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KLM Technology Group #03-12 Block Aronia, Jalan Sri Perkasa 2 Taman Tampoi Utama 81200 Johor Bahru Malaysia	STRUCTURAL ENGINEERING DESIGN CRITERIA (PROJECT STANDARDS AND SPECIFICATIONS)	

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SCOPE

This Project Standard and Specification summarizes the codes and standards and standard design criteria and practices that will be used during the project engineering, design and construction. These criteria form the basis of the design for the structural components and systems for the project. More specific design information will be developed during the detailed design phase to support equipment procurement and construction specifications.

Prior to the start of any increment of construction, the proposed lateral-force procedures for project structures and the applicable designs, plans and drawings for project structures will be submitted for approval.

Proposed lateral-force procedures, designs, plans, and drawings shall be those for:

- Major project structures
- Major foundations, equipment supports, and anchorage
- Large, field-fabricated tanks
- Switchyard structures

REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

1. American Institute of Steel Construction (AISC).
 - S335 - "Specification for Structural Steel Buildings - Allowable Stress Design and commentary."
 - S303 - "Code of Standard Practice for Steel Buildings and Bridges."
 - S329 - "Allowable Stress Design Specifications for Structural joints using ASTM A325 or A490 Bolts."
 - M016 - "Manual of Steel Construction Allowable Stress Design."
2. American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members," Edition Cold-Formed Steel Design Manual Parts I-VII.
3. American Welding Society (AWS)

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- D1.1—Structural Welding Code—Steel
 - D1.3—Structural Welding Code—Sheet Steel
4. American Concrete Institute (ACI)
- ACI 318/318R “Building Code Requirements for Structural Concrete (ACI 318) and commentary (ACI 318R).”
 - ACI 318.1 and Commentary - ACI 318.IR.
 - ACI 530 “Building Code Requirements for Concrete Masonry Structures and Commentary (ASCE 5) (TN4S 402).”
 - ACI 212.3R “Chemical Admixtures for Concrete.”
 - ACI 302.IR “Guide for Concrete Floor and Slab Construction.”
 - ACI 35OR “Environmental Engineering Concrete Structures.”
5. Structural and Miscellaneous Steel.
- ASTM A569/A569M - Standard Specifications for Steel Carbon (0.15 m maximum percent) Hot-Rolled Sheet and Strip, Commercial Quality.
 - American Society for Testing and Materials (ASTM). The following codes and standards shall be included as a minimum
 - ASTM A36/A36M “Standard Specification for Structural Steel.”
 - ASTM A992 Specification for Structural Steel.
 - ASTM A53 “Standard Specification for Pipe, Steel Black and Hot-Dipped, Zinc Coated, Welded and Seamless.”
 - ASTM A276 “Standard Specification for Stainless and Heat Resisting Steel Bars and Shapes.”
 - ASTM A500 “Standard Specification for Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.”
 - ASTM A695 “Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.”
 - ASTM A307 “Standard Specification for Carbon Steel Bolts and Studs.”
 - ASTM A153/A153 “Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.”
 - ASTM A182 “Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.”
 - ASTM A185 “Standard Specification for Welded Steel Wire Fabric, Plain, for Concrete Reinforcement.”
 - ASTM A615/A615 “Standard Specification Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.”
 - ASTM A-706-60 Specification for Reinforcing Steel Bars in Concrete.

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- Masonry Institute of America, "Reinforced Masonry Engineering Handbook."
 - American Water Works Association (AWWA).
 - AWWA D100 "Welded Steel Tanks for Water Storage, (AWS D5.2).
 - "Addendum D100A (AWS D5.2-84A)."
 - AWWA C301 "Prestressed Concrete Pressure Pipe, Steel Cylinder Type for Water and Other Liquids."
 - AWWA C302 "Standards for Reinforced Concrete Water Pipe Noncylinder Type, Not Prestressed."
6. American Association of State Highway and Transportation Officials. (AASHTO) (GDHS-2), "A Policy on Geometric Design of Highways and Streets."
 7. National Fire Protection Association Standards (NFPA).
 - NFPA 850 Fire Protection for Electric Generating Plants.
 8. Steel Structures Painting Council Standards (SSPC).
 9. American Society of Nondestructive Testing (ASNT-TC-IA).
 10. American Society of Civil Engineers (ASCE):
 - ASCE 7-98, Minimum Design Loads for Buildings and Other Structures
 11. Code of Federal Regulations, Title 29—Labor, Chapter XVII, Occupational Safety and Health Administration (OSHA).
 - Part 1910—Occupational Safety and Health Standards.
 - Part 1926—Construction Safety and Health Regulations
 12. National Association of Architectural Metal Manufacturers (NAAMM)—Metal Bar Grating Manual.
 13. Hoist Manufacturers Institute (HMI), Standard Specifications for Electric Wire Rope Hoists (HMI 100).
 14. National Electric Safety Code (NEESC), C2-1993
 15. OSHA Williams-Steiger Occupational Safety and Health Act of 1970.
 16. Steel Deck Institute (SDI)—Design Manual for Floor Decks and Roof Decks.

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STRUCTURAL DESIGN CRITERIA

Datum

Site topographic elevations will be based on an elevation survey conducted using known elevation benchmarks.

Frost Penetration

The site is located in an area free of frost penetration. Bottom elevation of all foundations for structures and equipment, however, will be maintained at a minimum of 12 inches below the finished grade.

Temperatures

The design basis temperatures for civil and structural engineering systems will be as follows:

- Maximum Determined by Site
- Minimum Determined by Site

Design Loads

1. General

Design loads for structures and foundations will comply with all applicable building code requirements.

2. Dead Loads

Dead loads will consist of the weights of structure and all equipment of a permanent or semi-permanent nature including tanks, bins, wall panels, partitions, roofing, drains, piping, cable trays, bus ducts, and the contents of tanks and bins measured at full operating capacity. The contents of the tanks and bins, however, will not be considered as effective in resisting structure uplift due to wind forces; but will be considered as effective for seismic forces.

3. Live Loads

Live load will consist of uniform floor live loads and equipment live loads. Uniform live loads are assumed equivalent unit loads that are considered sufficient to provide for movable and transitory loads, such as the weights of people, portable equipment and tools, small equipment or parts, which may be moved over or placed on the floors during maintenance operations, and

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planking. The uniform live loads will not be applied to floor areas that will be permanently occupied by equipment.

Equipment live loads are calculated loads based upon the actual weight and size of the equipment and parts to be placed on floors during dismantling and maintenance or to be temporarily placed on or moved over floors during installation.

Lateral earth pressures, hydrostatic pressures, and wheel loads from trucks, will be considered as live loads.

Uniform live loads will be in accordance with ASCE Standard 7, but will not be less than the following:

- Roofs 20 pounds per square foot (psf)
- Floors and Platforms
(steel grating and checkered plates) 100 psf

In addition, a uniform load of 50 psf will be used to account for piping and cable trays, except that where the piping and cable loads exceed 50 psf, the actual loads will be used.

Furthermore, a concentrated load of 5 kips will be applied concurrently to the supporting beams of the floors to maximize stresses in the members, but the reactions from the concentrated loads will not be carried to the columns.

- Floors (elevated concrete floors) 100 psf

In addition, elevated concrete slabs will be designed to support an alternate concentrated load of 2 kips in lieu of the uniform loads, whichever governs. The concentrated load will be treated as a uniformly distributed load acting over an area of 2.5 square feet, and will be located in a manner to produce the maximum stress conditions in the slabs.

- Control Room Floor 150 psf
- Stairs, Landings, and Walkways 100 psf

In addition, a concentrated load of 2 kips will be applied concurrently to the supporting beams for the walkways to maximize the stresses in the members, but the reactions from the concentrated loads will not be carried to the columns.

- Pipe Racks 50 psf

Where the piping and cable tray loads exceed the design uniform load, the actual loads will be used. In addition, a concentrated load of 8 kips will be applied concurrently to the supporting beams for the walkways to maximize the stresses in the members, but the reactions from the concentrated loads will not be carried to the columns.

- Hand Railings

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Hand railings will be designed for either a uniform horizontal force of 50 pounds per linear foot (plf) applied simultaneously with a 100 plf uniform vertical live load, or a 200-pound concentrated load applied at any point and in any direction, whichever governs.

- Slabs on Grade 250 psf
- Truck Loading Surcharge Adjacent to Structures 250 psf
- Truck Support Structures AASHTO-HS-20-44
- Special Loading Conditions Actual loadings

Laydown loads from equipment components during maintenance and floor areas where trucks, forklifts or other transports have access, will be considered in the design of live loads.

Pipe hanger loads for the major piping systems will be specifically determined and located. Piping expansion and dynamic loads will be considered on an individual basis for their effect on the structural systems. Loads imposed on perimeter beams around pipe chase areas will also be considered on an individual basis.

Pipe loads for other areas will be treated as uniform loads per unit floor area, and will be carried to the columns and foundations as dead loads. Pipe loads will not be considered as reliable dead load for uplift.

Equipment loads will be specifically determined and located. For major equipment, structural members and bases will be specifically located and designed to carry the equipment load into the structural system. For equipment weighing less than the uniform live load, the structural system will be designed for the live load.

The Steam turbine support systems will be designed for the following loads:

- Deadloads
- Live loads
- Normal torque loads (turbine)
- Temperature and pressure loads
- Seismic loads
- Emergency loads, such as turbine accident loads, and any temperature and pressure loads present during the emergency

4. Earth Pressures

Earth pressures will be in accordance with the recommendations contained in the project-specific geotechnical report.