Technical Supervision Regulation for Safety of Stationary Pressure Vessels

1 General provisions

1.1 Regulation aims
This regulation is enacted in accordance with the Regulations on Safety Supervision of Special Equipment in order to ensure the safe operation of stationary pressure vessels, to protect the safety of people’s lives and property, and to promote national economic development.

1.2 Stationary pressure vessel
Stationary pressure vessels refer to pressure vessels with the exception of portable pressure vessels (rail tanks, tank cars, tube trailers, tank containers etc.), gas cylinders and medical oxygen chambers.

1.3 Applicable scope
This regulation applies to stationary pressure vessels (hereinafter referred to as pressure vessels) within the scope of the Regulation on Safety Supervision of Special Equipment, which must meet the following requirements:

1. has a working pressure greater than or equal to 0.1MPa (gauge pressure, liquid hydrostatic pressure is excluded, idem below); (Note 1)
2. the product of the volume and the working pressure is greater than or equal to 2.5MPa x L; (Note 2)
3. the medium contained therein should be gas, liquefied gas, or liquid with its maximum working temperature higher than or equal to its standard boiling point. (Note 3)

In addition, Ultra-high Pressure Vessels should meet the provisions set out in “Technical Supervision Regulation for Safety of Ultra-high Pressure Vessels”; Non-metallic Pressure Vessels should meet the provisions set out in “Technical Supervision Regulation for Safety of Non-metallic Pressure Vessels”; Simple Pressure Vessels should meet the provisions set out in “Technical Supervision Regulation for Safety of Simple Pressure Vessels”. Pressure vessels which are not within the jurisdiction of the above-mentioned regulations shall adhere to all of the provisions specified in this regulation.

1.4 Special provisions of applicable scope

1.4.1 Pressure vessels which only need to meet the requirements for materials, design and the manufacturing process specified in this regulation

The pressure vessels listed below, and those which are within the applicable scope of this regulation, must only meet the relevant provisions specified in Clause 2, Clause 3, Clause 4 of this regulation:

1. vehicle gas storage tanks which are not simple pressure vessels, and gas storage tanks for portable air compressors;
2. non-independent pressure vessels in cryogenic installations, pressure vessels in
direct-fired absorption chiller installations, aluminium plate-fin heat exchangers;
(3) spiral plate heat exchangers, brazed plate heat exchangers;
(4) air-pressure tanks in automatic hydraulic pneumatic water supplement installations (non-tower water supply), gas or pneumatic water supplement pressure tanks (foam) of fire prevention installations;
(5) pressure vessels in water treatment installations used for ion exchanging or filtering, water expansion tanks for hot water boilers;
(6) totally enclosed composite equipment for special use in the electric power industry (such as capacitance pressure vessels);
(7) tyre vulcanising tanks and pressure bearing rubber moulds used in the rubber industry.

1.4.2 Pressure vessels which only need to meet the design requirements and requirements of administrative licence for manufacturing

For pressure vessels within the applicable scope of this regulation, if the volume is greater than 1L and smaller than 25L, or the inner diameter (for non-circular cross-section, this refers to its width, height or diagonal line; if it is a rectangle shaped cross-section, then this refers to its diagonal line; if it is an ellipsoidal shaped cross-section, this refers to its major axis) is smaller than 150mm, then the pressure vessel should meet the relevant provisions specified in Section 3.1 and Section 4.1.1 of this regulation only; its design and manufacturing should be processed in accordance with the Standards of relevant products.

1.5 Non-applicable pressure vessels

This regulation does not apply to the following pressure vessels:
(1) pressure vessels with a volume of less than or equal to 1L;
(2) waste heat boilers which are within the applicable scope of the Technical Supervision Regulation for Safety of Boilers;
(3) pressure vessels, the working pressure of which - under normal operating conditions - is smaller than 0.1MPa (including pressure vessels for which during the feeding process or discharging process the instantaneous pressure is greater than or equal to 0.1MPa);
(4) non-independent pressure bearing component of machines (including air cylinder or pressure-bearing casing of any compressors, generators, pumps, diesel engines);
(5) dismountable gasket plate heat exchangers (including semi-welded plate heat exchangers), and air-cooled heat exchangers.

1.6 Scope definition of pressure vessel

For pressure vessels within the jurisdiction of this regulation, the scope thereof includes:

1.6.1 Main pressure-bearing components

The main pressure-bearing components of a pressure vessel include the tube body, head (end cover), manhole cover, manhole flange, manhole nozzles, expansion joint, equipment flange, shell plate of spherical tank, tube plate and heat exchanging tube of heat exchanger, equipment main stud bolt which is more than M36 (include M36), nozzle and tube flange with their nominal diameter greater than or equal to 250mm.

1.6.2 Related parts and positions
(1) the weld groove of the first circumferential welding joint between the welding connecting of the equipment or outer piping and pressure vessel, the first threaded joint of the threaded connecting, the first flange sealing surface of the flange connecting, the first sealing surface of special connector or pipe connecting;
(2) the pressure-bearing cover and its fastener for those parts of the pressure vessel which open and close;
(3) the connection welding seam between non-pressure bearing components and the pressure vessel.

1.6.3 Safety accessories

The safety valve, bursting disc device, emergency shut off device, safety interlocking device, pressure gauge, liquid level gauge, temperature gauge which are directly connected to the pressure vessel.

1.7 Supervision and management

(1) The design, manufacture (including assembly welding, idem below), installation, alternation, maintenance, use, inspection and testing of pressure vessels should conform strictly to the provisions of this regulation.
(2) The safety supervision organisations for special equipment at all levels (hereinafter referred to as the Safety Supervision Organisation) should be responsible for the safe supervision of pressure vessels, and should supervise the implementation of this regulation.
(3) The manufacturing unit (manufacture, installation, alternation, and maintenance), use unit, inspection and testing organisation etc., should conform to the relevant provisions for information management of special equipment, and should timely enter any required data into the information management system of special equipment.

1.8 Connection with technical standards and administrative regulations

This regulation specifies the compulsory essential safety requirements for pressure vessels; any technical Standards or administrative regulations of enterprises and institutions which relate to pressure vessels should not be fewer than the requirements set out in this regulation.

1.9 Categorisation of pressure vessels

According to different hazard levels, the pressure vessels which are within the applicable scope of this regulation shall be divided into three categories by administrative supervision (see Appendix A for the categorisation method), and implement supervisory administration.

1.10 Special provisions for new materials, new technologies and new manufacturing processes

For pressure vessels which adopt new materials, new technologies, new manufacturing processes and which may need special service requirements, but which are not able to meet the requirements set out in this regulation, the concerned organisations should submit the relevant technical information such as evidence, data, results from the designs, research, and tests, as well as inspection and testing reports etc. to the General Administration of Quality Supervision, Inspection and Quarantine (hereinafter referred to as AQSIQ); AQSIQ entrusts the Technical Committee for Safety of Special Equipment (hereinafter referred to the Safety Technical Committee) to organise and conduct technical evaluations. Once the results of the
technical evaluation have been approved by AQSIQ, they can then be used for trial production and trial service.

1.11 Reference Standards

The Standards listed below are the reference Standards of this regulation (hereinafter referred to as the Reference Standards):

(1) GB 150 Steel pressure vessels
(2) JB 4732 Steel pressure vessels – Design by analysis
(3) GB 151 Tubular heat exchangers
(4) GB 12337 Steel spherical tanks
(5) JB/T 4710 Steel vertical vessels – Supported by skirt
(6) JB/T 4731 Steel horizontal vessels on saddle supports
(7) JB/T 4734 Aluminium welded vessels
(8) JB/T 4745 Titanium welded vessels
(9) JB/T 4755 Copper pressure vessels
(10) JB/T 4756 Nickel and nickel alloy pressure vessels

Note 1: (1) Working pressure refers to pressure vessels under normal working conditions, the maximum pressure which the vessel top reaches (gauge pressure).

(2) For pressure vessels which are equipped with multi-cavities (such as heat exchangers, waste heat boilers, jacketed pressure vessels), the higher category pressure cavity should be used as the category of the pressure vessel, and service administration should be conducted according to this category, however, design requirements and manufacturing technology requirements respectively should be proposed according to the category of each pressure cavity. When conducting categorisation to a pressure cavity, the design pressure of that pressure cavity shall be used as the design pressure, and the geometric volume of that pressure cavity should be used as the volume.

Note 2: The volume refers to the geometric volume of the pressure vessel, which is calculated and rounded off using the dimensions indicated in the design drawings (manufacturing tolerance is not taken into consideration). The volume of the inner parts which are permanently connected to the inside of the vessel can be deducted.

Note 3: When the main medium contained within the vessel is a liquid, and where its maximum working temperature is lower than its standard boiling point, if the product of the gas spatial volume (non-instantaneous) and the design pressure is greater than or equal to 2.5MPa x L, then it should be considered as within the applicable scope of this regulation.
Appendix A

Categorisation of pressure vessels and determination of pressure grade and variety

A1 Categorisation of pressure vessels

A1.1 Media categories

The media of pressure vessels are divided into the following two categories, including gas, liquefied gas or liquid where its maximum working temperature is higher than or equal to its standard boiling point.

(1) Category 1 media: chemical media, flammable media, or liquefied gas where the toxicity levels are extremely or highly harmful;
(2) Category 2 media consists of media with the exception of those belonging to Category 1, such as water vapour, nitrogen gas, etc.

A1.2 Media perniciousness

Media perniciousness refers to, during the manufacturing process of a pressure vessel, due to an accident causing a large quantity of medium to come into contact with the human body, leading to an explosion or a serious level of occupational chronic disease due to frequent leakage; it is indicated by the toxicity level and explosion hazard level of the medium.

A1.2.1 Toxicity level: comprehensively considers factors such as acute toxicity, maximum allowable concentration and industrial chronic disease. The maximum allowable concentration of extremely harmful product should be lower than 0.1mg/m$^3$; the maximum allowable concentration of highly harmful product should be within the range of 0.1~ 1.0mg/m$^3$; the maximum allowable concentration of medium harmful product should be within the range of 1.0 ~ 10.0mg/m$^3$; the maximum allowable concentration of less harmful product should be greater than or equal to 10.0mg/m$^3$.

A1.2.2 Flammable media: refers to media such as gas, or the explosive mixture formed by the vapour of liquid, thin mist and air, with its lower explosive limit smaller than 10%, or the differential value between its upper explosive limit and lower explosive limit is greater than or equal to 20%.

A1.2.3 The toxicity hazard level and explosion hazard level of a medium should be determined in accordance with the two Standards GB 5044-1985, Classification of health hazard levels from occupational exposure to toxic substances and HG 20660-2000, Classification of toxicity hazard levels and explosion hazard levels from the chemical media of pressure vessels. When both hazards do not agree, then the higher level hazard (danger) should be taken as criteria.

A1. 2 Categorisation

A1.2.1 General categorisation

The categorisation of pressure vessels should choose the categorisation diagram according to the characteristics of the medium first, then on the basis of design pressure $p$ (unit MPa) and volume $V$ (unit L) to indicate the coordination point, and finally determine the categorisation of the vessel.
(1) For Category 1 media, see Diagram A1 for the categorisation of the pressure vessels.
(2) For Category 2 media, see Diagram A2 for the categorisation of the pressure vessels.

A1.2.2 Categorisation method for pressure vessels equipped with multi-cavities

For pressure vessels which are equipped with multi-cavities (such as tube pass and shell pass of heat exchangers, and jacketed pressure vessels), the higher category pressure cavity should be taken as the category of the pressure vessel, and service administration should be conducted according to this category, however, the design requirements and manufacturing technology requirements respectively should be proposed according to the category of each pressure cavity. When conducting categorisation of a pressure cavity, the design pressure of that pressure cavity shall be used as the design pressure, and the geometric volume of that pressure cavity should be used as the volume.

A1.2.3 Categorisation method for pressure vessels with multi-medium contained in a single cavity

Where multiple types of media are contained in a single pressure cavity, then categorisation should be determined in accordance with the higher level of medium group.

A1.2.4 Categorisation method for pressure vessels with very low quantity of medium contents

When the quantity of a certain harmful substance is only of a very low amount in the medium, the hazard level and quantity of the medium should be taken into comprehensive consideration, and the category of the medium should be determined by the design company of the pressure vessel.

A1.2.5 Categorisation method for pressure vessels of special circumstances

(1) When the coordination point is placed on the categorisation line in Diagram 1 or Diagram 2, then categorisation should be determined in accordance with the higher categorisation.

(2) In the case of a medium which is not clearly indicated in Standards GB5044 or HG 20660, the chemical properties, hazard level and the quantity of the medium should be taken into comprehensive consideration and the category of the medium should be determined on the basis thereof by the design company of the pressure vessel.
Diagram A1 Categorisation diagram of pressure vessels – Category 1 media

[Diagram showing categorisation based on pressure and volume]

Diagram A2 Categorisation diagram of pressure vessels – Category 2 media

A2 Determination of pressure grades

The design pressure (p) of pressure vessels are divided into four pressure grades – low pressure, medium pressure, high pressure and ultra-high pressure:

1. Low pressure (code L) vessels $0.1 \text{MPa} < p < 1.6 \text{MPa}$;
2. Medium pressure (code M) vessels $1.6 \text{MPa} < p < 10.0 \text{MPa}$;
3. High pressure (code H) vessels $10 \text{MPa} < p < 100 \text{MPa}$;
4. Ultra-high pressure (code U) vessels $p \geq 100 \text{MPa}$;

A3 Variety determination of pressure vessels

In accordance with the functioning principles of the production and processing technology of the pressure vessels, the vessels can be divided into Reactor Pressure Vessels, Heat-exchanger Pressure Vessels, Separator Pressure Vessels, and Collector Pressure Vessels. They are divided as below:

1. Reactor Pressure Vessels (code: R): the type of pressure vessels mainly used to complete the physical and chemical reaction of the medium, such as reactors, reaction vessels, decomposing pots, sulfurising tanks, decomposing towers, polymerisers, high pressure autoclaves, ultra-high pressure autoclaves, synthetic towers, shift furnaces, steaming pots, spherical digesters, still kettles, gas generators, etc.
2. Heat-exchanger Pressure Vessels (code: E): the type of pressure vessels mainly used to complete the heat exchanging of medium, such as tubular waste heat boilers, heat exchangers, coolers, condensers, vaporizers, heaters, sterilizers, stainers, dryers, steamers/fryers, preheat pans, solvent pre-heaters, steamers, desolventiser toasters, electric steam generators, gas generator water jackets, etc.
3. Separator Pressure Vessels (code: S): the type of pressure vessels mainly used to complete the cushioning of the pressure balance in liquid media and to complete gas purification and separation, such as separators, filters, oil collectors, buffers, scrubbers, absorption towers,
copper washing towers, dry towers, stripping towers, gas-distributing cylinders, de-aerators etc.

(4) Collector Pressure Vessels (code: C, among which the code of the spherical tank is B): the type of pressure vessels mainly used to store, hold media such as gas, liquid, or liquefied gas, example different models of storage tanks.

For pressure vessels of the same type, if they have more than two function principles of process technology at the same time, then the variety of the pressure vessel should be determined by the main function of the processing technology.
Appendix B  

Product Nameplate of Pressure Vessel

(1) Product Nameplate of Pressure Vessel

<table>
<thead>
<tr>
<th>Supervision and Inspection mark</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Vessel Category</th>
<th>Manufacturing Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product No.</td>
<td>Vessel Category</td>
<td>Manufacturing Grade</td>
</tr>
<tr>
<td>Design Pressure</td>
<td>Mpa</td>
<td>Maximum Allowable</td>
</tr>
<tr>
<td>Design Temperature</td>
<td>℃</td>
<td>Working Pressure</td>
</tr>
<tr>
<td>Volume</td>
<td>m³</td>
<td>Working Medium</td>
</tr>
<tr>
<td>Design Life</td>
<td>Year</td>
<td>Product Standard</td>
</tr>
<tr>
<td>Manufacturing Date</td>
<td>Year Month</td>
<td>Manufacturing Licence No.</td>
</tr>
<tr>
<td>Manufacturer</td>
<td></td>
<td></td>
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<tr>
<td>Equipment Code</td>
<td></td>
<td>Registration No.</td>
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The redlining copy of the nameplate should be kept with the Product Quality Certificate of the pressure vessel.
### (2) Product Nameplate of Heat Exchanger

<table>
<thead>
<tr>
<th>Field</th>
<th>Information</th>
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</thead>
<tbody>
<tr>
<td>Product Name</td>
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</tr>
<tr>
<td>Product No.</td>
<td></td>
</tr>
<tr>
<td>Vessel Category</td>
<td></td>
</tr>
<tr>
<td>Manufacturer Grade</td>
<td></td>
</tr>
<tr>
<td>Vessel Net Weight (kg)</td>
<td></td>
</tr>
<tr>
<td>Heat-exchange Area (m²)</td>
<td></td>
</tr>
<tr>
<td>Tube Pass (Jacket) Design</td>
<td></td>
</tr>
<tr>
<td>Pressure of pressure - Sight Test</td>
<td></td>
</tr>
<tr>
<td>Maximum allowable working pressure</td>
<td></td>
</tr>
<tr>
<td>Design Temperature (°C)</td>
<td></td>
</tr>
<tr>
<td>Working Medium</td>
<td></td>
</tr>
<tr>
<td>Shell Pass (Shell)</td>
<td></td>
</tr>
<tr>
<td>Manufacturing Date (Year, Month)</td>
<td></td>
</tr>
<tr>
<td>Manufacturer</td>
<td></td>
</tr>
<tr>
<td>Equipment Code</td>
<td></td>
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<tr>
<td>Registration No.</td>
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</table>

The rubbing edition of the nameplate should be kept with the Product Quality Certificate of the pressure vessel.
Appendix C

**Product Qualification Certificate of Pressure Vessels**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing Licence No</td>
<td></td>
</tr>
<tr>
<td>Product Name</td>
<td>Product No</td>
</tr>
<tr>
<td>Equipment Code</td>
<td>Product Drawing No</td>
</tr>
<tr>
<td>Category of Pressure Vessel</td>
<td>Manufacturing Grade</td>
</tr>
<tr>
<td>Design Unit</td>
<td></td>
</tr>
<tr>
<td>Design Licence No</td>
<td></td>
</tr>
<tr>
<td>Manufacturing Date</td>
<td>Year             Month Date</td>
</tr>
</tbody>
</table>

The quality of this product is verified during the manufacturing process and it has met the requirements set out in the Technical Supervision Regulation for Safety of Stationary Pressure Vessels, relevant Standards, Design Drawings and the requirements specified in the Contract for Goods.

<table>
<thead>
<tr>
<th>Signature and Stamp of Quality Assurance Engineer</th>
<th>Special seal for quality inspection of product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day       Year       Month</td>
<td>Day       Year       Month</td>
</tr>
</tbody>
</table>

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## Product data sheet of pressure vessels

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Product No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Life</td>
<td>Year</td>
</tr>
</tbody>
</table>

### Vessel Inner Diameter
- **Standard** mm
- **Tube Material**
- **Head Material**

### Lining Material
- **Jacket Material**
- **Tube Thickness** mm

### Head Thickness
- **Lining Wall Thickness** mm
- **Jacket Thickness** mm

### Vessel Volume
- **Vessel Height (Length)** mm
- **Shell Weight** kg

### Inner-parts Weight
- **Filling Weight** kg
- **Heat Preservation/Insulation** (Yes/No)

### Design Pressure of Shell Pass
- **Design Temperature of Shell Pass** °C
- **Maximum Allowable Working Pressure of Shell Pass** MPa

### Design Pressure of Tube Pass
- **Design Temperature of Tube Pass** °C
- **Maximum Allowable Working Pressure of Tube Pass** MPa

### Design Pressure of Jacket
- **Design Temperature of Jacket** °C
- **Maximum Allowable Working Pressure of Jacket** MPa

### Medium of Shell Pass
- **Medium of Tube Pass**
- **Medium of Jacket**

### Structure Type
- **Nondestructive Testing Ratio** %

### Installation Type
- **Support Type**

### Heat Treatment
- **Temperature of Heat Treatment** °C

### Pressure-tight Test
- **Pressure of Pressure-tight Test** MPa

### Seal Test

### Safety Accessories and relative devices

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Specification</th>
<th>Quantity</th>
<th>Manufacturer</th>
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<tr>
<td></td>
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</table>
Appendix D Code numbering methods of special equipment

D1 Basic numbering method

The equipment code is the code name of the equipment, which must be unique, and consists of the basic code of the equipment, the code of the manufacturer, the manufacturing year, and the manufacturing sequence number.

<table>
<thead>
<tr>
<th>Equipment Basic Code</th>
<th>Manufacturer Code Name</th>
<th>Manufacturing Year</th>
<th>Manufacturing Sequence Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>x x x x</td>
<td>x x x</td>
<td>x x</td>
<td>x x x</td>
</tr>
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</table>

D2 Meaning of the code

D2.1 The basic code of the equipment

Compiled according to the equipment code (4 Arabic numerals) of the variety type listed in the Special Equipment Catalogue. For example, for High Pressure Vessels it should be “2120”.

D2.2 Manufacturer Code name

The code name of the manufacturer should be formed by the code of the administrative region (2 Arabic numerals) where the Approval Authority of Production Licence is located and the Manufacturer Sequence Number (3 Arabic numerals) which is included in the Manufacturing Licence Number of the manufacturer. For example, for a manufacturer of pressure vessels that is situated in Heilongjiang Province, after being examined and approved by AQSIQ, the code of its Manufacturing Licence Number is “TS2210890 – 2008”, of which the number 10 is used to indicate the code of the administrative region for AQSIQ, the sequence number of the licence is 890, and the code of the manufacturer should be “10890”; if it is examined and approved by the Quality & Technology Supervision Bureau of Heilongjiang Province, then its Production Licence Number code should be “TS2223010 – 2008”, of which the number 23 is used to indicate the code of the administrative region for Heilongjiang Province, the sequence number of the licence is 10, and the code of the manufacturer should be “23010”.

D2.3 Manufacturing year

The manufacturing year of the product manufactured (4 Arabic numerals). For example, for products manufactured in 2008, the manufacturing year should be “2008”.

D2.4 Manufacturing sequence number

The product sequence number made by the manufacturer itself (4 Arabic numerals). For example, for any variety type of pressure vessels which are manufactured in 2008, if the manufacturing sequence number for this product is 89, then it should be numbered as “0089”.

If the manufacturing sequence number exceeds 9999, then it can be replaced by phonetic alphabet.
For example, if the manufacturing sequence number for a certain variety pressure vessel product is 10000 or 11000, then the manufacturing sequence number should be A000 or B000. The rest may be inferred.