



PETRA
Programme for Earthquake
and Tsunami Infrastructure
Reconstruction Assistance

KFW



**CONSULTING SERVICE FOR THE DESIGN AND
CONSTRUCTION SUPERVISION FOR IN-PATIENTS,
PHARMACY AND MURAI BUILDINGS IN TWO HOSPITALS IN
CENTRAL SULAWESI**

ANNEX 1

TECHNICAL SPECIFICATION

FOR BUILDINGS CONSTRUCTION IN

GENERAL HOSPITAL OF ANUTAPURA
AND
GENERAL HOSPITAL OF TORA BELO

PALU CITY AND SIGI REGENCY, CENTRAL SULAWESI PROVINCE

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CHAPTER 1. GENERAL EXPLANATION AND PREPARATION WORKS

1.1. GENERAL EXPLANATIONS

1.1.1. Scope of Work

The implementation of the construction work of the Inpatient buildings, Pharmacy and Maternity building will be carried out into the appropriate package of activities that will be listed in the contract document with details to be determined further. For each activity listed in the contract, the contractor is obliged to fulfill the requirements listed in this document.

In order to support such activities, the Contractor shall provide all manpower, supervision, adequate tools and equipment, materials, services, installed testing equipment, and all necessary expense items, among others:

Supply	Fabrication	Assembly
Instalment	Transport	Quality Assurance
Handling & Unloading	Field Installation	Material Sample
Warehousing	Placement	Mock up
Testing	Evaluation	
Material Assembling	Field Erection	
Construction	Receiving	

And specific requirements stated in the following chapters.

The Contractor shall perform all work as described in this document and UNDP strategies, plans and procedures so as to provide all services required to construct, install, test and deliver a complete and operable facility. The Contractor shall provide all adequate and competent construction management, personnel, supervision, staff, labour, construction planning, scheduling, documentation, construction quality, Health-Safety-Environment (HSE) and testing devices in order to complete the Work in accordance with the Standard of Performance.

This section will be explain the construction of buildings/facilities at Anutapura and Tora Belo Hospital, consist of:

1. Murai Inpatient Building at Anutapura Hospital
2. Pharmacy Building at Anutapura Hospital
3. Pinus / Ebony Inpatient Building at Tora Belo Hospital
4. Maternity Building at Tora Belo Hospital

1.1.2. Supervision, Work Plan and Report

Supervision for this work will be carried out by a Consultant, PT. Arkonin Engineering Manggala Pratama. This Consultant is assigned by the UNDP.

The Consultant's task is supervising the implementation of the work and the skills of Contractor who carry out the work. Duties and orders can be given in oral and written and its contained in a formal daily report.

The Consultant does not have the authority to exempt Contractor from the obligations specified in the employment agreement (Contract).

The Consultant has to refuse the execution of a job or the use of materials that do not meet the conditions in the contract documents, and reduce the risk of UNDP to order demolition.

Work Plan

Within no later than 10 (ten) days after being appointed by UNDP, Contractor must immediately send a general and detail work plan to be approved by Consultant/UNDP, including:

- Time schedule, sequence of work implementation and methods that will be used in carrying out the work, to be discussed and agreed by Consultant/UNDP.
- Full details of the organizational structure and personnel list that will be assigned in the project, to be verified and approved by Consultant/UNDP in accordance with Contractor's bid proposal.
- Personnel's schedule that is arranged in a table and in diagram form.
- Material procurement schedule
- Equipment procurement schedule
- Procedure for implementation both technically and administratively.

The Contractor must carry out the work based on the weekly implementation plan. This weekly schedule must be approved by the Consultant. The approval of the work plan or other requirement from UNDP does not mean exempting Contractor from a duty of responsibility stated in the contract.

Reports

- A. Contractor is required to develop and submit periodic reports of the implementation of the work in writing to the Consultant.
- B. In the daily report, note the following:
 - Progress of daily work, materials and equipment supply, the number of workers, and weather conditions.
 - Duties and orders given by the Consultant.
 - Variation of works, either additional or reduction of works.
 - The daily report has signatures from Contractor and Consultant and the report will be used as the next report file.
- C. In the weekly report, note the following:
 - Weekly reports are based on current field conditions. Contractor reports only physical progress. This weekly report format follows the bill of quantity format for the progress of work items. The contents of this report include :
 - Bill of Quantity volume and progress of each job
 - Volume completed (Last week, this week and total)
 - Progress/Weight in percent for each work item (previous week, current week and total)
 - Cumulative value of progress this week (in percent)
 - Compilation of daily reports in one week. Weekly reporting is according to the physical development of the building.
- D. In the monthly report, note the following:

Monthly report is the complete project report consisting of important information which is summarized in one book. Following are the contents of the monthly report:

- Project data, stating the name of the project, package name, project location, contract number, contract date, time of implementation, time of work handover, project location, and so on.
- End of month progress report
- Minutes of meetings
- List of staff in the project
- List of tools and quantity.
- Photo-video documentation of the work

The above three types of reports are commonly used in a project and always contain the progress of the works completed by the Contractor. The report must be completed with photos that are dated and made in 5 (five) copies.

1.1.3. Risk of Increasing Prices, Other General Requirements, Sizes and Notations

Risk of Increasing Material Prices and Wages

1. If during the implementation of the work there is a price increase, Contractor cannot submit a request for a review and calculation of the additional price or demand an additional fee. Contractor is deemed to have taken into account the factors mentioned above when submitting the bid price.
2. Price increases should not be a reason to degrade or reduce the quality of work, reduce the volume of work, and / or slow down the time to complete the work as specified in the contract.
3. If there is an increase in prices due to government policy in monetary or other fields, it will be determined later by UNDP.

Other General Requirements

The work that must be carried out by Contractor is:

1. Procurement, security and supervision of all kinds of equipment, tools and materials to be used in the implementation.
2. Installation, testing and maintenance of all materials and equipment within the specified time limit.
3. Workforce deployment according to needs, expertise and skills.
4. Willing to perform overtime work if conditions required.

Sizes and Notations

1. All sizes in architectural, structural, mechanical and electrical drawings are finished sizes, unless there are other provisions that will be explained later.
2. If there are any differences or discrepancies in size and notation, it must be confirmed by Consultant
3. Complete Construction Drawings (Architecture, Structure, Mechanical and Electrical, and technical specifications) can be obtained through Consultant with the acknowledgement of UNDP.
4. Contractor must examine and understand the entire process and technical work so that they can adjust the program and work in an integrated and simultaneous manner.
5. Contractor is required to provide SHOP DRAWINGS made in 3 (three) copies; 1 (one) set for Contractor, 1 (one) set for UNDP and 1 (one) set for Consultant.
6. During the execution of the work, Contractor is obliged to put a mark of a certain color in the image of the parts of the building that have been carried out, including if there are changes from the original drawing.

7. Before each part of the work is started, Contractor is required to submit SHOP DRAWING and must obtain the approval from UNDP assisted by Consultant.
8. Should there are discrepancies between SHOP DRAWINGS and technical requirements - specifications, then the technical requirements and specifications prevail, unless specified otherwise by Consultant/UNDP.
9. If there are hesitance of the drawings, Contractor must submit to UNDP/ the Consultant at least 1 (one) week before being implemented.
10. The difference cannot be used as an excuse by Contractor to claim on the execution time

1.1.4. Basic Pillar, Building Peil and Boundary Measurement

Basic Pillar (Bench Mark) and Peil Implementation Requirements

1. Clearing work before implementation
This work includes clearing the project area of all impurities and rubbish both organic and inorganic waste which will later disrupt and / or reduce the quality of work on it.
2. Protection work against existing installations
 - a. This work includes the protection of existing installations that exist inside the Project Site and declared by Consultant/UNDP to still function. In this case Contractor must maintain it from interference / defects.
 - b. If the existing installation path that is still functioning must be moved, Contractor must perform this work in accordance with the written decision of Consultant/UNDP.
3. Making Basic Stake (Bench Mark)
 - a. The location of the stake will be determined by Consultant/UNDP
 - b. Basic stake mark is made of reinforced concrete material with a 20 x 20 cm cross section, firmly embedded into the soil as deep as 1,00 m with the part that appears above the soil surface sufficiently to facilitate further measurement.
 - c. Basic stake is made permanent, irreversible, clearly marked and maintained intact until written instructions are provided from UNDP to dismantle it

Work Determination of Basic Building Peil or P 0.00

1. P ± 0.00 Architectural finishing is the main floor leveling / peil with bench mark reference made by Consultant at the site measurement stage.
2. The measuring board / bouwplank is made of wood with a thickness of 3 cm and a width of 15 cm, straight and shaved flat on the top side. Benchmarks are mounted on wooden stakes 5/7 which are 1.50 m apart from each other so that they cannot be moved or changed.
3. The height of the top of the measuring board must be the same as the other and / or flat waterpass, unless otherwise desired by Consultant/UNDP.
4. After completing the installation of the benchmarks, Contractor must report to Consultant/UNDP for approval.

Boundary Measurement

1. Contractor are required to carry out measurements and depictions of the construction site accompanied by information about peil elevation, the location of existing buildings, the location of land boundaries using optical devices and have been verified by the relevant parties.
2. Any discrepancies that might occur between the drawings and the actual situation on the ground must be reported immediately to Consultant/UNDP to be asked for a decision.
3. Determination of elevation and angles must be done with T2 type Waterpass/Theodolite.
4. Contractor must provide T2/Waterpass type Theodolites along with officers who serve them for the purpose of examination by Consultant /UNDP.

5. Right angle measurements using prisms or threads in phytagorean triangles are only allowed for small parts that have been approved by Consultant/UNDP.
6. Existing and still functioning installations must be marked and protected from damage that might occur as a result of this project work, for that it must be included in the measurement drawings.
7. Contractor are responsible for any damage caused by work that has been done.
8. All Buildings site measurement images must obtain approval from Consultant/UNDP include:
 - a. Coordinate system, according to the provisions of the picture.
 - b. Peil each vertex coordinates and transition with a height interval of 25 cm.
 - c. Planned Work Camp location, place to store open materials, place to store closed materials, water sources, and toilets.

1.1.5. Technical Support on Operation and Maintenance Building Training on Operation and Maintenance

The Contractor shall provide Training on operation and maintenance to the Employer's personnel and the Employer's maintenance contractors in all aspects of the Equipment. These aspects shall include Hardware and Software operation and maintenance.

The Contractor shall submit (4) four sets of Operation and Maintenance Manual at the time of training. The Manual shall be compiled on paper of A4 size and bound in hard cover and appropriately labeled. Information shall be organized neatly and concisely. If the Operation and Maintenance Manual is found to be inaccurate or inadequate during the execution of the work or during defects liability period, the Contractor shall make the necessary corrections and furnish supplements. All amendments shall be made and amended copies shall be resubmitted by the Contractor at no cost to the UNDP.

The manual shall include the following:

- a) A brief description of the project.
- b) A general description of the operation of the project. The Instruction Manuals shall describe the equipment/system as a whole and shall give a step by step procedure for any operation likely to be carried out during the life of the equipment / system, including operation and maintenance.
- c) A separate section of the Manual shall be devoted to each size and type of Plant and/or equipment/system. It shall contain a detailed description of its construction and operation and shall include all relevant pamphlets. Electrical Plant and/or equipment shall be described in operation step by step giving the complete sequence of operation. The detailed sections of the Manual, if necessary, shall contain further maintenance instructions and fault location charts.
- d) Drawings of single line diagram of the electrical control circuits and all the relevant wiring diagrams shall be included. Every control circuit single line diagram must be accompanied by the circuit description.
- e) Detailed description of all controls and display and their functional role in systems operations.
- f) Procedures which affect system and personnel safety shall be specifically identified.
- g) All emergency procedures related to Plant and/or equipment, power failure, alarm, rescue operation, etc.
- h) Preventive maintenance schedule to indicate the inspection required at regular intervals, the inspection procedure, the routine cleaning and lubricating operations, the regular safety checks and similar steps.

- i) General trouble-shooting guide to assist maintenance staff in rapid analysis and correction of malfunctions.
- j) Plant and/or Equipment and Spare Part Schedule

A complete list of materials, Plant and/or equipment and spare parts showing quantity, location, make, type, rating, addresses and telephone numbers of manufacturers, suppliers and local agents, etc.

Technical Support Requirements

The Contractor shall provide technical support and advice with respect to the operation and maintenance of the Equipment in accordance with the Specifications during the Defects Liability Period.

The Contractor shall replace any operational part of the Equipment with the latest equivalent product at no charge to the Employer if the operational part of the Equipment is made obsolete with the absence of technical support and spare parts and the Contractor shall ensure that the replacement product shall inter-operate seamlessly with any existing equipment.

Commissioning Test

The Contractor shall implement all necessary quality control activities to identify and correct deficiencies. It should be noted that although the installation activity will be under the supervision from Consultant/UNDP, this supervision is not intended to supplement the Contractor's quality control. Nevertheless, UNDP reserves the right to reject the Equipment and/or Works or performance deemed to be in non-compliance with the specifications.

The Contractor shall be responsible for all necessary materials, works, labour required to carry out the works including testing and commissioning of all newly installed systems.

The Contractor shall ensure that commissioning and Provisional Acceptance Test are effectively implemented so that prior to operation, the Equipment is capable of meeting the requirements of the Contract including that for safety and reliability.

The Contractor shall set-up a systematic and safe procedure for progressive turning on of power supplies for testing and commissioning purposes before practical completion. They shall be jointly responsible for the whole electrical installation until it is handed over to the Employer.

The Contractor shall notify the Architect / M & E Engineer in writing of his programme to test and commission the equipment and systems at least seven (7) days before actual execution.

The Contractor shall prepare and provide printed testing and commissioning record forms of approved format. The Contractor shall submit two (2) copies of a written report on the results of the test, etc within seven (7) days of completion of such test, irrespective of test results.

The Contractor shall deploy on a full-time basis for two (2) months after the practical completion date, one the Consultant or equal to attend to complaints relating to malfunctions, overloads, tripping, unbalance and to readjust where necessary to suit the requirements of space occupants.

1.2. GENERAL TECHNICAL REQUIREMENTS FOR IMPLEMENTATION

1.2.1. Technical Regulations

1. General Rules and Standards used for this work but not limited include:
 - a. Indonesia Industrial Standard (SNI); All SNI related to the quality of building construction and Calculation & Construction Method;
 - Persyaratan Beton struktural Untuk Bangunan Gedung SNI 03-2847-2013)
 - Peraturan Konstruksi Kayu Indonesia (SNI Kayu 2002)
 - Persyaratan Umum Instalasi Listrik 2011 (PUIL 2011)
 - b. All Standards / Codes/ Guidelines that can be implemented on specific works which issued by Institutions / Professional Associations / Producers Associations / National Testing Institutions or from other countries, to the extent that these are deemed relevant;
 - Permenaker No. 12 tahun 2015 tentang Keselamatan Instalasi dalam Bangunan.
 - Peraturan Menteri Lingkungan Hidup No. 5 tahun 2014. About waste-water quality standards
 - Standards and rules or conditions that apply specifically to Local Electric Providers Operators (PLN).
 - c. Other standards such as: IEC, JIS, BS, VDE, AVE, AS, DIN, ASTM, ISO and others as long as they do not conflict with the standards and regulations that apply in Indonesia
 - American Society for Testing Materials (ASTM);
 - American Concrete Institute-ACI 318-89;
 - American International Steel Construction-AISC;
 - Japan International Standard (JIS).
2. If it turns out that in the work plan and these requirements there are contradictions/ abnormalities/deviations from the regulations as stated in paragraph (1) above, then Contractor shall use requirements stated in those standards.

1.2.2. Using Size and Site Information

Usage Size

1. Contractor is still responsible for keeping all the provisions contained in the work plan and the terms and working drawings with additions and changes.
2. Contractor is obliged to check the veracity of the overall measures and parts and immediately notify the Consultant of any discrepancies found in the work plan and the terms and working drawings as well as in the written approval of the Consultant.
3. Taking the wrong measurements in implementation, in any case the responsibility of Contractor, therefore Contractor is required to conduct a thorough inspection of the pictures and documents that exist.

Site Information

Before starting the work, Contractor must understand the conditions of the site or other things that might affect the implementation of the work and must have taken into account all the consequences.

Contractor must pay special attention to the regulations on the location of the workplace, material placement, security and continuity of operations during the work.

Contractor must study carefully all parts of the drawings, Technical Specifications and agenda in the bidding document, in order to adjust to the field conditions so that the work can be completed properly.

1.2.3. Cleanliness and Discipline

1. Storage/placement of materials in warehouses or in the yards must be arranged in such a way as not to interfere safety of work / public and also to facilitate the inspection and research of materials by the Consultant and UNDPs.
2. Contractor are required to make urinals and toilets for workers in certain places approved by The Consultant to ensure cleanliness and health in the project.
3. Implementing workers are not permitted to:
 - a. Stay overnight at a place of work except with the permission of the Consultant / UNDP.
 - b. Cook at work except with the permission of the Consultant.
 - c. Bring in food, drink, cigarette vendors, etc. at work.
 - d. Exiting the work location freely.
4. Other regulations regarding order will be issued by the Consultant / UNDP at the time of implementation.

1.2.4. Examination, Term and Condition of Building Material Examination and Provision of Materials / Goods

1. If the Technical Specification mentions the name and manufacturer of a material and goods, then, in this case, it is intended to show the quality level of the materials and goods used.
2. Every change of name and manufacturer of a material and goods must be approved by the Consultant / UNDP and if not specified in the Technical Specifications and drawings, the materials and goods supplied by the Contractor must obtain prior approval from the Consultant / UNDP.
3. Sample of materials and goods to be used in the work must be immediately provided at Contractor's expense, after being approved by the Consultant / UNDP, it must be assumed that the materials and goods will be used in the execution of the work later.
4. Sample of materials and goods are kept by the Consultant / UNDP to be used as a basis for rejection if it turns out that the materials and goods used are not suitable according to their quality or nature.
5. In submitting a bid price, Contractor must have entered all the necessary costs for testing various materials and goods. Without this, Contractor remains responsible for the costs of testing materials and goods that do not meet the requirements of the Consultant / UNDP's order

Term and Condition of Building Material

1. The contractor must provide appropriate building materials both in quantities and qualities based on scope of work. As long as there are no other provisions in this Technical Specification and Minutes of Meeting, the materials and conditions of implementation must meet the conditions that applicable in Indonesia.
2. Before starting the work, the Contractor must submit sample of material to Consultant/ UNDP for approval. Material that does not meet the requirements or declared rejected by the Field Supervisor may not be used and must be immediately removed from the site no later than 48 hours.
3. If the materials rejected by the Consultant still being used by the Contractor, the Consultant will orders to demolish the part of the work that uses the material. All losses due to demolition are responsibility of the Contractor.

4. If there is a dispute regarding the quality of the materials used, the Consultant has the right to ask the Contractor to check the material by the official Laboratory for Material Research Institute at the Contractor's expense. Prior to the certainty of the results of the examination from the Laboratory, the Contractor was not permitted to continue the parts of the work.
5. The storage of materials must be regulated and carried out not interfere with the implementation of work and avoidance of materials from damage.
6. General requirements for building materials are as below, whereas building materials not yet mentioned here will be directly implied in the future articles regarding the requirements for implementing construction components

1.2.5. Discrepancies in Documents, Shop Drawing and As Build Drawing

Discrepancies in Documents

1. If there are discrepancies between the construction drawings and Technical Specifications, Contractor must ask the Consultant/UNDP in writing and Contractor must comply with the decision.
2. The measurement/dimension contained in the final drawings are applicable and the dimension with number is what should be followed rather than the dimension scaled from the drawings, but if possible this dimension should be taken from the finished work.
3. If there are things mentioned in construction drawings, technical specifications or documents, which are different or contradictory, then this must be interpreted not to eliminate one to another to emphasize the problem. If this happens then what will be taken as a benchmark is one that has a technical weight or has a high-cost weight.
4. If there is a difference between:
 - a. Architectural drawings with structural drawings, then what is used as a handle in functional measurements is architectural drawings, while for the type and quality of materials and goods are structural drawings.
 - b. Structural drawings with mechanical drawings, then what is used as a handle in measuring the quality and type of material is mechanical drawings.
 - c. Architectural drawings with electrical drawings, then what is used as a handle in functional measurements is architectural drawings, while for the size and quality of materials are electrical drawings

Shop Drawing

1. If there are deficiencies in the explanation, in the construction drawing, or additional pictures / detailed drawings are needed or to enable Contractor to carry out and complete the work in accordance with the provisions, Contractor must make these shop drawings in 3 (three) copies and the cost of making the drawings is the Contractor's responsibility. Work based on these shop drawings can only be carried out after obtaining approval from the Consultant.
2. Shop drawings can only be changed if instructed in writing by UNDP, following the Consultant's explanation and consideration.
3. Changes to this plan must be drawn up in accordance with what was ordered by UNDP, which clearly shows the difference between the shop drawings and the plan changes.
4. Shop drawing must be submitted to the Consultant for approval before being implemented.

As-built Drawing

1. Contractor must develop Asbuilt Drawings that are following what has been done, which clearly show the difference between the Shop drawings and the work carried out. Items that have not been included in the Shop drawings either due to irregularities, changes in the order of UNDP / The Consultant must be included in As-built drawing.

2. As-built Drawings must be submitted in the following 3 (three) copies (original image) for which the manufacturing costs are come by Contractor.

1.3. PREPARATION WORKS

Scope of Work

1. This work includes the supply, utilization of manpower, materials, equipment and tools needed to carry out the construction of this project.
2. This section covers temporary fence, demolition, cleaning up locations, installing bowplanks, making directors site office and material warehouses, supplying working water and lighting, as well as mobilization and demobilization.

1.3.1. Temporary Fence

Installing temporary fence around the project site. Fence build for safety, stand firm during construction periods. Making fence from wood and zinc wave with local foundation, height is 2.50m.

1.3.2. Demolition

Demolition of damaged buildings to prepare the site ready to developed new building. Demolition consist of :

1. Dismantling damaged buildings that have been appointed by the Consultant/UNDP.
2. Collect and remove/dispose material from demolition outside of the hospitals area unless otherwise determined by the Consultant/UNDP.
3. This Specification sets out the requirements for the demolition of an existing structure, and disposal of the demolition waste, which may or may not contain contaminated material.

Permit and Demolition Plan

- The contractor must be make a list of existing building materials to be demolished
- The Contractor shall be obtain all special permits and licenses and give all notices required for performance and completion of the structure demolition and removal work, hauling, and disposal of debris.
- Submit a comprehensive demolition plan, describing the proposed sequence, methods, and equipment for demolition, removal, and disposal of structure(s); include salvage if required.

Demolition as follows:

- Before dismantling the existing concrete structure building, a shop drawing and sequence must be submitted
- Building structures, including superstructure, substructure, foundations and approach structures, shall be completely removed.
- Piles shall be removed to a minimum of 1,5 m below the bottom of foundations unless shown otherwise on the Construction Drawings.
- Building structures, including foundations, footings, and foundation systems shall be completely removed.
- Miscellaneous structures, including box culverts, shall be completely removed.
- Utility services to facilities to be removed or demolished shall be disconnected, cut, and capped.

Protection of Person and Property, Utilities, Noise & Dust and Unknown Condition

The Contractor must appoint a person experienced in building demolition and coordinate with the Building Owner, UNDP and Consultant

- **Protection of Persons and Property:**
 - Install clear marks and signs on the demolition area to provide information about demolition work
 - Install chain link fencing around the area of demolition work as specified in construction facilities.
 - Erect and maintain temporary bracing, shoring, lights, barricades, signs, and other measures as necessary to protect the public, workers, and adjoining property from damage from demolition work, all in accordance with applicable codes and regulations.
 - Open depressions and excavations occurring as part of this work shall be barricaded and posted with warning lights when accessible through adjacent property or through public access. Operate warning lights during hours from dusk to dawn each day and as otherwise required in the contract documents.
 - Protect utilities, pavements, and facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by demolition operations.
- **Protection of Utilities:**
 - Protect active sewer, water, gas, electric, and other utilities; and drainage and irrigation lines indicated or, when not indicated, found or otherwise made known to the Contractor before or during demolition work. If utility is damaged, immediately notify the utility owner for corrective action.
 - Arrange with and perform work required by utility companies and municipal departments for discontinuance or interruption of utility services due to demolition work.
- **Noise and Dust Abatement:**
 - Provide continuous noise and dust abatement as required to prevent disturbance and nuisance to the public and workers and to the occupants of adjacent premises and surrounding areas. Dampen or cover areas affected by demolition operations as necessary to prevent dust nuisance.
 - When a certain level of noise is unavoidable because of the nature of the work or equipment involved, and such noise is objectionable to the occupants of adjacent premises, make arrangements with the jurisdictional authorities to perform such work or operate such equipment at the most appropriate time periods of the day. Provide abatement measures to the extent feasible and practicable.
- **Unknown Conditions:**
 - The Contract Documents may not represent all surface conditions at the site and adjoining areas. The known surface conditions are as indicated, and shall be compared with actual conditions before commencement of work.
 - Existing utilities and drainage systems below grade are located from existing documents and from surface facilities such as manholes, valve boxes, area drains, and other such surface fixtures. The Contractor's proposed methods of demolition shall be designed to allow for the possibility that the existing pipe, sewer, utility or other facility are in a location that is three feet from that shown on the Design Drawings.

- If existing active services encountered are not indicated or otherwise made known to the Contractor and interfere with the permanent facilities under construction, notify the Consultant/UNDP in writing, requesting instructions on their disposition. Take immediate steps to ensure that the service provided is not interrupted, and do not proceed with the work until written instructions are received.

Disposal of Removed Material, Debris, Salvage and Backfill

- Dispose of removed materials, waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction.
- Burying of trash and debris on the site will not be permitted. Burning of trash and debris at the site will not be permitted
- Remove trash and debris from the site at frequent intervals so that their presence will not delay the progress of the work or cause hazardous conditions for workers and the public.
- Items or materials to be salvaged shall be identified by the Consultant / UNDP or as indicated in the Contract Documents.
- All backfill material shall be placed free of voids and objectionable wastes and decomposable material.

Provide Temporary Support

- Maintain the structure to be demolished and all its elements in a safe and structurally stable condition to prevent the unexpected collapse of part or all the structure
- Where appropriate, provide temporary propping, bracing, shoring or other types of support as necessary to maintain stability of the structure. Support load bearing component before cutting or demolishing.
- Inform to the Consultant regarding the debris disposal area

1.3.3. Site Clearing

Before starting the work of building a new building, Contractor must clean and clear the location from plants and other objects that are considered to be able to interfere with the construction.

Work Equipment, Mobilization, and Demobilization

1. Contractor must prepare and procure work equipment and auxiliary equipment that will be used at the project site in accordance with the scope of work and take into account all transportation costs.
2. Contractor must maintain order and smoothness during the movement of heavy equipment that uses public roads so as not to disturb traffic.
3. The Consultant / UNDP has the right to order to add equipment or reject equipment that is not appropriate or does not meet the requirements.
4. When the work has been completed, Contractor is obliged to immediately demobilize all the equipment, repair the damage caused and clean up all the dirt/debris that caused by the process of mobilization/demobilization.
5. In addition to providing the necessary tools as intended in paragraph (1), Contractor must provide supporting tools so that they can work in any condition, such as: tents for working on rainy days, scaffolding on the sides outside buildings or other places that need it, as well as Occupational Health and Safety (OHS) equipment and others.
6. Contractor must demobilize after the contract is completed. As for the demobilisation activities carried out, including the dismantling of all installation and construction

equipment, all the excess materials, all based on the approval of the supervision consultant.

Measurement

1. Contractor must have calculated the costs for measuring and researching the size of the building layout or elevations (Bouwplank), including the provision of Back Mark or Line Offset Mark, on each floor of the building.
2. The measurement results must be reported to The Consultant/UNDP that they can be determined as guidelines or references in carrying out the work in accordance with the plan drawings and technical requirements.

1.3.4. Facilities at Site

Facilities at construction sites are as follows:

Working Water Facilities and Lighting

1. For the sake of carrying out the work during the project, Contractor must calculate the cost of providing clean water for working water, drinking water for workers and bathroom water.
2. The water in question is clean, whether coming from PAM or water sources, as well as the procurement and installation of water distribution pipes for the purpose of carrying out work and for the Directors site office, Contractor offices, bathrooms-toilets or other places deemed necessary .
3. Contractor must also provide a source of electricity to carry out the work, the needs of Project Supervisor and lighting of the project at night as security during the project lasts 24 hours a day.
4. Procurement of lighting can be obtained from the PLN connection or by procuring a Generator Set, and all permits for such work are the responsibility of Contractor. The procurement of lighting facilities includes the procurement and installation of installations and armature, electrical sockets and switches-panels

Work Camp for Worker

1. Contractor must make work camp and building a place for rest and place of prayer for Contractors workers.
2. Work station is a building with an area that is sufficient to work for a worker/executive worker and has a fairly good condition, protected from the influence of weather that can hamper the smooth work.

Project Security

1. Contractor must guarantee the safety of the project, both for Contractor belongings, the Consultant, as well as maintaining the integrity of the existing buildings from the disruption of the executing workers or damage due to work implementation.
2. Contractor must place security officers 24 hours a day, divided into 3 (three) shifts, and must always carry out security checks every day after finishing work.
3. To control and maintain the working order of its workers, each Contractor worker is required to wear a special identification that must be worn on the part of the body that is easily visible to security personnel.
4. Contractor's workers are not permitted to stay overnight on site unless security officers are on duty at night.

Project Office (Director's Site Office) and Its Equipment

1. Contractor must provide a project management office complete with equipment / furniture and other work facilities needed for project implementation as follows:
 - a. 3 (three) sets of work tables complete with chairs
 - b. Meeting table for 10 people
 - c. Computer and printer devices
 - d. 2 pieces Calculator (Minimum 12 digits)
 - e. 1 (one) metal file cabinet locked
2. Contractor must also provide the project manager's working tools in the field, as follows:
 - a. Safety shoes that are resistant to nails, safety helmets and raincoats of 5 sets each
 - b. 2 (two) 5 meters roll meter tape
 - c. Caliper / schuifmaat and steel brackets
3. The Consultant / Project Management Office, Implementing Office and Warehouse, the working water pump is a supporting facility in the implementation of the project and is used when finished work.

Office and Implementation of Warehouse

1. Contractor must establish an office on the project site where the executive representative works, equipped with the necessary office equipment.
2. Contractor must also provide a warehouse with an area that is sufficient to store building materials and equipment to avoid weather disturbances and theft.
3. Placement of offices and executive buildings must be arranged in such a way that they are easy to reach and do not hamper the implementation of work.

Supplying Project Facilities

1. Contractor must also calculate the consumption costs for meetings / meetings with UNDP or his representative and the guest assigners who are interested in the project.
2. Fire extinguisher units must be placed on each floor of the building with a radius of approximately 50 meters, inside the Project office and other places that require them.

Fire Extinguishers

1. During the execution of the work, Contractor must provide a fire extinguisher in the form of a fire extinguisher that can be used to extinguish the fire caused by electricity, oil and gas with a capacity of 7 kg.
2. Fire extinguisher units must be placed on each floor of the building with a radius of approximately 50 meters, inside the board of directors and other places that require them.

Entry, Temporary Road and Drainage

1. If deemed necessary, in accordance with the conditions and situation of the location, Contractor must have taken into account the construction of a temporary entrance and / or temporary work bridge approved by the Consultant.
2. The construction of a temporary entrance or bridge must follow the rules and all permits relating to the work are the responsibility of Contractor.
3. Contractor must avoid damage to existing access facilities by managing the vehicle routes used and limiting / dividing the load.
4. Damage to the road or other objects caused by the work of Contractor, the mobilization of equipment and the input of materials will be the responsibility of Contractor and must be repaired immediately.

5. The contractor must make a temporary drainage to keep the building area always in a dry / state flooded with rain water or waste water. The drainage and tunnel is connected to the nearest ditch according to the Consultant instructions.

Situation - Location for Work Preparation

1. The location of the project will be submitted to the Contractor as is the case during the Meeting. The contractor should conduct a through study of the conditions of the project site.
2. Carelessness or negligence in evaluating the situation in the site is entirely the responsibility of the Contractor and cannot be used as an excuse to file a claim.

1.3.5. Construction Permit and Documentation

Construction permit and documentation as follows.

Construction - Related Permits

1. Contractor must take care of and calculate costs for making permits that are needed and related to the implementation of work, including: lighting permits, material removal permits, disposal permits, collection permits, route and road use permits, building use permits and building permits others that are required under local or other regulations.
2. Cost of Building Permit (IMB), is the responsibility of the Local Government.
3. Delay in the execution of work caused by the aforementioned paragraph (1) above becomes the responsibility of Contractor.

Documentation

1. Contractor must calculate the cost of making the documentation and sending it to UNDP and other parties as needed.
2. What is meant by work documentation is:
Project photos-video from 0% to 100%, color, minimum postcard size, for the purpose of monthly reports made by Contractor and assist by the Consultant. 5 (five) sets of albums that must be submitted at the handover of the work for the first time.

1.4. HEALTH AND SAFETY ENVIRONMENT (HSE)

1.4.1. Scope of Work

- a. Provide labour, materials, equipment and other assistive devices to carry out work as stated in this technical specifications with good and perfect results.
- b. The price of this work is included in the preparatory work scope, if it is not listed on the work item then this work remains an obligation that must be carried out.
- c. Indicators of success are the implementation of the project in an orderly, safe and no work accidents that occur in the project environment.
- d. The Construction Contract must provide for the implementation of the following plans:
 - Occupational Health and Safety
 - Groundwater
 - Air Quality
 - Noise and Vibration
 - Erosion, Drainage and Sediment Control
 - Traffic Management
 - Waste Management
 - Monitoring Social Impacts, and
 - Stakeholder Engagement

Environmental quality monitoring is carried out at the location that has the potential to cause pollution impacts on environmental components such as air quality, noise, vibration, surface water, groundwater, as well as social-economic and public health.

The scope of work includes the following matters:

- 1) Doing work preparations
- 2) Collecting data in the field both primary and secondary
- 3) Analyze the data obtained and provide recommendations for follow up to environmental management.

Monitoring of environmental quality with the parameters above for ambient air, water (groundwater and surface water) and the vibration is done in 2 points for each Hospital area. The following is a monitoring table related to environmental impacts that must be monitored and managed by when pre-construction, during construction and operation phase, including:

Table 1.1. Occupational Health and Safety Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
OHS1: Health and safety issue of the construction workers	OHS1.1 Establishment of an OHS organisation with clear roles, responsibilities, authority and resources.	Project start	Project manager	Annual review of compliance with key regulations.
	OHS1.2. Completion of hazards identification and risk assessment for each sub-project.	Sub-Project start	Project manager	Included in Monthly OHS Report
	OHS1.3 Conduct safety induction before work started. PPE utilization for workers. Conduct regular site inspections, submit reports and oversee corrective action.	Construction and operation phases	Project manager	Monthly or as directed by UNDP

Table 1.2. Groundwater Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & Reporting
GW1: Increase of gross pollutants, hydrocarbons, metals and other chemical pollutants into the groundwater and/or surface water environment.	GW1.1 Conduct regular surface and groundwater quality monitoring in the location where the groundwater is likely to be impacted, including assessing the changes to groundwater quality.	Construction and operation phases	Project manager	Two monthly or as directed by UNDP
	GW1.2: Prevent contaminated surface water from entering aquifers via boreholes and wells - protect from runoff and flooding and keep surrounds clean.	All phases	All personnel	On-going
	GW1.3: Designated areas for storage of fuels, oils, chemicals or other hazardous liquids should have compacted impermeable bases and be surrounded by a bund to contain any spillage. Refuelling to be	Entire construction and operation phase	All personnel	On-going

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & Reporting
	undertaken in areas away from water systems			
	GW1.4: Check all vehicles, equipment and material storage areas daily for possible fuel, oil and chemical leaks. Undertake refuelling at designated places away from water systems.	All phases	All personnel	Daily and maintain records
	GW 1.5: Minimise the use of herbicides, pesticides and other chemicals and use only biodegradable herbicides that have minimal impact on water quality and fauna. Use only as per directions.	All phases	All personnel	Monthly reporting to UNDP

Table 1.3. Air Quality Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
AQ1: Increase in dust levels at sensitive receptors.	AQ1.1 Implement effective dust management measures in all areas during design, construction and operation.	Pre and during construction	All personnel	Daily and maintain records
	AQ1.2: Source sufficient water of suitable quality for dust suppression activities complying with any water restrictions.	During construction	Project manager	Daily and maintain records

Table 1.4. Noise and Vibration Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & Reporting
N1: Increased noise levels	N1.1: Select plant and equipment and specific design work practices to ensure that noise emissions are minimized during construction and operation.	Pre and during construction	Contractor	Maintain records
	N1.2: Specific noise reduction devices such as silencers and mufflers shall be installed as appropriate to site plant and equipment.	Pre and during construction	Contractor	Maintain records
	N1.3 Consultation with nearby residents in advance of construction if noise-generating construction activities are to be carried out.	Construction phase	All personnel	Daily and maintain records
	N1.4 All incidents, complaints and non-compliances related to noise shall be reported in accordance with the site incident reporting procedures and summarized in the register.	Construction phase	Project manager	Maintain records

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & Reporting
N2. Vibration due to construction	N2.1 Identify properties and structures that will be sensitive to vibration impacts resulting from construction and operation of the project.	Pre and during construction	Contractor	Maintain records
	N2.2 Design to give due regard to temporary and permanent mitigation measures for noise and vibration from construction and operational vibration impacts.	Pre-construction	Contractor	Maintain records
	N1.4 All incidents, complaints and non-compliances related to vibration shall be reported in accordance with the site incident reporting procedures and summarized in the register.	Construction phase	Project manager	Maintain records

Table 1.5. Erosion, Drainage and Sediment Control Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & Reporting
C1: Loss of soil material and sedimentation to the surface and/or groundwater systems from site due to earthwork activities	C1.1. Develop and implement an EDSCP for any surface works, embankments and excavation work, water crossings and stormwater pathways.	Construction phase	All personnel	Maintain records
	C1.2: Ensure that erosion and sediment control devices are installed, inspected and maintained as required.	Construction phase	All personnel	Maintain records
	C1.3: Schedule/stage works to minimise cleared areas and exposed soils at all times.	Pre and during construction	Project manager	Maintain records
	C1.4: Incorporate the design and location of temporary and permanent EDSC measures for all exposed areas and drainage lines. These shall be implemented prior to pre-construction activities and shall remain onsite during work	Pre and during construction	Project manager	Maintain records
	C1.5: Locate stockpile areas away from drainage pathways, waterways and sensitive locations.	Pre and during construction	Project manager	Maintain records

Table 1.6. Traffic Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
TM1: Disruption due to Project vehicular traffic.	TM1.1: Consultation with the local communities concerning measures to minimise adverse environmental and social impacts due to project traffic.	Pre and during the construction phase	Project manager	Maintain records
	TM1.2: Ensure project vehicles are properly serviced and maintained especially concerning the noise and engine emissions.	Construction phase	Project manager	Maintain records

Table 1.7. Waste Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
WM1: Production of waste and excessive use of resources	WM1.1: Preference shall be given to materials that can be used to construct the project that would reduce the direct and indirect waste generated.	Pre and during construction	Contractor	Maintain records
	WM1.2: Daily waste management practices shall be carried out.	Pre-construction	Contractor	Maintain records
	WM1.3: The use of construction materials shall be optimised and where possible a recycling policy adopted.	Entire construction and operation phase	Contractor	Maintain records
	WM1.4: Separate waste streams shall be maintained i.e. general domestic waste, construction and contaminated waste. Specific areas on site shall be designated for the temporary management of the various waste streams.	During construction	Contractor	Daily and maintain records
	WM1.5: Any contaminated waste shall be disposed of at an approved facility.	During construction	Contractor	Maintain records
	WM1.6: Fuel and lubricant leakages from vehicles and plant shall be immediately rectified.	Entire construction and operation phase	Contractor	Maintain records
	WM1.7: Disposal of waste shall be carried out in accordance with the Government of Indonesia requirements.	During construction	Contractor	Maintain records

Table 1.8. Social Impact Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
D1: Negative perception and/or social tension related to the change of land use or GBVH incident	D1.1: Carry out community consultation on the purpose and benefits of making changes to land use.	Pre-construction	Project manager	Maintain records
	D1.2: Get community buy-in on any change of land use.	Pre-construction	Project manager	Maintain records
	D1.3: Ensure compliance with gender-sensitive Grievance Redress Mechanism process.	Entire construction and operation phase	Project manager	Maintain records
D2: Public nuisance caused by construction/ operation activities (e.g. noise, dust etc)	D2.1: Carry out community consultation before undertaking activities.	Pre-construction	Project manager	Maintain records
	D2.2: Implement appropriate management plans (groundwater, air, EDSCP).	Construction and operation	Site supervisor	Daily and maintain records
	D2.3: Ensure compliance with the Grievance Redress Mechanism process.	Entire construction and operation phase	Project manager	Maintain records

1.4.2. Standards and Requirements

Applicable standards and requirements are as follow:

- Undang-undang Nomor 1 tahun 1970 tentang Keselamatan Kerja;
- Peraturan Pemerintah Nomor 41 tahun 1999 Tentang Pengendalian Pencemaran Udara;
- Peraturan Pemerintah Nomor 82 tahun 2001 Tentang Pengendalian Pencemaran Air;
- Peraturan Menteri Kesehatan Nomor 13/MEN/X/2011 Tentang Nilai Ambang Batas Faktor Fisika dan Faktor Kimia Di Tempat Kerja;
- Peraturan Menteri Kesehatan Nomor 416/Menkes/Per/IX/1990 Tentang Syarat dan Pengawasan Kualitas Air;
- Peraturan Menteri Lingkungan Hidup Republik Indonesia Nomor 5 Tahun 2014 Tentang Baku Mutu Air Limbah Sebagaimana Diubah Dalam Peraturan Menteri Negara Lingkungan Hidup dan Kehutanan Republik Indonesia No.P.68/Menlhk/Setjen/Kum.1/8/2016 Tentang Baku Mutu Air Limbah Domestik;
- Peraturan Menteri Tenaga Kerja RI Nomor 01/MEN/1980 tentang Keselamatan dan Kesehatan Kerja Pada Konstruksi Bangunan;
- Peraturan Menteri Pekerjaan Umum Nomor 09/PRT/M/2008 tentang Pedoman SMK3 Konstruksi Bidang Pekerjaan Umum;
- Keputusan Menteri Pekerjaan Umum No. 441/ KPTS/1998 tentang Persyaratan Teknis Bangunan Gedung; dan
- Surat Keputusan Bersama Menteri Tenaga Kerja dan Menteri Pekerjaan Umum No. Kep. 174/MEN/1986, dan No. 104/KPTS/1986 tentang K3 Pada Tempat Kegiatan Konstruksi;
- Instruksi Menteri PUPR Nomor: 02/IN/M/2020 tentang Protokol Pencegahan Penyebaran Corona Virus Disease 2019 (COVID-19) dalam Penyelenggaraan Jasa Konstruksi.

1.4.3. Access Entrances and Exits

- Work access is the area of the project office, manufacturing area, work area and access/path connecting all three. Planned and prepared before use.

- b. There are entrances and exits, both for routine and emergency in the project office and well maintained.
- c. There are boundaries or warning signs or fences that give marks to the work area of the project office, establishment of the fieldwork area and lane/access links to the public areas of the community.
- d. Roads and trajectories for workers are given borders and safety and clear warning signs, especially those that intersect with Construction Workers and or the general public.

1.4.4. Project Safety Fence, Barrier, Barricades

Falling from height is the main cause of fatality cases in construction. Contractor must make every effort to prevent the workers from incident.

As a general requirement, when working at locations higher than 2 meters, protection from falls must be provided. Open sides or edges of workplaces or roads must be barricaded with materials that can withstand the physical strength of 100 kg, footboards and safety nets must also be provided.

The tubular pipe is the only material that is allowed to be used as a barricade and fence. The perimeter is closed with warning signage on it. Barricade and fence will be made before the construction activities are carried out. Barricade and fence will be built to ensure work security within the project environment, including the safety of building materials and work tools contained in it.

1.4.5. Protection of Existing Buildings and the Surrounding Environment

Contractor is responsible for carrying out the protection of third parties and security oversight in relation to work.

Contractor will provide the necessary protection to prevent damage or loss from:

- a. All work and people who may have an interest in work.
- b. All work and materials and equipment must be placed safely under the supervision of Contractor or one of the Sub-Contractor.
- c. Work property or that borders with work.
- d. All property belonging to other people or third parties around the work location.

Contractor must comply with all applicable laws, regulations and provisions concerning the safety of people, property and protect against damage, injury or loss. Contractor is required to repair and compensate for losses, if it turns out to be negligent with the obligations stated above.

1.4.6. Daily Cleaning, Cleaning of the Project Site, Disposal of Remaining Material out of the Project Site.

Contractor must guarantee that full attention will be paid to the cleanliness of the project from day to day, control of environmental cleanliness and environmental impact and that all provision of facilities and infrastructure for prevention related to environmental pollution and protection of land and surrounding waterways by taking into account:

- a. Materials, scattered materials must be tidied up well before, during work and after working hours.
- b. Work tools, other tools used must not obstruct and endanger work access and are stored after working hours are finished.
- c. Trash can according to the type of waste and volume that occurs, always cleaned and collected and ready to be transported out of the project.

- d. Trash should not be allowed to accumulate, there must be a schedule and routine cleaning.
- e. Workplaces that are slippery because water, oil, or other substances must be cleaned immediately.
- f. Everyone must remove the scattered nails, protruding steel/wire, sharp pieces of metal, all of which can be dangerous.
- g. To prevent dust pollution during the dry season, Contractor must regularly water the land or gravel haul road and must cover the transport truck with tarpaulin.
- h. The amount of material available in the field for use today is not excessive, so as not to disturb and endanger work access (the rest is returned to the public warehouse).
- i. Waste material, dismantled materials and waste are routinely taken out of the project site with the approval of The Consultancy Board of Directors.

1.4.7. Occupational Health and Safety

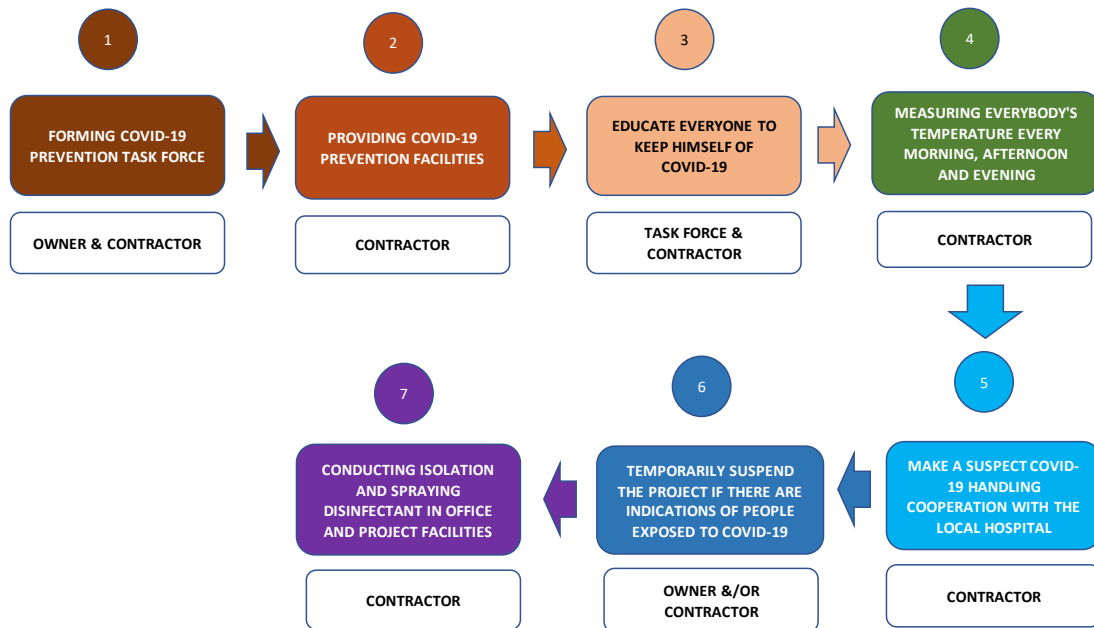
Occupational health and safety (OHS) since the Covid-19 pandemic will be based on the Ministry of Public Works Instruction No. 02/IN/M/2020 (Instruksi Menteri PUPR No. 02/IN/M/2020 tentang Protokol Pencegahan Penyebaran Corona Virus Disease 2019 (COVID-2019) dalam Penyelenggaraan Jasa Konstruksi).

1.4.7.1. Protocol Prevention COVID-19 in Construction Project

1. Introduction
 - a. This protocol is intended as a general guide for owner/user/organizer with consultant, contractor, Subcontractor, Vendor/Supplier and Fabricator, foreman and workers in preventing COVID-19 outbreak in the construction project.
 - b. This protocol is part of the overall policy to realize the safety of construction. Safety of construction is occupational safety and health; Public safety; and safety of the environment in every phase of construction (life cycle of building and infrastructure development).
 - c. This protocol is valid in construction projects organized by the Government and/or local governments and/or National State-Owned Enterprises (BUMN), as well as private and/or joint investments. Each stakeholder in a construction project can follow up on the implementation of this Protocol following their respective company policies.
2. Establishment Preventive Task Force COVID-19
 - a. The owner/user/organizer with consultant Supervisor and/or contractor shall form the COVID-19 preventive Taskforce.
 - b. The Taskforce is at least 5 (five) persons consisting of Chairman concurrently member and 4 (four) members representing owner/user/organizer, consultant, contractor, subcontractor, Supplier Vendor.
 - c. The Task Force shall have the duties, responsibilities and authorities to conduct: (i) socialization, (ii) education, (iii) promotion of techniques and (iv) the method of prevention of COVID-19 in the field project, (v) examination of potentially infected persons, whether managers, engineers, architects, employees/staff, foreman, workers and project guests, (vi) identify potential COVID-19 hazards in the site, (vii) health checks related to the potential for COVID-19 infection of all workers and project guests, (viii) monitoring the health conditions of workers and controlling mobilization/demobilization of workers, and (ix) procurement of health facilities in the field.

3. Provision of Health Facilities in The Site
 - a. Contractors must provide a clinic room in the site equipped with adequate health facilities, such as oxygen cylinders, body temperature meters (Thermoscan), blood pressure gauges, medicines, and medical personnel.
 - b. The contractor shall have the operational cooperation of health protection and Prevention of COVID-19 with the hospital and/or public health center with the project site for emergency measures (emergency).
 - c. Contractors must provide body temperature measuring facilities (thermoscan), handwashing with soap disinfectant (hand sanitizer) include handwashing facilities, tissue, masks in the Office and site projects for managers, engineers, architects, employees/staff, foreman, workers and project guests.
4. Implementation of COVID-19 Prevention in The Site
 - a. Task Force to install the poster (flyers) both digital and physical about the appeal/COVID-19 prevention recommendations, such as handwashing, wearing masks, to be deployed or installed in strategic places on the Project site.
 - b. The Joint Taskforce of the Medical officer shall provide explanation, recommendation, campaign, promotion of COVID-19 prevention technique in each morning (Safety morning talk).
 - c. Task Force prohibits an ill person with a temperature indication of > 38 degrees Celsius (all managers, engineers, architects, employees/staff, foreman, worker and project guests) to come to the project location.
 - d. The medical officer performs measuring the body temperature to all workers, and employees with the Security Staff and the security personnel every morning, afternoon and afternoon.
 - e. If found managers, engineers, architects, employees, foremen and workers in the project site are exposed to the COVID-19 virus, the Medical Officer assisted by the Project Safety Officer conducts evacuation and disinfecting spraying at the site, facilities, handles and work equipment.
 - f. Report to PPK if a positive worker and/or patient under surveillance (PDP) has been found and recommends temporary suspensions of activities.

COVID-19 PREVENTION PROTOCOL MECHANISM IN CONSTRUCTION PROJECT



Source: Ministry Instruction (INMEN PUPR No. 02/IN/M/2020 tentang Protokol Pencegahan Penyebaran Corona Virus Disease 2019 (COVID-2019) dalam Penyelenggaraan Jasa Konstruksi)

For all workers, regardless of specific exposure risks, it is always a good practice to:

- Frequently wash hands with soap and water for at least 20 seconds. When soap and running water are unavailable, use an alcohol-based hand rub with at least 60% alcohol. Always wash hands that are visibly soiled.
- Avoid touching eyes, nose or mouth with unwashed hands.
- Practice good respiratory etiquette, including always wearing a mask.
- Avoid close contact with other people.
- Stay home if sick.
- Recognize personal risk factors.

1.4.7.2. Risk Control

Potential Danger is something that has the potential for an incident to result in a loss. Risk is a combination of possible hazard and likelihood of occurrences.

The types of accidents that often occur in construction projects are as follows:

- a. Fall down
- b. Falling object hit
- c. Step on, stumble, and bump
- d. Pinched and trapped
- e. High temperature / flammable contacts
- f. Mains contact
- g. Contact with hazardous materials (Chemical / Radiation)

For this reason, Contractor is required to carry out a Safety Monitoring Plan by doing the following:

- a. Prepare a work plan with work methods that pay attention to:
 - Risks that may arise from each type of work to be performed.

- Pay attention to the types of accidents that often occur in these activities.
- The existence of construction equipment that moves.
- For critical locations or actions that would pose a hazard to workers, Contractor is required to provide an officer who helps alert Workers when doing their work.
- b. Contractor is required to provide safety equipment in accordance with the type and location of work to be carried out.
- c. If there is any activity that will cause a spark or source of fire, Contractor is required to provide a standby officer with a Portable Fire Extinguisher.
- d. The Safety Monitoring Plan Form must be submitted and signed by the Supervisory Board before the work concerned is carried out.

Jobs that require a Safety Monitoring Plan and a work permit from the Supervisory Board:

- a. Working in a confined area, narrow, sewer
- b. Work-related to maintenance, cleaning, direct contact with the highway that is being used
- c. Use dangerous chemicals
- d. Use flammable material
- e. Use explosive material
- f. Electricity-related work
- g. Work by diving
- h. Install, dismantle, move scaffolding
- i. Move heavy items/objects
- j. Demolition work
- k. Work outside normal working hours without The Consultant
- l. Excavation of more than 2 (two) meters
- m. Working at height

1.4.7.3. Worker Facilities

- a. Worker beds
Contractor is required to provide worker beds outside the project site for beds, breaks, changing clothes and safe clothing storage. The size of the beds is quite comfortable for workers equipped with toilets and safe cooking places.
- b. Drinking water
Drinking water is available for workers who meet health standards.
- c. Clean water and Toilet
There is a clean water tub of sufficient size to wash hands to maintain cleanliness and an adequate number of toilets for the number of workers available.
- d. Cooking place, Worker Canteen.
Workers' cooking places and canteens are outside the project site. No cooking is permitted at the Construction Project site.
- e. First aid.
Every activity of work carried out in the workplace carries the risk of work accidents (mild to severe). Various preventive measures are taken so that accidents do not occur. In addition, the skills to perform first aid measures are still needed to deal with the possibility of an accident. Therefore, in every workplace must have a First Aid officer (First Aid), or at least every employee has the skills to do first aid when a work accident or MEDICAL emergencies occur.

1.4.7.4. Personal Protective Equipment (PPE)

Contractor is required to provide Personal Protective Equipment (PPE) for Workers and Guests who come to the project site by providing work safety equipment that serves to prevent and

protect Workers and project visitors from possible work accidents. The main PPE that must be provided is protective helmets and safety shoes while other PPE is provided according to the type of work performed. Various types and types of PPE can be:

- a. Helmet: Cap / Head protection Protects from falling objects, hard objects colliding, hit by heat and rain;
- b. Safety Shoes: Protective feet Protects feet from sharp objects, tripping on hard objects, pressure and punches, wet, slippery and muddy floors, adjusted for the type of danger;
- c. Safety Glasses: Glasses / Las Shield Protects from welding rays, glare, flying particles, bounced powder, radiation, dangerous liquid splashes;
- d. Earplug: Ear protection / Earmuff Protect from painful sounds for too long, with noise limits above 85 db;
- e. Mouth / nose / oxygen masks: Protects against work that uses chemical materials/powders, contaminated air, dust, smoke, insufficient oxygen levels;
- f. Gloves / rubber / leather / fabric / plastic: Protect hands from corrosive chemicals, sharp and rough objects, keep materials clean, get electrocuted;
- g. Safety belt / harness: Protect from the danger of falling from working height above 2 meters and around the building;
- h. Protective Vest with Scotchlite: to help the user visibility at night or in dark places;
- i. Life jacket: Protect from the danger of falling into the water, drowning, unable to swim.

All PPE equipment used meets SNI standards. During work, workers must use suitable work clothes, shirts with sleeves and long pants.

1.4.7.5. Signs and Alerts

Safety Sign / OHS Sign is a visual media in the form of a pictogram to be placed in the project area that contains messages so that every Worker always pays attention to aspects of work health and safety.

The function of the Safety Sign / OHS Sign is as follows.

- a. To find out restrictions or fulfil orders/requests, warnings or to provide information
- b. Prevent accidents (signal to danger)
- c. Indicates the location of safety and fire fighting equipment
- d. Give directions and instructions on emergency procedures.

Contractor is required to provide sufficient Safety Sign / OHS Sign for the above matters

1.4.7.6. Heavy Equipment / Mechanical Operation

General mechanical heavy equipment such as excavators, motor graders, bulldozers, wheel loaders, Vibro rollers, pneumatic tire rollers, dump trucks, Concrete Molen, Concrete Pump etc.

Contractor shall provide and pay attention to the following matters:

- a. Feasibility of Mechanical Heavy Equipment, there is an inspection and is declared by a competent Mechanic/officer and the equipment operated by the operator has competence (SIO) that is still valid;
- b. Every preparation for operation of the equipment must be carried out without a load test first, which involves safety: brakes, gears, steering, rearview mirror, arm movements, alarms and backward signs, turn signal if everything is good then it can operate;
- c. If working on a crossing road where there are other road users, the Operator must work/move in the same direction (not opposite) so as not to be surprised, shocked or unable to suspect the movement;

- d. If working in a location where there are other activities, the operator must be assisted by 2 officers who give the signal of assistance and observers of the surrounding activities;
- e. When the operation is complete, the tool position must be safe: neutral gear, bucket lowered, cab and panel compartments closed, engine off, parked at the designated location. (within a safe distance from road users and activities in the environment);
- f. Installed a warning sign not to rest in and around the equipment for the operator or other workers;
- g. Contractor must not use vehicles that emit very loud noise (noise). In residential areas, a noise disturbance must be installed and maintained always in good condition on all equipment with motorcycles, under Contractor's control;
- h. Contractor must also avoid using heavy noisy equipment in certain areas until late at night or in vulnerable areas such as near Settlements, Offices and others.

1.4.7.7. Fire Prevention

Fire is an event that can cause loss to life, production equipment, production processes and work environment pollution. Especially in the event of a large fire that can paralyze or even stop the construction process, so this gives a very big loss.

To prevent this, the Contractor is obliged to make efforts to extinguish the fire, such as:

- a. Control of every form of energy;
- b. Provision of detection facilities, alarms, fire extinguishers and evacuation facilities
- c. Control of the spread of smoke, heat and gas;
- d. Establishment of fire suppression units at workplaces;
- e. Conducting regular fire fighting exercises and drills;
- f. Have a fire emergency management plan book for workplaces employing more than 50 (fifty) workers and or workplaces with the potential for moderate and severe fire hazards.

Contractor shall train its workers in efforts to control each form of energy, such as:

- a. Identifying all energy sources in the workplace/company in the form of equipment, materials, processes, work methods and the environment that can cause a firing process (heating, sparks, flames or explosions);
- b. Conduct assessment and control of fire risk based on laws and regulations or applicable technical standards;
- c. The project location is not allowed at all to smoke.

1.4.8. Termite Resistant Works

Scope of Work

- 1. Provide labour with materials, equipment and other aids to carry out work as stated in this specification with good results and accepted by The Consultant.
- 2. This work includes soil maintenance for termites for the entire building area.
 - a. The land around the building
 - b. Other parts deemed necessary

Material Requirements

- 1. Use a termite-resistant material that is concentrated (concentrate) can be dissolved or can be diluted with water specially formulated to eradicate the spread of termites. Oil fuels are not justified as diluents, provide solutions containing Chlordane / Drildrin / Gama BHC chemicals or approved by the authorities.
- 2. Dilute with water to the concentration recommended by the manufacturer.

3. Other solutions may be used if recommended by the manufacturer approved by local regulations, for this use a solution that is not harmful to plants.

Terms of Implementation

1. Anti-termite for soil.
 - a. Prepare the surface of the area to be carried out work of anti-termites. Get rid of foreign objects that can reduce the effectiveness of treatment. Loosen and level the soil surface that will be given an anti-termite, except for areas that have been compacted, under the slab and foundation if recommended by the manufacturer of anti-termite work can be done before soil compaction is carried out.
 - b. This work must be carried out by pest control companies that have received permission from the authorities.
 - c. Put a warning sign on the area that has been given termites and get rid of the warning sign if other construction work can continue.
 - d. Repeat the termite work if the area replaced by termites is disturbed by further work, excavation, landscape, site grading or other construction work.
 - e. Termite guarantee by the applicator is minimal 30 (thirty) years.

CHAPTER 2. TECHNICAL SPECIFICATION OF STRUCTURE WORKS

2.1. TECHNICAL SPECIFICATION FOR BORE PILE WORK

2.1.1. General

Bore Pile is a foundation work that is carried out to make a deep foundation by making a hole in the soil with a certain diameter and depth that includes steel reinforcement into the hole by pouring concrete into the hole.

For this project, the deep hole refers to the structure drawing of foundation.

2.1.2. Bore Piles Specification & Tools

Bore Pile for anutapura hospital :

- Model : Concrete bore Pile
- Fc Concrete : F'c : 300 kg/cm²
- Size of Pile : Diameter 500 MM
- Length of Pile : 12000 MM
- Reinforced Steel (Concrete) : Steel Bar 12 Diameter 16 MM
- Spiral : Steel Bar Diameter 10 @ 100/200 MM
- Allowable design load : 701,2 Kn -- > 71,5 ton
- Maximum bore load : 143 ton (200% x Design load)
- Bore machine : Auger Machine

Bore Pile for Tora Belo hospital (Pinus / Ebony) :

- Model : Concrete bore Pile
- Fc Concrete : F'c : 300 kg/cm²
- Size of Pile : Diameter 400 MM
- Length of Pile : 18000 MM
- Reinforced Steel (Concrete) : Steel Bar 12 Diameter 13 MM
- Spiral : Steel Bar Diameter 10 @ 100/200 MM
- Allowable design load : 814,4 Kn -- > 83,04 ton
- Maximum bore load : 166,08 ton (200% x Design load)
- bore machine : Auger Machine

2.1.3. Soil Condition

The sub-surface materials generally consisted of in average 5 meters of sand / silty sand fill material. The consistency of fill ranged from very dense at the top to loose with depth. Soft clay layer in thickness varying between 1.5 to 7 meters was found below the fill material. The main soil types encountered underlying the upper soft clay layer include silty clay, silty sand, sandy silt, tuffaceous / cemented sand, and tuffaceous silt. The consistency of cohesive soils was medium stiff to very stiff while the granular soils are medium dense to very dense and some were cemented.

2.1.4. Stake Out Installation & Horizontal / Vertical Position Tolerance

The Contractor is responsible for stake out installation for pile position and must be approved by the Consultant/UNDP before commencing the Boring works.

Bore Pile position from each bore must be signed by stake out with 300 mm height from the surface.

Before commencing the works, the Boring, bore position must be check and exactly in a vertical position.

2.1.5. Marking on Concrete Bore Piles

Every bore hole for pile must have a reference number, date of concrete pouring, and before boring, each section must be marked at every 0.5 m intervals.

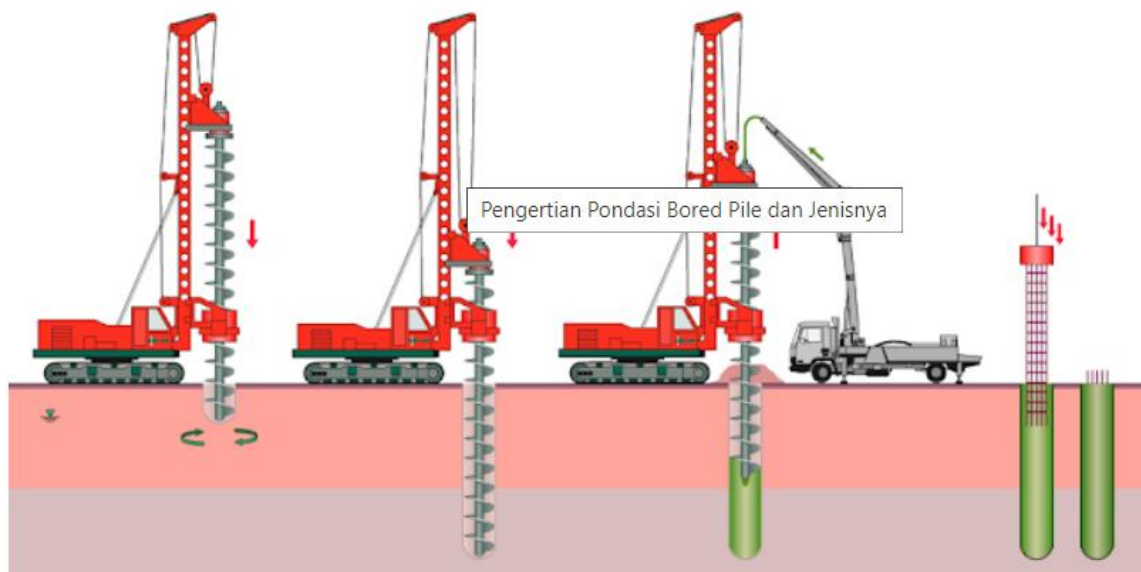
2.1.6. Bore Piling Records

Each bore pile will be recorded for every 1.00 m depth. The pile will be penetrated until reaching maximum jacking load 50 ton (200% design load) unless otherwise noted by the Consultant/UNDP. Contractor shall submit every report of pile-driven to the Consultant/UNDP.

Piling Records Report shall be consist of :

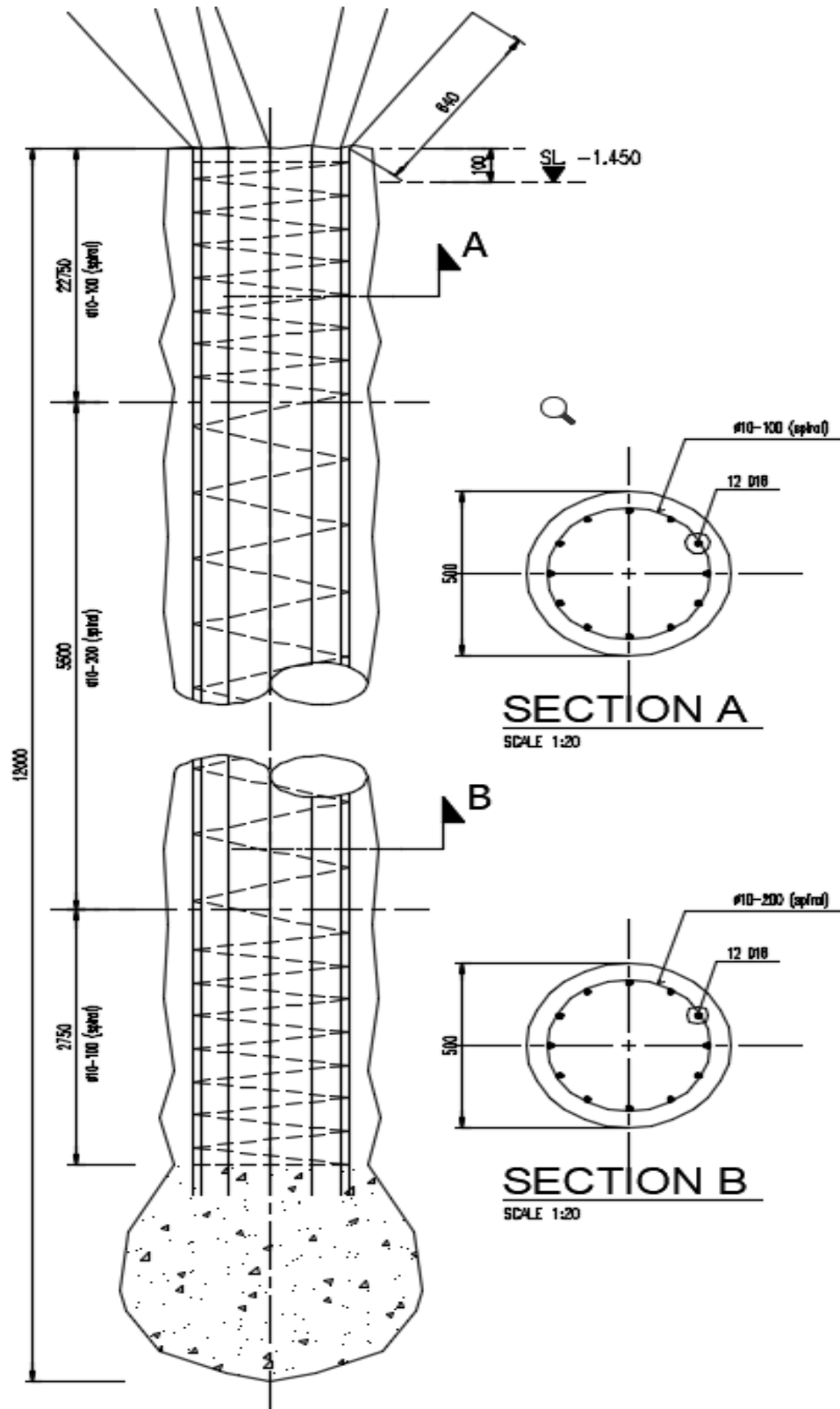
- a. Name of Project
- b. Bore hole Location
- c. Bore Pile Dimension
- d. Concrete Strength
- e. Date of concrete pouring
- f. Allowable design load
- g. Total length of bore pile
- h. Ground level
- i. Bottom of bore pile elevation
- j. Cut-off level
- k. Pile effective length
- l. Weather
- m. Disturbance
- n. Discrepancy when installation.

2.1.7. Instalation Stages

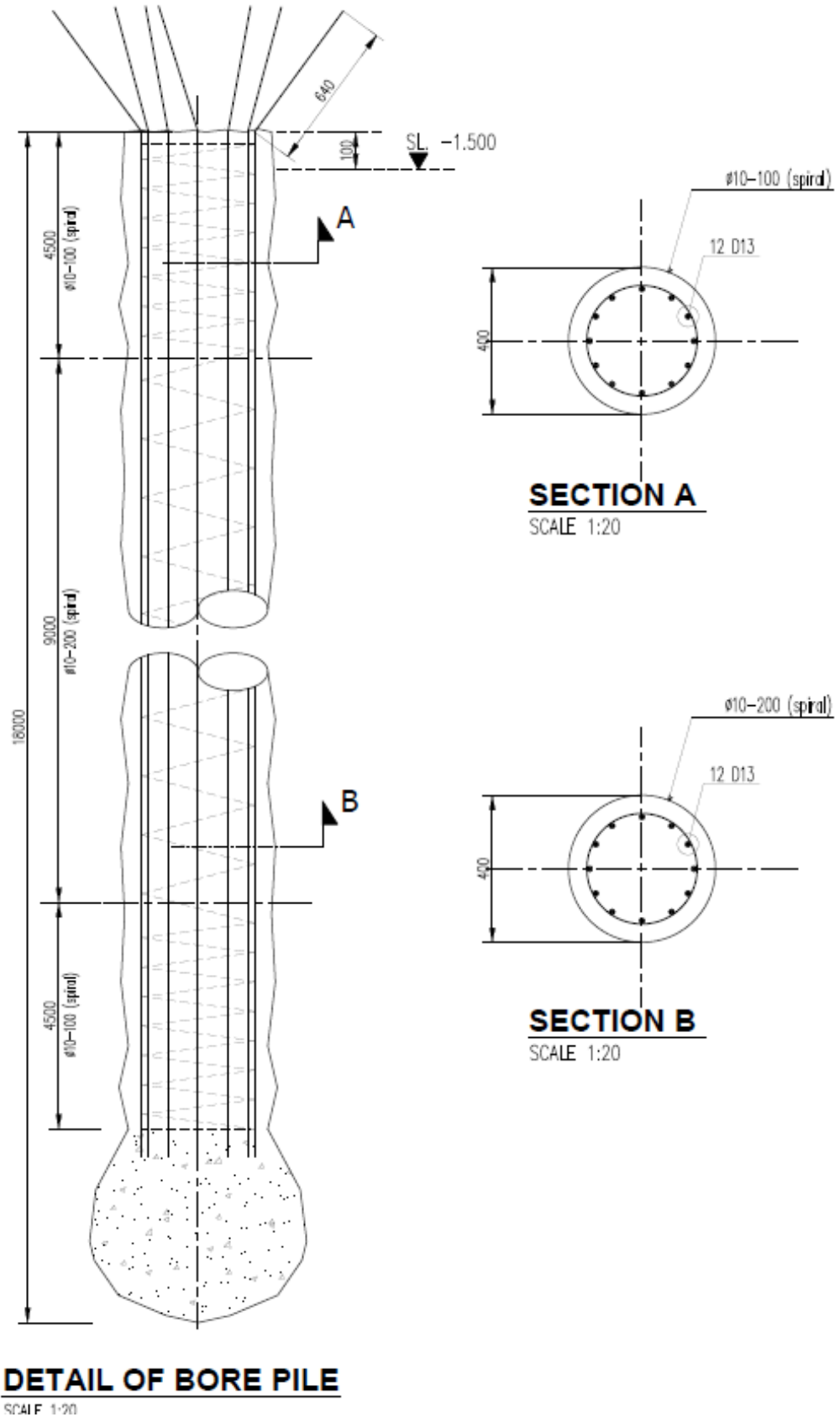


2.1.8. Attachment

A. Bore Pile for Anutapura Hospital = 500mm (Diameter)



B. Bore Pile for Tora Belo Hospital (Pinus / Ebony) = 400mm (Diameter)



LAPORAN PEMASANGAN TIANG BORE SISTEM AUGER

PROYEK :

JENIS BANGUNAN :

POSISI TIANG BOR :

DATA-DATA BOR TIANG

- Ukuran :

- Mutu Beton :

- Tanggal Cor :

- Lampiran Gambar :

NO. URUT BORE :

NAMA OPERATOR :

NO. ALAT :

Tanggal Bore :/...../.....

Jam Mulai :

Jam Selesai :

Total Jam : Jam

TOTAL PANJANG TIANG : m

BESI UTAMA :

BESI SPIRAL :

CATATAN PENGAWAS :

.....

....

.....

....

Mengetahui :

KONTRAKTOR BOREPILE
PELAKSANA

ARKONIN EMP

UNDP

(.....)

(.....)

(.....)

2.2. TECHNICAL SPECIFICATION FOR EARTH WORK

2.2.1. Scope of Works

This specification covers the requirements for earth work such as clearing, grubbing, excavation, filling, backfilling and relevant items to be performed for Inpatient Buildings, Pharmacy and Maternity Building in two hospitals in Central Sulawesi, Indonesia.

2.2.2. References

The requirements contained in the latest editions of the following standards shall form an integral part of the requirements of this specification in the manner and to the extent specified herein.

ASTM D1557 - Test Method for Laboratory Compaction Characteristic of Soil Using Modified Effort (56000 ft-lbs/cuft (2700 kN-M/cuM))

ASTM D1556 - Test Method of Test for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

2.2.3. General Requirements

- (1) The whole site within the boundary limits indicated on the design drawings shall be cleared of all trees, bushes, vegetable growth, roots, humus, debris and other existing obstructions.
- (2) All other permanent obstruction above and below ground like road or concrete pavement, ditch, burning pit, building or workshop, foundation and piping shall be relocated and/or demolished as directed and shall be removed from the site.
- (3) Site conditions which exist shall be inspected and assessed before commencement of the work on site.
- (4) All labour including all necessary excavating, transporting, lifting, haulage and transport equipment to deal with every class of materials shall be provided.
- (5) All excavating and earth moving plant and machines shall be of appropriate and shall be maintained at all times in good working order.
- (6) On completion of the work, all plant, equipment tools and all temporary works, surplus excavated materials and debris shall be removed from the Site to leave the Site clean.

2.2.4. Materials

- (1) All materials used for filling, backfilling and banking shall be free from organic matter, rubbish, broken pieces of concrete, and other foreign substances and shall be approved by the Consultant/UNDP prior to use.
- (2) Materials used for back filling around foundations, structures and pits shall not contain stones and the lump of soil exceeding 50 mm in size.
- (3) When filling large areas for site preparation and site reclamation the soil shall not contain stones and lumps of soil exceeding 150 mm in size.
- (4) Clayey soil shall be used for the construction of earth dykes, unless a lining is applied to the surface of the dyke to prevent liquid leakage.
- (5) Materials used for back filling around underground piping and cables shall be granular materials not containing stones or lumps which shall pass through a 5 mm sieve.
- (6) When back filling around concrete pipes and ductile pipes other suitable materials not harmful to the surface of pipes shall be subject to approval by the Consultant/UNDP.

2.2.5. Clearing and Grubbing

- (1) All vegetation and obstacles, surface and underground shall be cleared from the site prior to excavation or filling.
- (2) All organic topsoil shall be stripped and deposited in the area designated on the drawings or as directed by the Consultant/UNDP. The depth of stripping shall be approved by the Consultant/UNDP.
- (3) Roots of trees and any obstacles projecting above the finished surface shall be grubbed and replaced with suitable materials approved by the Consultant/UNDP. The grubbed materials shall be disposed of as directed by the Consultant/UNDP.
- (4) Proper temporary drainage shall be provided and maintained earthwork prior to starting.

2.2.6. Excavation

- (1) The Contractor shall notify the owner technically in writing at least 3 days prior to the start of any excavation subject to approval from The Consultant/UNDP.
- (2) Excavation shall be done to the dimensions, levels, lines and profiles indicated on the drawings or as otherwise specified by The Consultant/UNDP.
- (3) The faces and beds of all excavations, after being excavated to the required dimensions, shall be carefully trimmed to the required profiles and levels, and be cleaned of all loose mud, dirt and other debris.
- (4) No excavation shall be refilled or built upon until the excavation has been inspected and approved by The Consultant/UNDP.
- (5) If sheeting and shoring are required, a detailed scheme indicating type, depth, installation procedure and relevant detail shall be submitted to The Consultant/UNDP or review before installation.
- (6) If mud or foreign matter is encountered at the excavated bottom, such matter shall be excavated and replaced with suitable materials.
- (7) Over-excavation below the specified level shall be filled with suitable material or with lean concrete up to the specified level of the foundation bottom and approved by The Consultant/UNDP.
- (8) Where an existing facility to be encountered below grade during excavation the location shall be examined in advance and excavation shall be carefully done so as not to damage such facility.
- (9) The width of the trench at the bottom of underground piping shall be in accordance with the construction drawings and based on pipe size, depth and soil condition but shall not be less than the pipe diameter plus 500 mm to keep access for inspection and mechanical compaction.
- (10) Sides of excavation shall be stabilized by cutting the sides to the proper stable angle or by any other suitable methods and maintained during the works.
- (11) Should the article and findings such as relics and fossils be discovered in excavation area or elsewhere, it shall be informed to The Consultant/UNDP and such things shall be disposed of with care according to the instruction of The Consultant/UNDP.
- (12) Water, which may affect construction work, flowing in from outside shall be drained away by suitable means.

2.2.7. Disposal of Excess Soil

- (1) Excess soil shall be disposed off at the area designated by The Consultant/UNDP.
- (2) Excess soil shall not be mixed with construction debris and rubbish.
- (3) The surplus soil disposal area shall be properly drained and graded.

2.2.8. Back Filling (Existing Material)

- (1) Back filling shall not be allowed before forms are removed and trash, debris, water and sludge are cleared and construction below grade is inspected, tested and approved.
- (2) Back filling shall be done in layers not exceeding 30 cm in thickness before compaction unless otherwise specified on the drawing.
- (3) Topsoil or material containing vegetation shall not be used as back fill material.
- (4) Compaction of the materials shall be accomplished with equipment approved by The Consultant/UNDP. If there is any trouble with Contractor Equipment, Contractor shall immediately repair that such equipment in 48 hours during that time Contractor can not operate the mentioned equipment, Contractor shall replace with the new equipment to substitute the broken equipment.
- (5) Back fill material shall have the proper moisture content for the required degree of compaction and be placed carefully around the structures and thoroughly compacted to prevent any damage to the permanent work.
- (6) Back fill around underground piping and cables shall be accomplished in the following manner:
 - a) Granular materials shall be used to back fill around underground piping and cables to a depth of 20 cm above the top of pipes and 15 cm above the top of cables.
 - b) Material from excavations may be used as back fill material above pipe. However, the material shall be subject to the approval by The Consultant/UNDP.
- (7) Back fill material shall not be placed against unsupported walls until the mortar or concrete has attained sufficient strength for supporting the back fill load.
- (8) Back fill material shall be compacted to meet the requirements of article 2.2.11 of this specification.

2.2.9. Filling and Compaction

- (1) Filling shall be done in layers not exceeding 50 cm in thickness before compaction and compacted thoroughly using approved equipment.
- (2) Each layer of soil shall extend over the full width of the embankment.
- (3) Fill and embankment shall be compacted to the lines and grades indicated on the drawings.
- (4) Material shall be compacted to meet the requirements of article 2.2.11.
- (5) The section of the fill or embankment in which the sample fails the test specified in article 2.2.15 shall be completely removed and reconstructed to meet the requirements of article 2.2.11.

2.2.10. Preparation of Base for Roads and Foundation

- (1) Soft soil and obstacles encountered in the subgrade shall be removed and replaced with suitable material as approved by The Consultant/UNDP.
- (2) The base shall be compacted as specified on the drawings before placing fill material.
- (3) The base shall be true to the line and elevation showed on the drawings.

2.2.11. Compaction

- (1) Unless otherwise specified on the drawings, back fill material shall be compacted to not less than 90% of maximum dry density determined by ASTM D1557.
- (2) Soils under foundations or structures shall be compacted to not less than 90% maximum dry density for piled foundations and to not less than 95% maximum dry density for spread foundations.
- (3) Maximum dry density shall be determined by ASTM D1557.
- (4) Before commencing compaction the maximum thickness of each layer before compaction and the minimum number of passes by the compaction equipment shall be determined by

the field compaction test specified in article 2.2.15.3 to ensure that compaction meets the specified requirements. The above maximum thickness, compaction equipment and the minimum number of passes shall be approved by The Consultant/UNDP.

- (5) The following measures shall be taken to control the moisture content of dry soil :
 - a) The thickness of each layer shall be limited to a thickness through which sprayed water is absorbed to the bottom of the layer. When the soil absorbs more water than necessary for the compaction compacting operation shall be started after the moisture content becomes suitable for compaction.
 - b) The material and water shall be mixed prior to filling by construction equipment such as shovel or backhoe until the optimum moisture content is obtained.
 - c) Other methods may be applicable if approved by The Consultant/UNDP.

2.2.12. Drainage Area

- (1) In order to provide suitable drainage facilities to prevent flooding of the graded areas and drain road construction areas, drainage area shall be provided.
- (2) Drainage shall consist of open type earthen ditches running parallel and adjacent to roads.
- (3) The slope and shape of temporary drainage ditches shall be such to minimize erosion and sedimentation.

2.2.13. Dewatering

- (1) A suitable dewatering system shall be provided to maintain quality and ensure the progress of earthwork.
- (2) Where necessary a temporary sump and trench shall be installed for dewatering and, when no longer required, shall be backfilled with suitable material approved by The Consultant/UNDP.
- (3) Prior to excavation dewatering methods shall be submitted to The Consultant/UNDP for approval.

2.2.14. Tolerance

Unless otherwise specified the finished surfaces shall be within the following tolerances.

- (1) Excavation
Level of excavation bottom of foundation and structure :
+ 0.0 mm
- 20 mm
- (2) Banking

- Level of general banking	: ± 30.0 mm
- Level of tank foundation	: ± 30.0 mm
- (3) Site Surface

- Level of process and utility areas	: ± 30.0 mm
- Level of the other areas	: ± 50.0 mm

2.2.15. Inspection and Control

1. General

The final lines, levels and slopes shall be inspected to ensure that the specified requirements have been met.

2. Inspection of Compaction

- a) Back fill shall be accepted when the material has been placed in layers not exceeding the specified thickness and compacted with equipment in at least the number of passes determined in accordance with article 2.2.11.(1).
- b) Inspection of compaction for earthwork shall be performed in accordance with the compaction tests specified in article 2.2.15.3 hereunder.

3. Field Compaction Control

- a) The maximum dry density of back fill material shall be determined in accordance with ASTM D 1557.
- b) Dry density in place shall be obtained following ASTM D1556.
- c) Compaction shall be considered to meet the specified requirements when the value "C" shown below is not less than the value specified on the drawings or in the Job Specifications.

$$C = \frac{W}{W \text{ max.}} \times 100 \%$$

where ;

W : dry density obtained from ASTM D1556

W max. : maximum dry density obtained from ASTM D1557.

- d) A method determining the specified compaction, other than above, may be employed if approved by The Consultant/UNDP and provided that the relationship between the results of the adopted method and the specified density is established before the inspection. Compaction shall be considered to meet the specified requirements when this relationship is met.

Deviations from the above methods must be submitted in writing at the time of bid submission. No alternate methods will be accepted after bid evaluation.

4. Test Report

Test reports shall be prepared for all tests and submitted to the Consultant/UNDP immediately after the tests are completed.

2.2.16. Safety of Works

- (1) Temporary fences, guard rails, barricades, lights and other protective measures required for the safety of works and personnel shall be provided and maintained.
- (2) Method of the safety of works shall be met with the safety regulation of The Consultant/UNDP.

2.3. TECHNICAL SPECIFICATION FOR CONCRETE WORK

2.3.1. Scope

This specification covers the requirements for concrete work for Inpatient Pharmacy and Maternity Building of two hospitals in Central Sulawesi, Indonesia.

2.3.2. References

The requirements mentioned in the latest editions of the following codes and standards shall form an integral part of the requirements of this specification in the manner and to the extent specified herein.

ACI 117	Standard Tolerances for Concrete Construction and Materials.
ACI 211.1	Recommended Practice for Selecting Proportions for Normal and Heavy Weight and Mass Concrete
ACI 301	Specifications for Structural Concrete for Building.
ACI 304	Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
ACI 305	Recommended Practice for Hot Weather Concrete
ACI 313	Recommended Practice for Design and Construction of Concrete Bins, Silo and Bunkers for Storing Granular Material.
ACI 315	Manual of Standard Practice for Detailing Reinforced Concrete Structures.
ACI 318	Building Code Requirements for Reinforced Concrete.
ACI 347	Recommended Practice for Concrete Formwork.
ASTM A36/A36M	Specification for Carbon Structural Steel.
ASTM A185	Specification for Steel Welded, Wire Fabric, Plain for Concrete Reinforcement.
ASTM A615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
ASTM C31	Practice for Making and Curing Concrete Test Specimens in the Field.
ASTM C33	Specification for Concrete Aggregates.
ASTM C39	Test Method for Compressive Strength of Cylindrical Concrete
ASTM C94	Specification for Ready-mixed Concrete.
ASTM C109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50 mm Cube Specimens).
ASTM C143	Test Method for Slump of Hydraulic Cement Concrete.
ASTM C150	Specification for Portland Cement.
ASTM C172	Practice for Sampling Freshly Mixed Concrete.
ASTM C260	Specification for Air-Entraining Admixtures for Concrete.
ASTM C494	Specification for Chemical Admixtures for Concrete
ASTM C618	Spec. for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Concrete.
AWS D12.1	Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
-	Manufacturer's Specification

2.3.3. Materials

1. Cement

Cement shall be Portland cement conforming to ASTM C 150, Type-I, for all concrete structure.

2. Admixtures

- a) Admixtures to be used in concrete shall be subject to prior approval from Consultant/UNDP and shall conform to the following standards or be an approved equal to:

Air-entraining admixtures	ASTM C260
Water-reducing, retarding,	

- and accelerating admixtures ASTM C494
- Pozzolanic admixture ASTM C618
- b) Admixtures shall be the same composition as the admixture used in establishing the required concrete proportions.
- c) Accelerating admixtures containing calcium chloride shall not be used for reinforced concrete.

3. Water

The mixing water for the concrete shall be potable and shall be free from injurious amount of oil, acid, salt, alkaline, and organic matters. Non-potable water may be used if mortar test cubes made from non-potable water result in 7-day and 28-day strengths equal to at least 90 percent of strengths of similar specimens made from potable water. The strength comparison shall be made from identical mortar cubes, except for the mixing water, prepared and tested in accordance with ASTM C 109. Mixing water must not contain more than 1000 ppm of Sulphates and 500 ppm of chlorides.

4. Aggregates

- a) The aggregates for the concrete shall conform to the requirements given in ASTM C 33.
- b) Aggregates failing to meet the requirements of ASTM C 33, but which have been shown by special tests or actual service to produce concrete of adequate strength and durability, may be used if approved by The Consultant/UNDP.
- c) Sieve analyses conforming to the requirements given in ASTM C136 shall be carried out periodically and the test results shall be immediately submitted to The Consultant/UNDP for approval.

5. Reinforcing Steel

- a) Reinforcing steel bars and wire fabric shall conform to the ASTM A615, Grade 60 and ASTM A185, respectively.
- b) Certified mill test reports shall be submitted as requested by The Consultant/UNDP.

2.3.4. Storage of Materials

- (1) Cement shall be stored in weather tight buildings, bins, or silos which will provide protection from moisture and contamination. Sacks of cement shall not be stacked in piles exceeding 13 sacks. When storing cement in sacks the floors shall be a minimum of 30 cm above ground level and shall be paved with concrete to prevent the absorption of water.
- (2) The aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates.
- (3) Sand shall be allowed to drain until it has a uniform moisture content before it is used.
- (4) Reinforcing steel, whether fabricated or not, shall not be placed directly on the ground. Care shall be taken to prevent reinforcing steel from being deformed during storage.
- (5) Admixtures shall be stored as recommended by the manufacturer.

2.3.5. Proportioning

1. Strength of Concrete

The compressive strength of concrete to be used shall be designed as specified in the drawings.

Mix proportion of concrete shall be determined in accordance with the provisions in **Table 2.5 Sec. 2.3.15**.

2. Slump of Concrete

- a) Slump of concrete shall be in accordance with **Table 2.1**.

Table 2.1. Slump of Concrete

Type of Construction	Maximum (mm)	Minimum (mm)
Reinforced footings	75 (100)*	25 (50)*
Plain footings, caissons and substructure walls	75 (100)*	25 (50)*
Slabs, beams, and reinforced walls	125 (150)*	25 (50)*
Columns	125 (150)*	25 (50)*
Road pavement	75 (100)*	25 (50)*

* For concrete to be placed by pumping methods, the maximum and minimum slump of concrete shall be as shown in parentheses.

- b) Maximum slump shown in Table 2.1 may be increased 25 mm for methods of consolidation other than vibration.

3. Maximum Size of Coarse Aggregate

Unless otherwise specified or approved by The Consultant/UNDP, the maximum nominal size of aggregate shall not exceed :

- One-fifth of the narrowest dimension between sides of forms.
- One-third of the depth of slabs.
- Three-quarters of the minimum clear spacing between individual reinforcing bars.

4. Selection of Proportions

- The proportion of ingredients shall be selected in accordance with the requirements given in ACI 211.1-81 and to produce proper placeability, durability, strength, and other required properties.
- All proportions for concrete shall be approved by The Consultant/UNDP.
- The rule of proportions of ingredients including water-cement ratio shall be determined by trial mixing.

2.3.6. Mixing

- The concrete shall be mixed in a batch mixer capable of combining the aggregates, cement, and water thoroughly into a uniform mass within the specified mixing time and of discharging the concrete without harmful segregation.
- The operation manual including the following information - on the batching and mixing plant proposed - shall be submitted to The Consultant/UNDP for approval
 - Accuracy of scales for weighing concrete ingredients
 - Rated capacity of mixer
 - Recommended revolutions per minute of mixer
 - Method of charging aggregates and cement
 - Water tank capacity and type of water - measuring device
 - Maximum daily capacity of plant (8 hours)
- Except as provided in para. (4) below, batches of 0.74 cubic meter or less shall be mixed for less than 1 minute. The mixing time shall be increased 15 sec. for each 0.74 cubic meter of fraction thereof additional capacity. At least three-quarters of the required mixing time shall take place after the last mixing water has been added.

- (4) A shorter mixing time may be permitted if performance tests indicate that the time is sufficient to produce uniform concrete.
- (5) In hot weather mixing time shall be held to the minimum which will ensure adequate concrete quality and uniformity.
- (6) Mixer drums and blades shall be checked frequently during hot weather, and the interior of the mixer shall be free from accumulations that will interfere with mixing action.
- (7) Tolerances for measuring ingredients shall be as specified in ACI 304, Table 3.1.2, attached.
- (8) Use of air-entraining admixture and other chemical admixtures shall be made in accordance to ASTM C494.

2.3.7. Transporting

- (1) Concrete shall be transported from the mixer to the place of final deposit by the method approved by The Consultant/UNDP.
- (2) The method must prevent segregation, loss or contamination of the ingredients.
- (3) The maximum time from concrete mixing to final placing of concrete shall be as follows :

Table 2.2. Time Limit from Concrete Mixing to Placing

Concrete Grade	Ambient Temp.	Max. Time
High grade concrete (More than 270 kg/cm ² design strength)	25°C and lower	45 min.
	Higher than 25°C	30 min.
Ordinary Grade Concrete	25 °C and lower	60 min.
	Higher than 25°C	45 min.

Concrete transported for more than **Table 2.2** may be used if it is proved by tests that the concrete satisfies all requirements give in this specification and any other relevant document

2.3.8. Placing

- (1) Prior to concreting the interior of the forms shall be thoroughly clean and be free from all foreign matters and accumulated water. The interior of wooden forms shall be wetted prior to concreting.
- (2) Concrete shall be deposited as nearly as practicable at its final position to avoid segregation due to rehandling or flowing.
- (3) Concrete shall be placed at such a rate that concrete is plastic at all times and flows readily into the spaces between the bars.
- (4) Concrete that has partially hardened or been contaminated by foreign matters shall not be used.
- (5) Concreting, once started, shall proceed continuously until the placing of concrete for the specific pour is completed.
- (6) Maximum height of concrete placing per-one layer shall not exceed 3.0 m.
- (7) All concrete shall be thoroughly consolidated by suitable means, preferably by vibration during placing, and shall be thoroughly worked around the reinforcement, anchor bolts and other embedded fixtures, and into the corners of the forms. An adequate number of spare vibrators shall be kept always at the site during all concrete placing operations.
- (8) Construction joints other than those shown on the drawings shall be minimized and, if necessary to revise the quantity and positions, shall be approved by The Consultant/UNDP.

- (9) Where joints are to be made the surface of the concrete shall be cleaned thoroughly, roughened, and all laitance shall be removed by brushing or chipping and treated with a thin layer of neat cement before additional fresh concrete is placed.
- (10) The concrete surface of vertical joints shall be thoroughly wetted and coated with neat cement grout immediately before placing adjoining concrete.
- (11) Grooves shall be formed at construction joints as directed in the drawings.
- (12) All horizontal surfaces, unless otherwise specified, shall be given a wooden trowel finish. Where non-skid surfaces are required the surfaces shall be broom finished.
- (13) Concrete showing structural defects shall be demolished and replaced. Concrete showing only surface defects shall be chipped out to sound concrete, treated with an epoxy bonding agent and then patched with concrete of rich mortar or epoxy mortar.
- (14) The repair method for the above shall be subject to the approval from The Consultant/UNDP.
- (15) Holes left by withdrawal of tie-rods shall be filled solidly with cement mortar and be made flush.
- (16) The drop height for the concrete shall not exceed 1.5 meters. Temporary openings chute or hose shall be provided to avoid segregation of concrete where the drop height exceeds 1.5 meters.
- (17) Reinforced concrete must not be placed directly upon the ground. Base could be either a blinding concrete or polyethylene sheeting of suitable thickness.

2.3.9. Curing

- (1) All concrete surfaces shall be kept wet at least 5 days after placing except the high early strength concrete shall be maintained for at least 3 days.
- (2) The concrete surfaces shall be covered with burlap, cotton fabric or other suitable material, such as a curing compound, immediately after finishing the surface.
- (3) The covering material shall remain in place during the full curing period. The covering material can be removed when the concrete has hardened sufficiently, provided that the surface is immediately covered with sand, straw, or other similar materials. In either case, the materials shall be kept thoroughly wet during the full curing period.
- (4) Wood forms shall be kept moist during the curing period.
- (5) The curing compound shall be applied in accordance with the manufacturer's directions.
- (6) Sea water shall not be used for curing.
- (7) No load shall be placed on the concrete during the curing period unless permission is given by The Consultant/UNDP.

2.3.10. Repairing Defective Concrete

The Consultant/UNDP shall be immediately notified if defects, such as honeycombing or detrimental cracking, are found in the concrete after the forms are removed. All defects in the concrete shall be repaired in accordance with the requirements given in ACI 301, Chapter 9, and the following stipulations:

- (1) Repairs shall not be carried out unless the repair procedure is approved by The Consultant/UNDP. All defects detrimental to structural strength, durability, and water tightness shall be repaired by the method approved.
- (2) All honeycombed and other defective concrete shall be removed to sound concrete. The sound surface shall be inspected by The Consultant/UNDP prior to patching as specified in para. 8.(13).

2.3.11. Formwork

- (1) Design of the formwork and its construction shall be done to attain safe installation and shall be approved by The Consultant/UNDP.
- (2) Before concreting is commenced the forms shall be thoroughly cleaned and free from all dust, dirt and other debris. Temporary openings shall be provided where necessary to drain away water and rubbish.
- (3) All form work, whether timber or metal, shall be fixed in perfect alignment and securely braced to withstand displacements and deflections due to construction loads, such as vertical, horizontal and impact construction loads.
- (4) Where necessary to maintain the specified tolerances, the form work shall be cambered to compensate anticipated deflections caused in the form work by the weight and pressure of the fresh concrete and by construction loads. The tolerances for the installation of the formwork shall be as specified by ACI 347.
- (5) Waterproofed plywood forms shall be used for surfaces visible after construction.
- (6) Suitable moldings or chamfer strips shall be placed at the corners of column, beam, and wall forms where the concrete will be exposed to view.
- (7) All anchor bolts, pipes, angles, insert plates etc., to be embedded in or through the concrete shall be fixed firmly in the forms which shall be cut neatly and accurately for a tight fit.
- (8) The internal surface of the forms shall be coated with form oils or other releasing agents approved by The Consultant/UNDP prior to the placing of reinforcing steel.
- (9) Temporary openings shall be provided at the base of column and wall forms, and at other points where necessary, to facilitate cleaning and inspection immediately before the concrete is deposited.
- (10) Removal of Forms
 - a) Forms shall be removed in such manner to ensure the complete safety of the structure. Where the structure as a whole is adequately supported on shores, side forms of beams, girders, and columns, and similar vertical forms can be removed after a lapse of 12 hours during which the air temperature exceeds 10°C, or when the compressive strength of the concrete reaches 50 kgf/cm².
 - b) Forms and shoring in the form work used to support the weight of concrete in beams, slabs, and other structural members shall remain in place until the structure attains sufficient strength to support the dead load and other imposed loads. Field-cured specimens shall be used to estimate the structural strength.
 - c) Forms other than mentioned above and shoring shall remain in place for periods of time less than those shown in **Table 2.3**. If high- early-strength concrete is used, this period may be reduced if approved by The Consultant/UNDP.

Table 2.3. Removal Form work Schedule

	Clear Span between Support (C.S)	L.L ≤ D.L (Days)	L.L > D.L (Days)
Beam and Girder Soffit	C.S ≤ 3.0	7	4
	3.0 < C.S ≤ 6.0	14	7
	6.0 < C.S	21	14
Floor Slab	C.S ≤ 3.0	4	3
	3.0 < C.S ≤ 6.0	7	4
	6.0 < C.S	10	7

here; C.S ... Distance in meter between supports, referred to structural supports and not to temporary formwork or shores.

L.L. ... Live Load

D.L. ... Dead Load

- d) After removal of forms for the cable pit, the concrete surface shall be cleaned and all burrs and any injurious obstructions shall be removed.

(11) All form surfaces shall be cleaned before re-use.

2.3.12. Reinforcing The Steel Work

- (1) All reinforcing bars shall be bent cold before being placed in position.
- (2) Reinforcing bars shall be free from mud, dirt, loose mill scale, oil, grease, and any other foreign matters that may reduce the bond between the bar and the concrete
- (3) All reinforcing bars shall be placed exactly as shown in the drawings and be supported by an adequate number of small precast mortar blocks with tie wire cast-in, or with other approved chairs and spacer. The strength of the mortar shall be same or greater than that of the concrete.
- (4) Reinforcing bars shall be tied adequately at the inter sections with annealed steel wire and be held in position rigidly by using spacers, chairs, or hangers to prevent displacement by construction loads or by the placing of concrete.
- (5) Splices shall be located as shown in the drawings. Additional splices not shown in the drawings shall be subject to the approval of The Consultant/UNDP..
- (6) Reinforcing bar shall not be spliced in a line at one location but staggered at a distance equals to 30 times the bar diameters as a minimum.
- (7) Length of lap for splicing and concrete to reinforcing steel shall be as indicated in the drawing and standard drawing.
- (8) Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits or embedded items. When bar are moved more than one bar diameter or sufficient to exceed the above tolerances, the resulting arrangement of the bar shall be approved by The Consultant/UNDP.
- (9) When required or approved welding of the reinforcing steel shall conform to AWS D 12.1.
- (10) No welding shall be done at the bend of the bar. Welding of the crossing bars (tack welding) shall not be permitted except directed by The Consultant/UNDP. High strength rebars shall not be welded.
- (11) Fabricating and placing tolerances shall be specified in ACI 301 para.5.6. as attached.

2.3.13. Anchor Bolt Setting

Anchor bolt setting for the foundation shall be in accordance with the following stipulations :

1. Anchor Bolt with Template

- a) When setting anchor bolts with templates, supports shall be provided to avoid any movement of the anchor bolts templates at the time of concrete placing.
- b) Supporting frame for setting template shall not be fixed on the reinforcement bars or forms.
- c) Tolerance of template setting shall be as follows :

Table 2.4. Tolerance of Template Setting

Position	Orientation	Level	Verticality
± 3 mm	± 2 mm on the Periphery	+ 5 mm + 0 mm	(t/300) mm

2. Anchor Bolt with Gauge Plate

- a) Gauge plates shall be used for direct anchor bolt setting for steel structures, etc. where templates are not used.
- b) Gauge plate shall be firmly fixed to the forms.
- c) Tolerance for gauge plate setting shall be as follows :
 - Position : ± 3 mm
 - Level : + 5 mm
 - + 0 mm

3. Anchor Bolt with Anchor Box

- a) Size and depth of anchor box shall be according to the drawings.
- b) Tolerance of anchor box setting shall be as follows:
 - Position : ± 10 mm
 - Level : + 0 mm
 - 20 mm
- c) Anchor bolt shall be set after the inside of anchor box is cleaned and drained.
- d) Filling materials for the anchor box shall be concrete or mortar (cement 1 : sand 2 by volume) in ordinary cases.
- e) When specification of machine, equipment, etc. require the use of non-shrinking cement for filling anchor box, contractor shall use it and submit to The Consultant/UNDP the specifications catalogs and/or samples of non-shrinking cement for approval.

2.3.14. Grout and Mortar Finishing for Foundations

The grout and mortar finishing for the foundations shall be in accordance with the following stipulations:

- (1) The thickness of the grout or mortar finishing shall be as shown on the construction drawing.
- (2) In no case shall the thickness of the grout be less than 20 mm.
- (3) In the grout mixture, the ratio of cement to sand shall be 1 to 3 by weight.
- (4) Surface of concrete over which grout will be applied shall be rough.
- (5) Special non-shrink grout shall be used for support of large heavy duty and reciprocating equipment where close alignment must be maintained.
- (6) Grout shall be sloped from base plate to the edge of foundation for drainage.

2.3.15. Concrete Test

1. Mix Proportion Test

Prior to the commencement of concrete works, contractor shall perform mix proportion test to determine the kinds and mix proportion of cement, coarse aggregate, fine aggregate, water and admixtures.

Results of the mix proportion test shall be reported to The Consultant/UNDP in the prescribed form shown in the **Table 2.5** attached herewith.

Table 2.5. Result of Mixing Proportion Test of Concrete

Specimen No.				
Strength 28-days		(kg/cm ²)		
Cement type				
Maximum size of coarse Aggregate		(mm)		
Slump		(cm ²)		
Air Content		(%)		
Water cement ratio		(%)		
Fine Aggregate Ratio				
Unit Water Content		(kg/m ³)		
Absolute Volume (1/m ³)	Cement			
	Fine Aggregate			
	Course Aggregate			
Weight (Kg/m ³)	Cement			
	Fine Aggregate			
	Course Aggregate			
Admixture (CC/M ³) or (gr/m ³)				
Test Result for Compressive (Kg/cm ²)	Strength	7-day age specimen		
		28-day age specimen		
REMARKS				

2. Compressive Strength Test

Compressive strength tests shall be carried out in accordance with the following procedures:

- Compressive strength tests shall be performed by an apparatus approved by The Consultant/UNDP, and shall be in accordance with ASTM C-94.
- Obtaining samples of concrete for making compressive strength tests specimens shall be in accordance with ASTM C 172.
- A minimum of four specimens shall be made in accordance with ASTM C 31 unless otherwise specified.
- Two specimens shall be made for each test at the given age. At least, one test shall be done for each 100 cubic meter or fraction thereof; for each mix design of structural concrete to be placed in any one day.
- The age of strength tests, unless otherwise specified, shall be 7 days and 28 days.
- The strength of the concrete shall be considered satisfactory if the following requirements are met:
 - The average strength value of all specimens used in the three consecutive strength tests (average of six or more cylinders) equals to or exceeds the specified strength.
 - The value obtained in an individual strength test (average of two or more cylinders) does not fall below the specified strength more than 35 kg/cm².

3. Slump Test

- Slump test shall be made in accordance with ASTM C 143 unless otherwise specified.
- Frequency of slump test shall be determined based on the weather conditions and on the operating condition of the mixer; however, the tests shall be made at least twice a

day, once in the morning and once in the afternoon. The Consultant/UNDP reserves the right to slump test every load of concrete.

- c) Unless otherwise shown in the drawings, the tolerance for slump tests is shown in para 5.2. Table-1.

4. Air Content Test

Air content tests shall be carried out if requested by The Consultant/UNDP and in accordance with the requirements given in ASTM C 138, ASTM C 173, or ASTM C 231.

5. Water Filling Test for Concrete Ponds

Unless otherwise shown in the drawings, a water filling test shall be carried out before back filling the concrete ponds. Water shall be filled to the highest level expected and maintained for minimum of 24 hours. Concrete ponds shall be back filled only after obtaining the approval of The Consultant/UNDP.

2.3.16. Hot Weather Concreting

Concrete work in hot weather shall be in accordance with ACI 305.

2.4. TECHNICAL SPECIFICATION FOR STEEL WORK

2.4.1. Scope

This specification covers the requirements for shop fabrication of structural steel for Inpatients Pharmacy and Maternity Building of two hospitals in Central Sulawesi, Indonesia.

This specification covers : delivery of raw steel, shop drawing preparation, fabrication, completion of surface treatment, mark identification, packing, preparation for shipment, and shipping to site.

2.4.2. References

The requirements contained in the latest editions of the following standards shall form an integral part of the requirements of this specification in the manner and to the extent specified herein.

AISC	American Institute of Steel Construction
AWS D1.1	American Welding Society Standard
SSPC	Steel Structures Painting Council
ASTM	American Society for Testing and Materials
JIS	Japanese Industrial Standard
	Manufacturer's Specification.

2.4.3. Materials

Structural Steel	ASTM A 36, JIS G 3101 SS-400 or equal
High Strength Bolts	ASTM A 325, ASTM A 490, ASTM A 394
Common Bolts	ASTM A 307
Electrodes	ANSI/AWS A5.1
Stainless steel	ASTM A 240 type 304
Stainless clad steel	ASTM A 240 type 304
Aluminum	ASTM B 209

2.4.4. Preparation

- (1) Steel materials delivered to the shop shall be placed on sleepers so that the steel shall not be in direct contact with the ground.
- (2) Prior to marking, material with deformations shall be duly corrected in such manner so as not to injure the material. Removal of deformations shall be done either by a mechanical method or by heating (not to exceed 650°C).
- (3) Steel material shall be removed off all loose mill scale and foreign matter and be made clean. Mill scale shall not be removed during general preparation of steel. Mill scale shall be removed only whenever needed. For example: during surface preparation for painting and welding.

2.4.5. Cutting, Bending and Bolt Holes

1. Cutting

- a) Cutting of steel material may be done by either one of the mechanical methods of sawing, shearing, and grinding or by automatic gas cutting.
- b) Deformation and burst resulting from cutting shall be corrected or be ground smooth.

2. Bending

Steel materials shall be bent under ambient temperature or by heating not to exceed 650°C.

3. Bolt Holes

- a) Bolt holes shall be drilled or punched.
- b) Burst around the holes shall be removed properly.
- c) Holes shall be positioned accurately and shall correspond to each other where members meet.
- d) Tolerance of the holes shall be as shown in Figure-1.
- e) Diameter of holes for bolts other than anchor bolts shall be maximum 1.6 mm in excess of the nominal bolt diameter.
- f) Diameter of holes for anchor bolts shall be 5.0 mm in excess of the nominal bolt diameter.

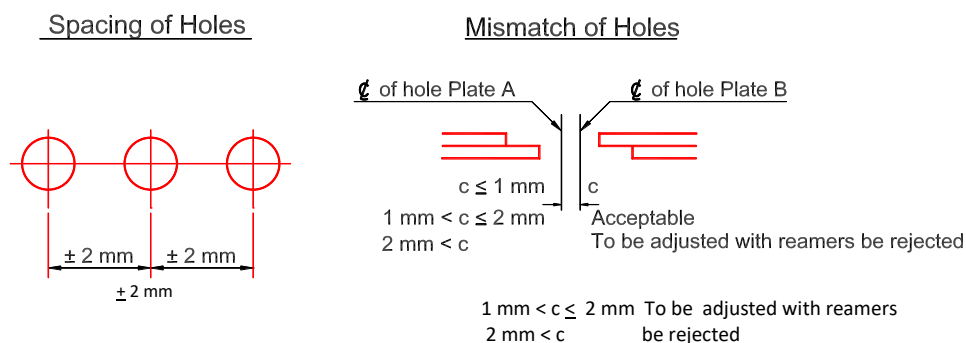


Figure 2.1. Tolerance of Bolt Holes

2.4.6. High Strength Bolting

1. Bolt Length

The required bolt length shall be determined by adding the value shown in **Table 2.6** to the grip length shown in **Figure 2.2**. Special bolts shall be in accordance with the manufacturer's specification approved by The Consultant/UNDP.

Table 2.6.
Length to be added to the grip length (l_1)

Bolt size	With one washer
M12	20 mm
M16	25 mm
M20	30 mm
M22	35 mm
M24	40 mm

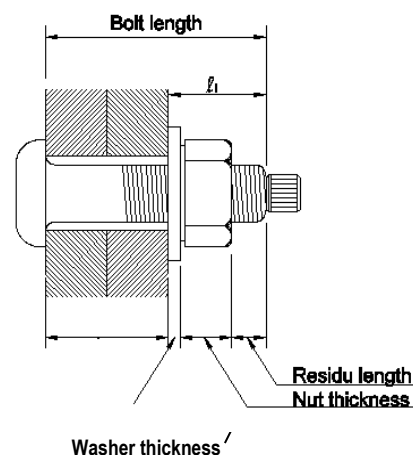


Figure 2.2. Bolt Detail

Note : The length determined by the above tables should be adjusted to the next longer size.

2. Contact Surfaces

Within the fabrication steel structural surfaces in the high strength bolt connection to come in contact with each other material shall be cleaned of any loose mill scale, dust, oil, lacquer or paint. Paint surface preparation (epoxy resin primer coat, inorganic zinc rich paint) might be applied to the surface.

Otherwise, the surface must be protected from dust by using a proper material, which then shall be removed prior to erection.

3. Handling Bolts, Nuts and Washers

When handling bolts, nuts and washers for transporting, storing or other purposes, precautions shall be taken so that the threads and coated surfaces will not be damaged. Bolts, nuts and washers shall be kept free from dust, moisture and other foreign matters and be prevented from rusting.

4. Inspection of High Strength Bolts

All high strength bolts shall be inspected visually in accordance with the manufacturer's specification. In addition to above, strength test for tension limit of bolts shall be randomly performed.

5. Tightening Bolts

Tightening bolts for structural shall be applied in accordance with the Construction Specification for Erection of Structural Steel.

2.4.7. Welding

1. General

- The vendor shall submit detailed welding procedures and welder qualification test records for The Consultant/UNDP approval prior to commencement of the work
- Welders, welding operators and tackers engaged in this work at vendor's shop, shall be qualified in accordance with ANSI/AWS D1.1.
- Welds shall be made only by welders, tackers, and welding operators who are qualified by the tests.

- d) All pre-qualified welding procedures to be used shall be referred to the Consultant/UNDP for its approval by a written procedure specification. The suggested form showing the required information in the procedure specification is given in Appendix-1.
- e) Except when the written evidence of a previous qualification test is accepted by the Consultant/UNDP, joint welding procedure to be employed in executing the work shall be qualified prior to use in accordance with Section 5 of AWS D1.1.
- f) Welding shall not be done when surfaces are wet or, exposed to rain, or high winds nor when welders are exposed to inclement conditions.
- g) The size and lengths of welds shall not be less than those specified in the standard drawing and detailed drawings, nor shall they be substantially in excess of those requirements without the approval of The Consultant/UNDP.
- h) The location of welds shall not be changed without the approval of The Consultant/UNDP.
- i) Base metal less than 3 mm thick is not acceptable in welding for fabrication of structural steel.

2. Preparation

- a) Edge preparation of welding joints shall be in accordance with Section 3.2 of ANSI/AWS D1.1 (about welding Process) after brushing and/or grinding to remove loose mill scale, slag, rust, grease and any other foreign materials.
- b) Prior to welding on previously deposited metal, all slag shall be removed and the weld and the adjacent base metal shall be cleanly brushed.
- c) Welding shall not be allowed when the surface of welding joints is wet, exposed to rain or heavy winds.
- d) For SMAW (Shielded Metal Arc Welding) process, the following type of electrode shall be used.
 - For major beam connection.
Low hydrogen type electrode (AWS class SFA 5.1, E7016 for roof pass and E7018 for capping, or equivalent).
 - For miscellaneous connection such as handrail etc.
High titania potassium type electrode (AWS class SFA 5.1, E6013).
Other welding materials such as high cellulose type or illuminate type shall be prohibited.
- e) Drying of electrodes shall be performed in accordance with following instruction as per table below before being used.

Table 2.7. Drying of Electrodes

	DURATION OPENED FROM PACKAGE	TEMPERATURE & DURATION	
		DRYING	REBACKING
LOW HYDROGEN	< 24 Hours	TEMP 300 ~ 400°C DURATION 1 Hr	----
	≥ 24 Hours	----	TEMP 300 ~ 400°C DURATION 24 Hr
HIGH TITANIA POTASSIUM	< 24 Hours	TEMP 70 ~ 100°C DURATION 0.5 Hr	----
	≥ 24 Hours	----	TEMP 70 ~ 100°C DURATION 24 Hr

- f) After drying mentioned in point.5, each welder shall hold low hydrogen type electrodes in a portable dryer at the temperature of 100 – 150°C to prevent from absorbing additional humidity.
- g) All product welds shall be visually inspected in accordance with the acceptance standards and requirements of ANSI/AWS D1.1, Section 8.15 "Quality of Welds" and Section 3.6 "Weld profiles". Also, the weld shall not have any cracks, undercut exceeded 0.8 mm depth, exposed surface porosity, and slag inclusions.
- h) LPT (Liquid Penetrant Test) shall be performed at the rate of 10% random, but subject to change depending on the welding production performance.

3. Welder Performance Qualification Test

Qualification test for welders and tackers at field portion shall be in accordance with the following:

- a) Structural welder for groove welds
Test position shall be 3G. Welds shall be examined by "Visual inspection and radiography examination" in accordance with ANSI/AWS D1.1.
In case of arising 4G position for actual production welding, 4G test position shall be applied.
- b) Structural welder for fillet welds
Test position shall be 3F, and 4F. welds shall be made by multiple passes and visually inspected. Welds shall not have any cracks surface porosity, slug inclusion and undercutting (over 0.8 mm depth).
- c) Tacker
Test position shall be 3F and 4F. Welds shall be made by single pass and fillet-weld-break-test shall be carried out in accordance with ANSI/AWS D1.1. Break - test report shall be submitted to The Consultant/UNDP before work.

4. Preparation of Base Metal

- a) The surfaces and the edges to be welded shall be free from loose scale, slag, rust, grease, paint, and any other foreign matter except that mill scale, which withstands vigorous wire brushing, may remain.
- b) The joint surfaces shall be free from fins and tears.
- c) Preparation of edges by gas cutting, where practicable, shall be done by a mechanically guided torch.

5. Assembly

- a) The parts to be joined by fillet welds and separations between facing surfaces of lap joints and of butt welds landing on a backing shall be brought into as close contact as practicable
- b) The parts to be joined by groove welds shall be brought into correct alignment.
- c) The members to be welded shall be held in the correct position by bolts, clamps, wedges, guy lines, struts, other suitable devices or by tack welds until welding is completed. The use of jigs and fixtures is recommended where practicable.
- d) Suitable allowances shall be made for warpage and shrinkage.
- e) Tack welds shall be subject to the same quality of requirement as the final welds.
- f) In assembling and joining parts of a structure or of built-up members and in welding reinforcing parts to members, the such procedure and sequence shall minimize distortion and shrinkage.

6. Filler Metal

All filler metal that has been removed from its original package shall be protected or stored so that its characteristics or welding properties will not be affected. Marking sign should be applied before electrode taken in oven dryer.

The wet electrodes shall not be used. Low hydrogen electrodes shall be dried in accordance with the instruction of the manufacturer before being used

7. Preheat and Interpass Temperature

Prior to welding, the base metal shall be preheated as required to the temperature called for in **Table 2.8**.

Table 2.8. Minimum Preheat and Interpass Temperature

Based Metal	Thickness of the thickest part point of welding	
	Up to 20 mm	over 20 mm to 38 mm
Shield metal-arc Welding with low Hydrogen electrodes	None *	20°C

* Where the base metal temperature is below 0°C, the base metal shall be preheated to at least 20°C and be maintained during welding.

8. Welding Procedure

a) General

- 1) Arc strikes outside the area of permanent welds shall be avoided on any base metal.
- 2) Before welding over previously deposited metal, all slag shall be removed and the weld and adjacent base metal shall be brushed clean.
- 3) End tab shall be used for groove welds in a manner that will ensure sound welds.
- 4) End tab, if used, shall be removed upon completion and cooling of the weld and the ends of the weld shall be made smooth and flush with the abutting parts.
- 5) After welding is completed, temporary bolt holes shall be plugged with steel, welded and ground smooth.
- 6) Steel backing, if used, shall be made continuously to the full length of the weld, and need not be removed unless otherwise specified.
- 7) Weld near or around equipment shall only be done with proper grounding to eliminate the damage to equipment. Such damage includes that to bearings and electronic equipment.
- 8) Cooper burn shall be avoided
- 9) Welding machines must be calibrated periodically

b) Manual Shield Metal-Arc Welding

- 1) The work shall be done on the flat position whenever practicable.
- 2) The classification and diameter of electrodes, electrode-arc length, voltage and amperage shall be suited to the thickness of the materials, type of groove, welding position and other circumstances attending the work.
- 3) The maximum diameter of the electrodes shall be as follows:
 - 8.0 mm for all welds made on the flat position, except root passes.
 - 4.0 mm for horizontal fillet welds, and root passes of groove welds made on the flat position with backing and with a root opening of 4.0 mm or more.
 - 3.0 mm for root passes of groove welds and all other welds not include above

Welds made by E70XX are specified in AWS specifications and low-hydrogen electrodes in the vertical and overhead positions. The minimum size of root pass shall be such as to prevent cracking.

- 4) The maximum thickness of subsequent layers to the root pass of fillet welds and of all layers of groove welds shall be :
 - 6.4 mm for root passes of groove welds.
 - 3.2 mm for subsequent layers of welds made on the flat position.
 - 4.8 mm for subsequent layers of welds made on the vertical, overhead and horizontal positions.
- 5) The maximum leg fillet weld which may be made in one pass be:
 - 9.6 mm on the flat position.
 - 8.0 mm on the horizontal or overhead positions.
 - 12.7mm on the vertical position.
- 6) Where the welding on vertical position is performed, the progressions of all passes shall be upwards.
- 7) Except when produced with the aid of backing material or welded on the flat position from both sides in square-edge material not more than 8 mm thick with a root opening not less than one-half the thickness of the thinner part joined, groove welds shall have the root of the initial layer gouged out on the back side before welding is started from the side, and shall be so welded as to secure sound metal and complete fusion throughout the entire cross-section.

c) Submerged arc welding

Submerged arc welding shall be done in accordance with Section 4, (about performance Qualification) part C, submerged arc welding, of AWS D1.1.

d) Gas metal - arc and flux cored arc welding

Gas metal-arc and flux cored arc welding shall be done in accordance with Section 4, (about performance Qualification) part D, gas metal-arc and flux cored arc welding of AWS D1.1

9. Inspection Tolerances and Correction of Welding

a) Base metal

- 1) Prior to welding, all base metal surfaces shall be inspected visually and when some defects or notches are found, they shall be removed and repaired by grinding and welding with a low-hydrogen electrode not to exceed 4 mm in size, observing the applicable requirements of Section 7.8.2 of this specification, and grinding the completed weld smooth and flush with the adjacent surface to produce a workmanlike finish. For inspection, refer to section "6" AWS D1.1
- 2) In the repair and determination of limits of internal defects visually observed on sheared or oxygen cut edges and caused by entrapped slag or refractory, de-oxidation products, gas pockets, or blow holes, the amount of metal removed shall be the minimum needed to remove the defect or to determine that the permissible limit shown in **Table 2.9** is not exceeded.

Table 2.9. Limits on Acceptability and Repair of Mill Induced

Description of Discontinuity	Repair Required
Any discontinuity 25 mm in length or less	None ----- need not be explored
Any discontinuity over 25 mm in length and 3 mm maximum depth	None ----- but the depth should be explored
Any discontinuity over 25 mm in length with depth over 3 mm but not greater than 6 mm	Removed ----- need not weld
Any discontinuity over 25 mm in length with depth over 6 mm but not greater than 25 mm	Completely removed and welded.
Any discontinuity over 25 mm in length with depth greater than 25 mm	5.15.1.1 of AWS D1.1. shall be followed.

b) Tolerances of assembly

- 1) The alignment, groove angle, root opening and cleanliness of the surface to be welded shall be inspected prior to welding and these tolerances shall be as shown in **Appendix**.
- 2) The dimension of the cross section of welded joint, which varies from the specified dimension by more than the tabulated tolerances shall be referred to The Consultant/UNDP for its approval or correction.

c) Dimensional tolerances

The dimensional tolerances of welded structural members shall be within the values specified in Section 10 of this specification.

d) Weld profiles

- 1) Welds shall be free from undercuts, insufficient throat, overlaps, insufficient leg, or excessive reinforcement. Tolerances of these defects shall be as shown in **Appendix**.
- 2) Defective portions of the weld shall be removed without substantial remove of the base metal. Additional weld metal to compensate the deficiency in size shall be deposited using an electrode preferably smaller than that used in making the original weld and preferably not more than 4.0 mm in diameter.
Defective or unsound welds or base metal shall be corrected by removing and replacing the entire weld, or as follows.
 - (a) Overlap or excessive convexity :
Reduced by removal of excess weld metal
 - (b) Excessive concavity of weld or crater, undersize weld, under cutting: Make additional welds.
 - (c) Excessive weld porosity, excessive slag inclusions, incomplete fusion: Remove and re-weld.
 - (d) Cracks in weld or base metal :
Remove the crack and sound metal 50 mm beyond each end of crack and re-weld.

- e) Correction of distorted members
Members distorted by welding shall be straightened by mechanical means or by carefully supervised application of a limited amount of localized heat.
The temperature of heated area shall not exceed 650° C (a dull red color).

2.4.8. Identification Mark

1. Requirements

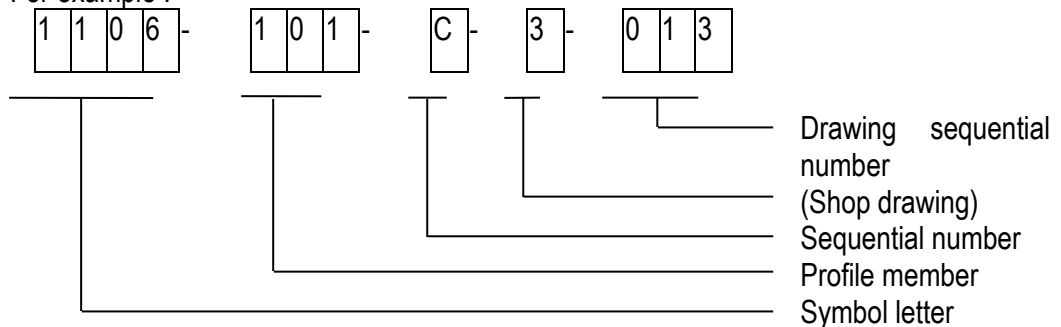
- All fabricated steel pieces shall be clearly identified in accordance with this specification.
- When any member consists of two or more pieces, each of them shall have different identification marks.
- Identical members may have the same identification mark.
- The identification marks to be applied on the steel members shall be identical to those used in the erection drawings and the packing lists.
- Steel pieces that lack sufficient space for lettering shall be identified with tags.

2. Coding System

The coding system for each member of steel shall be as follows :

- Identification marks shall consist of a prefix number, a symbol letter and sequential number as specified.
- Project name for identifying the project.
- Prefix number for identifying the building/facilities or structure shall be as shown in Table-5
- Elevation numbers index for symbol letter for identifying the elevation of member, if necessary.

For example :



- Symbol letter for each number shall be as shown in Table-6.
- Profile number for identifying the profile size.
- Sequential number for identifying the location of member or different number to each other.
- Drawing number shall be applied different number for each drawing in the same building/ facility and same drawing number.

Table 2.10. Prefix Number for Building/Facilities or Structure

Prefix no.	Facility
	General Lay-Out of Hospitals

Table 2.11. Symbol Letter for Coding System

Member of parts	Symbol Letter	Remarks
Columns	C	
Girders Rigid Joint	GX GY	x direction y direction
Girders Pin Joint	GBX GBY	x direction y direction
Beams or Tie beam	BX BY	x direction y direction
Trusses	T	
Post or stud	P	
Vertical bracing	VB	
Horizontal bracing	HB	
Floor joist	J	
Floor plates (checkered plate),	Y	Include floor deck, plates Grating ,expanded metal, etc
Stairs	ST	
Ladders	LD	
Hand Rails	HR	

3. Drawing Numbering System for Shop Drawing

The numbering system shall be as follows :

- Drawing number shall consist of a project number/project name, a prefix number, symbol letter and sequential number as specified.
- Prefix number for identifying the building or structure shall be as shown in Table-5.
- Symbol letter for each member shall be as shown in Table-7.
- When the project name or symbol is required, it shall proceed with the identification mark.

For example :

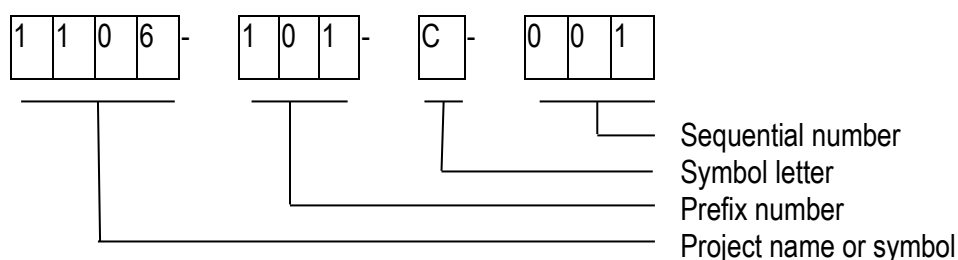


Table 2.12. Symbol Letter for Numbering System of Shop Drawing

Member of part	Symbol letter	Remarks
General Arrangement	GA	
Columns	C	
Girders	G	
Beam of Ties	B	
Trusses	T	
Frame	F	Shipped in one pieces
Post and stud	P	
Vertical Bracing	VB	
Horizontal Bracing	HB	
Knee Bracing	KB	
Floor joists	J	
Floor plates	CH	Include floor deck, plates, grating, expanded material, etc.
Hand railing	H	
Stairs	ST	
Ladder	LD	
Hand Rail	HR	
Loose brackets	BK	
Loose splice plate	SP	
Loose gusset plate	GP	
Loose cleats	CL	
Shim plates	SH	
Backing bar	BB	

4. Marking

The marking shall be applied at the appropriate places as shown in **Appendix**.

2.4.9. Painting

Shop painting for structural steel and detail application of painting shall be applied in accordance with Painting Specification. Before applying paint, the surface shall be prepared as required by SSPC – SP10.

2.4.10. Inspection, Tolerances and Correction

1. Inspection

- All fabricated material shall be inspected at the shop prior to shop painting or galvanizing.
- The fabricated materials shall be assembled and erected temporarily, and inspected at the shop, if specifically requested.

2. Tolerances

- Straightness
 - Structural members consisting primarily of a single rolled shape shall be straight within the appropriate tolerances allowed by the standards or codes specified in this specification.
 - Built-up structural members fabricated by bolting and welding shall be straight within the tolerances listed in **Table 2.13**.

Table 2.13. Tolerance of Members Built-up Straightness

Item	Length (mm)	Tolerances (mm)
Column	$L \leq 14000$	$d \leq L / 1,000$ or 10
	$L \geq 14000$	$d < 10 + (L - 14000) / 1,000$
	All	$d \leq L' / 1,000$
Girder and beam where there is no specified camber or sweep	All	$L / 1,000$ or $d \leq 10$ which is smaller
Girder and beam from specified camber.	$L \leq 24,600$	$- 6.4 \leq d \leq + 6.4$
	$L \geq 24,600$	$- 0.26 L / 1,000 \leq d \leq + 0.26 L / 1,000$

where, L : Total length
d : Deviation from straightness
L' : Length between points which are to be laterally supported

b) Length

Members without ends, finished as contact bearing, may have a variation from the detailed length not greater than the following tolerances :

where, $L < 9,000$; $d < 1.6$

$L > 9,000$; $d < 3.2$

L : Total length (mm)

d : Variation from the detailed length (mm)

c) Shape

The tolerances for shapes of structural members consisting primarily of a single rolled shape shall be in accordance with the specifications or codes specified in this specification.

The tolerance for shapes of structural members built-up from plates shall be in accordance with **Appendix**.

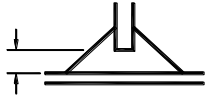
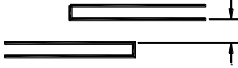

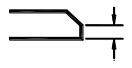



d) Others

Other tolerances for fabricated members shall be in accordance with **Appendix**.

3. Correction

The correction of fabricated members shall be done before the shop painting in accordance with the applicable provisions of this specification.

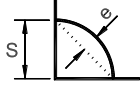

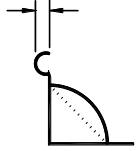
APPENDIX 1 TOLERANCE OF ASSEMBLY

Item	Figure	Tolerance (MM)	
		Root Not gouged	Gouged
Separator of fillet welding joint (Note 1)		4.8	-
Separator of facing surface of lap joint and butt joint on backing		1.6	-
Misalignment at butt welded joint (Note 2)		3.2 or t/10 whichever smaller	3.2 or t/10 whichever smaller
Root face of joint		± 1.6	not limited
Root opening without backing (Note 3)		± 1.6	+ 1.6 - 3.2
Root opening without backing		+ 6.4 - 1.6	-
Groove angle of joint		± 5 deg	+ 10 deg - 5 deg

Notes :

- (1) If the separation is 1.6 mm or greater, the size of the fillet welds shall be increased by the amount of the separation. In case involving shapes after straightening and in assembling the gap cannot be closed sufficiently to meet this tolerance, a maximum gap of 8.0 mm is acceptable provided a sealing weld or suitable backing material is used to prevent a melt thru.
- (2) In correcting misalignment, the parts shall not be drawn into a greater slope than 4/100.
- (3) Root opening wider than these tolerances but not be greater than the thickness of the thinner part may be built up by welding to acceptable dimensions.

APPENDIX 2 TOLERANCE OF WELD PROFILE

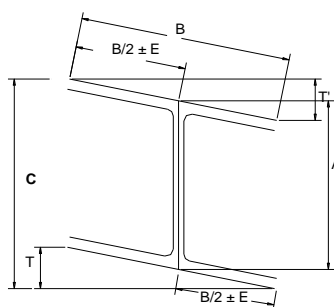
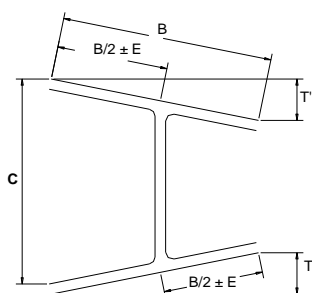
Tolerance (mm)	Figure	Item	Standard
Convexity of fillet weld		$e = 0.1 s + 0.76$	AWS D 1.1 Item 5.24
Reinforcement for groove weld		3.18	AWS D 1.1 Item 5.24.4
Undercut		0.26 for ransverse direction to primary tensile stress 0.8 for all other situations	AWS D 1.1 Table 6.1

APPENDIX 3

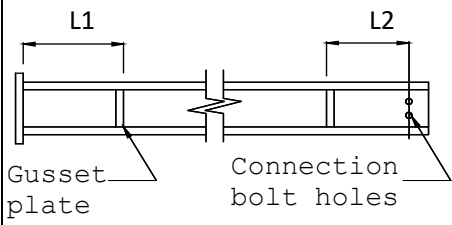
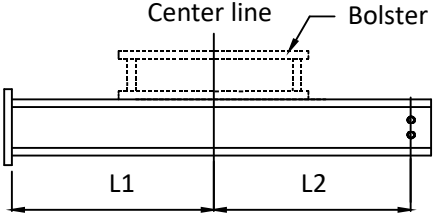
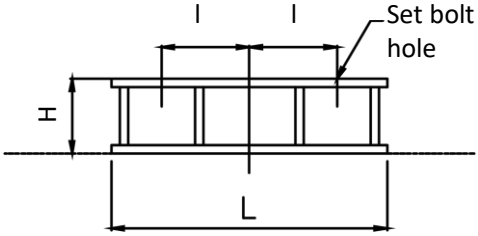
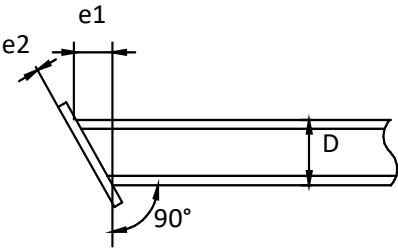
TOLERANCE FOR SHAPES OF BUILT-UP MEMBERS

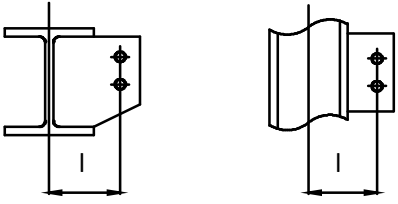
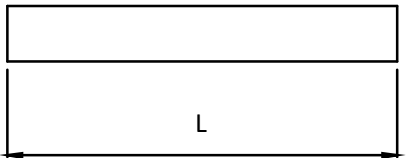
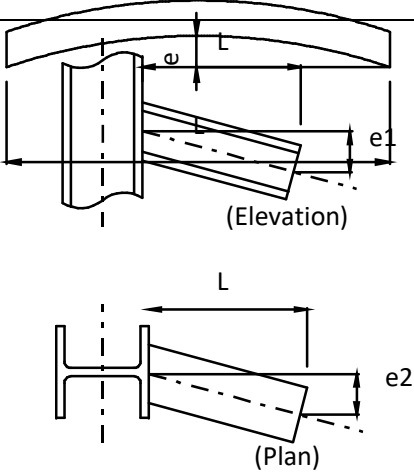
Description		Section Nominal Size	Tolerance (mm)
Thickness	(t ₁)	Up to 16 From 16 up to 24 From 25 up to 39 Over 40	± 1.0 ± 1.5 ± 2.0 ± 2.5
	(t ₂)	Up to 16 From 16 up to 24 From 25 up to 39 Over 40	± 1.5 ± 2.0 ± 2.5 ± 3.0
(B) Flange width		All size	± 3.0
(A) Depth		Up to 400 From 400 up to 599 Over 600	± 3.0 ± 4.0 ± 5.0
(T + T') Flanges, out of square, Maximum		Up to 300 Over 300	0.024 B 0.030 B
(E) Web off center, Maximum		Up to 300 Over 300	± 3.0 ± 4.5
(C) Maximum Depth at any Cross-Section over theoretical depth		Up to 300 Over 300	(A) + 1/2 (T + T') (A) + 1/2 (T + T')

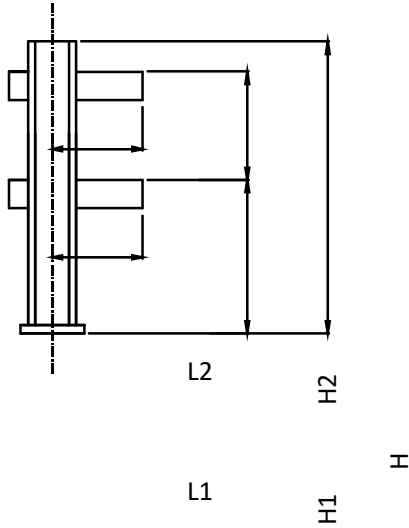
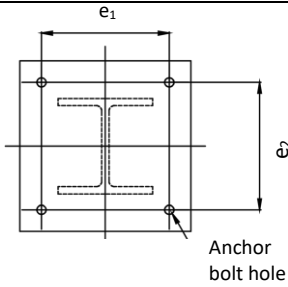
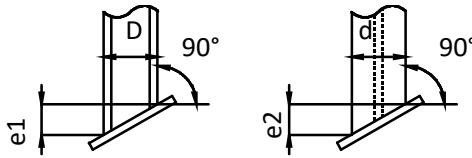
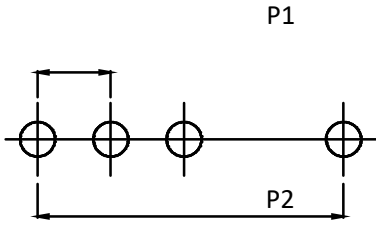
Tolerance for shapes of built-up Members
(Remarks for definition on table above)



APPENDIX 4 FABRICATION TOLERANCE

Item	Figure	Tolerance
(1) Distance from end or Connection bolts hole to Gusset plate (L1, L2)		$L1 \text{ or } L2 : \pm 2 \text{ mm}$
(2) Distance from end or Connection bolts hole to Gusset plate (L1, L2)		$L1 \text{ or } L2 : \pm 2 \text{ mm}$
(3) Bolster (H, L, l)		$H : \pm 1.5 \text{ mm}$ $L : \pm 2.0 \text{ mm}$ $l : \pm 1.0 \text{ mm}$
(4) Perpendicularity of end Plate to beam (e1), and Flatness of end plate (e2)		$e1 : \pm D/100 \text{ and } 2 \text{ mm or less}$ $e2 : \text{max. } 0.5 \text{ mm unevenness}$

Item	Figure	Tolerance
(5) Distance from center of The member to center of The bolt hole of gusset Plate (l)		$l : \pm 1.5 \text{ mm}$
(6) Beam length (L)		$L : \pm 3 \text{ mm}$
(7) Bending or deflection (e/L)		For beam $1/1000$ and e is max. +10 mm, -0mm For column $1/1500$ and e is max. +5 mm, -0mm
(8) Angle at column to beam Connection (e1/L, e2/L)		$1/300$, and e1 and e2 are 3 mm or less

Item	Figure	Tolerance
(9) Floor height column Length (H1, H2, H) Project length of Bracket (L1, L2)		H : ± 3 mm H1, H2 : ± 3 mm L1, L2 : ± 3 mm
(10) Center to center Distance of anchor bolt Hole (e1, e2)		e1, e2 : ± 3 mm
(11) Perpendicularity of Base plate to column Center line (e1, e2)		e1, e2 : $\pm D/100, d/100$ and 3 mm or less
(12) Center to center Distance of bolt holes (P1, P2)		P1 : ± 1 mm P2 : ± 2 mm

Item	Figure	Tolerance
(13) Flatness of girder web		A/150 and B/150
(14) Out-of-straightness of intermediate stiffener		12.7 with due regard to any members which frame into them
(15) Out-of-straightness of bearing stiffener	DITTO	$D < 1,800$ $d \leq 6.4$ $D \geq 1,800$ $d < 12.7$
(16) Offset of stiffener from theoretical center line		t (thickness of stiffener)

CHAPTER 3. TECHNICAL SPECIFICATION OF ARCHITECTURAL WORK

3.1. EXPLANATION OF THE WORK

3.1.1. General Explanation

1. Laws/Regulations:

- a. Undang – Undang Republik Indonesia No. 2 Tahun 2017 tentang Jasa Konstruksi
- b. Undang – Undang Republik Indonesia No. 28 Tahun 2002 tentang Bangunan Gedung
- c. Peraturan Presiden Republik Indonesia No. 16 Tahun 2018 tentang Pengadaan Barang / Jasa Pemerintah
- d. Peraturan Menteri Pekerjaan Umum Republik Indonesia No. 07/PRT/M/2014 tentang Standar dan Pedoman Pengadaan Pekerjaan Konstruksi dan Jasa Konsultansi
- e. Peraturan Menteri Pekerjaan Umum Republik Indonesia No. 45/PRT/M/2007 tentang Pedoman Teknis Pembangunan Bangunan Gedung Negara
- f. Peraturan Menteri Pekerjaan Umum Republik Indonesia No. 29/PRT/M/2006 tentang Pedoman Persyaratan Teknis Bangunan Gedung
- g. Peraturan Menteri Pekerjaan Umum dan Perumahan Rakyat No. 14/PRT/M/2017 tentang Persyaratan Kemudahan Bangunan Gedung
- h. Peraturan Menteri Pekerjaan Umum Republik Indonesia No. 26/PRT/M/2008 tentang Persyaratan Teknis Sistem Proteksi Kebakaran Pada Bangunan Gedung dan Lingkungan
- i. Peraturan Menteri Pekerjaan Umum Republik Indonesia No. 20/PRT/M/2009 tentang Pedoman Teknis Manajemen Proteksi Kebakaran di Perkotaan
- j. Peraturan umum Pemeriksaan Bahan-bahan Bangunan (PUPB NI-3/56)
- k. Peraturan Beton Bertulang Indonesia 1971 (PBI 1971)
- l. Peraturan Umum Bahan Nasional (PUBI 1982)
- m. Peraturan Perburuhan di Indonesia (Tentang Pengarahan Tenaga Kerja)
- n. Peraturan-peraturan di Indonesia (Tentang Pengarahan Tenaga Kerja)
- o. SKSNI T-15-1991-03
- p. Peraturan Umum Instalasi Air (AVWI)
- q. Standar Perencanaan Ketahanan Gempa untuk Bangunan Gedung SNI 1726-2002
 - 1) Tata Cara Perhitungan Struktur Beton untuk Bangunan Gedung SNI 03-2847-2002
 - 2) Tata Cara Perencanaan Struktur Baja untuk Bangunan Gedung SNI 03-1729-2002
 - 3) Pedoman Perencanaan Pembebanan Untuk Rumah dan Gedung SNI - 1727:2013

Scope of Works

The main work to be carried out by the Contractor is the Construction of Murai Inpatient Building and Pharmacy building at Anutapura Hospital, Palu and the Construction of Pinus/Ebony Inpatient building and Maternity building at Tora Belo Hospital, Sigi District, Central Sulawesi.

The Scope of Architectural works are :

- a. Installing Heubel wall and plastering
- b. Installing Aluminum doors and windows complete with glazing
- c. Roof works

- d. Ceiling works
- e. Glaze/glass works
- f. Installing hinges, door keys and accessories
- g. Installation of water supply
- h. Installation of Sanitary equipment
- i. Floor works
- j. Installation of toilet wall
- k. Other works

Work to be carried out based on:

- a. Terms and conditions in this Technical Specification.
- b. Detail engineering design (DED) drawings, Bill of Quantity (BoQ) and Technical Specification.
- c. Descriptions and explanations in the tender process.
- d. Indonesian laws and regulation concerning the building construction in terms of technical and labor aspects.

3.1.2. Elevation Benchmark (Peil)

The building elevation benchmark (Peil) will be determined by the Consultant/Hospital Authority or UNDP.

- 1. Peil ± 0.00 of the building are taken + 0.55 m from the land at the site specified in the drawing.
- 2. The excavation thickness, Foundation, Tie Beam, Door/Window Frame, Ceiling, etc. must refer to Peil ± 0.00 respectively.

3.1.3. Dimensions

- 1. The dimension of the works can be obtained from the Drawing. Other dimensions that are not presented in the drawing should be discussed with the Consultant/UNDP.
- 2. If there are discrepancies between the drawing and Technical specification, the Technical specification prevail.

3.2. TECHNICAL REQUIREMENTS.

3.2.1. Masonry Wall

Masonry Wall include:

- a. Installation of Celcon/Heubel brick:
 - 1) Celcon/Heubel brick must be of good quality and uniform in size.
 - 2) Celcon/Heubel masonry using mortar proportion of 1 PC and 4 Sand.
- b. This work includes the provision of labor, material, equipment and tools.
- c. The work of this Celcon/Heubel brick includes all the details shown in the drawing.

1. Related Work

Mortar and masonry.

2. Standard

- a. Heubel must meet the NI-10
- b. Portland Cement must meet the NI-8.
- c. Sand must meet the NI-3 Article 14, paragraph 2.
- d. Water must meet PVBI-1982 Article 9.

3. Material / Product

- a. The lightweight brick to be used is the best quality Celkone local product that has been approved by the Consultant/UNDP with a uniform size of 10x20x40.
- b. Wall plastering using the MU-301, PM-200 with mortar MU-200, PM-300

4. Implementation

Brick masonry/brick Celkone /Heubel, using mortar MU-300, PM-100.

After the brick is installed, the mortar/joint should be scraped flat and cleaned with broomstick and poured with water.

Prior to plastering with MU-301, PM-200 Lightweight Brick must be moistened with water, and the joint has been scraped and cleaned.

After plastering work completed, wall smoother (*acian*) or ceramic/wall tile works are not allowed at least until 48 hour. *Acianto* to be used is MU-200, PM-300 or wall tile.

Installation of brick wall to be done in stages. Each stage consists of a maximum 8-10 layers each day, follow by practical concrete column.

The brick wall with area larger than 12 m² must be framed/protected by adding reinforced concrete columns (*kolompraktis*) and/or beams (*baloklatei*) with size of 12 x 12 m, with minimum 4 reinforcement bar of diameter 10 mm. Minimum diameter of Stirrup is 6 mm with maximum distances of 20 cm.

Making holes on the wall for scaffolding/steiger purposes are absolutely forbidden.

Making temporary holes on lightweight brickwall related to other relevant concrete works must be reinforced by minimum 6 mm diameter rebar with maximum distances of 75 cm. The rebar must be well cast into the concrete prior to brick works and the length of rebar into the brick is minimum 30 cm unless otherwise specified.

The installation of broken bricks is at maximum 2%. Bricks that broke to more than 2 pieces are not allowed to use.

The general masonry of brick wall must produce a final thickness of 13 cm. The exception thickness of particular wall at certain part of construction will be determined by the Consultant. The masonry works must be done carefully, neat, and perpendicular.

3.2.2. Plastering Works

All plastering uses 1 PC and 3 sand mortar.

1. Standard

Plastering work must be carried out by the Contractor referring the conditions stated in this Technical Specification, PUBI 1982, SII.0013-81, PUBI 1970 and all instructions given by the Consultant during the work.

2. Material / Product

Portland Cement

Portland Cement must meet the NI-8.

Sand

Sand must meet the NI-3 Article 14, paragraph 2.

Water

Water must meet PVBI-1982 Article 9.

Plastering Mortar Requirement

The proportion of the mortar mixture/composition must follow the requirements below:

	PC (Portland Cement)	PS (Sand)
Waterproof Plastering	1	2
Corner Plastering	1	3
Concrete Plastering	1	3
Ordinary Plastering	1	5

3. Work Implementation :

- Prior to plastering work, all mortar grout must be scraped and cleaned with wire brush. Brick surface must be moistened with water, before the plastering mortar can be applied and spread.
- Plastering work must start from the upper left corner and be continued to the lower right. The work must be maintained so that no waves occur, and the results must be flat and uniform. Corners and edges must be a straight.
- Finished plastering works must be maintained wet for 7 days from the date of completion.
- Mortar mixture for plastering work must be the same as that used for the brickwork.
- Plastering work should only be started after the brick/concrete work is completely dry.

3.2.3. Aluminum Frame, Doors and Windows Work

- a. The aluminum materials for building purposes are permanent (not temporary)
- b. The aluminum frame, doors and windows are made of aluminum type Aleksindo or equivalent, with size according to Drawings **(AN-AR-0703 -0704) / (TP-AR-0603-0605)**.

1. Term of Implementation

- a. Before starting the work, the contractor is required to examine the drawings and conditions at site (size and peil holes and provide samples with scale of 1:1)
- b. The fabrication must be completed before the work begins, by making a complete shop drawing with the instructions of the Consultant/UNDP, including the floor plan, location, brand, quality, shape and size.
- c. All frame, window and door frames are fabricated precisely according to size and field conditions so the results can be accounted.
- d. Cutting process of aluminum and stainless steel should be kept away from iron material to avoid sticking iron dust on its surface. It is recommended to work in a safe shelter carefully without causing damage to the surface.
- e. Aluminum welding only allowed by using non-activated gas (argon) from the inside so that the connection is not visible.
- f. The frame edge must be connected firmly and thoroughly with screws, rivets, staples and must precisely match. Welding must be neat to obtain quality and shape in accordance with the drawings.

- g. The anchors for aluminum and stainless steel frames made of steel plates with a minimum thickness of 2 mm and 1.2 mm placed at intervals of 600 mm.
- h. The screwing must be installed invisibly from the outside with stainless steel / stainless steel screws, so that the hair line of each connection must be waterproof and meet the water strength requirement of 100 kg / m². The gap between the glass and the aluminum and stainless steel jamb system must be covered by a sealant.
- i. It is required that aluminum and stainless steel sills are equipped with the following possibilities:
 - 1) Qualified as frame for glass.
 - 2) Matches the open / swing window and can be installed door closer.
 - 3) The frame system can accommodate frameless glass doors.
 - 4) Having accessories that can support the above possibilities.
- j. For hard ware fittings and reinforcing materials where the aluminum frame will come in contact with iron, copper or other metal surfaces must be given a layer of chromium to avoid corrosion contact.
- k. The tolerance of mounting aluminum and stainless steel on one side of the wall is 10-25 mm which is then filled with lightweight concrete / grout
- l. Especially for the open window / aluminum swing work to be considered before the frame installed. Surface areas of horizontal wall (wall holes) attached to the lower and upper threshold must be waterproofed.
- m. To obtain the impermeability to air leakage, especially in conditioned rooms, mohair should be placed and if necessary synthetic rubber or materials from synthetic resin can be used. Applied on the swing door and double door.
- n. Sealant around the corner of the frame that looks bordered by the wall to make it waterproof and soundproof.
- o. The bottom edge of the exterior frame threshold to be equipped with flashing for rainwater retaining.

2. Maintenance Requirements

• Repair

- a. Contractor is obliged to repair damaged/defective/stained of frame work. The repairs are carried out according to the direction of the Consultant/UNDP and does not interfere with other finishing work.
- b. If the damage to this work is not cause by owner when the work is carried out, the Contractor is obliged to repair the work until it is declared acceptable by Consultant/UNDP. Costs incurred for this repair work are the responsibility of the Contractor.

• Security

- a. Contractor must provide protection against the surface of the installed frames.
- b. The costs required for security are the responsibility of the Contractor, until the work is well received (Final handover).
- c. The protection materials are carried out according to the conditions specified in the material requirements and other requirements (according to the manufacturer's requirements).

3. Terms of Acceptance

The work will be accepted on the following conditions:

- a. The frame work must be in a precise position with one another, guaranteed neatness, and not deformed; and constitutes an integral part of the type of door specified in the design drawings and material specifications.

- b. Work implementation have fulfilled the requirements in the design drawings, shop drawings and directions issued by the Consultants/UNDP.

3.2.4. Roof Works

- a. The roof uses heat-resistant sheets and leak from good quality aluminum foil.
- b. Roof covering using colored glazed metal sheetas used on the existing buildings. The roof finishing will be painted with good quality color according to the color of the sheet.
- c. The Roof type is metal roof with 5mm thickness, shape. The size and color of the roof is according to the drawing and plan.
- d. Connection of metal roof covering is at least one and a half waves of zinc and no visible light if seen from below.
- e. The screws are mounted on the top side of the roof bow.
- f. The Contractor must show and provide samples of roofing material for approval by the Consultant/UNDP before instalment.
- g. The roof colors maybe changed by Consultant/UNDP during the construction period.
- h. On each sheet of roofing material, the brand, Production Type and Material Thickness must be stated.
- i. The Contractor must guarantee that there are Instructions manual to install and Store Material at the work location by the Factory Expert before the roof installation work begins.
- j. Each sheet of roofing material brought in by a work location must be in good condition with no defects in the paint surface and no curved aluminum zinc coating.
- k. Roofing material must be stored in a material warehouse if not immediately used. Roofing material must not be wet / damp and in direct contact with the ground.
- l. Crest material, gable or rooftop using zinc metal roof tile with specifications according to Bestek Pictures.
- m. The Contractor must show and provide samples of Crest or Gable material for approval by the Consultant/UNDP before instalment.
- n. The Crest or Gablecolors maybe changed by Consultant/UNDP during the construction period..
- o. On each sheet of Crest or Gable material, the brand, Production Type and Material Thickness must be stated.
- p. Each sheet of roofing material / roof joints brought to the work location must be in good condition with no paint surface defects and no curved aluminum zinc coating.
- q. The shape of the Crest or Gable material must be in accordance with the shape and model of the roof.
- r. Crest or Gable material must be stored in the material warehouse if not immediately used. Must not be wet / damp and be in direct contact with the soil.
- s. The jointing tool uses zinc nails or as recommended by the Factory.

3.2.5. Ceiling Works

1. Ceiling Materials

- a. Gypsumboard
 - 1) Ceiling hanging frame is made of 40x40mm hollow steel.
 - 2) Ceiling is made of Jaya board gypsumboard 9mm thick.
 - 3) List ceiling using gypsum minimalist profile material size 10cm.

3.2.6. Glass Works

For the purposes of doors, windows, light windows, Boventigth, room dividers use plain glass (tempered) using Asahimas products of standard quality according to thickness and color specified in the picture **(AN-AR-0703 -0704) / (TP-AR-0603-0605)**.

3.2.7. Hinges, Door Keys and Accessories

- a. Doors and windows use aluminum type Alexindo White powder coating 4" or equivalent
- b. Hinges for each door using good quality Nylon door hinges Arch brand or equivalent size 3 x 4 inch as much as 3 pieces and for window use good quality butterfly hinge Arch brand or equivalent as much as 2 pieces.
- c. For bovenlighth windows (BV) using the color frame and trellis of good quality of Dicky brandor equivalent.
- d. For doors using push door hanger Muller Robin brand of good qualityor equivalent.
- e. Each shutters are provided with latches and wind hooks of good quality.
- f. Locks for aluminum door panels use the complete with accessoriesof Dekson brandor equivalent.
- g. The lock for the bathroom door uses slot of Alpha brandor equivalent.

3.2.8. Paint Finishing Work, Grill Out Door AC and Railing

- a. All indoor walls and ceilings (Gypsum, GRC) are painted with special interior wall paints of the **Dulux** brand or equivalent in accordance colors approved by the Consultant/UNDP. The colors used are from standard colors, not mixed. For external use, use special **Dulux** brand exterior qualityor equivalent.
- b. Iron material from the Grill according by the Consultant/UNDP. Grill module size 300 cm using Hollow Frame 20x40mm (in the bottom area) and 40x40mm Full to top, Main Frame structure using UNP 100.
- c. Iron type Black Nippon matteor equivalent.
- d. Railing / Backrest on the Ladder of Stainless Steel.
- e. Railing in the corridor in using stainless steel 5"
- f. Railing Ramp using Hollow 20x40mm main frame 40x40mm hand railing 40x50mm finishing black iron paint. Dimensions of Railing Size and Model according to Drawing.
- g. All toilets that are for patients must use a stainless steel bar with a size of 5 " for the handle next to the closet.
 - **TOTO Disability Hand Rail GT114C6** or equivalent
 - **TOTO Disability Hand Rail GT114CL9** or equivalent
- h. If not specified otherwise in the Drawing, Railing is tethered / anchored to the floor, floor plates and columns with anchor bolts of diameter 3/8".
- i. Railing points and anchoring Railing at least 4 points for each span.

3.2.9. Clean Water Installation Work

- a. Clean water installation is carried out using **Wavin** brand paralon pipe material or equivalent according to drawings.
- b. Installation of clean water for hot water using galvanized pipes according to the size in the picture.

3.2.10. Installation of waste water system, Septic tank and Drainage

- a. Installation of waste water is distinguished between washing and bathing waste water installations with closet / spoel hook waste water installations installed separately using 1st quality Wavin paralon pipe material or equivalent according to the size in the figure. The closet / spoelhook waste water pipe is connected to the septic tank while washing and bathing wastewater is channeled to the Hospital waste water installation network according to the picture.
- b. Installation of septic tank at a location determined by the Consultant/UNDP with a size of 1.5 x 1.5 x 2 m3.

- c. Bathroom floor or toilet / lavatory mounted filter / floor drain brand **Toto (Tx 1bv1)** stainless material or equivalent
- d. The drainage channel according to the picture and connected to the hospital drainage channel network using **Dusaspun** brand or equivalent printed concrete size 60x60 cm.

3.2.11. Sanitary Works

- a. Installation of closet and accessories using Toto brand quality standards or equivalent.
- b. Installation lavatory and accessories plus the hot water / cold, glass, towel using Toto brand quality standards or equivalent.
- c. Shower Ex. TOTO TX 471 SP / Equivalent (Shower sets and faucets)
- d. Water faucets, faucet for hot / cold water with a shower spray, use **Toto** brand closet quality standard or equivalent.

1. Scope of Work

- a. Included supply of labor, materials, equipment and other assistive devices used in this work to achieve quality and perfect work results in their use / operation.
- b. Installation work lavatory, urinals, closet, faucet, toilet fixtures, floor drain, clean out and metal lavatory.

2. Related Works

- a. Waterproofing
- b. Plumbing

3. Approval

- a. All material before installed must be presented to the Consultants and the requirements / conditions for approval. Materials that are not approved must be replaced with no extra cost.
- b. If it is deemed necessary to exchange / replace materials, the replacement must be approved by the Consultant based on the contractor's example.

4. Material / Product :

- a. To lavatory, urinals, toilets and faucet using TOTO brand or equivalent.
- b. Floor drain and clean out using TOTO, or equivalent.

5. Implementation:

- a. Before installation begins, the Contractor shall examine the existing images and field conditions, including studying the shape, pattern, placement, installation-sparing sparing, how to install and details according to the drawings.
- b. If there is discrepancy in this case between the images with drawings, pictures with specifications and so on, then the Contractor shall immediately report to the Consultants.
- c. The contractor is not permitted to start work if there is discrepancy / difference in that place before resolved.
- d. During the implementation always held testing / inspection for the perfection of the work and functions.
- e. Contractor is obliged to repair / repeat / replace if any damage occurred during the implementation and the warranty period, at the expense of the Contractor, as long as the damage is not caused by the actions of owners.

6. Lavatory Works

- a. The lavatory using the TOTO brand or equivalent complete with all accessories as listed in the brochure. Types are used can be seen in the attached schedule sanitair.
- b. Installation of Lavatory and accessories is already selected no parts are chipped, cracks or other defects and has been approved by the Consultant.
- c. The height and construction of the installation must be adjusted accordingly to the drawings as well as the instructions of the production in the brochure. The installation must be good, neat, water passed and cleaned of all dirt and stains and the connection of the plumbing installation should not be any leaks.

7. Closet Works

- a. Installation of Monoblock along with all the accessories using TOTO brand or equivalent, the type used can be seen in the attached sanitair schedule.
- b. Installation of Closet cringe along with all the accessories using TOTO brand or equivalent. Types are used including faucets press, the color will be determined by the Consultant.
- c. Installation of Toilet along with the accessories is already selected, no part of the chipped, cracks or other defects and has been approved by the Consultant.
- d. For basic monoblock worn old teak planks exalted 3 cm and dipped in a preservative solution of waterproof, shaped like a basic toilet. Toilet screwed onto the board with brass screws.
- e. Toilets should be attached securely appropriate location and height of the image, water pass. All the stains to be cleaned, the pipe connections should not be any leaks.

8. Faucets Work

- a. All faucet, except wall faucets, using TOTO brands or equivalent with a chromed finish. The size is adjusted to the needs of each according to the drawing of plumbing and brochures sanitair tools. Wall taps are used with long necks and a mounting ring which must be attached to a T.23 B 13 V 7 (N) type wall).
- b. Installation of Faucet on the yard must have a lavatory thread in the serving space and can be connected to a swan neck pipe (extension). Tap for lavatory in space type T. 30 AR 13 V 7 (N).
- c. Stop faucet that can be used for the brand Kitazawa or equivalent brass with a green colored round, diameter and placement according to drawing.
- d. Faucet should be installed in clean water with a strong pipe, elbow, placing it must be in according to drawings.

9. Floor Drain and Clean Out

- a. Installation of Clean out the floor drain and used are metal verchroom, pit him. 2 "is equipped with a siphon and a hinged cover for the floor drain and depverchroon with thread to clean out using TOTO brand or equivalent.
- b. Installation of floor drain in places according to drawing.
- c. Installation of floor drain has been selected, without defects and approved by Consultant/UNDP.
- d. In the areas that will be installed floor drain, floor coverings must be perforated neatly, using a small chisel to shape and size according to the size of the floor drain.
- e. Connection of metal pipe with concrete / concrete floor using a waterproof adhesive Embeco type MTC and the top layer thickness of 5 mm filled with glue Araldit type Cibaor equivalent.

- f. After the floor drain and clean out installed, the couple must be neat water pass, cleaned of stains of cement and there are no leaks.

10. Metal Lavatory Works

- a. Metal lavatory using Diethelm brand type 46/107 or equivalent minimum thickness of 1 mm, stainless steel materials, the type of the basin to the room outlets and two basin to be able to tap on it.
- b. Installation of Metal lavatory already selected, no defective parts and glued firmly according to drawing.
- c. After the metal lavatory is installed, the location of the installation height according to the drawings, either water pass and free of leaks of water.

3.2.12. Floor Works

1. Before the floor work, floor tile installed base of 15 cm thick sand after water poured and compacted.
2. Floor work and terrace floor use ceramic granite motif size 60 x 60 cm from Roman Tile brand or equivalent, motif Homogeneous Anti slip 10 X 60 cm HT / Granite Black
3. Bathroom floor work uses 20 x 20 ceramic tiles specifically for bathrooms and 20 x 40 walls from Roman brands or equivalent.
4. The floor work between the room and the bathroom using orange ceramic motif / rough skin motif for the road size 30 x 30 cm from Roman brand or equivalent.
5. Terrace next to the building using Conblock.
 - Using backfill sand under the Conblock with 10 cm thickness.
 - Using K.200 conblock. 6 cm of Pearl / Diamond quality or equivalent.
 - Conblock installation area must be completely level with respect to the face according to drawings.
 - Conblock installation pattern must be in accordance with detailed drawings, or technical directors / Consultant's instructions.
 - The width of the joint must be the same, forming a straight line, according to the picture and the joint must be filled with sand.
6. The side terrace / corridor uses stainless steel tactile stud tiles (for blind patients).
7. Ramp floor uses Andesite Stone 60 x 60 cm + Anti Slip Rough 10 cm.
8. The Contractor must prepare 'tiling manual', which contains a description of the material, how to install, the system of supervision, repair / correction, protection, testing and others for inspection and approval by the Field Directors.
9. Before the installation begins, prepare the lay out of the grout, connections with other finishing and joint dimensions, this is to obtain an approval from the Consultant. Interior view frame l = 2 mm, exterior pair l = 5 mm.
10. Tile selection :
Tiles that enter the site must be selected, according to the specified size, shape and color.
11. Tile section :
The edge of tiles cut must be polished with grinder or stone.
12. Level :
Determined by this specification or adjusted in the drawing, the level listed in the drawing is the floor finish level because the basic screeding must be adjusted so that different thicknesses of the finish surface may be leveled.
The floor must be completely flat; both those that are determined flat and those that are determined to have a slope.

13. The specified floor has a slope, the slope must not be less than 25mm at a distance of 10m for the toilet area. As for other areas, it should not be less than 12mm at a distance of 10m. The slope must be straight so the water can flow all without leaving a puddle.
14. If the thickness of the screed is not possible to get a proper slope, the Contractor shall immediately report to the Consultant for solution.
15. Floor Surface Preparation:
The contractor must prepare the surface so as to qualify necessary, before installing the tile.
 - a. The Contractor shall provide a report to the Consultant of each field regarding the conditions will adversely affect the implementation of the work.
 - b. Concrete surface that will be plastered for pasting tiles, must be roughened and cleaned of dust and other loose materials. Before plastering is carried out, this surface must be clean.
 - c. Discrepancy of the concrete surface should not be more than 5 mm for a distance of 2m, in all directions. The bulge must be discharged (chip off), bending the depth filled with mortar (1:2), so that the base plastering (setting bed) has the same thickness.
 - d. Inside installation of ceramic wall tiles (internal)
 - e. Before installation begins, the base plastering and tile must be moistened. Use thread to determine the lay out of tiles, which has been determined and install a line of tiles to be a benchmark for subsequent installation.
 - f. Unless otherwise specified, the installation of the tiles have to start from the bottom to the top.
 - g. In tile installation, attach to the back of the mortar and flatten the tile, then the tiles that have been given this mortar are pressed into the base plaster. Then the surface of the tile is beaten slowly until the adhesive mortar fully covers the back of the tile and a part of the stir is pressed out from the edge of the tile.
 - h. Every day of installation, it is not allowed to install tiles with a height higher than the following conditions:
 - 1,2 m - 1,5 m, for tile height 60 mm,
 - 0,7 m - 0,9 m, for tile height 90 - 120 mm,
 - max 1,8 m, for semi-porcelain tile.
16. If the tile is installed, a mortar that is in grout (joint) should be discarded / removed with a brush or other methods cause damage the surface of the tile.
17. Mortar littering the surface of the tile must be removed with damp cloth.
18. Installation of granite tile (filling naad) must be in accordance with manufacturer's recommendations.
19. Inspection
 - a. Bond.
 - b. When implementing tile installation, take a number of tiles that have been installed, in a condensed manner, to ensure that the adhesive mixture is properly bonded to the back of the tile and has been installed properly.

3.2.13. Installation of Toilet Wall

- a. The toilet walls entirely special ceramic wall mounted 20 x 40 cm size from Roman brand or equivalent.
- b. Janitor wall HT 60X60 Ex. **Roman Tile** or equivalent
- c. Wall and Pantry Table HT 60X60 Ex. **Roman Tile** or equivalent
- d. Installation Ceramic Floor
Tile installed on surfaces that have been in the screed.
The composition of the mortar for screed:

-
- Dry area : 1 PC : 3 sand.
 - Wet area : 1 PC : 2 sand.
 - e. For installation over a large area, it must be carried out continuously. And 'Head' course (guide line course) must be provided at intervals of 2.0 m - 2.5 m. Other tile installations are guided by this guideline.
 - f. Scrape all the mortar attached to the naad and clean it during the tile installation process. Tile work should not be stepped on within 24 hours after installation.
 - g. Grouts on tile installation must be filled with colored grout tile material and installation conditions must be in accordance with the manufacturer's recommendations.

CHAPTER 4. TECHNICAL SPECIFICATION OF MECHANICAL & ELECTRICAL WORKS

4.1. PRELIMINARY

4.1.1. General

- a. This technical specification describes the procedures and requirements for procurement, installation and testing of all equipment and materials so that the system can function properly and can be accepted by UNDP
- b. The contractor should learn and understand all regulations, general requirements, standards and tender documents.
- c. General Technical Requirements for Implementation, Job Description, Administrative Requirements, instruction and official information to the Contractor, are an inseparable part of the official tender documents and implementation.

4.1.2. Works Implementation

- a. Contractor who carries out this work must be experienced, accomplished and reputable, responsible and has sufficient expertise.
- b. The contractor shall mobilize from all the experts and all the workers filed for execution of work in accordance with the organizational structure of the field which has been approved by the Consultant/UNDP.
- c. The contractor must have Work Permit/Installation (SIKA) from PT. PLN (Persero) that is still valid or SKA and SKT Certificate issued by the association membership or other relevant agencies.
- d. SIKA or SKA and SKT are on behalf of these companies and experts from the company, which will be responsible for the installation of mechanical/electrical works.
- e. If needed, particularly for the Company which has a Work Permit or certificate from outside Central Sulawesi, the Contractor must hold special permission letter from the relevant local authorities

4.1.3. Codes and Standards

In performing the mechanical/electrical works, the following codes and standards apply:

- a. Peraturan Umum Instalasi Listrik (PUIL) of 2000.
- b. Standar Nasional Indonesia (SNI)
- c. Standar Industri Indonesia (SII)
- d. Standar Listrik Indonesia (SLI)
- e. Peraturan Menteri Kesehatan RI No. 24 of 2016
- f. Peraturan Menteri Kesehatan RI No. 2306 of 2011
- g. Pedoman Teknis Prasarana Rumah Sakit issued by Direktorat Jenderal Bina Upaya Kesehatan, Kementerian Kesehatan
- h. Regulations issued by PT. PLN (Persero).
- i. Regulations issued by Kementerian Ketenagakerjaan RI
- j. The explanation given at the time of pre-Bid meeting (Aanwijzing).
- k. The explanation given by the Consultant/UNDP.
- l. International Standards to be used are the International Electrotechnical Commission (IEC) and the International Standard Organization (ISO).
- m. Regulations/Standards of the country or the manufacturer

4.1.4. Permit and License

- a. The contractor must prepare all permits required to carry out the work, testing and operation of the installed mechanical / electrical system.
- b. All documents, examinations, tests, etc. required for obtaining these permits must be made by the Contractor or other party appointed by UNDP.
- c. All costs required for the licensing process are borne by the contractor.
- d. The contractor must submit all permits and official documents from the authorized agencies obtained regarding this mechanical / electrical system to the Consultant/UNDP.

4.1.5. Warehouse and Security

- a. The contractor must provide a warehouse for materials, equipment and working tools that should be held by the contractor prior to be transported to the site.
- b. The contractor shall provide storage on site for materials, equipment and working tools.
- c. The contractor is responsible for transportation of materials, equipment and working tools from the warehouse to the location and displacement within sites.
- d. The contractor is responsible for the security of materials, equipment and working tools from theft and vandalism, both in warehouse and storage place
- e. All costs for the replacement and repair of lost or damaged materials, equipment and working tools are fully borne by the Contractor.

4.1.6. Water and Electricity

The need for water and electricity for work must be carried out by the Contractor, including installation, wages/bills and dismantling. UNDP is not responsible for reimbursing the costs incurred by the Contractor.

4.1.7. Work Plan

- a. Before starting the work, the contractor must make a detailed Work Plan that is completed with an implementation schedule, this work plan must be in line and match with the work plan of the other work fields and must obtain approval from the Consultant/UNDP.
- b. If there are changes, the Contractor must notify the Consultant/UNDP in writing and submit suggestions for improvement.
- c. The contractor must be responsible and make close observations of its work plan, so as not to interfere/affect the smooth running of other work and the overall time of work completion.
- d. The contractor must make careful records for each step of the implementation of the work such as:
 - Date of order, arrival, installation, inspection and material testing.
 - Type, size, capacity, brand, amount of equipment, main materials, supporting materials, working tools and others.
 - Number of workers, workers' identity, position and others.
 - Equipment for safety, security and health.
 - Steps of each section of work.
 - Barriers/constraints.
 - Changes that occur.
 - Weather/climate conditions.
 - Others.

4.1.8. Coordination

- a. The contractor must carry out coordination with other parties concerned for the smooth implementation of the project.
- b. The contractor must study and check the work results of other parties that might affect the smooth running of its work, if there is a disturbance then the Contractor must notify all parties and provide suggestions for remedies.
- c. Losses due to lack of coordination with other parties, negligence or lack of responsiveness to the emergence of problems, remain the responsibility of the Contractor.
- d. The contractor is responsible for the safety, care and maintenance and ways of using all equipment provided or completed by another party or purchased or leased from another party.

4.1.9. Design Drawings and Shop Drawings

- a. Shop drawings or tender drawings are information in the form of drawings about the scope of work to be carried out
- b. Specifications and plan drawings are a complementary and mutually binding entity.
- c. Drawing of the installation plan shows the general layout, but in the process must pay attention to field conditions/projects. Architectural drawings, structures, landscapes etc. should be used as the reference in preparing bids, carrying out work and coordinating
- d. The contractor must examine the entire drawing plan carefully for possible errors and incompatibilities, both in terms of the magnitude of the work and the method of installation. If there is an error or non-conformity, it must be addressed in writing in the tender process. Otherwise it is assumed that the contractor is fully aware of it and it is the Contractor's obligation to carry it out without additional costs.
- e. Before works started, the Contractor must submit and obtain approval of detailed shop drawings from the Consultant/UNDP. The drawings must provide detailed and clear information on the installation of all components of the equipment.

4.1.10. Equipment and Materials

- a. Before the works begin, the Contractor must submit a list of equipment and materials to be installed in 3 (three) copies to the Consultant/UNDP.
- b. The contractor must submit catalogues/brochures and samples of equipment and materials to be installed to the Consultant/UNDP for approval. All costs associated with submitting this sample are the contractor's responsibility. As for the main equipment which is not possible to deliver, for example, the Contractor can simply submit a complete catalogues/brochures.
- c. Equipment or components to be installed must be of one brand in order to facilitate maintenance. Likewise for the material to be used.
- d. The contractor is required to recheck all sizes and/or capacities of the equipment to be installed. If there are doubts, the contractor can ask the Consultant/UNDP.
- e. If an error occurs in determining the size or capacity of equipment that was not previously consulted with the Consultant/UNDP, it will be the responsibility of the contractor to fix/replace, without additional costs.
- f. It is not permissible to replace equipment and materials contained in the specifications. If there is an unavailability of equipment and or material that must be replaced, the contractor must submit a certificate from the manufacturer about the unavailability of equipment and or material. Replacement must be equal or better and have the approval from the Consultant/UNDP, without additional costs.

4.1.11. Sub Contractors

- a. As long as it is not contradicting with the regulations, the contractor can use the additional staff as Sub Contractor.
- b. Sub Contractor must obtain prior approval from the Consultant/UNDP.
- c. Remaining job is the responsibilities of the main contractor.

4.1.12. Internal monitoring

- a. Main Contractor is fully responsible for all work.
- b. Contractor must appoint experts to supervise every part of the work
- c. These experts must be ready at the sites and able to make decisions of work.
- d. The Consultant/UNDP can reject the experts, if deemed less capable or can hamper the implementation of work

4.1.13. Safety and Security of Works

- a. Contractors are responsible for safety and security, both for workers and the work environment. In the event of an accident in the course of work, the contractor is obliged to immediately take action to help and report the incident to the competent authority (Kementerian Ketenagakerjaan, etc.) and to account for it in accordance with applicable regulations.
- b. A complete First Aid Kit must be available at working area.
- c. Other regulations relating to safety and security will be issued by the Consultant/UNDP.

4.1.14. Reports and Photo Documentation

- a. Contractor is required to make a Daily Report that records all instructions, orders and details of the work. Daily Report on the same date must be submitted to the Consultant/UNDP to be examined and approved.
- b. Based on the daily report, a weekly or monthly report is made, which contains as follows:
 - Number of employee
 - Progress update
 - Used of materials and equipment
 - Obstacles experienced
 - Guest site visit
 - Other events that need to be accessed
- c. Weekly and Monthly Reports must be signed by the Consultant/UNDP as an evidence that they have agreed to the report.
- d. Contractors must take color photographs of postcard size for documentation of each stage:
 - Location before work begins
 - Stage of work
 - During force majeure
 - Handover I
 - Handover II

This photo is posted on an A4 size album with a short description.
- e. Each report and photo album are made of 3 (three) sets. After obtaining approval, each is submitted to the Consultant, UNDP and one are kept by contractor.

4.1.15. Addition and Subtraction

- a. Variation of works due to latent conditions etc. must be reported to and approved by the Consultant/UNDP.

- b. Submission of material and other variation must be made in writing to the Consultant/UNDP for approval.

4.1.16. Work adjustment

- a. Drawings of plans and specifications from other fields of work must be studied and coordinated. The implementation of the installation work must be planned carefully, so that interference with other parts of the work can be eliminated/minimized. The contractor must report all parts of the building construction that will be used for installation work.
- b. Every installation job must be carried out at the right time and condition, so as not to obstruct other work. If there are difficulties that can hamper the pace of work, these must be reported immediately to the Consultant/UNDP to be immediately resolved.
- c. If changes must occur, the contractor tries to make the changes which are still within certain limits, so that other fields of work are still proceeding as planned.

4.1.17. Work Repair

- a. The contractor must repair the damage to other occupations caused by its work.
- b. If the damage repair has been completed, the contractor must disassemble all equipment/materials that are not used and clean the location of items that are not needed.

4.1.18. As Built Drawing / Manual / Certificates

After the work is completed, the Contractor is required to submit to UNDP, in the form of installation drawings in accordance with those that are installed (as built), instruction manuals, guarantee letters, permits and official information as well as certificates/approvals from the authorized related to the work.

4.1.19. Handover

- a. All work is declared to be completed if the Contractor has completed the work properly, correctly and safely and has been approved by the Consultant/UNDP.
- b. At the time of the First Handover of Work, the Contractor must submit:
 - Minutes of test results and trial run of all works and the letter of statement/test certificate signed by an official from the authorized.
 - Catalogues of all installed equipment and materials.
 - Operating and Maintenance Manual in Indonesian of all installed equipment and materials.
 - Warranty certificate for all equipment and materials.
 - As built drawings throughout the installation of 5 (five) sets, consisting of 1 set of A1 size, 3 sets of A3 size and files in the flashdisk.
- c. At the time of the Second Handover of Work, the Contractor must submit:
 - Minutes of the Second Job Handover (maintenance period).
 - Complete licensing documents
 - Documents containing instructions from Consultant/UNDP and efforts to improve the work that has been done related to these instructions.
 - Equipment identification results.
 - The working method for the entire installation.
 - Operator training certificate.

4.1.20. Maintenance and Warranty Period

- a. The contractor is required to maintenance with period of 90 (ninety) calendar days for installation and 1 (one) year for the equipment to be installed, starting from the first handover.
- b. During the maintenance period Consultant/UNDP will issue a list of defects that contains defects or damage or malfunctioning parts of works/equipment and instruct the contractor to immediately repair it. The final list of defects is issued 14 days before the end of the maintenance period.
- c. During the maintenance period, Contractor is required to place (at a minimum) an expert operator for each part of the job, who will also act as a trainer for the prospective operator.
- d. If damage does not occur due to an error, the contractor is entitled to receive payment for repair/replacement work in accordance with the procedure for additional work.
- e. Contractor is obliged to carry out a warranty period for 1 (one) year for equipment that has passed the maintenance period, starting from the handover of the second job.
- f. Contractor is still responsible for any damage to equipment during the warranty period, unless stated otherwise in the contract.

4.1.21. Protection for UNDP

UNDP must be exempt from all juridical claims that may occur due to the use of materials, equipment, certificates, licenses etc. by the contractor.

4.1.22. Testing and Trial-run

- a. All the equipment and materials before installation and after installation, and before they are operated normally, the Contractor shall perform the inspection, testing and trial run.
- b. The Contractor is responsible for all costs, equipment, supply of electricity, labor and others, either against it or by third parties.
- c. All main materials proposed to be equipped with a test certificate, either by the manufacturer or by an authorized third party for this test.
- d. Trial-run of the entire installation work including load testing should be in accordance with the procedures and suggestions from the factory and the regulations/standards related.

4.2. ELECTRICAL WORK**4.2.1. General**

The contractor must offer the entire scope of work described in this specification and as shown in the drawings, where the equipment and material used must comply with the provisions of this specification. If there is a difference between the specifications of the equipment and/or materials installed with the specifications required in this book, the contractor must replace the equipment and/or materials to meet the specifications required in this book, without additional costs.

4.2.2. Scope of work

- a. Procurement, installation and setup of equipment and materials that are described in this specification and drawings, among others:
 - 1) Low voltage cables
 - 2) Low voltage panels
 - 3) The lighting installation (including switches), regular outlet 200W, special outlet and connection box
 - 4) Armature lighting inside and outside the building, a regular outlet 200W, a special outlet and connection box

- 5) Grounding systems
- b. Procurement, installation and adjustment of auxiliary equipment and auxiliary materials, both mentioned in the drawings and specifications or not mentioned but technically required to obtain a perfect result, secure, ready-made and reliable.
- c. Carrying out inspection, testing and validation of all the work by the relevant authorities
- d. Assist owners in the process of connecting electricity to local PT. PLN (Persero)

4.2.3. Equipment and Materials

1. Low Voltage Panel (SDP)

- a. Low voltage panels must comply with SII/SNI Standards or international VDE/DIN standards and IEC and PUIL regulations
- b. General specifications.

Voltage	: 400/231 V
Frequency	: 50 Hz
Main Busbar Current Rating	: 3.200 A or with minimum 1.5 x IAF from CB
Degree of protection	: IP 55
- c. For indoor, free standing and perfectly grounded type, the panel door must be equipped with a master key.
- d. The panels must be made of 2 mm thick iron plate with an iron frame and all must be zinc-chromate and finished with 3 layer powder coating (± 0.15 mm) in gray or other colors as requested by the Consultant/UNDP.
- e. The layout of the components and other equipment must be properly arranged, safe, easy to operate, easy for maintenance and repair.
- f. The wiring line is neatly arranged, protected, and easy to repair and add. Terminals for incoming or outgoing cables, both power and control cables, are placed in a safe and easy place to connect.
- g. Each panel must have 5 copper busbars consisting of R-S-T-N-E which size must be taken into account so that the temperature risen in the panel does not exceed 65°C during peak load; each busbar must be colored according to PLN regulations.
- h. The size of each panel unit must be adjusted to the needs and room conditions.
- i. The number and type of panel components are shown in the drawings
- j. Equipped with indicator lights and meters according to the drawings
- k. Products from Pokasa, Nobi or equivalent
- l. Prior to procurement, the Contractor must submit a catalog, working drawings, certificates of eligibility and testing to the Consultant/UNDP for inspection and approval.

2. Panel Distribution / Control

- a. Low voltage panels must comply with SII/SNI Standards or international VDE/DIN standards and IEC and PUIL regulations
- b. General specifications.

Voltage	: 400/231 V
Frequency	: 50 Hz
Main Busbar Current Rating	: 2.000 A or with minimum 1.5 x IAF from CB
Degree of protection	: IP 55
- c. Types of indoor, free standing or wall mounted pairs with openings above and/or below, perfectly grounded, panel doors must be equipped with a master key.
- d. The panels must be made of 2 mm thick steel plate with an iron frame and all parts of the panel must be zinc-chromate and finished with 3 layer powder coating (± 0.15 mm) in gray paint or other colors as requested by the Consultant/UNDP.

- e. The layout of the components and other equipment must be properly arranged, safe, easy to operate, easy for maintenance and repair.
- f. The wiring line is neatly arranged, protected, and easy to repair and add. Terminals for incoming or outgoing cables, both power and control cables, are placed in a safe and easy place to connect.
- g. Each panel must have 5 copper busbars consisting of R-S-T-N-E which size must be taken into account so that the temperature risen in the panel does not exceed 65° during peak load, each busbar must be colored according to PLN regulations.
- h. The size of each panel unit must be adjusted to the circumstances and needs.
- i. The number and type of panel components are shown in the drawing.
- j. Recommended production from Pokasa, Nobi or equal.
- k. Before procurement, the Contractor must submit a catalog, working drawings, certificates of eligibility and testing to the Consultant/UNDP to be checked and obtain approval

3. Low Voltage Panel Components

- a. Molded Case Circuit Breaker (MCCB)
 - Rated continuous current: as drawings, adjustable
 - Type: fixed mounted.
 - Number of phase/pole: 3 phases (3 or 4 poles)
 - Rated operating voltage: 380 Volt.
 - Rated Frequency: 50 Hz
 - Permitted ambient temp.:max. 55°C.
 - Rated short circuit breaking capacity: as drawing
 - Mechanism Operator: manual operation.
 - Over load release: adjustable
 - Instantaneous over current: Permanently set
 - Auxiliary switch: 1 NO + 1 NC
- b. Miniature Circuit Breaker (MCB)

• Rated continuous current	: as needed
• Type	: fixed mounted.
• Number of phase /pole	: 1 or 3 phases (1, 3 or 4 poles)
• Rated operating voltage	: 220/380 Volt.
• Rated Frequency	: 50 Hz
• Permitted ambient temp.	: Max. 55°C.
• Rated short circuit breaking capacity	: as drawings
• Operator Mechanism	: manual operation
- c. All the components and auxiliary equipment/material are from the Low Voltage Panel from Schneider, ABB or equivalent

4. Low Voltage Cables

- a. Low Voltage cables and associated equipment must comply with the Standard SII/SNI or international standards VDE/DIN and IEC regulations and PUIL.
- b. The cable must be able to be used for min voltage. 0.6 kV, except for NYM types is 0.5 KV
- c. Conductor of soft material annealed uncoated copper

- d. Cable types NYM, NYY and NYA for wiring inside buildings; while the types of NYFGbY or NYRGbY for underground cable
- e. The type and size of the cables used must be in accordance with drawings, if there are changes that have to be proposed and to seek prior approval to the Consultant/UNDP
- f. Production of the Supreme, Kabelindo or equivalent
- g. Before the procurement, the Contractor must submit samples, catalogs/brochures and cable testing certificate to the Consultant/UNDP for review and approval

5. Lighting

a. Lamp

1) Tube Lamp TL-LED.

- Color light cool white/daylight, efficacy min. 115 lms / W, CRI of 95 or 70 corresponding to mounting locations
- working voltage of 220-240 Volt, frequency 50 Hz, ambient Temp.Range (-40 ~ +55°C)
- For light fittings G13
- wattage according to the drawing
- TL-LED lights are products of Philips or equivalent
- Before the procurement, the Contractor must submit samples and catalogs/brochures to the Consultant/UNDP for review and approval

2) LED Bulb

- The light color cool daylight lamps, efficacy min. 95 lms/W, CRI of 95 or 70 corresponding to mounting locations
- working voltage of 220-240 Volt, frequency 50 Hz, ambient Temp.Range (-40 ~ +55°C)
- For E27 light fittings
- wattage according to the drawing
- Bulb-LED lights are products of Philips or its equivalent
- Before the procurement, the Contractor must submit samples and catalogs/brochures to the Consultant/UNDP for review and approval

b. Fixtures

1) TL-LED RM-ML (Recessed Mounted Mirror Louvre)

- Recessed is mounted and equipped with a mirror and louvre, no glare.
- Using TL LED type with wattage 14.5 W
- Using a steel plate with a minimum thickness of 0.4 mm and finished by powder coating
- Construction of fixtures should provide maximum illumination efficiency, robust, secure, simple and neat for easy maintenance and repair work.
- All fixtures should be equipped with a grounding terminal.
- Type of lamp fittings do not use bolt nut
- The fixtures are products of Lucolite, Artolite or equivalent
- Before the procurement, the Contractor must submit samples and catalogs/brochures to the Consultant/UNDP for review and approval

2) TL-LED TKI

- Embedded/recessed mounted and equipped with mirrors, no glare.
- Using TL LED type with wattage 14.5 W

- Using a steel plate with a minimum thickness of 0.4 mm and finished by powder coating
 - Construction of fixtures should provide maximum illumination efficiency, robust, secure, simple and neat for easy maintenance and repair work.
 - All fixtures should be equipped with a grounding terminal.
 - Type of lamp fittings do not use bolt nut
 - The fixtures are products of Lucolite, Artolite or equivalent
 - Before the procurement, the Contractor must submit samples and catalogs/brochures to the Consultant/UNDP for review and approval
- 3) Berets
- The base of the fixture from a steel plate is finished by powder coating and equipped with aluminium reflector
 - The lamp house (cover/cap) is rectangular or round of heat-resistant acrylic material. The size of the cover/cap minimum 20x20 cm or diameter 20 cm, clear or white color.
 - Using a light bulb LED type with wattage 10.5 W
 - The fixtures are products of Lucolite, Artolite or equivalent
 - Before the procurement, the Contractor must submit samples and catalogs/brochures to the Consultant/UNDP for review and approval
- 4) Down Light
- The fixtures of aluminum sheet is finished by powder coating, round and equipped by aluminium reflector.
 - Using a light bulb LED type with wattage 10.5 W
 - The size of the fixtures is min. 8 cm. diameter.
 - The fixtures are products of Lucolite, Artolite or equivalent
 - Before the procurement, the Contractor must submit samples and catalogs/brochures to the Consultant/UNDP for review and approval
- 5) High Bay Lights
- The fixtures use die-cast aluminium with polyester which are painted, equipped with tempered glass lens and a gasket seal, the color of white light house.
 - Lighting distribution : medium or wide
 - Degree of protection: IP 65
 - At the time of installation, the accessories recommended by the manufacturer must be used.
 - The fixtures must be equipped with a grounding terminal.
 - The Lamps of Fortimo or HBX type are products from Philips or its equivalent
 - Before the procurement, the Contractor must submit samples and catalogs/brochures to the Consultant/UNDP for review and approval
- 6) Spotlights
- The fixtures uses extruded aluminium painted polyester, optical lens cover and use polycarbonate, equipped with adjustable bracket.
 - Lighting distributor: medium or wide

- Degree of protection: IP 65
 - The fixtures must be equipped with a grounding terminal.
 - BVP type lamps are the products of Philips or its equivalent
 - Before the procurement, the Contractor must submit samples and catalogs/brochures to the Consultant/UNDP for review and approval
- 7) Orientation lights
- Orientation lights uses LED lamps equipped with battery and charger.
 - Orientation lights automatically light up when the power source of the PLN/generator outages.
 - Orientation lights use the TL-8W LED lamp, the lamp housing from galvanized steel plate with a minimum thickness of 0.7 mm cover from acrylic.
 - Using battery Nickel Cadmium Dry Cell types with maximum charging time 24 hours and must be capable of operating for at least 2 hours
 - Equipped with indicator and push-button for checking the condition of the battery.
 - Orientation lights are products of Lucolite, Artolite or the equivalents
 - Before the procurement, the Contractor must submit samples and catalogs/brochures to the Consultant/UNDP for review and approval
- 8) Exit lights (Emergency)
- Exit lights (emergency) use LED lamps equipped with battery and charger.
 - Exit lights (emergency) light up automatically in dark surroundings and circumstances at the time of the power source PLN/generator operates or outages.
 - Exit lights (emergency) using 5W LED lamp, the lamp housing of aluminum/heat-resistant plastic, paper EXIT on acrylic that can be seen/read from both sides.
 - Using battery Nickel Cadmium Dry Cell types with maximum charging time of 24 hours and must be capable of operating for at least 2 hours.
 - Equipped with indicator and push-button for checking the condition of the battery.
 - Exit lights (emergency) are products of Lucolite, Artolite or the equivalent
 - Before the procurement, the Contractor must submit samples and catalogues/brochures to the Consultant/UNDP for review and approval

6. Switches And Equipment Contacts

a. Switch

- Made of white plastic heat resistant, flush mounting.
- Baud using a binder not the kind of claw-fix
- Equipped with thick steel box min. 35 mm.
- The ability of the switch contacts min. 16 Amps / 250 Volts.
- For wet areas, the switch should be waterproof.
- Product of MK, Clipsal or the equivalent

- b. Ordinary/Regular Outlet
 - Made of white plastic heat resistant, flush mounting.
 - Baud using a binder not the kind of claw-fix.
 - Equipped with thick steel box min. 35 mm.
 - The ability of the stock contacts is a minimum of 16 Amps/250 volts and has a grounding terminal.
 - Power outlet (Phase 1) is also equipped with switches, indicator lights and plug containing a fuse.
 - For wet areas, the contact box should be waterproof.
 - Products of MK, Clipsal or the equivalent
- c. Special outlet (3 Phase)
 - Made of heat-resistant plastic, surface mounting.
 - Ability socket adapted to the needs (see drawing), min. 16 Amps at 380 Volts/3 Phase.
 - Have 5 poles for 3 Phase system with neutral and earth.
 - Equipped with the appropriate plug.
 - For wet areas, the contact box should be waterproof.
 - Product of MK Comando, ABB or the equivalent.
- d. Control Unit
 - Made of heat-resistant plastic or cast iron, surface mounting and waterproof.
 - Equipped with on-off switch that has the ability to fit the needs min. 16A at 380/220 V, whether to switch or rotary switch press.
 - Terminals must match the size of cable used equipment/machinery. Entries minimum size of 3/4 inches and are equipped cable gland.
 - Products of MK Comando, ABB or the equivalent.
- e. Junction Box
 - Used for cable connection to the equipment/machinery.
 - Made of heat-resistant plastic or cast iron, surface mounting and waterproof.
 - The terminal of the junction box must match the cable size used by the equipment/machine. Likewise the ability to pass the electric current the number of terminals is adjusted by the number of cable cores used by the machine/equipment.
 - Products of MK Comando, ABB or the equivalent.

7. Motor Controller/Starter

- a. DOL Starter
 - Motor with a capacity of <2 HP - 1 Phase that does not have a built-in thermal protection, yet has a manual starter, then using a seat load/bimetal corresponding to each starter.
 - Motor with a capacity of under 5 HP - 1 phase and 3 phase will be connected directly by using DOL starter or another starter that fits the image.
 - Components DOL starter (thermal overload relays, contactors, push-button and indicator) are arranged in a starter box made of polycarbonate
 - Capacity and placement DOL starter according to the instructions in the drawing.
 - Starter DOL components must be either Schneider or the equivalent

- Motor with a capacity of > 5 HP - 3 phase should use the YD starter or Soft Starter or Variable Speed Drive (VSD)
- b. YD starter
 - Used for motors with a capacity of > 5 HP - 3 phase.
 - Component YD starter (thermal overload relays, contactors, timers, control relays, push-buttons, indicators) are arranged in a starter box made of polycarbonate or galvanized steel plate.
 - YD starter placement capacity and according to the instructions in the drawing.
 - YD starter components must be either Schneider or the equivalent
- c. Soft Starter
 - Using power electronic circuits to reduce the motor starting current by regulating incoming voltage
 - Soft Starter can be used for motors with different capacities
 - Soft Starter components are arranged in panels made of polycarbonate or galvanized steel plate (depending on the capacity)
 - Soft Starter selected must be compatible with Full System Control and Data Acquisition Programmable Logic Control (SCADA, PLC) which has been used
 - Capacity and Soft Starter placement according to the instructions in the drawing.
 - Soft Starter is a product of Schneider ATS 48 or the equivalent

8. Installation Supplies

- a. Protective Pipes/Conduits
 - Protective pipe embedded in the wall/cast using rigid high impact PVC pipe (min. AW class) with inner diameter > 2 X outside diameter of the cable
 - Protective pipes that are not embedded in the walls/cast (outbow) using plainsteel conduit of National Matsushita, Panasonic or equal. We can also use PVC compact mini trunking of EGA, MK or equal.
 - For cables above the ceiling which are not embedded in the wall/cast and not on the rack, must use a flexible pipe of PVC with an inner diameter > 2 X outside diameter of the cable.
 - Use appropriate supporting materials (elbow, box, coupling/socket, etc.), the same brand as the conduit used and installed in the right and safe way.
- b. Cable Rack and Cable Ladder
 - Material of perforated steel plate with a thickness of minimum 1.6 mm for feeder cable installation and minimum 1.2 mm for lighting installations
 - Using U-type cable racks with openings (holes) of about 50%, while cable ladder is using W-type. Both have suitable covers.
 - Finishing with electric painting minimum 12 microns
 - Length per part minimum 2.4 meters with width and height referring to the drawing; for the installation of lighting, width and height of cable rack is used as needed.
 - Use appropriate supporting materials (elbow, 3 ways, cross, reducer, joint etc.), with the same brand as the cable rack/cable ladder used and installed the correct and safe way.
 - Branded Trayindo, Trias or the equivalent.

c. **Auxiliary Materials and Equipment**

- Auxiliary materials and equipment might be mentioned in this specification or not, but it is technically required to complete the installation in order to obtain a good, compliant, safe and reliable result
- The cable clamps, fastener (cable tie) etc. that used to be manufactured.
- The connection between the wiring for lighting and socket installation should be done in a terminal box, color cable must be safe. terminal box used must be large enough and fitted lid.
- All cable connections to terminal equipment must use the appropriate cable shoe size and fitted the right way

4.2.4. Implementation

1. Panel Installation

- Panel location as shown in the drawing and adapted to local conditions, if there is difficulty in determining the location of the panel, guidance will be provided by the Consultant/UNDP.
- For panels installed embedded, the cable from/to the terminal panel must be protected with PVC pipes that are embedded in the wall in a firm and orderly fashion. Whereas for panels that are mounted against the wall (outbound), the cable from/to the terminal panel must go through a cable ladder and be arranged/tied neatly. The panel must be fixed firmly to the wall with 4 baud binders (dina-bolt) with a diameter of min. $\frac{5}{8}$ ", generally the height of the panel mounted on the wall (wall mounted) = 1.60 meters from the floor (axis).
- Panels that are installed standing on the floor must be equipped with a strong concrete foundation with height according to the drawing min. 10 cm above the floor surface (for outdoor min. 30 cm) and is equipped with 4 armature/anchor diameter of min. $\frac{5}{8}$ ", cable from/to terminal panel through cable trenches or ducts.
- Connecting cables to terminals (terminations) must use the appropriate cable shoes. Installation of cable shoes can use press-pliers for sizes up to 16 mm² and hydraulic crimping tools for sizes up to 400 mm². Installation of cable shoes and termination must be good, will not cause harmful electric symptoms and cause dangerous electrical symptoms.
- Each cable that enters/exits from the panel must be equipped with a rubber gland or a tight cover without a sharp surface
- The contractor must prepare shop drawing for each panel installation and submit it to the Consultant/UNDP for inspection and approval.
- Note: the installation of the motor controller/starter follows the requirements for panel installation

2. Withdrawal Cable on Building

- Withdrawal of underground cables must meet the applicable regulations/standards, the requirements of the manufacturer and shown in the drawings/specification
- Cable ends must be marked with a clear mark cable and not easily separated
- Outbow cable plugged in horizontal/vertical must use the rack/cable ladder, arranged neatly and tied with a cable tie.
- Cables are installed embedded in the wall should use protective pipe/conduit from PVC
- There shall be no cable connection' cable branching must use terminal box which is equipped with terminals and cover.

- All cable terminations must use the appropriate cable shoes. Installation cable shoes in accordance with the above description
- All cables to be installed through walls or concrete sleeve must be made of PVC pipe with a diameter AW minimum 2 ½ times of the cable diameter.
- Each power cabling should be given supplementary length of ± 1 m each end.

3. Underground Cable Withdrawal

- Underground cable withdrawals must meet applicable regulations/standards, manufacturer's requirements and those shown in the drawings/specification
- It is not allowed to change the cable type and size without the approval from the Consultant/UNDP
- Underground cable withdrawal line as shown in the drawing and adapted to local conditions, if there is a problem or difficulty in determining the cable line, guidance will be provided by the Consultant/UNDP
- Excavation can only be carried out after the underground cable withdrawal route is surveyed, inspected and approved by the Consultant/UNDP
- Laying/pulling of the new ground cable can be done after the excavation is examined and received approval from the Consultant/UNDP
- Cables should not be twisted and labeled with lead indicating direction and phase at any distance of ± 1 meter, the thickness of the sand layer and the installation of protective bricks must be applied as required in the drawing/specification.
- Underground cable lines crossing roads or pavement must be protected with a minimum of class AW PVC pipe
- Containment is not permitted before the Consultant/UNDP checks and approves the placement of the cable.
- After the confinement is completed, every 15 meters must be installed concrete pegs 20 x 20 x 60 cm and read "Underground cable". These stakes are painted yellow with red writing.
- Cables that penetrate walls or floors must use sleeve pipes of the size according to the drawing, these pipes must be at least from PVC – AW class
- Connecting cables is avoided, except when circumstances does not allow. The connection can be done after obtaining permission from the Consultant/UNDP, by using Cable Sealing/Cast Resin made by 3M or equivalent. Above the connection is placed a concrete stake that read "Mof Cable".
- Cables should not be bent with a radius less than 15x in diameter. Above the turn is placed a concrete stake that read "Underground Cable" and the direction of the turn.
- This work should not be done at night.

4. Lighting Fixture Installation

- Installation of lighting fixture must comply with the regulations/standards applicable, the requirements of the manufacturer and shown in the drawings/specification
- The mounting location light fixture in the sited should be coordinated first with the related parties/contractors and obtain approval from the Consultant/UNDP.
- Must be strong, neat, flat and straight so it does not diminish the aesthetic value of the room
- Should be minimized as small as possible loading fixture to the ceiling or other part of the building, so it does not cause deformation of the ceiling or other part of the building. A light fixture mounted on the ceiling will be equipped with a wire hanger (hanger) is strong, except for the light type of beret and down-light.

- Cable connection to the fixture must use cable shoes with a given reserve a minimum length of 0.5 meters.

5. Installation Switches and Connecting Devices

- Installation of switches and connecting devices mentioned above must meet applicable regulations/standards, the requirements of the manufacturer and be shown in the drawing/specification
- The installation location must be coordinated first with the related parties/contractors and obtain approval from the Consultant/UNDP
- Must be sturdy, neat and straight so it does not reduce the aesthetic value of the room
- The height of the switch installation is average 120 cm from the floor
- The height of regular outlet installation in public areas (corridors, waiting rooms, nurse stations etc.) is 30 ~ 40 cm from the floor, and for the in-patient room, maternity etc. is 120 ~ 150 cm from the floor
- The height of the installation of power outlets, special outlets, control units and junction boxes is adjusted to the location of the equipment to be served, but at least 30 cm from the floor

6. Grounding

- The Grounding System must meet the applicable regulations and requirements shown in the drawings/specification.
- Grounding system is a network of earth inside and outside of the building that is connected with several ground points
- All electrical equipment, metal equipment and structural building parts of metal must be connected to the grounding system. The cable rack, cable ladder and metal in the cable channel must be connected to the grounding system in several places to be perfectly grounded.
- Grounding for panels and other electrical equipment uses NYA/BCC, while for metal equipment and building structures uses BCC, the conductor size is as per drawing (min. 4 mm²). Connecting the ground to the equipment using cable shoes, connecting the ground to the building structure with welded, the connection between the conductor and branching using a connector/reducer of copper
- The ground point must be equipped with a 40 x 40 cm control box, ground electrodes using copper rods with a diameter of min. 1 " with depth of 4 meters.
- Soil resistance at each ground point <1 Ohm measured after 3 days without raining, the earth electrodes can be added in number and depth, then paralleled in order to achieve a soil resistance value <1 Ohm.
- The measurement of land resistance is carried out by the contractor and witnessed by the Consultant/UNDP.

4.2.5. Installations Testing

- After the electrical work completed by the contractor and approval or endorsement from the Consultant/UNDP, it must be tested.
- The test shall be conducted in accordance with the applicable regulations/standards, the requirements of the manufacturer and shown in the drawing/specification.
- The contractor must plan and establish detailed testing schedule to be submitted to the Consultant/UNDP and gain its approval.
- If results of the test are not good or did not meet the regulations/standards/requirements, the Contractor must refine it to obtain a good result, with costs fully borne by the Contractor.

- Each good results test must be written in the news-event to be signed by the Contractor and the Consultant/UNDP. The Minutes of this test will become the attachment of acceptance of the first phase of work.
- Testing should be performed include:
 - 1) No Load Test
 - 2) Full Load Test
 - 3) Operation Test (Trial Run)

1. No Load Test

The test is performed without the load and one by one to the equipment:

- a. Panel
Tests include, but are not limited to, those mentioned below:
 - Visual inspection
 - Insulation resistance measurement with 1000 volt megger
- b. Cable
Tests include, but are not limited to, those mentioned below:
 - Visual inspection
 - Measurement of insulation resistance at 1000 volts megger
- c. Testing Installation 0.6 / 1 kV
Tests include, but are not limited to, those mentioned below:
 - Measurement of insulation resistance with 1000 volt megger
 - Measurement of installation resistance with 1000 volt megger
 - Measurement of grounding resistance

2. Full Load Test (NA)

Full load test was conducted by loading equipment gradually until it reaches full load according to its capacity, the test is conducted on transformers

The transformer is operated with a given load "artificial/bank" gradually until reaching full load as well as the observation of the entire meter, indicator etc.

Note:

Implementation of no-load test and full load test on transformers, MV panels and MV cables should be done by an independent third party, namely PT. PLN (Persero) - Litbang Ketenagalistrikan (JTK) at Jln. Duren Tiga, South Jakarta.

3. Operation Test

Operation test is to operate the electrical system with the actual load (attached) and an operation test of any kind of load attached, because at the time of this operation test any type of load is also fully operational. 3x24-hour operation test performed.

4.3. LIGHTNING PROTECTION

4.3.1. General

The contractor must offer the entire scope of work described in this specification and as shown in the drawings, where the equipment and material used must comply with the provisions of this specification. If there is a difference between the specifications of the equipment and/or materials installed with the specifications required in this book, the contractor must replace the equipment and/or material to meet the specifications required in this book, without additional costs.

4.3.2. Scope of Work

- a. Procurement, installation and arrangement of the equipment and materials mentioned in the drawings/specification, includes:
 - Air Termination
 - Down Conductor
 - Earth Termination
 - Grounding
- b. Procurement, installation and regulation of auxiliary equipment, whether or not mentioned in the drawings, but generally/technically necessary to obtain a perfect, ready-to-use and reliable system.
- c. Carrying out checks, tests and endorsements throughout the installation.
- d. Carry out maintenance of all installations and provide training for officers from the owner

4.3.3. Equipment and Materials

1. Air Terminal (Protector Head)

- Air terminal is electrostatic (single pole type) and does not have moving parts with a minimum protection radius of 70 meter
- Air terminal from non-corrosive material.
- Air terminal must be completely insulated with mounting poles and other building parts.
- In the air terminal, an obstruction lamp installed (optional)

2. Down Conductor

- The down conductor used is 2 x 35 mm² HV coaxial cable or 70mm² HV shielded cable (as required by the manufacturer).
- There is no connection to the down conductor

3. Mounting Pole

- Mounting Pole consists of steel poles or steel construction with a height of 5 meters higher than the highest roof of the protected building (or as required by the manufacturer)
- The pole location is in the drawing and will be adjusted to the site's situation.

4. Earth Termination

- Earth termination is the connection between the down conductor and the grounding system, which can be used at any time to measure the resistance of the grounding system.
- This connection must be strong mechanically or electrically, inside the control box by using a parallel clamp or sleeve connection

5. Grounding System

- Grounding system must meet applicable regulations and the requirements shown in the drawing/specification.
- Grounding System for lightning protection must be separated from the grounding system of building electricity
- The ground point must be equipped with a 40x40x40 cm control box or according to the instructions in the drawing, grounding electrodes use copper rods with a diameter of min. 1 "with depth of 4 meters.
- Soil resistance at each grounding point <2 Ohm measured after 3 days without raining, grounding electrodes can be added in number and depth, then paralleled to achieve a soil resistance value <2 Ohm.
- The measurement of ground resistance is carried out by the contractor and witnessed by the Consultant/UNDP

4.3.4. Implementation

- Installation of lightning protection system must be correct and strong/sturdy so as not to cause interference with the construction and aesthetics of other buildings.
- The location of the lightning protection system is adjusted to the conditions at the site
- The air terminal is installed at the top of the pole using the correct equipment (connection sleeve), so that it will be mechanically strong but isolated from the pole
- The cables that go down vertically must be clamped to be strong, straight and neat on the frame/pole wall, the distance between the clamps is max. 1 meter.
- Control box of construction/masonry and covered with checkered plates for periodic measurements of soil resistance

4.3.5. License

- The contractor must have special permission and experience in the installation of Lightning Protection and be proven by providing a list of projects that have been done.
- The contractor is responsible for taking care on the licensing of the installation of the Lightning Protection system at the local Department of Manpower (Dinas Ketenagakerjaan) until it is certified/recommended.

4.3.6. Testing

Testing or measuring of soil resistance is carried out using megger after 3 consecutive days without raining and must be carried out by the contractor in the presence of the Consultant/UNDP.

4.4. TELEPHONE SYSTEM

4.4.1. General

The contractor must offer the entire scope of work described in this specification and shown in the drawings, in which equipment and materials used must comply with the provisions of this specification. When there is a difference between the specification of equipment and/or materials are installed to the specifications required by this book, then the contractor must replace equipment and/or the material to meet the specifications required by this book, without any additional cost.

4.4.2. Scope of work

- a. Procurement, installation and adjustment of the equipment and materials mentioned in the drawing/specification, among others:
 - Wiring telephone system, along with outlets and telephone sets.
 - Terminal/frame distribution in buildings (DF).
 - Connecting cable between MDF and DF. Telephone Central (PABX) and MDF have been installed in other buildings (Administration Bldg)
- b. Procurement, installation and adjustment of auxiliary equipment, both of which have been mentioned in the drawing or not, but in general/technical service is necessary to obtain a perfect system, ready to use and reliable.
- c. Examinations, testing and approval of the entire installation.
- d. Carrying out maintenance of the entire installation and provide training for officers from the User/Hospital

4.4.3. Equipment And Materials

1. Distribution Frame

- a. Every telephone line connection must use jumpering system and insulated terminals according to Perum Telekomunikasi standards. The terminal is placed firmly and neatly organized in a panel box called Distribution Frame.
- b. Distribution Frame (DF) found on each floor.
- c. DF is made of steel plate with a thickness of 1 mm. All must be finished by painting powder coating (3 layers, ± 0.15 mm) in kanzai gray or other colors as requested by the Consultant/UNDP. Powder coating must be done with the right method and by experienced staff
- d. For locations with high humidity, MDF / DF must be equipped with airtight doors.
- e. Number of terminals according to instructions in the drawing.

2. Cable

- a. The cables must have backup cables for replacement in case of damage and/or to accommodate future developments.
- b. For inside of the building, types of ITC (indoor telephone cable) is used with a minimum diameter of 0.6 mm. The core number of cable according to the instructions in the drawing
- c. For outside of the building and embedded, types of UTC (underground telephone cable) is used with a diameter of 0.6 mm and the number of cores per the instructions in the drawing.
- d. The cable used is a product from Supreme, Kabelindo or equivalent.
- e. Not allowed to change the type, size and number of cores without the approval of the Consultant/UNDP

3. Conduit

- a. All telephone wires inserted into the protective pipe from PVC pipe - D diameter of 1/2", while for the cables attached to the wall (outbow) can use the mini compact PVC trunking MK brand or equivalent
- b. Installation of the conduit must be clean, strong and regular. Equipped clamps, elbow and appropriate auxiliary equipment and installed the right way.
- c. To facilitate identification, then the telephone conduit in each range of ± 2 meters should be painted blue with width of 2 cm or with the words "telephone"

4. Outlet

- a. Made of heat-resistant plastic, flush mounting and not claw fix type.
- b. Steel box equipped with a minimum thickness of 3.5 mm
- c. Made by MK, Clipsal or equivalent.

5. Telephone Set

The telephone set must be compatible with an existing telephone system. The number and type of telephone set provided are in accordance with the instructions in the drawing, where the installation is carried out in stages according to the needs. The telephone set is desk type and wall mounted types that have been declared good by Perum Telkom, that the telephone set is able to work normally on the Perum Telkom local network. Each telephone set must have the following minimum facilities:

- a. Automatic connection with pulse dialing for internal conversation.
- b. Specific number for connection to Operator Desk.
- c. Number 0 for direct connection (only used for certain telephone sets).
- d. "Transfer of call" can be done for each branch plane using the ground button.
- e. All talks are "private" so that all interruptions must be accompanied by an acoustic signal.

4.4.4. Implementation

- a. Location of DF, an outlet and a telephone as shown in the drawing and adapted to local conditions. If there is difficulty in determining the location can be requested instructions from the Consultant/UNDP
- b. Generally the height of DF mounted on the wall is ± 2.75 meters and the telephone outlet is ± 0.50 meters.
- c. Withdrawal of the channel (in conduit) should be grouped neatly with the code number sequence according to the location of a telephone.
- d. Installation of conduit in concrete is installed before casting, while those inside the wall are carried out before plastered walls. This protective pipe is maintained so as not to break.
- e. The withdrawal of underground cables must have a minimum depth of 70 cm to the surface not compacted and at least 120 cm for surface hardened, laying cable protected with bricks that read PHONE. Connection is not allowed on underground cables.
- f. Underground cable withdrawals should not be carried out at night and must be witnessed/approved by the Consultant/UNDP.
- g. Implementation, inspection and testing of installation results shall be carried out according to the regulations issued by the Corporation of Telecommunications.

4.4.5. Testing

- a. Tests are performed after all equipment is installed properly.
- b. The test carried out is a function test, where the entire system must be able to function properly as required
- c. Testing done by contractors witnessed by the Consultant/UNDP

4.5. SOUND SYSTEM**4.5.1. General**

The contractor must offer the entire scope of work described in this specification and shown in the drawings, in which equipment and materials used must comply with the provisions of this specification. If it turns out there is a difference between the specification of equipment and/or materials are installed to the specifications required by this book, then the contractor must

replace equipment and/or the material to meet the specifications required by this book, without any additional cost.

4.5.2. Scope of work

- a. Procurement, installation and setup of equipment and materials from the sound system mentioned in the drawing/specification, among others:
 - Pre Amplifier Mixer
 - Equalizer
 - Power Amplifier
 - Line Selector
 - Microphone
 - Monitor Panel
 - Radio Tuner
 - Music Player
 - Blower Unit
 - Ceiling Speaker
 - Attenuator
 - Network or cabling and Terminal Box
- b. Procurement, installation and adjustment of auxiliary equipment, both of which have been mentioned in the drawing or not, but in general/technical service necessary to obtain a perfect system, ready to use and reliable.
- c. Examination, testing and approval of the entire installation.
- d. Carry out maintenance of the entire installation and provide training for officers from the User/Hospital

4.5.3. Equipment And Material

1. Major Equipment

The entire main equipment contained in the central sound system is a series of design of a product/brand and the brand allowed is TOA, Panasonic or equivalent. The main equipment consists of:

- a. Pre Amplifier Mixer
 - Unit digital mixer equipped with a Mic/Line Input Module, Line Output Module, Car Call Chime Module and Evacuation Module
 - The power source: 220V, 50Hz.
 - Power consumption: 40W.
 - Operating temperature: $\pm 5^{\circ}\text{C} \sim \pm 40^{\circ}\text{C}$.
 - Frequency response: 20Hz ~ 20KHz
 - Have at least five input channels with modules that will have a variable input sensitivity of 1 mV ~ 87 mV
- b. Equalizer
 - Type: 1-Channel 1/3 Octave Graphic Equalizer.
 - The power source: 220V, 50Hz.
 - Power consumption: 11W.
 - Frequency response: 20Hz ~ 20KHz
 - Harmonic Distortion: <0.01% at 1 KHz.
 - The input impedance: 10 K Ohm.
 - Equalizer sliders: Bands 28 Center Freq 31.5 Hz ~ 16 KHz, Boost / Cut ± 12 dB.

- Input level control: ± 12 dB.
 - High-pass filter: Adjustable Cutoff Freq 15 Hz ~ 300 Hz, 12 dB per oct.
 - Low-pass filter: Adjustable Cutoff Freq 2.5 KHz ~ 30 KHz, 12 dB per oct
- c. Power Amplifier
- Total output: 240W and 180W (as indicated in the drawing)
 - The output voltage: 50V / 70V / 100V
 - Frequency response: 40Hz ~ 20KHz
 - Distortion: <1% in the frequency limit
 - Power consumption : 22VA / 194VA (no signal / rated output) for PA 60W
: 32VA / 658VA (no signal / rated output) for PA 240W
 - The power source: 220V, 50Hz
- d. Speaker line selector
- Power source: 24V DC
 - Consumption electric current: 400 mA
 - Power handling: 250 W
 - Number of channels: 5 (minimum)
 - Operating Temperature: $-10^{\circ}\text{C} \sim \pm 40^{\circ}\text{C}$
- e. Microphone
- Type: dynamic microphone
 - Polar pattern: Cardioid (unidirectional)
 - Frequency response: 100 s / d to 10,000 Hz.
 - Output impedance: 600 Ohm, $\pm 30\%$ at 1 KHz, balanced.
 - Output level: -58 dB (1 KHz, 0dB = 1V / pa).
 - Microphone must be fitted with Heavy Duty Press to Talk Switch and selectable zone.
- f. Monitor Panel
- The monitor panel has audio and visual functions with 70Vdc and 100Vdc line input voltages and has controls for the channel selector switch, monitor volume, watt meter and line input selector switch. Monitor panel mounted on a standard rack/box.
- g. Radio Tuner
- Has control for AM/FM/OFF selector switch, volume control and tuning. AM / FM tuning range = 550KHz-1650KHz / 90MHz-108MHz. The working voltage is 24 Vdc and the current consumption is 55 mA
- h. Music Player
- CD/DVD/MP3 player, response frequency 2Hz - 20KHz and distortion <1%
- i. Blower unit
- Automatic work with ventilation abilities of 2500 liters/min and power consumption 10VA

2. Ceiling Speaker

Speaker has frequency between 90Hz ~ 12kHz, output power of 3W / 1.5W (on tap at 1.5W) with sound pressure level at 1W and 1m is not less than 90dB, angle of at least 90°

3. Attenuator

Attenuator or volume control has input capacity of 6W and 4-step level control

4. Cable

Using NYMHY 3x1,5 mm² cable for the entire installation, either from the main equipment to the terminal box or the terminal box to the attenuator and speakers. Cable production is from Supreme, Kabelindo or equivalent

5. Terminal Box

Terminal box is made of steel plate with a thickness of 1 mm with a finishing powder coating layer 3 (± 0.15 mm) kanzai gray or other colors as requested by the Consultant/UNDP. Location of the terminal box according to the instructions in drawings

6. Conduit

Using protective pipes of PVC pipe - D diameter 1/2 ". Installation of the conduit must be clean, strong and regular. Equipped clamps, elbow and appropriate auxiliary equipment and installed the right way.

4.5.4. Implementation

- All the cables installed above the ceiling are outbow using conduit pipe clamped on a concrete slab/truss/cable rack with a distance of 100 cm, the minimum distance with the power cord is 50 cm.
- All cables are mounted on the shaft using a conduit pipe which is clamped to the wall / cable ladder with distance of 150 cm, the minimum distance is 50 cm power cable
- Splicing / branching carried out in connection boxes using Spring Electrical Connector, Durados or Cable Connection
- Cabinet rack mounted or free standing monitor in central sound system
- All equipment must be grounded using NYA cable 4mm².

4.5.5. Testing

- Tests performed after all equipment are installed properly, there are no defects and complete
- This experiment is a test function, whereby the entire system must be able to function properly as required.
- Testing done by contractors witnessed by the Consultant/UNDP

4.6. FIRE DETECTION SYSTEM

4.6.1. General

The contractor must offer the entire scope of work described in this specification and as shown in the drawings, where the equipment and material used must comply with the provisions of this specification. If there is a difference between the specifications of the equipment and/or materials installed with the specifications required in this book, the contractor must replace the equipment and/or material to meet the specifications required in this book, without additional costs.

4.6.2. Scope of work

Procurement, installation, adjustment and testing equipment as well as auxiliary material from the fire detection system mentioned in the drawing/specification, among others:

- a. The wiring between the control panel with the terminal box on each floor.

- b. Wiring of the terminal box to the equipment.
- c. Smoke Detector (photoelectric)
- d. Heat Detector, (rate of rise and fixed temperature)
- e. Break glass push-button/manual station).
- f. Alarm Bell
- g. The control panel and terminal box.

4.6.3. Equipment and Materials

The entire main equipment fire detection system is a series of design of a product/brand and the brand is allowed is Nittan, Honeywell or equivalent. The main equipment consists of:

1. Smoke Detector.

- a. Type : photoelectric ionization
- b. Model : Ceiling mounted with plug and equipped with pilot lamp.
- c. Sensitivity : can be adjusted from the smoke concentration of 5%.
- d. Ability to work : airspeed 50-300 ft / min.
Limit temp. 0 – 50°C.
limit humidity 0 - 95% (relative).
- e. Area covered : diameter 7 m (min)
- f. Rating voltage : 24 V_{DC}
- g. Normal flow / alarm : 100 micro A / 100 milli A

2. Heat Detector

- a. Type : temp fixed and rate of rise
- b. Model : Ceiling mounted with plug and equipped with pilot lamp
- c. Sensitivity : fixed 136°F and the rate of rise 15°F
- d. System : normally open
- e. Current rating : max.50 milli A
- f. Rating TEG : 24 V_{DC}
- g. Area covered : diameter 5 m (min) .

3. Switch Device (Break-glass Manual Station)

- a. Wall mounted, equipped with break-glass and push button to activate the alarm bell.
- b. Its contacts after the operation cannot be returned to the original position automatically, returns to the initial position can only be done manually.
- c. Red color and equipped with an indicator light and a telephone jack for testing.
- d. Contact capacity 30 V_{DC} - 250 Miliampere

4. Alarm Bell

- a. For alarm signals in each zone is used the vibrating bell type with 85 s/d 95 dB.
- b. Wall mounted and weather prof
- c. The alarm can only be turned off from the control panel.

5. Indicator lamp

- a. Compact and weather proof
- b. 100 mm in diameter and 75 mm thick.
- c. The working temperature up to 60°C and current consumption 18 mA
- d. The lights can only be turned off from the control panel.

6. Control panel

- a. The indicator light that will light up at the time of their trouble when there is an open circuit or short circuit of channels (each zone of the lamp).
- b. The power indicator light is always on, if the system is working normally.
- c. The indicator light which states that the system works with a battery backup.
- d. The alarm buzzer will sound in events such as:
 - Power supply off
 - If an open circuit or short circuit occurs in one area.
 - The main power supply is back
- e. Each incident has a kind of sound signal.
- f. The buttons for the purposes set back buzzer and sound the alarm signal to its original state (turn off the beep).
- g. Self rectifier which has a value of output according to need.
- h. Contacts backup (spare contacts):
 - For the purposes of a telephone
 - To turn on the fire pump
 - To turn on the exhaust fan
 - To turn off electrical power sources.
 - And others.
- i. This control panel is the Master Control Fire Alarm/Detection for this building which is one part of the whole system.
- j. minimum number of zones as needed (Murai: 6 zones, Pinus: 4 zones, Maternity: 2 zones)

7. Battery

- a. Battery should be provided for A back up power supply.
- b. use storage batteries of sealed lead cell types..
- c. Must be able to work automatically when the main power supply turn off
- d. The battery must be re-chargeable.
- e. The battery must be normal voltage, with the capacity of the ampere hour adjusted to the need, so that the battery can provide a normal supply to the system for 24 hours continuously..

8. Battery charger

- a. The system must provide battery charger are always ready to replenish the battery, when the battery has been used up.
- b. Replenishment should be done automatically.
- c. The charging current can be set and the rating values must be adjusted according to battery capability. When the battery is fully charged, the battery charger should stop automatically.

9. Conduit

Using protective pipes of PVC pipe - D diameter ½ ". Installation of the conduit must be clean, strong and regular. Equipped clamps, elbow and appropriate auxiliary equipment and installed the right way.

10. Cable

- a. Using NYA 1,5 mm² or NYAF 1.5 mm² for wiring of the detector and manual station, whereas for wiring of the alarm bell and lamp use the size of 2.5 mm².
- b. Product of Supreme, Kabelindo or equivalent.
- c. Not allowed to change the type and size of cable.

4.6.4. Implementation

1. All cables must be protected by conduit pipes, where the pulls of the pipes should not be visible from the outside (for aesthetics purpose).
2. All pipe pulls which are above the ceiling must be installed outwardly and clamped at the bottom of a concrete plate or beam. The clamp used must be suitable for this purpose with a size appropriate to the size of the pipe.
3. The cable used for this purpose is a cable of PVC insulation with the number and size of the cable adjusted to the needs or requirements given by the manufacturer.
4. Installation using "phi" connections on equipment terminal.
5. The connection between the cable (NYAF) and the equipment terminal when using band clamps, the end of the conductor must be coated with solder lead/vertin first.
6. As long as this connection does not use a band clamp, the end of the conductor must be equipped with cable shoes with the same capacity as the conductor and pressed/soldered on the conductor.
7. The cabling system is an automatic self-supervised system that can distinguish 3 conditions:
 - Alarm condition
 - Trouble condition
 - Grounded condition

4.6.5. Operating system

- a. Local Control Panel mounted on the wall (wall mounted) on the lower floor where each occurrence of fire on the upper floors/other can be recognized through the sign of lights and bell sound on the local control panel. Beside, checking can be done from the local zone control panel manually. Also damage to the line zone can be seen directly from the local control panel with lights and bell mark where new lights can be turned off when the damage was irreparable.
- b. Each floor/zone is equipped with a manual station (switch box) that can be done manually/pressed and can be done even though the detector is not yet working. Pushing the switch button will sound the alarm bell both for the floor and the bell in the local control panel.
- c. Each floor is equipped alarm bell that will work when the detector or switch box at work.
- d. Location and number of detectors according to plan drawings.
- e. Local control panel should be connected to the Main Control Panel is in Administration building through the under ground cable.

4.6.6. Testing

- Tests performed after all equipment is installed properly, there are no defects and complete
- This experiment is a test function, whereby the entire system must be able to function properly as required.
- Testing done by contractors witnessed by the Consultant/UNDP

4.7. NURSE CALL SYSTEM

4.7.1. General

The contractor offers the entire scope of work described in this specification and as shown in the drawings, where the equipment and materials used must comply with the provisions of this specification. If there is a difference between the specifications of the equipment and/or materials installed with the specifications required in this book, the contractor must replace the equipment and/or material to meet the specifications required in this book, without additional costs.

4.7.2. Scope Of Work

- a. Procurement, installation, arrangement and testing of the Nurse Call System equipment mentioned in the drawing/specification, include:
 - Nurse Call Center
 - Bed Head Console
 - Call station extension
 - Pull cord call station
 - Room Indicator lamp
 - Nurse Call Reset
- b. Procurement, installation and arrangement of auxiliary equipment, both those mentioned in the drawings or not, but generally/technically it is necessary to obtain a system that is perfect, ready to use and reliable.
- c. Carry out inspection, testing and approval of the entire installation.
- d. Carry out maintenance of all installations and provide training for officers from the User/Hospital.

4.7.3. Equipment and Materials

All equipment of nurse call system is a series of design of one product/brand and the required brands are Commax, Boss or equivalent. The main equipment consists of:

1. Master control of Nurse Call (Nurse Call Center)

- Shows the room/bed number of the patient who is calling
- Able to communicate via interphone
- Able to save miss-call when it is busy (on-line) and will automatically serve it after the first call is finished
- Power supply : 220V, 50 Hz
- Power Consumption : 15VA (standby), 30VA (operation)
- Capacity, minimum : Murai (12 beds & 24 beds), Pinus (2x36 beds), Maternity (12 beds)

2. Bed Head Console

- Made of aluminum with a thickness of min 2mm painted powder coating 3 layers with a color determined later, length 1.2m with width adjusted to the needs
- Nurse call device is able to: call station & display, room indicator lamp switch, emergency notification, broadcast throughout ward.
- Equipped with bed light, extension call station, power outlet (2), O2 outlet
- Power Supply: 220, 50 Hz
- Products of Progas, Berkah Bersama or equivalent

3. Call Station Extension

Easy to connect to bed head console, equipped with a strong cable, the signal with a push button

4. Pull Cord Station

Cues by pulling on the switch cord or push button, this station should be waterproof

5. Room Indicator Lamp

It consists of at least 2 colors which indicates the state of regular calls and emergency calls

6. Nurse Call Reset

Push button to reset the room indicator lamp.

4.7.4. Implementation

Nurse Call system equipment is installed at the location according to instructions in the drawings/specifications and coordinated with the Contractor of the related work (electricity, medical gas etc.), if there is any doubt in determining the installation location, guidance from the Consultant/UNDP can be sought.

All equipment of the master control is placed on the nurse station, bed head console is placed on the wall above the patient bed with a height of 120-150 cm from the floor, pull cord station is placed on the toilet with a height of 90-120 cm from the floor. While the room indicator lamp is mounted on the door of the patient's room or on the side of the door with a height of 2.25 meters from the floor. All installation of this equipment must refer to the instruction manual from the manufacturer.

4.7.5. Testing

All equipment in the Nurse Call system must be functional-tested by the agency holding the equipment, where the company must provide a guarantee letter for the operation of the system after it turns out the test results are good.

4.8. MATV**4.8.1. General**

The contractor must offer the entire scope of work described in this specification and as shown in the drawings, where the equipment and material used must comply with the provisions of this specification. If there is a difference between the specifications of the equipment and/or materials installed with the specifications required in this book, the contractor must replace the equipment and/or material to meet the specifications required in this book, without additional costs.

4.8.2. Scope of Work

- a. Procurement, installation and arrangement of equipment and materials from the MATV system mentioned in the drawings/specification, among others:
 - Antenna
 - Divider
 - Receiver
 - Modulator.
 - Active Combiner

- Spur, Coupler. Splitter
- TV outlets
- TV set
- b. Procurement, installation and arrangement of auxiliary equipment, both those mentioned in the drawings or not, but generally/technically necessary to obtain a system that is perfect, ready to use and reliable.
- c. Carry out inspection, testing and approval of the entire installation.
- d. Carry out maintenance of all installations and provide training for officers from the User/Hospital.

4.8.3. Equipment and Materials

The main equipment of the MATV system is a series of designs of one product/brand and the required brands are Nexus, Panasonic or equivalent.

The main equipment consists of:

1. UHF antennas

Antenna type	: Yagi-directive antenna.
Band Frequency	: 470 to 770 MHz
Channel	: 21 to 69.
Total Elements	: 44-directors, reflector + dipole.
Polarization	: horizontal/vertical possible.
Gain	: maximum 14 dB
Junction box	: ABS weather-proof molding.
Horizontal beam width	: 35°
Vertical beam width	: 42°
Resistance to wind	: \pm 130 km per hour.
Connector	: 75 ohm "F" female

2. Modulator

Selectable Output Channel Color System	: PAL/SECAM/NTSC
Audio Operation Module	: Mono/Stereo/Dual
Input frequency	: 50 - 858.5 MHz
Input Level	: 40.5 ~ 84 dBm
Output Frequency Range	: 47 - 862 MHz
Output Level	: 75 ~ 90 MHz
Supply Voltage	: + 12 VDC

3. Active Combiner

Number of Input/output	: 8/1
Frequency Range	: 4 - 862 MHz
Input / output impedance	: 75 ohm
Gain Regulation	: 20 dB

4. Receiver TV Set

Video Input	: 1V (p – p)
Input Antenna	: VHF/UHF 75 ohm
Receive System	: CCIR standard, PAL, SECAM, NTSC
Dimension Screen	: 21"
Facility	: Audio/Video with infra-red remote control

5. Splitter

Frequency Range : 5 – 2050 MHz
Connector : F Female

6. Tap (Directional) Coupler

Losses : -10 dB
Way : 2, 3, 4 ways
Connector : F Female

7. TV Outlet

Model : Single
Side Loss : 0.4 dB – 1.2 dB

8. Wires and Conduits

Wiring from Antenna to MATV equipment uses Coaxial RG 11/7C cable, while to the outlet point uses RG 6/5C coaxial cable. Conduit uses PVC pipe High Impact resistance min diameter of 20 mm

4.8.4. Implementation

The main equipment of the MATV system (Divider, Modulator, Active Combiner, etc.) is placed in a special room (control room/administration/ nurse room). The MATV system must be able to output video.

Tee units/couplers/splitters are placed in a sufficiently protected location and have a safe enough distance from the influence of electrical installation interference, especially above the ceiling.

4.8.5. Testing

All equipment in this sound system must be tested by the agency holding the equipment, where the company must provide a guarantee letter for the operation of the system after it turns out the test results are good. Measurement of video signal level is done by dB Gain Meter.

4.9. CCTV

4.9.1. General

The contractor must offer the entire scope of work described in this specification and as shown in the drawings, where the equipment and material used must comply with the provisions of this specification. If there is a difference between the specifications of the equipment and/or materials installed with the specifications required in this book, the contractor must replace the equipment and/or material to meet the specifications required in this book, without additional costs.

4.9.2. Scope Of Work

- a. Procurement, installation and management of equipment and materials from the CCTV system mentioned in the drawing/specification, including:
 - Indoor Dome Camera
 - Digital Video Recorder
 - TV Color Monitor

- b. Procurement, installation and arrangement of auxiliary equipment, both those mentioned in the drawings or not, but generally/technically necessary to obtain a system that is perfect, ready to use and reliable.
- c. Carry out inspection, testing and approval of the entire installation.
- d. Carry out maintenance of all installations and provide training for officers from the User/Hospital.

4.9.3. Materials And Equipment

Equipment and supporting materials must meet technical specifications, the Contractor may propose alternatives which are commensurate with the requirements, but the replacement must obtain official and written approval from the Consultant/UNDP.

The main equipment of CCTV systems is a series of designs of one product/brand and the permitted brands are Samsung, Nexus or equivalent. The main equipment consists of:

1. Indoor Fixed Dome Camera

Image Sensor	: 1/2.9" Progressive CMOS
Max. Resolution	: 1280 x 720
Min. Illustration	: Color : 1.0 Lux, 0.002 Lux (Sense-up) BW : 0.5 Lux, 0.001 Lux (Sense-up)
ICR for Day & Night	: Yes
Night Vision Distance	: 20 meter
Day & Night	: Auto/Color/BW/EXT-L/EXT-H
Backlight	: Off/Digital WDR / BLC / HLC
Lens	: 4mm Fixed LENS
Digital Zoom	: x1 - x4 (On/Off)
Network	: RJ-45 (10/100 Base-T)
Connection Mode	: Fixed IP, DHCP & DDNS

2. TV Color Monitor

Function	: Accept baseband video and audio signals and converts than to any channel
Transmission standard	: PAL and or NTSC
Spurious standard	: Less than - 60 dB
Output frequency	: 47 - 230 MHz
Output level	: + 95 dBuV
Video input level	: 1 Vp-p (3 dB)
Video frequency response	: 25 Hz to 5.0 MHz (1 dB)
Audio input level	: 300 mV RMS
Power requirement	: + 12 Vdc - 150 mA

3. Digital Video Recorder

Video Input/output	: as shown in the drawing, 1V (p-p)/75 ohm, PAL composite video signal with looping trough (BNC)
Spot Output	: 1 terminal, 1V (p-p)/75 ohm (BNC)
Multi-screen output	: 1 terminal, 1V (p-p)/75 ohm (BNC)
Synch Output	: 1 VBS, 1 V (p-p)/75 ohm
Audio Input/output	: 10 dB, unbalanced
External Storage	: SCSI Interface

Copy

: SCSI Interface

4.9.4. Implementation

The camera is installed according to the instructions in the drawing and adjusted to the conditions at the site, the Acting Worker must submit a proposal for the placement of this camera on how to install the camera by hanging on the ceiling or ceiling with a reinforcement frame/hanger that is hung/clamped on a concrete/roof frame.

Main equipment such as; the camera drive unit, sequential switcher, TV color monitor and Time lapse VTR are placed in the nurse's room or other room as indicated in the plan drawing.

Installation cables used for video cues and for control purposes use RG 59 / U coaxial cable, power cables use NYMHY 2 x 1.5 mm² or 2 x NYA 1.5 mm² all of which must be inserted in the PVC high impact pipe. 20 mm.

4.9.5. Testing

After this CCTV work is completed, testing and commissioning must be carried out by experienced personnel witnessed by Consultant/UNDP. Testing costs become the burden of the Contractor.

4.10. AIRCONDITIONING WORKS**4.10.1. General**

The contractor must offer the entire scope of work described in this specification and as shown in the drawings, where the equipment and material used must comply with the provisions of this specification. If there is a difference between the specifications of the equipment and/or materials installed with the specifications required in this book, the contractor must replace the equipment and/or material to meet the specifications required in this book, without additional costs.

4.10.2. Scope of Work

- a. Procurement, installation and arrangement of equipment and materials described in this specification and drawings, including:
 - Air conditioning unit
 - Mechanical ventilation
 - Wiring, piping and drainage
- b. Procurement, installation and arrangement of auxiliary equipment and auxiliary materials, both mentioned in the drawings or specifications or not mentioned but technically necessary to obtain a perfect, safe, ready-to-use and reliable result.
- c. Carry out checks, tests and endorsements of all work results by the authorized agency.

4.10.3. Equipment and Materials**1. Multi/Single Split Type**

- Has good efficiency performance
- Has a powerful inverter and is able to cool the room quickly <20 minutes
- Very low noise
- Ability to make diagnosis self
- Low wattage
- COP : minimum 4

- Distance from OU to IU : length 35 m, height 15 m
- Outdoor unit
The casing of the outdoor unit must be waterproof, galvanized steel which is finished using baked enamel. The coil must be made from a seamless copper tube with aluminum fin. Fan type of condensing unit is propeller with direct connection
 - Power supply : 220-240 V, 50 Hz
 - Compressor type : hermetically sealed swing
 - Refrigerant : R-32
 - Safety devices : high pressure, over heating & over current
- Indoor Unit
The casing of the indoor unit throughout the inner surface must be insulated with 25 mm thick fiber glass or mineral wool material. Blower from indoor fin of centrifugal type, double inlet or single inlet forward curved, multi blade with direct or indirect movement using a belt.
The coil must be made of a seamless copper tube complete with a mechanical aluminum fin, the refrigerant (liquid) line has a combination of moisture indicator and sight glass, refrigerant filter drier, and liquid line solenoid valve. An adequate container can hold air condensation in the operating state and drain it to the pipe drain.
All units must be equipped with a 25 mm thick washable aluminum filter. A room thermostat equipped with a switch off, fan speed (low, med, high), cool and room temperature setting will enable the unit to operate
 - Power supply : 220-240 V, 50 Hz
 - Temp. Control : micro computer
 - Cooling capacity : see drawing

2. Cassete Type

- Air flow uniformly at 3600 (round flow)
- Has good efficiency performance
- Has a powerful inverter and is able to cool the room quickly <20 minutes
- Very low noise
- COP (2 - 5) PK : (4 - 3)
- Distance from OU to IU : length 50 m, height 30 m
- Outdoor unit
The casing of the outdoor unit must be waterproof, galvanized steel which is finished using baked enamel. The coil must be made from a seamless copper tube with aluminum fin. Fan type of condensing unit is propeller with direct connection
 - Power supply <3PK : 220-240 V, 50 Hz, 1 ph
 - Power Supply > 3PK : 380 - 415 V, 50 Hz, 3 ph
 - Compressor type : hermetically sealed swing
 - Refrigerant : R410a
 - Safety devices : high pressure, over heating & over current
- Indoor Unit
The casing of the indoor unit throughout the inner surface must be insulated with 25 mm thick fiber glass or mineral wool material. Blower from indoor fin of centrifugal type, double inlet or single inlet forward curved, multi blade with direct or indirect movement using a belt.
The coil must be made of a seamless copper tube complete with a mechanical aluminum fin, the refrigerant (liquid) line has a combination of moisture indicator and

sight glass, refrigerant filter drier, and liquid line solenoid valve. An adequate container can hold air condensation in the operating state, pump and drain it to the drain pipe. All units must be equipped with a 25 mm thick washable aluminum filter. A room thermostat equipped with a switch off, fan speed (low, med, high), cool and room temperature setting will enable the unit to operate.

- Power supply <3PK : 220-240 V, 50 Hz, 1 ph
- Power Supply> 3PK : 380 - 415 V, 50 Hz, 3 ph
- Temp. Control : micro computer
- Cooling capacity : see drawing

3. Air Filters

Pre filters for Indoor Units, fresh air fans must be metallic type, must be fire resistance and washable 50 mm thick with 30-35% efficiency and 94-96% arrestance in a state of low velocity (ASHARAE test std. 52-76).

Filters must be fitted tightly together and so must the frame. No gaps are closed with plates due to lack of filter size. The filter to be installed must be proven from the filter brand brochure on its type and efficiency.

The initial air flow resistance at a speed of 1.52 m/s (300 fpm) must not exceed 20 Pa (0.08 "WG) and the maximum air resistance will eventually be 125 Pa (0.5" WG). The filter must be able to operate at air flow speeds up to 500 fpm without damage. All filters must be underwriter laboratory class 1 or equivalent. Filter installation must be in accordance with the manufacturer's recommendations. Access must be provided for inspection or cleaning purposes.

4. Fan (Wall or Ceiling)

- Fan of propeller type for wall or ceiling.
- The fan must be driven directly.
- For external wall fans complete with automatic shutter from aluminum types
- For wall fans with large capacity and high static pressure (high pressure fan), the stainless steel fan frame is painted with a die-cast aluminum impeller.

5. Refrigerant Pipes

- Refrigerant pipes must be de-oxidized phosphorous seamless copper pipes, both the suction and gas sections must be insulated with insulating material in accordance with the manufacturer's recommendations so that condensation does not occur.
- All shut off valve connections inside the outdoor unit must be brazed to prevent refrigerant leakage
- Refrigerant pipe insulation used is XLPE close cell type with fire rated Class "O" with a thickness of at least 10 mm for suction lines and 10 mm for Liquid lines and must be protected with a cover on parts exposed to the sun, preferably one brand insulation with a supplied refrigerant pipe.

6. Cable

- Using NYY cable, the size according to the instructions in the drawing

7. Brand

- Air conditioning unit : Daikin or equivalent
- Refrigerant pipes : Inaba Denko or equivalent
- Insulation : Armaflex or equivalent

- Refrigerant : Dupont or equivalent
- Fan : Daikin or equivalent
- Cable : Supreme or equivalent

4.10.4. Implementation

1. Installation of air conditioning Unit

- Before the work begins the Contractor must make a shop drawing for the installation of equipment from this air conditioning system. All equipment is installed according to the location shown in the drawing and if there is any doubt, instructions from the Consultant/UNDP can be sought.
- Installation of equipment (especially indoor units) must be completely straight/horizontal and neat. The outdoor unit, indoor unit and all vibrating parts must be equipped with a Vibration isolator/Eliminator. This tool must be able to reduce engine vibration with 90% efficiency. The type of vibration dampers selected must be in accordance with the needs of the machine/unit to be damped. Vibration dampers installed must be in accordance with the requirements/recommendations of the manufacturer of the machine/machine. Vibration dampers can be Neoprene Pad, Neoprene Mounts, spring collators, Restrained Isolators, Pipe Hanger etc.
- Installation of indoor units on walls and outdoor units on oversets or walls must coordinate well with architectural and civil works, so that the effect of these installations can be minimized on the aesthetics and structural of buildings.

2. Piping works

- All refrigerant pipes must be done carefully and as well as possible, before installing all parts must be clean, dry and free from dust and dirt. The contractor must take into account the difference in height and distance between the outdoor unit and indoor unit, so as not to exceed the limits given by the manufacturer.
- Hard drawn tubing pipe joints must be connected with wrought copper fittings or non porous brass fittings, and silver solder is recommended by blowing noble gases such as dry nitrogen into the pipe being joined to avoid the formation of oxide crust in the pipe.
- Soft tinted 50-50 "solder should not be used," tinted 95-5 "solder can be used except in hot gas discharge pipes. Soft drawn tubing can be connected with solder, flame or other suitable for refrigerant pipes in "pre-charged refrigerant lines" pipes provided by the manufacturer, they must be installed in accordance with factory requirements
- Soft drawn tubing can be connected with solder, flame or other suitable for refrigerant pipes. In "pre-charged refrigerant lines" pipes provided by the manufacturer, they must be installed in accordance with factory requirements
- Refrigerant pipes must be supported and hung properly to prevent bending and transmitting machine vibrations to the building. Refrigerant pipes must be installed in accordance with "ASHRAE Guide Book" requirements and/or requirements of the manufacturer.
- Fittings for flare points should be standard SAE forged brass flares according to ARI 720 standard with short shank flare units. The strainer should be installed in a refrigerant network before entering the thermostatic expansion valve.

3. Wiring

- Wiring must comply with the wiring diagram provided by the manufacturer and all cables embedded in the wall, both for power and control, must be protected by using

PVC-AW conduit pipes. Cable above the ceiling must use a cable rack (may be combined with a cable rack from a lighting installation)

- Wiring cannot be connected, if this cannot be avoided then connection can only be done in a doors or connection box. Connecting the cable to the terminal must use the appropriate schone cable.

4.10.5. Testing

Implementation testing must follow generally accepted standards and instructions from the manufacturer, carried out using measuring equipment that meets/complies.

1. Measuring Equipment

- Measurement of airflow velocity
 - Anemometer, Air Velocity Meter or Pitot tube with inclined manometer
- Measurement of air temperature
 - Thermometers, psychometric slings
- Measurement of rotation (rpm)
 - Tachometer or the like
- Electrical measurements
 - Voltmeter and ampermeter
- Pressure measurement
 - Barometer/pressure gauge

2. Implementation Testing

- Complete detailed testing must be carried out on the entire system and its parts, so that the appropriate measurement quantities or output quantities specified in the plan are obtained.
- Tests must be carried out by trained and responsible personnel, before the test must be approved and the method to be carried out for testing
- Tests must be witnessed by the Consultant/UNDP

4.11. FIRE FIGHTING SYSTEM

4.11.1. General

The contractor must offer the entire scope of work described in this specification and as shown in the drawings, where the equipment and material used must comply with the provisions of this specification. If there is a difference between the specifications of the equipment and/or materials installed with the specifications required in this book, the contractor must replace the equipment and/or material to meet the specifications required in this book, without additional costs.

4.11.2. Scope of Work

- a. Procurement, installation and arrangement of equipment and materials described in this specification and drawings, including:
 - Hydrant Box
 - Piping in buildings
 - Fire Extinguisher
- b. Procurement, installation and arrangement of auxiliary equipment and auxiliary materials, both those mentioned in the drawings or specifications or those not stated but technically necessary to obtain a perfect, safe, ready-to-use and reliable result.

- c. Carry out checks, tests and endorsements of all work results by the authorized agency

4.11.3. System Explanation

This firefighting system only consists of installing a hydrant system in a building and a fire extinguisher. The hydrant system only reaches the ground floor shaft or control box, which will be connected to the main fire lighting system (to be built later).

4.11.4. Equipment

1. Fire pipe

- Uses medium class black steel pipes
- All fittings must be the same type/material as the pipe used.
- Diameter and pipeline are as stated in the planning drawing.

2. Hydrant Box

- Recessed steel box type A1, size 660 mm x 520 mm x 150 mm
- Painted zincromate base and finishing with a 0.15mm powder coating in red with HYDRANT white writing on a lid that can be opened 1800 and has a stopper.
- Equipped with a hydrant/landing valve, a 1.5 "hose reel of 30 m long canvas and nozzle from aluminum or brass

3. Fire Extinguisher

- Fire extinguisher is planned as a complete firefighting system intended for early prevention before the automatic detection equipment works.
- The type selected is A2 type

4.11.5. Implementation

1. Pipes in buildings

- Installation of pipes and equipment and other equipment must be in accordance with the plan and must be done in the right way to ensure cleanliness and tidiness.
- All pipes and fittings must be cleaned carefully and thoroughly before being installed/connected.
- Piping works must be equipped with valves, fittings and other necessary equipment/materials.
- All pipelines that will be connected to equipment must be equipped with union or flange
- Curved joints, reducers and expanders and way connections in piping work must use factory-made fittings
- Valve must be easily reached for maintenance and replacement
- During installation, if there are open ends of the pipe in the piping work that are left at each stage of the work, it must be closed using caps or plugs to prevent the entry of dirt/other objects.
- All pipe cuts must use a pipe cutter and must be neat and not sharp (sanded).
- All pipes must be installed in a straight line with the wall/part of the building in horizontal and vertical directions.
- All pipelines to be connected with equipment must be equipped with nut or flange
- Piping should not be used for electric ground
- Piping must be supported or hanged with hangers, brackets or saddles properly and perfectly so that it is possible to expand or stretch movements at distances that should not exceed 2 meters (horizontal) and 3 meters (vertical)

- Before a pipe is installed, the support must be installed first in perfect condition. All installations must be neat and as good as possible.
- All pipes and hangers, supports must be painted zinchromate and painted according to applicable regulations.

2. Pipe Sheath

- Sheath for pipes must be installed properly every time the pipe penetrates concrete construction.
- The sheath must be of sufficient size to provide looseness outside the pipe or isolation of a gap between the sheath and the outer wall of the pipe of at least 25 mm.
- Sheath for walls made of cast iron or steel pipes.

3. Welding Connection

- This welding connection applies between the pipe and welding fittings.
- Before the welding work begins, the executor of the work must submit to the Site Superintendent a sample of the weld results for written approval.
- Welders must have welding certificates and may only work after having written permission from the Consultant.
- Every former welded joint must be immediately painted with special paint to prevent corrosion.
- Welding equipment that may be used is an electric welding tool that is in good condition according to the assessment by the Consultant.

4. Valve installation.

Valves must be provided and installed as required in the plan drawings and specifications for the system to work properly.

4.11.6. Testing

- a. The contractor must carry out tests on the installation system that has been installed, either in part or in whole, in accordance with the regulations that have been in force or specified by the specifications. Testing equipment is provided by the Contractor
- b. The test must be witnessed and the results must be approved by the Consultant/UNDP. If there are inappropriate results, the Contractor must find the cause, correct and repeat the testing
- c. All pipe installations must be tested with a pressure test of 15 Atm parts per part, each for 4 hours continuously, without any leakage/decrease in the test pressure

4.12. MEDICAL GAS SYSTEM

4.12.1. General

The contractor must offer the entire scope of work described in this specification and shown in the drawings, in which equipment and materials used must comply with the provisions of this specification. If it turns out there is a difference between the specification of equipment and/or materials are installed to the specifications required by this book, then the contractor must replace equipment and/or the material to meet the specifications required by this book, without any additional cost.

4.12.2. Scope of work

- a. Procurement, installation and setup of equipment and materials that are described in this specification and drawings, among others:
 - Medical Gas Pipeline Installation
 - O2 gas outlet
 - Zone Valve (complete with box).
- b. Procurement, installation and adjustment of auxiliary equipment and auxiliary materials, both mentioned in the drawings or specifications or that are not mentioned but technically required to obtain a perfect result, secure, ready-made and reliable.
- c. Carrying out inspection, testing and validation of all the work by the relevant authorities

4.12.3. Equipment and Materials

1. Gas Pipe

Pipe materials used throughout this installation is Copper Pipe (99% pure) B88 Type L according to ASTM or equivalent standards

2. Zone Valve

- Equipped Box of material aluminum
- According to the image size
- Has a display to show the gas pressure
- Valve Three Pc Body SUS 304
- Already proven gas leak test
- 2896 meets the US standard, NFPA 99 standards, and Japanese Standard
- Standard ISO 7396 -1

3. Gas Outlet O2

- Stainless steel
- SIS models (each different outlets)
- 100% pneumatic testing at each outlet followed by a decent bail for medical gas service

4.12.4. Implementation

1. Preparation

- Contractor shall submit brochures and detailed drawings of the equipment that will be used to obtain the approval from the Consultant/UNDP
- Submit samples of materials to be used, if it turns out that the Consultant/UNDP has doubt on the quality of the material/specific tool then materials/tools will be sent to the Laboratory of Research for Product Quality at the expense of the Contractor and if it is the quality of materials/equipment is not in accordance with the requirements of the material/instrument in question must be replaced immediately.
- Create and submit shop drawings for review and approval by the Consultant/UNDP
- Providing skilled personnel in their field . The contractor must provide a certificate verifying that the personnel has experience and skills in accordance with the requirements
- Provide adequate working equipment and well water fitting, water pump, pipe cutter and others.
- Before the installation Works, the Contractor is obliged to know the track and the position of Electrical Installation, Grounding Systems, Water and Sanitation.

- If in the implementation of the work there is one part that may be difficult for its installation, the Contractor may request direction from Consultant/UNDP.

2. Medical Gas System Installation Works (Oxygen)

- Pipe to be installed should be clean, color-coded according to the type of gas his medic and marked the direction of flow.
- Medic gas pipeline should meet the safety of the structure and utility of building
- Pipe sizes tailored to the needs
- Connecting pipe to be welded with silver welding wire, so that the connection pipe and durable perfect meeting. Welding gas used is a mixture of oxygen, acetylene and during the welding process to be fed nitrogen
- Cutting the pipe must use the appropriate pipe cutter
- Installation of the pipe above the ceiling should be equipped with a holder and hangers are fastened firmly on the concrete or roof frame (not allowed in the framework of the ceiling)
- Distance holder or hanger average of 1 meter, both vertical and horizontal
- Installation of the pipe in the wall must be protected by a PVC-AW and marked with the type of gas and the gas flow direction
- Equipped distribution valve and/or valve surgery room divider and the added emergency valve/emergency

3. Installation of Medical Gas Outlets

a. Wall Outlet

- Installed at a height of 140-150 cm from the floor, except when combined with bed head console
- To serve one bed, then it is placed on the right side of the bed and to serve 2 beds then it is placed in the middle of the second bed
- For use in the operating room/surgical, outlets mounted on the wall near the head of the patient on the operating table
- Use another section, outlet mounted on the wall adjacent to the equipment medic who need it.

b. Overhead Outlet

Mounted on the ceilings near the point of use, usually near the head of the patient bed in the room and premature new born room. Overhead outlet also installed above the crib. Pipes used should be absolutely clean.

c. Ceiling Column

Installation is similar to overhead ceiling outlet, but since these tools have quite heavy burden (± 100 Kg) then it should be hung on a strong construction ceiling to withstand the load

d. Surgery room

Installation of outlets in the operation room/surgery room should be able to function automatically, the outlet will be closed when it is not in use and open on sat connected with a gas channeling tool

e. **Sequence and Color**

The order of installation of gas outlet medic must remain as follows: Oxygen, Nitrous Oxide, compressed air and suction air. Besides, it must be equipped with gas name medic, different colors, sizes and couplers different.

4.12.5. Testing

- a. The contractor must carry out tests on the installation system that has been installed, whether provided by all, in accordance with the regulations that have been applied or specified by the specifications. Testing equipment is provided by the Contractor
- b. Testing must be witnessed and the results should be approved by Consultant/UNDP. If there are results that do not fit, then the contractor must find the cause, fix and repeat testing
- c. Medical gas pipeline must be tested pneumatically using press media Nitrogen gas (N₂) with a pressure of 2 x pressure testing of the installation work or 10 kg / cm² for 2x24 hours

4.13. ACCESS DATA SYSTEM

4.13.1. General

The contractor must offer the entire scope of work described in this specification and shown in the drawings, in which equipment and materials used must comply with the provisions of this specification. If it turns out there is a difference between the specification of equipment and/or materials are installed to the specifications required by this book, then the contractor must replace equipment and/or the material to meet the specifications required by this book, without any additional cost

4.13.2. Scope of Work

- a. Procurement, installation and setup of equipment and materials that are described in this specification and drawings, among others:
 - Distribution switches and access switches
 - Connecting cable distribution switch to the access switch.
- b. Procurement, installation and adjustment of auxiliary equipment and auxiliary materials, both mentioned in the drawings or specifications or not mentioned but technically required to obtain a perfect result, secure, ready-made and reliable.
- c. Carrying out inspection, testing and validation of all the work by the relevant authorities

4.13.3. Explanation System

The scope of work consists of the installation of distribution switch and access switches, and the wiring that connects the switches, the location of distribution switches and access switches fit within the image. For the work of procurement, installation and setup of servers and computers will be performed by the hospital. Similarly, the wiring from the switch to the server distribution and core switches (other networks) as well as the wiring of the access switch to each computer.

4.13.4. Equipment and Material

1. Distribution Switch

- The size of the unit as standard rack mount 19 "
- Having the ability stackable
- It has 30 10/100/1000 RJ45
- Has 4 ports with LC connector SX SFP transceiver.

- Having a band width min 32Gbps forwarding and 38,7Mpps
- Distribution switch will provide connections throughout the access switches with Giga-bit Technology 1000 Base-T
- It has AC power supply unit.

2. Access Switch

- The size of the unit as standard rack mount 19 "
- It has 30 port10 / 100/1000 RJ45
- Has 4 SFP ports.
- Having a band width min 32Gbps forwarding and 38,7Mpps.
- Access switches will provide connections throughout Outlet Data with Giga-bit technology 1000 Base-T.
- It has AC Power supply unit

3. Network Management System (NMS)

- NMS is software that has the ability to manage all the routers and switches that are used for network communications system. NMS system must come from the same vendor with a switch device maker
- NMS should have a good ability in making the application: configuration, administration, monitoring, and failure detection and as a tool for problem analysts LAN and WAN network devices, NMS-based GUI.
- NMS should be able to perform automatic discovery and smart in forming the network topology view.
- NMS must support real-time monitoring capability for the current protocol, applications and interfaces in order to create the appropriate filter so as to save costs and improve performance.
- NMS system must be able to provide inventory information of network devices including memory, slots and boot ROM version of the software.
- NMS system should be able to update the software and configuration to the device that has been and can be done on a scheduled basis, this provides time savings and error in an update network.
- NMS offered should be able to manage all the devices installed switches.
- Has a certificate of authenticity of the product from Indonesian Principle

:

4. Cable Unshielded Twisted Pair (UTP)

- Meet the International standard EN 50 288; IEC611565; ISO/IEC11801 and National TIA/EIA -568-B.2-1
- Type UTP Category 6 cable with a length of at least 305Mtr / box
- Low Smoke Zero Halogen (LSZH)
- Conductor Cross - Section (AWG): 24
- Environmental characteristic: Flame Retardant
- Rating Operating Temperature: -20°C/+ 60°C.
- Conductor Diameter Characteristic: 0,58mm

5. RJ45 Patch Cord

- Meets the International Standard ISO/IEC118901
- LSZH, Flame retardant jacket as standard
- Color Orange/White/Green

- Connections Plug RJ45 Cat.6
- Must correspond (same brand) to UTP cable

6. UTP Patch Panels

- Size 19 "
- 24 Ports
- sliding Mechanism
- Modular / Snap In
- Category 6
- Must correspond (same brand) to UTP cable

7. Outlet Data

- Blank Model for Modular - Snap In 2/4port
- Type: Face plate RJ45 (category 6)
- Must correspond (same brand) to UTP cable

8. Rack and Wall Rackmount

- Size 19 "
- 45 U and 15 U
- 4 units and 1 unit Fan
- Min 10 units of power outlets and min 6 power outlets
- Rackmount UPS 2.8
- 1KVA
- Manageable
- Min ½ jam backup battery capacity, 100% full load
- Supports 125 power rate.

9. Product provisions

The main equipment of the data access system is a series of design of a product / brand and the brand is allowed is SISCO, Dlink and equal

4.13.5. Implementation

- For cables that are installed outside the wall/concrete must be protected PVC pipe or PVC mini trunking. This installation is clamped at a distance of 60cm. Clamps used in concrete plasters - use concrete nails or fisher.
- For cables installed within the walls (embedded) should use PVC-D
- Electrical cable connection should use Spring Connector.
- All equipment must be grounded NYA cable/BCC

4.14. VERTICAL TRANSPORTATION (LIFT)

4.14.1. General

The contractor must offer the entire scope of work described in this specification and shown in the drawings, in which equipment and materials used must comply with the provisions of this specification. If it turns out there is a difference between the specification of equipment and/or materials are installed to the specifications required by this book, then the contractor must replace the equipment and/or the material to meet the specifications required by this book, without any additional cost

4.14.2. Scope of work

- a. Procurement, installation and setup of equipment and materials that are described in this specification and drawings, among others:
 - Lifting Car, Truss and Doors
 - Car operating panel (COP)
 - Indicators and buttons
 - Guide Rail, rope and Counterweight
 - Control Panel and Motors.
- b. Procurement, installation and adjustment of auxiliary equipment and auxiliary materials, both mentioned in the drawings or specifications or not mentioned but technically required to obtain a perfect result, secure, ready-made and reliable.
- c. Carrying out inspection, testing and validation of all the work by the relevant authorities
- d. Administering licensing to the Department or related agencies

4.14.3. Equipment and Materials**1. Car Truss**

- Made of painted steel profiles corrosion protection.
- In this framework is to be found at least four Sliding Type Guide rail bottom right in the Guide Rail.
- Each Guide Shoes must be equipped with a lubrication system (self-lubrication) to prevent rapid wear.
- In order to lower the pedestal where the train floor, there should be a rubber pads.

2. Floor of the Car

- Made of painted steel plate corrosion resistant.
- The upper part is coated with a 1.2 cm thick granite (granite by other parties or determined by the Architect).
- The strength of the floor should be within the capacity of the lift.

3. Wall of the Car

- Train wall material elevators will be determined later by the Architect.
- On the outside should be covered with a sound-dampening materials.

4. Ceiling of the Car

- Material ceiling the elevators will be determined later by the Architect.
- Ceiling heights not less than 2800 mm where there are emergency doors which can only be opened from the top of the car and equipped with safety switches.
- Lighting must be supplied by the Lift Contractor.
- At the top should be covered with a sound-dampening materials.
- Equipped with a fan.

5. Doors of the Car

- Has two doors/openings towards the east and west, with the same size door
- Made from thick stainless steel min. 2 mm where the finish will be determined by the Architect.
- Mover car doors are electric motors equipped with speed control devices.
- On the inside should be lined with a sound-dampening materials.
- Above the doors of the passenger elevators wear transom and each car door jamb wear.

- Emergency exits are located on the ceiling that can only be opened from outside. Equipped with a switch that prevents the elevator moves when the emergency door open.

6. Car Operating Panel (COP)

- There are 2 are respectively located on both sides of the carriage door.
- Touch the button that is used is a button that is equipped with lights.
- Supplies panel include:
 - Touch button for every floor
 - Touch button to open the car door
 - Touch button to close the doors of the car
 - Touch button for emergency stop
 - Touch buttons for lights
 - Touch buttons for exhaust fan
 - Key switches for control Attended
 - Overloaded sign lights are equipped with a buzzer
 - Emergency lights with the resources of Dry Cell Battery, 12-volt NiCad
 - Intercom to the control room/security (3-way)
 - The speakers are connected to the Public Address System for emergencies

7. Landing Door

- The same type and dimensions of the doors of the car.
- Made of 2 mm thick stainless steel with finishing determined by the Architect.
- Equipped with a key to open manually and electrically and mechanically interlock and equipped with automatic closers with weight closer.

8. Hall Button

- For the bottom floor there is a one touch button for operation up.
- For the top floor there is a one touch button for operation down.
- For other floors there are two touch buttons for up and down operation.
- On the ground floor there is a separate switch Fire in a box that is protected with a thin glass.

9. Car Position Indicator

- For each elevator there is one located above the ground floor.
- Must be equipped with a signpost and a gong that lights and sounds at the time of arrival of the car.
- On the other floors there are internal hall consisting of directional car journey and gong.

10. Buffer

- Buffer used must be type of oil buffer in which the upper part is given a rubber thickness of 5 mm.
- For each elevator min. used 2 pieces of fruit for the buffer where the car buffer and others to counter weight buffer.
- Each buffer must be equipped with a safety switch that is connected to the control panel.

11. Guide Rail

Rail should be installed in each bracket maximum distance of 2.5 m by means of brackets.

- Rail must be clamped to the bracket using slip sliding bolts and nuts.

12. Counter Weight

- Order counter weight made of steel profiles.
- The contents of the counter weight is heavy cars plus 50% of the capacity of the cars, which are made of cast iron, or according to the manufacturer's standards.
- Framework must be painted with anti rust paint.

13. Compensating

- Consists of a rope made of steel wire with a core that is equipped with a manila rope tensioning.
- Rope tensioning pulley in the form of a given load, is placed in the pit and is equipped with a safety switch.

14. Electric motor

- Alternating current motor 380 V/3PH/50Hz complete with gear box and pulley and deflection.
- Motor driven with micro-processor control panel.
- Equipped motor mounting 25 mm thick rubber pads as a vibration damper, which is currently working machine 3 mm maximum deflection of the rubber.

15. Control System

- Every elevator must have a control panel in the control room to operate.
- There is one master control panel that controls all of the elevators.
- Control system is equipped with a supervisory panel.

16. Rope

- Rope used is a steel wire with a core manila.
- Diameter min. 13 mm or according to manufacturer's recommendations. The number of lanes in accordance with the recommendations of the manufacturer (manufactured)

17. Safety Device

- Safeguard against excess passengers.
- Security against the upper limit and lower limit of operational elevators. (6 cm from the lower floor level and 10 cm from the top floor limit).
- Security against an extension rope.
- Safeguard against rope tension.
- Safeguard against over speed.
- Security against the elevator door if photoelectric beam path is cut off.
- Safety against fire.
- Security against disappearance electrical power supply.

18. Elevator Control Panel

- This control panel is of the type Free Standing Type with ventilation holes Close to taste.
- All components can work well at temperatures up to 40°C and RH max. \pm 70%.

4.14.4. Technical Data Lift Bed:

1. Passenger Lift Basic Specifications:

- Type : Bed Lifts
- Capacity : 1600 kg
- Speed : 60 meters per minute
- Operation : Duplex
- Entrance : Double Entrance
- Number of units : 1 unit
- Number of Stops : 2 pcs
- Number of doors : 4 pcs
- Name floor : 1, 2
- Hoistway Size (WxD) : 2400 x 2800 mm
- Car Inside (WxD) : 1500 x 2300 mm
- Overhead (WxH) : 1100 x 2100 mm
- Pit : 1500 mm
- Overhead : 4500mm
- Machine room Height : 2500mm (at the top)
- Power : @ 11 kW / 380V / 3PH / 50Hz

2. Car Supplies:

- Ceiling Lighting : Globe Lamp with acrylic cover
- Car Door : Stainless Steel Etching
- Return Front Walls : Stainless Steel Etching
- and Rear Walls : Stainless Steel Etching
- Hand Rail : Stainless Steel
- Entrance Column : Standard
- Kick Plates : Standard
- Floor : Finishing anti-skid vinyl
- Ventilation : Blower type, customized installation with a ceiling conditions.
- Emergency Light : Provided
- Interphone & Sound System : In addition to the engine room also to the control room (connected to the emergency elevator).

3. Supplies Hoist Way:

- Jamb floor Lobby : Narrow jamb without Transom Panel, Etching Mirror Stainless Steel
- Hall door floor lobby : Standard
- Hall door typical floor : Standard
- Typical Floor Jamb : Narrow jamb without Transom Panel, Etching Mirror Stainless Steel (type and shape see architecture drawing).
- Landing Sill : Extruded hard aluminum (standard product).

4. Signal:

- Car Operating Panel : Touch Button type
- Car position indicator : Digital type, together with the car operating panel
- Hall position Indicator : Digital type (see architecture drawing)

-
- Hall call button : Touch button type
 - Face Plate : Finished Stainless Steel
 - Interface to the BAS : Yes

5. Features:

- Overload devices
- Safety edge
- Fire Emergency return linked to the fire alarm system
- Emergency stop switch
- Car arrival gong
- Up & down indicator arrows
- Door photo cell
- Quick Earth devices
- Rescue Automatic Device (ARD)
- EPO (Emergency Power Operation)
- Fireman System

4.14.5. Others

Additional equipment required, although not illustrated or described in this specification should be provided by the contractor so that the installation can work properly and can be justified.