Continuous Fryer: Water Evaporated, Oil Uptake and Heat

Water evaporated, oil absorbed and heat load of a continuous fryer from product feed, moisture in and out and oil content of the fried product.

Method: Mass and energy balances (definitions); latent heat of water 2 257 kJ/kg at 100 °C

Input parameters

Unit system: SI

Parameter	Value	Unit
Raw product feed	2,000.0	kg/h
Moisture in the raw product	78.000	%
Moisture in the fried product	2.0000	%
Oil in the fried product	34.000	%
Product specific heat	3.5000	kJ/(kg·K)
Product in	15.000	°C
Losses share	15.000	%

Calculated results

Parameter	Value	Unit
Fried product	687.50	kg/h
Water evaporated	1,546.2	kg/h
Oil taken up	233.75	kg/h
Fryer heat load	1,334.9	kW

Notes for this case

- Oil taken up must be replaced by fresh oil; a high turnover keeps the oil fresh.

Formula and method

$$\dot{M}_p = \frac{\dot{M}(1-w_1)}{1-w_2-o_2}, \quad \dot{E} = \dot{M}w_1 - \dot{M}_p w_2, \quad Q = \frac{\dot{M}c_p(100\,°C - T_1) + \dot{E}\lambda}{1-\varepsilon}$$

Variables

$\dot{M}$	Raw product feed	kg/s
w_1	Moisture in the raw product	-
w_2	Moisture in the fried product	-
o_2	Oil in the fried product	-
c_p	Product specific heat	J/(kg·K)
T_1	Product in	K
$\mathcal{E}$	Losses share	-
$\dot{M}_p$	Fried product	kg/s
$\dot{E}$	Water evaporated	kg/s
$\dot{M}_o$	Oil taken up	kg/s
Q	Fryer heat load	W

Method and standards

Solids, water and oil balances.

Assumptions and limits

- Product heated to 100 °C; λ at 100 °C.
- Not included: heating the fresh make-up oil from storage to frying temperature, and heating low-moisture products (crisps) above 100 °C towards the oil temperature. For such products the load is underestimated; add these terms or raise the losses share.

References

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Report details

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Release checks	2 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/chemical/food-dairy/deep-fryer-heat-load

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.