Steam Purity from Carry-over (TDS in Steam)

Dissolved solids carried into the steam by boiler water carry-over, the solids reaching the superheater or turbine per year, and the boiler water TDS a steam purity limit allows.

Method: Mass balance of solids carried by droplets

Input parameters

Unit system: SI

Parameter	Value	Unit
Boiler water TDS	2,000.0	ppm
Mechanical carry-over, share of steam From steam purity tests or the drum internals maker; foaming raises it sharply.	0.10000	%
Steam flow	20,000	kg/h
Steam purity limit (TDS in steam)	1.0000	ppm
Operating hours per year	8,000.0	h

Calculated results

Parameter	Value	Unit
TDS in the steam	2.0000	ppm
Highest boiler water TDS for the steam limit	1,000.0	ppm
Solids carried with the steam	0.040000	kg/h
Solids carried per year	320.00	kg

Notes for this case

- Steam TDS exceeds the limit: lower the boiler water TDS (more blowdown) or improve the drum separators.
- Mechanical (droplet) carry-over only: vaporous carry-over of silica, and of salts at high pressure, is not included.

Formula and method

$$C_s = c\,C_{bw} \qquad C_{bw,max} = \frac{C_{lim}}{c} \qquad \dot{m}_{sol} = \dot{m}_s\,C_s \qquad m_{yr} = \dot{m}_{sol}\,t$$

Variables

C_{bw}	boiler water TDS	–
c	mechanical carry-over, share of steam	–
$\dot{m}_s$	steam flow	kg/s
C_{lim}	steam purity limit	–
t	operating hours	s
C_s	TDS in steam	–
$C_{bw,max}$	highest boiler water TDS	–
$\dot{m}_{sol}$	solids carried	kg/s
m_{yr}	solids per year	kg

Method and standards

Solids carried by droplets of boiler water in proportion to the carry-over; mass fractions throughout.

Assumptions and limits

- Mechanical (droplet) carry-over only; steady operation. Vaporous carry-over (silica, and salts at high pressure) is not included; there is no pressure input.
- A maximum boiler water TDS of 100 % or more means the limit does not restrict it, and none is shown.

References

- Mass balance of solids carried by droplets

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/boilers-power-plant/water-treatment/steam-purity-carryover

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.