

Industrial vortex generator (IVG) for chemical-free cooling (IVG-CT) water reuse in industrial processes

Supplementary information

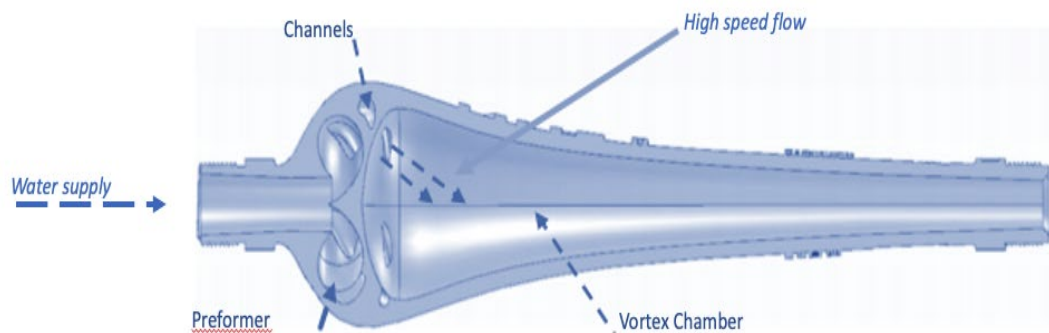


Figure 1. Schematic of the Vortex Process Technology – key element of the industrial vortex generator technology for cooling towers.

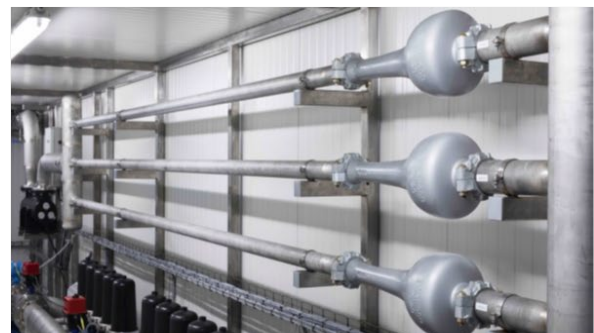


Figure 2. Pictures of a modular industrial Vortex generator for cooling towers unit.

Table 11: Performance of the industrial Vortex generator technology (IVG-CT®) in three full scale industrial installations (Food industry, pharmaceutical industry, data centre).

	Before IVG-CT®	After IVG-CT®
Food industry - (frozen potato processing plant – Lab Weston Meijer, USA)		
Type of cooling and cooling towers: Evaporative condensers for ammonia cooling		
Evaporation capacity (MW)	24	24
Water evaporation (m ³ /h)	37.2	37.2
Water consumption (m ³ /h)	68.2	42.5 (37% reduction)
Cooling water thickening (Cycles of concentration)	2.2	10.0
Chemicals used (kg per annum)	28 640	0 (100% reduction)
Payback period (years)	-	2.2
Pharmaceutical industry - (AMGEN, USA)		
Type of cooling and cooling towers: Open cooling towers for cooling chillers		
Evaporation capacity (MW)	20	20
Water evaporation (m ³ /h)	31	31
Water consumption (m ³ /h)	62.0	34.4 (44.5% reduction)
Cooling water thickening (Cycles of concentration)	2.0	10.0
Chemicals used (kg / annum)	26 040	0 (100% reduction)
Payback period (years)	-	3
Data centre - (Amsterdam, NL)		
Evaporation capacity (MW)	35	35
Water evaporation (m ³ /h)	55	55
Water consumption (m ³ /h)	95.0	62.0 (35% reduction)
Cooling water thickening (Cycles of concentration)	2.0 to 3.5	6.0 to 8.0
Chemicals used (kg / annum)	15 780	0 (100% reduction)
Payback period (years)	-	2.7