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Table 2.1 Feedwater for steam boilers (except attemperator spray water) and hot water boilers

Parameter	Unit	Feedwater for steam boilers		Make-up water for hot water boilers
Operating pressure	Bar (= 0,1 MPa)	> 0,5 to 20	> 20	Total range
Appearance	--	Clear, free from suspended solids		
Direct conductivity at 25 °C	--	Not specified, only guide values relevant for boiler water see table 2.2		
pH value at 25 °C	--	> 9,2 [b]	> 9,2 [b]	> 7,0
Total hardness (Ca + Mg)	mmol/l	< 0,01[c]	< 0,01	< 0,05
Total hardness	°dH	< 0,05	< 0,05	< 0,03
Iron (Fe)	mg/l	< 0,3	< 0,1	< 0,2
Copper (Cu)	mg/l	< 0,05	< 0,03	< 0,1
Silica (SiO_2)	mg/l	Not specified, only guide values for boiler water relevant, see table 2.2		--
Oxygen (O_2)	mg/l	< 0,05 [d]	< 0,02	--
Oil/grease	mg/l	< 1	< 1	< 1
Organic substances (as TOC)	--	See footnote [e]		
[f] Carbon dioxide (CO_2)	mg/l	< 25	< 10	--

[a] With copper alloys in the system the pH value shall be maintained in the range 8,7 to 9,2.

[b] With softenend water pH value > 7,0 the pH value of boiler water according to table 2.2 should be considered.

[c] At operating pressure < 1 bar total hardness max. 0,05 mmol/l shall be acceptable.

[d] Instead of oberserving this value at intermittent operation or operation without deaerator if film forming agents and/or excess of oxygen scavenger shall be used.

[e] Organic substances are generally a mixture of several different compounds. The composition of such mixtures and the behavior of their individual component under the conditions of boiler operation are difficult to predict. Organic substances may be decomposed to form carbonic acid or other acidic decomposition products which increase the acid conductivity and cause corrosion or deposits. They also may lead to foaming and/or priming which shall be kept as low as possible.

[f] HKB advises to include this parameter in your measurements.

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Table 2.2 Boiler water for steam boilers and hot water boilers

Parameter	Unit	Boiler water for steam boilers using			Boiler water for hot water boilers
		Feedwater direct conductivity > 30 µS/cm		Feedwater direct conductivity ≤ 30 µS/cm	
Operating pressure	Bar (= 0,1 MPa)	> 0,5 to 20	> 20	> 0,5	Total range
Appearance	--	Clear, no stable foam			
Direct conductivity at 25 °C	µS/cm	< 6 000 [a]	See figure 2.1 [a]	< 1 500	< 1 500
pH value at 25 °C	--	10,5 to 12,0	10,5 to 11,8	10,0 to 11,0 [b,c]	9,0 to 11,5 [d]
Composite alkalinity	mmol/l	1 to 15 [a]	1 to 10 [a]	0,1 to 1,0 [c]	< 5
Silica (SiO_2)	mg/l	Pressure dependent, according to figure 2.2			--
Phosphate (PO_4)	mg/l	10 to 30	10 to 30	6 to 15	--
Organic substances	--	See footnote [f]			--
[g] Oxygen Scavanger Na_2SO_3	mg/l	10 - 30	10 - 20	--	--

[a] With superheater consider 50 % of the indicated upper value as maximum value.

[b] Basic pH adjustment by injecting Na_3PO_4 additional NaOH injection only if the pH value is < 10.

[c] If the acid conductivity of the boiler feedwater is < 0,2 µS/cm, and its Na + K concentration is < 0,010 mg/l, phosphate injection is not necessary. Under the conditions AVT (all volatile treatment, feedwater pH ≥ 9,2 and the boiler water pH ≥ 8,0) can be applied. In this case the acid conductivity of the boiler water is < 5 µS/cm.

[d] If non-ferrous materials are present in the system, e.g. aluminum, they may require lower pH value and direct conductivity, however, the protection of the boiler has priority.

[e] If coordinated phosphate treatment is used; considering all other values higher PO_4 –concentrations are acceptable.

[f] See [e] in table 2.1.

[g] Not applicable when using film-forming amines.

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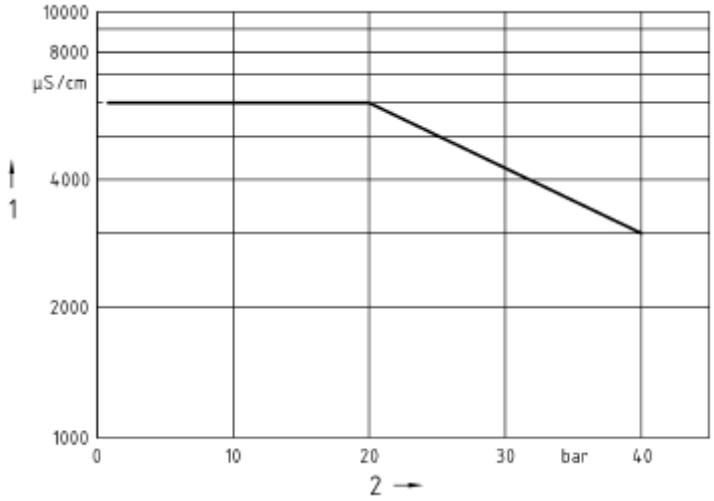
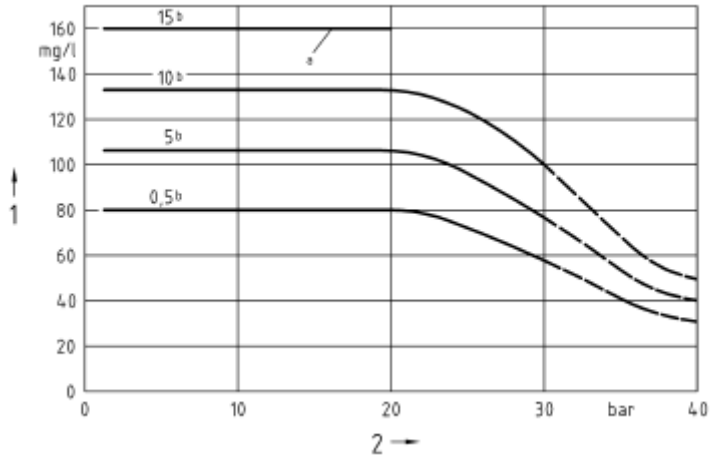
Figure 2.1 – Maximum acceptable direct conductivity of the boiler water dependent on the pressure; Feedwater direct conductivity > 30 µS/cm



Key
1 Direct conductivity
2 Operating pressure

Figure 2.2 – Maximum acceptable silica content (SiO_2) of the boiler water dependent on the pressure



Key
1 Maximum silica content
2 Operating pressure
a) This level of alkalinity is not permissible > 20 bar
b) Alkalinity in mmol/l