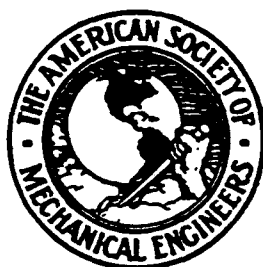


**SUGGESTED RULES FOR CARE
OF
POWER BOILERS
SECTION VII
A.S.M.E. BOILER CONSTRUCTION CODE**



**REPORT OF SUBCOMMITTEE OF BOILER CODE COMMITTEE
ON CARE OF STEAM BOILERS AND OTHER PRESSURE
VESSELS IN SERVICE**

**THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
29 WEST THIRTY-NINTH STREET, NEW YORK**

1935

Boiler Code Committee

D. S. JACOBUS, <i>Chairman</i>	W. G. HUMPTON
E. R. FISH, <i>Vice-Chairman</i>	J. O. LEECH
C. A. ADAMS	I. E. MOULTROP
H. E. ALDRICH	C. O. MYERS
H. C. BOARDMAN	H. B. OATLEY
W. H. BOEHM	JAMES PARTINGTON
R. E. CECIL	WALTER SAMANS
F. S. CLARK	S. K. VARNES
A. J. ELY	A. C. WEIGEL
V. M. FROST	H. LER. WHITNEY
C. E. GORTON	C. W. OBERT, <i>Honorary Secretary</i>
A. M. GREENE, JR.	M. JURIST, <i>Acting Secretary</i>

HONORARY MEMBERS

F. W. DEAN	W. F. KIESEL
W. F. DURAND	M. F. MOORE
T. E. DURBAN	H. H. VAUGHAN
C. L. HUSTON	

Conference Committee

STATES

Arkansas	J. D. NEWCOMB
California	F. A. PAGE
Delaware	T. R. ARCHER
District of Columbia	H. K. KUGEL
Hawaiian Islands	WM. E. SMITH
Indiana	JAMES DONOHUE
Maine	E. K. SAWYER
Maryland	L. M. CAVE
Massachusetts	G. A. LUCK
Michigan	DANIEL O'CONNOR
Minnesota	GEORGE WILCOX
Missouri	
New Jersey	J. F. SCOTT
New York	W. H. FURMAN
North Carolina	W. E. SHUPING, JR.
Ohio	C. O. MYERS
Oklahoma	W. L. NEWTON
Oregon	C. H. GRAM
Pennsylvania	B. M. BOOK
Rhode Island	A. J. BEAUREGARD
Utah	C. I. SMITH
Washington	B. GRETZKE
Wisconsin	M. A. EDGAR

CITIES

Chicago, Ill.	GERALD GEARON
Detroit, Mich.	H. H. MILLS
Erie, Pa.	J. M. LYNCH
Evanston, Ill.	E. M. GOODMAN
Houston, Texas	F. D. GARVIN
Kansas City, Mo.	J. J. RYAN
Los Angeles, Cal.	C. E. MCGINNIS
Memphis, Tenn.	F. A. HECKINGER
Nashville, Tenn.	L. C. PEAL
Omaha, Neb.	C. W. FOSTER
Parkersburg, W. Va.	
Philadelphia, Pa.	WM. BETZ, JR.
St. Joseph, Mo.	J. G. BOLLOCK
St. Louis, Mo.	J. C. BRYAN
Scranton, Pa.	A. C. MITCHELL
Seattle, Wash.	L. M. BARRINGER
Tampa, Fla.	A. H. SCHLEMAN
Tulsa, Okla.	T. C. CANNON

Subcommittee on Boilers of Locomotives

JAMES PARTINGTON, *Chairman*
F. H. CLARK

J. M. HALL
H. B. OATLEY

Subcommittee on Care of Steam Boilers and Other Pressure Vessels in Service

F. M. GIBSON, *Chairman*
V. M. FROST
J. R. GILL
J. A. HUNTER
H. J. KERR

S. T. POWELL
C. W. RICE
H. F. SCOTT
N. STAHL
F. G. STRAUB

Subcommittee on Ferrous Materials

H. LER. WHITNEY, *Chairman*
A. J. ELY
H. J. FRENCH
H. W. GILLETTE
W. G. HUMPTON
J. J. KANTER

E. F. KENNEY
H. J. KERR
A. B. KINZEL
L. A. SHELDON
A. E. WHITE
E. C. WRIGHT

Subcommittee on Heating Boilers

C. E. GORTON, *Acting Chairman*
W. H. BOEHM
C. E. BRONSON
J. A. DARTS

F. W. HERENDEN
W. E. STARK
J. W. TURNER

Subcommittee on Material Specifications

*A.S.M.E.
Conferring
Committee*
P. R. CASSIDY,
Chairman
A. M. GREENE, JR.
J. O. LEECH
P. J. SMITH

*A.S.T.M.
Conferring
Committee*
C. L. WARWICK,
Chairman
E. J. EDWARDS
C. F. W. RYS

*A.A.S.M.
Technical Committees
Conferring Committee*
J. O. LEECH,
Chairman
E. F. KENNEY
A. D. PEACE

Subcommittee on Miniature Boilers

C. E. GORTON, *Chairman*
JAMES PARTINGTON,
Vice-Chairman
E. R. FISH

W. H. FURMAN
G. A. LUCK
C. O. MYERS
C. W. OBERT

Subcommittee on Nonferrous Materials

H. B. OATLEY, *Chairman*
J. J. AULL
D. K. CRAMPTON
A. M. HOUSER

F. P. HUSTON
H. C. JENNISON
E. F. MILLER
JOSEPH PRICE

Subcommittee on Rules for Inspection

J. A. COLLINS, *Chairman*
S. H. BARNUM
L. E. CONNELLY
WILLIAM FERGUSON

C. E. GORTON
F. W. HERENDEN
JAMES PARTINGTON

Subcommittee on Special Design

D. B. WESSTROM, *Chairman*
W. L. BOWLER
R. E. CECIL
H. E. ROCKEFELLER

D. B. ROSSHEIM
W. H. ROWAND
E. O. WATERS
F. S. G. WILLIAMS

Subcommittee on Unfired Pressure Vessels

E. R. FISH, *Chairman*
C. A. ADAMS
W. H. BOEHM
C. E. BRONSON
R. E. CECIL

PAUL DISERENS
A. W. LIMONT, JR.
H. S. SMITH
D. B. WESSTROM

Subcommittee on Welding

*A.S.M.E. Boiler Code
Committee*
JAMES PARTINGTON, *Chairman*
C. A. ADAMS
A. M. CANDY
R. E. CECIL
J. H. DEPPELER
E. R. FISH
R. K. HOPKINS
T. McL. JASPER
L. A. SHELDON

*Conference Committee of
American Welding Society*
C. W. OBERT, *Chairman*
J. J. CROWE
E. H. EWERTZ
F. C. FYKE
J. W. OWENS
A. KIDD
H. E. ROCKEFELLER
L. H. ROLLER

Rules for Inspection

General

C-92 All power boilers should be given one internal inspection and at least one, but preferably two external inspections per year by the state or municipal inspectors having jurisdiction, or by the inspectors of the insurance company carrying the risk. These inspectors are hereinafter termed "authorized inspectors."

C-93 Similar inspections should be made by the person responsible for the boiler plant as a whole or his duly authorized representative who is hereinafter termed the "plant inspector." Such inspections shall be supplementary to and in no wise considered as supplanting or superseding the inspections made by authorized inspectors. Such inspections shall be made in accordance with the following rules:

C-94 A record of each inspection shall be kept in a uniform manner so that any change of condition can be definitely compared, especially with reference to thickness of scale, corrosion, erosion, cracks, and other unusual conditions.

C-95 Between periodical inspections by authorized inspectors, the plant inspector shall closely observe the operation and condition of the boilers and shall report immediately to the proper authorities any serious defects, doubtful conditions, or unusual occurrences.

C-96 An external inspection by the authorized inspector shall comprehend the superficial examination of the boiler, its appurtenances and connections, and does not necessarily require that the boiler be off the line. It is a form of examination made primarily to check up the care and management.

C-97 The internal inspection of the boiler shall include the examination of the previous boiler repair and inspector records and a comprehensive and thorough examination in every detail of the boiler itself, embracing particularly the

determination of the suitability of the boiler for the pressure carried, strength of its parts, possible deterioration in service, and advisability of its continuance under the pressure approved previous to inspection.

Preliminary

C-98 No particular preparations shall be necessary for an external inspection other than giving the plant inspector convenient access to the boiler and its connections.

C-99 The internal inspection shall call for somewhat extensive preparation, mainly the proper cooling and opening up of the boiler together with a thorough cleaning of the boiler and setting.

C-100 The walls, baffles, tubes, and shell shall be thoroughly swept down and the ash and soot removed to give the plant inspector opportunity to closely examine all the parts.

C-101 Where steam soot blowers are used, they shall be used before the tubes become sufficiently cooled as to cause condensation which will tend to make the soot cling to the tubes.

C-102 When boiler and setting are sufficiently cooled, the blow-off valve shall be opened and the water removed. Then the manhole and handhole covers shall be removed to allow circulation of air through the boiler.

C-103 The inside of shell, drums, and tubes shall then be washed down thoroughly to remove mud, loose scale, or similar deposits. The washing operation shall be conducted from above as far as possible to carry the material downward to blow-off or lower handholes.

C-104 Use hose with sufficient water pressure or hand tools, if necessary, to remove scale. Disconnect the blow-off line and run the water to waste, or, when practicable, provide a screen which can be inserted in the openings to the blow-off connection. Wash the tubes of horizontal-return tubular boilers from below as well as from above.

See that the water does not come in contact with the brickwork of the combustion chamber, or if this cannot be avoided, see that the brickwork is dried out carefully when firing up.

C-105 Before entering the drums or shell of a boiler, see that the blow-off valves, the main stop valve, the feedwater valves, and other valves are closed. Use some reliable method of safeguarding any one entering the shell or drum.

It is recommended that when the blow-off valves of a boiler being cleaned are connected into a common header, the blow-off valves of all other boilers be properly safeguarded against opening into the boiler being cleaned.

When electric extension cords are used for entering a boiler, the cord should not only be well insulated but designed to withstand mechanical injury and maintained in good condition. The lamps should be provided with suitable guards.

C-106 The plant inspector shall have available the data on the boiler, dimensions, age, particulars as to previous defects noted, if any, and shall watch for any indication of decrease in the pressure-carrying capacity of the boiler and report any such findings to his immediate superiors.

External Inspection

C-107 The plant inspector shall examine the boiler for level, noting whether or not there has been any tendency to settlement, especially the transverse level of the top tubes in horizontal-return tubular boilers. He shall see that proper provision is made for expansion and contraction of the boiler and the setting.

C-108 Examination shall then be made of the feed and blow-off connections to see that they are clear and in good working condition.

C-109 Examination shall be made for evidences of corrosion on the exterior of shell from rain coming down the stack, or from leaking roofs, valves, or pipes.

C-110 Inspection shall be made to see if there is any leakage of flame on dry sheets, particularly at the back arch of return-tubular boilers, which should be entirely clear of the rear tube sheet with sheet metal or asbestos rope covering the gap. Tie rods and buck stays shall be examined for condition and possible shifting from place.

C-111 The plant inspector shall note the proximity of overhead shafts or any machinery which might drop on or strike the boiler in case of accident.

C-112 The plant inspector shall note the presence of lumber or other material piled on boiler or setting for purposes of drying or storage and which may endanger the setting or the safety and accessibility of the apparatus. The practice of drying or storing materials on top of boiler settings should not be allowed.

C-113 A careful examination shall be made of the safety valve, its connection to the boiler, its escape pipe, its drain and supports. All openings should be free and clear.

Test the valves in accordance with the instructions given for the particular plant. Test the safety valves by gently raising the valve off the seat by hand, or, when practicable, test the valves daily by raising the steam pressure to the popping pressure of the safety valve. Small chains or wires attached to the levers of pop safety valves and extended over pulleys to other parts of the boiler room may be used. If the valve sticks, do not try to release it by hammering; drop the pressure in the boiler and clean the valve seat or correct any other defect that may be found. When an additional safety valve is installed on a boiler in excess of the capacity required by Section I of the Code and the capacity of that valve is equal to the capacity of the faulty safety valve, the boiler may remain in operation until it can be conveniently taken out of service.

C-114 The water glass, gage cocks, water-column connections, and blow-offs shall be tested to see if the connections are free. Boiler pressure gages and master gages shall be checked with other reliable gages in the same system. It should also be done after replacing water glasses and more frequently when trouble is experienced with boiler compounds, foaming, priming and other feedwater troubles that are apt to cause choking of the connections.

Internal Inspection

C-115 The plant inspector shall enter the drums of the boiler to make personal examination of conditions, but before entering he shall first make sure that they have been properly ventilated and that there is no inflammable gas present.

C-116 Before entering the shell or drum the plant inspector shall see that the blow-off and surface blow-off valve,

the main and auxiliary steam valves, feedwater valves, and all other valves on connecting pipes are closed, and a reliable method of safeguarding these valves while anyone is inside the boiler shall be used.

C-117 Careful examination of the interior of the boiler shall be made for cracks, broken stays, pitting, corrosion, erosion, scale, and thin places in the shell. The upper half of drums in the steam space shall be examined particularly for signs of grease and oil.

C-118 The interior of the tubes should be examined for scale and deposits and the space between the tubes in the case of a return-tubular boiler rendered visible by lowering a candle or small light between them for the purpose of making sure that there is no restriction of the circulation.

C-119 The condition of the feed pipe and of the trough under it, if used, shall be noted. Dry pipes shall be examined to see that their openings and perforations are free from deposits. All interior fittings shall be examined for loose connections.

C-120 The interior face of the riveted joints shall be examined for condition of riveting, thinness of metal, corrosion, cracks, etc. The plant inspector shall note any wasting away and cracking of stays and braces. Particular examination shall be made of any welded stays or braces.

C-121 If fusible plugs are used, see that they are kept in good condition and that they are not used for more than one year as provided for in Par. A-19 of the Appendix to the Code. When the boiler is open, scrape clean and bright the exposed surfaces of the fusible metal as well as the surface of the boiler near the plugs. If the fusible metal does not appear sound, renew the plug. Never refill a plug with anything but new metal of a quality specified in Par. A-19 of the Appendix to the Code.

Furnace and Parts Exposed to Fire

C-122 The plant inspector shall go into the furnace for the examination of the exterior of the tubes, shell, brickwork, and baffles.

C-123 Where soot blowers are used the inspector should examine them and also examine the boiler tubes for injury due to discharge from the blower nozzles.

C-124 The plant inspector shall examine the setting for cracks, settlement, and loose brick which may lean against the boiler. Where brickwork is used as insulation of steel supporting members, it shall be examined to see that it is in good condition and that the air space, if any, is maintained. The furnace lining shall be examined for spalling, cracking, and settlement. In vertical water-tube boilers, the bridge walls shall be inspected to see that the mud drum is properly protected. The plant inspector shall examine baffle and check walls particularly for holes which may permit flaming through.

C-125 The blow-off connection should be examined carefully for corrosion and weakness where it connects with the boiler. The protective cover of brick or tile should be intact and not interfere in any way with the expansion of the boiler or pipe.

C-126 Particular attention shall be given the tube ends and tube sheets in the case of horizontal-return tubular boilers. The plant inspector shall note any corrosion of the sheets, signs of leaking tubes, excessive thinning of the tubes from repeated rollings, and the condition of tube ends of circulating tubes and mud-drum nipples of water-tube boilers.

C-127 The plant inspector shall note any tendency to corrosion from leakage of manhole and handholes under tubes in tube sheets of return-tubular boilers.

Appurtenances

C-128 An examination of the condition of the main header and its connections to the boiler shall be made to ascertain that it is properly supported, that due allowance is made for expansion and contraction without throwing strains on the boiler, and that the non-return stop valves are in good working condition and so placed that there is no pocket in the connection to hold water unless it be properly drained.

C-129 The plant inspector shall note the position of the steam gage and gage cocks and make sure the water pipe

connecting the water columns drains toward the boiler. Check the position of the water glass by leveling across the top row of tubes or from the position of the fusible plug.

C-130 Check the pipe line and all exterior supports to see that the proper tension and alignment are maintained. Where boiler foundations are independent of building foundations, joints on the steam and feed connections shall be disconnected once a year, or other reliable means shall be employed to check possible settling.

Care and Management

C-131 The plant inspector shall note particularly any evidences of carelessness in the care and management of the boiler and its appurtenances.

C-132 The plant inspector shall recommend immediate remedy of any unsafe conditions or undesirable practices that may be discovered and shall report promptly and fully on the results of his inspection to his immediate superiors.

C-133 The plant inspector should be furnished a copy of all reports of inspections made by authorized inspectors and see that all recommendations in such reports are promptly and carefully carried to completion.

C-182 Do not use any combustibles for igniting a coal fire in such a manner as to cause excessive smoke or possible flare-back. Where pulverized coal, gas, or oil is used as fuel, make sure that the outlet damper is open to create light draft before introducing and igniting fuel.

C-183 When the economizer is by-passed, the inlet damper to the economizer shall be closed tightly.

Insulation

C-184 Wherever insulating materials are used they shall be inspected periodically and at times of internal inspections. They shall be maintained, as far as practicable, to the full value of their insulating properties and free from objectionable cracks or openings. Freedom of movement for expansion good condition. Feed-pump pressure regulators, when used, as possible.

FEEDWATER SUPPLY

Control of Water Supply

C-185 Feed pumps and injectors shall be maintained in good condition. Feed-pump pressure regulators, when used, shall be maintained in good condition and shall be frequently tested under throttled discharge.

C-186 Sufficient head and quantity of water shall be maintained in feedwater tanks to prevent loss of suction of the feed pumps, and where hot water is fed to or allowed to splash in feedwater tanks, sufficient head and quantity of water shall be maintained in the tank to prevent entrainment of vapors and possible vaporization at the pump suction.

C-187 All feedwater tanks shall be maintained free of oil and shall be cleaned as often as necessary to prevent an objectionable accumulation of sediment or other undesirable foreign matter.

C-188 Feedwater lines shall be kept free from objectionable vibration.

C-189 Leaks in the feedwater line shall be stopped as soon as possible.

C-190 Periodical inspections shall be made for possible scale and defective check valves in the feed line. For locating deposits or other obstructions in a feed pipe, it is recommended that a pressure gage be placed on the discharge cham-