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KLM Technology Group #03-12 Block Aronia, Jalan Sri Perkasa 2 Taman Tampoi Utama 81200 Johor Bahru Malaysia	HYDROSTATIC PRESSURE TESTING OF PIPING (PROJECT STANDARDS AND SPECIFICATIONS)	

KLM Technology Group has developed; 1) Process Engineering Equipment Design Guidelines, 2) Equipment Design Software, 3) Project Engineering Standards and Specifications, and 4) Unit Operations Manuals. Each has many hours of engineering development.

KLM is providing the introduction to this guideline for free on the internet. Please go to our website to order the complete document.

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SCOPE

This Project Standard and Specification specifies pressure and leak test procedure and acceptance criteria of piping. This document is restricted to rigid metallic pipelines constructed from carbon steel, clad steel, stainless steel and the like. It does not address flexible pipelines or cement-lined pipelines, nor pipelines constructed from other materials such as GRP or RTRP.

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 Contractor. For undated references, the latest edition of the referenced documents including any supplements applies.

DEFINITIONS AND TERMINOLOGY

Calculated Test Pressure - The test pressure determined in this Project Standard and Specification below.

Minimum Test Pressure - The lowest allowable test pressure gauge reading (the calculated test pressure plus the additional pressure resulting from the static head of the test fluid).

Maximum Test Pressure - The highest allowable test pressure gauge reading (the pressure test rating of the "weakest" component in the test system).

Category D Fluid Service - A fluid service in which all the following apply:

- The fluid handled is nonflammable, nontoxic, and not damaging to human tissues
- The design gauge pressure does not exceed 10.35 bar
- The design temperature is between -29 C and 186 C

Category M Fluid Service - A toxic fluid service in which exposure to very small quantities of the fluid in the environment can produce serious irreversible harm to

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persons on breathing or bodily contact, even when prompt restorative measures are taken.

Damaging to Human Tissues - A fluid which, under expected operating conditions, can harm skin, eyes, or exposed mucous membranes so that irreversible damage may be done unless prompt restorative measures are taken. Restorative measures may include flushing with water, administration of antidotes, medication, etc.

Minimum Test Pressure - The lowest allowable test pressure gauge reading (the calculated test pressure plus the additional pressure resulting from the static head of the test fluid).

Maximum Test Pressure - The highest allowable test pressure gauge reading (the pressure test rating of the "weakest" component in the test system).

UNITS

This Standard is based on International System of Units (SI) except where otherwise specified. However, nominal sizes of piping component shall be in accordance with inch system

PRESSURE TEST SYSTEM

1. As large a piping system as practicable including its associated equipment shall be hydro tested together as a unit, unless the difference among their design pressures exceeds 15 percent of the lowest design pressure of the system components.

The test pressure in the system shall be equal to the test pressure applied to the system component of which the design pressure is the lowest among the system as mentioned in the following paragraph.

Where piping systems of different design pressures are fully welded together, then "cascade" pressure testing will be required, (i.e. complete the pressure test on the higher pressure system prior to system closure welding and then repeat full Pressure Test Procedure for the test of the combined systems at the lowest pressure).

2. Heat exchangers, pressure vessels and fired heaters may be included in a test system provided the system test pressure does not exceed the shop test pressure of any of the included items

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3. The following equipment and components shall not be included in the system. The equipment shall be isolated from the system.
 - a. Rotary equipment such as pumps, compressors and turbines.
 - b. Safety valves rupture discs, flame arresters, and steam traps.
 - c. Pressure vessels with sophisticated internals.
 - d. Equipment and piping lined with refractoriness.
 - e. Storage tanks.
 - f. Filters.
 - g. Heat exchangers of which tube sheets and internals have been designed for differential pressure between tube side and shell side.
 - h. Instruments such as control valves, pressure gages, level gages, and flowmeter (excluding thermocouples).
4. Exclusions

The followings are excluded from the requirements of this specification:

 - a. Any package unit previously tested by the manufacturer in accordance with the applicable codes.
 - b. Plumbing systems, which are tested in accordance with the applicable plumbing codes.
 - c. Lines and systems that are open to the atmosphere such as drain, vents, open discharge of relief valve, and atmospheric sewers.
 - d. Instrument impulse lines between the block valve at the process or utility line and the connected instrument.
5. Although instruments shall normally be excluded from the system, process lead lines shall be tested to the first block valve together with the piping system.

Any vents or bypasses downstream of the instrument's first block valves shall be opened or the instrument shall be disconnected during the test to insure full protection of that instrument.
6. All sprinkler piping shall be flushed and then plugged for pressure testing; heads, rosettes and nozzles shall be fitted after pressure testing.
7. The test shall be hydrostatic using water, except if there is a possibility of damage due to freezing, or if the operating fluid or piping material would be adversely affected by water. Any other suitable liquid shall be used with contractor's approval.

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- a. Testing on site with Kerosene or other inflammable fluids or compressed air shall be avoided as far as possible (except where specifically called for) and shall be carried out only with the approval of contractor.
- b. If a flammable liquid is used, its flash point shall be not less than 50C and consideration shall be given to the test environment.

The potential exists for water to freeze in a pipeline under test when ground temperatures are below freezing. To avoid this occurrence, either additives such as methanol or ethylene glycol are added to the water during filling to reduce the freezing point of the test water. Alternatively Heated Water can be circulated through the test section for several hours until the temperature of the pipe and surrounding ground reach 2 to 4oC.

Addition of chemicals in the test water would pose additional concerns due to contamination of piping and disposition of test water. Contaminated water must not be disposed of, and should be treated first. Treatment should be limited to ensure that the quality of effluent Test water is accordance with acceptable regulatory standards.

8. Hydrostatic Testing shall not be considered for the following:
 - a. Gas, steam, or vapor lines when the weight of the hydro test liquid would overstress supporting structures or pipe wall.
 - b. Piping with linings subject to damage by the hydro test liquid.
 - c. The instrument air headers shall be tested with dry oil-free air. The commodity test may be used if the systems are completed and the instrument air compressor is operational.
9. All pipe supports and anchors should be fitted prior to flushing and pressure testing and any temporary supports required during fabrication and erection removed. In certain cases, additional pipework supports may be required due to the weight of the testing medium.