

Outline
for Safety Performance Supervisory Inspection
of Boiler and Pressure Vessel Products

Appendix 1
Supervisory Inspection Rule for Safety Performance of
Boiler and Pressure Vessel Products

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A. BOILER

I. Applicable scope

This outline is the general requirements for supervisory inspection of the safety performance of stationary pressure-containing boilers with water medium and organic fluid Heaters and their parts. The supervisory agency may adjust the items and contents based on the actual situation.

II. Contents of supervisory inspection

1. Supervisory inspecting the items related to the safety performance of the product during boiler manufacturing.
2. Supervisory examining the implementation of the quality system of the supervised manufacturer

III. Items and methods of supervisory inspection

1. Drawing and data review

- (1) Review the design data of the boiler products,
- (2) Examine the standards and technology for boiler manufacture and inspection;
- (3) Review the standards and technology for non-destructive examination (NDE);
- (4) Review the approval formalities of design change (including material substitution).

2. Manufacture quality of drum (shell), furnace, tube-plate, reverse combustion chamber, vertical flue and lower support ring

- (1) Check material certificate and material re-test report
- (2) Check the selection and formalities of substitute materials
- (3) Check the transplantation of material identification
- (4) Appearance examination (including base metals and welds)
- (5) Examine weld position and stagger between the abutting welds
- (6) Check the identification steel stamp of welders and welding operators
- (7) Spot-check geometric dimension (including difference between the maximum and the minimum inner diameters of cylinder, angularity, straightness, misalignment and location of opening)
- (8) Measure wall thickness of cylinders and heads (tube plate) (if necessary)
- (9) Examine the number and manufacturing method of welding test plate
- (10) Check property test reports of welding product test plate and verify the test results
- (11) Check NDE report and spot-check the x-ray films. The number of the x-ray films being checked should not be less than 30 per cent of the total number of films (films at cross joint, T-joint and at doubtful position and welding repair should be included.
- (12) Check heat treatment records and report
- (13) Check hydrostatic (pressure) test (including testing pressure, temperatures of test medium and of environment, pressure raising rate, pressure dwelling time and validation of pressure gauge calibration)
- (14) Check the dimensions and appearance of openings for tube, the rectification of tube joints and machining quality.

3. Supervisory inspection of manufacturing quality for header

- (1) Check material certificate and material re-testing report
- (2) Check the selection of substitute materials and material substitution formalities
- (3) Examine the transfer of material identification
- (4) Examine surface quality (including weld)
- (5) Wall-thickness measurement (if necessary)
- (6) Check the identification steel stamp of welders
- (7) Check spectrum analysis report of alloy steel tube, weld and of components and parts
- (8) Verifying the number and manufacturing method of welding test plate
- (9) Check the mechanical property test report of the product welding test plate and verify the test result
- (10) Check NDE report and spot check x-ray films. The number of the x-ray films being checked should not be less than 30 per cent of the total number of films
- (11) Check heat treatment technology and report
- (12) Check hydrostatic (pressure) test (including testing pressure, temperatures of testing medium and of environment, pressure raising rate, dwelling time and the validation of calibration for pressure gauges)
- (13) Examine the opening dimension and surface quality of tube hole, rectification of tube-joints and machining quality

4. Supervisory inspection of manufacturing quality for tubes

- (1) Check material certificate and material re-testing report
- (2) Check the selection of substitute materials and material substitution formalities
- (3) Check the transfer of material identification
- (4) Appearance examination (including weld)
- (5) Spot-check geometry (including bending quality of tubes and difference between the maximum and the minimum inner diameters)
- (6) Review the spectrum analysis report for alloy steel tube, welds, components and parts
- (7) Verifying the number and manufacturing method tube test samples made by either cutting from tubes or attaching with tubes
- (8) Check the mechanical property test report of the product welding test plate and verify the test result
- (9) Check NDE report and spot check x-ray films. The number of the x-ray films being checked should not be less than 30 per cent of the total number of films
- (10) Conduct sounding of tube by balls
- (11) Check hydrostatic (pressure) test (including testing pressure, temperatures of test medium and of environment, pressure raising rate, dwelling time and validation of calibration for pressure gauges)

5. Safety appurtenance

The number, specifications, types and certificates of compliance of safety appurtenance should meet the relevant requirements.

6. Thermal adjusting test for safety performance of compact oil-fired or gas-fired boilers in manufacturer

- (1) Check if the types and specifications of safety valves, pressure gauges and water level indicators meet the requirements.
- (2) Check if the water level control devices are sensitive
- (3) Check if the over-pressure protection devices are sensitive
- (4) Check if the ignition program controllers and fire extinguish protection devices are sensitive
- (5) Check if the burner matches the boiler

7. Examination of delivery technical document of boilers

- (1) Check the delivery technical documents
- (2) Check the contents on nameplate and stamp the supervisory inspection symbol on it

8. Supervisory inspection data

Once the product has passed the supervisory inspection, the supervisory inspector should summarize the data and verifying papers in time according to the Supervisory Inspection Items for Safety Performance of Boiler Products and issue the Supervisory Inspection Certificate.

9. The supervisory inspector should check the following documents of the supervised companies

- (1) Quality manual
- (2) The list of appointment and dismissal of quality system personnel
- (3) The list of qualified welders and welding operators engaged in boiler welding (including qualified items, term of validity in their certificates and identification steel stamp)
- (4) The list of personnel engaged in NDE (including qualified items, level and term of validity in their certificates)
- (5) The list of inspectors engaged in boiler quality inspection
- (6) Boiler design data, technological document and inspection and testing report and record and a summarized table of welding procedure qualification
- (7) Supervised manufacturer production plan for boilers
- (8) Sub-contracts for boiler production

B. Pressure Vessel

I. Applicable scope

This outline is applied to the supervisory inspection on safety performance of pressure vessel except for gas cylinders.

II. Contents of supervisory inspection

1. Supervisory inspecting the items related to the safety performance of the product during pressure vessel manufacturing.
2. Supervisory examining the implementation of the quality system of the supervised manufacturer

III. Items and methods of supervisory inspection

1. Drawing and data

- (1) Examine the certification of pressure vessel designer, conform the effectiveness of its qualification
- (2) Review the effectiveness of standards on manufacture and inspection for pressure vessel
- (3) Review the approval formalities for design change (including material substitution).

2. Materials

- (1) Check material certificate and material re-test report
- (2) Check the transplantation of material identification
- (3) Check the selection and formalities of substitute materials for main pressure parts

3. Welding

- (1) Check the welding procedure qualification and their records, verify that the welding technology used in product production is in accordance with the relevant standards and codes.
- (2) Confirm the number and manufacturing method of the welding test plate.
- (3) Check the property test report of the product welding test plates and confirm the test results.
- (4) Check identification steel stamps of welders and welding operators.
- (5) Check formalities and procedures for welding repair.

4. Visual and dimensional examination

- (1) Examine the appearance of welded joints.
- (2) Check the mechanical damage on the surface of base metal
- (3) Check the difference between maximum and minimum diameters of shell. Check the straightness of the cylinder of vertical vessel with height more than 30 meters, Check the arrangement of welds and the deviation of figure in head and record their actual dimensions. Check the main dimensions of the forming petal for spherical vessels.

5. Non-destructive examination

- (1) Check x-ray film arrangement map and NDE report. Verify the proportion and position of NDE. For the spot-NDE pressure vessel, check the extension RT for the repaired welds. As for the UT or surface flaw detection, the supervisory inspector should conduct random on-site supervisory inspection in addition checking the report.
- (2) Check the x-ray films. The number of the x-ray films being checked should not be less than 30 per cent of the whole and should not less than 10 films (including the x-ray films at T-joint, doubtful area and at the repaired area).

6. Heat treatment

Check and confirm the correspondence between heat treatment curve and actual heat treatment parameter and procedure.

7. Pressure test

Before pressure test, confirm that all required items have passed the supervisory inspection and the supervised manufacturer has kept the testimony of the whole-completed work. During pressure test, the supervisory inspector shall check the test equipment, instruments, preparation work for testing and verify the test results on the site.

8. Safety appurtenance

The number, specifications, types and certificates of compliance of safety appurtenances should meet the requirements.

9. Leak test

Check the leak test result to assure that it meets to the requirement of concerned code, standards, and design drawing.

10. Delivery technical data

- (1) Check the technical data to be delivered
- (2) Check the nameplate if the contents on it are in accordance with the relevant requirements and the supervisory inspection stamp has imposed.

11. Supervisory inspection data

Once the product has passed the supervisory inspection, the supervisory inspector should summarize and verify the testifying paper in time according to the Supervisory Inspection Items for Safety Performance of Pressure Vessel Products and issue the Supervisory Inspection Certificate.

C. Gas cylinder

I. Applicable Scope

This outline is applicable to the supervisory inspection for safety performance of gas cylinders.

II. Supervisory inspection content

1. Supervisory inspecting the items related to the safety performance of the product during gas cylinder manufacturing.
2. Supervisory examining the implementation of the quality system of the supervised manufacturer.

III. Items and methods of supervisory inspection

1. Check if the enterprise standard (i.e. the standards formulated by manufacture itself) has established and being approved by safety supervision department of AQSIQ. Confirm that the design documents of gas cylinders have been checked and approved by inspection agency in accordance with the relevant requirements. The general drawings of gas cylinders should bear the symbol of being checked and approved. Check the type approval testing results of the gas cylinders.
2. Check and confirm the material certificates of the proper of gas cylinders. Confirm that all kinds of data meet the requirements of corresponding codes and standards and design documents.
3. Check the materials of the gas cylinder proper; verify the chemical composition per heat and the re-testing results. The supervisory inspection agency may conduct the re-testing if necessary. Confirming the re-test results for macrostructure of material if the gas cylinders are made of billet. Verifying the situation and results of NDE per each tube if the gas cylinders are made of seamless steel tubes.
4. Check the identification of the acceptable material before and the transportation identification of the after cutting.
5. Check the welding procedure qualification and its record, Confirm the welding procedures used in gas cylinder production are conform to the relevant standards and codes. Check the proof test reports for heat treatment parameter and procedure of seamless gas cylinders.
6. On-site witness the hydrostatic pressure tests of each gas cylinder and confirm the test pressure, dwelling time, test results and the cylinder's serial numbers stamped on each gas cylinders whether have been recorded.
7. The supervisory inspector shall select and mark the sampling gas cylinders with small or medium volume and record the serial numbers of them. The inspection results of the appearance and other items, that require to be inspected one by one according to the product standards, should accord with the requirements as specified in the relevant codes and standards.
8. Check if the material of product welding test plate for big gas cylinders (>150 liters) are in conformity with the material of the gas cylinder proper. Before product welding test plate is cut off from longitudinal weld, the supervisory inspector should stamp the Supervisory Inspection Symbol on it for verification and confirm whether the manufacturing number and identification number of the welder is in existence.
9. The supervisory inspector should choose and mark one sample cylinder per batch of acetylene gas cylinders, and records its manufacturing number. When the sample cylinder is sectioned, the inspector should check the gap between packing and wall of the cylinder, packing appearance, surface holes and the preparation of packing sample on the spot. During the test of compressive strength, bulk density and porosity etc. of the sample packing, the supervisory inspector should conduct on-site spot check and verify the test records.
10. On-site check if the process and test results of mechanical property testing conform to the relevant requirements.
11. The supervisory inspector shall sample the gas cylinders for performing flattening test according to the rules, check the preparation work before the test and witness the test on the site. Check the span between plungers, flattened value and whether there is crack in the flattened place under loading.
12. Check the section, preparation of cold bending test specimens for seamless gas cylinders and the cold bending test method and test results of them.
13. Check the metallographic report. Check metallographic photo if necessary. As for gas cylinders under heat re-treatment, check the test specimen and metallographic photo of the sample cylinder. Check the section and preparation of the dissection specimen from the bottom of gas cylinder, examine its macroscopic analysis result and measuring the shape and size of the bottom structure of gas cylinder.

14. The supervisor should sample one test cylinder from every batch of products, witness the hydraulic burst test on the site. Check test equipment, instruments and safe protection measures before the test. Validate the test records and results.
15. Check the appearance, stamp mark, color and mark of the gas cylinder. The color should be in conformity with standard color card.
16. Check the batch inspection report of delivery gas cylinders. Each gas cylinder should attach with certificate of compliance with the stamp of supervisory inspector. The supervisory inspector should put supervisory inspection stamp on each gas cylinder.
17. The supervisory inspector should review the following documents of the supervised
 - (1) Quality manual
 - (2) The list of appointment and dismissal of quality system personnel
 - (3) The list of personnel engaged in NDE (including items in certificate, level and term of validity, etc.)
 - (4) The list of personnel engaged in gas cylinder quality inspection
 - (5) Manufacturing technological documents and inspection data as well as the list of welding procedure qualification.
 - (6) Enterprise standards, design documents and fatigue test verification report for gas cylinder.

IV. Quantity of gas cylinders to be supervisory inspected

1. Each batch gas cylinders must complete all supervisory inspection items listed in Supervisory Inspection Items Form.
2. If the unacceptable items found during supervisory inspection, the items should be re-inspected and re-tested with additional quantity, which should be in accordance with the requirement of relevant standards or decided by supervisory inspection agency when the requiring quantity for re-inspection and re-testing is unavailable in the standards. The supervisory inspection agency can add additional supervisory inspection items to the Supervisory Inspection Item Form when necessary.

D. Non-metallic pressure vessels

I. Applicable scope

This outline is applied to the supervisory inspection of the safety performance of glass-fiber-reinforced plastic vessels and graphite vessels.

II. Supervisory inspection content

1. Supervisory inspection of the items related to the safety performance of non-metallic vessels during their manufacture.
2. Supervise and examine the implementation of quality system of the supervised manufacturer.

III. Items and methods of supervisory inspection

1. Drawing and Data

- (1) Check the certified stamp of pressure vessel design to confirm the validity of its qualification.
- (2) Check the validity of applied manufacturing and inspection standards.
- (3) Check the formalities of design change.

2. Materials

- (1) Check material certificate of main body.
- (2) Check the transplantation of material identification.
- (3) Check the material substitution formalities.

3. Technology qualification

- (1) Check the technology qualification of glass-fiber reinforced plastic vessel product
- (2) Check the assessment for graphic vessel products per certified material standard (CMS) and certified cohesive standard (CCS).
Assessment:
For dipped non-penetrating graphite product, check the infusing procedure qualification and cohesive procedure qualification.
- (3) Check the property test reports of product test plate and confirm the test result.
- (4) Check the certification of qualification of workers engaged in on-site manual paste operation of glass reinforced plastic and graphite cohesion

4. Appearance and geometry

- (1) Check the surface appearance of the joint especially the appearance of fillet joints.
- (2) Check the products' appearance.
- (3) Check the data of total weight, Babbit hardness, content of resin, moisture absorptivity of laminate materials etc.
- (4) Spot-check the grain composition test, bending strength, tensile strength, tensile strength of adhesive.

5. Pressure test

Before pressure test, confirm that all related items have passed the supervisory inspection and the supervised manufacturer has kept the evidence of the whole-completed work. During pressure test, the supervisory inspector shall check the test equipment, instruments, preparation work for testing and verify the test results.

6. Safety appurtenance

Check if the specifications and number of safety appurtenance accord with the relevant stipulations

7. Delivery technical data

Check if the contents of product's certificate of compliance and product quality certificate are correct and complete and if the final issuing and signing (stamping) formalities are complete and correct. Check if the as-built drawing can reflect the factual manufacture situation of the product.

8. Name-plate

Check the nameplate if the contents on it are in accordance with the relevant stipulation

E. Baric oxygen chamber for medical treatment

I. Applicable scope

This outline is applied for all kinds of baric oxygen chamber for medical treatment with working pressure equal to or less than 0.3 MPa.

II. Supervisory inspection contents

1. Supervisory inspection the items concerning products' safety performance during the process of manufacturing and installing baric oxygen chamber for medical treatment, i.e., including supervisory inspection during manufacturing and supervisory inspection during installation.
2. Supervisory examining the implementation of the quality system of the baric oxygen chamber manufacturer.

III. Items of supervision inspection

1. Design drawing and related data

- (1). Check if the design drawings of the chamber and of the main system of the product have reviewed and approved in accordance with the relevant stipulation and if the drawings has borne a design approval stamp so as to confirm the validity of their qualification.
- (2). Confirm the effectiveness of the standards for manufacture, installation and for inspection on design drawing.
- (3). Check the certificates of compliance, quality certificates, as-built drawing and supervisory inspection certificate of the auxiliary pressure vessel for the baric oxygen chamber.
- (4) Check if the contents of on-site commission report are complete and correct and if all the functions of the baric oxygen chamber meet the requirements of related standards and codes.
- (5) Check the on-site supervisory inspection record for installation, including system leak test record, purge records of supply and exhaust piping for both oxygen and gas, degrease record of supply and exhaust piping for oxygen, and welding and NDE record.
- (6) Check the qualification of the personnel engaged in manufacture (installation) and inspection of the baric oxygen chamber, including welders and welding operators, non-destructive examiners and electricians.
- (7) Verify whether the volume of the chamber per person meets the requirements in relevant standards.

2. Materials

- (1) Check the material certificate of the chamber proper and main pressure parts (including plate, pipe for supply gas and for supply and exhaust oxygen).
- (2) Check material certificate of observation windows, illumination window and the organic glass for illumination windows. The material must free of obvious scuffing and mechanical damage or aging silvery vestiges.
- (3) Check if the decoration materials in the chamber meet the related requirements of GB12130 or related standards for the baric oxygen chamber.
- (4) Check the certificates of compliance of valves, sealing components and cables.
- (5) Check the material substitution formalities for main pressure parts and components and for organic glass.

3. Manufacture, inspection and testing

- (1) Check the applied welding procedure qualification of the baric oxygen chamber.
- (2) Spot-check the identification steel stamp and the qualification of the welder and welding operator performing the welding of the chamber.
- (3) Check the surface quality of welded joint, Especially attention to the appearance of fillet joint between observation window and chamber, supply passage and chamber, and the chamber door and head.
- (4) Check the x-ray film map and the flaw detection report. Verify the NDE detection rate, x-ray position and assessment result of flaw detection.

4. Equipment in the chamber

- (1) Check if the supply passage, chamber door in the chamber, which has quick-actuating door structures opening outwards, has installed with safety interlock devices.
- (2) Check if the manual operational device in quick-actuating door structures opening outwards, which has equipped with the electric or pneumatic gearing device, can open the door within the specified time.
- (3) Check the connections of electrical cables and if they are easy to examine and repair when the electrical appliances are fitted in the chamber.
- (4) Check if the oxygen-collecting opening for oxygen gauge is placed in the middle of the chamber and its outlet is out of the ornamental plate.
- (5) Check the mark, reliability and sensitivity of emergency exhaust device.
- (6) Check if there is a ground wire for eliminating electricity in the baric chamber.

5. Electric appliances and communications

- (1) Confirm that the chamber adopts both cold light source and external illumination, and is equipped with emergency illumination system, which can work automatically as soon as the power source of chamber was broken.
- (2) The intercom device between control desk of oxygen chamber and the chamber room should be sensitive and with clear voices.
- (3) Check the resistance and connections of grounding device of the chamber proper and the cases of other device.
- (4) Check if the electric motor and controller for air-conditioning device are fixed outside of the chamber.
- (5) Check the leakage electric current to the earth.
- (6) Check the certificates of compliance or quality documents of attached electric appliances

6. Supply and exhaust systems for gas and oxygen

- (1) Check the function of sound alarm and light warning device of the oxygen gauge. Check if the oxygen electrode is valid when the oxygen gauge is based on the principle of galvano-chemistry.
- (2) Check the material for the oxygen exhaust piping in the chamber and the link between oxygen exhaust piping and the chamber.
- (3) Check the leakage rate of the chamber during the leak test.
- (4) Check the control valves at the high pressure side of the oxygen manifold, check the anti-malfunction device and warning sign at the connection between manifold and oxygen gas cylinder.
- (5) Check the outfits of gas storage tanks, air purifier and oil and water separators.
- (6) Check the certificates of compliance or quality documents of flow meters, thermometers pressure gages and other instruments.

7. Heat treatment

Check the area or parts of the baric oxygen chamber, which require heat treatment. Confirm the heat treatment parameter and procedure and its actual report.

8. Safety appurtenances

- (1) Check the quantity, accuracy and scale of the pressure gauges in the oxygen chamber.
- (2) Check the type, quantities and set pressure of the safety valves on the chamber proper and on the auxiliary pressure vessels.

9. Check if the fire-fighting equipment in the chamber meets the requirements of GB12130.

10. Name-plate

Check if the contents and specifications on the nameplates of the baric oxygen chamber and its auxiliary pressure vessels meet the relevant requirements.

IV. Methods of supervisory inspection

1. Both manufacture and installation supervisory inspection for baric oxygen chamber for medical treatment should use the Supervisory Inspection Item Form. The items should be done during manufacture at the place where the oxygen chamber manufacturer located as far as possible.
2. Except the items listed in this outline to be supervised and inspected during both manufacture and installment, all the other items that have passed the supervisory inspection during manufacture should not undergo repeated supervisory inspection during installation.
3. The agency, which undertakes the manufacture supervisory inspection, should sign on the items that pass the supervisory inspection for confirmation and issue the Manufacture Supervisory Inspection Certificate. The agency, which undertakes the installation supervisory inspection of oxygen chamber, should sign on the items that have passed the supervisory inspection for confirmation and issue the Supervisory Inspection Certificate and stamp the Supervisory Inspection Mark on the name-plate of the oxygen chamber.
4. The supervisory inspector shall put „acceptable“ on the „Supervisory Inspection Result“ column for those items which are conform with relevant codes and standards and put the name and serial number of their testifying paper with his/her signature on the „Working Testimony“ column. The supervisory inspector should put the measuring data or existing problems on the „Supervisory Inspection Result“ column and describing the actual situation of non-conform with the relevant codes and standards in detail in addition to the handled measures of supervised manufacture on the „Note“ column, if the items are not conform to the relevant codes and standards.