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		Rev: 01
		April 2012
KLM Technology Group #03-12 Block Aronia, Jalan Sri Perkasa 2 Taman Tampoi Utama 81200 Johor Bahru Malaysia	<b>SPECIFICATION FOR SPHERICAL VESSELS</b>  <b>(PROJECT STANDARDS AND SPECIFICATIONS)</b>	

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## 1. GENERAL

### 1.1 Scope

1.1.1 This specification covers additional requirements for engineering in regard to the design, material, fabrication, inspection, testing and supply of Section VIII Div.1 Spherical Vessels.

## 2. DESIGN

### 2.1 Shell Design

2.1.1 Sphere shells shall be calculated according to the requirements of ASME Section VIII, Division 1, using the required design temperature, design pressure, and corrosion allowance.

2.1.2 No fatigue analysis is required in the design of the spheres.

2.1.3 In the design of sphere supports, special attention shall be given to the loads imposed on the spherical shell. Consideration shall be given to secondary forces resulting from service temperatures or changes in temperature; test and operating pressure; liquid loads, both with and without pressure application; piping reactions, and normal supporting loads. Consideration shall be given to loads resulting from differential settlement of foundations where this is anticipated

### 2.2 Support Column Design

2.2.1 Spheres shall have suitably numbered support columns constructed of steel pipe and rigidly welded to the shell.

2.2.2 Support columns shall be capable of supporting the sphere filled with water.

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- 2.2.3 Support columns shall be sufficiently large to ensure stability, taking into consideration of external loads and deflections due to pressure expansion or thermal expansion and the weight of the sphere plus contents.
- 2.2.4 Calculations for support column including induced shell stresses shall be submitted to PURCHASER.
- 2.2.5 The design of support columns shall be done according to Appendix G, ASME Section VIII, Division 1.
- 2.2.6 Whenever possible, support columns shall be attached to equatorial zones by a reinforcing plate large enough to ensure even distribution of loads.
- 2.2.7 Diagonal bracing members shall not be attached directly to a sphere unless adequate provisions are made for such loads in the design of the sphere.
- 2.2.8 Support columns and their members shall be designed and fabricated so as to prevent accumulation of water. Where this is impracticable, adequate drainage openings shall be provided to prevent such accumulation.
- 2.2.9 Attachment welds to shell shall be full penetration type of ASME Section VIII Division 1.
- 2.2.10 Support columns welds on the shell shall clear the meridional and latitudinal shell plate welds by at least 50 mm.
- 2.2.11 If postweld heat treatment after erection is required by the code, a sufficient clearance shall be provided in the anchor bolt holes in the footings, to allow for expansion of the sphere.
- 2.2.12 At the base of each column a slide plate to the required dimension shall be provided.

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2.2.13 VENDOR shall submit the expected final settlement of foundation measured after hydrostatic test in the following manner for PURCHASER's approval:

- 1) Even settlement
- 2) Tilting of tank
- 3) Out of plane settlement

### **2.3 Opening Reinforcement**

- 2.3.1 Nozzles shall be constructed as integrally reinforced forged nozzles.
- 2.3.2 Neither nozzle nor its reinforcement shall straddle a weld joint at a shell. All welded accessories shall be at least 50 mm removed from weld joints.
- 2.3.3 For nozzle larger than 1-1/2 inch which have longer projection than 400 mm, appropriate reinforcement shall be considered.

### **2.4 Nozzles and Manholes**

- 2.4.1 For temperature connection located below maximum liquid level, thermo well installation shall be provided on shell using flanged connection.
- 2.4.2 Basically, manhole shall be provided only at top of sphere. However, for construction convenience, bottom manhole may be provided, but seal weld or welded cap shall be provided after erection work completed. Top manhole shall be provided with davit to facilitate removal of the cover.
- 2.4.3 Spheres to be fully post weld heat treated in the field shall be provided with an enlarged filling 1 discharge connection of sufficient size for access of post weld heat treat equipment. See Figure 2A.
- 2.4.4 After post weld heat treatment of the sphere, the filling 1 discharge line shall be welded to the connection with a tapered dollar plate. See Figure 2B.

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2.4.5 Butt weld between the tapered dollar plate and the sphere cap plate shall be locally post weld heat treated thereafter.

## 2.5 Internals and Externals

2.5.1 Removable internal parts shall be able to disassemble into pieces to pass through manhole.

2.5.2 When water spray system is specified on the data sheet or drawings, the tank shall be provided with the spray nozzles for water spray system and riser pipes with supports.

2.5.3 External lugs such as pipe support lugs, insulation lugs shall be provided on sphere shell or their support.

2.5.4 Sphere shall have fireproof clips attached on their support columns and shell.

## 2.6 Stairways and Platforms

2.6.1 Stairways and platforms shall be provided to allow access to operating valves and instruments. Auxiliary structures to services instruments, connections, shall be provided where required.

2.6.2 A stairway shall be provided from grade to the top of the sphere and shall have handrails.

2.6.3 Stairways shall have the following provisions:

- 1) Maximum angle with a horizontal line shall be 45"
- 2) Minimum effective tread width shall be 235 mm.
- 3) Minimum effective width of stairways shall be 760 mm.
- 4) Stair landings shall not be less than 750 mm in the direction of the stairway.