ENGINEERING
TOMORROW

ATEX instruction

PAHT G pumps

PAHT G 2-308 Ex in dust and gas applications

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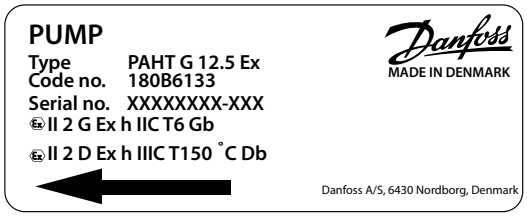
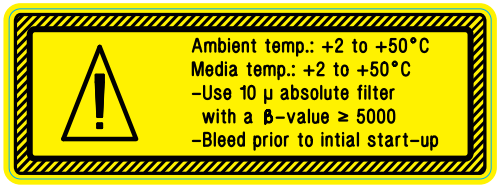
The Danfoss pumps are marked for application in "Group II Category 2 or Category 3 systems.

II 2 G Ex h IIC T6 Gb
II 2 D Ex h IIIC T150 °C Db





Example "ATEX pump label"

This document describes how to integrate a pump in a system depending on the Category demand.

Equipment groups (Annex I of the Directive 2014/34/EU)				
Group I (mines, mine gas and dust)		Group II (other explosive atmospheres gas/dust)		
Category M		Category 1	Category 2	Category 3
1	2	G (gas) (Zone 0) D (dust) (Zone 20)	G (gas) (Zone 1) D (dust) (Zone 21)	G (gas) (Zone 2) D (dust) (Zone 22)
For equipment providing a very high level of protection when endangered by an explosive atmosphere	For equipment providing a high level of protection when likely to be endangered by an explosive atmosphere	For equipment providing a very high level of protection when used in areas where an explosive atmosphere is very likely to occur	For equipment providing a high level of protection when used in areas where an explosive atmosphere is likely to occur	For equipment providing a normal level of protection when used in areas where an explosive atmosphere is less likely to occur

1. Common demands for Category 2 and 3 installations

This instruction is a supplement to existing product instruction as ATEX components are subject to some limitations compared to standard components. The limitations are described in this ATEX instruction.

Validity:
Approvals are only related to water as fluid. If other fluids are used these must be non-flammable fluids.

The pumps are designed to pump liquids and not gasses! It is the user's responsibility to ensure that the pump is fluid filled during start-up and operation.

Fluids:
If the pump is to operate on other fluids than water, please contact Danfoss. Other operation and maintenance conditions might apply.

Minimum suction pressure:
The user must always ensure that the pump is bleeded. The pumps must always be operated with a "positive head" on suction port. The allowable minimum and maximum inlet pressure for the suction port can be found in the pump data sheet.

Maximum discharge pressure:
It is the user's responsibility that the pump discharge pressure does not exceed *the max continuous discharge pressure* stated in the pump data sheet.

Temperature:
The pump is not to be operated in systems where the fluid temperature exceeds 50 °C/122 °F.

Examples of flammable gases and their belonging Gas Group and Temperature Class

Group	Gas (example)	Ignition temperature [° C]	Temperature class					
			T1	T2	T3	T4	T5	T6
I	Methane	595	x					
IIA	Propane	450		x				
	Benzene	498	x					
	Ethyl nitrite	95						x
	Methanol	440		x				
	Acetone	539	x					
	Ethane	515	x					
	Hexane	225			x			
IIB	Ethylene	440		x				
	Diethyl-ether	175				x		
	Ethylene oxide	429		x				
	Ethanol	400		x				
	Methyl ether	240			x			
IIC	Acetylene	305			x			
	Hydrogen	560		x				
	Carbon disulfide	90						x

Source: EN/IEC 60079-20-1

Classification of Dust Groups		
IIIA	Combustible flying's	e.g. cotton > 0.5 mm
IIIB	Non-conductive dust	R > 100 Ω/m
IIIC	Conductive dust	R ≤ 1000 Ω/m

Ignition temperature of dust (examples)		
Material	**Cloud [° C]**	**Layer [° C]**
Coal dust	380	225
Polythene	420	(melts)
Methyl cellulose	420	320
Starch	460	435
Flour	490	340
Sugar	490	460
Grain dust	510	300
Phenolic resin	530	> 450
Aluminium	590	> 450
PVC	700	> 450
Soot	810	570

Filtration:
The fluids entering the pump must as a minimum always be filtered according to the specification found in the pump data sheet.

External impacts due to:
Gases:
The pumps are made in materials resistant to most common gases. The user of the pump must ensure that materials used are resistant to the gases applied.

In ATEX dust applications, the layer of dust may never exceed 5 mm [0.2 inch], we recommend to paint the components in contrasting colors, to make deposits more visible. Any cleaning of surfaces, especially around polymer labels, must be carried out with a wet cloth and must be antistatic.

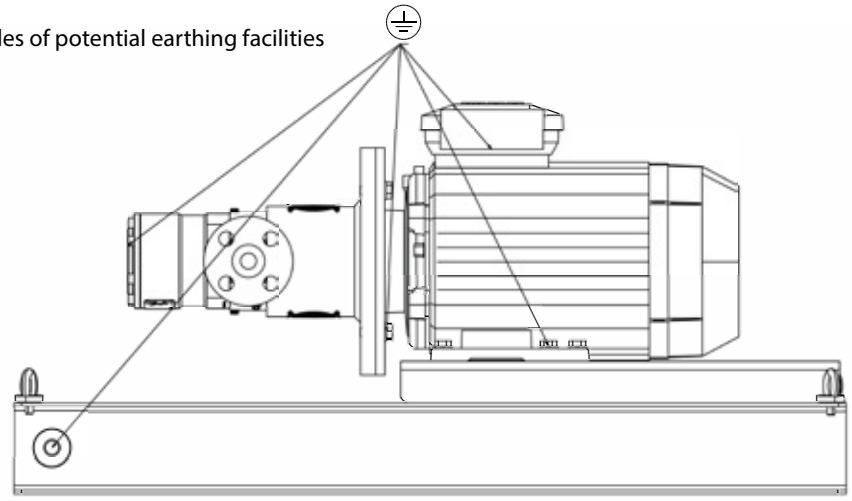
If attaching additional polymer labels, each label must not exceed a thickness of 0.2 mm and not exceed surface area of 8000 mm^2 when attached to metallic surface, and not exceed 2000 mm^2 when attached to non-metallic surfaces.

Assembly of pump drive unit:
Motor - Pump assembly and system integration:
When assembling the pump with the bell housing, flexible couplings and motor, it is the builder's responsibility that the parts used conform to the ATEX directive and that the components are assembled and running according to the operational data/design found in product data sheets and instructions.

All parts must be potential equalized:
All parts must be potential equalized by Protective earthing (PE) conductor, according to local regulations and according to IEC 60034-1. The recommended cross-sectional size of the conductor is given in the table below.
The individual parts must be equipotential bonded by a conductor or be "electrically" in contact - use of a conductor is recommended. Connection facilities shall be effectively protected against corrosion, and shall be designed so that the electrical conductors cannot be readily loosened or twisted.

Cross-sectional area of phase conductors, S mm^2	Minimum cross-sectional area of the corresponding PE conductor, Sp mm^2
$0 < S \leq 35$	16
$S > 35$	0.5 S

Examples of potential earthing facilities



Choice of bell housing and coupling
The material for the bell housing can be steel, stainless steel or aluminium with a magnesium content below 7,5%.

The bell housing must have an inspection and a drain hole. The drain hole must be placed at the lowest point to ensure the fluid can get out if there is a small leak from the pump shaft seal.

In dust applications, the bell housing, which covers the rotating parts, must minimum be an IP5x, dust proof.

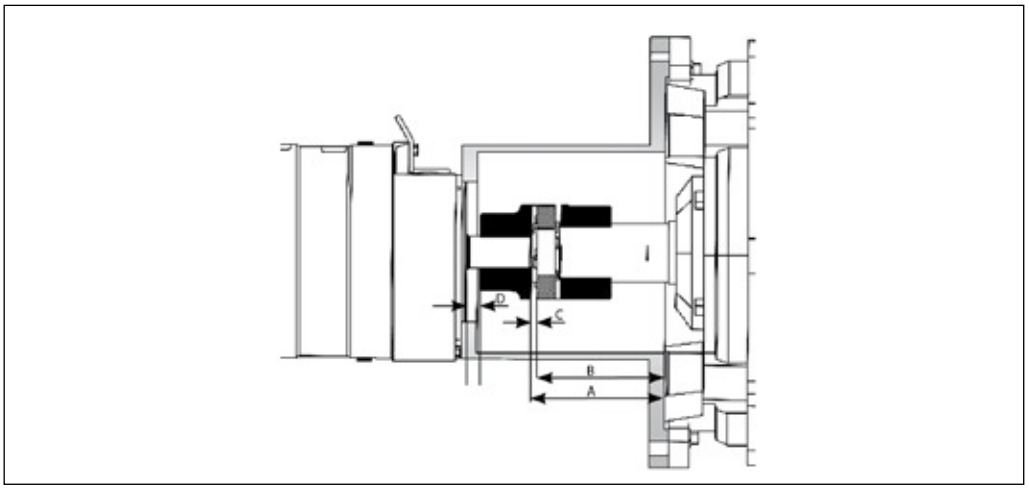
Make sure that inspection and drain holes are dust proof and we recommend often inspecting for dust or fluid accumulations.

The dust may not come in contact with rotating parts, as this can cause an increased temperature.

The distance between bell housing and the rotating parts must be at least 5 mm [0.2 inch]. Coupling for use in hazardous areas are marked with regard to the respective permissible conditions of use.

Aluminium as coupling material is generally excluded for explosive areas.

See special conditions for safe use in coupling operation- and ATEX instruction from coupling supplier.



Mounting of bell housing and coupling:
1. Mount the coupling on pump shaft. Ensure an air gap between end of coupling and pump flange of min. 4 mm [0.16 inch] “D” .
2. Mount the bell housing on pump. Secure bolts with the right torque - see pump instruction.
3. Measure the longest distance “A” from top of bell housing to the bottom of coupling claw.
4. Mount the coupling on motor shaft. Ensure the coupling and motor flange are not in contact with each other.
5. Measure from motor flange to the top of the coupling. That measurement “B” shall be 3-5 mm [0.12 - 0.2 inch] shorter than the measurement “A”.
6. Adjust respectively, verify the measurement, and secure both couplings with the right torques on the locking screws (see coupling operation & mounting instruction).
7. Mount the elastic spider and mount the bell housing/pump on the motor. After mounting it must be possible to move the elastic spider 3-5 mm [0.12 - 0.2 inch] axial “C”. The check can be done through the inspection hole of bell housing. Secure motor flange bolts with the right torque - see pump instruction.

Caution! Read the pump & coupling Installation, Operation, Maintenance instructions before mounting.

Electric motor
Motor for use in hazardous areas are marked with regard to the respective permissible conditions of use.

Marking:
Category 2, Zone 1: Ex d, Ex de, Ex e
Category 3, Zone 2: Ex nA

All rating plate values relating to certification must be carefully checked to ensure that the motor protection, atmosphere and zone are compatible.

See special conditions for safe use in electric motor operation manual and ATEX instruction.

Caution! Ensure with regular inspection the motor flange is not affected by severe corrosion.

Motors in variable speed operation:
Certain criteria must be considered to ensure that the combination of VFD and motor can be used safely. The requirements depend on the protection type in use.

The motor must be dimensioned so that its surface temperature remains at a safe level with respect to the temperature class. In most cases

this requires either combined type tests or the use of direct temperature control.

Caution! Consult motor manufacturers for right dimensioning.

Cabling and electrical connections
Suitable cable plugs must be used for the connection of all main cables.

The cable connection must fulfil the requirement stated in the national standards for installation or in the standard EN 60204-1 and EN 60079-14.

In addition, earthing or bonding connection facilities on the outside of electrical apparatus must provide effective connection of a conductor.

Caution! Read the Installation, Operation, Maintenance manual of the chosen motor to ensure all applicable warranties.

Failure modes due to operational conditions
Following operational conditions can cause a pump failure:

- Pump running dry
- Too high inlet pressure
- Too low inlet pressure
- Too high temperature of the fluid being pumped
- Too high ambient temperature
- Pump is pumping against blocked port
- Pump operate with a non-specified/ approved fluid
- Pump running the wrong direction
- Non-return valve in front of the pump inlet
- Insufficient filtration
- Pump is not being serviced accordance to Danfoss specifications.

Danfoss recommends building systems with a high inherent safety degree. The PI&D on the next pages shows how a high degree of safety can be reached when using a Danfoss pump.

2. Design guide for Category 2 (zone 1) systems

2.1 Temperature sensor

A pump breakdown/failure in a Category 2 rated system can cause increasing pump housing temperature.

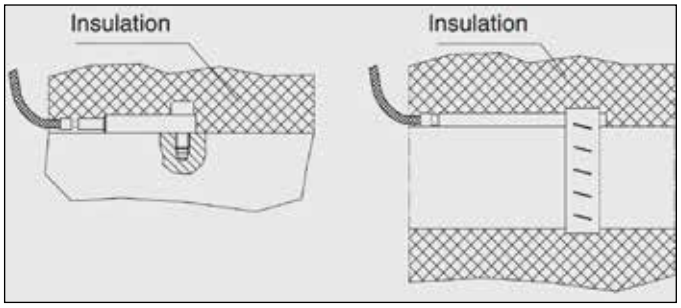
In a Category 2 system,a sensor must be mounted on the pump to monitor pump housing temperature. It's optional to use a surface sensor (S1) or screw-in sensor (S2).

The system must stop the pump if temperature sensor exceeds 60°C/140°F.

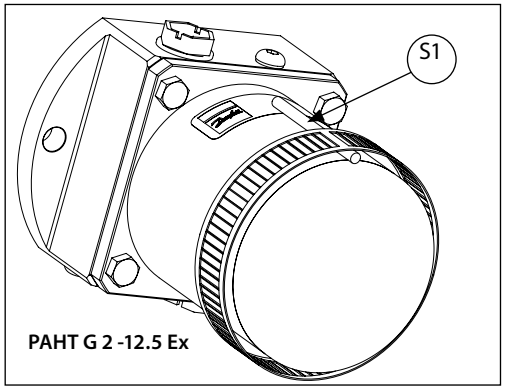
Surface temperature must never exceed 2/3 of minimum ignition temperature of the dust cloud, not even in the case of malfunctions.

The sensor can be mounted on the pump as shown in the drawings next page. Use the M6x10 (A), M8x10 (B) thread or strap to fix the temperature sensor - ensure good thermal contact between the sensor and the pump surface.

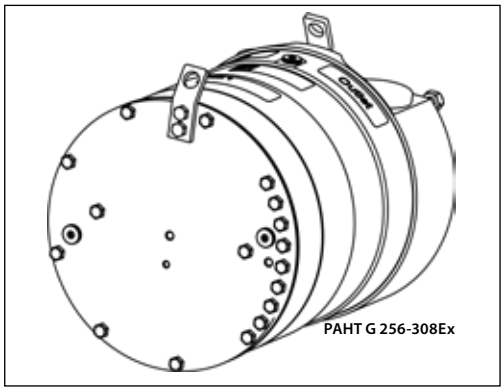
If pump unit is placed in an environment that could lead to significant heat loss, influencing the accuracy of the temperature measurement, it's recommended to use the screw-in sensor. Additional measure could be to insulate the sensor with a material having suffcient temperature resistance. This is mainly an issue if running close to the set temperature for stopping the unit.



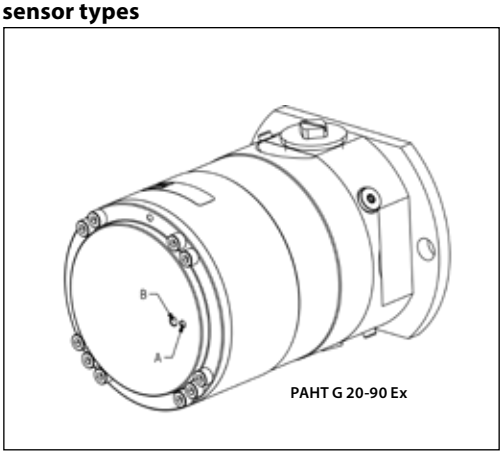
PAHT G 2 -12.5 Ex pump mounted with sensor

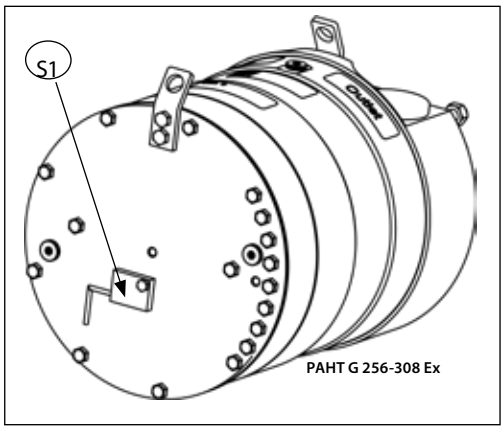


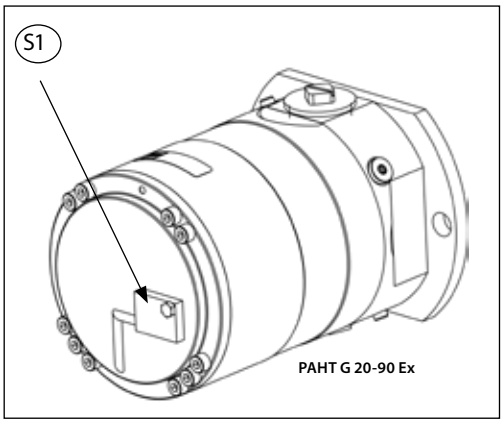
PAHT G 256 - 308 Ex without and with different sensor types

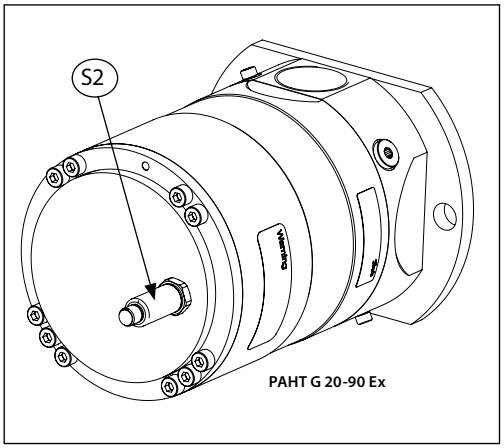


PAHT G 20 - 90 Ex without and with different sensor types









2.2 Pressure sensor

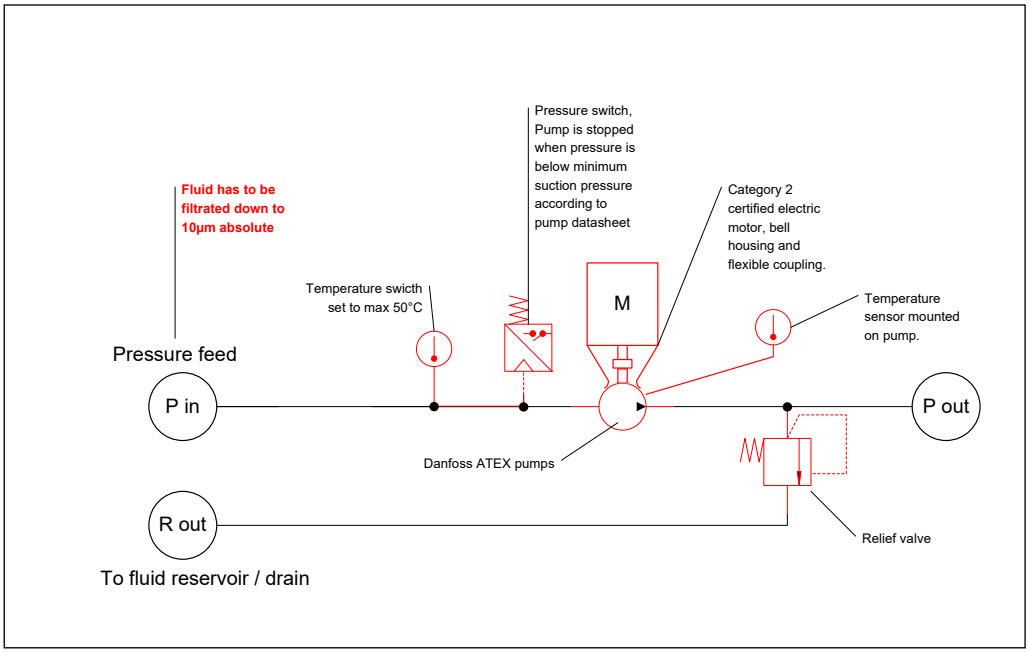
Checking whether suction port is fluid filled and fluid flows unrestricted:

To monitor if suction line is fluid filled at right pressure, a pressure switch/sensor must be placed in the pump suction port. This switch/ sensor must as a minimum be set to the minimum suction pressure specified in the pump data sheet. Pump must be stopped by system, if pressure declines below sensor pressure setting.

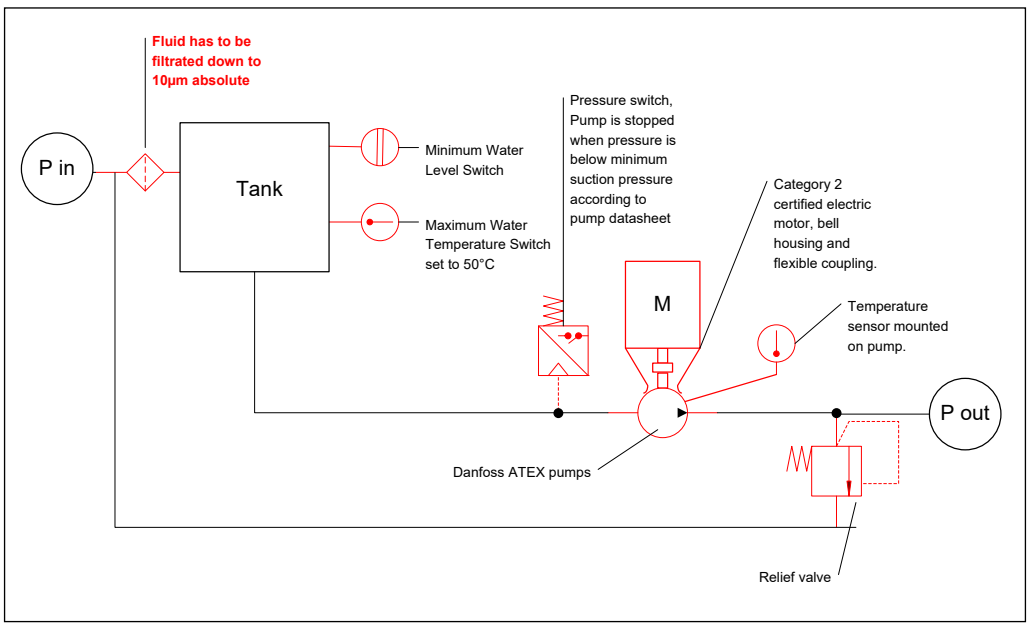
2.3 Preferred system design and P&ID for Category 2 pump

Pressure and temperature sensors are mounted due to a direct demand originating from ATEX risk evaluation.

The pump is directly fed by a pressure line (feed pump).



System where fluid is supplied from tank. Pump is placed outside the tank. Pump suction port is always below fluid level.



3. Design guide for Category 3 (zone 2) systems

3.1 Pressure sensor

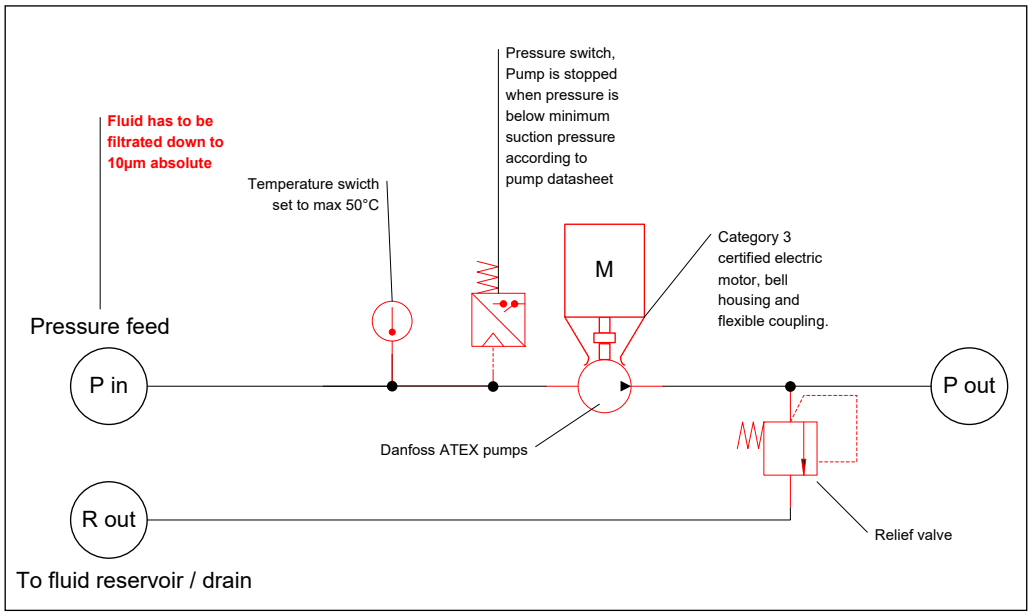
Checking whether suction port is fluid filled and fluid flows unrestricted:

To monitor if suction line is fluid filled at right pressure, a pressure switch/sensor must be placed in the pump suction port. This switch/ sensor must as a minimum be set to the minimum suction pressure specified in the pump data sheet. Pump must be stopped by system, if pressure declines below sensor pressure setting.

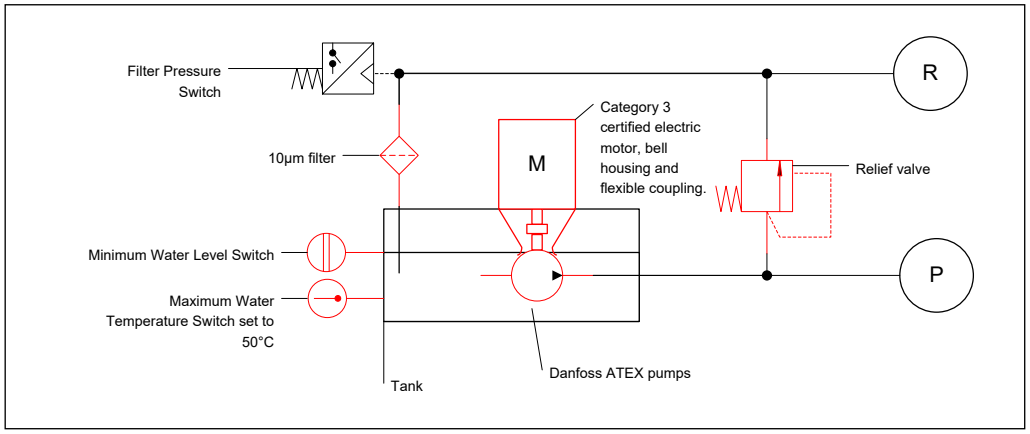
3.2 Preferred system design and P&ID for Category 3

Pressure sensor is mounted due to a direct demand originating from ATEX risk evaluation.

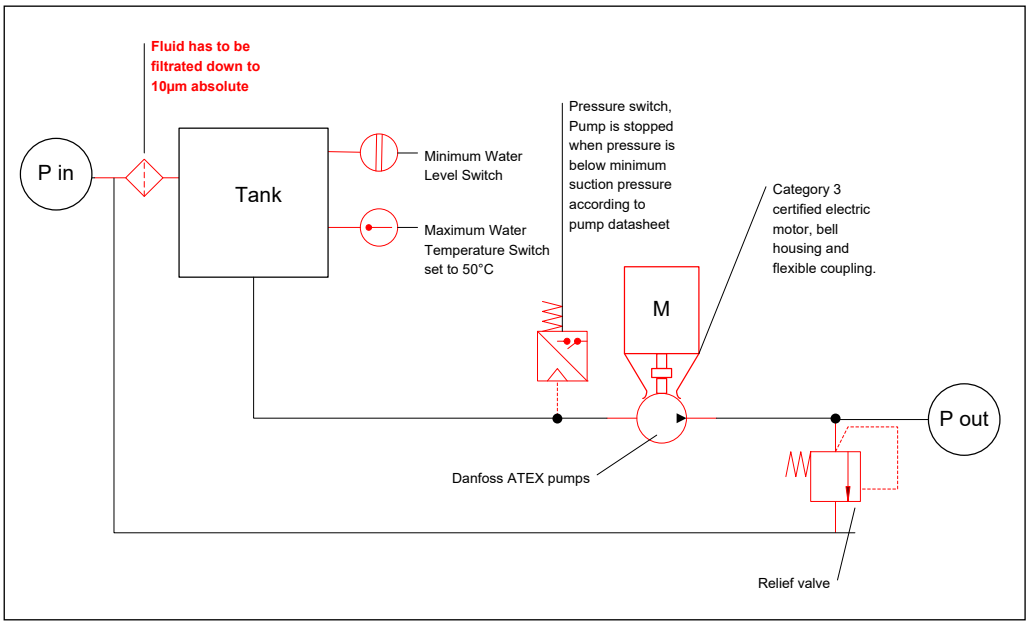
The pump is directly fed by a pressure line (feed pump).



System where fluid is supplied from tank. Pump is submerged into tank and suction port is always fluid covered.



System where fluid is supplied from tank. Pump is placed outside the tank. Pump suction port is always below fluid level.



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