



JABATAN KERJA RAYA MALAYSIA
CAWANGAN KEJURUTERAAN ELEKTRIK
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Tarikh : 23 hb. Februari 2016

Semua Ketua Jurutera Elektrik Ibu Pejabat JKR Kuala Lumpur
Semua Ketua Jurutera Elektrik Negeri

PEKELILING PENGARAH KANAN CAWANGAN KEJURUTERAAN ELEKTRIK
BIL. 1 TAHUN 2016

ADDENDUM NO.3(REV. 1), ADDENDUM NO. 4, ADDENDUM NO. 5 & ADDENDUM NO. 6
TO L-S1:SPECIFICATION FOR LOW VOLTAGE INTERNAL ELECTRICAL INSTALLATION
(Rujukan: CKE.LS.01.01.(06).2016)

1.0 TUJUAN

Surat Pekeliling ini adalah bertujuan untuk memaklumkan pemakaian *Addendum No. 3(Rev. 1), No. 4, No. 5 dan No. 6* kepada Spesifikasi (L-S1) *Low Voltage Internal Electrical Installation* (Rujukan: CKE.LS.01.01.(06).2016) dalam kerja-kerja elektrik.

2.0 PENGGUNAAN

Dokumen-dokumen ini merupakan tambahan kepada Spesifikasi (L-S1) *Low Voltage Internal Electrical Installation* dan harus dirujuk bersama dokumen L-S1.

Spesifikasi ini merupakan ketetapan umum yang perlu dipatuhi dalam rekabentuk dan pelaksanaan projek-projek elektrik.

Dokumen-dokumen tersebut boleh dicapai melalui laman web *JPedia (Facet: WikiSpecs)*.

3.0 PENGUATKUASAAN DAN PENAFIAN

Surat Pekeliling ini adalah berkuatkuasa serta merta daripada tarikh pekeliling ini ditandatangani. Penggunaan dan pemakaian spesifikasi ini adalah untuk projek-projek Kerajaan yang berada di bawah tanggungjawab dan pengurusan JKR sahaja. Oleh itu, Cawangan Kejuruteraan Elektrik tidak akan bertanggungjawab di atas sebarang penggunaan dan pemakaian bukan di bawah pengurusan JKR.

**PEKELILING PENGARAH KANAN CAWANGAN KEJURUTERAAN ELEKTRIK
BIL. 1 TAHUN 2016**

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menurut perintah,



.....
(DATO' Ir. HJ MOHD FAZLI BIN OSMAN)

PENGARAH KANAN

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ADDENDUM 3 REVISION 1: SPECIFICATION FOR LOW VOLTAGE INTERNAL ELECTRICAL INSTALLATION (L-S1)

	ADDENDUM 3	CKE.LS.01.01.(05).2015
		Date of Issued: April 1999
SECTION: 11.0	LUMINAIRES	Revision of Addendum: 1
		Date: Jun 2015
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11.1 FLUORESCENT LUMINAIRES

11.1.1 TUBULAR TYPE FLUORESCENT LUMINAIRES

11.1.1.1 Fluorescent luminaires shall be of the type approved by Suruhanjaya Tenaga and JKR.

11.1.1.2 Fluorescent luminaires shall comply with MS IEC 60598-1 and MS IEC 60598-2-1 or MS IEC 60598-2-2.


11.1.1.3 Fluorescent luminaires shall have housing made from good quality mild steel sheet of minimum thickness 0.50mm and shall be of sound and rigid construction suitable for suspended and surfaced mounted installation. The metalwork shall be rust inhibited to prevent corrosion and, unless otherwise approved by the S.O.'s Representative, shall be sprayed with an undercoat of zinc chromate primer and finished with two coatings of super white baked enamel.

11.1.1.4 Wiring within the luminaire shall be carried out with heat resistant cable marked with the word "HR 105°C". It shall be done in a neat way with holder to hold the cable in position and also to avoid contact with heat producing components. Cables shall be terminated in a termination block marked "L" and "N" for connection to the incoming wires. A brass direct pressure type earth terminal shall be provided in the casing near the termination block for earth connection. This earth terminal shall be clearly marked with the standard earth terminal symbol.


11.1.1.5 All components in the luminaire shall be guaranteed for a minimum of 2000 hour life. All components in the fluorescent luminaires shall be manufactured by the manufacturer or being supplied by others. The components shall be marked with "made for" if supplied by other manufacturer except high frequency electronics ballast if specified, fluorescent tube, starter, cable and holders for fluorescent tube and starter. The components shall be of the type approved by Suruhanjaya Tenaga and JKR.

11.1.1.6 TUBULAR TYPE FLUORESCENT LUMINAIRES T8 (FD 26)

11.1.1.6.1 The electromagnetic ballast shall comply with MS IEC 61347-1, MS IEC 61347-2-8 and MS 141:PT.2. The ballast shall be of the type approved by Suruhanjaya Tenaga and JKR. Unless otherwise specified, they shall be polyester resin impregnated, silent operation type fitted with terminal block for easy wiring. For 18 watts and 36 watts fluorescent tubes, the watt loss of the ballast shall be 6 watts. The mounting of the ballast shall be in such a way that easy dismantling and replacement can be effected within the casing.

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- 11.1.1.6.2 The fluorescent luminaires shall be power factor corrected to at least 0.9 lagging.
- 11.1.1.6.3 The capacitor shall comply with MS IEC 61048 and MS IEC 61049 and shall be of dry, self-healing, aluminium metalised polypropylene type. Proper tool clip shall be provided to hold the capacitor in position.
- 11.1.1.6.4 The starter shall comply with MS IEC 60155 and the starter holders comply with MS IEC 60400. For the single channel luminaires, the starter shall be fitted at the side of the casing. In cases where starters are to be fitted from the outside of the luminaire casing, the starter holders shall be installed in such a way that the starters shall not protrude out of the casing by more than 10mm.
- 11.1.1.6.5 In the case where high frequency electronics ballast is specified, the ballast shall be of type approved by Suruhanjaya Tenaga and JKR. The ballast shall comply to MS IEC 61347-1, MS IEC 61347-2-3 and MS IEC 60929, BS EN 55015 for radio frequency interference suppression and MS IEC 61000-3-2 for harmonics distortion. They shall be of preheat start, non-dimming, low in-rush starting current and low leakage current type. Rated maximum operating temperature of a ballast case shall not exceed 70°C. The Ballast shall be rated a minimum Energy Efficiency Index Classification (EEI) of A2 as per CELMA/ELC Guide.
- 11.1.1.6.6 Harmonics distortion shall be within the limits in accordance with MS IEC 61000-3-2. However, total harmonics distortion shall be less than 25% where third harmonics component shall not be more than 15%. The ballast shall operate and maintain consistent light output over voltage variation from -10% to +5% of the rated voltage and power factor of not less than 0.95. Overvoltage protection at 350 volts and automatic shutdown in the event of lamp failure shall also be incorporated. The electronic ballast shall have five year warranty from the manufacturer.
- 11.1.1.6.7 The lampholders shall comply with MS IEC 60400 of robust and well designed construction suitable for bi-pin fluorescent tubes. The lampholders shall be made of polycarbonate material. Lamp holders for use with electronic ballast shall be rated minimum 500V or higher than U-out rating of electronic ballast, (whichever is higher).

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- 11.1.1.6.8 All fluorescent tube shall be provided with its own ballast (except for electronic ballast).
- 11.1.1.6.9 Louvres and reflectors for the luminaires shall be made of high purity anodized aluminium with at least 99.85% pure aluminium with no iridescent mirror finished. The thickness of the reflector shall be minimum 0.4mm and total light reflection of reflector shall be minimum 86%.
- 11.1.1.6.10 The prismatic and opal diffuser shall be made of Ultra Violet (UV) stabilised Flame Retardant Polyethylene Terephthalate Glycol (PETG) or minimum UV-stabilised flame retardant material.
- 11.1.1.6.11 Louvres, reflectors and diffusers shall give good even light distribution with minimal glare in both the axial and transverse planes. Photometric data for the luminaires shall be made available and submitted to S.O.'s Representatives when required.

11.1.1.7 TUBULAR TYPE FLUORESCENT LUMINAIRES T5 (FD 16)

- 11.1.1.7.1 The high frequency electronics ballast shall be of type approved by Suruhanjaya Tenaga and JKR. The ballast shall comply to MS IEC 61347-1, MS IEC 61347-2-3 and MS IEC 60929, BS EN 55015 for radio frequency interference suppression and MS IEC 61000-3-2 for harmonics distortion. They shall be of preheat start, non-dimming, low in-rush starting current and low leakage current type. Rated maximum operating temperature of a ballast case shall not exceed 70°C. The Ballast shall be rated a minimum Energy Efficiency Index Classification (EEI) of A2 as per CELMA/ELC Guide.
- 11.1.1.7.2 Harmonics distortion shall be within the limits in accordance with MS IEC 61000-3-2. However, total harmonics distortion shall be less than 25% where third harmonics component shall not be more than 15%. The ballast shall operate and maintain consistent light output over voltage variation from -10% to +5% of the rated voltage and power factor of not less than 0.95. Overvoltage protection at 350 volts and automatic shutdown in the event of lamp failure shall also be incorporated. The electronic ballast shall have five year warranty from the manufacturer.


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- 11.1.1.7.3 The lampholders shall comply with MS IEC 60400 of robust and well designed construction suitable for bi-pin fluorescent tubes. The lampholders shall be made of polycarbonate material. Lamp holders shall be rated minimum 500V or higher than U-out rating of electronic ballast, (whichever is higher).
- 11.1.1.7.4 Louvres and reflectors for the luminaires shall be made of high purity anodized aluminium with at least 99.85% pure aluminium with no iridescent mirror finished. The thickness of the reflector shall be minimum 0.4mm and total light reflection of reflector shall be minimum 90%.
- 11.1.1.7.5 The prismatic and opal diffuser shall be made of Ultra Violet (UV) stabilised Flame Retardant Polyethylene Terephthalate Glycol (PETG) or minimum UV-stabilised flame retardant material.
- 11.1.1.7.6 Louvres, reflectors and diffusers shall give good even light distribution with minimal glare in both the axial and transverse planes. Photometric data for the luminaires shall be made available and submitted to S.O.'s Representatives when required. For luminaires T5 cross louvre type, the Light Output Ratio (LOR) shall be minimum 80%.

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11.1.2 DOWNLIGHT TYPE COMPACT FLUORESCENT LUMINAIRES

- 11.1.2.1 The luminaires shall be of type approved by JKR. The luminaires shall comply with MS IEC 60598 and relevant part of IEC 60598 or equivalent.
- 11.1.2.2 The luminaires shall have two separate components comprising of an electrical control gear and optical systems. The construction of the luminaires shall be either in two separate housing/compartments or integral.
- 11.1.2.3 Electrical control gear system comprises of ballast, capacitor etc. The optical system shall incorporate a one piece full bowl reflector, lamp holder(s) etc. Luminaires shall have either horizontal or vertical pin type lamp connection.
- 11.1.2.4 The housing of the control gear system shall be made from extruded aluminium or good quality mild steel sheet of thickness not less than 0.8 mm and shall be of sound and rigid construction suitable for suspended installation. The metalwork shall be rust inhibited to prevent corrosion. The housing of the control gear system shall be coated by electrostatic powder. The housing shall be provided with a means to dissipate heat. Rubber grommets shall be provided at cable entry.
- 11.1.2.5 Wiring within the control gear system shall be carried out with heat resistant cable marked with the word 'HR 105°C'. It shall be done in a neat way with holder to avoid contact with heat-producing components. Cables shall be terminated in a termination block marked 'L' and 'N' for connection to the incoming wires. A brass direct pressure type earth terminal shall be provided in the control gear near the termination block for earth connection. This earth terminal shall be clearly marked with the standard earth terminal symbol. The HR 105°C cable shall be used to connect the optical system and the control gear system. It shall not be more than 300mm long. The cables shall be enclosed in a cable sleeve HR 105°C.
- 11.1.2.5.1 Electrical connection and disconnection of the control gear system from the incoming supply cables and optical system shall be through a plug & socket/connection unit. It shall be made from flame retardant material. The plug & socket shall be rated at 10A. A conduit fitting that terminates the flexible conduit to the lamp control gear shall be provided. The cable clamp arrangement shall not damage the insulation of the cables.
- 11.1.2.5.2 The manufacturer shall provide installation instruction for each model of the luminaires by means of hook or other suitable method.

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11.1.2.6 The reflector shall be made of high purity anodized aluminium with at least 99.85% pure aluminium with no iridescent mirror finished (e.g. polished aluminium). The thickness of the reflector shall be minimum 0.5 mm. The support shall be made from mild steel with minimum thickness of 1.3 mm. The ring shall be made from die-cast aluminium with minimum thickness of 1.3 mm. The support and ring shall be coated by electrostatic powder. The clip shall be made from stainless steel. For horizontal lamp connection, the diameter of the reflector shall be large enough for easy relamping of lamps.

11.1.2.6.1 Photometric data for the luminaires shall be made available and submitted to S.O.'s Representatives when required. The required photometric data for the luminaires shall be Polar Curve, Utilization Factors, Luminance Distribution Table, Downward Light Output Ratio, Upward Light Output Ratio, Light Output Ratio, Spacing to Mounting Height Ratio and Threshold Increment.

11.1.2.6.2 Light Output Ratio for the luminaires shall be minimum 70%.

11.1.2.7 The lamp holder shall be G24 type for the 10W/13W/18W/26W compact fluorescent lamp (CFL) without integral control gear. The lamp holder shall comply with MS IEC 60400, made to fit individual lamp wattage and not interchangeable. The lampholder shall be made of non-metallic, heat resistant material and be rigidly fixed onto the optical compartment. The lampholder shall be incorporated with a housing made from extruded aluminium or good quality mild steel sheet or aluminium die cast with a mechanism to dissipate heat (heat sink).


11.1.2.8 The ballast shall comply with MS IEC 61347-1, MS IEC 61347-2-8 and MS 141:PT.2 and shall be of the type approved by Suruhanjaya Tenaga and JKR. The ballast shall be polyester resin impregnated, silent operation type fitted with terminal block for easy wiring. The watt loss for the ballast shall be 6W.

11.1.2.8.1 For electronic ballast refer to 11.1.1.4

11.1.2.9 The capacitor shall comply with MS IEC 61048 and MS IEC 61049 and of type approved by Suruhanjaya Tenaga and JKR. The capacitor shall be cylinder shape type. The capacitor shall be dry, self healing, metalised polypropylene type with terminal block for easy wiring. The casing shall be made from aluminium or flame retardant plastic. The capacitor shall be mounted with nut and lock washer.


11.1.2.10 All components in the fluorescent luminaires shall be manufactured by the manufacturer or being supplied by others. The components shall be marked with "made for" if supplied by other manufacturer except high frequency electronics ballast if specified, compact fluorescent lamp, cable and holders for compact fluorescent lamp. The components shall be of the type approved by Suruhanjaya Tenaga and JKR.

**ADDENDUM 4:
SPECIFICATION FOR LOW
VOLTAGE INTERNAL ELECTRICAL
INSTALLATION (L-S1)**

	ADDENDUM 4	CKE.LS.01.01.(04).2015
		Date of Issued: April 1999
SECTION: 3.0	DISTRIBUTION BOARDS AND CONSUMER UNITS	Revision of Addendum: 0
		Date: Jun 2015
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3.0 DISTRIBUTION BOARDS

- 3.1 All Distribution Boards (metalclad and all insulated) shall be installed at locations indicated in the Drawings or as directed by the S.O.'s Representative. The Distribution Boards shall be assembled by licensed switchboard manufacturer, registered with Suruhanjaya Tenaga (ST) and Jabatan Kerja Raya.
- 3.2 They shall comply with MS IEC 60439-3 and unless otherwise specified, shall be surface mounted metalclad type. The sheet steel shall have minimum thickness of 1.2mm. They shall have hinged cover, rust-proof and finished with oven baked epoxy powder coating. Knockouts or other approved form of cable entries and suitable brass earthing bolt and nut shall be provided.
- 3.3 The Distribution Boards shall be equipped with HRC fuses or Miniature Circuit Breakers (MCB) of rating as specified in the Drawings. HRC fuses shall comply with relevant parts of IEC 60269. MCB shall have rupturing capacity not less than that indicated on Drawings and/or Bill of Quantities and shall comply with MS IEC 60898.
- 3.4 The busbars shall be hard drawn high conductivity copper. The current rating of the busbars shall not be less than the incoming switchgear rating. The neutral and earth connection for each circuit shall be individually connected to the neutral and brass earth bar/terminal respectively. The sequence of termination of the neutral and earth wires shall correspond to that of phase circuit.
- 3.5 For all-insulated Distribution Boards, the main switch shall be double pole MCB (Miniature Circuit Breaker) provided with a clear indication of 'ON-OFF' positions. The main switch shall comply with MS IEC 60947-3 and have fully shrouded incoming cable terminals. The contacts shall be of long switching life type.

	ADDENDUM 4	CKE.LS.01.01.(04).2015
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- 3.6 Where surge protective device is specified, the device and its associated equipment shall be housed in separate compartment immediately after where the incoming switchgear is connected.
- 3.7 All outgoing cables shall have alphanumeric circuits number labels. The labels of the neutral and earth shall correspond to that of the phase circuit.
- 3.8 Engraved labels with white lettering on a black background shall be fitted externally (using rivet) on the front cover of the distribution board/consumer unit describing its usage and with a suitable designation for identification.
- 3.9 Each Distribution Board shall be provided with a laminated schematic diagram and paste on the inside cover of the Distribution Board. The details shall include fuse rating/MCB rating, cable size, number and type of loads etc. The description of each circuit printed thereon shall include the corresponding circuit number in the as installed schematic diagram.
- 3.10 All Distribution Boards shall be provided with top and bottom entry/exit with minimum 50mm x 50mm pre-cut hole. The opening shall be fitted with flat, removable gland plate to cover the hole.
- 3.11 Where Distribution Board is specified to be installed at special service conditions as per clause 7 of IEC 61439-3:2012 and clause 7.2 of IEC 61439-1:2011 where variations in temperature and humidity take place at such speed where condensation is liable to occur inside it, each Distribution Board shall be provided with meshed louvre or ventilation vent with filter for adequate ventilation and/or one number anti condensation heater complete with automatic thermostat control, ON OFF switch and indicating lamp.

**ADDENDUM 5:
SPECIFICATION FOR LOW VOLTAGE
INTERNAL ELECTRICAL
INSTALLATION (L-S1)**

	ADDENDUM 5	CKE.LS.01.01.(05).2015
		Date: April 1999
	LAMPS	Revision of Addendum : 0
		Date: Jun 2015
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12.1 The tubular fluorescent lamps shall comply with MS IEC 60081 and MS IEC 61195 and shall be bi-pin type. The lamp characteristic shall be as per Table 12A:

Nominal Diameter (mm)	Nominal Length (mm)	Power (W)	Base	Min. lumens (after 100 hrs/25°C)	Nominal Colour temp. (Kelvin)	Colour Ren. Index (Ra)	ILCOS code	Proprietary Code	Rated Lifespan (hrs)
26	600	18	G13	1300	4000 & 6500	80 -89	FD	T8	10,000
26	1200	36	G13	3250	4000 & 6500	80 - 89	FD	T8	10,000
16	550	14	G5	1100	4000 & 6500	80 - 89	FDH	T5	20,000
16	550	24	G5	1700	4000 & 6500	80 - 89	FDH	T5	20,000
16	1150	28	G5	2400	4000 & 6500	80 - 89	FDH	T5	20,000
16	1150	54	G5	4150	4000 & 6500	80 - 89	FDH	T5	20,000

Table 12A : Lamp characteristics for tubular fluorescent


12.2 The compact fluorescent lamp without integral control gear shall comply with IEC 60901 and IEC 61199 and shall be 2/4-pin type and of 2/4-limb and shall be rated for 8000 hours life at rated voltage. The lamp characteristic shall be as per Table 12B.

Power (watt)	Base	Min. lumens (after 100 hrs)	Nominal Colour temperature (Kelvin)	Colour Rendering Index (Ra)	ILCOS code
10	G24d-1/ G24q-1	600	4000	80 -89	FSQ
			6500		
13	G24d-1/ G24q-1	900	4000	80 - 89	FSQ
		855	6500		
18	G24d-2/ G24q-2	1200	4000	80 - 89	FSQ
		1130	6500		
26	G24d-3/ G24q-3	1800	4000	80 - 89	FSQ
		1700	6500		

Table 12B: Lamp characteristics for compact fluorescent

12.3 The compact fluorescent lamp with integral control gear shall comply with IEC 60968 and IEC 60969, and shall be of E14 or E27 screw type base and shall be guaranteed for 10000 hours life at rated voltage. Unless otherwise specified, they shall have an outer cylindrical or spherical diffusing bulb.

ADDENDUM 6: SPECIFICATION FOR LOW VOLTAGE INTERNAL ELECTRICAL INSTALLATION (L-S1)

	SPECIFICATION FOR LOW VOLTAGE INTERNAL ELECTRICAL INSTALLATION (L-S1)	CKE.LS.01.01.(06).2016
		Date: April 1999
SECTION: 2.0	ADDENDUM NUMBER 6 SWITCHBOARDS	Revision Of Addendum : 0
		Date : Jan 2016
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2.2.1.5 Unless otherwise specified in the drawings and/or bill of Quantities, the switchboards shall be of Form 2b and comply with MS IEC 60439-1. The busbars shall be separated from the switchgears/functional units and the incoming and outgoing terminals. The form of separation shall be achieved by metallic or non-metallic rigid barriers/partitions. All switchgears shall be mounted so as to give adequate clearance for cable and busbar connections.

2.2.1.6 Switchgears shall be mounted on insulation runners where connected to busbars and on steel supports where cable connection are made. The insulation runners shall be of minimum 10mm thickness and mounted on steel support or back panel of the enclosure whichever is more appropriate.

2.2.1.7 Cables connection between the busbars and the switchgears shall be neatly arranged and mounted on cable runner. The terminals of the switchgears for external cable connections shall be at least 200mm above the base of the switchboards and, moreover, so placed that the cables can be easily connected to them. Withdrawable type of switchgears shall be mounted on the framework assembly, including the runner rails and fixed rear isolation contacts, which shall be supplied as a part of the switchgear assembly. Each withdrawable switchgear shall be housed in its own compartment with rear connected busbars.

2.2.1.8 All indicating instrument which need to be read by the operator shall not be located higher than 2m above the base of the switchboard. All operating devices such as handle, push buttons, etc., shall be located at such a height that they can easily be operated, and in general, the centerline shall not be higher than 2m above the base of the switchboard. In the case where building automation devices, transducers and relays are provided, they shall be separately housed in a compartment of the section of the switchboard. All wiring from the devices, transducers and relays shall be neatly arranged and connected to the terminal blocks with removal links mounted on rail. Terminals shall be identified and labelled in accordance with IEC 60445.