Applications

SKD self-priming rotodynamic pumps with side channel and centrifugal impeller before the first stage serve to pump liquids within the corrosion resistance limits of materials used for their construction. Liquids can contain trace amounts of solid particles up to 0.5 mm in size. SKD is a self-priming pump. Pump priming is necessary but there is no need to prime its suction pipeline with liquid.

SKD pumps can pump liquid with a minimum excess pressure over boiling point. Small NPSHr net positive suction head in pumping system and very good priming ability are of particular advantage.
SKD pumps are designed to pump crude-oil derivative fuels and propane-butane mix, without gaseous phase fraction.

Technical specifications

capacity	0,2 ÷ 30 m^3/h
delivery head	up to 310 m *
pumped liquid temperature	-40°C ÷ +180°C
liquid density	up to 1,3 kg/dm^3
liquid viscosity	up to 150 mm^2/s
mass	37,0 ÷ 436,0 kg
motor power	0,25 ÷ 30,0 kW
rotation speed	1450 obr/min (50 Hz) and 1800 obr/min (60 Hz)
rotations direction	clockwise, looking on the pumps from drive side

*) Delivry head is lowered by 10-20% for hot liquids from +70°C do +110°C.

Product marking structure

S	K	D	6	0	8	1	1	6	1	0	5	0	0	2	1
a	a	f	b	c	c	d	e_1	e_2	e_3	e_4	h	i	i	i	k

a a	- classification group
f	- product variety (D - fot work with deep suction)
b	- pump type/size (2 ÷ 8)
c c	- pump type/dimension (number of stages) (01 ÷ 08)
d	- pump material execution as in MATERIAL EXECUTION
e_1 e_2 e_3 e_4	- pump constructional execution as in CONSTRUCTIONAL EXECUTION
h	- supply completeness as in SUPPLY COMPLETENESS
i i i	- motor type
k	- product cosmetics as in PRODUCT COSMETICS (protective coatings)

Material execution of SKD pumps

SKD pumps are produced in eight material executions ***

Pump elements	Material "d"							
	1	2	3	4	5	6 **	7	8
Casing	gray cast iron	tin bronze	gray cast iron	gray cast iron	ductile cast iron	freezeproof ductile cast iron	cast carbon steel	austenitic cast steel
Members	gray cast iron	chromium cast iron	gray cast iron	chromium cast iron	gray cast iron	freezeproof ductile cast iron	cast carbon steel	austenitic cast steel
Impeller	tin bronze	tin bronze	ductile cast iron	tin bronze	tin bronze	tin bronze	tin bronze	special austenitic cast steel
Shaft	stainless steel	acid-proof steel	stainless steel	acid-proof steel	stainless steel	stainless steel	stainless steel	acid-proof steel
Shaft seal	soft-cord seal *							
	mechanical front seal *							

* seal material selection depends upon medium pumped

** minimum working temperature -40°C

*** pumps can be made of other materials (high-nickel cast iron, cast steel) but this requires technical and trade agreements

Constructional execution

Constructional execution No e_1 e_2 e_3 e_4	Constructional execution	SKD pump						
		2	3	4	5	6	7	8
			●	●	●	●	●	●

1030	Pump with cord seal and chamber for -30°C ÷ +70°C liquid temperature							
1040	Pump with cord seal and chamber for -30°C ÷ +70°C liquid temperature	●						
1110	Pump with single front V-type seal for -30°C ÷ +70°C liquid temperature	●	●	●	●	●	●	●
1130	Pump with single front seal of US-type for -30°C ÷ +70°C liquid temperature		●	●	●	●	●	●
1140	Pump with single front seal of VB-type for -30°C ÷ +70°C liquid temperature		●	●	●	●	●	●
1160	Pump with single front seal of 502-type for -40°C liquid temperature	●	●	●	●	●	●	●
1200	Pump with single front seal of 502-type and repair kit, for -30°C ÷ +70°C liquid temperature	●	●	●	●	●	●	●
1360	Pump with single front seal of V-type with quenching for -30°C ÷ +70°C liquid temperature	●	●	●	●	●	●	●
1380	Pump with single front seal of US-type with quenching for -30°C ÷ +70°C liquid temperature		●	●	●	●	●	●
1390	Pump with single front seal of VB-type with quenching for -30°C ÷ +70°C liquid temperature		●	●	●	●	●	●
1400	Pump with single front seal of 502-type with quenching for -30°C ÷ +70°C liquid temperature	●	●	●	●	●	●	●
1430	Pump with single front seal of 502-type with quenching and repair kit for -30°C ÷ +70°C liquid temperature	●	●	●	●	●	●	●
1600	Pump with double front seal in BACK TO BACK V + V-type System with barrier liquid for -30°C ÷ +70°C liquid temperature	●	●	●	●	●	●	●
1610	Pump with double front seal in BACK TO BACK V + VB-type System with barrier liquid, for -30°C ÷ +70°C liquid temperature		●	●	●	●	●	●
1630	Pump with double front seal in BACK TO BACK V + US-type System with barrier liquid for -30°C ÷ +70°C liquid temperature		●	●			●	●
1640	Pump with double front seal of BED-type for -30°C ÷ +70°C liquid temperature		●	●	●	●	●	●
1650	Pump with double front seal of BED-type with buffer/barrier liquid system for -30°C ÷ +70°C liquid temperature		●	●	●	●	●	●
5160	Pump with single front seal of 502-type for -40°C ÷ +70°C liquid temperature	●	●	●	●	●	●	●
5640	Pump with double front seal of BED-type for -40°C ÷ +70°C liquid temperature		●	●	●	●	●	●
5650	Pump with double front seal of BED-type for -40°C ÷ +180°C liquid temperature		●	●	●	●	●	●

Supply completeness

1 - Pump with free shaft end.
2 - Pump with coupling.
3 - Pump with coupling and foundation plate.
5 - As in 3 plus electric motor.

Product cosmetics

1 - Standard
2 - Special

Design

At SKD pumps suction side there is an axial inlet of increased diameter, outlet opening at the discharge side is directed vertically upwards. Before the first stage at the suction side a centrifugal impeller and stator are applied. Pump stages are typical circulation pump stages with side channels and open impellers. Encased ball bearings and an appropriate shaft seal are located at the pump discharge side. Depending on pump purpose and constructional execution a front seal is used, among others things, to ensure total tightness.

The front seal can be lubricated and flushed with pumped or outside liquid. In LPG-execution pumps a special sealing LOCTITE-573 mass is applied, in other executions 0.11 mm thick gaskets are used between stages. LPG pumps are subject to a special test for tightness and mechanical strength. The SKD pump is additionally equipped with a diffuser installed on its suction housing, and with a circulation pipe through which the slide bearing placed in pump stator is lubricated by liquid contained in the pump when it pumps air from suction pipeline.

Features:

- many years of reliable operation and easy access to replacement parts guaranteed,
- execution of individual requirements and products adjusted to customer's needs,
- permanent technical supervision as well as guarantee and post-guarantee service,
- low procurement and operation costs,
- relatively long life in difficult operation conditions,
- high resistance against changeable climatic conditions, including operation in extreme ambient conditions,
- cooperation with underground tanks.

Technical requirements for hydraulic system in the liquid hydrocarbons pumping process (propane-butane liquefied gas)

Liquid compounds like propane-butane and other mixtures are subject to specific laws of physics. Propane-butane liquefied gas is a mixture of upper saturated hydrocarbons characterized with high vapour pressure dependence on ambient temperature. In normal physical conditions (1013 hPa, 20°C) they are heavier than air (gas density is higher than air density) and when their outflow is uncontrolled, they trail close to the ground surface filling all hollows in. In its volatile phase the gas is highly inflammable and when mixed with air creates a very dangerous explosive mixture. In its liquid phase it is lighter than water and, when evaporating, floats on the surface. Passing from liquid to the volatile phase in a free space begins at -30°C (50/50 propane/butane mixture). To keep the propane-butane mix in liquid state during the whole distribution process and especially at the pump first stage impeller inflow, liquid pressure must be subjected to any excess pressure A_p in relation to its value determined from the liquid evaporation curve.

Pumps working conditions

To ensure undisturbed pumping process and pump operation, the following basic equation conditions must be fulfilled:

$H_{zs} = -(NPSH_r + \Delta h_s)$ [m]

Δh_s	hydraulic losses in suction pipeline (m)
H_{zs}	geometrical inflow height (n)
$NPSH_r$	required net positive suction head as specified by the manufacturer to guarantee proper pump operation (m)

When the required Hzsvalue calculated for the complex (LPG station) in the technical project is not met, it will lead to pump destruction. Destruction of the front mechanical seals on the pump shaft, pump slide bearing and the whole hydraulic system (impellers and members) is likely. A properly designed pumping system must fulfil the conditions:

$NPSH_{av} > NPSH_r$ [m]

$NPSH_{av}$	available net positive suction head in pumping system [m]

H_{zs} inflow height can be optimized through Δh_s hydraulic losses reduction in suction (inflow) pipeline and this is the only parameter in which we can interfere.

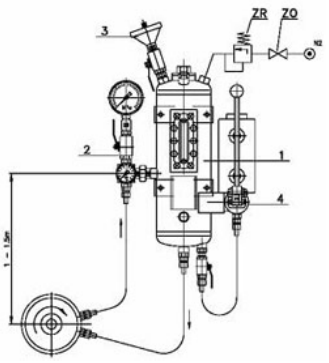
Technical requirements

When performing the installation, the following technical requirements should be observed:

- strive to limit flow resistance in the suction pipe to the minimum,
- do not change the pipe section area just before the pump through the installation of elbows, filters, dampers or reducers,
- to calm gas stream down, a pipe section before a pump of 20 pipeline diameters length is absolutely necessary.

Inflow height Hzs [m] specified on the basis of geometrical formula must be unconditionally kept. The ball valve at the pump discharge side must be half-open during pump switch-off. When the ball valve is fully open a danger of total gas evaporation exists (pump will operate off its catalogue operating range). Both ball bearings: in the pressure equalization conduit at the suction side to the tank and at the suction side must be fully open. One should be absolutely sure that the pump is filled with liquid gas during the pump start up.

To ensure that the pump is primed with gas, fitting a ball valve downstream in discharge, flow meter or flow gauge conduit is recommended,

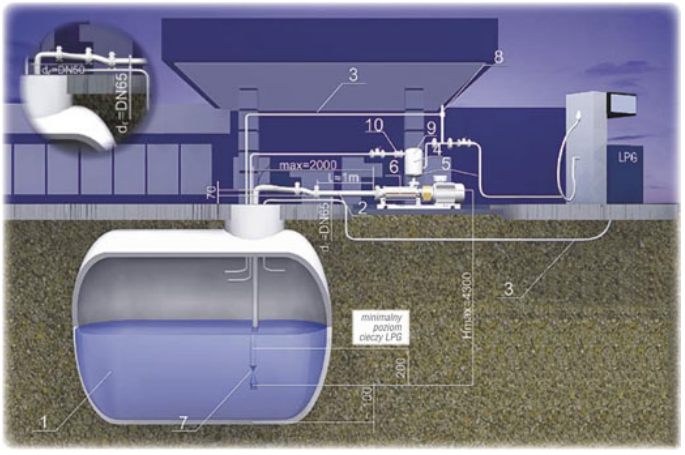


- suction pipeline should be as short as possible so as to protect the whole pumping system against outside heat,
- gas flow velocity in suction pipeline should not exceed 1 m/s,
- if liquids are contaminated, a filter should be installed in the pipeline,
- free filter crossing area must be at least three times larger than rated pump inlet diameter,
- the filter should be periodically cleaned,
- suction pipeline minimum diameter should be at least equal to pump connector diameter (dr>ds) on the whole pipeline length (from tank outlet to pump connection),
- gas flow direction is marked on the pump with arrows,
- the pipe system must be made in such a way which enables stress-free pipe to pump connection (use of compensators is recommended),
- the pipe system should be carefully cleaned from welding chips, file dust, rust and similar foreign matter before its connection to the pump,
- when the pump is used in an explosion-endangered area, the equipment used must fulfil the appropriate safety rules in force,
- motor rotation direction must be the same as pump rotation direction (as shown on pump suction housing).

Observe local regulations on electrical equipment,

- motor rotation direction: left when looking at the pump from motor side,
- after pump is set on the foundation and line-connected, check coupling setting.

Example schematic diagram of SKD pump application in cooperation with underground tank

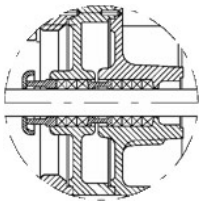


1. - storage tank
2. - inflow suction pipeline
7. - discharge pipeline
8. - bypass valve

3. - gas phase pipeline
4. - gas phase separator
5. - discharge pipeline
6. - pump
9. - pressure gauge
10. - orifice plate
11. - valve

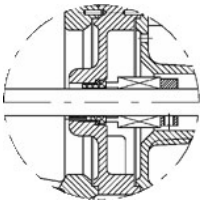
Note: Suction pipeline must be insulated against warming by sunbeams.

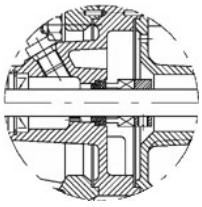
SKD pumps shaft sealing systems



System of cord seal with chamber

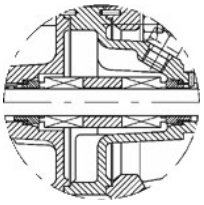
System of front single seal





System of front single seal with quenching

System of front double seal in BACK TO BACK arrangement with barrier liquid



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