

Technical Specification

for

**the Partitioning works for the WERP Project
Office inside K-Span.**

Contents

1. PRE-CONSTRUCTION WORK	4
1.1. Notice to Proceed	4
1.2. Site restrictions	4
1.3. MINIMUM SAFETY REQUIREMENTS DURING CONSTRUCTION	5
1.4. Existing services	6
1.5. Adjoining Property Records:	6
1.6. Project Signboards	6
1.7. Contractor's Representative	6
1.8. Program of Work.....	7
1.9. Completion of the Works.....	7
1.10. Reinstatement	7
1.11. Adjoining Property	8
1.12. Post Construction Works.....	8
1.13. Submittals Schedule.....	8
1.14. Health Measures.....	8
2. CONCRETE WORK.....	10
2.1. General	10
2.2. Materials.....	10
2.3. Concrete Mixing and Placing.....	11
2.4. Curing	11
2.5. Finishing.....	12
2.6. Inspection and Testing	12
2.7. Quality Control.....	12
3. STEEL WORK.....	13
3.1. General	13
3.2. Material	14
3.3. Fabrication	14
3.4. Erection.....	15
3.5. Painting.....	16
3.6. Quality Control.....	16
3.7. Safety	17
4. SANDWICH PANEL	17
4.1. General	17
4.2. Material Requirements	17

4.3.	Installation	17
4.4.	Quality Control.....	18
5.	ELECTRICAL WORK	18
5.1.	General	18
5.2.	Materials.....	18
5.3.	Power Distribution	19
5.4.	Lighting	19
5.5.	Fire Alarm System	20
5.6.	Security System.....	20
5.7.	Communication Systems.....	21
5.8.	Testing and Commissioning.....	21
5.9.	Quality Control.....	21
6.	MECHANICAL WORK	21
6.1.	General	21
6.2.	Heating, Ventilation, and Air Conditioning (HVAC).....	22
6.3.	Plumbing.....	23
6.4.	Fire Protection	24
6.5.	Quality Control.....	24
7.	PVC DOORS AND WINDOWS	24
7.1.	General	24
7.2.	Materials.....	25
7.3.	Performance Requirements	25
7.4.	Fabrication and Installation.....	25
7.5.	Quality Control.....	25
8.	TILING WORK	26
8.1.	General	26
8.2.	Materials.....	26
8.3.	Surface Preparation	26
8.4.	Wall Surfaces	26
8.5.	Floor Surfaces	27
8.6.	Tile Installation	27
8.7.	Finishing.....	27
8.8.	Quality Control.....	27

1. PRE-CONSTRUCTION WORK

1.1. Notice to Proceed

Notice to Proceed will be issued within 3 days after signing the contract. The contract period begins on the day the Notice to Proceed is issued. The Engineer and Contractor will carry out a joint condition-in survey using video or digital photographs to record the condition of the site upon handover to the Contractor. This will determine the state of the site that the Contractor must hand back upon completion of the works. The Contractor will carry out a detailed site set out survey for the works. The contractor may not proceed with on-site mobilization or construction works before the Engineer approves the following documentation that shall be covered in Program:

- Condition-in Survey
- Site Survey
- Work Method Statement
- Program
- Quality Assurance / Quality Control Plan (QA/QC) as per minimum requirement 1.3
- Contractor's Quality Control Plan specification.
- Health and Safety Plan (H&S) as per minimum requirement Health and Safety Specification.
- Environmental Protection Plan as per minimum requirement
- Dust and Noise Protection Plan
- Schedule of Materials and Installed Equipment

A Pre-Construction Meeting will be held between the Engineer and the Contractor to review the above documentation. If the documentation is incomplete, the Contractor will have 3 calendar days to revise and resubmit the documentation for approval.

1.2. Site restrictions

- **Site security limitations:** Comply with any restrictions on site area, access or working times advised by the Engineer.
- **Access:** Access on to and within the site, use of the site for temporary works and
- constructional plant, including working and storage areas, location of offices, workshops, sheds, roads and parking, is restricted to the areas shown on the drawings or as agreed with the Engineer.

1.2.1. Occupied Areas of Site or Buildings

For the parts of the site designated as occupied areas in the Occupied Areas schedule:

- Allow occupants to continue using the area for the required period.
- Make available safe access for occupants.

- Arrange work to minimize nuisance to occupants and ensure their safety.
- Protect occupants against weather, dust, dirt, water or other nuisance, by such means as temporary screens.

1.3. MINIMUM SAFETY REQUIREMENTS DURING CONSTRUCTION

At a minimum, the Contractor must provide at his own cost safety equipment for his employees and ensure that the equipment is used appropriately. He shall require and ensure that his subcontractors also comply with the requirements of this section. Minimum safety equipment includes the following:

- Hard hats must be provided for and worn by all employees and site visitors when in the vicinity of overhead, falling or other related hazards.
- Close-toed shoes must be worn by all construction workers when the potential for injury to feet or toes is present. This includes but may not be limited to workers in trenches, where tools or materials can fall from above them, workers operating any equipment, workers carrying materials or supplies at the job site.
- Eye protection must be worn during all cutting, grinding and welding processes or any construction
- process where the potential for air-borne particulates or flash from a welding operation could injure a worker's eyes.
- Hearing protection must be worn by workers engaged in very loud activities such as metal grinding or cutting, operating an electric saw, or operating loud machinery.

The Contractor shall take all necessary measures to protect the work and prevent accidents during the construction. He shall provide and maintain sufficient night-lights, barricades, guards, temporary sidewalks, temporary bridges, danger signals, watchmen and necessary alliances and safeguards to properly protect life and property. He shall also protect all excavations, equipment and materials so that the public are not be endangered.

The Supervisor or his representative, and any representative of the Contracting Authority has the right and ability to stop work at any stage and any element should that person believe that these minimum safety requirements are not being met or that the health and safety of the workers, public or other people present at the site is at risk of injury. The Contractor shall have no recourse for time extension should the work be delayed due to a safety-related stoppage. The cost for providing adequate safety equipment and supplies is included in the Contractor's cost for the project.

No separate payment shall be made to the Contractor for complying with the stipulations of this Sub-Clause.

1.3.1. Protection of persons and property

- **Temporary works:** Provide and maintain required barricades, guards, fencing, shoring, temporary roadways, footpaths, signs, lighting and traffic flagging.
- **Accessways, services:** Do not obstruct or damage roads and footpaths, drains and watercourses and other existing services in use on or adjacent to the site. Determine the location of such services. If damage occurs, immediately repair it at the Contractors cost.

- **Property:** Do not damage property which is to remain on or adjacent to the site, including adjoining property encroaching onto the site. If damage occurs, immediately repair it at the Contractors cost.

1.4. Existing services

Attend to existing services as follows:

- If the service is to be continued, repair, divert or relocate as required.
- If the service is to be abandoned, cut and seal or disconnect, and make it safe.

Submit proposals to the Engineer for action for existing services before starting this work. Minimize the number and duration of interruptions.

1.5. Adjoining Property Records:

For properties described in the Adjoining Properties to be Recorded schedule:

The Contractor is to inspect the properties with the Engineer and owners and occupants of the properties, before start of work. Make detailed records of conditions existing within the properties, especially structural defects and other damage or defacement. Arrange for at least 2 copies of each record, including drawings, written descriptions, and photographs, to be endorsed by the owners and occupants, or their representatives, as evidence of conditions existing before commencement of work. Submit one endorsed copy of each record to the Engineer. The Contractor is to keep the other endorsed copy.

The Contractor will be required to comply with the approved Health and Safety Plan.

1.6. Project Signboards

Provide project-specific signboards and the following:

- Location, size and wording as directed by the Engineer.
- Maintain in good condition for the duration of the work.
- Remove on completion.
- Obtain approval before display of advertisements or provision of other signboards.

1.7. Contractor's Representative

- The contractor must employ a suitably experienced engineer as the Site Manager.
- This person must be on site during working hours, and fluent in English and technical terminology.
- The Contractor's Site Manager will have the authority to make all decisions concerning the project on behalf of the Contractor.

1.8. Program of Work

The Contractor is to provide a construction baseline program with MS Project which has the following information:

- Sequence of Work. (Work Breakdown Structure) Activity inter-relationships. (Should be closed loop)
- Activity durations with start and finish dates Periods within which various stages or parts of the work are to be executed.
- Time scale: Calendar Days Line items in the program are to be based on the UNOPS Bill of Quantities numbering system (see index).
- Update the program weekly.
- Submit hardcopy and softcopy.
- Identify changes since the previous version, and show the actual starts and finishes, actual percentage of completion for each item of work.
- Site Meetings Hold and attend weekly site meetings throughout the contract and ensure attendance of appropriate subcontractors, the Site Manager and Engineer. The meeting schedule may be modified by the Engineer.

The meeting will consider the following items:

- Technical issues.
- Commercial issues.
- Program.
- Quality of work.

Items Supplied by Owner Materials and other items identified in the Items to be Supplied schedule will be supplied free of charge to the Contractor for installation in the execution of the works. Unload and take delivery of them, inspect them for defects and then take care of them. If defects are found, advise. Return unused items to the owner.

1.9. Completion of the Works

- Final Cleaning Before Practical Completion, clean throughout, including interior and exterior surfaces exposed to view.
- Clean carpeted and soft surfaces.
- Clean debris from the site, roofs, gutters, downpipes and drainage systems.
- Remove waste and surplus materials.

1.10. Reinstatement

- Before practical completion, clean and repair damage caused by installation or use of temporary work and restore existing facilities used during construction to original condition.

1.11. Adjoining Property

At practical completion, for properties described in the Adjoining Properties to be Recorded schedule inspect the properties with the Engineer and owners and occupants of the properties, recording any damage that has occurred since the pre-commencement inspection.

1.12. Post Construction Works

The Contractor will provide the following documentation after all site construction has been completed:

- Warranty Statement
- Material Test Certificates
- As-Built Drawings
- List of the suppliers with their contact information
- Spare materials, where applicable

A condition-out survey will be conducted with the Contractor and Engineer at which damages caused by the Contractor will be identified. The Engineer will determine if the Contractor is to make repairs or if the damage will be deducted from the Contractor's final invoice.

Removal of plant Within 10 working days after practical completion, remove temporary works and construction plants are no longer required. Remove the balance before the end of the defects liability period.

1.13. Submittals Schedule

The Contractor shall submit a detailed listing of all submittals (e.g., mix designs, material certifications) and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include:

- Specification item number;
- Item description;
- Description of submittal;
- Specification paragraph requiring submittal;
- Scheduled date of submission.

1.14. Health Measures

1.14.1. Noise Management:

The contractor shall, as far as practicable, ensure that all processes, machines and equipment used, do not cause workers to be exposed to excessive noise, i.e. above an equivalent sound level of 85 dBA for 8 hour workday. This can be done by implementing one or more of the following measures:

- Engineering noise control, e.g., modifying noisy processes, machines and equipment, relocating noisy processes or isolating them within enclosures, erecting sound barriers, reducing kinetic or potential energy and regularly maintaining machines and equipment;
- Administrative noise control, e.g., rotating noisy jobs among workers so that they are not exposed to noise above the permissible exposure limit;

- Using quiet machines and equipment when such machines and equipment are available in the market. Examples are generators, compressors and concrete breakers. The contractor shall provide hearing protectors for workers who are exposed to excessive noise and ensure that they are worn at all times. Warning signs to remind workers that hearing protectors must be worn shall be put up at areas with excessive noise.
- Contract workers should be trained and educated on the hazards of noise, noise control and prevention.

1.14.2. First-Aid

All workplaces as specified within the class or description shall establish and implement a first-aid program to provide emergency treatment to victims of accidents, chemical poisoning or excessive exposure to toxic substances. The program shall include:

- First-aid facilities;
- First-aid boxes;
- First-aid room, where there are 500 or more workers at site;
- First-aid treatment procedures;
- First aid for exposure to toxic or corrosive substances
- Standard procedures;
- Maintenance of first-aid facilities.
- All first-aid provisions shall comply with the UNOPS Health & Safety (First-Aid) Regulations.

1.14.3. Electrical Works

Where work to be carried out involves electricity/power, installing temporary wiring, usage of power tools and equipment, no worker shall connect, maintain or modify electrical tools, equipment or installation unless the worker is a qualified electrician.

- The contractor shall take every reasonable precaution to prevent hazards to workers from energized electrical equipment, installations and conductors.
- No person, other than a person authorized to do so by the contractor of the project, shall enter or be permitted to enter a room or other enclosure containing exposed energized electrical parts.
- The entrance to a room or other enclosure containing exposed energized electrical parts shall be marked by conspicuous warning signs stating that entry by unauthorized persons is prohibited.
- All electrical equipment, installations, conductors and insulating materials shall be suitable for their intended use and shall be installed, maintained, modified and operated so as not to pose a hazard to a worker.
- Contractor shall use mats, shields or other protective devices or equipment, including personal protective equipment, adequate to protect the worker from electrical shock and burns.

2. CONCRETE WORK

2.1. General

2.1.1. Scope

This specification outlines the requirements for concrete work for the project, including materials, mixing, placing, curing, and finishing.

2.1.2. Standards

All materials and workmanship shall conform to the following standards:

- ✓ ACI 318-19: Building Code Requirements for Structural Concrete
- ✓ ASTM C33: Standard Specification for Concrete Aggregates
- ✓ ASTM C39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- ✓ ASTM C94: Standard Specification for Ready-Mixed Concrete
- ✓ ASTM C150: Standard Specification for Portland Cement

2.2. Materials

2.2.1. Concrete:

Design Strength: 3000 psi (20.7 MPa)

Water-Cement Ratio: As recommended by the concrete supplier to achieve the specified strength.

Cement:

- Type I Portland cement conforming to ASTM C150.

Fine Aggregate (Sand):

- Clean, well-graded sand conforming to ASTM C33.
- Fine aggregate gradation shall be suitable for the required concrete strength and workability.

Coarse Aggregate:

- Clean, durable, well-graded coarse aggregate conforming to ASTM C33.
- Coarse aggregate gradation shall be suitable for the required concrete strength and workability.
- Well-graded crushed granite shall be used as coarse aggregate (20-25mm for reinforced concrete; 35-40mm for mass concrete)

Water:

Potable water.

Admixtures:

If required, admixtures shall be approved by the engineer and shall not adversely affect the concrete properties.

2.2.2. Reinforcement

Reinforcement shall meet the following standards:

- ✓ Steel: ASTM A615 Grade 60 (414 MPa) deformed bars.
- ✓ Bar Sizes: As specified in the structural drawings.
- ✓ Bar Placement: As shown on the structural drawings and as directed by the engineer.
- ✓ Bar Spacing: As shown on the structural drawings and as directed by the engineer.
- ✓ Bar Lap Splices: As specified in ACI 318-19.
- ✓ Reinforcement shall be kept free of oil, mud, rust prior to use.

2.3. Concrete Mixing and Placing

2.3.1. Mixing

- Concrete shall be mixed in a batch plant or truck mixer to ensure uniform consistency.
- Batching of concrete shall be by volume and Tilting Mixer shall be employed for mixing of fresh concrete
- Mixing time shall be sufficient to achieve a uniform mixture.

2.3.2. Placing:

- Concrete shall be placed in forms within a maximum of 1 hour after mixing.
- Concrete shall be consolidated using vibration methods to eliminate voids and ensure proper placement.
- Concrete shall be placed in lifts not exceeding the maximum specified in ACI 318-19.
- Concrete shall be placed gently and not tipped or dropped from a height, it shall then be thoroughly rammed into positions to fill the forms and surround the reinforcement without displacing it and without the formation of voids or cavities.
- Reinforcement shall be accurately placed and secured in its proper position before concrete placement.

2.4. Curing

2.4.1. Curing Methods

- **Water curing:** Continuous water curing for a minimum of 7 days.
- **Membrane curing:** Using a high-quality curing compound approved by engineer applied immediately after finishing.

2.4.2. Curing Temperature

- The temperature of the concrete shall be maintained above 50°F (10°C) during the curing period.

2.5. Finishing

2.5.1. Finishing Methods

- The concrete surface shall be finished to the required texture and smoothness as specified in the drawings or as directed by the engineer.
- Common finishing methods include:
 - Screeding
 - Floating
 - Troweling
 - Broom finishing

2.5.2. Protection of Fresh Concrete

- Fresh concrete shall be protected from premature drying, freezing, and other adverse conditions.

2.6. Inspection and Testing

2.6.1. Concrete Testing

- Concrete cylinders shall be cast and cured in accordance with ASTM C39 to determine compressive strength.
- The sampling and testing to be performed by an independent third-party laboratory which is approved by the employer.

2.6.2. Inspection

- The contractor shall be responsible for the inspection of all materials and workmanship to ensure compliance with this specification.
- The contractor to inform the supervision engineer at least 24 hours before activity commencement and facilitate their inspection.
- All work to be tested by the laboratory and inspected by the supervision engineer to be eligible for the payment.

2.7. Quality Control

- The contractor shall maintain a quality control program to ensure that the concrete work meets the specified requirements.

- The contractor shall submit a concrete mix design to the engineer for approval prior to the start of concrete placement.
- **Concrete Mix Design:**

A detailed concrete mix design should be prepared by a qualified engineer or concrete supplier. This design will specify the exact proportions of cement, water, fine aggregate, and coarse aggregate required to achieve the desired strength and workability.
- **Material Quality Control:**

Regular testing of materials, such as cement, sand, and aggregate, should be conducted to ensure that they meet the specified quality standards.
- **Environmental Conditions:**

The environmental conditions during concrete placement and curing can significantly impact the final concrete strength. Factors such as temperature, humidity, and wind speed should be considered when designing the concrete mix and curing plan.
- **Concrete Slump:**

The slump of the concrete mix should be monitored to ensure proper workability. A slump test measures the consistency of the concrete and its ability to flow and fill the formwork.

3. STEEL WORK

3.1. General

3.1.1. Scope

This section includes fabrication and erection of structural steel work, as shown on drawings including schedules, notes, and details showing size and location of members, typical connections, and types of steel required. This specification outlines the requirements for steel work, including material supply, fabrication, erection, welding, and painting.

3.1.2. Standards

All materials and workmanship shall conform to the following standards:

- ✓ ASTM A36: Standard Specification for Carbon Structural Steel
- ✓ ASTM A325: Standard Specification for High-Strength Bolts for Structural Steel Joints
- ✓ AWS D1.1: Structural Welding Code - Steel
- ✓ AISC 360-16: Specification for Structural Steel Buildings
- ✓ ASTM A500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing

- ✓ ASTM- A6: Specification for General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use
- ✓ ASTM- A53: Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
- ✓ ASTM- A307: Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile Strength
- ✓ ASTM- A501: Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
- ✓ ASTM- E94: Guide for Radiographic Testing
- ✓ ASTM- E142: Method for Controlling Quality of Radiographic Testing
- ✓ ASTM- F959: Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners American Welding Society (AWS)
- ✓ AWS-D1.1: Structural Welding Code- Steel

3.2. Material

3.2.1. Steel

- **Steel:** Structural steel shall conform to ASTM A36.
- **Anchor Bolts:** Anchor bolts shall be stainless steel, ASTM A325 Grade, and threaded overall length.
- **Box Section:** Box section shall be ASTM A500 or its equivalent.

3.3. Fabrication

3.3.1. Submissions Product Data

Submit product data or manufacturer's specifications and installation instructions for the following products:

- Include laboratory test reports and other data to show compliance with specifications (including specified standards).
- Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
- Anchor bolts.
- Unfinished threaded fasteners.
- High-strength bolts (each type), including nuts and washers; include direct tension indicators if used.

3.3.2. Material Safety Data Sheets (MSDS)

Submit MSDS for structural steel (each type), anchor bolts, unfinished threaded fasteners, high-strength bolts (each type) including nuts and washers, structural steel primer paint and nonmetallic shrinkage-resistant grout.

3.3.3. Shop Drawings

Submit shop drawings, including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams. Include details of cuts, connections, cambers, holes and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.

3.3.4. Fabrication Tolerances

All fabrication tolerances shall conform to AISC 360-16.

3.3.5. Welding

All welding shall be performed by certified welders in accordance with AWS D1.1.

3.3.6. Welder Certifications:

Provide certification that welders to be employed in work have satisfactorily passed qualification tests in accordance with AWS D1.1. If recertification of welders is required, retesting will be the Contractor's responsibility.

3.3.7. Welding Procedures

Welding procedures shall be qualified in accordance with AWS D1.1.

3.3.8. Welding Inspection

- Welding inspections shall be performed by a qualified welding inspector.
- **Test reports:** Submit test reports conducted on shop- and field-bolted and welded connections. Include data on type(s) of tests conducted and test results

3.3.9. Bolt Connections

Bolt connections shall be made using high-strength bolts in accordance with AISC 360-16.

3.4. Erection

3.4.1. Erection Plan

A detailed erection plan shall be submitted to the Engineer for review and approval prior to erection.

3.4.2. Erection Equipment

Adequate erection equipment shall be provided to ensure safe and efficient erection.

3.4.3. Field Welding

Field welding shall be minimized and shall be performed in accordance with AWS D1.1.

3.4.4. Field Bolt Tightening

Field bolts shall be tightened to the specified torque in accordance with AISC 360-16.

3.5. Painting

3.5.1. Surface Preparation

Steel surfaces shall be prepared in accordance with SSPC-SP 10, "Near-White Metal Blast Cleaning."

3.5.2. Paint System

A suitable paint system shall be applied to provide adequate corrosion protection. The paint system shall be selected based on the specific environmental conditions and service requirements.

3.5.3. Paint Application

Paint shall be applied in accordance with the manufacturer's recommendations and industry standards.

3.6. Quality Control

3.6.1. Material Certification

Material certification shall be provided for all steel materials.

3.6.2. Welding Inspection

Welding inspections shall be performed to verify compliance with welding procedures and code requirements.

3.6.3. Dimensional Checks

Dimensional checks shall be performed to ensure that the fabricated components meet the specified tolerances.

3.6.4. Field Inspection

Field inspections shall be performed to verify that the steel work is being erected and installed in accordance with the drawings and specifications.

3.7. Safety

3.7.1. Safety Plan

A comprehensive safety plan shall be developed and implemented to ensure the safety of all personnel involved in the steel work.

3.7.2. OSHA Compliance

All work shall be performed in compliance with OSHA regulations.

4. SANDWICH PANEL

4.1. General

4.1.1. Scope

This specification outlines the requirements for sandwich panels to be used for partitioning work.

4.1.2. Standards

All materials and workmanship shall conform to the following standards:

- ✓ EN 1602:
- ✓ EN 13165:
- ✓ ISO2896
- ✓ EN 12086

4.2. Material Requirements

4.2.1. Core Material:

- **Density:** $40 \pm 2 \text{ kg/m}^3$
- **Thermal Conductivity Coefficient:** $\leq 0.015 \text{ W/mK}$
- **Water Absorption by Volume:** $\leq 2\%$
- **Temperature Resistance:** -180°C to $+140^\circ\text{C}$

4.3. Installation

- **Surface Preparation:** The surfaces to which the panels are to be fixed shall be clean, dry, and structurally sound.
- **Panel Installation:** The panels shall be installed using appropriate fixings and sealants to ensure a tight and weatherproof installation.
- **Joint Sealing:** The joints between the panels shall be sealed with a suitable sealant to prevent air leakage and moisture ingress.

- **Finishing:** The edges of the panels shall be finished with appropriate trims or profiles.

4.4. Quality Control

- **Quality Assurance:** A quality assurance program shall be implemented to ensure that all materials and workmanship meet the specified requirements.
- **Inspection:** Regular inspections shall be conducted to verify compliance with the specifications.
- **Additional Considerations:**
 - **Acoustic Performance:** Consider the acoustic performance requirements of the project and select panels with appropriate sound insulation properties.
 - **Durability:** Ensure that the panels are durable and resistant to damage from impact, moisture, and UV radiation.
 - **Sustainability:** Consider the environmental impact of the panels and select products with recycled content or low VOC emissions.

5. ELECTRICAL WORK

5.1. General

5.1.1. Scope

This specification outlines the requirements for electrical work within the project, encompassing power distribution, lighting, fire alarm, security, and communication systems.

5.1.2. Standards

All materials and workmanship shall conform to the following standards:

- ✓ **NEC:** National Electrical Code
- ✓ **NFPA 70:** National Electrical Code
- ✓ **IEEE:** Institute of Electrical and Electronics Engineers Standards
- ✓ **UL:** Underwriters Laboratories Standards

5.2. Materials

5.2.1. Conduits

Rigid metal conduit (RMC) or electrical metallic tubing (EMT) shall be used for all electrical installations.

5.2.2. Wiring

Copper conductors shall be used for all wiring.

5.2.3. Outlets and Switches

Commercial-grade devices shall be employed.

5.2.4. Lighting Fixtures

Energy-efficient LED fixtures shall be utilized.

5.2.5. Panels and Circuit Breakers

UL-listed and NEC-compliant panels and circuit breakers shall be installed.

5.2.6. Transformers

UL-listed and NEC-compliant transformers shall be used.

5.2.7. Cable Trays

Cable trays shall be utilized to organize and route cables.

5.3. Power Distribution

5.3.1. Service Entrance

A service entrance, sized to meet the project's electrical load requirements, shall be installed.

5.3.2. Main Distribution Panel

A main distribution panel shall be installed to distribute power to branch circuit panels.

5.3.3. Branch Circuit Panels

Branch circuit panels shall be installed to distribute power to individual circuits.

5.3.4. Circuit Breakers

Circuit breakers shall be installed to protect circuits from overcurrent.

5.3.5. Grounding

A grounding system shall be installed in accordance with NEC requirements.

5.4. Lighting

5.4.1. Lighting Design

Lighting design shall be tailored to the specific needs of each area, considering factors such as illuminance levels, uniformity, and color rendering index.

5.4.2. Lighting Fixtures

Energy-efficient LED lighting fixtures shall be used to reduce energy consumption.

5.4.3. Emergency Lighting

Emergency lighting shall be installed in accordance with NEC requirements.

5.4.4. Exit Signs

Exit signs shall be installed in accordance with NEC requirements.

5.5. Fire Alarm System

5.5.1. Fire Alarm Control Panel

A fire alarm control panel shall be installed to monitor fire alarm devices.

5.5.2. Smoke Detectors

Smoke detectors shall be installed in accordance with NEC requirements.

5.5.3. Heat Detectors

Heat detectors shall be installed in accordance with NEC requirements.

5.5.4. Manual Pull Stations

Manual pull stations shall be installed in accordance with NEC requirements.

5.5.5. Notification Appliances

Notification appliances shall be installed to alert occupants of a fire emergency.

5.6. Security System

5.6.1. Security Control Panel

A security control panel shall be installed to monitor security devices.

5.6.2. Intrusion Detectors

Intrusion detectors shall be installed to detect unauthorized entry.

5.6.3. CCTV Cameras

CCTV cameras shall be installed to monitor specific areas.

5.6.4. Access Control System

An access control system shall be installed to control access to secure areas.

5.7. Communication Systems

5.7.1. Data Cabling

Data cabling shall be installed to support network connectivity.

5.7.2. Telephone Systems

Telephone systems shall be installed to support voice communication.

5.7.3. Voice/Data Cabling

Voice/data cabling shall be installed to support both voice and data communication.

5.8. Testing and Commissioning

5.8.1. Testing

All electrical systems shall be rigorously tested to ensure compliance with NEC and other applicable standards.

5.8.2. Commissioning

All electrical systems shall be comprehensively commissioned to ensure proper operation.

5.9. Quality Control

5.9.1. Quality Assurance

A robust quality assurance program shall be implemented to guarantee that all electrical work is executed to the highest standards.

5.9.2. Inspection

Regular inspections shall be conducted to verify compliance with the specifications.

6. MECHANICAL WORK

6.1. General

6.1.1. Scope

This specification outlines the requirements for mechanical work for an office project, encompassing Heating, Ventilation, and Air Conditioning (HVAC), plumbing, and fire protection systems.

6.1.2. Standards

All materials and workmanship shall conform to the following standards:

- ✓ ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers
- ✓ NFPA: National Fire Protection Association

- ✓ UPC: Uniform Plumbing Code
- ✓ IPC: International Plumbing Code

6.2. Heating, Ventilation, and Air Conditioning (HVAC)

6.2.1. System Design

The HVAC system shall be designed to provide optimal comfort, energy efficiency, and indoor air quality. Considerations include:

- **Load Calculations:** Accurate load calculations to determine heating and cooling requirements.
- **System Selection:** Selection of appropriate HVAC systems, such as VRF systems, chillers, or air-cooled units, based on project-specific needs.
- **Ductwork Design:** Proper design, sizing, and insulation of ductwork to minimize energy loss and noise transmission.
- **Air Distribution:** Effective air distribution to ensure uniform temperature and humidity throughout the building.
- **Controls:** Advanced control systems to optimize system performance and energy efficiency.

6.2.2. Equipment

- **HVAC Units:** High-efficiency, energy-star rated HVAC units, including chillers, boilers, air handling units, and fan coil units.
- **Piping:** Properly sized and insulated piping systems for refrigerant, water, and steam.
- **Ductwork:** Properly sized, insulated, and sealed ductwork to minimize energy loss and noise transmission.
- **Fans:** High-efficiency fans to reduce energy consumption.
- **Coils:** Efficient heat transfer coils for heating and cooling.
- **Filters:** High-efficiency filters to improve indoor air quality.

Item	Specifications	Standards/Notes
Inline Exhaust Fans	Airflow $\geq 420 \text{ m}^3/\text{hr}$, noise $\leq 40 \text{ dB}$, backdraft damper, vibration isolator.	ASHRAE Standards
Stainless Steel Exhaust Vent	200mm round, corrosion-resistant premium quality.	
Aluminum Adjustable Grille	100mm round, durable, adjustable, lightweight.	
Light Clamp Ceiling Hanging	100mm, with PVC rubber gasket.	
Flexible Duct	100mm diameter, made of aluminum, fire-resistant material.	

Galvanized Steel Ductwork	24-gauge, insulated with non-combustible material.	Comply with ASHRAE and fire safety standards.
Threaded Rod and Accessories	10mm, galvanized for corrosion resistance.	
Backdraft Damper	200x150mm, shutter lock type.	
Split AC Units	Wall-mounted, variable speed compressor, 9,000 Btu/hr and 18,000 Btu/hr capacity. Min Ambient Temperature in winter season: -15 C Max Ambient Temperature in summer season: 50 C	SEER ≥ 16, sourced from SAMSUNG or equivalent.
Control Systems	Programmable thermostats and BAS integration.	Energy-efficient operations

6.2.3. Controls:

Thermostats: Programmable thermostats to optimize energy efficiency.

Building Automation Systems (BAS): Advanced BAS to monitor and control HVAC systems, optimizing energy usage and occupant comfort.

6.3. Plumbing

6.3.1. Plumbing Fixtures

Item	Specifications	Standards/Notes
Pipes (PPR PN20)	Diameters: 20mm, 25mm, 32mm, 40mm; thermal conductivity ≤ 0.24 W/mK.	Comply with IPC and UPC standards.
Socket Fittings	PPR PN20 socket fittings for all pipe diameters.	
Gate Valves	Rated PN20, available in diameters: 20mm, 25mm, 32mm, 40mm.	Tested at 2x maximum operating pressure.
Reducer Tees	PN20, dimensions: 40x32mm, 32x25mm, 25x20mm.	
Water Heaters	Energy-efficient, tankless, 50-liter capacity.	
Floor Drains	Stainless steel, 150x150mm, with 3-inch diameter.	
Muslim Shower	Double faucet, high-quality brand.	
Coats and Hooks	Wall-mounted, corrosion-resistant.	

6.3.2. Piping

- **Water Supply Piping:** Properly sized and installed water supply piping to ensure adequate water pressure and flow.
- **Drainage Piping:** Properly sized and installed drainage piping to prevent clogs and backups.

- **Vent Piping:** Properly sized and installed vent piping to prevent sewer gas from entering the building.

6.3.3. Water Heating:

- **Water Heaters:** Energy-efficient water heaters, such as tankless or high-efficiency tank-type water heaters.

6.4. Fire Protection

- **Fire Extinguishers:** Properly rated and placed fire extinguishers to combat small fires.

Item	Specifications	Standards/Notes
Fire Extinguishers (Powder)	ABC type, 20 lb, multi-purpose, Made in USA or equivalent.	NFPA Standards
Fire Extinguishers (CO2)	13 lb, multi-purpose, Made in USA or equivalent.	NFPA Standards

6.5. Quality Control

- **Quality Assurance:** A robust quality assurance program to ensure compliance with specifications and codes.
- **Inspections:** Regular inspections to verify the quality of workmanship and materials.
- **Testing and Balancing:** Thorough testing and balancing of HVAC systems to ensure proper performance.
- **Commissioning:** Comprehensive commissioning of all mechanical systems to verify proper operation.

7. PVC DOORS AND WINDOWS

7.1. General

7.1.1. Scope

This specification outlines the requirements for PVC doors and windows for the project.

7.1.2. Standards

All materials and workmanship shall conform to the following standards:

- ✓ EN 14351-1: Windows and doors - Thermal performance - Calculation method
- ✓ EN 12407: Windows and doors - Sound insulation

7.2. Materials

7.2.1. PVC Profile

PVC profile shall be PVC 8000 or equivalent.

7.2.2. Glass

- **Thickness:** 4 mm.
- **Type:** Double or triple glazing with blast film.
- **Hardware:** High-quality hardware, including hinges, handles, locks, and other accessories according to drawing notes.
- **Sealants:** High-performance sealants to ensure watertightness and air tightness.

7.3. Performance Requirements

- **Thermal Performance:** The doors and windows shall meet or exceed the required thermal performance standards, as specified in EN 14351-1.
- **Sound Insulation:** The doors and windows shall meet or exceed the required sound insulation standards, as specified in EN 12407.
- **Security:** The doors and windows shall meet or exceed the required security standards, as specified in EN 1627.
- **Weather Resistance:** The doors and windows shall be resistant to wind, rain, and other weather conditions.
- **Durability:** The doors and windows shall be durable and long-lasting.

7.4. Fabrication and Installation

- **Fabrication:** The doors and windows shall be fabricated in accordance with the manufacturer's instructions and industry standards.
- **Installation:** The doors and windows shall be installed by qualified installers in accordance with manufacturer's instructions and industry standards.
- **Sealants and Flashing:** Proper sealing and flashing shall be used to ensure watertightness and air tightness.

7.5. Quality Control

- **Quality Assurance:** A quality assurance program shall be implemented to ensure that all materials and workmanship meet the specified requirements.
- **Inspection:** Regular inspections shall be conducted to verify compliance with the specifications.

8. TILING WORK

8.1. General

8.1.1. Scope

This specification outlines the requirements for tile work, including preparation of surfaces, tile selection, installation, and finishing.

8.1.2. Standards

All materials and workmanship shall conform to the following standards:

- ANSI A137.1: Standard Specification for Ceramic Tile
- ANSI A108.1: Standard Practice for the Installation of Ceramic Tile

8.2. Materials

8.2.1. Tiles

- **Wall Tiles:** Ceramic or porcelain tiles of appropriate size and color.
- **Floor Tiles:**
 - **Toilets:** Ceramic or porcelain tiles with a slip-resistant finish.
 - **Corridors:** Ceramic or porcelain tiles with a smooth finish.

8.2.2. Adhesives

High-quality tile adhesive suitable for the specific tile and substrate.

8.2.3. Grout

High-quality grout, color-matched to the tiles.

8.2.4. Sealant

High-quality sealant to seal the grout joints and prevent water penetration.

8.3. Surface Preparation

8.4. Wall Surfaces

- Remove any loose paint, wallpaper, or other debris.
- Ensure the surface is clean, dry, and structurally sound.
- Apply a suitable primer if necessary.

8.5. Floor Surfaces

- Remove any existing flooring materials.
- Ensure the surface is clean, dry, and level.
- Apply a suitable leveling compound if necessary.

8.6. Tile Installation

8.6.1. Tile Layout

- Plan the tile layout to minimize cutting and maximize visual appeal.
- Use tile spacers to maintain consistent joint widths.

8.6.2. Tile Adhesion

- Apply tile adhesive to the substrate or the back of the tiles, following the manufacturer's instructions.
- Press the tiles firmly into the adhesive and ensure proper alignment.

8.6.3. Grouting

- After the adhesive has cured, apply grout to the tile joints using a rubber float.
- Remove excess grout and clean the tiles.

8.6.4. Sealing

* Once the grout has cured, seal the grout joints to prevent water penetration and staining.

8.7. Finishing

- **Cleaning:** Clean the tiles and grout thoroughly to remove any residue.
- **Edge Treatment:** Install tile edging or trim as required to finish the edges of the tiled areas.

8.8. Quality Control

- **Quality Assurance:** A quality assurance program shall be implemented to ensure that all materials and workmanship meet the specified requirements.
- **Inspection:** Regular inspections shall be conducted to verify compliance with the specifications.