MECHANICAL ENGINEERING

VAC- VENTILATION AND AIR CONDITIONING

REHABILITATION OF THE SAUDI MATERNITY HOSPITAL

KASSALA HEALTH CITADEL, SUDAN

DETAILED DESIGN

TECHNICAL CONDITIONS

ampc International Health Consultants

jfa engenharia

TABLE OF CONTENTS

1. GENERAL 3
1.1. SCOPE OF WORKS 3
1.2. CALCULATIONS 3
1.3. WORKING DRAWINGS 3
1.4. CONSTRUCTION DRAWINGS 5
1.5. REGULATIONS 5
1.6. WORKMANSHIP AND MATERIALS 5
1.7. INSPECTIONS AND TESTS AT MANUFACTURE'S WORK 6
1.8. PROTECTION AND CARE OF PLANT AND EQUIPMENT 7
1.9. GUARDS 7
1.10. AIR-CONDITIONED STORAGE 7
1.11. PAINTING 7
1.12. MANUFACTURER'S NAMEPLATES 8
1.13. SUNDRY BUILDERS WORK IN CONNECTION WITH SERVICES 8
1.14. NOISE 9
1.15. ANTI-VIBRATION MOUNTINGS AND SOUND ABSORPTION 9
1.16. AS BUILT DRAWINGS 9
1.17. OPERATING AND MAINTENANCE INSTRUCTIONS 11
1.18. INSTRUCTION AND TRAINING 12

1. GENERAL

1.1. SCOPE OF WORKS

A. This Section covers the basic general requirements applicable to all works that shall be provided by the Contractor.

1.2. CALCULATIONS

A. The Contractor shall acquaint himself with the constructional details of the buildings and exterior works both before and during the course of erection and shall take his own particulars with regard to the installation of mechanical equipment. The Contractor shall check the sizes of all mechanical equipment taking into account any additions or deletions required to ensure the installations fit into the room or other spaces allocated and in relation to other plant and equipment being provided.

B. The Contractor shall undertake and prepare all necessary calculations and drawings relating to the mechanical equipment and for all associated structural and builder's and services work, except where specifically defined otherwise in the Specification and/or on the Drawing.

C. The Contractor shall provide and submit to the Engineer all calculations, drawings and supporting data for the mechanical equipment.

D. The Contractor shall provide calculations, details, drawings and technical data to enable the Engineer to ascertain the correctness of the specialist designs of the associated supports, bases and fixings.

1.3. WORKING DRAWINGS

A. The Contractor shall provide for approval working drawings of the whole mechanical works. The drawings shall include, but not necessarily be limited to the followings:

1. Schedules of all equipment’s to be installed, together with start and running power consumption.

2. Indicate with accurate dimensions sizes and positions of all plant, equipment, pipes, conduits, trunking, underfloor ducting, cable tray, cables together with all inspection points and cable joints.

3. Fully indicate all ductwork, pipework, sizes and positions of all plant equipment’s and valves together with all inspection points and test positions.

4. Fully indicate all builder's work requirements inclusive of all foundations, bases, plinths, sumps and holes together with the overall sizes and masses of the plant concerned.

5. Show the disposition and depth of all cables, pipes, ducts, buried direct in the ground and taken at intervals where change of direction occur and where cables increase or decrease in number/size and at every point where the services enter into or depart from ducts or buildings.

6. Indicate the number, size and services for every cable, ducts and pipes for every service within the building. Circuit lists for every distribution board shall be entered onto the relevant drawings and such lists shall agree with the lists fixed within the distribution board door.

7. Indicate all equipment and control wiring diagrams together with all specialist systems.

8. Show all cables in pits and ducts on drawings to a scale of 1:50 or larger.

9. Show clearly all plumbing, drainage and setting out dimensions for all drainage pipework and manholes, both within the building and throughout.

10. The site, together with intended drainage pipework backfill, or surround in each location, schedule to be included to indicate manhole, cover size, etc.

B. The symbols used for each service for all working drawings shall be shown on separate drawings.

C. In addition to the working drawings, the Contractor shall obtain and provide at the request of the Engineer, two sets of all manufacturer's detailed drawings for all items of plant, equipment, apparatus and materials. These drawings shall be suitably titled and have drawings references number added. Specific requirements are given in the individual specification Sections.

D. All drawings, diagrams and schedules called for in this clause shall be submitted to the Engineer for examination and approval.

E. The Contractor shall make due allowance for an approval/comment period and it must be clearly understood that the correctness of the submitted information will directly affect this comment/approval period.

F. The Contractor shall be responsible for co-ordinating all mechanical, electrical, fire protection plumbing, drainage condensate, and irrigation works, and engineering systems such that each may be installed in a proper manner, ensuring correct performance and allowing adequate maintenance access. All services shall be installed such that the positioning of ducts, pipes, cables, and all items of equipment avoid conflict. The Contractor's working drawings shall indicate any services

coordination needs prior to submission to the Engineer for approval; tender drawing shall not be reissued as working drawings.

1.4. CONSTRUCTION DRAWINGS

A. Following approval of the Contractor's drawings by the Engineer, they shall constitute "Construction Drawings" and the equipment shall be manufactured and installed in accordance with those approved drawings. The acceptance by the Engineer of any such drawing shall not relieve the Contractor of his responsibility under the Contract and shall not commit the Engineer or make the Engineer liable for any mistake of the manufacturer's deficiencies in strength or efficiency in operation of any part of any item for its specified purpose.

B. The Engineer reserves the right subsequently to amend or add to the Construction Drawings as may be necessary or expedient.

1.5. REGULATIONS

A. The installation materials and components shall comply with all relevant statutory instructions and regulations current at the date of tender, whether so detailed or not.

1.6. WORKMANSHIP AND MATERIALS

A. The Contractor shall be responsible for ensuring that the components or each system are mutually compatible and integrated to form fully efficient systems complying with the Drawings and Specification. Corresponding parts throughout the Works shall be made to gauge and be interchangeable wherever possible. The Contractor shall, when required by the Engineer, prove interchange ability by the actual interchange of the various parts.

B. All articles and materials specified to conform to British and other standards shall be clearly and indelibly marked with the appropriate standard number specified except where marking is impracticable when relevant documents shall include this information.

C. All materials and workmanship shall be to the satisfaction of the Engineer. The Contractor shall maintain a competent supervising engineer and supervisors for each specialization and for each section of the work on Site throughout the whole of the time to the completion of the works. The Engineer shall give prior approval to the appointment of this supervising engineer and shall have the authority to withdraw this approval at any time. No person shall be allowed to execute any type of work, which is normally carried out by a skilled tradesman unless he is thoroughly experienced and proficient in the trade concerned. The Engineer shall have the authority to require any tradesman to demonstrate his proficiency to the satisfaction of the Engineer.

D. Where "stainless steel" is specified or used it shall have resistance to atmospheric corrosion and be of a grade to suit its particular use. Particular attention shall be made to the prevention of seizure

by fretting where two corrosion resistant metals are in contact, by the selection of materials of suitable relative hardness and surface finish and the applications of lubricants.

E. Particular attention shall be paid to the prevention of corrosion due to the close proximity of dissimilar metals. Where it is necessary to use dissimilar metals in contact, they shall be selected so that the bimetallic corrosion is as low as possible.

1.7. INSPECTIONS AND TESTS AT MANUFACTURE'S WORK

A. All works, materials and the like rejected shall be corrected or replaced as necessary at the Contractor's own expense to the satisfaction of the Engineer.

B. Where the mechanical equipment is composite unit of several individual pieces manufactured in different places, it shall be assembled and tested as one complete working unit, at the manufacturer's works, to the relevant test or tests required.

C. The Contractor shall submit his proposed programme of tests for the Engineer' approval six weeks before the commencement of testing.

D. The aforementioned works tests carried out before delivery to the Site shall not in any way relieve the Contractor of completing satisfactory Site tests after erection as specified.

E. The Contractor shall give the Engineer reasonable notice, at least ten clear days in writing, of the date and the place at which any mechanical Equipment will be ready for testing as provided in the Contract and the Engineer shall thereupon at his discretion notify the Contractor of his intention either to release such part upon receipt of works tests certificates or of his intention to inspect such part. The Contractor shall forward to the Engineer six duly certified copies of all relevant test readings.

F. The Contractor shall provide, free of charge, such labour, materials, electricity, fuel, water, stores, apparatus, instruments and other things as may be reasonably demanded to carry out efficiently such tests of the mechanical equipment in accordance with the Contract, and shall provide facilities to the Engineer or to his authorised representative to accomplish such testing. Where inspection or testing is to be carried out at a Sub-contractor's works, a representative of the Contractor shall be present.

G. Works tests shall also be carried out such that due consideration is given to the Site conditions under which the mechanical equipment is required to function. The tests certificates shall give all details of such tests.

1.8. PROTECTION AND CARE OF PLANT AND EQUIPMENT

A. All mechanical equipment shall be packed in robust containers to prevent damage and mishandling during transport to Site. Before dispatch from works all mechanical equipment shall be thoroughly cleaned, protected against damage, deterioration, corrosion and ingress of dirt and packed and protected suitable for prolonged storage in a humid and saline atmosphere.

During storage and erection at the Site, the mechanical equipment shall be kept clean and free from dirt and debris, and water shall not be allowed to remain in any pockets of the equipment. All items of mechanical equipment shall be stored clear to the ground on suitable timbers to the approval of the Engineer.

All mechanical equipment, particularly electrical and other sensitive instrumentation shall at all times be protected so that it is not subject to damage by rainwater, moisture dust, etc., from any source. Mechanical equipment which may be damaged by heat or sun shall be protected accordingly. All open piped ends and duct ends whether installed or in store shall be fitted with plastic caps or suitable protective covering.

1.9. GUARDS

A. A guard shall be provided for all open unprotected intakes to axial fans, centrifugal flowfans, for V-belt drives or in any position required by the UK Factories Act.

Fan guards shall be made of galvanized steel wire mesh, not greater than 25mm attached to a rigid galvanised steel rod framework. The fan maker shall manufacture the fan guards.

Cleaning: The Contractor shall be responsible for cleaning all mechanical equipment at all times to the satisfaction of the Engineer. The cleaning shall be carried out notwithstanding the fact that the installation or any part thereof may be in use of partial use within the premises in occupation by others. A Certificate of Completion will not be issued until the Engineer is satisfied that all dirt, jointing materials and other extraneous and injurious materials have been removed.

1.10. AIR-CONDITIONED STORAGE

A. The Contractor shall provide air-conditioned site stores for all goods that deteriorate when subjected to the site climatic conditions detailed. The contractor will adhere strictly to the Manufacturer's instructions with regard to storage temperatures for all materials being used for the construction of this project.

1.11. PAINTING

A. The preparation, painting and treatment of mechanical equipment surfaces shall be in accordance with technical specifications.

B. Full details of the manufacturer's standard finishes shall be given to the Engineer for his approval prior to manufacturer. Special care shall be taken to ensure standard finishes are suitable for the particular conditions applicable to the individual items of plant.

C. Any damage to paintwork occurs shall be made good by the Contractor at his own cost to the satisfaction of the Engineer.

D. Where it is the usual practice of the manufacturer of special items such as pumps, compressors, electric motors, gear boxes, switch gear, etc., to apply a high standard of protective enamel paintwork in the shops before despatch; this will be acceptable provided any subsequent damage to the paintwork is made good by the Contractor, at his own cost.

E. The inside of outdoor control cubicles, cabinets, etc., where condensation is liable to occur, shall be coated with an approved anti-condensation composition.

F. The Contractor shall obtain the paint manufacturer's guarantee that each coat of paint is compatible with the previous and subsequent coats so that peeling, flaking and other faults do not occur.

G. The Contractor shall include for painting all pipes, ducts, flange edges, etc., prior to their being insulated.

H. Final decoration of exposed pipework, brackets and ductwork shall be carried out in accordance with standards.

1.12. MANUFACTURER'S NAMEPLATES

A. Nameplates: Each item of mechanical equipment and plant shall have the manufacturer's name or trademark on a corrosion-resistant nameplate securely affixed in a conspicuous place. The manufacturer's name or trademark may be cast integrally with stamped or otherwise permanently marked upon the item of the equipment. The nameplate shall show the equipment reference number, date of manufacture and the capacity. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplates.

1.13. SUNDRY BUILDERS WORK IN CONNECTION WITH SERVICES

A. The Contractor shall supply two complete sets of any special tools necessary for the operation, maintenance and dismantling of the mechanical equipment. The Contractor shall supply wall-mounted strongboxes, each fitted with a suitable lock and two keys, and located near the item of mechanical equipment for which they will be used. The Contractor shall not use such tools during the erection of the mechanical equipment.

1.14. NOISE

A. The Contractor shall provide a quiet installation. All items of mechanical equipment shown on the Drawings shall be carefully chosen with a view to silent operation. The Contractor shall prepare detailed noise level calculations to indicate the anticipated noise levels in all critical areas.

B. All possible steps shall be taken, (e.g. by the use of sound insulation, anti-vibration mountings, and careful design of motors, fans, ducts, bends, dampers, grilles and other equipment) to reduce the noise produced by the mechanical equipment.

1.15. ANTI-VIBRATION MOUNTINGS AND SOUND ABSORPTION

A. The Contractor shall provide and fix all mechanical equipment to prevent noise and the transmission of vibration through the structures.

B. All fans, motors, compressors and other items, as appropriate, shall be mounted on resilient mountings in such a manner that the plant foundations are isolated from the floor or structure. In addition, all rotating plant shall be statically and dynamically balanced.

C. Mechanical vibration shall be eliminated by the use of anti-vibration mountings and flexible connections to ensure an isolation efficiency of 95% from the building structure except where defined otherwise on the Drawings or in the Specification.

D. Spring type anti-vibration mountings shall be the captive partially encased and restrained type to prevent lateral movement.

1.16. AS BUILT DRAWINGS

A. Thirty days prior to the date of the handing over certificate, the Contractor shall provide for approval "as built" record drawings of the whole works.

B. The Drawings shall include the following:

1. General arrangements of all services to a scale of not less than 1:50.
2. Detailed layouts of plantrooms and similar spaces to a scale of not less than 1:20.
3. Schedules of all plant and crossed referenced equipment to the maintenance manual.
4. All equipment and control wiring diagrams together with specialist system i.e. public address, fire alarms, etc.
5. These may be produced separately or included with the general distribution diagrams.

6. Indicate with accurate dimensions, sizes and positions of all plant, equipment and valves together with all inspection points and test positions. All plants to have indicated manufacturer's name, model and type number also cross referenced to maintenance manual.

7. Fully indicate all ductwork, pipework, sizes and positions of all plant equipment and valves together with all inspection points and test positions. All plant to have indicated manufacturer's name model and type number also cross referenced to maintenance manual.

8. Show the disposition and depth of all cables, pipes, ducts, buried direct in the ground and taken at intervals where cable increase or decrease in number/size and at every point where the services enter into or depart from ducts or buildings.

9. Indicate the number, sizes and services for every cable, duct, pipe, for every service within each building. Circuit lists for every distribution board shall be entered on to the relevant drawings and such lists shall agree with the list fixed within the distribution board door.

10. Show clearly on-site drawings all the new buildings together with all other existing buildings and other permanent features with dimensions between such buildings and cables, pipes, ducts, etc. clearly marked, together with installed backfill and surround to each service.

11. Indicate all equipment and control wiring diagrams together with all specialist systems i.e. public address, fire alarm, etc. Diagrams must be co-ordinated and show all required interlocks etc. between systems or components.

12. Show clearly all plumbing and drainage and setting out dimensions for all drainage pipework and manholes both within the building throughout the site, together with drainage pipework backfill, or surround in each location. A schedule shall be included to indicate each manhole size, cover size, invert level and ground level.

C. The symbol used for each service for all as built drawings shall be shown on separate drawings.

D. In order to achieved accurate as built drawings, all relevant information relating to the mechanical works shall be entered onto prints supplied immediately after the work has been carried out. The marked-up prints shall be available for inspection at the Contractor's site office at any reasonable time during the progress of the works.

E. All service routes, intersections and joints shown on the prints and finally recorded shall be actually physically measured from permanent features and accurate distances shall be shown on the Drawings.

F. In addition to the as built drawings, the Contractor shall obtain and provide two sets of all manufacturer's detailed drawings for all items of plant, equipment, apparatus and materials. These drawings shall be suitably titled and have drawing reference numbers added.

G. The Contractor shall provide two copies for all as built drawings for review comments and approval. Upon receiving approval in writing from the Engineer, or his representative, the Contractor shall provide one copy of each approved as built drawing.

1.17. OPERATING AND MAINTENANCE INSTRUCTIONS

A. The working, operating and maintenance instruction shall be prepared in draft as soon as the working drawings are in hand and shall take the form of a manual in which fully detailed information relating to the maintenance and operation of the complete installation and its component parts is presented.

1. Overall general description of the complete equipment installed together with the method of functioning.
2. Full technical descriptions of each and every item of equipment, including the electrical circuit details as applicable.
3. Operating procedures for each section of the works and each individual item of equipment or plant.
4. Planned maintenance schedules for the installation and its component parts to include commissioning performance details and measurements.
5. Schedule of components comprising each and every item of equipment including manufacturer's name, description and part number of each component.
6. A copy of the manufacturer's literature, describing each item of equipment, plant fittings and accessory type used throughout the installation. This literature shall list the technical data available, together with catalogue list numbers for replacement purposes.
7. Generally, all drawings must be arranged to flood out from their position and be entirely visible when any part of the manual is being read. They shall be printed on linen backed paper.
8. Each section shall be encased in a loose-leaf ring binder covered in plastic material of an approved colour and of a type which shall be flat when open.
9. The Contractor shall include for the preparation and supply of six copies of the above operating and maintenance instructions for each section after all details have been approved by the Engineer.
10. Electric transfer of "As Built" drawings shall be provided as required by the Engineer.

1.18. INSTRUCTION AND TRAINING

The Contractor shall be responsible for the provision of suitably qualified personnel for the instruction and supervision of the Employer's staff at Site in the operation and routine maintenance of all mechanical equipment and associate works. Unless specified to the contrary in the specific technical clauses instruction and training shall be for periods of six hours daily for two days after the satisfactory commissioning of the installation and as necessary, after each subsequent commissioning of a system or part thereof.