# 巴厘通用能源公司

## PT.GENERAL ENERGY BALI

锅炉侧输灰管道支撑钢架、海水喷淋泵房钢架及出口管道钢架防腐刷漆、烟囱钢梁加固防腐、六大风机钢架加固技术规范书

Corrosion protection painting for boiler-side ash handling pipelines support steel frames, seawater spray pump room steel frames and outlet pipeline steel frames; corrosion protection and reinforcement for chimney steel beams; Technical Specification Document for Reinforcement of Six Major Fan Steel Frames

批准（APPROVE）：

审核（VERIFY）：

编制（Prepared by）：

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# 1.总则 General Requirements

## 1.1 适用范围 Scope of application

本技术规范书适用于巴厘通用能源公司锅炉区域：输灰管道支撑综合钢架、输灰管道本体、灰库综合钢架。海水喷淋泵房区域：泵房整体钢架结构、喷淋出口管道支撑钢架防腐刷漆。烟囱钢梁加固防腐、六大风机钢架加固外委项目，明确承包方在技术、质量、安全、环保、进度、责任及义务等方面的要求，以确保项目高质量完成。

This Technical Specification Document applies to the following areas of Bali General Energy Company: the integrated steel frame for the ash transport pipeline supports, the ash transport pipeline body, and the integrated steel frame for the ash storage silo; the seawater spray pump house area: the overall steel frame structure of the pump house and the anti-corrosion painting of the steel frame supporting the spray outlet pipelines; the chimney steel beam reinforcement and anti-corrosion treatment; and the outsourced project for reinforcing the steel frames of the six major fans. This document specifies the requirements for the Contractor regarding technology, quality, safety, environmental protection, schedule, responsibilities, and obligations to ensure the high-quality completion of the project.

**1.2** 本外委施工及验收严格遵循国家、行业现行标准、规范，主要依据如下：

All outsourced construction and acceptance processes strictly comply with current national and industry standards and specifications, primarily based on the following criteria:

1.2.1 相关国家、行业标准

Relevant national and industry standards

1.2.1.1 《钢结构工程施工质量验收标准》（GB 50205-2020）

1.2.1.1 Quality Acceptance Standards for Steel Structure Engineering Construction (GB 50205-2020)

1.2.1.2 《建筑防腐蚀工程施工及验收规范》（GB 50212-2014）

1.2.1.2 Code for Construction and Acceptance of Building Corrosion Prevention Engineering (GB 50212-2014)

1.2.1.3 《涂装前钢材表面锈蚀等级和除锈等级》（GB/T 8923-2011）

1.2.1.3"Rust Grade and Rust Removal Grade of Steel Surfaces Before Coating" (GB/T 8923-2011)

1.2.1.4 《火电施工质量检验及评定标准（锅炉篇）》

1.2.1.4 "Standards for Quality Inspection and Evaluation of Thermal Power Plant Construction (Boiler Section)"

1.2.1.5 《工业设备、管道防腐蚀工程施工及验收规范》（HG/T 20229-2019）

1.2.1.5 "Code for Construction and Acceptance of Anti-Corrosion Engineering for Industrial Equipment and Pipelines" (HG/T 20229-2019)

1.2.1.6 《烟囱工程施工及验收规范》（GB 50078-2008）

1.2.1.6 Code for Construction and Acceptance of Chimney Engineering (GB 50078-2008)

1.2.1.7 《钢结构加固设计标准》（GB 51367-2019）
1.2.1.7 "Design Standard for Steel Structure Reinforcement" (GB 51367-2019)
1.2.1.8 《火力发电厂烟囱（烟道）内衬防腐、保温技术导则》（DL/T 1838-2018）
1.2.1.8 Technical Guidelines for Anti-corrosion and Thermal Insulation of Chimney (Flue) Linings in Thermal Power Plants (DL/T 1838-2018)
1.2.1.9 巴厘通用能源公司设备防腐运维管理制度、安全文明施工管理规定
1.2.1.9 Bali General Energy Company – Equipment Anti-Corrosion Operation and Maintenance Management System; Safety and Civilized Construction Management Regulations
1.2.1.10 《色漆和清漆 防护涂料体系对钢结构的防腐蚀保护》（GB/T 30790）
1.2.1.10 "Paints and varnishes - Protection of steel structures by protective paint systems" (GB/T 30790)
1.2.1.11 《火力发电厂烟囱（烟道）防腐蚀工程施工技术规程》（DL/T 5736-2016）
1.2.1.11 "Technical Specification for Construction of Anti-corrosion Engineering for Chimney (Flue) of Thermal Power Plants" (DL/T 5736-2016)

### 1.3 技术规范的解释权 Right of interpretation

本技术规范书由巴厘通用能源公司生产技术部编制并解释，未尽事宜由双方协商确定。

This technical specification is prepared and interpreted by the Production Technology Department of Bali General Energy Company. Any matters not covered shall be determined by negotiation between the two parties.

## 2. 工作范围 Working scope

### 2.1 项目概述 Project Overview

2.1.1 项目名称
Project Name
输灰管道支撑综合钢架、输灰管道本体、灰库综合钢架；海水喷淋泵房区域：泵房整体钢架结构、喷淋出口管道支撑钢架防腐刷漆；烟囱钢梁加固防腐、六大风机钢梁加固
Ash conveying pipelines – integrated steel frames, ash conveying pipeline bodies, and ash storage silo integrated steel frames; Seawater spray pump house area – overall steel frame structure of the pump house; anti-corrosion painting and support steel frames for the spray outlet pipelines; Chimney steel beams – reinforcement and anti-corrosion treatment; Six major fan steel beams – reinforcement
2.1.2 项目地点
Project Location
印度尼西亚巴厘通用能源公司
PT. GENERAL ENERGY BALI
2.1.3 项目背景及目的
Project Background and Purpose

六大风机钢梁、输灰系统管道、钢架从#3 炉至灰库区域长期暴露在锅炉粉尘、高温环境中，管道、钢结构表面存在氧化锈蚀、旧涂层起皮、脱落、返锈现象。海水喷淋泵房钢架及出口管道钢架处于海边高湿、高盐雾腐蚀环境，钢结构锈蚀速率快，原有防腐涂层老化失效，不仅影响设备外观整洁度，还会造成钢结构壁厚损耗、承载力下降，存在设备安全隐患。烟囱投运多年，长期处于高温、烟气腐蚀、户外暴晒、风荷载交变工况下，附属支撑钢梁、平台钢梁、拉结钢构普遍存在锈蚀起皮、局部截面减薄、焊缝老化、轻微变形、螺栓松动等问题，部分构件承载力、稳定性下降，存在结构安全隐患；原有钢结构防腐涂层老化、粉化、脱落，防腐防护功能失效。烟囱内胆原有保温层存在空鼓、开裂、脱落、受潮失效、接缝漏风漏热等缺陷，导致烟囱外壁温差超标、热量损耗大、局部结露腐蚀内胆结构，影响烟囱整体运行寿命。本次外委目的是对上述所有钢结构、外露管道进行全方位除锈翻新、防腐涂装作业，恢复设备防腐防护性能。彻底解决设备钢结构锈蚀、涂层脱落、外观破损等问题，提升设备结构耐久性、抗腐蚀能力，保障烟囱内部、输灰系统、海水喷淋系统长期安全稳定运行。

The six major fan steel beams, ash conveying system pipelines, and steel frames extending from Boiler #3 to the ash storage area have been exposed for an extended period to boiler dust and high-temperature environments; consequently, the surfaces of these pipelines and steel structures exhibit oxidation corrosion, peeling or detachment of existing coatings, and re-corrosion. The steel frames of the seawater spray pump room and the outlet pipeline steel frames are located in a coastal environment characterized by high humidity and severe salt spray corrosion; as a result, the steel structures experience rapid corrosion rates, and their original anti-corrosion coatings have aged and failed. This not only compromises the aesthetic cleanliness of the equipment but also leads to reduced wall thickness of the steel structures and diminished load-bearing capacity, posing potential safety hazards. The chimney has been in operation for many years and has endured prolonged exposure to high temperatures, flue gas corrosion, outdoor sun exposure, and cyclic wind loads; as a result, the auxiliary support steel beams, platform steel beams, and tie-down steel structures commonly exhibit issues such as corrosion-induced peeling, localized section thinning, aging of welds, slight deformation, and loose bolts. Furthermore, the load-bearing capacity and stability of certain components have declined, creating structural safety risks. The original anti-corrosion coatings on the steel structures have aged, become powdery, or peeled off, rendering their protective function ineffective. Additionally, the original insulation layer within the chimney liner suffers from defects such as hollowing, cracking, peeling, moisture-induced failure, and air/heat leakage at joints, which results in excessive temperature differences across the outer wall of the chimney, significant heat loss, and localized condensation corrosion of the liner structure, thereby adversely affecting the overall operational lifespan of the chimney. The objective of this outsourced project is to perform comprehensive rust removal, renovation, and anti-corrosion coating work on all aforementioned steel structures and exposed pipelines to restore the equipment's anti-corrosion protection performance. This initiative aims to thoroughly resolve issues such as steel structure corrosion, coating detachment, and surface damage, thereby enhancing the structural durability and corrosion resistance of the equipment and ensuring the long-term safe

and stable operation of the chimney interior, the ash conveying system, and the seawater spray system.

2.1.4 工程范围

Project scope

2.1.4.1 烟囱钢梁加固防腐：

2.1.4.1 Chimney steel beams – reinforcement and corrosion protection

2.1.4.1.1 标高 22.3 米，钢梁防腐刷漆，平台防滑波纹板腐蚀透光的减薄 1/3 的更换，0 米--22.3 米爬梯打磨防腐刷漆，（18m*2.4 ㎡=43.2 ㎡肋板约 1 ㎡，14.2m*2.4 ㎡=68.16 ㎡，4.8m*1.2 ㎡*5=28.8 ㎡，9.6m*1.2 ㎡*4=46.08 ㎡，总计 187.24 ㎡）

2.1.4.1.1 The structure has a height of 22.3 meters; steel beams are coated with anti-corrosion paint, corrugated anti-slip platform plates with corrosion thinning exceeding 1/3 are replaced, and ladders from 0m to 22.3m are polished and coated. (18m×2.4m=43.2 ㎡, rib plate ~1 ㎡, 14.2m×2.4m=68.16 ㎡, 4.8m×1.2m×5=28.8 ㎡, 9.6m×1.2m×4=46.08 ㎡, total 187.24 ㎡)

2.1.4.1.2 标高 0 米至 160 米爬梯生根焊接处，防腐刷漆（300*300*122 块=10.98 ㎡）

2.1.4.1.2 At the root welding points of ladders ranging from 0 m to 160 m in height, apply anti-corrosion coating (300×300×122 pieces = 10.98 m² )

2.1.4.1.3 标高 80 米向下 2 个爬梯打磨防腐刷漆（3.6m*0.42 ㎡*18=27.22 ㎡）

2.1.4.1.3 Apply anti-corrosion coating to two ladders extending downward from a height of 80 meters （总面积： 3.6 m × 0.42 m² × 18 = 27.22 m²).

2.1.4.1.4 航标灯基座打磨防腐刷漆（4*0.9 ㎡*3=10.8 ㎡）

2.1.4.1.4 Polishing and anti-corrosion painting of navigation light bases (4 × 0.9 m² × 3 = 10.8 m²)

2.1.4.1.5 标高 120 米不锈钢窗户破损一个更换，向下 2 个爬梯打磨防腐刷漆，（3.6m*0.42 ㎡*18=27.22 ㎡）。烟囱内胆局部保温修复约 18 ㎡：采用玻璃纤维保温棉，厚度 80mm，密度 80kg/m³，外覆铝箔包裹，不锈钢丝固定。锚固牢固，无空鼓、开裂，接缝密封严密。

2.1.4.1.5 One stainless steel window at 120 meters elevation is damaged and requires replacement; apply anti-corrosion coating to two ladders extending downward (3.6m×0.42m×18=27.22 ㎡). Chimney inner liner local insulation repair ~18 ㎡: glass fiber insulation cotton, thickness 80mm, density 80kg/m³, wrapped with aluminum foil, fixed with stainless steel wire.

2.1.4.1.6 标高 160 米人孔门框架锈蚀比较严重，焊接加固，打磨刷漆，钢梁锈蚀打磨刷漆，人孔门及盖板重新制作，刷漆防腐。航标灯基座锈蚀，打磨刷漆（已计算）。（18m*2.4 ㎡=43.2 ㎡肋板约 1 ㎡，14.2m*2.4 ㎡=68.16 ㎡，4.8m*1.2 ㎡*5=28.8 ㎡，9.6m*1.2 ㎡*4=46.08 ㎡总计 186.24 ㎡焊接另算。

2.1.4.1.6 The frame of the manhole door at 160 meters elevation exhibits severe corrosion; it has been welded for reinforcement, ground and painted. The steel beams have also been ground and painted due to corrosion. The manhole door and cover plate have been remade and coated with anti-corrosion paint. The buoy base shows corrosion and has been ground and painted (cost included). Total area: 18 m × 2.4 m = 43.2 m² (rib plates approximately 1 m² each), 14.2 m × 2.4 m = 68.16 m², 4.8 m × 1.2

m × 5 = 28.8 m², and 9.6 m × 1.2 m × 4 = 46.08 m², totaling 186.24 m²; weldng costs are calculated separately.

2.1.4.1.7 清理施工遗留废料及杂物，清理排雨槽。（预估 2 吨）

2.1.4.1.7 Clear construction waste and debris, and clean the rainwater drainage channels (estimated 2 tons).

2.1.4.2 输灰管道支撑综合钢架、输灰管道本体、灰库综合钢架。海水喷淋泵房区域：泵房整体钢架结构、喷淋出口管道支撑钢架防腐刷漆：

2.1.4.2.1 输灰系统（3 台炉电除尘、省煤器）管道从#3 炉至灰库顶部区域（包含所有输灰管道）的防腐刷漆：3 台炉电除尘输灰管道、3 台炉省煤器输灰管道型号：Φ168×8 共计 464 米、面积 244.89 ㎡，Φ140×8 共计 900 米、面积 395.84 ㎡，Φ114×8 共计 470 米、面积 168.33 ㎡。

2.1.4.2.1 Anti-corrosion painting of ash conveying pipelines (including those for the electrostatic precipitators and economizers of all three furnaces) extending from Furnace #3 to the top area of the ash storage bin: -Electrostatic precipitator ash pipelines: Φ168×8, total length 464 m, total area 244.89 m²; -Economizer ash pipelines: Φ140×8, total length 900 m, total area 395.84 m²; - Φ114×8 pipelines: total length 470 m, total area 168.33 m².

2.1.4.2.2 综合钢架总面积：（立柱面积：5000*2*3.14*0.109*77=263.54 ㎡、连接梁面积：9000*250*6*76=1026 ㎡、5000*250*6*2=15 ㎡、横梁面积：3000*250*6*38=171、启动锅炉蒸汽母管短梁面积：1500*250*6*72=162 ㎡、锅炉至电除尘通道钢架面积：7000*250*6*57=598.5 ㎡）

总计：2236.04 ㎡

2.1.4.2.2 Total steel frame area: (Column area: 5000 × 2 × 3.14 × 0.109 × 77 = 263.54 m²; Connection beam area: 9000 × 250 × 6 × 76 = 1,026 m²; 5000 × 250 × 6 × 2 = 15 m²; Crossbeam area: 3000 × 250 × 6 × 38 = 171 m²; Short beam area for the boiler steam header: 1500 × 250 × 6 × 72 = 1,620 m²; Steel frame area for the pipeline from the boiler to the electrostatic precipitator: 7000 × 250 × 6 × 57 = 5,985 m²) Total: 2,236.04 m²

2.1.4.2.3 六大风机电动葫芦连接钢梁螺栓更换：（6 台引风机螺栓型号 M24×100mm、8.8 级，共计 96 条）、（6 台送风机螺栓型号 M24×100mm、8.8 级，共计 144 条）、（6 台一次风机螺栓型号 M24×100mm、8.8 级，共计 144 条）含螺母垫片。

2.1.4.2.3 Replacement of bolts connecting the six large fan electric hoists to steel beams: (for 6 induced draft fans: bolt model M24 × 100 mm, Grade 8.8; total: 96 bolts), (for 6 supply fans: bolt model M24 × 100 mm, Grade 8.8; total: 144 bolts), (for 6 primary air fans: bolt model M24 × 100 mm, Grade 8.8; total: 144 bolts); includes nuts and washers.

2.1.4.2.4 六大风机电动葫芦连接钢梁腐蚀加固、刷防腐漆（6 台引风机、6 台送风机、6 台一次风机）。加固方式：对锈蚀减薄超过原厚度 30%的钢梁采用贴板加固（钢板材质 Q235B，厚度≥6mm），焊接符合 GB 51367-2019 要求；锈蚀未超标的进行除锈防腐处理。

2.1.4.2.4 Corrosion reinforcement and anti-corrosion painting of the steel beams connecting the six large fan electric hoists (6 induced draft fans, 6 forced draft fans, 6 primary air fans). Reinforcement method: steel beams with corrosion thinning

exceeding 30% of original thickness shall be reinforced with steel plates (Q235B, thickness ≥6mm), welding complies with GB 51367-2019; beams below threshold shall be derusted and coated.

2.1.4.2.5 海水喷淋泵房钢架及出口管道钢架防腐刷漆：

2.1.4.2.5 Corrosion protection painting for the steel frame and outlet pipeline steel frame of the seawater spray pump room

2.1.4.2.5.1 喷淋泵出口管钢架面积：高 5.9m、宽 3.79m、长 175.76、横梁 489.53m、立柱 300m，防腐总面积：615.83 m²

2.1.4.2.5.1 Steel frame area of the spray pump outlet pipe: height 5.9 m, width 3.79 m, length 175.76 m; crossbeam length 489.53 m; column height 300 m; total anti-corrosion coverage area: 615.83 m²

2.1.4.2.5.2 喷淋泵房钢架面积：主梁 83m、柱子 92m、次梁 54m，防腐总面积：363.60 m²

2.1.4.2.5.2 Steel frame area of the sprinkler pump room: main beam – 83 m, columns – 92 m, secondary beams – 54 m; total anti-corrosion coverage area: 363.60 m²

备注：以上面积为参考工程量，结算以现场实际完成合格工程量为准。

Note: The above area represents a reference quantity; the final settlement shall be based on the actual qualified work volume completed at the site.

# 3. 技术要求 Technical requirements

## 3.1 主要技术指标 Main technical indicators

3.1.1 主要技术参数要求

Technical parameter requirements

3.1.1.1 钢材除锈等级：严格执行 GB/T 8923- 2011，除锈等级达到 Sa2.5 级（非常彻底的喷射或抛射除锈）；表面无氧化皮、浮锈、油污、灰尘，处理后 4 小时内开展涂装，防止二次返锈。

3.1.1.1 Steel rust removal grade: Strictly adhere to GB/T 8923-2011; rust removal grade shall reach Sa2.5 (very thorough blast cleaning); surface free of mill scale, rust, oil, and dust; coating shall be applied within 4 hours after treatment.

3.1.1.2 防腐涂层配套体系：采用环氧富锌底漆 2 道（每道干膜≥40μm）+ 环氧云铁中间漆 1 道（干膜≥60μm）+ 聚氨酯面漆 2 道（每道干膜≥40μm），总干膜厚度≥220μm。涂层附着力、厚度、耐盐雾、耐温性能满足规范及甲方要求，适应沿海盐雾、高温粉尘烟气环境。

3.1.1.2 Anti-corrosion coating system: 2 coats epoxy zinc-rich primer (≥40μm DFT each) + 1 coat epoxy micaceous iron oxide intermediate (≥60μm DFT) + 2 coats polyurethane finish (≥40μm DFT each), total DFT ≥220μm. Coating adhesion, thickness, salt spray resistance, temperature resistance meet specifications.

3.1.1.3 钢结构加固焊接工艺、焊缝质量符合 GB 51367 标准；加固后构件强度、刚度满足设备运行荷载。

3.1.1.3 The welding processes and weld quality for steel structure reinforcement shall comply with the GB 51367 standard; the strength and stiffness of the reinforced components shall satisfy the operating load requirements of the equipment.

## 3.2 质量要求 Quality requirements

3.2.1 承包方需满足的质量标准

Quality standards that contractors must meet

3.2.1.1 企业资质及人员要求：乙方应具备钢结构防腐、钢结构加固施工相应作业能力，熟悉电厂高盐雾、高温粉尘工况防腐施工；开工前提交四措两案并经甲方审核批准。

3.2.1.1 Enterprise Qualifications and Personnel Requirements: Party B shall possess the requisite operational capability for steel structure corrosion protection and steel structure reinforcement works, and shall be familiar with corrosion protection construction under high-salt-spray and high-temperature dust conditions at power plants; before commencing work, Party B shall submit the "Four Measures and Two Plans" for review and approval by Party A.

3.2.1.2 特种作业人员（焊接、高处作业等）必须持有效证件上岗。

3.2.1.2 Personnel performing special operations (e.g., welding, work at height, etc.) must hold valid certification to work on such tasks.

3.2.2 质量验收标准及方法

Quality acceptance standards and methods

3.2.2.1 文件审查：开工前提交四措两案、材料合格证、检测报告、人员资质、机具清单；隐蔽工程必须经甲方验收合格，方可进入下一道工序。

3.2.2.1 Document Review: Before commencing work, submit the "Four Measures and Two Plans," material qualification certificates, test reports, personnel qualifications, and equipment inventory; concealed works must be approved by the Client before proceeding to the next construction phase.

3.2.2.2 除锈验收：目视及对比 GB/T 8923-2011 标准照片样板检查，达到 Sa2.5 级，表面无可见油脂、污垢、氧化皮、铁锈和油漆涂层等附着物，任何残留的痕迹应仅是点状或条纹状的轻微色斑。

3.2.2.2 Rust Removal Acceptance: Visual inspection and comparison with GB/T 8923-2011 standard photo samples, reaching Sa2.5 grade; surface free of visible grease, dirt, mill scale, rust and paint coating; any residual traces shall only be slight spots or streaks.

3.2.2.3 涂层验收：涂层外观均匀，无流挂、漏涂、起皮；采用涂层测厚仪检测干膜厚度，总厚度≥220μm，每 10 ㎡检测不少于 5 点，85%以上测点达标，最低值不低于设计值的 85%；附着力按 GB/T 9286 划格法抽检，合格等级≤1 级。

3.2.2.3 Coating Acceptance: The coating shall exhibit a uniform appearance with no sagging, missed areas, or peeling; DFT measured by coating thickness gauge, total thickness ≥220μm, no less than 5 points per 10 $m^2$, over 85% of points meet the standard, minimum value not less than 85% of the design value; adhesion tested by GB/T 9286 cross-cut method, grade ≤1.

3.2.2.4 钢结构加固验收：焊缝外观检查，按规范进行无损检测抽查；螺栓紧固力矩符合标准。

3.2.2.4 Steel Structure Reinforcement Acceptance: Surface inspection of welds; non-destructive testing shall be conducted according to the relevant codes via random sampling; bolt tightening torque shall comply with the specified standards.

3.2.2.5 整体验收按照 GB50205- 2020、GB50212- 2014、GB50078 等标准执行。
3.2.2.5 The overall acceptance shall be conducted in accordance with standards such as GB50205-2020, GB50212-2014, and GB50078.
3.2.3 质量保证期：本工程防腐涂层质量保证期为竣工验收合格之日起 2 年，钢结构加固质量保证期为 5 年。质保期内出现涂层起皮、脱落、返锈等质量问题，乙方接到通知后 48 小时内到场免费返修。
3.2.3 Quality Warranty Period: Anti-corrosion coating warranty period is 2 years from final acceptance; steel structure reinforcement warranty period is 5 years. Within warranty period, Party B shall arrive within 48 hours for free repair if coating peeling, rusting, etc. occur.

## 3.3 施工及安装要求 Construction and installation requirements

3.3.1 施工工艺及技术要求
Construction technology and technical requirements
3.3.1.1 施工前做好构件表面处理，清除油污、盐分、灰尘；海边环境避开高湿度、雨天开展涂装作业。
3.3.1.1 Perform proper surface treatment of structural components prior to construction, removing oil stains, salt deposits, and dust; for coastal environments, avoid conducting coating operations during high humidity or rainy weather.
3.3.1.2 钢结构加固焊接做好构件保护，不得损伤原有设备、管道；焊接后及时清除焊渣，对焊缝打磨除锈防腐。
3.3.1.2 For steel structure reinforcement welding: ensure proper protection of structural members to avoid damaging existing equipment or pipelines; promptly remove weld slag after welding; and perform grinding on the weld seams to remove rust and apply anti-corrosion treatment.
3.3.1.3 烟囱内部保温作业做好通风、有毒有害烟气防护；保温层锚固、搭接、密封严格按工艺执行。
3.3.1.3 For internal insulation work on chimneys, ensure proper ventilation and protection against toxic and hazardous flue gases; the anchoring, overlapping, and sealing of the insulation layer shall be strictly carried out in accordance with the specified process requirements.
3.3.1.4 高空作业、动火作业严格执行电厂工作票制度；脚手架、作业平台验收合格后方可使用。
3.3.1.4 For high-altitude work and hot work, the power plant work permit system shall be strictly implemented; scaffolding and working platforms may only be used after passing the acceptance inspection.
3.3.1.5 所有旧件拆除、废料转运不得磕碰原有设备，拆除构件、旧螺栓按甲方指定位置存放。
3.3.1.5 During the removal of all old components and the transfer of waste materials, no impact shall be applied to the original equipment; removed components and old bolts shall be stored at the locations designated by Party A.
3.3.1.6 每道工序完工后承包方先行自检，自检合格报甲方验收。

3.3.1.6 Upon completion of each construction phase, the Contractor shall conduct a self-inspection; if the self-inspection is satisfactory, the Contractor shall submit the results to Party A for acceptance.
3.3.1.7 由于甲方现场工器具等所需缺乏，所以本次工作中使用的所有工器具以及消耗品等均需要乙方提供。如（口罩、磨片、切片、焊机、氧气乙炔带子、氧气乙炔表、打磨工具、刷漆工具、电动工器具、焊条、灯具、倒链、卡环、钢丝绳、吊具、安全带、卷扬机、滑轮等），甲方只提供脚手架搭设、拆除，油漆，所需槽钢、角铁、螺栓，氧气乙炔。
3.3.1.7 Due to Party A's shortage of on-site tools and equipment, all tools, consumables, and related items required for this project shall be provided by Party B. Examples include: masks, grinding discs, cutting tools, welding machines, oxygen-acetylene hoses, oxygen-acetylene meters, grinding tools, painting tools, electric tools, welding electrodes, lighting fixtures, reverse chainsaws, clamps, steel wire ropes, lifting gear, safety harnesses, winches, pulleys, etc. Party A shall only provide the erection and dismantling of scaffolding, painting services, the required channel steel, angle iron, bolts, and oxygen-acetylene equipment.

# 4. 进度要求 Progress requirements

4.1 总工期要求
Total construction period requirements
4.1.1 本次施工工期：3 个月（90 日历天），具体开工日期以甲方通知为准。关键节点：开工后 15 天内完成输灰系统防腐，30 天内完成海水喷淋泵房防腐，60 天内完成六大风机加固防腐，90 天内完成烟囱全部工作并竣工验收。乙方每周五提交施工周报。
4.1.1 Construction duration: 3 months (90 calendar days), actual start date per Party A's notice. Key milestones: ash conveying system within 15 days, seawater spray pump room within 30 days, six fans reinforcement within 60 days, chimney all work within 90 dayss. Weekly report every Friday.
4.2 工期延误罚则：因乙方原因造成工期延误，每延误 1 天罚款合同总价的 0.5%，累计罚款上限为合同总价的 10%。延误超过 15 天，甲方有权解除合同并追究乙方违约责任。
4.2 Penalty for Schedule Delay: For delays caused by Party B, a penalty of 0.5% of total contract price per day, cumulative cap 10%. If delay exceeds 15 days, Party A has the right to terminate the contract.

# 5. 安全及环保要求 HSE requirements

## 5.1 安全管理 Safety Management

5.1.1 施工安全管理要求
Construction safety management requirements
5.1.1.1 遵守法律法规：严格遵守国家有关安全生产的法律法规，如《中华人民共和国安全生产法》《建设工程安全生产管理条例》等。
5.1.1.1 Compliance with laws and regulations: strictly abide by the national laws and regulations on production safety, such as Safety Law of the People's Republic of

China, Regulations on the Administration of Safe Production Safety in Construction Projects, etc.

5.1.1.2 安全管理制度：严格遵守巴厘通用能源公司安全管理制度。

5.1.1.2 Safety management system: Strictly abide by the safety management system of Bali General Energy Company.

5.1.1.3 安全培训：三级安全教育：公司级、车间级、班组级。

5.1.1.3 Safety Training: Three-tier safety education system: company-wide, workshop-level, and team-level.

5.1.1.4 安全管理机构：承包方需设立专职安全人员，必须持证上岗，明确项目经理为安全生产第一责任人。

5.1.1.4 Safety management organization: The contractor shall set up full-time safety personnel, who must hold the certificate, and make it clear that the project manager shall be the first responsible person for production safety.

5.1.1.5 现场安全管理：开工前需安全评估，危险源辨识，临时用电需符合“三级配电、五芯电缆、漏电保护”等要求，严禁私拉乱接，严禁违章作业，合理规划施工现场，确保施工区域安全、整洁、有序，设置安全警示标志，提醒施工人员注意安全。

5.1.1.5 Site safety management: safety before start assessment, hazard identification, temporary electricity needs to conform to the "tertiary distribution, five core cable, leakage protection" requirements, it is forbidden to private pull disorderly, and illegal operation is strictly prohibited. Reasonable planning and construction site, ensure the construction area is safe, neat, and orderly, set the safety warning signs to remind construction personnel to pay attention to safety.

5.1.1.6 文明施工与环保：合理规划场地布局，保障施工人员休息与饮食安全。

5.1.1.6 Civilized construction and environmental protection: reasonably planning the site layout to ensure the rest and food safety of the construction personnel.

5.1.1.7 责任追究：对违反安全规定的行为，依法依规追责，发生事故严肃调查处理。

5.1.1.7 Accountability investigation: Those who violate safety regulations shall be held accountable according to laws and regulations, and accidents shall be seriously investigated and dealt with.

5.1.1.8 高空作业人员系好安全带，搭设稳固的作业平台，严禁高空抛物。动火作业配备防火器材，清理周边易燃物，防止火灾事故。

5.1.1.8 High-altitude workers must fasten their safety belts and establish stable work platforms. It is strictly prohibited to throw objects from heights. Fire prevention equipment must be provided for hot work operations, and flammable materials in the vicinity must be cleared to prevent fire accidents.

5.1.2 施工人员资质及培训要求

Construction personnel qualifications and training requirements

5.1.2.1 施工人员资质要求：年龄在 18-60 周岁之间，身体健康，无妨碍从事本工种的疾病（如高血压、心脏病等），需提供有效证件及体检报告，特殊工种需持证上岗（如焊接与热切割作业操作证）。

5.1.2.1 Qualification requirements for construction personnel: between 18 and 60 years old, healthy, with no diseases (such as hypertension, heart disease, etc.) of the

work, valid certificates and physical examination reports, and special work with certificates (such as welding and hot cutting operation certificates).

5.1.2.2 安全教育培训要求：三级教育：公司级、车间级、班组级，考试合格方可上岗。

5.1.2.2 Safety training system: Three-tier education (company, workshop, and team level), with only those who pass the exam authorized to work.

5.1.3 防范措施及应急预案

Preventive measures and emergency plans

5.1.3.1 风险预防措施：风险辨识与管控、技术措施、管理措施。

5.1.3.1 Risk prevention measures: risk identification and control, technical measures and management measures.

5.1.3.2 安全防护标准化：个人防护用品、现场防护措施。

5.1.3.2 Safety protection standardization: personal protective equipment and on-site protection measures.

5.1.3.3 设备与机械安全管理、文明施工与环保措施。

5.1.3.3 Equipment and machinery safety management, civilized construction and environmental protectionotection measures.

5.1.3.4 应急组织机构与职责：应急指挥部以项目经理为总指挥，安全员、技术负责人等为成员。

5.1.3.4 Emergency organization and responsibilities: The emergency headquarters shall take the project manager as the chief commander, and the safety officer and the technical leader as the members.

5.1.3.5 职责分工：救援组、疏散组、通讯组、后勤组。

5.1.3.5 Division of responsibilities: rescue group, evacuation group, communication group and logistics group.

5.1.3.6 应急物资储备：救援箱（含止血带、纱布、药品等）、灭火器、应急照明、对讲机、AED 等。

5.1.3.6 Emergency supplies reserve: rescue box (including tourniquet, gauze, medicine, etc.), fire extinguishers, emergency lighting, walkie-talkie, AED, etc.

5.1.3.7 应急响应流程：报警与报告、紧急处置、保护现场、善后处理。

5.1.3.7 Emergency response process: alarm and report, emergency disposal, site protection and after-treatment.

## 5.2 环保要求 Environmental requirements

5.2.1 施工现场环保管理措施

Environmental protection management measures at construction sites

5.2.1.1 施工过程中采取降尘、降噪措施，减少粉尘、噪音污染。

5.2.1.1 During the construction, dust and noise reduction measures are taken to reduce dust and noise pollution.

5.2.1.2 废弃保温材料、废旧构件、施工垃圾分类收集，按环保要求清运处理，不得污染土壤、水体。

5.2.1.2 Waste insulation materials, construction waste components, and construction waste shall be collected separately and transported and disposed of in accordance with environmental protection requirements, ensuring no soil or water pollution.

5.2.1.3 施工废水、油污集中处理，达标排放，严禁随意倾倒。
5.2.1.3 Centralized treatment of construction wastewater and oil pollution, with discharge strictly compliant with standards, and random dumping is strictly prohibited.
5.2.2 废弃物处理规定
Waste disposal requirements
5.2.2.1 拆除的旧废料按照甲方人员要求放在指定的位置。
5.2.2.1 The dismantled old materials shall be placed at the designated location as required by Party A.

## 6 管理及罚则 management and penalty

6.1 乙方应服从甲方现场（安全文明施工、施工工艺质量、工期控制、人员供应）管理，因乙方管理不善或因乙方员工违章操作造成的人身伤害，由乙方自行处理并承担全部责任；因乙方员工人为原因造成的设备损坏由乙方承担由此引发的一切赔偿责任。
6.1 Party B shall comply with Party A's on-site management (including safety and civilized construction, construction quality, schedule control, and personnel supply). Any personal injuries caused by Party B's poor management or employees 'violation of operating procedures shall be handled by Party B, which shall bear full liability. Party B shall also assume all compensation liabilities for equipment damage caused by its employees' intentional acts.
6.2 乙方在工作中不服从甲方的管理和工作安排，视情节轻重每次考核 20 万—200 万印尼盾。
6.2 If Party B fails to comply with Party A's management and work arrangements during employment, a fine of 200,000 to 2,000,000 Indonesian Rupiah (IDR) will be imposed per assessment, depending on the severity of the violation.
6.3 施工中发生质量问题，不及时报告，自行处理并掩盖的，考核 40 万—100 万印尼盾/每次，导致事故按程度另计，最高按非停考核。
6.3 Failure to report quality issues during construction, self-resolution, or concealment will incur a penalty of 400,000 to 1,000,000 Indonesian rupiah per incident. The severity of the incident will determine additional penalties, with the maximum penalty being a non-stop assessment.
6.4 现场施工因措施不当、发生火灾、跑水、跑气、跑油现象，考核 40 万印尼盾/每次。
6.4 On-site construction will incur a penalty of 400,000 Indonesian rupiah (IDR) per incident due to improper measures, including fire, water leakage, gas leakage, or oil spillage.
6.5 乙方在施工中如损坏设备、元件、仪表、仪器、电缆、电线等，考核 40 万印尼盾/每次，并且甲方有权要求 100%按采购价索赔。
6.5 If Party B damages equipment, components, instruments, cables, or wires during construction, a penalty of 400,000 Indonesian rupiah (IDR) will be imposed per incident, and Party A reserves the right to claim full compensation at the original purchase price.
6.6 发生管理性、指挥性、作业性违章，考核 40 万印尼盾每人次。

6.6 A penalty of 400,000 Indonesian rupiah (IDR) per violation will be imposed for managerial, command, or operational violations.
6.7 违反工作票管理制度，考核 20 万～200 万印尼盾/次。
6.7 Violation of work permit regulations will result in a penalty of 200,000 to 2,000,000 Indonesian rupiah per offense.
6.8 修后达不到甲方确定的验收标准，考核 20 万～200 万印尼盾/次。
6.8 If the post-repair quality fails to meet the acceptance criteria set by Party A, a penalty of IDR 200,000 to 2,000,000 will be imposed per instance.
6.9 本规范书罚款金额以印尼盾（IDR）为单位，结算时按付款当日汇率折算为人民币。
6.9 Penalty amounts in this specification are in Indonesian Rupiah (IDR), converted to RMB at the exchange rate on payment date.

**附件一：工作量统计**

# 工作量统计

| 序号 | 名称 | 项目 | 单位 | 数量 | 备注 |
|---|---|---|---|---|---|
| 1 | 防腐刷漆 Corrosion protection painting | 标高 22.3 米，钢梁防腐刷漆，0 米--22.3 米爬梯打磨防腐刷漆 Elevation: 22.3 m; steel beams – anticorrosive painting; ladder section (0 m – 22.3 m) – grinding and anticorrosive painting | ㎡ | 187.24 | |
| 2 | | 标高 0 米至 160 米爬梯生根焊接处，防腐刷漆 At the root welding point of the ladder spanning from 0 m to 160 m, apply anti-corrosion paint. | ㎡ | 10.98 | |
| 3 | | 标高 80 米向下 2 个爬梯打磨防腐刷漆 Elevation: 80 m; two downward climbing ladders; grinding, anti-corrosion treatment, and painting. | ㎡ | 27.22 | |
| 4 | | 标高 80、160 米航标灯基座打磨防腐刷漆 Grinding, anti-corrosion treatment and painting of navigation beacon base (elevation: 80 m and 160 m) | ㎡ | 10.8 | |
| 5 | | 标高 120 米向下 2 个爬梯打磨防腐刷漆 Elevation: 120 m; two downward climbing ladders; grinding, anti-corrosion treatment, and painting. | ㎡ | 27.22 | |
| 6 | | 输灰系统（3 台炉电除尘、省煤器）管道从#3 炉至灰库顶部区域（包含所有输灰管道）防腐刷漆 Corrosion protection painting for all ash conveying pipelines extending from Boiler #3 to the top section of the ash storage bin (including all ash conveying pipelines). | ㎡ | 168.33 | |

| | | | | | |
|---|---|---|---|---|---|
| 7 | | 综合管架（从#3 炉电除尘至灰库）防腐刷漆<br>Comprehensive utility rack (from the #3 boiler electrostatic precipitator to the ash storage bin) – anti-corrosion painting | ㎡ | 2236.04 | |
| 8 | | 喷淋泵房所有管架防腐刷漆<br>Apply anti-corrosion paint to all pipe supports in the spray pump room. | ㎡ | 363.60 | |
| 9 | | 喷淋泵出口管钢架防腐刷漆<br>Steel frame anti-corrosion painting for the spray pump outlet pipe | ㎡ | 615.84 | |
| 10 | 废料清理<br>Waste removal | 清理施工遗留废料及杂物，清理排雨槽<br>Clear away leftover construction waste and debris; clean the stormwater drainage channel. | T | 2 | |
| 11 | 平台加固、焊接，其它破损更换<br>Platform reinforcement and welding; replacement of other damaged components | 标高 22.3 米平台防滑波纹板腐蚀透光的减薄 1/3 的更换<br>Replacement of anti-slip corrugated sheeting on a 22.3 m high platform, which has been thinned by one-third and exhibits corrosion-induced light transmission. | | | |
| 12 | | 标高 120 米不锈钢窗户破损一个更换<br>Stainless steel window at 120 meters height – replace one damaged unit. | | | |
| 13 | | 标高 160 米人孔门框架锈蚀比较严重，焊接加固，人孔门及盖板重新制作，刷漆防腐<br>The manhole door frame, located at an elevation of 160 meters, suffers from severe rusting; it has been subjected to welding reinforcement, and the manhole door as well as its cover plate have been re fabricated and painted for corrosion protection. | | | |

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|---|---|---|---|---|---|
| 14 | | 六大风机电动葫芦连接钢梁螺栓更换：（6 台引风机螺栓型号 M24×100mm、8.8 级，共计 96 条）、（6 台送风机螺栓型号 M24×100mm、8.8 级，共计 144 条）、（6 台一次风机螺栓型号 M24×100mm、8.8 级，共计 144 条）含螺母垫片。<br>Replacement of bolts used to connect steel beams for six fan-driven electric hoists: (6 units of draft fans – bolt type M24×100 mm, Grade 8.8; total: 96 bolts), (6 units of supply fans – bolt type M24×100 mm, Grade 8.8; total: 144 bolts), (6 units of primary fans – bolt type M24×100 mm, Grade 8.8; total: 144 bolts); includes nuts and washers. | | | |
| 15 | | 六大风机电动葫芦连接钢梁腐蚀加固、刷防腐漆（6 台引风机、6 台送风机、6 台一次风机）。加固方式：对锈蚀减薄超过原厚度 30%的钢梁采用贴板加固（钢板材质 Q235B，厚度≥6mm）<br>Corrosion reinforcement and anti-corrosion painting for six fan-driven electric hoists connected to steel beams (6 exhaust fans, 6 supply fans, and 6 primary fans). Reinforcement method: For steel beams where the corrosion-induced thickness reduction exceeds 30% of the original thickness, reinforcement shall be performed by applying steel plates (material: Q235B; thickness ≥ 6 mm). | | | |