

 **OPTIMEX**
SEALLESS PUMPS

CIRCULATION



API
685



EPIC

DESIGN, MANUFACTURING & REPAIR

OPTIMEX is exclusively dedicated to the design, manufacturing, tests and after-sales services of canned motor pumps.

This technology is characterised by a compact and monobloc design without a mechanical seal. Designed for use with dangerous, toxic and explosive liquids and for major and high-value processes, canned motor pumps are chosen for their robustness and reliability. They confer the highest level of safety against the risk of leakage thanks to their double hermetically-sealed containment.

To ensure customer satisfaction, our entire range of canned motor pumps is designed and manufactured in France and tested in accordance with the following standards:

DIRECTIVES:

- Machinery – 2006/42/EC
- Low Voltage Electrical Equipment – 2014/35/EU
- Electromagnetic Compatibility – 2014/30/EU
- Pressure Equipment – 2014/68/EU

STANDARDS:

- Quality Management Systems – ISO 9001:2015 & NF EN ISO 80079-34
- End suction centrifugal pumps – ISO 2858
- Sealless Rotodynamic Pumps – ISO 15783
- Sealless Centrifugal Pumps for the Petroleum, Petrochemical and Gas Industry Process service – API 685
- Nuclear Power Plant Equipment – RCC-M/MX/MRX

Remaining attentive to its international customers' requirements, OPTIMEX adapts its production to local Ex-proof directives (ATEX – 2014/34/UE, CUTR, UL, CSA).

SUMMARY

OPTIMEX CIRCUALATIONS	2
SPECIFICATION OF DESIGN	4
NORMAL CIRCULATION	6
OVERPRESSURED CIRCULATIONS	8
COOLED CIRCULATION	11
CIRCULATION SR6	12
FILTERED CIRCULATIONS	14

OPTIMEX CIRCULATION PLANS

OPTIMEX has established 4 main categories to designate the circulation of the liquid pumped inside canned motors.

In addition to the fluid circulation plans defined in API 685, OPTIMEX develops and tests specific circulation plans to optimise machine operation.

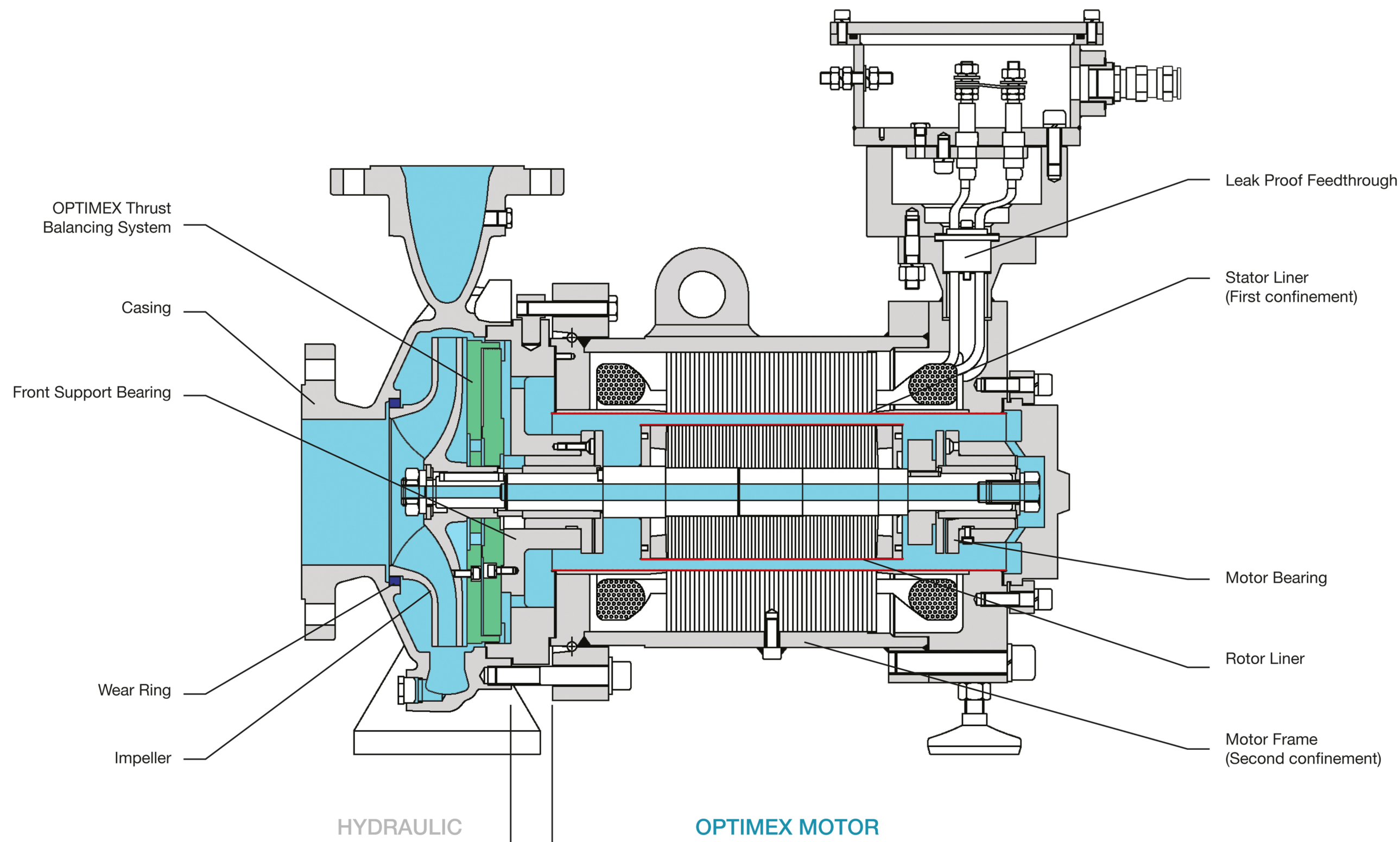
In fact, selecting a circulation plan is an essential step in designing a canned motor pump as it ensures adequate dissipation of OPTIMEX is exclusively dedicated to the design, manufacturing, tests and after-sales services of canned motor pumps.

Thanks to its know-how, OPTIMEX can assist you throughout this stage to propose the most suitable circulation plan for your process, including a study of the evolution of the temperature and pressure of the fluid inside the motor (thermal balance).

The table below defines the most commonly proposed circulation plans.

CATEGORY	LIQUID PROPERTIES	OPTIMEX REF.	API 685 REF.
Normal	Clear liquid, non boiling (VP < 1Bar), hot or cold (T°<350°C)	N1	1-S
		N2	-
		S1	1-SD
Overpressurised	Clear liquid, boiling (VP > 1Bar), hot or cold, Low NPSHa	S3	-
		S5	-
		SR6	-
Cooled	Clear liquid, very hot (T° ≤ 400°C) Loaded liquid, very hot (T° ≤ 400°C)	R1	23-S
		F4	53-S
Filtered	Loaded liquid, hot or cold	F5	-

SPECIFICATION OF DESIGN

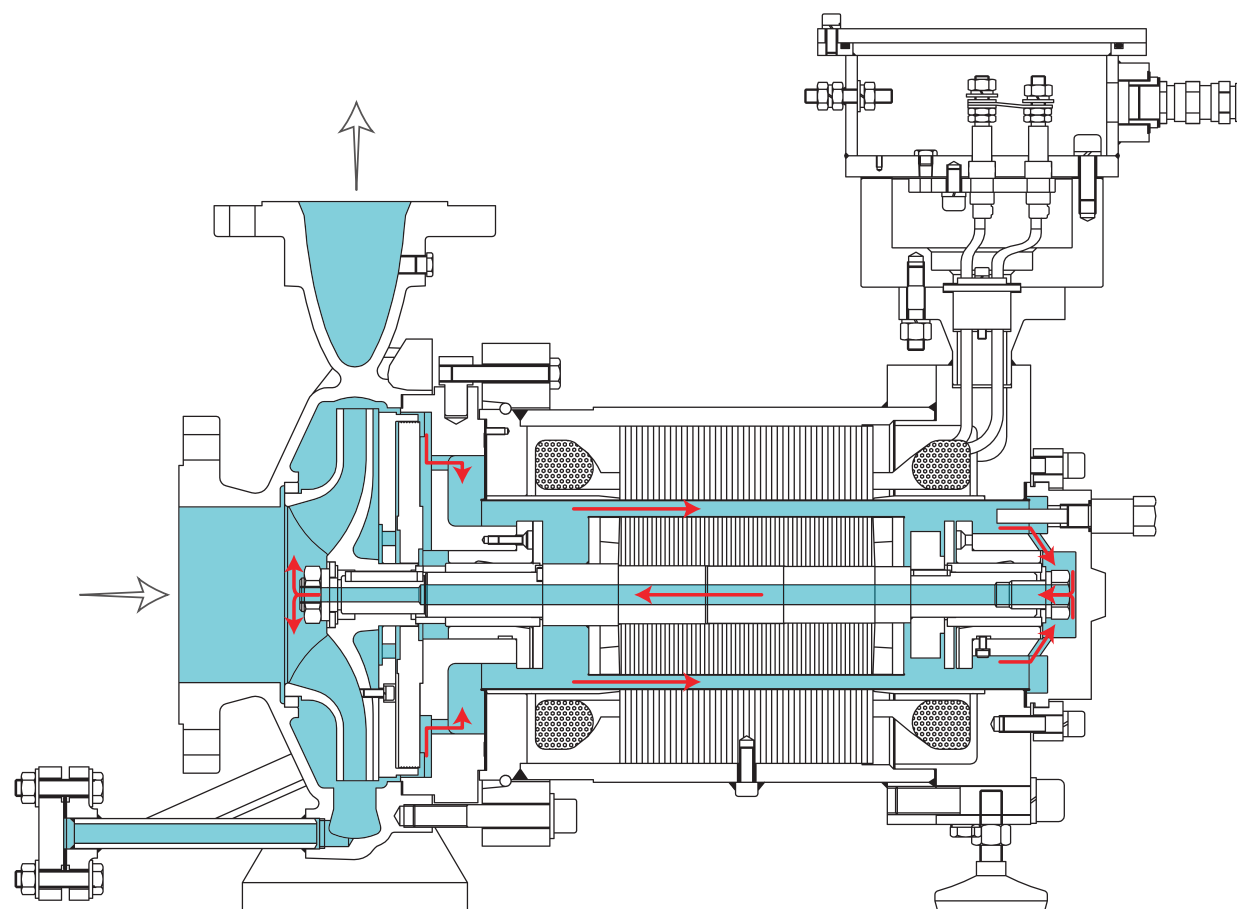


OPTIMEX CIRCULATION PLAN N1 - API 1-S

Standard single-stage pump:

- Motor cooling circulation: internal
- Liquid flowing in the rotor chamber: pumped liquid

Injection into the motor from the hydraulic casing (at the impeller periphery), circulation through the gap between the rotor and stator, and return to the pump suction via the hollow shaft.



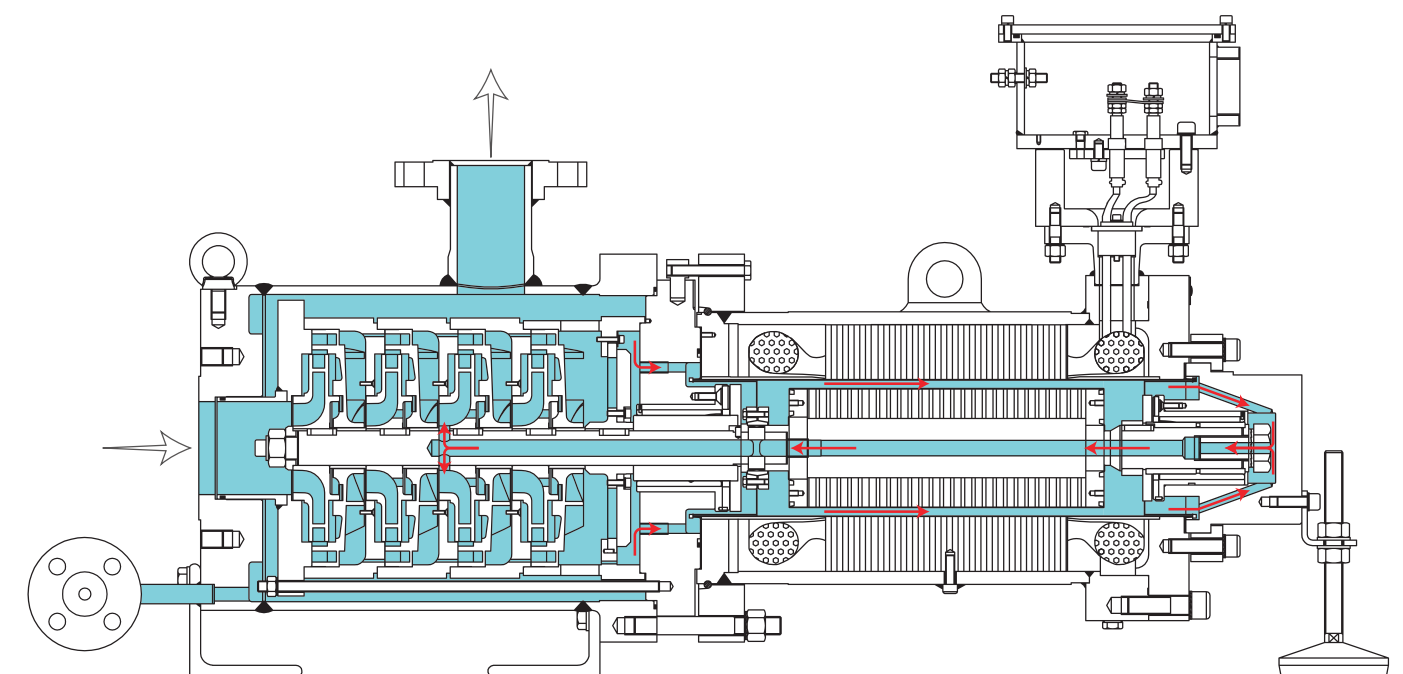
→ : Pumped liquid circulation → : Circulation inside the canned motor pump

OPTIMEX CIRCULATION PLAN N2

Standard multi-stage pump:

- Motor cooling circulation: internal
- Liquid flowing in the rotor chamber: pumped liquid

Injection into the motor from the hydraulic casing (at the impeller periphery), circulation through the gap between the rotor and stator, and return to the pump casing, in between two impellers, via the hollow shaft.



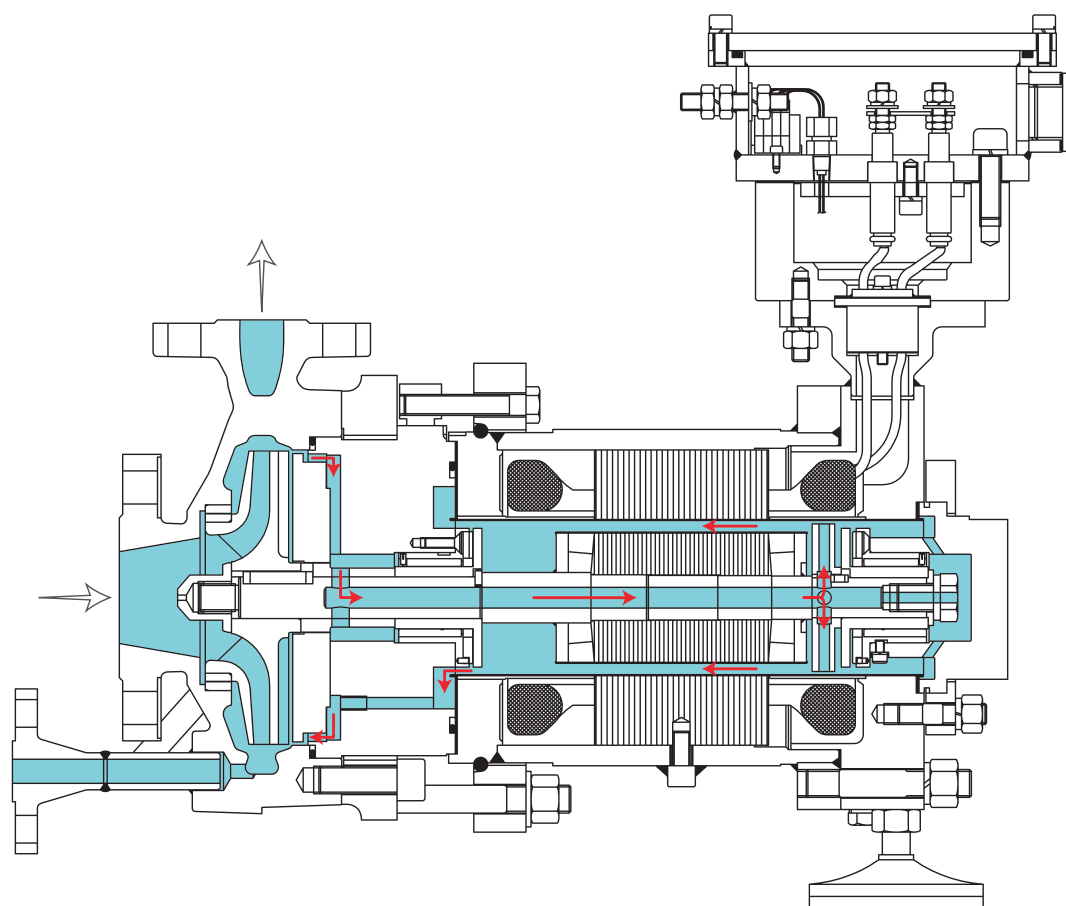
→ : Pumped liquid circulation → : Circulation inside the canned motor pump

OPTIMEX CIRCULATION PLAN S1 – API 1-SD

Single-stage pump for liquefied gas:

- Motor cooling circulation: internal
- Liquid flowing in the rotor chamber : pumped liquid

Injection into the motor from the hydraulic casing (at the impeller periphery), passage through the hollow shaft, overpressurised by an auxiliary impeller, circulation through the gap between rotor and stator and return to the hydraulic casing at the impeller periphery.



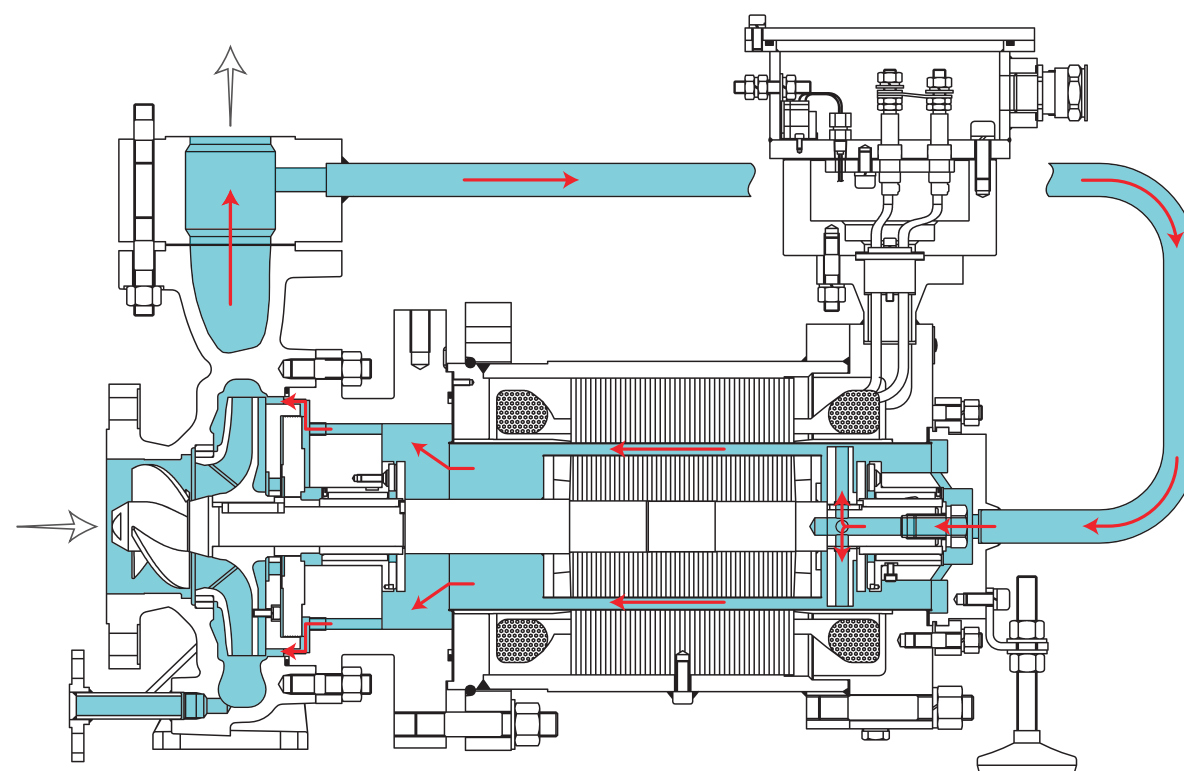
→ : Pumped liquid circulation → : Circulation inside the canned motor pump

OPTIMEX CIRCULATION PLAN S5

Single-stage pump for liquefied gas:

- Motor cooling circulation: external
- Liquid flowing in the rotor chamber : pumped liquid

Injection into the motor via an external pipe from the discharge nozzle, overpressurised by an auxiliary impeller, passage through the gap between rotor and stator and return in the hydraulic casing in a high-pressure zone at the impeller periphery.



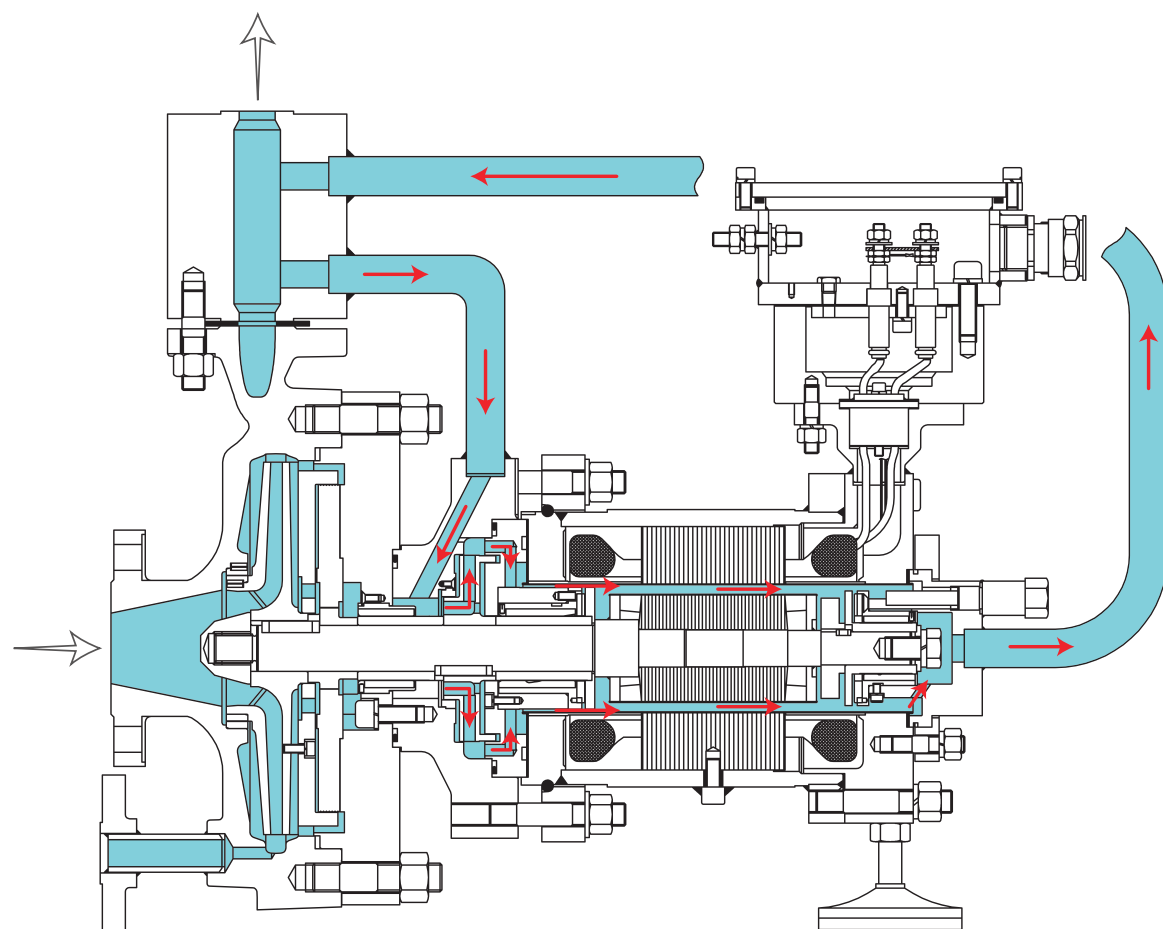
→ : Pumped liquid circulation → : Circulation inside the canned motor pump

OPTIMEX CIRCULATION PLAN S3

Single-stage pump for liquefied gas:

- Motor cooling circulation : external
- Liquid flowing in the rotor chamber : pumped liquid

Injection into the motor from the discharge nozzle, overpressurised by a large auxiliary impeller, passage through the gap between rotor and stator and return to the discharge nozzle via an external pipe.



→ : Pumped liquid circulation → : Circulation inside the canned motor pump

→ : Liquid process

OPTIMEX CIRCULATION PLAN R1 - API 23-S

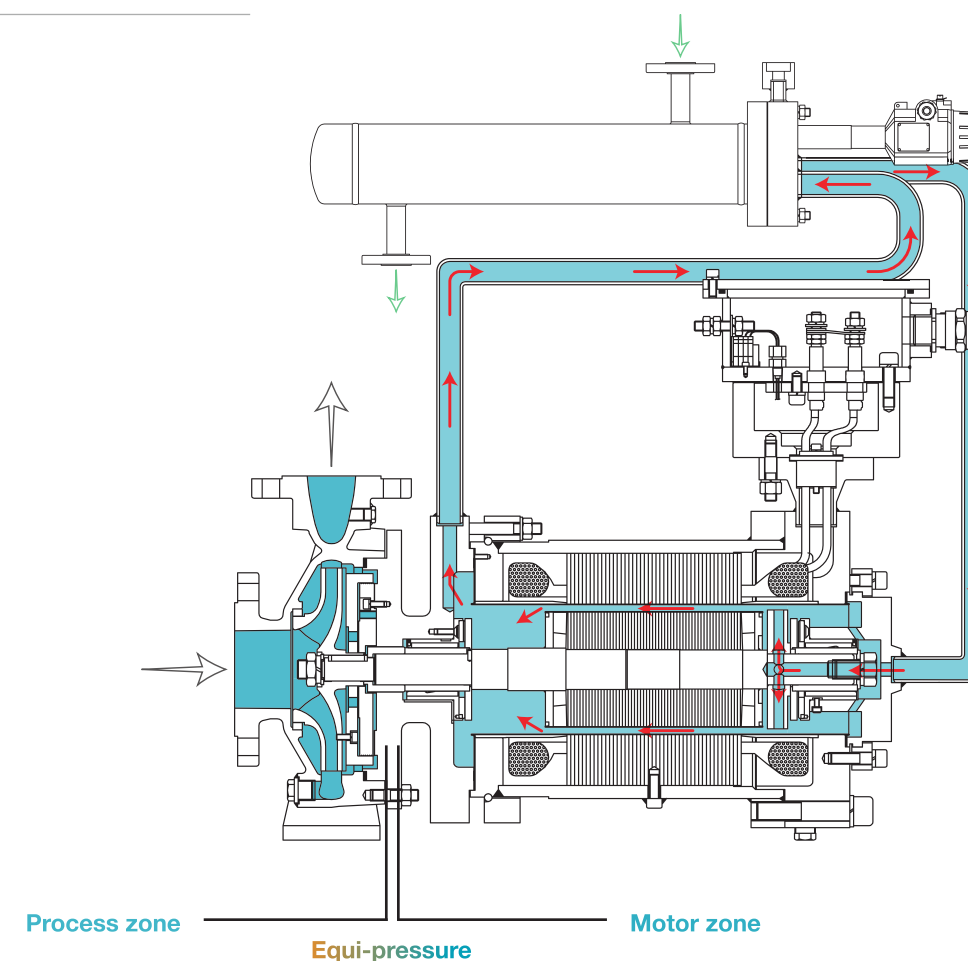
Pumps for hot liquid:

Circulation according "23-S" according to API 685: circulation with cooling loop and exchanger.

The pump can be defined in 2 main zones:

- Process zone for a hot temperature area => maxi temperature (up to 400°C)
- Motor zone for a medium temperature area => maxi temperature (up to 100°C)

Pumped liquid and motor liquid are identical and they slightly communicate in order to establish an equi-pressure between the 2 areas (high and low temperature). On the motor side the liquid circulates in an external heat exchanger, flow is established by an auxiliary impeller. A thermal barrier is built between the hydraulic casing and the motor (air or water).



→ : Cooling liquid injection → : Pumped liquid circulation → : Circulation inside the canned motor pump

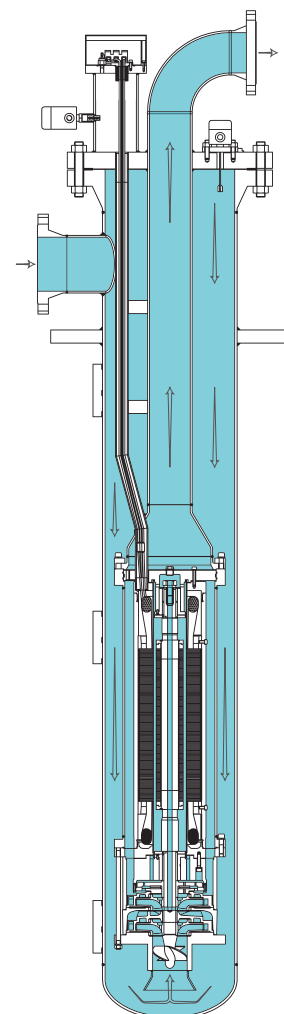
Hot liquid process :
Cooled liquid process :

OPTIMEX CIRCULATION PLAN SR6

Pump for liquefied gas with high vapour pressure:

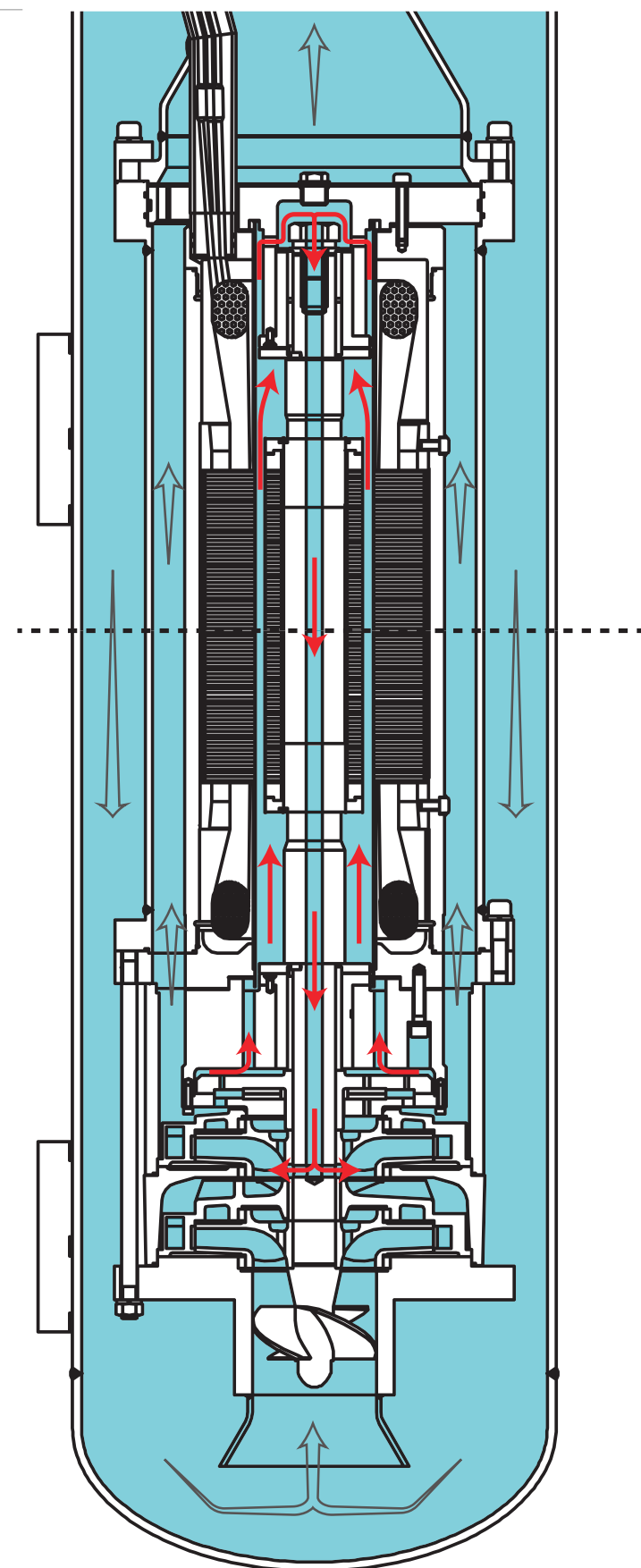
Low NPSH available, high risk of vaporisation, high static pressure, etc.

- A part of the liquid called « process flow » is discharged through a double casing around the motor, in order to dissipate calories externally, and to complement the cooling of the internal circulation.
- A second part of the liquid is injected into the motor from the hydraulic casing (at the impeller periphery), then circulates through the gap, and is re-injected back into the process flow at the front support bearing.
- This circulation plan is feasible on all type of pump.



→ : Pumped liquid circulation

: Liquid process



→ : Pumped liquid circulation → : Circulation inside the canned motor pump

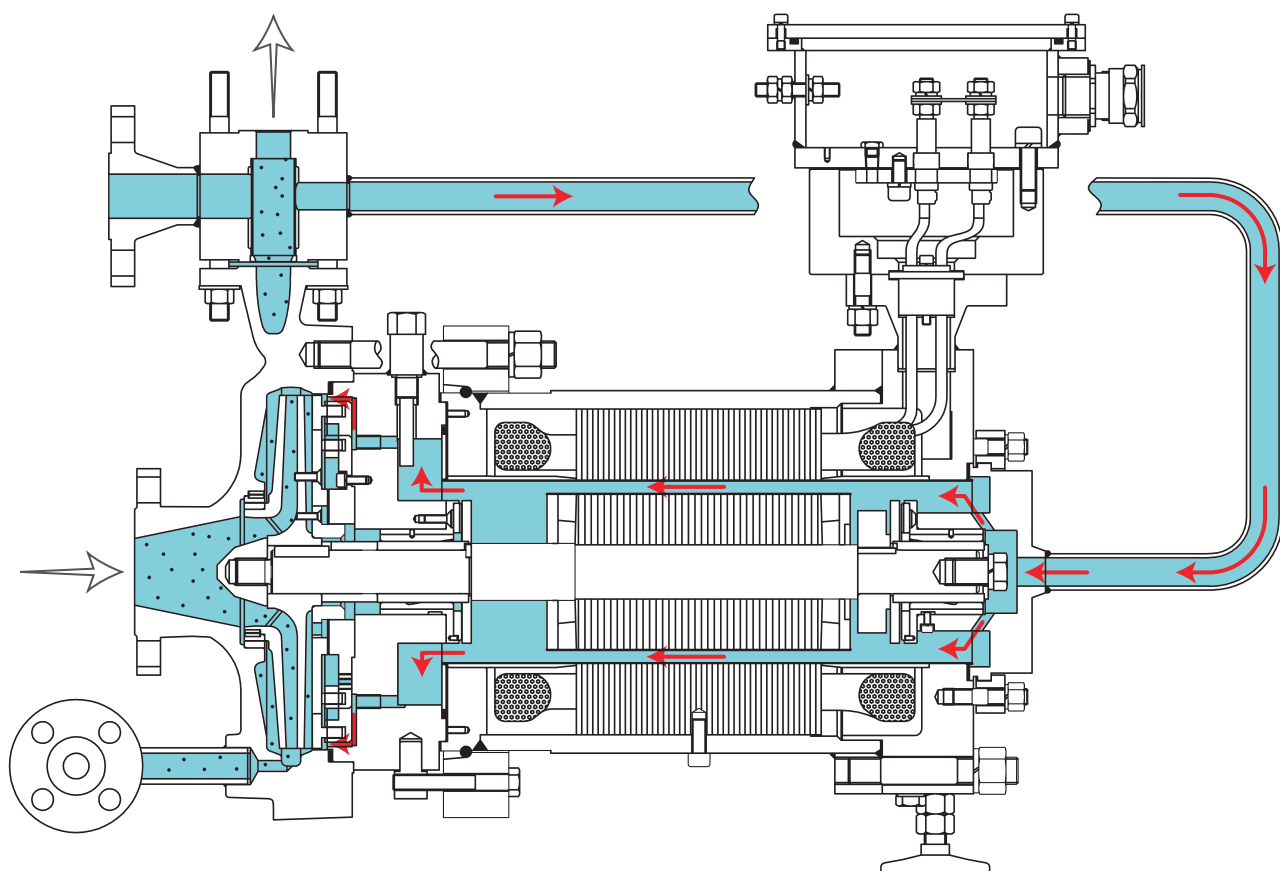
Liquid process :

OPTIMEX CIRCULATION PLAN F5

Single-stage pump for dirty liquid:

- Motor cooling circulation: external
- Liquid flowing in the rotor chamber: pumped liquid
- Particles quantity: $Q < 0.1\%$ of weight
- Particles size: $\varnothing 0.1\text{mm} < S < \varnothing 1\text{mm}$

Injection in the motor from the discharge nozzle through a self-cleaning tangential filter, overpressurised by a large auxiliary impeller, passage through the gap and return in the hydraulic casing in high pressure zone at the impeller periphery.



→ : Pumped liquid circulation → : Circulation inside the canned motor pump



OPTIMEX CIRCULATION PLAN F4 - API 53-S

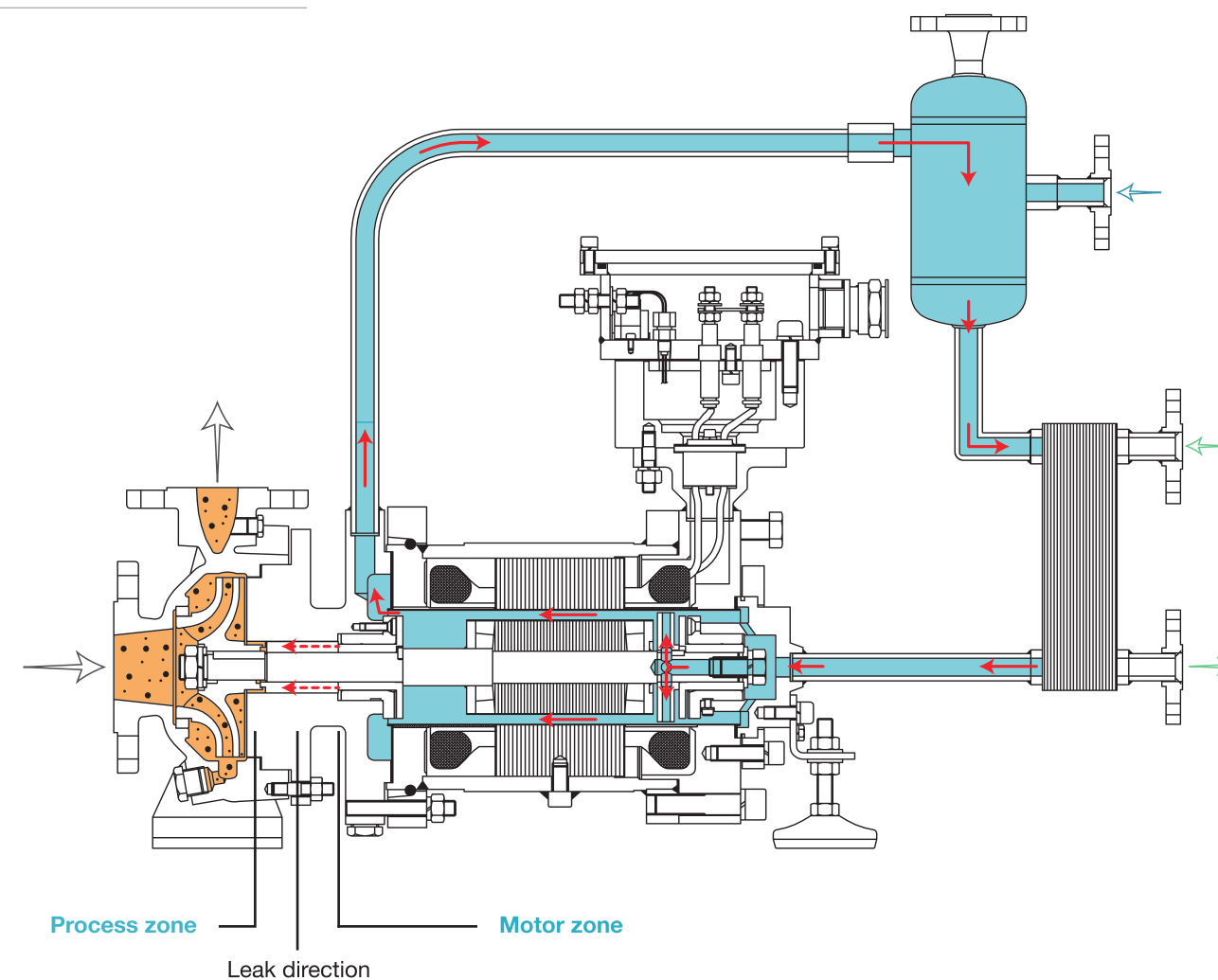
Pump for liquids with a high solids content OR for gases content:

- Motor cooling circulation: external
- Liquid flowing into the rotor chamber: external liquid

A clear liquid compatible with the process is injected into the motor. The liquid circulates through the motor in a closed loop thanks to an auxiliary impeller.

The heat from the engine is dissipated through a heat exchanger.

Injection flow and pressure are determined by OPTIMEX in order to ensure that the injected liquid leaks from the motor into the process and not the contrary.



→ : Compatible clean liquid → : Cooling liquid injection → : Pumped liquid circulation → : Circulation inside the canned motor pump

Hot & loaded process liquid :

Clear liquid :



269, rue de Montepy
69210 Fleurieux sur l'Arbresle
France

Tél : +33 (0)4 72 52 95 74
contact@optimex-pumps.com

www.optimex-pumps.com