "Comitato Elettrotecnico Italiano" for the Italian territory, available in the Italian language and only in some cases in English.

CEI 64-8 (2003) Electrical Installations of Buildings

ITALIAN/EUROPEAN HARMONIZATION STANDARDS (UNI EN)(UNI ENV)(CEI EN)
(UNI EN ISO)(UNI ISO)

NOTE: A UNI EN, UNI ENV, CEI EN, UNI EN ISO or UNI ISO is a European Standard with a coincident

Italian National Standard or International Standard. The two standards are identical, with most (but not all) EN's available in the English language and the UNI available only in the Italian language.

CEI EN 50014	(1999) Electrical Apparatus for Potentially Explosive Atmospheres - General Requirements
CEI EN 50018	(2003) Electrical Apparatus for Potentially Explosive Atmospheres - Flameproof Enclosure 'd'
CEI EN 60081	(2001) Double-Capped Fluorescent Lamps - Performance Specifications
CEI EN 60192	(2002) Low Pressure Sodium Vapour Lamps
CEI EN 60357	(2001) Tungsten Halogen Lamps (Non-Vehicle)
CEI EN 60432-1	(2001) Incandescent Lamps - Safety Specifications - Part 1: Tungsten Filament Lamps for Domestic and Similar General Lighting Purposes
CEI EN 60432-2	(2001) Incandescent Lamps - Safety Specifications - Part 2: Tungsten Halogen Lamps for Domestic and Similar General Lighting Purposes
CEI EN 60529	(2000) Degrees of Protection Provided By Enclosures (IP Code)
CEI EN 60598-1	(2003) Luminaires - Part 1: General Requirements and Tests
CEI EN 60598-2-1	(1997) Luminaires - Part 2: Particular Requirements. Section 1: Fixed General Purpose Luminaires
CEI EN 60598-2-2	(1998) Luminaires - Part 2: Particular Requirements. Section 2: Recessed Luminaires
CEI EN 60598-2-22	(1999) Luminaires - Part 2-22: Particular Requirements. Luminaires for Emergency Lighting
CEI EN 60662	(2001) High-Pressure Sodium Vapour Lamps
CEI EN 60901	(2004) Single-Capped Fluorescent Lamps - Performance Specifications

CEI EN 60920	(1998) Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements
CEI EN 60921	(2000) Ballasts for Tubular Fluorescent Lamps - Performance Requirements
CEI EN 60922	(1998) Auxiliaries for Lamps - Ballasts for Discharge Lamps (Excluding Tubular Fluorescent Lamps) - General and Safety Requirements
CEI EN 60923	(2002) Performance Requirements for Ballasts for Discharge Lamps (Excluding Tubular Fluorescent Lamps) - Performance Requirements
CEI EN 60924	(1991; Amend. 1993) D.C. Supplied Electronic Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements
CEI EN 60925	(2002) D.C. Supplied Electronic Ballasts for Tubular Fluorescent Lamps - Performance Requirements
CEI EN 60928	(1996) Auxiliaries for Lamps - A.C. Supplied Electronic Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements
CEI EN 60929	(1998) A.C. Supplied Electronic Ballasts for Tubular Fluorescent Lamps - Performance Requirements
CEI EN 61000-3-2	(2002) Electromagnetic Compatibility (EMC) Part 3-2: Limits - Limits for Harmonic Current Emissions (Equipment Input Current up to and Including 16 A Per Phase) IEC 61000-3-2:2000, Modified
CEI EN 61167	(1999) Metal Halide Lamps
CEI EN 61195	(2000) Double-Capped Fluorescent Lamps - Safety Specifications

ITALIAN NATIONAL ASSOCIATION FOR UNIFICATION OF STANDARDS (UNI)

NOTE: A UNI Norm is a technical normative recognized as Italian Law, submitted by a private organization "Ente Nazionale Italiano di Unificazione" for Italy and is available only in the Italian language. It is the National Standard.

 UNI 10380 (1994) Lighting - Interior Lighting with
 Artificial Light

1.2 RELATED REQUIREMENTS

Section 16050, "Basic Electrical Materials and Methods," applies to this section, with the additions and modifications specified herein. Materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 16402, "Interior Distribution System." Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in this section.

1.3 DEFINITIONS

1.3.1 Average Life

Time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

1.3.2 Total Harmonic Distortion (THD)

The root mean square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SUBMITTALS

NOTE:

Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item is required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Recommended codes for Army projects are "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are

considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Submit the following in accordance with Section 01330, "Submittal Procedures." Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the European lighting industry and UNI 10380, as applicable, for the lighting system specified.

SD-02 Shop Drawings

Occupancy sensors

SD-03 Product Data

- Fluorescent lighting fixtures; G
- Fluorescent electronic ballasts; G
- Electronic dimming ballast; G
- Dimming ballast controls; G
- Light Level Sensor; G
- Fluorescent electromagnetic ballasts; G
- Fluorescent lamps; G
- [Electromagnetic Interference Filters]
- High-intensity-discharge (HID) lighting fixtures; G
- HID ballasts; G
- High-pressure sodium (HPS) lamps; G
- Low-pressure sodium lamps; G
- Metal-halide lamps; G
- Incandescent lighting fixtures; G
- Incandescent lamps; G
- Dimmer switch; G
- Lighting contactor; G
- Time switch; G
- Photocell switch; G

- Power hook fixture hangers; G
- Exit signs; G
- Emergency lighting equipment; G
- Central emergency system; G
- Occupancy sensors; G

SD-04 Samples

NOTE: Samples involve additional shipping cost. Use only for special fixtures or for an item for which a large quantity is required on a project. If samples are not essential to the specific application, delete them.

- Lighting fixtures, complete with lamps and ballasts; G

SD-06 Test Reports

- Operating test
- Submit test results as stated in paragraph entitled "Field Quality Control."

SD-10 Operation and Maintenance Data

NOTE: Require O&M manuals for lighting control systems that use low voltage control circuits. Example: Light level sensors used with dimming ballast, or occupancy sensors used with power packs.

- Lighting Control System, Data Package 5; G

Submit operation and maintenance data in accordance with Section 01781, "Operation and Maintenance Data" and as specified herein, showing all control modules, control zones, occupancy sensors, light fixtures, and all interconnecting control wire, conduit, and associated hardware.

1.5 QUALITY ASSURANCE

1.5.1 Fluorescent Electronic Ballasts

Submit ballast catalog data as required in the paragraph entitled "Fluorescent Lamp Electronic Ballasts" contained herein. As an option, submit the fluorescent fixture manufacturer's electronic ballast specification information in lieu of the actual ballast manufacturer's

catalog data. This information shall include published specifications and sketches, which covers the information required by the paragraph entitled "Fluorescent Lamp Electronic Ballasts" herein. This information may be supplemented by catalog data if required, and shall contain a list of vendors with vendor part numbers.

1.5.2 Samples - Lighting Fixtures, Complete With Lamps and Ballasts

Submit one sample of each fixture type and large order item for inspection, review, and approval. The sample shall be retained for comparison against the remainder of the fixtures. The sample may be used in the final fixture installation.

1.5.3 Lighting Control System

Submit operation and maintenance manuals for lighting control systems that provide basic data relating to the design, operation, and maintenance of the lighting control system for the building. This shall include:

- a. Schematic diagram of the lighting control system.
- b. Manufacturers' operating and maintenance manuals on active lighting control equipment. Lighting control equipment shall include, if indicated: occupancy sensors, power packs, dimming ballasts, and light level sensors.

1.5.4 Occupancy Sensors

Submit occupancy sensors catalog data as required in the paragraph entitled "Occupancy Sensors" contained herein. Final quantity and layout of all occupancy sensors shall be provided in accordance with the occupancy sensor manufacturer's instructions and recommendations. Provide scaled floor plan of each controlled area, showing sensor's location(s) and a diagram illustrating each sensor's area of coverage. These shop drawings shall be provided by the occupancy sensor's manufacturer with the manufacturer's name clearly identified on the drawings. Final sensor layout (quantity and location) shall provide full coverage over the controlled area. Full coverage shall provide hand and arm motion detection for office and administration type areas, and walking motion for industrial areas, warehouses, storage rooms and hallways. Final locations shall also be selected as required to avoid nuisance activation and deactivation due to sudden temperature or airflow changes.

1.6 ELECTRONIC BALLAST WARRANTY

NOTE: The warranty clause in this section has been approved by a Level 1 Contracting Officer, and may be used without further approval or request for waiver.

Furnish the electronic ballast manufacturer's warranty. The warranty period shall not be less than 5 years from the date of manufacture of the

electronic ballast. Ballast assembly in the lighting fixture, transportation, and on-site storage shall not exceed 12 months, thereby permitting 4 years of the ballast 5 year warranty to be in service and energized. The warranty shall state that the malfunctioning ballast shall be exchanged by the manufacturer and promptly shipped to the using Government facility. The replacement ballast shall be identical to, or an improvement upon, the original design of the malfunctioning ballast.

PART 2 PRODUCTS

2.1 SOURCE MANUFACTURERS

2.1.1 Fluorescent Lamp Electronic Ballasts

The following manufacturers provide products that generally comply with these specifications:

- a. Advance Transformer Co.
Rosemont, IL
www.advancetransformer.com
- b. Disano Illuminazione
Milan, Italy
www.disano.it/uk
- c. Helvar
Helsinki, Finland
www.helvar.com
- d. Magnetek
Nashville, TN
www.magnetek.com
- e. Osram
Munich, Germany
www.osram.com
- f. Philips Lighting Co.
Eindhoven, Netherlands
www.lighting.philips.com
- g. Tridonic
Dornbirn, Austria
www.tridonic.com

2.1.2 Fluorescent Lamp Electronic Dimming Ballasts

The following manufacturers provide products that generally comply with these specifications:

- a. Advance Transformer Co.
Rosemont, IL
www.advancetransformer.com

- b. Disano Illuminazione
Milan, Italy
www.disano.it/uk
- c. Helvar
Helsinki, Finland
www.helvar.com
- d. Magnetek
Nashville, TN
www.magnetek.com
- e. Osram
Munich, Germany
www.osram.com
- f. Philips Lighting Co.
Eindhoven, Netherlands
www.lighting.philips.com
- g. Tridonic
Dornbirn, Austria
www.tridonic.com

2.1.3 Light Level Sensor

The following manufacturer provides products that generally comply with these specifications:

- a. Helvar
Helsinki, Finland
www.helvar.com

2.1.4 Fluorescent Lamp Electromagnetic Ballasts

The following manufacturers provide products that generally comply with these specifications:

- a. GE Lighting
Vicenza, Italy
www.gelighting.com
- b. Osram
Munich, Germany
www.osram.com
- c. Philips Lighting Co.
Eindhoven, Netherlands
www.lighting.philips.com

2.1.5 Fluorescent Lamps

The following manufacturers provide products that generally comply with these specifications:

- a. GE Lighting
Vicenza, Italy
www.gelighting.com
- b. Osram
Munich, Germany
www.osram.com
- c. Philips Lighting Co.
Eindhoven, Netherlands
www.lighting.philips.com

2.1.6 HID Ballasts

The following manufacturers provide products that generally comply with these specifications:

- a. GE Lighting
Vicenza, Italy
www.gelighting.com
- b. Osram
Munich, Germany
www.osram.com
- c. Osram
Via Savona, 105
20144 Milano (MI)
Tel: 02-42491
Fax: 02-4249458
Telex: 353526 OSRAMM I
http: <http://www.osram.it>
E-mail: marcom@osram.it
- d. Philips Lighting Co.
Eindhoven, Netherlands
www.lighting.philips.com
- e. Philips Lighting Co.
Via G. Casati, 23
20052 Monza (MI)
Tel: 039/203.1
Fax: 039/203.6118
Fax Marketing Communication: 039/203.6119

2.1.7 High Pressure Sodium Lamps

The following manufacturers provide products that generally comply with these specifications:

- a. GE Lighting
Vicenza, Italy
www.gelighting.com

- b. Osram
Munich, Germany
www.osram.com
- c. Osram
Via Savona, 105
20144 Milano (MI)
Tel: 02-42491
Fax: 02-4249458
Telex: 353526 OSRAMM I
http: http://www.osram.it
E-mail: marcom@osram.it
- d. Philips Lighting Co.
Eindhoven, Netherlands
www.lighting.philips.com
- e. Philips Lighting Co.
Via G. Casati, 23
20052 Monza (MI)
Tel: 039/203.1
Fax: 039/203.6118
Fax Marketing Communication: 039/203.6119

2.1.8 Low Pressure Sodium Lamps

The following manufacturers provide products that generally comply with these specifications:

- a. GE Lighting
Vicenza, Italy
www.gelighting.com
- b. Osram
Munich, Germany
www.osram.com
- c. Osram
Via Savona, 105
20144 Milano (MI)
Tel: 02-42491
Fax: 02-4249458
Telex: 353526 OSRAMM I
http: http://www.osram.it
E-mail: marcom@osram.it
- d. Philips Lighting Co.
Eindhoven, Netherlands
www.lighting.philips.com
- e. Philips Lighting Co.
Via G. Casati, 23
20052 Monza (MI)

Tel: 039/203.1
Fax: 039/203.6118
Fax Marketing Communication: 039/203.6119

2.1.9 Metal-Halide Lamps

The following manufacturers provide products that generally comply with these specifications:

- a. GE Lighting
Vicenza, Italy
www.gelighting.com
- b. Osram
Munich, Germany
www.osram.com
- c. Osram
Via Savona, 105
20144 Milano (MI)
Tel: 02-42491
Fax: 02-4249458
Telex: 353526 OSRAMM I
[http: http://www.osram.it](http://www.osram.it)
E-mail: marcom@osram.it
- d. Philips Lighting Co.
Eindhoven, Netherlands
www.lighting.philips.com
- e. Philips Lighting Co.
Via G. Casati, 23
20052 Monza (MI)
Tel: 039/203.1
Fax: 039/203.6118
Fax Marketing Communication: 039/203.6119

2.1.10 Incandescent Lamps

The following manufacturers provide products that generally comply with these specifications:

- a. GE Lighting
Vicenza, Italy
www.gelighting.com
- b. Osram
Munich, Germany
www.osram.com
- c. Philips Lighting Co.
Eindhoven, Netherlands
www.lighting.philips.com

2.1.11 Incandescent Dimmer Switch

The following manufacturers provide products that generally comply with these specifications:

- a. Bticino
Milan, Italy
www.bticino.com
- b. Gewiss
24069 Cenate Sotto BG, Italy
www.gewiss.com
- c. Legrand
Italy
www.legrand.it

2.1.12 Lighting Contactor

The following manufacturers provide products that generally comply with these specifications:

- a. ABB S.p.A.
20010, Vittuone (MI)
Viale dell'Industria, 18
Tel: 029034.1
Fax: 029034.7609
www.abb.it
- b. Bticino
Milan, Italy
www.bticino.com
- c. Bticino
Via Messina, 38
20154 Milano
Call Center BTicino 199.145.145
Web Site: www.bticino.it
E-mail: info.ind@bticino.it
- d. Schneider Electric
20041 Agrate (MI)
Tel: 039/6558111
Fax: 039/6056900
Telex: 301535 MAGGAL I
Web Site: www.schneider.it

2.1.13 Time Switch

The following manufacturers provide products that generally comply with these specifications:

- a. ABB S.p.A.
20010, Vittuone (MI)

Viale dell'Industria, 18
Tel: 029034.1
Fax: 029034.7609
www.abb.it

- b. Bticino
Milan, Italy
www.bticino.com
- c. Bticino
Via Messina, 38
20154 Milano
Call Center BTicino 199.145.145
Web Site: www.bticino.it
E-mail: info.ind@bticino.it
- d. Gewiss
24069 Cenate Sotto BG, Italy
www.gewiss.com
- e. Schneider Electric
20041 Agrate (MI)
Tel: 039/6558111
Fax: 039/6056900
Telex: 301535 MAGGAL I
Web Site: www.schneider.it

2.1.14 Photocell Switch

The following manufacturers provide products that generally comply with these specifications:

- a. ABB
Zurich, Switzerland
www.abb.com
- b. Bticino
Milan, Italy
www.bticino.com
- c. Bticino
Via Messina, 38
20154 Milano
Call Center BTicino 199.145.145
Web Site: www.bticino.it
E-mail: info.ind@bticino.it
- d. Legrand
Italy
www.legrand.it
- e. Merlin Gerin
www.schneider-electric.com

- f. Schneider Electric
 20041 Agrate (MI)
 Tel: 039/6558111
 Fax: 039/6056900
 Telex: 301535 MAGGAL I
 Web Site: www.schneider.it

2.1.15 Occupancy Sensor

The following manufacturers provide products that generally comply with these specifications:

- a. Bticino
 Milan, Italy
 www.bticino.com
- b. Gewiss
 24069 Cenate Sotto BG, Italy
 www.gewiss.com
- c. Helvar
 Helsinki, Finland
 www.helvar.com
- d. Legrand
 Italy
 www.legrand.it

2.2 GENERAL REQUIREMENTS

CEI EN 60598-1, CEI EN 60598-2-1, and CEI EN 60598-2-2, as applicable to the specific light fixture specified. All light fixtures shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization.

2.2.1 CE Marking and Display

Equipment, materials, components, assemblies and so forth which are subject to European Union (EU) economic directives shall have an approved Declaration of Conformity as demonstrated by an authorized display of the CE Mark (Conformite Europeenne Mark). The CE Mark logo shall be placed on the product, the product literature, and/or packaging as required by the respective EU directive, or directives.

2.3 FLUORESCENT LIGHTING FIXTURES

NOTE: Define the enclosure rating (IP Code) for each light fixture specified. Define this rating in the individual lighting fixture details.

CEI EN 60598-1, CEI EN 60598-2-1, and CEI EN 60598-2-2. Fluorescent fixtures shall have electronic ballasts unless specifically indicated

otherwise. Fixture enclosure ratings (IP Code) shall be in accordance with CEI EN 60529 and shall be as indicated on the drawings.

2.3.1 Compact Fluorescent Fixtures

Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Providing assemblies designed to retrofit incandescent fixtures is prohibited except when specifically indicated for renovation of existing fixtures. Fixtures shall use lamps as indicated.

2.3.2 Open-Tube Fluorescent Fixtures

NOTE: Select one of bracketed options where lamp breakage is detrimental, such as above food counters.

Provide with self-locking sockets, or lamp retainers (two per lamp).
[Provide lamps with shatter resistant coating, non-yellowing, nominal thickness of 0.40 mm, and with 97 percent (minimum) light transmission.]
[Provide a clear polycarbonate protective sleeve with end caps, over lamp, with 95 percent (minimum) light transmission. The sleeve shall be rated to withstand the thermal profile of the lamp and ballast.]

2.3.3 Fluorescent Lamp Electronic Ballasts

NOTE: Electronic ballasts may have system compatibility problems when installed in certain environments. The problems mainly concern the radiated and conducted EMI due to the relatively high switching frequencies inherent in electronic ballasts and possibly due to utilization of the same power source for lighting and other equipment. Environments where electronic ballasts have the potential for EMI are:

1. Libraries or other facilities which utilize magnetic detectors to prevent theft or inventory control. However, it has been reported that electronic ballasts have no impact on the magnetic detectors if the separation distance is greater than 3050 to 4575 mm. This includes distances in all directions through floors, ceilings, and walls.
2. Facilities using high frequency power line carrier (PLC) control systems, such as a central clock system. These PLC systems usually have a 50,000 Hz to 200 kHz carrier frequency which may be affected by the harmonics generated by the electronic ballasts.
3. Areas where sensitive electronic equipment is

installed such as hospital critical care units, other areas utilizing sensitive electronic equipment based life support systems, and electronic testing facilities.

4. Areas using infrared based controls such as infrared TV remote controls and security devices. Examples: Areas that have Line-of-Sight from the light fixture to the infrared receiver, such as BEQ berthing rooms and TV lounges unless specific waiver is given by cognizant EFD/EFA.

5. Air handling or open luminaries should not be specified with electronic ballasts because the cooling effect of the airflow around the luminaire lowers the operating temperature which reduces the efficiency.

For these areas, consider the alternative usage of T-8 lamps with electromagnetic ballast.

The electronic ballast shall as a minimum meet the following characteristics:

- a. Ballast shall comply with CEI EN 60928 and CEI EN 60929, unless specified otherwise. Ballast shall be designed for the wattage of the lamps used in the indicated application. Ballasts shall be designed to operate on the voltage system to which they are connected.
- b. Ballast harmonic distortion shall comply with CEI EN 61000-3-2.
- c. Power factor shall be 0.95 (minimum).
- d. Ballast shall operate at a frequency of 24,000 Hertz (minimum).
- e. Ballast shall have light regulation of plus or minus 10 percent lumen output with a plus or minus 10 percent input voltage regulation. Ballast shall have 10 percent flicker (maximum) using any compatible lamp.
- f. Ballast shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization.
- g. Ballast enclosure size shall conform to standards of electromagnetic ballasts. Ballast shall have circuit diagrams and lamp connections displayed on ballast packages. Ballast shall operate lamps in a parallel circuit configuration that permits the operation of remaining lamps if one or more lamps fail or are removed.
- h. Ballast shall operate in an instant start mode.
- i. Electronic ballast shall have a full replacement warranty of 5 years

from date of manufacture as specified in paragraph entitled "Electronic Ballast Warranty" herein.

2.3.3.1 F36T8 Lamp Ballast

- a. Ballast shall be capable of starting and maintaining operation at a minimum of 10 degrees C for F36T8 lamps, unless otherwise indicated. [When indicated, ballast shall be capable of starting and maintaining operation at a minimum of minus 20 degrees C for F36T8 lamps.]

NOTE: Four lamp ballasts may not be available in minus 20 degrees C capability.

- b. Input wattage (system wattage):

- [(1) 36 watts (maximum) when operating one F36T8 lamp.]
- [(2) 72 watts (maximum) when operating two F36T8 lamps]
- [(3) 108 watts (maximum) when operating three F36T8 lamps]
- [(4) 144 watts (maximum) when operating four F36T8 lamps]

NOTE: Multilevel switching for light control is recommended for some locations, such as offices, classrooms and conference rooms where multilevel lighting is desired. Drawings must clearly indicate where multiple ballast light fixtures are required.

- [c. Provide three [and four] lamp fixtures with two ballasts per fixture where multilevel switching is indicated.]

2.3.3.2 F18T8 Lamp Ballast

- a. Ballast shall be capable of starting maintaining operation at a minimum of 10 degrees C for F18T8 lamps, unless otherwise indicated.
- b. Input wattage (system wattage):
 - (1) 38 watts (maximum) when operating two F18T8 lamps.
 - (2) 74 watts (maximum) when operating four F18T8 lamps.

2.3.3.3 T-5 Long Twin Tube Lamp Ballast

- a. Ballast minimum starting temperature 10 degrees C.
- b. Input wattage (system wattage):
 - [(1) 47 watts (maximum) when operating one 40 watt T-5 lamp]

[(2) 92 watts (maximum) when operating two 40 watt T-5 lamps]

[(3) 139 watts (maximum) when operating three 40 watt T-5 lamps]

 NOTE: Multilevel switching for light control is recommended for some locations, such as offices, classrooms and conference rooms where multilevel lighting is desired. Drawings must clearly indicate where multiple ballast light fixtures are required.

[c. Provide three [and four] lamp fixtures with two ballasts per fixture where multilevel switching is indicated.]

2.3.3.4 Compact Fluorescent Lamp Ballast

- a. Ballast minimum starting temperature 10 degrees C.
- b. Input wattage (system wattage):

[(1) [6.5] [8.0] [10.0] [14.5] [20] [28] watts (maximum) when operating one [5] [7] [9] [11] [18] [26] watt lamp]

[(2) [38] [54] watts (maximum) when operating two [18] [26] watt lamps]

[(3) [____] watts (maximum) when operating three [____] lamps]

2.3.4 Fluorescent Lamp Electronic Dimming Ballast

 NOTE: Electronic dimming ballast may have the same system compatibility problems as normal light output electronic ballast when installed in certain environments. The problems mainly concern the radiated and conducted EMI due to the relatively high switching frequencies inherent in electronic ballast and possibly due to utilization of the same power source for lighting and other equipment. Environments where electronic ballast have the potential for EMI are listed in the criteria note for electronic ballast.

Electronic dimming ballasts as specified in the following paragraph, are for general workplace dimming and daylight harvesting for energy conservation. For architectural dimming applications with very low light levels, 100% to 1%, the specifier must review all parameters of this paragraph and ensure competitive sources.

Electronic dimming ballasts can be controlled by a number of devices: manual dimmers, occupancy

sensors, light level sensor, photosensors, and timers, or with energy management systems. All control types are not specified here and the specifier must ensure system compatibility between ballast and controls.

Option to permit the dimming ballast to ramp up to full light output when power is applied, is satisfactory for energy conservation designs. But may not be desirable for architectural dimming, example: conference rooms.

If dimming ballast and non-dimming ballast are used in the same area, designer and specifier may need to coordinate the ballast factors at full light output.

The electronic ballast shall as a minimum meet the following characteristics:

- a. Ballast shall comply with CEI EN 60928 and CEI EN 60929, unless specified otherwise. Ballast dimming capability range shall be from 100 to [20] [10] percent (minimum range) of light output, flicker free. Ballast shall start lamp at any preset light output setting. [When power is applied, ballast shall not ramp up to full light output and then dim to preset level.] Ballast shall be designed for the wattage of the lamps used in the indicated application. Ballasts shall be designed to operate on the voltage system to which they are connected.
- b. Ballast harmonic distortion shall comply with CEI EN 61000-3-2.
- c. Power factor shall be 0.95 (minimum) at full light output, and 0.90 (minimum) over the entire dimming range.
- d. Ballast shall operate at a frequency of 24,000 Hertz (minimum).
- e. Ballast factor at full light output shall be between 0.85 (minimum) and 1.00 (maximum). Current crest factor shall be 1.7 (maximum).
- f. Ballast shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization.
- g. Ballast shall have circuit diagrams and lamp connections displayed on the ballast. Ballast shall operate lamps in a parallel circuit configuration that permits the operation of remaining lamps if one or more lamps fail or are removed.
- h. Ballast shall operate in a rapid start mode.
- i. Ballast shall be capable of starting and maintaining operation at a minimum of 10 degrees C for F36T8 lamps, unless otherwise indicated.

2.3.4.1 F36T8 Lamp Ballast

Input wattage for indicated lamp quantity shall be:

- a. 38 watts (maximum) when operating one F36T8 lamp.
- b. 74 watts (maximum) when operating two F36T8 lamps.

2.3.4.2 Compact Fluorescent Lamp Ballast

Input wattage for indicated lamp quantity shall be:

- [a. [6.5] [8.0] [10.0] [14.5] [20] [28] watts (maximum) when operating one [5] [7] [9] [11] [18] [26] watt lamp]
- [b. [38] [54] watts (maximum) when operating two [18] [26] watt lamps]
- [c. [____] watts (maximum) when operating three [____] lamps]

2.3.5 Dimming Ballast Controls

The dimming ballast controls shall be a slide dimmer with on/off control. The slide dimmer shall be compatible with the ballast and control the ballast light output over the full dimming range.

2.3.6 Light Level Sensor

Sensor shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization. Light level sensor shall be capable of detecting changes in ambient lighting levels, shall provide a dimming range of 20 percent to 100 percent (minimum) and shall be designed for use with dimming ballast and voltage system to which they are connected. Sensor shall be capable of controlling 40 electronic dimming ballasts (minimum). Sensor light level shall be adjustable and have a set level range from 100 to 1000 LUX (minimum). Sensor shall have a bypass function to electrically override sensor control.

2.3.7 Fluorescent Electromagnetic Ballasts

NOTE: Include this paragraph if any of the optional subparagraphs are used.

CEI EN 60920 and CEI EN 60921. Ballasts shall be high power factor type (0.85 minimum), [unless indicated otherwise] and shall be designed to operate on the voltage system to which they are connected. Electromagnetic ballasts shall be energy saving type[unless specified otherwise]. Fixtures and ballasts shall be designed and constructed to limit the ballast case temperature to 90 degrees C when installed in an ambient temperature of [40] [____] degrees C.[Provide three [and four] lamp fixtures with two ballasts per fixture where multilevel switching is indicated.]

2.3.7.1 Electromagnetic Energy-Saving Ballasts

NOTE: Energy-saving ballasts are generally not available for low temperature applications (below 10 degrees C). Additionally, the combination of energy-saving ballasts and energy-saving lamps are not recommended below 15 degrees C.

CEI EN 60920 and CEI EN 60921. Provide energy-saving fluorescent ballasts of the certified full light output type[except where fixtures are provided with low temperature ballasts]. Provide ballasts which are compatible with energy-saving lamps. Input wattage for indicated lamp quantity shall be:

- a. 36 watts (maximum) when operating one F36T8 lamp.
- b. 38 watts (maximum) when operating two F18T8 lamps.
- c. 72 watts (maximum) when operating two F36T8 lamps.
- d. [___] watts (maximum) when operating one [___] lamp.
- e. [___] watts (maximum) when operating two [___] lamps.

[2.3.7.2 Electromagnetic Ballasts for Compact Fluorescent Lamps

NOTE: Provide compact fluorescent fixtures with electronic ballasts under normal conditions. Use this paragraph only where special conditions require electromagnetic ballasts.

Provide electromagnetic ballasts for compact fluorescent lamps. Ballasts shall be high power factor type (0.85 minimum) and shall be designed to operate on the voltage system to which they are connected. Ballasts located outdoors shall be low temperature type and shall be capable of starting the lamp at minus 20 degrees C.

][2.3.7.3 Electromagnetic Low Temperature Ballasts

NOTE: Low temperature ballasts should be indicated and specified where ambient temperatures may normally drop below 10 degrees C if required by the design. The drawings must clearly indicate where low temperature ballasts are required.

Provide fluorescent ballasts having a minimum starting temperature of minus [20] [___] degrees C for fluorescent lamps in fixtures mounted [in cold rooms,] [outdoors,] [in unheated buildings,] [and as indicated].

][2.3.7.4 Electromagnetic Ballasts for T-5 Long Twin Tube Lamps

 NOTE: Provide long twin tube fluorescent fixtures with electronic ballasts under normal conditions. Use this paragraph only where special conditions require electromagnetic ballasts.

Provide electromagnetic ballasts with an average input wattage of [49 or less when operating one 40-watt T-5 long twin tube lamp] [and] [86 or less when operating two 40-watt T-5 long twin tube lamps].

]2.3.8 Fluorescent Lamps

Fluorescent lamps shall comply with the following paragraphs. Average rated life is based on 3 hours per start. Lamps shall be the energy-saving type unless otherwise noted.

 NOTE: T-8 lamps with CRI of 85 and color temperature of 3800 K - 4000 K are recommended for most applications. Consult with the Station to determine if they have any preferences regarding color temperature and the color temperature of the lamps that are stocked. Ensure availability of the low mercury lamps and fulfill European requirements regarding mercury content.

Lamp lumen ratings vary greatly according to European lamp catalogs. Consult with the Station to determine if they have any preferences and to determine the lumen ratings of the lamps that are stocked. Based upon energy efficiency advantages, higher lumen rated lamps are preferred.

- [a. CEI EN 60081 and CEI EN 61195. F36T8 [low mercury] lamps, 36 watts (maximum), nominal length of 1200 mm, [3350] [2350] [____] initial lumens (minimum), CRI of 85 (minimum), color temperature of [3800 K] [____], and an average rated life of 12,000 hours.]
- [b. CEI EN 60081 and CEI EN 61195. F18T8 lamps, 18 watt (maximum), nominal length of 600 mm, [1350] [1000] [____] initial lumens, CRI of 85 (minimum), color temperature of [3800 K] [____], and an average rated life of 12,000 hours.]
- [c. CEI EN 60901. T-5, long twin tube fluorescent lamps, 40 watts (maximum), [4000 K] [____], 540 mm nominal length, 10,000 hours average rated life, 3500 initial lumens, CRI of 78 (minimum), 2G11 type base.]
- [d. CEI EN 60901. Compact fluorescent lamps shall be CRI 80 (minimum), [4000 K] [____], 10,000 hours average rated life, and as follows:

- (1) Twin tube, rated [5 watt, 250 initial lumens (minimum),] [7 watts, 400 initial lumens (minimum),] [9 watts, 600 initial lumens (minimum),] [and] [11 watts, 900 initial lumens (minimum),] [as indicated].
- (2) Double twin tube, rated [18 watts, 1200 initial lumens (minimum),] [and] [26 watts, 1800 initial lumens (minimum),] [as indicated].

[2.3.9 Electromagnetic Interference Filters

NOTE: Use filters only when specifically required by activity. Filters available for mounting within lighting fixtures provide only basic interference suppression. For shielded enclosures and secure facilities, provide power line filters in the circuits serving the lighting.

Provide in each fluorescent fixture mounted [in shielded enclosures] [where indicated]. [Filters shall be integral to the fixture assembly with one filter per ballast and shall suppress electromagnetic interference in the AM radio band from 500 to 1700 kHz.] [Filters shall be in the circuit serving the lighting fixtures mounted where indicated and shall conform to requirements of Section 16280, "Radio Frequency Interference Power Line Filters."]

]2.4 HIGH-INTENSITY-DISCHARGE (HID) LIGHTING FIXTURES

CEI EN 60598-1, CEI EN 60598-2-1, and CEI EN 60598-2-2.[Fixtures with metal-halide lamps shall be totally enclosed.]

2.4.1 AUXILIARY INSTANT-ON SYSTEM

NOTE: Specify auxiliary quartz or compact fluorescent system for luminaries where extinguishing of HID lamps caused by momentary power interruptions is unacceptable for safety or security reasons, and inclusion of a central emergency system is beyond the project scope.

Auxiliary [quartz] [compact fluorescent] systems shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization. Provide automatically switched instant-on [150] [250] [_____] watt [quartz] [compact fluorescent] lamp. [Quartz] [Compact fluorescent] lamp shall come on when luminaire is initially energized and following a momentary power outage and shall remain on until HID lamp reaches approximately 60 percent light output. Wiring for [quartz] [compact fluorescent] lamp shall be internal to the ballast and shall be independent of the incoming line voltage to the ballast. [Provide instant-on [quartz] [compact fluorescent] system for each HPS

fixture.] [Provide instant-on [quartz] [compact fluorescent] system as indicated.]

2.4.2 HID Ballasts

CEI EN 60922 and CEI EN 60923. Provide constant wattage autotransformer (CWA) or regulator, high power factor type ballasts. Provide single-lamp ballasts which shall have a minimum starting temperature of minus 30 degrees C. Ballasts shall be:

- a. Designed to operate on the voltage system to which they are connected.
- b. Designed for installation in a normal ambient temperature of [40] [_____] degrees C.
- c. Constructed so that open circuit operation will not reduce the average life.

High-pressure sodium (HPS) ballasts shall have a solid-state igniter/starter with an average life in the pulsing mode of 3500 hours at the intended ambient temperature. Igniter case temperature shall not exceed 90 degrees C in any mode.

2.4.3 High-Pressure Sodium (HPS) Lamps

CEI EN 60662. Provide lamp wattage as indicated.

[2.4.3.1 Standby HPS Lamps

NOTE: Dual ARC tube HPS Lamps may, under certain conditions be used as auxiliary stand-by lighting when momentary power interruptions are anticipated.

Standby HPS lamps shall have two arc tubes and an average rated life of 10,000 hours (minimum) and hot restart instant lumen output shall be 8 percent, minimum, of total light output.

]2.4.4 Low-Pressure Sodium Lamps

NOTE: Use low-pressure sodium where color rendition is not a factor, but high lamp efficiency is.

CEI EN 60192. Provide lamp wattage as indicated.

2.4.5 Metal-Halide Lamps

NOTE: Metal-halide lamp safe operation requires lamps to be turned off at least 15 minutes per week or lamp may rupture near the end of its expected

life. Lamp rupture may discharge glass and extremely hot quartz (greater than 900 degrees C) into the surrounding area. Therefore, designs for metal-halide lamps shall include weekly turnoff instructions when continuously operated, 24 hours per day, 7 days per week. These instructions shall be detailed on the drawings for posting at the control locations. For indoor use, color rendition index (CRI) and color temperature (CCT) may need to be specified.

CEI EN 61167. Provide lamp wattage indicated.

2.5 INCANDESCENT LIGHTING FIXTURES

CEI EN 60598-1, CEI EN 60598-2-1, and CEI EN 60598-2-2.

2.5.1 Incandescent Lamps

CEI EN 60432-1, CEI EN 60432-2, and CEI EN 60357 as applicable. Provide the number, type, and wattage indicated.

2.5.2 Incandescent Dimmer Switch

NOTE: Do not specify central dimming systems with this specification.

Dimmer switches shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization. Provide single-pole, [500] [1000] [_____] watt, 230 volt ac, full-range rotary on-off type with built-in electromagnetic interference filter.

2.6 RECESS- AND FLUSH-MOUNTED FIXTURES

Provide type that can be relamped from the bottom. Access to ballast shall be from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be as indicated.

2.7 SUSPENDED FIXTURES

NOTE: Specify shock absorbing hangers for fixtures in certain hazardous locations if indicated.

Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers. [Provide with swivel hangers to ensure a plumb installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size indicated.] [Hangers shall be shock-absorbing type where indicated.] Hangers shall allow fixtures to swing within an

angle of 0.35 rad. Brace pendants 1200 mm or longer [provided in shops or hangers] to limit swinging. Single-unit suspended [fluorescent] fixtures shall have twin-stem hangers. Multiple-unit or continuous row fluorescent fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 6 mm diameter unless indicated otherwise.

2.8 FIXTURES FOR HAZARDOUS LOCATIONS

NOTE: The designer is responsible for properly defining any special hazardous environments, to properly define and detail the contract documents accordingly, and to insure materials and equipment are available as required to comply with all applicable safety codes and norms. Additional reference publications may be required depending upon the type of hazardous environments that are encountered.

In addition to requirements stated herein, provide [fluorescent] [HID] [incandescent] fixtures for hazardous locations which conform to CEI EN 50014, [_____] and CEI EN 50018 for the specific hazardous material to which the lighting fixture is to be subjected. Fixtures installed in hazardous locations shall be approved and listed by a recognized European safety organization for the specific hazardous material involved.

2.9 LIGHTING CONTACTOR

NOTE: Provide operational requirements and electrical ratings for lighting contactors on the drawings. Customary European practice is to design lighting contactors as accessory modules to panelboards and to mount the contactors adjacent to the circuit's associated circuit breaker.

Lighting contactors shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization. Provide lighting contactors with operational features, electrical ratings, and number of poles as indicated on the drawings. Provide [electrically] [mechanically] held contactors. [The lighting contactor and photocell switch shall be an integrally designed assembly.] [Mount the lighting contactor as an integral part of the associated panelboard's assembly.] [Provide a separately mounted lighting contactor and mount in an enclosure conforming to CEI EN 60529 and approved for the environment in which the contactor is installed.] [Provide contactor with [Hand-Off-Automatic] [On-Off] selector switch. Provide a separately mounted selector switch in an enclosure suitable for the environment if switch is not provided integral to the contactor.]

2.10 TIME SWITCH

NOTE: Provide operational requirements and electrical ratings for time switches on the drawings. Customary European practice is to design time switches as accessory modules to panelboards and to mount the switches adjacent to the circuit's associated circuit breaker.

Photocells and time switches should not always be used together. Use the following information as a guide:

- 1. Lights on/lights off by photocell: Street parking lots. Any facility or street that requires lighting after dark.
- 2. Lights on by photocell; lights off by time switch: Most administration facilities, commissaries, hobby shops, or clubs. Any facility that does not stay open all night.
- 3. Lights on/lights off by time switch: Service stations, snack bars, barracks, or officers' quarters. Facilities that will be open to the public, or have personnel that must report before daylight and after dark, but not continually through the night.

Other considerations: Time switches with a skip-a-day feature may be useful for facilities with a 5-day work week. (Program time switch to skip Saturday and Sunday.) For facilities that do not stay open all night, it may be desirable to have lighting at night for security. Consult the Station for local policy procedures.

Time switches shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization. Provide electronic type time switches with operational features and electrical ratings as indicated on the drawings. Provide time switches with an electrical power reserve feature (running reserve feature) so that the timer continues to operate after normal electrical power has been lost.

[Mount the time switch as an integral part of the associated panelboard's assembly.] [Provide a separately mounted time switch and mount in an enclosure conforming to CEI EN 60529 and approved for the environment in which the switch is installed.] [Astronomic type time switches shall be arranged to turn "ON" at sunset and turn "OFF" at predetermined time between 8:30 p.m. and 2:30 a.m. or sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise.]

2.11 PHOTOCCELL SWITCH

NOTE: Provide operational requirements and electrical ratings for photocell switches on the drawings. Customary European practice is to provide photocell switches (referred to as "light sensitive switches") as an accessory component of the panelboard manufacturer.

Photocell switches shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization. Provide hermetically sealed cadmium-sulfide or silicon diode type cell rated for the voltage system to which it is connected. Switch shall turn on at or below 30 lux and off at 20 to 50 lux. A time delay shall prevent accidental switching from transient light sources.[The photocell switch and lighting contactor shall be an integrally designed assembly.]

2.12 POWER HOOK FIXTURE HANGERS

Power hook fixture hangers shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization. Provide assembly with through-wired power hook housing, interlocking plug and receptacle, power cord, and fixture support loop. Power hook housing shall be cast aluminum having two 20 mm threaded hubs. Support hook shall have safety screw. Fixture support loop shall be cast aluminum with provisions for accepting 20 mm threaded fixture stems. Power cord shall be a minimum length of 400 mm. The assembly's electrical rating shall be [220] [380] [_____] volts and [10] [16] [20] [_____] amperes.

2.13 EXIT SIGNS

CEI EN 60598-1 and CEI EN 60598-2-22. Exit signs shall be [self-powered] [remote-powered] type[as indicated] and shall be continuously illuminated.

2.13.1 Self-Powered Exit Signs (Battery Backup)

Provide with automatic power failure device, test switch, pilot light and fully automatic high/low trickle charger in a self-contained power pack. Battery shall be rated 6 volts minimum, shall be sealed electrolyte type, shall operate unattended, and shall require no maintenance (including no additional water) for a period of not less than 4 years. The fixture shall have emergency run time of 2 hours minimum. Self-power exit sign shall be clearly marked with details of their classification according to CEI EN 60598-2-22, Annex B, "Luminaire Classification".

[2.13.2 Remote-Powered Exit Signs

Provide remote ac/dc exit signs with provisions for wiring to external ac and dc power sources. Provide signs with ac lamps for normal illumination and dc lamps for emergency lighting.

2.14 EMERGENCY LIGHTING EQUIPMENT

NOTE: Lamp wattage shall be properly specified to provide the required illumination per European standards. In lieu of an installation involving many individual emergency lighting units, consider several emergency lighting units with remote heads or central system with zone control. Circuit shall be hard wired to normal power system. A variety of battery types exists. Each has differing life expectancies and maintenance requirements. Choose the battery type which best suits the application.

CEI EN 60598-1 and CEI EN 60598-2-22. Provide lamps in wattage indicated. Provide accessories required for remote-mounted lamps where indicated. Remote-mounted lamps shall be as indicated.]

2.14.1 Emergency Lighting Unit

Provide as indicated. Emergency lighting units shall be rated for 220 volts normal supply power and shall have emergency battery backup feature. Provide with automatic power failure device, test switch, pilot light and fully automatic high/low trickle charger in a self-contained power pack. Battery shall be rated 6 volts minimum, shall be sealed electrolyte type, shall operate unattended, and shall require no maintenance (including no additional water) for a period of not less than 4 years. The fixture shall have emergency run time of 2 hours minimum. Emergency lighting unit shall be clearly marked with details of their classification according to CEI EN 60598-2-22, Annex B, "Luminaire Classification".

2.14.2 Fluorescent Emergency System

NOTE: Designer shall decide on number of lamps and minimum lumens required to meet criteria.

CEI EN 60598-2-22. Each system shall consist of an automatic power failure device, test switch operable from outside of the fixture, pilot light visible from outside the fixture, and fully automatic solid-state charger in a self-contained power pack. Charger shall be either trickle, float, constant current or constant potential type, or a combination of these. Battery shall be sealed electrolyte type with capacity as required to supply power for [two lamps] [the number of lamps shown for each fixture type] for 120 minutes at a minimum of [15] [____] percent of the lamps' rated maintained lumens. Battery shall operate unattended and require no maintenance (including no additional water) for a period of not less than 4 years. Fluorescent ballasts powered by a DC power source shall comply with CEI EN 60924 and CEI EN 60925.

2.15 CENTRAL EMERGENCY SYSTEM

NOTE: Clearly show on plans how system is zoned. Determine physical size and weight of the system components, especially the batteries. Physical sizes of the batteries that are required for 120 minutes of operation become very significant. This especially includes their weight impact. Specialized structural considerations may be necessary.

CEI EN 60598-2-22. The central emergency system shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization. Each system shall supply [_____] watts of emergency power at [[220] [380] [_____] volts, 50 Hz sine wave ac] [[24] [_____] volts dc] for a minimum period of [120] [_____] minutes. [Sine wave ac system shall have an inverter output distortion of not more than 10 percent at unity power factor.] The system shall be designed to handle surges during loss and recovery of power. The system shall properly operate and be compatible with all connected loads. This includes all nonlinear loads such as electronic ballasts.

2.15.1 Operation

With normal power applied, batteries shall be automatically charged. Upon loss of normal power, system shall automatically disengage from the normal input line and switch to a self-contained inverter within [1 second when serving incandescent and fluorescent lamps] [2 milliseconds when serving HID lamps]. Inverter shall have built-in protection when output is shorted or overloaded. When normal power resumes, the emergency system shall automatically switch back to normal operation before the power loss. Size transfer switch for this function to handle 125 percent of full load.

2.15.2 Battery Charger

[Provide two-rate charger for lead-calcium batteries.] [Provide three-rate charger for nickel-cadmium batteries.] The charger shall be solid-state, completely automatic, maintaining the batteries in a fully charged condition, and recharging the batteries to full capacity.

2.15.3 Batteries

NOTE: Consult with the Activity to determine battery type preferences. Aviano Air Base, Aviano, Italy has a defined policy that discourages nickel-cadmium batteries.

Batteries shall be [sealed lead-calcium] [nickel-cadmium] type, shall operate unattended, and shall require no maintenance, including no additional water, for a period of not less than [10] [5] years.

2.15.4 Accessories

NOTE: Electrolyte level detector is not applicable to sealed batteries.

Provide visual indicators to indicate normal power, inverter power, and battery charger operation. Provide test switch to simulate power failure by interrupting the input line, [battery voltage meter,] [load ammeter,] [automatic brown-out circuitry to switch to emergency power when input line voltage drops below 75 percent of normal value,] [electrolyte level detector that will activate a visual or audio alarm in the event of a low water condition,] [time delay feature for areas with HID lighting,] [and] [low voltage cutoff (LVD) to disconnect inverter when battery voltage drops to approximately 80 percent of nominal voltage].

2.15.5 Enclosure

CEI EN 60529. Provide a free-standing cabinet with floor stand. Cabinet construction shall be of sheet steel (2 mm thick minimum) with baked-on enamel finish and locking type latch.

2.16 OCCUPANCY SENSORS

NOTE: Occupancy sensors are useful in lighting control applications for restrooms, conference rooms, utility areas, warehouses, and corridors. Additional design guidance can be found at the NAVFAC Criteria Office's website at: "http://criteria.navfac.navy.mil/criteria". Go to the "Interim Technical Guidance (ITG)" Article on Occupant Sensors (1 JUL 96) located under "Publications" / "Design Criteria".

- Typical sensor applications are:**
- Ultrasonic - Restrooms, Hallways**
- Infrared - Warehouses, Open Offices**
- Combination Sensor - Classrooms, Conference Rooms**

Occupancy sensors shall be approved and listed by a recognized European safety organization and shall have a "mark of quality" from such an organization. Occupancy sensors and power packs shall be designed to operate on the voltage and frequency indicated. Sensors and power packs shall have circuitry that only allows load switching at or near zero current crossing of supply voltage. Provide occupancy sensor mounting as indicated. Sensor shall have an LED occupant detection indicator. Sensor shall have adjustable sensitivity and adjustable delayed-off time range of 5 minutes to 15 minutes (minimum). Wall mounted sensors shall be ivory, ceiling mounted sensors shall be white. Ceiling mounted sensors shall have 360 degree coverage unless otherwise indicated. Sensor types and requirements shall be as follows:

- [a. Ultrasonic sensors shall be crystal controlled and shall not cause detection interference between adjacent sensors.]
- [b. Infrared sensors shall have a daylight filter. Sensors shall also have a fresnel lens that is applicable for indicated usage.]
- [c. Ultrasonic/infrared combination sensors shall require both ultrasonic and infrared sensor detection in order to turn lights on. Lights shall remain on if either the ultrasonic or infrared sensor detects movement. Infrared sensor shall have lens selected for indicated usage and daylight filter to prevent short wavelength infrared interference. Ultrasonic sensor frequency shall be crystal controlled.]

2.17 SUPPORT HANGERS FOR LIGHTING FIXTURES IN SUSPENDED CEILINGS

2.17.1 Wires

NOTE: Select zinc-coated steel wire for all locations except those listed in the note in the paragraph entitled "Wires, for Humid Spaces," below.

When spacing of hanger wires exceeds 1200 mm or when heavy lighting fixtures are supported, larger size wire (3.4 mm or 4.1 mm in diameter) should be specified.

Soft tempered steel wire conforming to test methods of EN 10218-1, Class B zinc coating EN 10244-2, and [2.7] [_____] mm in diameter. Hangers and attachment shall support a minimum 1330 N 300 pound ultimate vertical load without failure of supporting material or attachment.

[2.17.2 Wires for Humid Spaces

NOTE: Select stainless steel or nickel copper alloy wire for facilities where high humidity can be expected such as large kitchens, dishwashing areas, etc. Select a nickel copper alloy when hangers are used in an indoor pool environment.

When spacing of hanger wires exceeds 1200 mm or when heavy lighting fixtures are supported, larger size wire (3.4 mm or 4.1 mm in diameter) should be specified.

[Soft tempered stainless steel wire, number 1.4301, EN 10088-1, conforming to test methods of EN 10218-1, [2.7] [_____] mm in diameter. Hangers and attachment shall support a minimum 1330 N 300 pound ultimate vertical load without failure of supporting material or attachment.]

[Annealed nickel-copper alloy wire, [2.7] [_____] mm in diameter. Hangers and attachment shall support a minimum 1330 N 300 pound ultimate vertical load without failure of supporting material or attachment.]

][2.17.3 Straps

NOTE: Normally wire hangers should be used. If the project is in an area subject to violent storms, steel strap or rod hangers should be specified. Check with area NAVFAC EFD/EFA to determine if straps or rods are needed.

Galvanized steel, 25 mm by 5 mm, with a light commercial zinc coating or with an electrodeposited zinc coating.

][2.17.4 Rods

NOTE: Normally wire hangers should be used. If the project is in an area subject to violent storms, steel straps or rod hangers should be specified. Check with area NAVFAC EFD/EFA to determine if straps or rods are needed.

Threaded steel rods, [6] [8] [10] mm diameter, zinc or cadmium coated.

]PART 3 EXECUTION

3.1 INSTALLATION

NOTE: Electrical designer shall coordinate these requirements with architectural plans and specifications. Ensure requirements for antiterrorism/force protection for fixtures in suspended ceilings are included in and coordinated with Section 09510, "Acoustical Ceilings," by including "Seismic Restraint System" paragraph.

Lighting fixtures for facilities located in earthquake zones shall have additional supports and restraining devices as described in Army TI809-04, "Seismic Design for Buildings".

Installation of all lighting systems and the associated electrical systems shall be in accordance with CEI 64-8 and all applicable Italian norms and laws. Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. Mounting heights specified or indicated shall be to the bottom of fixture for

ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. Recessed and semi-recessed fixtures shall be independently supported from the building structure by a minimum of four wires [or straps] [or rods] per fixture and located near each corner of each fixture. Ceiling grid clips are not allowed as an alternative to independently supported light fixtures. Round fixtures or fixtures smaller in size than the ceiling grid shall be independently supported from the building structure by a minimum of four wires [or straps] [or rods] per fixture spaced approximately equidistant around the fixture. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently and provide at least two 20 mm metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture. Provide wires [or straps] [or rods] for lighting fixture support in this section. Lighting fixtures installed in suspended ceilings shall also comply with the requirements of Section 09510, "Acoustical Ceilings."

3.1.1 Electronic Dimming Ballast

All electronic dimming ballasts controlled by the same controller shall be of the same manufacturer. All fluorescent lamps on electronic dimming ballast control shall be seasoned or burned in at full light output for 100 hours before dimming.

3.1.2 Exit Signs and Emergency Lighting Units

NOTE: The bracketed subparagraph should only be used in special cases such as where energy monitoring systems are used and where facilities use breakers as switches. In these cases emergency lighting may have to be on separate circuits rather than connected ahead of the local switching.

Wire [exit signs] [and] [emergency lighting units] ahead of the switch to the normal lighting circuit located in the same room or area. Exit signs shall be continuously illuminated.

[3.1.2.1 Exit Signs

Wire exit signs on separate circuits and serve from [an emergency panel] [a separate breaker] [a fused disconnect switch]. Signs shall have only one control, which shall be [the circuit breaker in the emergency panel] [the separate breaker] [the disconnect switch]. Paint control device red and provide lockout.

]3.1.3 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations. Set adjustable

settings for photocell turn-on as approved by the Contracting Officer.

3.1.4 Occupancy Sensor

 NOTE: Before selecting locations for occupancy sensors, consult the Interim Technical Guidance (ITG) on Occupant Sensors, dated 1 Jul 96. This ITG is available from the NAVFAC Criteria Office's website at:
 "http://criteria.navy.mil/criteria". Look under "Publications" / "Design Criteria".

As a minimum requirement, provide quantity of sensor units indicated. Final quantity and layout of sensors shall be based upon the sensor manufacturer's instructions and recommendations. Provide additional units to give full coverage over the controlled area in accordance with the approved shop drawings. Full coverage shall provide hand and arm motion detection for office and administration type areas, and walking motion for industrial areas, warehouses, storage rooms and hallways. Final locations shall also be selected as required to avoid nuisance activation and deactivation due to sudden temperature or airflow changes. Locate the sensor(s) as indicated and in accordance with the manufacturer's instructions and recommendations. Set sensor "on" duration for 15 minutes.

3.1.5 Light Level Sensor

Locate light level sensor as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for 500 lux or for the indicated light level at the typical work plane for that area.

3.2 FIELD QUALITY CONTROL

Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.

3.2.1 Electronic Dimming Ballast

Test for full range of dimming capability. Observe for visually detectable flicker over full dimming range.

3.2.2 Occupancy Sensor

Test sensors for proper operation. Observe for light control over entire area being covered.

-- End of Section --