

**MIC1 WAREHOUSE**  
in  
MoT Plot #1668 Dekwaneh

**GENERAL GUIDELINE**

Site Build Unit  
Civil Works

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MIC1

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# 1 GENERAL

## 1.1 SUMMARY

The purpose of this document is to provide general guidelines regarding the design and execution of a MIC1 warehouse (outdoor area and indoor hangar) inside of MoT plot #1668 area at Dekwaneh.

## 1.2 REFERENCES

- A. Issues of the following documents, in effect at the time of solicitation for bids, form a part of this specification. In the event of conflict between this specification and the codes, standards, and specifications in this document, the most stringent and/or current requirement shall govern.
1. American Institute of Steel Construction (AISC) Manual of Steel Construction OR French code for steel construction (CM66) OR Eurocodes.
  2. American Welding Society (AWS) OR (CM66): Structural Welding Code OR Eurocodes.
  3. American Institute of Steel Construction (AISC) OR (CM66) OR Eurocodes: Specification for Structural Joints using ASTM A325 or A490 Bolts.
  4. American Concrete Institute (ACI) OR French Concrete code (BAEL91) OR Eurocodes: Building Code Requirements for Reinforced Concrete.
  5. Technical Report 34 - Concrete Industrial Ground Floors – A guide to design and construction.
  6. Best Practice in Steel Construction INDUSTRIAL BUILDINGS – Guidance for architects, Designers and Constructors.
  7. Lebanese Code LIBNOR NL137.

## 1.3 SUBMITTALS

- A. The following documents shall be provided by the designer, between others:
1. Complete installation drawings and details. The drawings must show all of the necessary pieces, their part section sizes.
  2. The manufacturer shall submit an elevation of the warehouse hangar as well as multiple sections showing all the members (columns, truss system, bracing, diagonals, struts, bolts, connections, foundations...) sizes, grades and distances.
  3. An assembly detailed plan is required showing the connection between different members of the hangar along with bolts and plates section and grade.
  4. Drawings showing the hangar concrete columns reinforcement.
  5. Drawings showing the hangar concrete columns foundations reinforcement.
- B. The designer shall provide the hangar detailed calculation notes:
1. The calculation note shall consist of the design hypothesis and criteria, the wind loads and other loads, the calculation and the results (sway, stresses in members, ...).
  2. It is also required to provide the hangar concrete columns foundations

calculation note:

The foundation drawings and design taking into account the ultimate wind effect. And using a soil bearing capacity of 2 kg/cm<sup>2</sup> (unless the existence of another recommendation based on the geotechnical data in the area).

3. The calculation note must include the calculation of the stability, dimensions, main steel, vertical steel and stirrups around anchoring bolts, anchoring bolts design, foundations, soil reactions...
4. The design shall be signed by a registered professional engineer.

#### **1.4 WARRANTY**

- A. All materials provided shall be guaranteed by the manufacturer against mechanical, electrical and workmanship defects. In the event defects become evident within the warranty period, the manufacturer shall furnish replacement parts and materials at no additional cost to the state. The warranty period shall commence with the date of the hangar's acceptance and remain in effect for one (1) calendar year.
- B. The manufacturer shall provide all hangar elements and accessories complete and in compliance with the submitted design drawings as approved by MIC1 or its consultant.
- C. In case of major defect in the supplied products, MIC1 reserves the right to reject the equipment. The supplier shall replace the defected system/parts under no cost from MIC1, including dismantling, hoisting, transportation and re-installation.
- D. The manufacturer shall be required to furnish all materials, equipment and/or services necessary to perform contractual requirements. Materials and workmanship in the construction of equipment for this contract shall conform to all codes, regulations and requirements for such equipment, specifications contained herein, and the normal uses for which intended. Materials shall be manufactured in accordance with the best commercial practices and standards for this type of equipment. Materials used in the production must be new.

#### **1.5 MATERIALS AND WORKMANSHIP**

The manufacturer shall be required to furnish all materials, equipment and/or services necessary to perform contractual requirements. Materials and workmanship in the construction of equipment for this contract shall conform to all codes, regulations and requirements for such equipment, specifications contained herein, and the normal uses for which intended. Materials shall be manufactured in accordance with the best commercial practices and standards for this type of equipment. Materials used in the production of the hangar must be new.

## 2 HANGAR (INDOOR AREA) GUIDELINES

### 2.1 MANUFACTURING

- A. Steel recommended countries of origin are one of the following: Sweden, Norway, Finland, France, Germany, Turkey or Romania.  
  
However, all steel manufactured outside Europe shall be accepted if they provide proof that it meets European standards and specifications mentioned in this document.
- B. Manufacturer should be ISO certified.
- C. The hangar vendor shall be a manufacturer, primarily and continuously involved in the design and production of similar structures for a period of at least ten (10) years.
- D. All fabrication, erection and identification of structural steel shall conform to AISC, CM66 or Eurocode specifications
- E. The manufacturer should be certified according to American (AISC), French codes and norms (CM66 & NV65 modifiées 80), or Eurocodes.
- F. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure.", if applicable.
- G. Hangar structure elements shall be guaranteed against fatigue failure for a period of 20 years.

### 2.2 DESIGN

- A. The hangar should be designed according to known international standards (American, French or European).
- B. The hangar structure should be designed to withstand the designated wind load according to the Lebanese Norms (LIBNOR NL137) while applying it within the international standard being used.
- C. The allowable unit stresses and the actual member stresses resulting from the specified design loads shall not exceed those given in the AISC or CM66 or Eurocode 3 codes.
- D. All members of the steel structure shall be considered primary members for the purpose of establishing allowable compressive stresses per AISC or CM66 or EC3, except those members whose sole function is to reduce the slenderness  $kl/r$  ratio of the primary members.
- E. Combined wind loads and SDL/LL loads shall be applied in combination such that the maximum stresses are produced in the structure. Multiple analyses/load cases/load combinations may be necessary to ensure that worst case design conditions have been investigated.
- F. The hangar design shall include all the required customer loading conditions.
- G. The design shall hold the structure within the critical twist, sway, and displacement limits.

- H. The designer must provide the detailed drawings, the assembly plans, the bolts, the welding if any, etc.
- I. The hangar floor (slab on grade) should be able to support the requested loads for an industrial warehouse according to ASCE-7 standard or equivalent standards, no less than  $3T/m^2$ .
- J. Designer is responsible for the design of the hangar foundation, slab on grade floor and soil beneath it to support the required loads.
- K. Soil capacity: For the design and construction of the hangar foundation, a  $2 \text{ kg/cm}^2$  soil bearing capacity should be considered.

If lower values are found on site, foundation redesign is required.

### 2.3 GENERAL DESIGN CONSIDERATIONS

- A. The provided drawings by MIC1 serve only as a general guideline or very preliminary design and proposals. These are susceptible to change once the design is developed or if the hangar design/execution forces modifications.
- B. The hangar shall be self-supported of 70mx40m horizontal footprint t size.
- C. The hangar type is "Single span symmetrical portal frame".
- D. The hangar facades should be vertical.
- E. The hangar roof shall be sloped at the middle all along the length/bigger dimension at a slope of 10 degrees.
- F. The hangar roof shall offset 50cm all around the hangar footprint on all sides.
- G. The hangar facades should be constructed of concrete masonry walls at 3m clear height (measured from the outside), then followed by metallic sheets reaching up to the roof. The masonry walls should respect known codes and execution standards (need for concrete columns, lintel, span, etc.).
- H. It is preferable that concrete columns support the hangar metallic columns for up to the fence height (~3m clear from ground). These concrete columns should not exceed 75cmx75cm in section, preferably around 50x50cm if possible.
- I. A clear height of 6m is needed on the edges of the hangar (lowest point). Highest point can be deduced considering the slope.
- J. The hangar should not have any internal columns (meaning it should be supported on the outer edges only while having a free open space inside).
- K. The span between each main supporting truss/structure system should be around 7m (to allow for the 2 big main entrances/delivery areas). Refer to provided drawings for more info.
- L. Bracing within the sides/facades planes or the roof plane is allowed (i.e. stiffening in longitudinal direction).
- M. Stiffening in the frame plane is allowed on the upper part (under roof) considering it doesn't affect the minimum clear height.
- N. The hangar structure should account for solar panels installation on the roof as well

as maintenance personnel. Refer to the provided drawings for the exact location. A structure should be provided to host the solar panels structure.

## 2.4 GENERAL EXECUTION CONSIDERATIONS

- A. Industrial concrete with needed high compressive strength should be used to construct the floor to increase durability, which will accommodate heavy-duty operations in the warehouse.
- B. After casting the reinforced concrete slab, the floor surface should be polished with a high-speed trowel machine to enhance floor surface durability, as well as to provide the required flatness and levelness of the floor.
- C. Control joints and movement joints should be suitably provided, if needed, to minimize drying and shrinkage cracks in the concrete floor.
- D. The floor surface should have suitable surface regularity, have suitable abrasion, chemical and slip resistance. Using water-based epoxy paint can be considered or similar other ways.
- E. The hangar floor top should be elevated from external outdoor area by around 40cm. A small ramp should lead from the outside to the inside of the hangar.
- F. The masonry wall surrounding the hangar (mentioned in 2.3.G) should be cement rendered and painted.
- G. The metal sheet roofing should prevent:
  - 1. any rain leakage (waterproof)
  - 2. any dust leakage (dustproof)
  - 3. and should be designed to resist the required wind load as well as additional DL or LL.
- H. Skylights could be installed to allow light transmission during daytime for energy-saving purposes.
- I. Adequate minimal natural cooling should be aimed for, considering there's no heat producing equipment inside of the warehouse:
  - 1. Extra roof ridge to allow hot air exhaust at the peak/middle of the hangar roof. (Adopt something like "REID steel ridge vent with cowl and bird mesh" to suppress the effect of the external wind on the ventilation, and forbid rain entering).
  - 2. Louvered sidings to allow fresh air intake shall be created on all 4 sides of the hangar (at high heights for security reasons).
- J. Steel nets should be installed along the louvers to prevent birds, rodents and other animals from entering the warehouse area.
- K. Two main doors should be provided with dimensions 5m W x 5m H, equipped with key operated electrical motor system.
- L. Sufficient high pressure, energy-saving lighting fixtures (T5 or LED) of 300 lux should be installed to provide light during nighttime operation.
- M. Adequate drainage is required on the 2 long sides of the hangar just in case of

emergency using floor trenches (without any floor slope).

- N. Water gutters to be installed on the 2 long sides of the roof leading to multiple drainage pipes routed to reach the nearest draining zone.
- O. A handrail of 1m high should be installed all around half of the roof (on the side hosting the solar panels) for safety purposes.
- P. A vertical access ladder reaching the roof, with a cabloc/anti-fall safety system, should be installed.
- Q. The hangar structure should account for solar panels installation on the roof as well as maintenance personnel. Refer to the provided drawings for the exact location. A structure should be provided to host the solar panels structure as well as the needed access platform. This is to avoid drilling through the roof and risk water infiltration issues.
- R. A fire system shall be installed inside of the warehouse. Refer to provided design for more info.
- S. The hangar walls and roof should be all white. Painting method statement, mixture and quantity shall be provided by the manufacturer.
- T. Two copper tinned lightning rods should be installed on each side of the hangar, with a minimum height of 1.5m.
- U. A grounding/earthing system should be provided, with two 50cm main bus bars on each side of the hangar; each bus bar drilled by 12 holes.

**END OF SECTION**