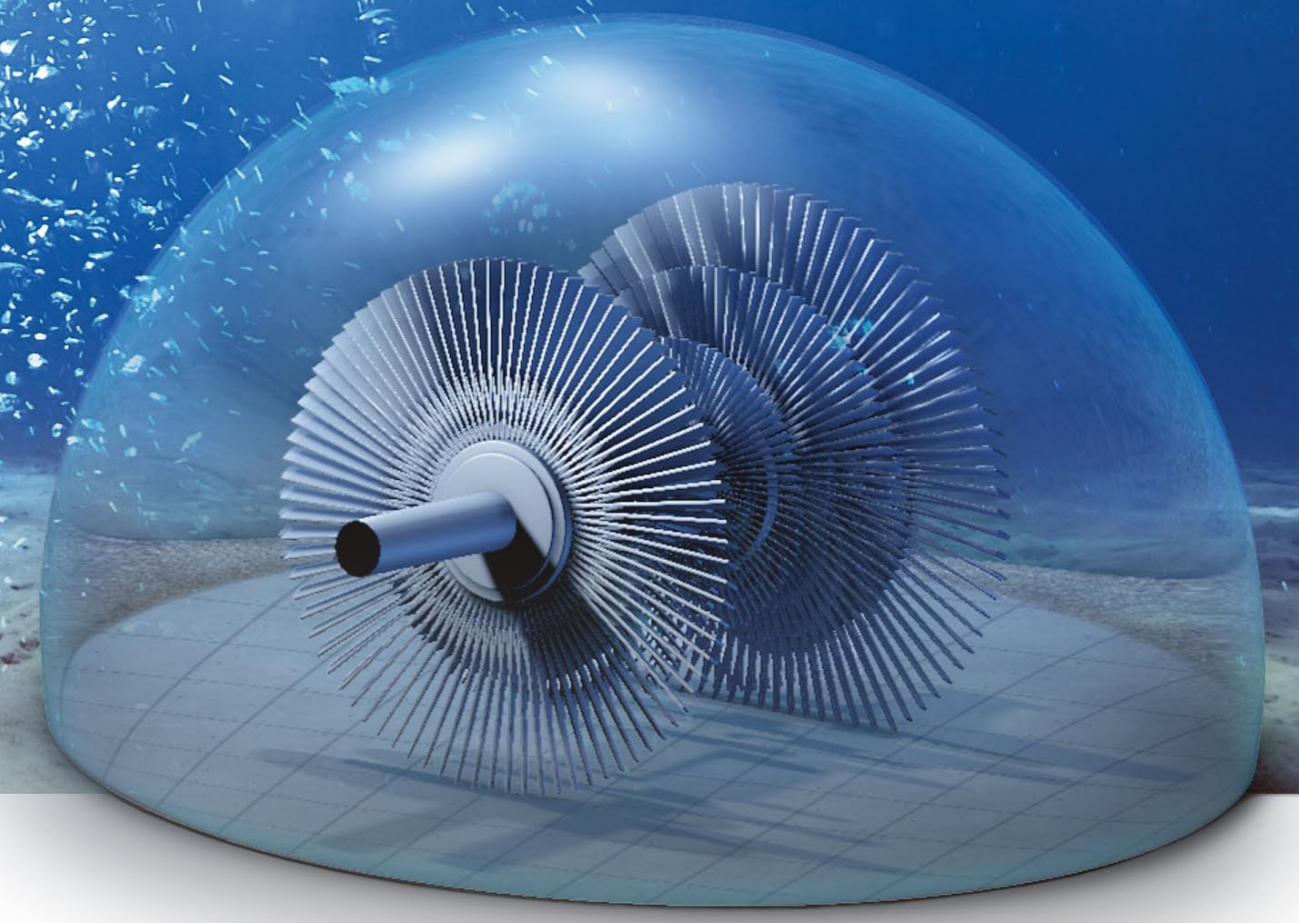


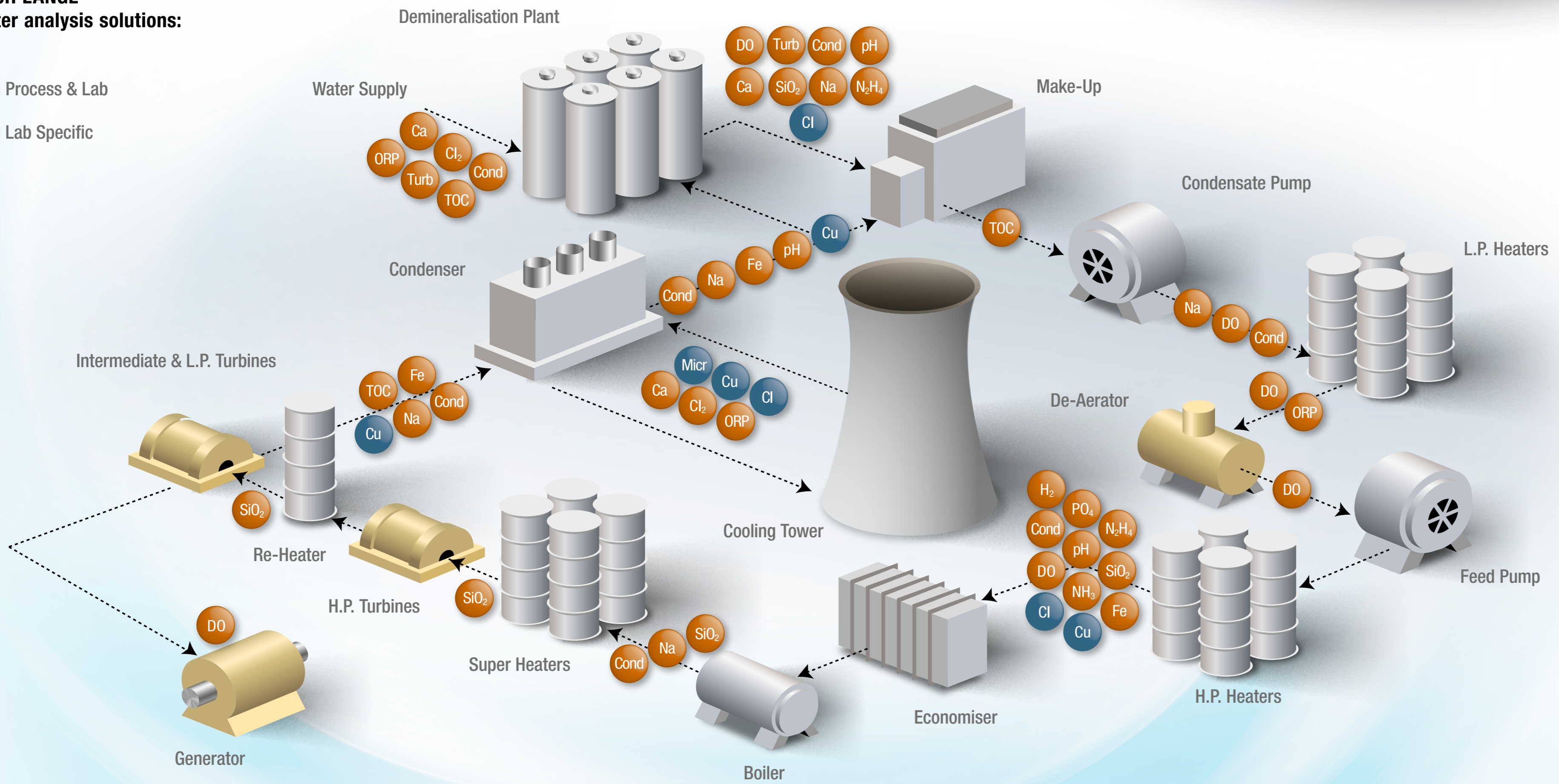
PROTECT YOUR EQUIPMENT!

ACTION LEVEL CONTROL SYSTEM



HACH LANGE water analysis solutions:

- Process & Lab
- Lab Specific



ACTION LEVELS FOR IMPORTANT PARAMETERS

EXAMPLES ACCORDING TO VGB STANDARD S-010

FEED WATER and Attemperator Spray Water			
Boiler Type	Once-through; copper free condensate/feed water system ¹⁾		
Feed Water Treatment	AVT (Alkaline)	OT	
pH	N	Plant-specific	Plant-specific
	AL 1	9.2	8.4
	AL 2	8.8	8.2
Acid Conductivity	N	Plant-specific	Plant-specific
	AL 1	0.20	0.15
	AL 2	0.30	0.20 ¹⁾
Conductivity (ammonia dosing)	N	Plant-specific	Plant-specific
	AL 1	4.3	0.7
	AL 2	1.7	0.4
Oxygen (O ₂)	N	Plant-specific	Plant-specific
	AL 1	100	250
	AL 2	250	500
Silica (SiO ₂)	N	Plant-specific	Plant-specific
	AL 1	20	20
	AL 2	50	50
Iron (Fe), total	N	Plant-specific	Plant-specific
	AL 1	10	10
	AL 2	20	20
Sodium (Na)	N	Plant-specific	Plant-specific
	AL 1	5	5
	AL 2	20	20
Organics (TOC/DOC)	N	Plant-specific	Plant-specific
	AL 1	5	5
	AL 2	20	20

Source: VGB standard VGB-S-010-T-00; 2011-12, table 2. The standard contains additional four tables for feed water, dependent on the boiler type: table 3, 4, 5 and 10. Key parameters: marked with blue.
 1) Once AL 2 is reached: stop oxygen dosing and change to AVT.
 2) Acid conductivity > AL 3 causes damage on superheaters due to contaminated spray-water.
 3) If there are components of aluminium in the water-steam circuit the values are not directly applicable.

STEAM for steam turbines			
Parameter	Unit	Without additional measurement of degassed, acid conductivity	With additional measurement of degassed, acid conductivity
		N	Plant-specific
Acid Conductivity ¹⁾	µS/cm	N	Plant-specific
		AL 1	0.20
		AL 2	0.50
Degassed, acid conductivity	µS/cm	N	Plant-specific
		AL 1	0.20
		AL 2	0.50
Silica (SiO ₂)	µg/kg	N	Plant-specific
		AL 1	20
		AL 2	50
Sodium (Na)	µg/kg	N	Plant-specific
		AL 1	5
		AL 2	10
Iron (Fe), total	µg/kg	N	Plant-specific
		AL 1	20
		AL 2	20
Copper (Cu), total	µg/kg	N	Plant-specific
		AL 1	3
		AL 2	—

Source: VGB standard VGB-S-010-T-00; 2011-12, table 9. Key parameters: marked with blue.
 1) The higher action limits may be applied when an increase in acid conductivity is associated with carbon dioxide, and organic degradation products are excluded as the cause.

BOILER WATER					
Boiler Type	Drum	Phosphate Treatment ¹⁾			
Boiler Water Treatment					
Steam Pressure (MPa)		< 4	4 to 10	> 10	
pH ²⁾	N	Plant-specific	Plant-specific	Plant-specific	
	AL 1	9.5	10.5	9.4	10.2
	AL 2	9.0	10.7	9.0	10.3
Conductivity ³⁾	N	Plant-specific	Plant-specific	Plant-specific	
	AL 1	100	50	30	
	AL 2	250	100	50	
Phosphate (PO ₄)	N	Plant-specific	Plant-specific	Plant-specific	
	AL 1	15	6	3	
	AL 2	See VGB-S-010-T-00; 2011-12, figure 19			
Silica (SiO ₂)	N	Plant-specific			
	AL 1	—			
	AL 2	2 x AL 1			
Organics (TOC/DOC)	N	See VGB standard, chapter 7.10: "It is recommended to strive for less than 0.1 mg/L"			
	AL 1	—			
	AL 2	—			

Source: VGB standard VGB-S-010-T-00; 2011-12, table 7. Key parameters: marked with blue.
 The standard contains additional five tables for boiler water, dependent on the boiler water treatment method used: table 6, 8, 11, 12 and 13.
 1) If other phosphates (e.g. Na₂HPO₄) are used, this table serves for orientation.
 2) In order to control or measure the pH value by phosphate treatment see Figure 23 in the VGB standard.
 3) With phosphate treatment there is no direct relationship between pH and conductivity. Thus, the pH value must be measured directly.

Recommendations from VGB PowerTech			
Action Level	Characteristics	Action during operation	Action during start-up
N	Plant-specific normal operating value	Supervision of key parameters	
N to AL 1	Acceptable range	Extend supervision to diagnostic parameters	
AL 1			
AL 1 to AL 2	Possible long term risk of failure	Identify and rectify the cause of the deviation within one week. Further actions to minimise possible damage to the plant should be taken	AL 1 should be reached for key parameters within 2 hours (warm start) and 8 hours (cold start)
AL 2			
AL 2 to AL 3	Risk of failure	Identify and rectify the cause of the deviation within one day. Further actions to minimise possible damage to the plant should be taken	Fire the boiler up. Check steam quality. At least AL 2 for all key parameters in steam should be reached before the turbine is started up
AL 3			
Outside AL 3	Immediate risk of damage. Chemistry out of control	Key parameters: Unit should be shut down as soon as possible using normal shut-down procedure. Diagnostic parameters: See AL 2 to AL 3	Identify the cause of excursion and take countermeasures before the start-up process is resumed

Key parameters:

Most important parameters. Preferably to be monitored continuously or at least several times per week (as long as normal values are observed) by means of laboratory analysis. Key parameters vary with the application.

Diagnostic parameters:

Parameters that provides valuable diagnostic data. Laboratory analysis is required for routine analysis and check of process monitoring instruments. If a key parameter deviates from the normal values, it is recommended to intensify the laboratory analysis.



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