



**TECHNICAL
SPECIFICATION**

技術規格

NCEM C71 - 006

April 2025

**LED LUMINAIRES FOR STREET
LIGHTING (20 & 25 METER HIGH
MASTS)**

用於街道照明的 LED 燈具（20 米和 25 米高桅杆）

Description 描述
LED LUMINAIRES TO REPLACE EXISTING 400W HPS LED 燈具取代現有的 400W HPS

(投標編號 TENDER REF.: PLD-CS022/25/99)

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1. OBJECTIVE AND SCOPE 目標和範圍

The objective of this specification is to state general conditions and technical requirements to be complied by Tenderer who want to submit their proposals for supplying LED luminaires for 20 & 25 Meter High Mast of street lighting in Macau. It applies to street lighting solid-state luminaires (LED) suitable for replacing the existing 400W HPS lanterns and used in new projects.

Long life expectancy, reduced maintenance and low energy consumption are the goals to achieve by replacing the old sodium fixtures with solid state technology.

According to the bill of quantities, the vendor should supply the related materials and equipment. The list is shown as below.

- a) Steel metallic pole structure (including but not limit to mounting accessories such as flanged-based high mast columns, bolts, anchor plate and etc.)
- b) Stainless steel metallic headframe and brackets (including but not limit to mounting accessories such as nuts, bolts and washers). The head frame and brackets should fit the existing high mast. (Both area lighting type and sports lighting type solution)
- c) LED Luminaires with diffuser as glare control (both area lighting type and sports lighting type solution)
- d) The power and manual operated raising and lowering gear.
- e) Electrical circuit material (including but not limit to Earthing and lightning protection facilities, ballasts, switchboard control equipment, internal wiring/ accessories and etc.)
- f) Structure, foundation, grounding/earthing, lightning protection design and related calculation
- g) Installation manual and method statement
- h) Training
- i) All the materials and equipment should be future-proof modular design and easily assembled for ease of maintenance. Major components such as the LED module and driver should be replaceable.

Construction of foundations of high masts and concrete pillars is not the responsibility of the supplier of this contract, and it will be carried out separately by other contractors.

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The design for structure and foundation to be submitted with offer shall include general and detailed dimensions and weight of each part, as well as the detailed list of materials, size, force calculation for the structure if one of the items a), b) and c) is selected.

The loading calculation for the raising and lowering gear system shall be submitted if item d) is selected.

Design and calculation for the electrical circuit of lightning protection system and grounding/earthing system should also be submitted if one of the items a), b), c) or d) is selected.

The bill of quantities of the material and equipment shall be defined in tender documents.

本規範說明了投標人必須遵守的一般條件和技術要求，投標人需要提交為桅杆高度為 20 米和 25 米用於街道照明 LED 燈具的建議書。該固態照明燈具 (LED) 可用於取替現有 400W HPS 燈具或用於新項目的公共道路照明燈具。

長生命週期、減少維護和低能耗是使用固態照明技術的 LED 燈具取代舊有鈉燈裝置的原因。

根據工程量清單，供應商應提供相關材料和設備。列表如下所示。

a) 鋼金屬桅杆結構 (包括但不限於法蘭型高桅杆、螺栓、錨板等安裝附件)

b) 不鏽鋼金屬燈頂架和支架 (包括但不限於螺母、螺栓和墊圈等安裝附件)。頂架和支架應適用於現有的高桅杆 (供應商應同時提供區域型公共照明燈具和運動型公共照明燈具解決方案)。

c) 附漫射屏為眩光控制措施之 LED 燈具 (供應商應同時提供區域型公共照明燈具和運動型公共照明燈具解決方案)。

d) 可同時使用動力和手動操作的升降裝置。

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e) 電力迴路材料 (包括但不限於接地系統、防雷系統、鎮流器、配電控制設備、內部接線/附件等) 。

f) 結構、基礎、接地、防雷設計及相關計算。

g) 安裝手冊和方法說明。

h) 培訓。

所有材料和設備應採用經得起未來考驗的模塊化設計，易於組裝，便於維護。當中的主要模塊如 LED 模塊和驅動器等應可更換的。

高桅杆和混凝土支柱的基礎施工不屬於本合同供應商的責任，該工作將由其他承包商獨立進行。

如果 a)、b) 和 c) 其中的一項被選中，與標書一起提交的結構和基礎設計應包括各部分的一般和詳細尺寸和重量，以及使用材料的明細、尺寸、受力計算書等。

如果選擇 d) 項時，應提交升降裝置的載荷計算。

如果選擇 a)、b)、c) 或 d) 項之一，應提交防雷系統和接地系統的計算書和電力編制計劃書。

材料和設備的工程量清單在招標書中的另一文件規定。

2. TECHNICAL REQUIREMENTS 技術要求

2.1 GENERAL 一般要求

Besides of the requirements which are mentioned in this specification, all the materials and equipment shall comply with relevant guideline and law which are issued by MSAR.

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The proposed materials and equipment shall comply with American National Standard vibration standard tests, as per ANSI C136.31 and 3-second peak wind gusts of 72ms^{-1} .

Glare Rating should limited to no more than 40 following CIE 112 Table 3.1 to maintain visibility. Supplier should provide diffuser as Glare control measure.

Vendor should submit structure, foundation, grounding, lightning protection design and related calculation in order to prove all the material and equipment can be operated properly under ambient condition. All the design and calculation should fulfill Macau's related law and guideline. If there is no Macau's guideline to follow, vendor should submit related design and calculation base on equivalent standard. In this case, the vendor should submit the standard at the same time.

除本規範中提及的要求外，所有材料和設備均應符合澳門特別行政區的相關指引和法律。

建議的材料和設備應符合美國國家標準 ANSI C136.31 的振動標準測試，並同時可滿足 72ms^{-1} 的 3 秒峰值陣風所產生的荷載要求。

眩光等級值按 CIE 112 標準表 3.1 不應高於 40，以保持能見度。供應商應提供漫射屏作為限制眩光的措施。

供應商應提交結構、基礎、接地、防雷設計和相關計算，以證明所有材料和設備在環境條件下都能正常運行。所有的設計和計算都應符合澳門的相關法律和指引。如果沒有澳門的指引，供應商應根據等效標準提交相關設計和計算。在這種情況下，供應商應同時提交相關標準的文件。

2.2 MATERIAL 材料

a. Steel Baseplate 鋼底板

Each mast shall have a uniform steel baseplate for bolting to the foundation together with a set of high tensile stainless steel foundation bolts, a lower steel anchor plate. Stainless steel foundation bolts and nuts shall conform to BS EN ISO 3506-1 and BS EN ISO 3506-2

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respectively, steel grade A4 and property class 80 or equivalent strength material. Where used, high strength friction grip bolts, nuts and washers shall conform to BS EN 14399 and BS EN 1993-1-8 or equivalent standard.

每個桅杆都應有一個統一的鋼底板，用於使用高強度不鏽鋼地腳螺栓、下部鋼錨板等附件固定在基礎上。不鏽鋼地腳螺栓和螺母應分別符合 BS EN ISO 3506-1 和 BS EN ISO 3506-2，鋼級 A4 和性能等級 80 或同等強度的材料。使用時，高強度摩擦夾緊螺栓、螺母和墊圈，應符合 BS EN 14399 和 BS EN 1993-1-8 或等效標準。

b. Mast Construction 桅杆施工

The columns, arm and brackets should be manufactured with a high-grade steel tubes in accordance with Grade S355J0H, conforming to BS EN 10210 or equivalent material. The steel used shall be weldable, aging resistant and suitable for hot-dip galvanizing. Welding shall be done before galvanizing.

Other equivalent strength steel may be acceptable provided that full details of its chemical composition, mechanical properties, calculation and specification are supplied with the tender documents. Welding shall conform to BS 499 and BS EN 1011.

A copy of the calculations for the design of the masts showing clearly the grade of steel to be used shall be submitted to with the tender document. The calculations shall take into account the weakening effect of the doorways. The calculation documents should be signed by registered technician in Macau DSSCU.

A base compartment of adequate size shall be provided at the mast base for housing the necessary winching mechanism equipment and accessories. The compartment shall have a vandal-resistant, weatherproof access door with heavy duty vandal-resistant locks, suitable for identical pattern keys. Six such keys shall be provided for each mast. Keyholes shall be provided with weather-proof cover plates. Adequate working space should be available for operating the hoisting equipment at the foot of the mast.

桅桿的立柱、支臂和支架應使用 S355J0H 等級的高級鋼管製造，應符合 BS EN 10210 或強度等效之材料。所用鋼材應可焊接、耐老化並適用於熱浸鍍鋅。鍍鋅前應進行焊接。

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其他同等強度鋼材也可以接受，前提是其化學成分、機械性能、計算和規格的全部細節與招標文件一起提供。焊接應符合 BS 499 和 BS EN 1011。

標明所用鋼材等級的桅杆設計計算書應與標書文件一併提交。計算應考慮由於門道所引起的弱化。計算文件須由澳門特別行政區土地工務局註冊技術員簽署。

桅杆底座應提供足夠大小的底座隔間，以容納必要的絞盤設備設備和附件。隔間應有一個防破壞、防風雨的檢修門，帶有防重型破壞的鎖，適用於相同樣式的鑰匙。應為每個桅杆提供六個同樣式的鑰匙。鑰匙孔應設有防風雨蓋板。桅杆底部應有足夠的工作空間用於操作起重設備。

c. Corrosion protection 防腐蝕保護

The general protection of steel for non-stainless steel part should be “hot dip galvanized to BS 729” with a minimum galvanization thickness of 65 microns. Removing of rust by any mechanical or chemical adequate method and surface cleaning must be done before galvanizing. The rooted portion of the column should be subsequently treated with an internal and external application of heavy-duty bitumen to a height of 250mm above ground level. Both internal and external mast surfaces shall be hot dip galvanized to BS EN ISO 1461 for protection purpose.

對於非不鏽鋼的鋼部分，一般保護應為“符合 BS 729 的熱浸鍍鋅保護層”，最小鍍鋅厚度為 65 微米。鍍鋅前必須通過機械或化學適當的方法除鏽和表面清潔。桅杆的根部應在距地面 250 毫米的高度進行內部和外部的重型瀝青處理。內部和外部桅杆表面均應根據 BS EN ISO 1461 進行熱浸鍍鋅以進行保護。

2.3 RAISING AND LOWERING GEAR 升降裝置

The headframe and bracket shall be raised and lowered by a self-sustaining worm-gear winch suitable for both manual and power-driven operations and located at the foot of the mast. The winch shall be double drum and double gear type. Two separate and identical suspension systems and independently anchored ropes shall be provided. The gear ratio for the winch shall be marked on the winch. The loading calculations for lanterns, headframe,

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steel wires and accessories shall be endorsed by a Registered Structural technician in Macau DSSCU.

The operating handle shall be removable for storage within the mast. The power tool shall be a multi-speed reversible tool incorporating a torque-limiting device which can be readily adjusted and locked. A remote-control switch shall be incorporated to allow the equipment to be operated from a distance of 10m. Arrangements shall be provided to support the power tool accurately and securely during operation.

A danger plate shall also be affixed and shall bear the following warning statement with Chinese translation: “Standing under the mobile carriage during the raising and lowering operations is forbidden” . The Vendor who has intention to bid this tender shall provide technical information on the design life span, replacement criteria, checklists for preventive maintenance and the recommended lubrication oil with renewal interval for the winch system during tendering process.

The winch and all hoisting equipment must be adequate to allow for attaching to the lantern hoisting ropes.

The hoisting ropes shall be made of stainless-steel wire, running from the winch to the lantern carriage over pulleys made of non-corrodible metal at the top of the mast. The pulley grooves shall be suitably protected against moisture, dirt, rust and fitted with guards to prevent derailment of the wire ropes. Self-lubricating pulley bearing shall be used.

All vital parts of the hoisting mechanism shall be of stainless steel or other non-corrodible material. Particular care shall be taken to ensure that the wire rope and electric cable cannot abrade against any component. In addition, the electric cables shall not share any weight load from the hoisting wire ropes.

When the lantern carriage is in the fully lowered position, at least to within 1m of the base line, a sufficient number of turns of the hoisting rope shall be left on the winch drum to ensure that the securing arrangements on the winch drum do not take the full load when hoisting.

The rope shall be as clearly visible as practicable during the hoisting operation and the last 2m of the rope above the winch shall be clearly and indelibly marked. There shall be a clear indicating near the winch to show that the lantern carriage has reached the designed operating height.

The winch shall be capable of being positively locked at any point in the full travel of the rope. A safety device shall be incorporated to automatically stop the lantern carriage during raising or lowering operations if pressure is released at the winch. The safe working load shall be

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plainly marked on the winch.

Details relating to lubrication, both of winch drive and hoisting rope, indicating type and frequency of application shall be given on an engraved label fixed to and adjacent to the winch in a visible position.

燈頂架和支架應可由位於桅杆底部的自持式絞盤以手動或動力形式驅動和操作其升高和降低。絞盤為雙捲筒雙齒輪式。應提供兩個相同的獨立懸吊系統和獨立錨固的繩索。齒輪比應標明在絞盤上。燈具、燈頂架、鋼絲和附件的載荷計算書應由澳門特別行政區土地工務局註冊的結構技術員簽署。

操作手柄應可拆卸，以便存放在桅杆內。電動工具應可提供多個懸吊速度和其轉向是可逆的，並裝有易於調節和鎖定的扭矩限制裝置。應配備遙控工具，以便在 10m 距離內操作相關設備。應提供相關方案以在保證在操作期間的準確性和安全性。

應貼警示牌，並附有以下中文警示：“升降作業時禁止站在升降裝置下方”。有意投標的供應商應在投標過程中提供有關裝降裝置絞盤的設計壽命、更換準則、預防性維護檢查表和更換潤滑油間隔等的技術信息。

絞盤和所有起重設備必須滿足連接到燈具懸吊繩索。

燈具懸吊繩索應由不鏽鋼絲製成，並通過位於桅杆頂部由不腐蝕金屬製成的滑輪連接絞盤到燈架/盤。滑輪槽應採取適當的防潮、防塵、防鏽措施，並裝有防護裝置以防止鋼絲繩脫軌。應使用自潤滑滑輪軸承。

升降裝置的所有重要部件均應由不鏽鋼或其他耐腐蝕材料製成。應特別注意確保鋼絲繩和電纜不會磨損任何部件。此外，電纜不應分擔來自懸吊鋼絲繩的任何重量載荷。

當燈架/盤處於下降限位時，距基線 1m 以內時，絞盤上應留有足夠圈數的懸掛繩索，以確保吊裝時，絞盤上的固定裝置不會完全滿載。

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在升降裝置操作期間，燈具懸吊繩索應盡量清晰可見，並且絞盤上懸吊繩索的最後 2m 應有清晰且不可磨滅的標記。絞盤附近應有明顯的標記，表明燈架/盤已達到設計工作高度。

絞盤應能夠在全行程中的任何一點均能可靠地鎖定懸吊繩索。如果在絞盤失去拉力，則應有安全/自鎖裝置以在升起或降下操作期間自動停止燈架/盤。安全工作荷載應清楚地標在絞盤上。

有關絞盤驅動和懸吊繩索潤滑的詳細資訊、使用方法和頻率，應附在絞盤上並在當眼位置以雕刻標籤方式標明。

2.4 LANTERN CARRIAGE 燈架/盤

The lantern carriage including housing, heat sink, head frame, brackets and etc. shall be of durable stainless steel construction fitted with LED luminaires with diffuser and related equipment fixings. The supplier should provide both solution for fitting with area lighting type LED luminaires and sports lighting type LED luminaires according to the bill of quantities. All the materials shall be suitable for Macau.

The lantern carriage or ring should be anchored to at least two suspension wires and shall not rotate about or chafe the mast when being raised or lowered and shall be fitted with guides or rollers to prevent damage to either the lantern carriage assembly or the mast in the raising or lowering process.

The lantern carriage shall be so constructed as to enable automatic location correction and to ensure locking in position when the assembly is in the raised position.

燈架/盤應包括設備箱、散熱片、燈頂架、支架等結構，應採用耐用的不鏽鋼結構，配有附漫射屏 LED 燈具和相關設備固定裝置。供應商應根據工程量清單同時提供與區域型公共照明 LED 燈具或運動型公共照明 LED 燈具兩種解決方案。所有材料均應適合在澳門使用。

燈架或盤應至少固定在兩根懸吊繩索上，在升起或降下時不得繞著桅杆旋轉或磨損其他設備，並應裝有導軌或滑輪，以防止在升高或降低的過程中，損壞燈架/盤的組件或桅杆。

燈架/盤的結構應能自動校正位置並確保當組件升至工作位置時能自動鎖定到位。

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2.5 LED LUMINAIRES LED 燈具

In addition to above, LED luminaires shall comply with IEC 62471 hazard class Group 1 or Exempt Group. The correlated color temperature requirement can refer to Table I. The color and lighting output of LED luminaire shall be consistent from visual perspective. The luminaire shall be in modular type so that replacement of parts such as drivers, LED circuit boards and other components can be carried out as necessary.

The supplier shall guarantee supply of compatible spare parts for a period of 10-year after the product guarantee period. LED luminaires shall have a minimum of 50,000 hours of lifetime at 70% lumen maintenance.

Luminaires shall be capable of withstanding the effects of vibration from structures, passing vehicles and prevailing winds. Vibration studies/analyses and tests shall be carried out on the proposed luminaires beforehand in order to illustrate that no premature failure of lamps would occur under the structural vibration. The proposed materials and equipment shall comply with American National Standard vibration standard tests, as per ANSI C136.31.

The maximum weight 15kg and windage area 0.3m² of luminaire shall be met in order to match the wind loading of the corresponding high mast lighting columns.

The LED luminaires shall be equipped with accurately profiled ultraviolet resistant optical lenses and durable anodized aluminum reflector or accurate beam control.

The bowl or other part giving access to the interior of the luminaires, when in the enclosed position, shall be firmly attached to the fixed part of the luminaires. In the open position, it shall be attached so that it may not accidentally detach or blow against the fixed part of the luminaire's assembly and mast.

Heat rejection from LED luminaire shall be achieved by means of cooling of natural ambient air.

The LED luminaires shall be designed for easy wiring and shall be provided with an earthing terminal.

Built-in humidity valve shall be provided to avoid moisture leak into the luminaire.

The inter-fixture power connectors shall be provided with integral male/female waterproof power connectors.

The Glare must be minimized as it reduces visibility. Glare rating should limited to no more

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than 40 following CIE 112 Table 3.1. Supplier should provide diffuser as the measure control to limit the Glare.

The LED luminaire shall be available to prevent flicker to the eye during operation.

According to bill of quantities, supplier shall provide both the sports lighting type and area lighting type. Also, the calculation for both types should be submitted during tendering process (Annex III). For calculation, the environmental pollution category is medium.

除上述之外，LED 燈具還應符合 IEC 62471 危險等級組 1 或豁免組的要求。相關色溫要求可參考表一。LED 燈具的顏色和光輸出在視覺上應保持一致。燈具應採用模塊化設計，以便根據需要更換驅動器、LED 電路板等部件。

供應商應保證在產品保修期後 10 年內提供兼容的備件。LED 燈具在 70% 的流明維持率下應至少有 50,000 小時的使用壽命。

燈具應能夠承受因結構振動、通過車輛和風時所產生的振動影響。應事先對提供的燈具進行振動研究/分析和測試，以說明在結構振動下燈具不會發生過早的故障。建議的材料和設備應符合美國國家標準 ANSI C136.31 振動標準測試。

燈具的最大重量不應超過 15kg 和風阻面積不應超過 0.3m^2 ，以滿足高桅杆燈柱的風荷載計算書。

LED 燈具應配備精確成型的抗紫外線光學透鏡和耐用的陽極氧化鋁反射器或精確的光束控制裝置。

燈具的底座或其他部分，當處於封閉位置時，應牢固地連接到燈具的固定部分。在打開位置，也應該牢靠地固定，以保證這些部件不會意外地分離或其與桅桿和燈具的固定部分被吹離。

LED 燈具的散熱應通過自然環境空氣的冷卻來實現。

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LED 燈具的設計應便於接線，並應提供接地端子。

應提供內置濕度閥，以避免濕氣滲入到燈具中。

電源連接器應提供一體化的公/母防水電源連接器。

必須盡量減少眩光，因為它會降低能見度。按 CIE 112 表 3.1 標準，眩光等級應不高於 40，供應商應提供漫射屏為限制眩光的措施。

LED 燈具在運行過程中應避免對眼睛造成閃爍。

根據工程量清單，供應商應提供運動型公共照明燈具和區域型公共照明燈具。此外，兩種類型的計算都應在招標過程中提交（附件 III）。計算時，環境污染類別為中等。

2.6 LIGHTNING PROTECTION 防雷保護

Each mast shall be effectively earthed for lightning protection by separate earth rods buried in the ground immediately adjacent to the mast. The lightning protection earth systems shall be kept separate from the mast “circuit” earth system. Since the construction of foundations of high masts and concrete pillars will be carried out separately by other contractors, the vendor should provide the design for the lightning protection including the foundation. The design should include the drawing, the material, the acceptance criteria, the tests and related calculation.

The earth rods shall be housed in suitable earth pits. The lightning protection system shall comprise a suitable earthing terminal at the base of the mast, conductors and earth rods. The conductors connecting the earth rods and the earthing terminal shall be of copper tapes with cross-sectional area not less than 70mm².

Disconnecting means shall be provided to disconnect the mast from the rods for testing.

The whole of the lightning protection system shall be in accordance with the recommendations of BS EN 62305.

It shall be the Vendor's responsibility who has intention to bid the tender to ascertain the soil

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resistivity under dry conditions and determine the necessary length and number of earthing rods. The resulting earth resistance shall not be greater than 5 ohms. During the tendering process, the vendor should assume the soil resistivity and submit the preliminary design for the earthing system. After the tender is awarded, the vendor should measure the real soil resistivity and revise the design according to the real situation if it is necessary.

每個桅杆應通過埋在緊鄰桅杆的地面上的獨立接地棒進行有效的防雷接地。防雷接地系統應與桅杆的 "電力迴路" 接地系統保持分離。由於高杆的地基和混凝土支柱的建設將由其他承包商進行，供應商應提供包括地基在內的防雷設計。該設計應包括圖紙、材料、驗收標準、測試和相關計算。

接地棒應設置在合適的地坑中。防雷系統應包括在桅杆底部的合適的接地終端、導體和接地棒。連接接地棒和接地終端的導體應是橫截面積不小於 70mm² 的銅帶。

應提供斷開裝置，以便將桅杆與接地棒斷開，進行測試。

整個防雷系統應符合 BS EN 62305 的要求。

有意投標的供應商應負責確定乾燥條件下的土壤電阻率，並確定必要的長度和接地棒的數量。由此產生的接地電阻不應大於 5 歐姆。在招標過程中，供應商應假定土壤電阻率，並提交接地系統的初步設計。中標後，供應商應測量真實的土壤電阻率，必要時根據實際情況對設計進行修改。

2.7 REQUIREMENT TABLE 要求表格

Besides the requirements which are mentioned above, the products should also fulfill the requirements as below.

除了上述要求外，產品還應該滿足以下要求。

Table I Conclusion of the Requirement 表一 要求的總結

Requirement 要求		Acceptance Criteria 驗收標準	Standard 標準配置
Ambient	Ambient	Suitable for temperatures between 5°C	

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Condition 周圍環境條件	Temperature 周圍環境溫度	and +45°C 適用於 5°C 至 +45°C 的溫度範圍	
	Average Humidity (Relative Humidity) 平均濕度 (相對濕度)	Luminaire prepared to withstand 95% of relative humidity 準備承受 95% 的相對濕度的燈具	
	Maximum Relative Humidity 最高相對濕度	Up to 100% 最高可達 100%	
	Typhoon Wind Speed 颱風風速	Withstand 72 ms ⁻¹ 3-seconds Peak Wind Gust 可承受 72 ms ⁻¹ , 3 秒的峰值陣風所產生的荷載	
Safety Standards 安全標準	Safety Requirements 安全要求	<ul style="list-style-type: none"> Compliant with GB 7000.1 / IEC 60598-1 符合 GB 7000.1 / IEC 60598-1 Compliant with GB 7000.5 / IEC 60598-2-3 符合 GB 7000.5 / IEC 60598-2-3 Compliant with GB 24819 / IEC 62031 符合 GB 24819 / IEC 62031 Compliant with GB 19510.1 / IEC 61347-1 符合 GB 19510.1 / IEC 61347-1 Compliant with GB 19510.14 / IEC 61347-2-3 符合 GB 19510.14 / IEC 61347-2-3 	
	Radio Frequency 無線電頻率	Compliant with GB 17743 / EN 55015 符合 GB 17743 / EN 55015	
	Input Harmonic 輸入諧波	Compliant with GB 17625.1 / IEC 61000-3-2 符合 GB 17625.1 / IEC 61000-3-2	
	EMC Immunity EMC 抗擾度	Compliant with GB 18595 / IEC 61547 符合 GB 18595 / IEC 61547	
	EMC Voltage Disturbance EMC 電壓擾動	Compliant with GB 17625.2 / IEC 61000-3-3 符合 GB 17625.2 / IEC 61000-3-3	
	Photobiological Safety	Compliant with IEC 62471 符合 IEC 62471	

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	光生物安全		
Factory 工廠	Experience 經驗	LED manufacturer has to submit proven record of minimum 5 consecutive years' experience in manufacturing LED road lighting, listing the total number of consecutive years LED 製造商必須提交至少連續 5 年製造 LED 道路公共照明的經驗記錄，並列出連續的總年數。	
Technology 技術	LED Package LED 封裝	SMD	
Electrical Characteristics 電氣特性	Voltage/ Frequency 電壓/頻率	Suitable for 230V/ 50Hz (Max & Min) 適用於 230V/50Hz (最大和最小)	
	Insulation Level 絕緣水平	≥ 600 Vrms	
	Power Consumption 消耗功率	Rated Power & Input Power 額定功率和輸入功率	
	Power Factor 功率因數	Not less than 0.92 不低於 0.92	
	Surge Protection 浪湧保護	U _{OC} (1.2/5) not less than 10kV _{L-E} U _{OC} (1.2/5) 不低於 10kV _{L-E}	IEC 61643-11
Material 材料	Steel Baseplate 鋼底板	Fulfill the requirement which is mentioned in clauses 2.2a 滿足第 2.2a 條中提到的要求。	BS EN ISO 3506-1 BS EN ISO 3506-2 BS EN 14399 BS EN 1993-1-8
	Mast Construction 桅杆施工	Fulfill the requirement which is mentioned in clauses 2.2b 滿足條款 2.2b 中提到的要求。	BS EN 10210 BS 499 BS EN1011
	Corrosion Protection 防腐蝕保護	Fulfill the requirement which is mentioned in clauses 2.2c 滿足第 2.2c 條中提到的要求。	BS729 BS EN ISO 1461
Raising and lowering gear 升降裝置		Fulfill the requirement which is mentioned in clauses 2.3 滿足第 2.3 條中提到的要求。	

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Luminous Structure 燈具的結構	IP Index IP 指數	Not Lower than IP65 不低於 IP65	IEC 60598/ IEC 60529
	Gaskets to guarantee IP65 during life cycle 墊圈保證在使用週期內達到 IP65	Yes or no, with description of material 是或否，並說明材料的情況	
	IK Index IK 指數	Not lower than IK 09 is preferred. Not lower than IK 08 must be fulfilled 不低於 IK09 為佳。必須滿足不低於 IK08 的要求	IEC 60598/ IEC 62262
	Cooling and Heat Sink 冷卻和散熱器	No additional cooling and exhaust fan is accepted. Heat sink shall integrate with the lighting equipment. 不接受額外的冷卻和排風扇。 散熱器應與照明設備相結合。	
	Flexibility for Replacement 替換的靈活性	LED Module and Driver LED 模組和驅動器	
	Windage Area for the luminaire 燈具的迎風面	<ul style="list-style-type: none"> Luminaire $m^2 =$ Arm $m^2 =$ Total $\leq 0.3 m^2$ - 燈具 $m^2 =$ - 臂具 $m^2 =$ - 總面積 ≤ 0.3 平方米	
	Vibration Test 振動測試	Compliant with 符合條件	ANSI C136-31
	Maximum Weight for the luminaire 燈具的最大重量	<ul style="list-style-type: none"> Luminaire kg = Arm kg = Total ≤ 15 kg - 燈具 kg = - 臂具 kg = - 共計 ≤ 15 kg	
Performance Requirements	Rated Luminous Flux	$\geq 34,000$ lm (equivalent to 400 W HPS) at 25°C	IEC 62722/ IEC 62717

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性能要求	(considering absolute photometry LOR = 1) 額定光通量 (考慮到絕對光度計 LOR=1)	在 25°C 時 $\geq 34,000$ lm (相當於 400W HPS)。	
	Rated life L ₇₀ @ t _a =25°C 額定壽命 L70 @ t _a =25°C	L70 > 50,000 hours For LED module and driver L70 > 50,000 小時 用於 LED 模組和驅動器	IEC 62722/ IEC 62717 (LM-80; TM 21)
	Lumen maintenance at 6000 h test duration 在 6000 小時測試時間的內流明維持率	$\geq 85\%$	IEC 62722/ IEC 62717
	Initial CRI 初始顯色指數	Not less than 70 不少於 70	IEC 62722/ IEC 62717
	Rated chromaticity (Size of MacAdam ellipse) 額定色度 (麥克亞當橢圓)	< 7-step < 7-步驟	IEC 62722/ IEC 62717
	Luminaire efficacy 燈具功效	Not less than 130 lm/W is preferred. Not less than 100lm/W must be fulfilled 不低於 130 lm/W 是首選。 必須滿足不低於 100lm/W 的要求。	IEC 62722/ IEC 62717
	Initial CCT 初始相關色溫度	2700K (Warm White) 2700K (暖白色)	IEC 62722/ IEC 62717
	Maintenance Factor 維修係數	0.8	CIE 115 equivalent 相當於 CIE 115
Luminous Distribution 光線分佈	Polar Diagram (Cutoff angles) 極坐標圖 (分界角度)	0 Cd for angles equal or greater than 75 degrees on the C0-180° plane is preferred. 0 Cd for angles equal or greater than 80 degrees on the C0-180° plane must be fulfilled	

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		<p>0 Cd for angles equal or greater than 75 degrees on the C270-90° plane is preferred. 0 Cd for angles equal or greater than 80 degrees on the C270-90° plane must be fulfilled</p> <p>在 C0-180°平面上，最好是光度角度大於或等於 75 度為 0 Cd。在 C0-180°平面上，須滿足 0 Cd 等於或大於 80 度角度的要求。</p> <p>在 C270-90°平面上，最好是光度角度大於或等於 75 度為 0 Cd。在 C270-90°平面上，必須滿足 0 Cd 的角度等於或大於 80 度的要求。</p>	
Lighting Levels 照明水平	Requirement in Table 2 and 7 of Macau Public Outdoor Lighting Design Guide 澳門公共戶外照明設計指南表 2 和表 7 中的要求	<ul style="list-style-type: none"> • Carriageways Table 2 - M1 • Sidewalk Lighting, Table 7 (where applicable) • Maintenance Factor = 0.8 <p>- 車行道 表 2-M1 - 人行道照明，表 7(如適用) - 維修係數=0.8</p>	Public Outdoor Lighting Design Guide 公共戶外照明設計指南
Special Requirement 特殊要求	Requirement in clause 4 of Macau Public Outdoor Lighting Design Guide 澳門公共戶外照明設計指南第 4 條的要求	<p>Compliance with guide and integration in architectural design of existing high masts.</p> <p>遵守指南，並融入現有高杆燈的建築設計中。</p>	Public Outdoor Lighting Design Guide 公共戶外照明設計指南

3. TECHNICAL DOCUMENTS TO SUBMIT WITH THE TENDER

隨投標書提交的技術文件

The Tenderers shall submit the following technical documents:

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- **ANNEX I** Data Schedule duly filed in (one English version is mandatory) completed with the following attachments:
 - Copy of leaflet or catalogue (one English version is mandatory) showing detailed technical features of the luminaires.
 - Photometric data showing the lighting distribution of the luminaire. Polar intensity diagram. (One English version is mandatory)
 - **Mandatory Test Reports**

投標人應提交以下技術文件。

- **附件一** 資料表（必須有一個英文版本）與下列附件一起填寫。
 - 顯示燈具詳細技術特徵的傳單或目錄的副本（必須有一個英文版本）。
 - 顯示燈具照明分佈的測光資料，強度極座標圖。(必須有一個英文版本)
 - **強制性測試報告**

Parameters 參數	Standard 標準	Issuer 發行人
General and particular requirements of the luminaire 燈具的一般和特殊要求	IEC 60598-2-3 and IEC 60598-1 or equivalent GB standards IEC 60598-2-3 和 IEC 60598-1 或同等的 GB 標準	Reputable Laboratory 有信譽的實驗室
Photobiological safety of the Luminaire 燈具的光生物安全	IEC 62471 or equivalent GB standards IEC 62471 或同等的 GB 標準	Reputable Laboratory 有信譽的實驗室
EMC levels 電磁相容性水準	IEC 61547 IEC 61000-3 or equivalent GB standards IEC 61547 IEC 61000-3 或同等的 GB 標準	Reputable Laboratory 有信譽的實驗室

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Lumen and color changes over the time (LED component) 流明和顏色隨時間變化 (LED 元件)	LM-80-08 or IEC 62717 or equivalent GB standards LM-80-08 或 IEC 62717 或同等的 GB 標準	Reputable Laboratory 有信譽的實驗室
Photometry and Colorimetry (luminaire) 測光和測色 (燈具)	LM-79-08 or IEC 62722-2-1 or equivalent GB standards LM-79-08 或 IEC 62722-2-1 或同等的 GB 標準	Reputable Laboratory 有信譽的實驗室
Vibration Test 振動測試	ANSI C136-31	Reputable Laboratory 有信譽的實驗室

- **ANNEX II** Schedule of deviations (one English version is mandatory).
The Tenderer must clearly state any deviation to this specification.

附件二 偏差表（必須有一個英文版本）。
投標人必須明確說明與本規範的任何偏差。

- **ANNEX III** Photometric study of luminance and/or illuminance levels, as required in CIE 115 and DSPA Guidelines with a short description of the used software and calculation methods (one English version is mandatory). The results shall be plotted on the plan in Annex III.1, Annex III.2, Annex III.3 and Annex III.4 for 20m and 25m high masts, for CCT 2700K (warm white), based on a maintenance factor = 0.8.

附件三 按照 CIE 115 和 DSPA 指南的要求，對亮度和/或照度水準進行光度測量研究，並簡要說明所使用的軟體和計算方法（必須有一個英文版本）。在附件 III.1、附件 III.2、附件 III.3 和附件 III.4 中，對於 20 米和 25 米高的桅杆，對於 CCT 2700K（暖白），基於維護係數=0.8 的研究結果應繪製在對應平面上。

- **ANNEX IV** Track Record of the manufacturer that proves it has 5 consecutive years' experience in manufacturing lighting LED road lighting luminaires

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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in a recent past, listing the total number of consecutive years.

附件四 製造商的業績記錄，證明其在近期有連續 5 年的 LED 道路公共照明燈具的製造經驗，列出連續的總年數。

- **ANNEX V** Stainless steel metallic arm structure, bolts, nuts and washers to fit the existing high mast. The design to be submitted shall include general and detailed dimension and weight of each part, as well as the detailed list of materials and arm size calculation.

附件五 不鏽鋼金屬臂結構、螺栓、螺母和墊圈，以適應現有的高桅杆。提交的設計應包括每個部分的一般和詳細的尺寸和重量，以及詳細的材料清單和燈臂的尺寸計算。

- **ANNEX VI** The loading and the force calculations for the mast construction, foundation shall be submitted. Calculations for the design of the masts should be showed clearly the grade of steel to be used. The calculations shall take into account the weakening effect of the doorways. The calculation document shall only be endorsed by a Registered Structural Technician in Macau DSSCU **after the tender is awarded** (if applicable).

附件六 應提交桅杆結構和基礎的載荷和受力計算。桅杆設計的計算書應清楚地顯示所使用的鋼材等級。計算結果應考慮到門洞的削弱作用。計算書須在中標後由澳門特別行政區土地工務局註冊結構技術員簽字（如適用）。

- **ANNEX VII** The loading calculations for the raising and lowering gear including but not limit to the lanterns, headframe, steel wires and accessories. The calculation document shall only be endorsed by a Registered Structural Technician in Macau DSSCU **after the tender is awarded** (if applicable).

附件七 升降裝置的荷載計算，包括但不限於燈具、燈頂架、懸吊鋼絲和附件。計算書應在中標後由澳門特別行政區土地工務局註冊結構技術員簽字（如適用）。

- **ANNEX VIII** Lightning protection system and grounding/earthing system design and calculation (including the foundation design).

附件八 防雷系統和接地/接地系統設計和計算（包括基礎設計）。

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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PHOTO OF AREA LIGHTING AND SPORTS LIGHTING

區域公共照明型燈具和運動公共照明型燈具的照片

1. AREA LIGHTING 區域公共照明型燈具



2. SPORTS LIGHTING 運動公共照明型燈具



TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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ANNEX I - DATA SCHEDULE

附件 I 資料表

Tender 招標人	
Submission Date 提交日期	
Supplier 供應商	
Manufacturer 廠商	

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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Requirement 要求		Acceptance Criteria 驗收標準	Data for CCT 2700K 用於 CCT 2700K 的資料
Ambient Condition 周圍環境條件	Ambient Temperature 周圍環境溫度	Operating Temperature (°C) 運行溫度(°C)	
	Humidity (Relative Humidity) 濕度 (相對濕度)	Maximum Allowed Mean Relative Humidity (%) 最大允許的平均相對濕 度 (%)	
	Peak Relative Humidity 最高相對濕度	Up to 100% 最高可達 100%	
	Typhoon Wind Speed 颱風風速	Withstand 72 ms⁻¹ 3- seconds Peak Wind Gust 可承受 72 ms⁻¹ · 3 秒 的峰值陣風所產生的荷 載	
Safety Standards 安全標準	Safety Requirements 安全要求	Compliant with GB 7000.1 / IEC 60598-1 符合 GB 7000.1 / IEC 60598-1	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
		Compliant with GB 7000.5 / IEC 60598-2-3 符合 GB 7000.5 / IEC 60598-2-3	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
		Compliant with GB 24819 / IEC 62031 符合 GB 24819 / IEC 62031	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
		Compliant with GB 19510.1 / IEC 61347-1 符合 GB 19510.1 / IEC 61347-1	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
		Compliant with	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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		GB 19510.14 / IEC 61347-2-3 符合 GB 19510.14 / IEC 61347-2-3	
	Radio Frequency 無線電頻率	Compliant with GB 17743 / EN 55015 符合 GB 17743 / EN 55015	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
	Input Harmonic 輸入諧波	Compliant with GB 17625.1 / IEC 61000-3-2 符合 GB 17625.1 / IEC 61000-3-2	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
	EMC Immunity EMC 抗擾度	Compliant with GB 18595 / IEC 61547 符合 GB 18595 / IEC 61547	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
	EMC Voltage Disturbance EMC 電壓擾動	Compliant with GB 17625.2 / IEC 61000-3-3 符合 GB 17625.2 / IEC 61000-3-3	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
	Photobiological Safety 光生物安全	Compliant with IEC 62471 符合 IEC 62471	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
Factory 工廠	Experience 經驗	LED manufacturer shall submit proven track records of minimum 5 consecutive years' experience in manufacturing LED road lighting, listing the total number of consecutive years LED 製造商必須提交至 少連續 5 年製造 LED 道路公共照明的經驗記 錄，並列出連續的總年 數。	Track Record To be Submitted 提交供應業績記錄
Technology	LED Package	SMD	

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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技術	LED 封裝		
Electrical Characteristics 電氣特性	Voltage/ Frequency 電壓/頻率	Volts Max 最高電壓 Volts Min 最低電壓	
	Insulation Level 絕緣水平	≥ 600 Vrms	
	Power Consumption 消耗功率	Watt Rated Power 額定功率 Watt Input Power 輸入功率	
	Power Factor 功率因數	Not less than 0.92 不低於 0.92	
	Surge Protection 浪湧保護	U _{OC} (1.2/5) not less than 10kV _{L-E} U _{OC} (1.2/5) 不低於 10kV _{L-E}	
Material 材料	Steel Baseplate 鋼底板	Fulfill the requirement which is mentioned in clauses 2.2a 滿足第 2.2a 條中提到的要求。	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
	Mast Construction 桅杆施工	Fulfill the requirement which is mentioned in clauses 2.2b 滿足條款 2.2b 中提到的要求。	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
	Corrosion Protection 防腐蝕保護	Fulfill the requirement which is mentioned in clauses 2.2c 滿足第 2.2c 條中提到的要求。	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
Raising and lowering gear 升降裝置		Fulfill the requirement which is mentioned in clauses 2.3 滿足第 2.3 條中提到的要求。	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
Luminous Structure 燈具的結構	IP Index IP 指數	Not Lower than IP65 不低於 IP65	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
	Diffuser for Glare control 眩光控制漫射屏	CIE 112 or equivalent GR < 40 CIE 112 或同等 GR < 40	Not greater than 不高於
	Gaskets to guarantee IP65 during life cycle 墊圈保證在使用週期內達到 IP65	Yes/No and description of material 是或否，並說明材料的情況	

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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	IK Index IK 指數	Not lower than IK 09 is preferred. Not lower than IK 08 must be fulfilled 不低於 IK09 為佳。必須滿足不低於 IK08 的要求	Not lower 不低於 IK ____
	Cooling and Heat Sink 冷卻和散熱器	Is there any additional cooling and/or exhaust fan in the lighting equipment? 照明設備中是否有任何額外的冷卻和/或排氣扇?	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
	Replacement 更換	LED Module and Driver LED 模組和驅動器	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
	Maximum Weight for the luminaire 燈具的最大重量	<ul style="list-style-type: none"> Luminaire kg = Arm kg = Total = ($\leq 15\text{kg}$) - 燈具 kg = - 臂力 kg = - 共計 = ($< 15\text{kg}$)	
	Windage Area for the luminaire (Max Surface) 燈具的迎風面積（最大表面）。	<ul style="list-style-type: none"> Luminaire m^2 = Arm m^2 = Total m^2 = ($\leq 0.3\text{m}^2$) - 燈具 m^2 = - 手臂 m^2 = - 總面積 = ($< 0.3\text{m}^2$)	
	Vibration Test 振動測試	Compliant with ANSI C136-31 符合 ANSI C136-31 標準	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>
Performance Requirements 性能要求	Rated Luminous Flux (considering absolute photometry LOR = 1) 額定光通量（考慮到絕對光度計 LOR=1）	IEC 62722/ IEC 62717; LM-80/ LM 79 (lm) $\geq 34000 \text{ lm at } 25^\circ\text{C}$ 在 25°C 時 $\geq 34,000 \text{ lm}$	

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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	Rated life L ₇₀ @ t _a =25°C > 50000 hours 額定壽命 L70 @ t _a =25°C	IEC 62722/ IEC 62717. LM-80; TM 21 (hours) IEC 62722/ IEC 62717. LM-80; TM 21 (小時)	LED = Driver 驅動器=
	Lumen maintenance at 6000 h test duration 在 6000 小時測試時 間內的流明維持率	IEC 62722/ IEC 62717 LM-80/ LM 79 (%) ≥ 85%	
	Initial CRI 初始顯色指數	IEC 62722/ IEC 62717 LM-80/ LM 79 Not less than 70 不少於 70	
	Rated chromaticity (Size of MacAdam ellipse) 額定色度 (麥克亞 當橢圓)	IEC 62722/ IEC 62717 LM-80/ LM79 (steps) < 7-step < 7-步驟	
	Luminaire efficacy 25°C 25°C 的燈具功效	IEC 62722/ IEC 62717 LM-80/ LM79 (lm/W) Not less than 130 lm/W is preferred. Not less than 100lm/W must be fulfilled 不低於 130 lm/W 是首 選。必須滿足不低於 100lm/W 的要求	Not less than 不低於 _____ lm/W
	Initial CCT 最初的 CCT	IEC 62722/ IEC 62717 LM-80/ LM 79 (K)	
	Maintenance Factor 維修係數	CIE 115 or equivalent = 0.8 CIE 115 或同等=0.8	To be Submitted in Annex III 在附件三中提交

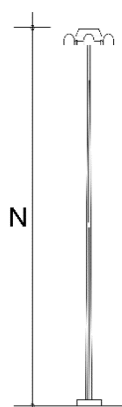
TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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	Glare Rating 眩光系數	CIE 112 or equivalent GR < 40 CIE 112 或同等 GR < 40	Not greater than 不高於
Luminous Distribution 光線分佈	Polar Diagram (Cutoff angles) 極坐標圖（分界角度）	Diagram 圖表	To be Submitted 有待提交
Lighting Levels 照明水準	Photometric Study 光度研究	Report and Drawings 報告和圖紙	To be Submitted in Annex III 在附件三中提交
Compatible Spare Parts 兼容產品 備件	Supply of a period after the product guarantee period 提供產品保證期後的期限	10-year 10 年	Y 是 <input type="checkbox"/> N 否 <input type="checkbox"/>

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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ANNEX III.1 - PHOTOMETRIC LEVELS ON TYPICAL ARRANGEMENT FOR 20M AND 25M HIGH MAST (ROADS AND RELATED AREAS OF TABLE 2 & 7 AND CLAUSE 4.4.3.3b IN DSPA GUIDELINES) FOR 400W HPS EQUIVALENT LED CONSIDERING MAINTENANCE FACTOR 0.8, FOR AREA LIGHTING

附件 III.1 - 20 米和 25 米高的桅杆上的光照度水平 (DSPA 指引中表 2、表 7 和第 4.4.3.3b 條中所載的道路和相關區域要求)，考慮到維護係數 0.8，與 400W HPS 等效的 LED 區域公共照明型燈具



燈具的高度

HIGHT OF LAMP		
N	X	Y
20M	22.5M	14M
25M	30M	14M

Please plot the luminance, illuminance, uniformities and threshold increment per each cases which is mentioned in the above table for the configuration below. The requirement can refer to the roads and related areas of TABLE 2 & 7 and clause 4.4.3.3b in DSPA guidelines. If the installation location is not mentioned in another tender document, the calculation for the location as below should be submitted.

- Carriageways Table 2 - M1 in DSPA guidelines
- Item 1, Sidewalk Lighting, Table 7 (where applicable) in DSPA guidelines
- Comprehensive area, High mast, clause 4.4.3.3 in DSPA guidelines

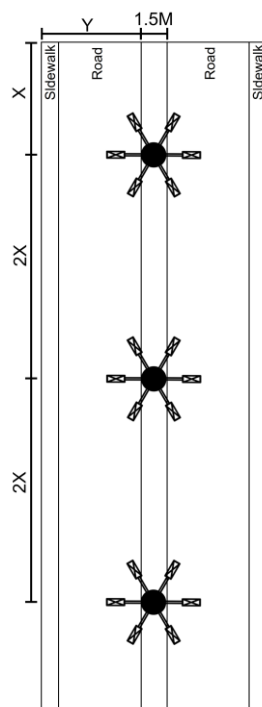
Annex III.1 is the calculation for area lighting type LED luminaires.

請繪製上表中提到的每種情況下的亮度、照度、均勻度和閾值增量。計算中應採用於以下配置，要求可參考DSPAG指引中的表2、表7和4.4.3.3b條款中所載的道路和相關區域要求。如果在其他招標書中沒有提到安裝位置，應提交以下位置的計算。

- 車行道 - DSPAG指引中的表2-M1
- 項目1，人行道照明，DSPAG指引中的表7(如適用)
- 綜合區域，高桅杆，DSPAG指引中的4.4.3.3條

附件III.1是區域公共照明型LED燈具的計算。

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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ANNEX III.2 - PHOTOMETRIC LEVELS ON TYPICAL ARRANGEMENT FOR 20M AND 25M HIGH MASTS (ROADS AND RELATED AREAS OF TABLE 2 & 7 AND CLAUSE 4.4.3.3b IN DSPA GUIDELINES FOR 400W HPS EQUIVALENT LED) CONSIDERING MAINTENANCE FACTOR 0.8, FOR AREA LIGHTING

附件三.2 – 20 米和 25 米高的桅杆上的光照度水平 (DSPA 指引中表 2、表 7 和第 4.4.3.3b 條中所載的道路和相關區域要求)，與 400W HPS 等效的 LED 區域公共照明型燈具

	燈具的高度		
	HIGHT OF LAMP		
	N	X	Y
	20M	22.5M	14M
	25M	30M	14M

Please plot the luminance, illuminance, uniformities and threshold increment per each cases which is mentioned in the above table for the configuration below. The requirement can refer to the roads and related areas of TABLE 2 & 7 and clause 4.4.3.3b in DSPA guidelines. If the installation location is not mentioned in another tender document, the calculation for the location as below should be submitted.

- Carriageways Table 2 - M1 in DSPA guidelines
- Item 1, Sidewalk Lighting, Table 7 (where applicable) in DSPA guidelines
- Comprehensive area, High mast, clause 4.4.3.3 in DSPA guidelines

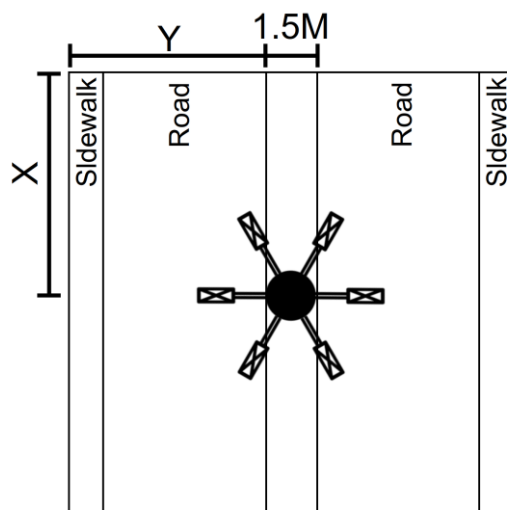
Annex III.2 is the calculation for area lighting type LED luminaires.

請繪製上表中提到的每種情況下的亮度、照度、均勻度和閾值增量。計算中應採用於以下配置，要求可參考DSPAG指引中的表2、表7和4.4.3.3b條款中所載的道路和相關區域要求。如果在其他招標書中沒有提到安裝位置，應提交以下位置的計算。

- 車行道 - DSPA指南中的表2-M1
- 項目1，人行道照明，DSPAG指南中的表7(如適用)
- 綜合區域，高桅杆，DSPAG指南中的4.4.3.3條

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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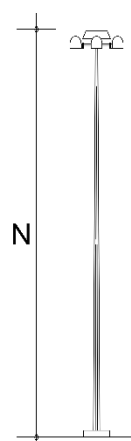
附件III.2是區域公共照明型LED燈具的計算。



TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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ANNEX III.3 - PHOTOMETRIC LEVELS ON TYPICAL ARRANGEMENT FOR 20M AND 25M HIGH MASTS (ROADS AND RELATED AREAS OF TABLE 2 & 7 AND CLAUSE 4.4.3.3b IN DSPA GUIDELINES FOR 400W HPS EQUIVALENT LED CONSIDERING) MAINTENANCE FACTOR 0.8, FOR SPORTS LIGHTING

附件三.3 - 20 米和 25 米高的桅杆上的光照度水平 (DSPA 指引中表 2、表 7 和第 4.4.3.3b 條中所載的道路和相關區域要求)，考慮到維護係數 0.8，與 400W HPS 等效的 LED 運動公共照明型燈具



燈具的高度

HIGHT OF LAMP		
N	X	Y
20M	22.5M	14M
25M	30M	14M

Please plot the luminance, illuminance, uniformities and threshold increment per each cases which is mentioned in the above table for the configuration below. The requirement can refer to the roads and related areas of TABLE 2 & 7 and clause 4.4.3.3b in DSPA guidelines. If the installation location is not mentioned in another tender document, the calculation for the location as below should be submitted.

- Carriageways Table 2 - M1 in DSPA guidelines
- Item 1, Sidewalk Lighting, Table 7 (where applicable) in DSPA guidelines
- Comprehensive area, High mast, clause 4.4.3.3 in DSPA guidelines

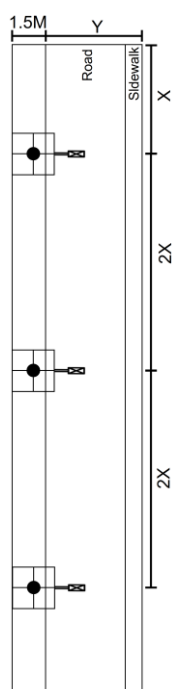
Annex III.3 is the calculation for sports lighting type LED luminaires.

請繪製上表中提到的每種情況下的亮度、照度、均勻度和閾值增量。計算中應採用於以下配置，要求可參考DSPAG指引中的表2、表7和4.4.3.3b條款中所載的道路和相關區域要求。如果在其他招標書中沒有提到安裝位置，應提交以下位置的計算。

- 車行道 - DSPAG指南中的表2-M1
- 項目1，人行道照明，DSPAG指南中的表7(如適用)
- 綜合區域，高桅杆，DSPAG指南中的4.4.3.3條

附件III.3是運動公共照明型LED燈具的計算方法。

<p>TAD</p>	<p>20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具</p>	
<p>NCEM C71 – 006 Ref. PLD-CS022/25/99</p>	<p>SOLID STATE PUBLIC LIGHTING 固態型公共照明</p>	<p>Page 37/44</p>



TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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ANNEX III.4 - PHOTOMETRIC LEVELS ON TYPICAL ARRANGEMENT FOR 20M AND 25M HIGH MASTS (ROADS AND RELATED AREAS OF TABLE 2 & 7 AND CLAUSE 4.4.3.3b IN DSPA GUIDELINES) FOR 400W HPS EQUIVALENT LED CONSIDERING MAINTENANCE FACTOR 0.8), FOR SPORTS LIGHTING

附件三.4 - 20 米和 25 米高的桅杆上的光照度水平 (DSPA 指引中表 2、表 7 和第 4.4.3.3b 條中所載的道路和相關區域要求)，考慮到維護係數 0.8，與 400W HPS 等效的 LED 運動公共照明型燈具

	燈具的高度		
	HIGHT OF LAMP		
	N	X	Y
	20M	22.5M	14M
	25M	30M	14M

Please plot the luminance, illuminance, uniformities and threshold increment per each cases which is mentioned in the above table for the configuration below. The requirement can refer to the roads and related areas of TABLE 2 & 7 and clause 4.4.3.3b in DSPA guidelines. If the installation location is not mentioned in another tender document, the calculation for the location as below should be submitted.

- Carriageways Table 2 - M1 in DSPA guidelines
- Item 1, Sidewalk Lighting, Table 7 (where applicable) in DSPA guidelines
- Comprehensive area, High mast, clause 4.4.3.3 in DSPA guidelines

Annex III.4 is the calculation for sports lighting type LED luminaires.

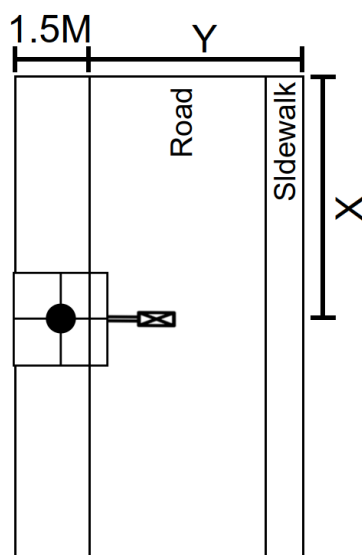
請繪製上表中提到的每種情況下的亮度、照度、均勻度和閾值增量。計算中應採用於以下配置，要求可參考DSPAG指引中的表2、表7和4.4.3.3b條款中所載的道路和相關區域要求。如果在其他招標書中沒有提到安裝位置，應提交以下位置的計算。

- 車行道 - DSPAG指南中的表2-M1
- 項目1，人行道照明，DSPAG指南中的表7(如適用)

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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- 綜合區域，高桅杆，DSPA指南中的4.4.3.3條款

附件III.4是運動公共照明型LED燈具的計算方法。



TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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ANNEX IV - TRACK RECORDS

附件四--供應業績記錄

Date of Completion 竣工日期	Customer/ Owner 客戶/業主	Title of the Project 項目名稱	Location/ Venue 地點/場所	Quantity of the Project 項目的數量	Value of the Project 項目的價值

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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ANNEX V - STAINLESS STEEL METALLIC ARMS

附件五--不鏽鋼金屬燈臂

Stainless steel metallic arm structure, bolts, nuts and washers to fit the existing high mast. The design to be submitted shall include general and detailed dimension and weight of each part, as well as the detailed list of material and arm size calculation.

不鏽鋼金屬燈臂結構、螺栓、螺母和墊圈，以適應現有的高桅杆。提交的設計應包括每個部分的一般和詳細的尺寸和重量，以及詳細的材料清單和手臂尺寸計算。

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TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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ANNEX VI – LOADING AND FORCE CALCULATION

附件六--載荷和力的計算

The loading and the force calculations for the mast construction, foundation shall be submitted. Calculations for the design of the masts should be showed clearly the grade of steel to be used. The calculations shall take into account the weakening effect of the doorways. The calculation document shall only be endorsed by a Registered Structural Technician in Macau DSSCU **after the tender is awarded** (if applicable).

應提交桅杆結構和基礎的載荷和受力計算。桅杆設計的計算書應清楚地顯示所使用的鋼材等級。計算結果應考慮到門洞的削弱作用。計算書須在**中標後**由澳門特別行政區土地工務局註冊結構技術員簽署（如適用）。

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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ANNEX VII – LOADING CALCULATION

附件七--載荷計算

The loading calculations for the raising and lowering gear including but not limit to the lanterns, headframe, steel wires and accessories. The calculation document shall only be endorsed by a Registered Structural Technician in Macau DSSCU **after the tender is awarded** (if applicable).

升降裝置的負荷計算，包括但不限於燈具、燈頂架、鋼絲和附件。計算書只應在中標後由澳門特別行政區土地工務局註冊結構技術員簽署（如適用）。

TAD	20 & 25M HIGH MAST USAGE STREET LIGHTING LED LUMINAIRES 20 和 25 米高的桅杆用於街道照明的 LED 照明燈具	
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ANNEX VIII – LIGHTNING PROTECTION AND GROUNDING/EARTHING SYSTEM

附件八--防雷和接地系統

Lightning protection system and grounding/earthing system design and calculation (including the foundation).

防雷系統和接地系統設計和計算（包括基礎）。