

ECLA**EUROPEAN CLASSIFICATION****F22B**

METHODS OF STEAM GENERATION; STEAM BOILERS (steam engine plants where engine aspects predominate [F01K](#); domestic central-heating systems using steam [F24D](#); heat exchange or heat transfer in general [F28](#); generation of vapour in the cores of nuclear reactors [G21](#))

Note

This subclass covers only methods of, or apparatus for, the generation of steam under pressure for heating or power purposes

Guide heading:

General aspects of, or methods for, steam generation

F22B1/00

Methods of steam generation characterised by form of heating method (solar heating [F24J](#); jackets or other cooling means in which steam is generated and which serve for cooling other apparatus, see the subclasses for such apparatus)

F22B1/00B

- [N: using combustion of hydrogen with oxygen (power plants using steam created by combustion of hydrogen with oxygen [F01K25/00B](#))]

F22B1/00S

- [N: using solar heat (solar heat collectors per se [F24J2/00](#); devices for producing mechanical power from solar energy [F03G6/00](#))]

F22B1/02

- by exploitation of the heat content of hot heat carriers

F22B1/02B

- • [N: with heating tubes in which flows a non-specified heating fluid (for nuclear reactors [F22B1/02C](#), for hot gas [F22B1/18M](#))]

F22B1/02C

- • [N: with heating tubes, for nuclear reactors as far as they are not classified, according to a specified heating fluid, in another group]

F22B1/02C2

- • • [N: with vertical U shaped tubes carried on a horizontal tube sheet]

F22B1/02C3

- • • [N: with vertical tubes between to horizontal tube sheets]

F22B1/02E

- • [N: Steam generation using heat accumulators ([F22B27/14](#) takes precedence)]

F22B1/04

- • the heat carrier being hot slag, hot residues, or heated blocks, e.g. iron blocks

F22B1/06

- • the heat carrier being molten; Use of molten metal, e.g. zinc, as heat transfer medium

F22B1/06B

- • • [N: for metal cooled nuclear reactors (heat-exchangers having a liquid metal as heat exchange medium [F28D7/00C](#))]

F22B1/06B2

- • • • [N: with double-wall tubes having a third fluid between these walls, e.g. helium for leak detection (heat-exchangers with double-wall tubes [F28D7/10](#); double-wall pipes per se [F16L9/18](#))]

F22B1/08

- • the heat carrier being steam

F22B1/10

- • • released from heat accumulators

F22B1/12

- • • produced by an indirect cyclic process

F22B1/12B

- • • • [N: Steam generators downstream of a nuclear boiling water reactor]

F22B1/12C

- • • • [N: Steam generators of the Schmidt-Hartmann type]

F22B1/14

- • • coming in direct contact with water in bulk or in sprays

F22B1/14B

- • • • [N: in combination with a nuclear installation]

- F22B1/14C [N: Loffler boilers]
- F22B1/16 . . the heat carrier being hot liquid or hot vapour, e.g. waste liquid, waste vapour
- F22B1/16B . . . [N: in combination with a nuclear installation]
- F22B1/16C . . . [N: using heat pipes (heat pipes per se [F28D15/00B](#))]
- F22B1/16D . . . [N: using an organic fluid]
- F22B1/18 . . the heat carrier being a hot gas, e.g. waste gas such as exhaust gas of internal-combustion engines (use of waste heat of combustion engines, in general, [F02G](#))
- F22B1/18B . . . [N: using the exhaust gases of combustion engines]
- F22B1/18B2 [N: using the exhaust gases of gas-turbines]
- F22B1/18C . . . [N: for gas-cooled nuclear reactors]
- F22B1/18D . . . [N: in combination with metallurgical converter installations]
- F22B1/18G . . . [N: the hot gas being under a high pressure, e.g. in chemical installations]
- F22B1/18G2 [N: the hot gas being loaded with particles, e.g. waste heat boilers after a coal gasification plant]
- F22B1/18H . . . [N: coming in direct contact with water in bulk or in sprays]
- F22B1/18K . . . [N: Waste heat boilers with supplementary firing]
- F22B1/18L . . . [N: Hot gas water tube boilers not provided for in [F22B1/18B](#) - [F22B1/18K](#)]
- F22B1/18L2 [N: the hot gas being loaded with particles, e.g. dust (with the hot gas being under high pressure [F22B1/18G2](#))]
- F22B1/18M . . . [N: Hot gas heating tube boilers with one or more heating tubes]
- F22B1/18N . . . [N: Systems therefor not provided for in [F22B1/18B](#) to [F22B1/18K](#)]
- F22B1/20 . . using heat evolved in a solution absorbing steam; Soda steam boilers
- F22B1/22 . . using combustion under pressure substantially exceeding atmospheric pressure
- F22B1/24 . . Pressure-fired steam boilers, e.g. using turbo-air compressors actuated by hot gases from boiler furnace
- F22B1/26 . . Steam boilers of submerged-flame type, i.e. the flame being surrounded by, or impinging on, the water to be vaporised[N: e.g. water in sprays]
- F22B1/26B . . . [N: the water being in bulk]
- F22B1/28 . . in boilers heated electrically [N: (superheating using an electrical heat source independent from heat supply of the steam boiler [F22G1/16B](#))]
- F22B1/28B . . [N: other than by electrical resistances or electrodes]
- F22B1/28C . . [N: with water or steam circulating in tubes or ducts]
- F22B1/28D . . [N: with water in reservoirs]
- F22B1/28D2 . . . [N: the water being fed by a pump to the reservoirs] [N0004]
- F22B1/28E . . [N: with water in sprays or in films]
- F22B1/28F . . [N: Instantaneous electrical steam generators built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls]
- F22B1/30 . . Electrode boilers
- F22B1/30B . . . [N: with means for injecting or spraying water against electrodes or with means for water circulation]
- F22B1/30B2 [N: with at least one electrode permanently above the water surface]

F22B3/00 Other methods of steam generation; Steam boilers not provided for in other groups

of this subclass [C0901]

- F22B3/02 . involving the use of working media other than water
- F22B3/04 . by drop in pressure of high-pressure hot water within pressure- reducing chambers, e.g. in accumulators ([steam accumulators per se F01K1/00](#))
- F22B3/04B . . [N: the drop in pressure being achieved by compressors, e.g. with steam jet pumps]
- F22B3/06 . by transformation of mechanical, e.g. kinetic, energy into heat energy
- F22B3/08 . at critical or supercritical pressure values

Guide heading: Kinds of steam boilers**F22B5/00 Steam boilers of drum type, i.e. without internal furnace or fire tubes, the boiler body being contacted externally by flue gas**

- F22B5/00B . [N: with rotating drums] [N9910]
- F22B5/02 . with auxiliary water tubes outside the boiler body
- F22B5/04 . Component parts thereof; Accessories therefor ([covers or similar closure members F16J13/00](#))

F22B7/00 Steam boilers of furnace-tube type, i.e. the combustion of fuel being performed inside one or more furnace tubes built-in in the boiler body

- F22B7/02 . without auxiliary water tubes
- F22B7/04 . with auxiliary water tubes
- F22B7/06 . . inside the furnace tube in transverse arrangements
- F22B7/08 . . inside the furnace tube in longitudinal arrangement
- F22B7/10 . . outside the boiler body
- F22B7/12 . with auxiliary fire tubes; Arrangement of header boxes providing for return diversion of flue gas flow
- F22B7/14 . with both auxiliary water tubes and auxiliary fire tubes
- F22B7/16 . Component parts thereof; Accessories therefor, e.g. stay-bolt connections
- F22B7/18 . . Walling of flues; Flue gas header boxes
- F22B7/20 . . Furnace tubes

F22B9/00 Steam boilers of fire-tube type, i.e. the flue gas from a combustion chamber outside the boiler body flowing through tubes built-in in the boiler body

- F22B9/02 . the boiler body being disposed upright, e.g. above the combustion chamber

F22B9/04	<ul style="list-style-type: none"> the fire tubes being in upright arrangement
F22B9/06	<ul style="list-style-type: none"> Arrangement of header boxes providing for return diversion of flue gas flow
F22B9/08	<ul style="list-style-type: none"> the fire tubes being in horizontal arrangement
F22B9/10	<ul style="list-style-type: none"> the boiler body being disposed substantially horizontally, e.g. at the side of the combustion chamber
F22B9/12	<ul style="list-style-type: none"> the fire tubes being in substantially horizontal arrangement
F22B9/14	<ul style="list-style-type: none"> Arrangement of header boxes providing for return diversion of flue gas flow
F22B9/16	<ul style="list-style-type: none"> the boiler body containing fire tubes disposed crosswise in inclined upward arrangement
F22B9/18	<ul style="list-style-type: none"> Component parts thereof; Accessories therefor, e.g. stay-bolt connections
F22B11/00	Steam boilers of combined fire-tube type and water-tube type, i.e. steam boilers of fire-tube type having auxiliary water tubes
F22B11/02	<ul style="list-style-type: none"> the fire tubes being in upright arrangement
F22B11/04	<ul style="list-style-type: none"> the fire tubes being in horizontal arrangement
F22B13/00	Steam boilers of fire-box type, i.e. the combustion of fuel being performed in a chamber or fire-box with subsequent flue(s) or fire tube(s), both chamber or fire-box and flues or fire tubes being built-in in the boiler body
F22B13/00B	<ul style="list-style-type: none"> [N: with flues, other than fire tubes]
F22B13/02	<ul style="list-style-type: none"> mounted in fixed position with the boiler body disposed upright
F22B13/02B	<ul style="list-style-type: none"> [N: with auxiliary water tubes inside the fire-box, e.g. vertical tubes (F22B13/10 takes precedence)] [N9910]
F22B13/02B2	<ul style="list-style-type: none"> [N: the tubes being in substantially horizontal arrangement] [N9910]
F22B13/04	<ul style="list-style-type: none"> mounted in fixed position with the boiler body disposed substantially horizontally
F22B13/06	<ul style="list-style-type: none"> Locomotive, traction-engine, steam-roller, or locomotive boilers
F22B13/06B	<ul style="list-style-type: none"> [N: Combination of low and high pressure locomotive boilers] [N9910]
F22B13/08	<ul style="list-style-type: none"> without auxiliary water tubes inside the fire-box
F22B13/10	<ul style="list-style-type: none"> with auxiliary water tubes inside the fire-box
F22B13/12	<ul style="list-style-type: none"> the auxiliary water tubes lining the fire-box
F22B13/14	<ul style="list-style-type: none"> Component parts thereof; Accessories therefor
F22B13/14B	<ul style="list-style-type: none"> [N: Firebox thermosiphons] [N9910]
F22B13/16	<ul style="list-style-type: none"> Stay-bolt connections, e.g. rigid connections
F22B13/18	<ul style="list-style-type: none"> Flexible connections, e.g. of ball-and-socket type
F22B15/00	Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally

F22B17/00	Water-tube boilers of horizontally-inclined type, e.g. the water-tube sets being inclined slightly with respect to the horizontal plane
F22B17/02	<ul style="list-style-type: none"> built-up from water-tube sets in abutting connection with two header boxes in common for all sets, e.g. with flat header boxes
F22B17/02B	<ul style="list-style-type: none"> <ul style="list-style-type: none"> [N: with combined inlet and outlet header boxes, e.g. connected by U-tubes or Field tubes] [N9910]
F22B17/04	<ul style="list-style-type: none"> <ul style="list-style-type: none"> the water-tube sets being inclined in opposite directions, e.g. crosswise
F22B17/06	<ul style="list-style-type: none"> <ul style="list-style-type: none"> the water-tube sets being bent angularly
F22B17/08	<ul style="list-style-type: none"> <ul style="list-style-type: none"> the water-tube sets being curved
F22B17/10	<ul style="list-style-type: none"> built-up from water-tube sets in abutting connection with two sectional headers each for every set, i.e. with headers in a number of sections across the width or height of the boiler
F22B17/10B	<ul style="list-style-type: none"> <ul style="list-style-type: none"> [N: with tubes in series flow arrangement] [N9910]
F22B17/12	<ul style="list-style-type: none"> <ul style="list-style-type: none"> the sectional headers being in vertical or substantially vertical arrangement
F22B17/14	<ul style="list-style-type: none"> <ul style="list-style-type: none"> the sectional headers being in horizontal or substantially horizontal arrangement
F22B17/16	<ul style="list-style-type: none"> Component parts thereof; Accessories therefor
F22B17/18	<ul style="list-style-type: none"> <ul style="list-style-type: none"> Header boxes; Sectional headers
F22B19/00	Water-tube boilers of combined horizontally-inclined type and vertical type, i.e. water-tube boilers of horizontally-inclined type having auxiliary water-tube sets in vertical or substantially vertical arrangement
F22B21/00	Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically
F22B21/00B	<ul style="list-style-type: none"> [N: involving a single upper drum (F22B21/36 takes precedence)]
F22B21/00C	<ul style="list-style-type: none"> [N: involving a central vertical drum, header or downcomer]
F22B21/00L	<ul style="list-style-type: none"> [N: specially adapted for locomotives] [N9910]
F22B21/02	<ul style="list-style-type: none"> built-up from substantially straight water tubes
F22B21/04	<ul style="list-style-type: none"> <ul style="list-style-type: none"> involving a single upper drum and a single lower drum, e.g. the drums being arranged transversely
F22B21/06	<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> the water tubes being arranged annularly in sets, e.g. in abutting connection with drums of annular shape
F22B21/06B	<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> [N: involving an upper and lower drum of annular shape]
F22B21/08	<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> the water tubes being arranged sectionally in groups or in banks, e.g. bent over at their ends
F22B21/08B	<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> [N: involving a combustion chamber, placed at the side and built-up from water tubes]
F22B21/08C	<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> [N: involving an upper drum and a lower drum and a fire-place between the two drums]
F22B21/08D	<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> [N: the tubes being placed in layers]

- F22B21/08F [N: Frames built-up from water tubes]
- F22B21/08G [N: involving an upper drum and a lower drum and two lateral drums]
- F22B21/10 . . . the water tubes being arranged in staggered rows
- F22B21/12 . . involving two or more upper drums and two or more lower drums, e.g. with crosswise-arranged water-tube sets in abutting connections with drums
- F22B21/12B . . . [N: involving crossed water tubes]
- F22B21/12C . . . [N: involving more than two lower or upper drums]
- F22B21/14 . . involving a single upper drum and two or more lower drums
- F22B21/16 . . . the lower drums being interconnected by further water tubes
- F22B21/18 . . involving two or more upper drums and a single lower drum
- F22B21/18C . . . [N: involving more than two upper drums and a single lower drum]
- F22B21/20 . . involving sectional or subdivided headers in separate arrangement for each water-tube set

- F22B21/22 . built-up from water tubes of form other than straight or substantially straight
- F22B21/24 . . bent in serpentine or sinuous form
- F22B21/26 . . bent helically, i.e. coiled
- F22B21/28 . . bent spirally
- F22B21/30 . . bent in U-loop form
- F22B21/32 . . . disposed horizontally in abutting connection with upright headers or rising water mains

- F22B21/34 . built-up from water tubes grouped in panel form surrounding the combustion chamber, i.e. radiation boilers
- F22B21/34E . . [N: Vertical radiation boilers with combustion in the lower part]
- F22B21/34E2 . . . [N: the vertical radiation combustion chamber being connected at its upper part to a sideways convection chamber]
- F22B21/34E2B [N: with a tube bundle between an upper and a lower drum in the convection pass]
- F22B21/34H . . [N: Horizontal radiation boilers]
- F22B21/34T . . [N: Radiation boilers with a burner at the top]
- F22B21/36 . . involving an upper drum or headers mounted at the top of the combustion chamber
- F22B21/36B . . . [N: involving a horizontal drum mounted in an upper corner of the boiler]
- F22B21/36C . . . [N: involving a horizontal drum mounted in the middle of the boiler]
- F22B21/38 . . Component parts thereof, e.g. prefabricated panels

- F22B21/40 . built-up from water tubes arranged in a comparatively long vertical shaft, i.e. tower boilers

- F22B23/00** **Water-tube boilers built-up from sets of spaced double-walled water tubes of return type in unilateral abutting connection with a boiler drum or with a header box, i.e. built-up from Field water tubes comprising an inner tube arranged within an outer unilaterally-closed tube**

- F22B23/02 . the water-tube, i.e. Field-tube, sets being horizontal or substantially horizontal
- F22B23/04 . the water-tube, i.e. Field-tube, sets being vertical or substantially vertical

- F22B23/06
 - Component parts thereof, e.g. Field water tubes ([heat-exchange tubes in general F28F](#))
- F22B25/00**
Water-tube boilers built-up from sets of water tubes with internally-arranged flue tubes, or fire tubes, extending through the water tubes
- F22B27/00**
Instantaneous or flash steam boilers
- F22B27/02
 - built-up from fire tubes
- F22B27/04
 - built-up from water tubes ([F22B27/12](#) to [F22B27/16](#) take precedence)
- F22B27/06
 - . bent in serpentine or sinuous form
- F22B27/08
 - . bent helically, i.e. coiled
- F22B27/10
 - . bent spirally
- F22B27/12
 - built-up from rotary heat-exchange elements, e.g. from tube assemblies
- F22B27/14
 - built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls [N: ([F22B1/28F](#) takes precedence)]
- F22B27/16
 - involving spray nozzles for sprinkling or injecting water particles on to or into hot heat-exchange elements, e.g. into tubes [N: ([F22B1/28E](#) takes precedence)]
- F22B27/16B
 - . [N: with film flow of water on heated surfaces]
- F22B29/00**
Steam boilers of forced-flow type
- F22B29/02
 - of forced-circulation type [N: ([F22B29/06](#) takes precedence)]
- F22B29/02B
 - . [N: without drums, i.e. without hot water storage in the boiler]
- F22B29/02B2
 - . . [N: operating at critical or supercritical pressure]
- F22B29/04
 - of combined-circulation type, i.e. in which convection circulation due to the difference in specific gravity between cold and hot water is promoted by additional measures, e.g. by injecting pressure-water temporarily
- F22B29/06
 - of once-through type, i.e. built-up from tubes receiving water at one end and delivering superheated steam at the other end of the tubes ([F22B33/00](#) takes precedence)
- F22B29/06B
 - . [N: Construction of tube walls]
- F22B29/06B2
 - . . [N: involving vertically-disposed water tubes]
- F22B29/06B3
 - . . [N: involving horizontally- or helically-disposed water tubes]
- F22B29/06B4
 - . . [N: involving upper vertically disposed water tubes and lower horizontally- or helically disposed water tubes]
- F22B29/06C
 - . [N: operating at critical or supercritical pressure (with recirculation during normal operation [F22B29/02B2](#))]
- F22B29/06D
 - . [N: operating with superimposed recirculation during normal operation ([F22B29/12](#) takes precedence)]
- F22B29/08
 - . operating with fixed point of final state of complete evaporation ([N: evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of

- ids for gas phase reactions [B01B1/00B](#)) [C0311]
- F22B29/10 . . operating with sliding point of final state of complete evaporation ([N: evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions [B01B1/00B](#)) [C0311]
- F22B29/12 . . operating with superimposed recirculation during starting and low-load periods, e.g. composite boilers
- F22B31/00** **Modifications of boiler construction, or of tube systems, dependent on installation of combustion apparatus; Arrangements of dispositions of combustion apparatus** (steam generation characterised by heating method [F22B1/00](#); combustion apparatus per se [F23](#))
- F22B31/00B . [N: with combustion in a fluidized bed (fluidized bed apparatus per se [B01J8/00](#); fluidized bed combustors [F23C11/02](#))]
- F22B31/00B2 . . [N: for boilers of the water tube type]
- F22B31/00B2B . . . [N: with tubes in the bed ([F22B31/00B2C](#) takes precedence)]
- F22B31/00B2C . . . [N: with tubes surrounding the bed or with water tube wall partitions]
- F22B31/00B2C2 [N: with tubes in the bed]
- F22B31/00B3 . . [N: for boilers of the shell type, e.g. with furnace box]
- F22B31/00B3B . . . [N: with auxiliary water tubes]
- F22B31/00B4 . . [N: Constructional features of bed cooling]
- F22B31/00B5 . . [N: Systems therefor]
- F22B31/00B6 . . [N: Controlling processes for fluidized bed boilers not related to a particular type]
- F22B31/00B8 . . [N: with recirculation of separated solids or with cooling of the bed particles outside the combustion bed]
- F22B31/00B8B . . . [N: with a fluidized heat exchange bed and a fluidized combustion bed separated by a partition, the bed particles circulating around or through that partition]
- F22B31/02 . Installation of water-tube boilers in chimneys, e.g. in converter chimneys
- F22B31/04 . Heat supply by installation of two or more combustion apparatus, e.g. of separate combustion apparatus for the boiler and the superheater respectively
- F22B31/04C . . [N: Steam generators specially adapted for burning refuse]
- F22B31/06 . . Installation of emergency heat supply
- F22B31/08 . Installation of heat-exchange apparatus or of means in boilers for heating air supplied for combustion

Guide heading: **Steam-generation plants; Control systems**

- F22B33/00** **Steam-generation plants, e.g. comprising steam boilers of different types in mutual association** (arrangements or dispositions of steam-generation plants in marine vessels [B63H21/00](#))
- F22B33/02 . Combinations of boilers having a single combustion apparatus in common
- F22B33/04 . . of boilers of furnace-tube type with boilers of water-tube type
- F22B33/06 . . of boilers of furnace-tube type with boilers of fire-tube type

- F22B33/08 . . of boilers of water tube type with boilers of fire-tube type
- F22B33/10 . . of two or more superposed boilers with separate water volumes and operating with two or more separate water levels
- F22B33/12 . Self-contained steam boilers, i.e. comprising as a unit the steam boiler, the combustion apparatus, the fuel storage, accessory machines and equipment
- F22B33/14 . Combination of low and high pressure boilers ([F22B13/06B](#) takes precedence) [\[C9910\]](#)
- F22B33/16 . . of forced-flow type
- F22B33/18 . Combinations of steam boilers with other apparatus
- F22B33/18B . . [\[N: in combination with a steam accumulator\]](#)
- F22B35/00** **Control systems for steam boilers** ([\[N: for fluidized bed boilers F22B31/00B6\];](#) regulation or control of steam power plants [F01K7/00](#); for regulating feed-water supply [F22D](#); for controlling superheat temperature [F22G5/00](#); control of combustion [F23N](#); regulating or controlling in general [G05](#))
- F22B35/00B . [\[N: Controlling by flue gas dampers \(for superheaters \[F22G5/04\]\(#\)\)\]](#)
- F22B35/00C . [\[N: Control by recirculating flue gases \(for superheaters \[F22G5/06\]\(#\)\)\]](#)
- F22B35/00D . [\[N: Control systems for steam generators of nuclear power plants\]](#)
- F22B35/00F . [\[N: Control systems for instantaneous steam boilers\]](#)
- F22B35/00G . [\[N: Control systems for waste heat boilers\]](#)
- F22B35/00L . [\[N: Control systems for two or more steam generators \(\[F22D5/36\]\(#\) takes precedence\)\]](#)
- F22B35/02 . for steam boilers with natural convection circulation
- F22B35/04 . . during starting-up periods, i.e. during the periods between the lighting of the furnaces and the attainment of the normal operating temperature of the steam boilers
- F22B35/06 . for steam boilers of forced-flow type
- F22B35/08 . . of forced-circulation type
- F22B35/08B . . . [\[N: without drum, i.e. without hot water storage in the boiler\]](#)
- F22B35/08B2 [\[N: operating at critical or supercritical pressure\]](#)
- F22B35/10 . . of once-through type
- F22B35/10A . . . [\[N: operating with superimposed recirculation during starting or low load periods, e.g. composite boilers \(\[F22B35/12B\]\(#\) takes precedence\)\]](#)
- F22B35/10B . . . [\[N: operating with fixed point of final state of complete evaporation, e.g. in a steam-water separator\]](#)
- F22B35/10C . . . [\[N: Control systems by injecting water \(for superheaters \[F22G5/12\]\(#\)\)\]](#)
- F22B35/10D . . . [\[N: operating at sliding pressure\]](#)
- F22B35/10F . . . [\[N: Control systems with auxiliary heating surfaces\]](#)
- F22B35/10H . . . [\[N: Control systems for steam generators having multiple flow paths\]](#)

- F22B35/12 . . . operating at critical or supercritical pressure
- F22B35/12B [N: operating with superimposed recirculation during starting or low load periods, e.g. composite boilers]
- F22B35/14 . . during the starting-up periods, i.e. during the periods between the lighting of the furnaces and the attainment of the normal operating temperature of the steam boilers
- F22B35/16 . . responsive to the percentage of steam in the mixture of steam and water
- F22B35/18 . Application of computers to steam boiler control

- F22B37/00** **Component parts or details of steam boilers** (venting devices [F16K24/00](#); steam traps or like apparatus [F16T](#))

- F22B37/00B . [N: Steam generators built-up from pre-fabricated elements]
- F22B37/00C . [N: specially adapted for nuclear steam generators, e.g. maintenance, repairing or inspecting equipment not otherwise provided for]
- F22B37/00C2 . . [N: Maintenance, repairing or inspecting equipment positioned in or via the headers]
- F22B37/00C2B . . . [N: Positioning apparatus specially adapted therefor ([F22B37/70C3](#) takes precedence)]
- F22B37/00C3 . . [N: Walking equipment, e.g. walking platforms suspended at the tube sheet (walking mechanism per se [B62D57/02](#))]
- F22B37/00C4 . . [N: Installation or removal of nuclear steam generators]
- F22B37/00D . [N: Adaptations for flue gas purification in steam generators, (flue gas purification in general [F23J](#); gas purification in general [B01D](#))]

- F22B37/02 . applicable to more than one kind or type of steam boiler
- F22B37/02B . . [N: Devices and methods for diminishing corrosion, e.g. by preventing cooling beneath the dew point]
- F22B37/04 . . and characterised by material, e.g. use of special steel alloy
- F22B37/06 . . Flue or fire tubes; Accessories therefor, e.g. fire-tube inserts
- F22B37/08 . . . Fittings preventing burning-off of the tube edges
- F22B37/10 . . Water tubes; Accessories therefor (working of metal tubes [B21D](#); pipes in general [F16L](#); repairing leaks in water tubes [F16L55/16](#); [F28F11/00](#); baffles, screens, or deflectors formed of water tubes [F23M9/10](#); cleaning internal or external surfaces of water tubes [F28G](#))
- F22B37/10B . . . [N: Tubes having fins or ribs]
- F22B37/10B2 [N: Walls built-up from finned tubes]
- F22B37/10B3 [N: Internally ribbed tubes]
- F22B37/10C . . . [N: Connection of tubes one with the other or with collectors, drums or distributors (in general [F16L](#))]
- F22B37/10F . . . [N: Penetrations of tubes through a wall and their sealing (in general [F16L5/00](#))]
- F22B37/10G . . . [N: Studding of tubes]
- F22B37/10H . . . [N: Protection of water tubes (in general [F16L57/00](#))]
- F22B37/10H2 [N: Protection of water tube walls]
- F22B37/12 . . . Forms of water tubes, e.g. of varying cross-section

F22B37/12B	. . . .	[N: Bifurcates]
F22B37/14	. . .	Supply mains, e.g. rising mains, down-comers, in connection with water tubes
F22B37/14B	. . . .	[N: involving vertically-disposed water tubes, e.g. walls built-up from vertical tubes]
F22B37/14C	. . . .	[N: involving horizontally-or helically-disposed water tubes, e.g. walls built-up from horizontal or helical tubes]
F22B37/14F	. . . .	[N: Panel shaped heating surfaces built up from tubes (F22B37/14G takes precedence)]
F22B37/14G	. . . .	[N: Flag-shaped panels built-up from tubes, e.g. from U-shaped tubes]
F22B37/14H	. . . .	[N: Tube arrangements for ash hoppers and grates and for combustion chambers of the cyclone or similar type out of the flues]
F22B37/14K	. . . .	[N: Tube arrangements for cooling orifices, doors and burners]
F22B37/14L	. . . .	[N: Tube arrangements for the roofs]
F22B37/16	. . .	Return bends
F22B37/16B	. . . .	[N: Closures for access openings in return bends (boiler plugs for drums or headers F22B37/22B4)]
F22B37/18	. . .	Inserts, e.g. for receiving deposits from water
F22B37/20	. . .	Supporting arrangements, e.g. for securing water-tube sets (construction of tube walls of furnaces including boiler furnaces F23M5/08)
F22B37/20D	. . . .	[N: Suspension and securing arrangements for walls built-up from tubes]
F22B37/20F	. . . .	[N: Suspension and securing arrangements for contact heating surfaces]
F22B37/20F2	. . . . .	[N: Horizontal tubes supported only away from their ends on vertical support tubes]
F22B37/20G	. . . .	[N: Supporting arrangements for individual tubes, e.g. for securing tubes to a refractory wall]
F22B37/20H	. . . .	[N: Supporting and spacing arrangements for tubes of a tube bundle]
F22B37/20H2	. . . . .	[N: Anti-vibration supports for the bends of U-tube steam generators]
F22B37/20K	. . . .	[N: Supporting arrangements for drums and collectors]
F22B37/20L	. . . .	[N: Backstay arrangements]
F22B37/22	. .	Drums; Headers; Accessories therefor (making boilers from sheet metal B21D51/24 ; pressure vessels in general F16J12/00 ; covers or similar closure members F16J13/00)
F22B37/22B	. . .	[N: Covers for drums, collectors, manholes or the like (in general F16J13/00)]
F22B37/22B2	. . . .	[N: Nozzle dams introduced through a smaller manway, e.g. foldable]
F22B37/22B4	. . . .	[N: Boiler plugs, e.g. for handholes (closures for access openings in return bends F22B37/16B)]
F22B37/22C	. . .	[N: Arrangements on drums or collectors for fixing tubes or for connecting collectors to each other]
F22B37/22D	. . .	[N: Protection of drums against combustion]
F22B37/22F	. . .	[N: Drums and collectors for mixing]
F22B37/22G	. . .	[N: Headers for distributing feedwater into steam generator vessels; Accessories therefor]
F22B37/24	. .	Supporting, suspending, or setting arrangements, e.g. heat shielding (frames, engine beds F16M)
F22B37/24C	. . .	[N: for bottom supported water-tube steam generators]
F22B37/24D	. . .	[N: for water-tube steam generators suspended from the top]

F22B37/24R	. . .	[N: for steam generators of the reservoir type, e.g. nuclear steam generators]
F22B37/24R2	. . . .	[N: with a vertical cylindrical wall]
F22B37/26	. .	Steam-separating arrangements (vapour-liquid separators, e.g. for drying steam, B01D ; B04)
F22B37/26B	. . .	[N: specially adapted for boiler drums]
F22B37/26C	. . .	[N: Valves with water separators]
F22B37/26D	. . .	[N: Apparatus for washing and purifying steam]
F22B37/26F	. . .	[N: Separator reheaters]
F22B37/26G	. . .	[N: specially adapted for steam generators of nuclear power plants]
F22B37/28	. . .	involving reversal of direction of flow
F22B37/28B	. . . .	[N: specially adapted for boiler drums]
F22B37/28C	. . . .	[N: specially adapted for steam generators of nuclear power plants]
F22B37/30	. . .	using impingement against baffle separators
F22B37/30B	. . . .	[N: specially adapted for boiler drums]
F22B37/30C	. . . .	[N: specially adapted for steam generators of nuclear power plants]
F22B37/32	. . .	using centrifugal force
F22B37/32B	. . . .	[N: specially adapted for boiler drums]
F22B37/32C	. . . .	[N: using a revolving element]
F22B37/32D	. . . .	[N: specially adapted for steam generators of nuclear power plants]
F22B37/34	. .	Adaptations of boilers for promoting water circulation ([N: F22B13/14B takes precedence]; auxiliary devices for promoting water circulation F22D7/00) [C0901]
F22B37/36	. .	Arrangements for sheathing or casing boilers
F22B37/36B	. . .	[N: Casings of metal sheets, e.g. expansion plates, expansible joints]
F22B37/38	. .	Determining or indicating operating conditions in steam boilers, e.g. monitoring direction or rate of water flow through water tubes (measuring or indicating instruments in general G01)
F22B37/40	. .	Arrangements of partition walls in flues of steam boilers, e.g. built-up from baffles (in flues or chimneys F23J13/00)
F22B37/42	. .	Applications, arrangements, or dispositions of alarm or automatic safety devices (for feed-water heaters F22D1/14 ; [N: emergency feed-water supply F22D11/00B]; alarms responsive to undesired or abnormal conditions G08B)
F22B37/42B	. . .	[N: Arrangements for detecting leaks]
F22B37/42D	. . .	[N: Valves for testing steam generators] [N9910]
F22B37/42E	. . .	[N: Feed-water supply alarm devices using floats] [N9910]
F22B37/42F	. . .	[N: Feed-water supply alarm devices using electric signals] [N9910]
F22B37/42G	. . .	[N: Feed-water supply alarm devices using dilatation of solids or liquids] [N9910]
F22B37/44	. . .	of safety valves (safety valves per se F16K)
F22B37/44C	. . . .	[N: Safety devices extinguishing the fire] [N9910]
F22B37/44E	. . . .	[N: Safety devices responsive to overpressure] [N9910]
F22B37/46	. . .	responsive to low or high water level, e.g. for checking, suppressing, extinguishing combustion in boilers (fire-fighting, fire extinction in general A62)
F22B37/47	. . .	responsive to abnormal temperature, e.g. actuated by fusible plugs (such alarms or devices per se G08B)
F22B37/47B	. . . .	[N: Safety devices with fusible plugs] [N9910]

- F22B37/48
 - . . Devices for removing water, salt, or sludge from boilers ([cleaning internal or external surfaces of water tubes F28G](#)); Arrangements of cleaning apparatus in boilers ([cleaning external surfaces of tubes by soot blowers F23J](#)); Combinations thereof with boilers
- F22B37/48B
 - . . . [\[N: specially adapted for nuclear steam generators\]](#)
- F22B37/48E
 - . . . [\[N: Devices for removing water, salt, or sludge from boilers \(\[F22B37/48B\]\(#\), \[F22B37/50\]\(#\), \[F22B37/52\]\(#\) and \[F22B37/54\]\(#\) take precedence\)\]](#) [\[N9705\]](#)
- F22B37/50
 - . . . for draining or expelling water
- F22B37/52
 - . . . Washing-out devices
- F22B37/54
 - . . . De-sludging or blow-down devices [\[N: \(\[F22B37/56B\]\(#\) takes precedence\)\]](#)
- F22B37/54B
 - [\[N: Valves specially adapted therefor \(valves in general \[F16K\]\(#\)\)\]](#)
- F22B37/56
 - . . Boiler cleaning control devices, e.g. for ascertaining proper duration of boiler blow-down
- F22B37/56B
 - . . . [\[N: Blow-down control, e.g. for ascertaining proper duration of boiler blow-down\]](#)
- F22B37/58
 - . . Removing tubes from headers or drums; Extracting tools
- F22B37/60
 - . specially adapted for steam boilers of instantaneous or flash type
- F22B37/62
 - . specially adapted for steam boilers of forced-flow type
- F22B37/64
 - . . Mounting of, or supporting arrangements for, tube units ([construction of tube walls of furnaces, e.g. boiler furnaces F23M5/08](#))
- F22B37/64B
 - . . . [\[N: involving upper vertically-disposed water tubes and lower horizontally- or helically disposed water tubes\]](#)
- F22B37/66
 - . . . involving vertically-disposed water tubes ([F22B37/64B takes precedence](#))
- F22B37/68
 - . . . involving horizontally-disposed water tubes ([F22B37/64B takes precedence](#))
- F22B37/70
 - . . Arrangements for distributing water into water tubes
- F22B37/72
 - . . . involving injection devices
- F22B37/74
 - . . . Throttling arrangements for tubes or sets of tubes
- F22B37/76
 - . Adaptations or mounting of devices for observing existence or direction of fluid flow ([devices per se G01P](#))
- F22B37/78
 - . Adaptations or mounting of level indicators ([level indicators per se G01F](#))