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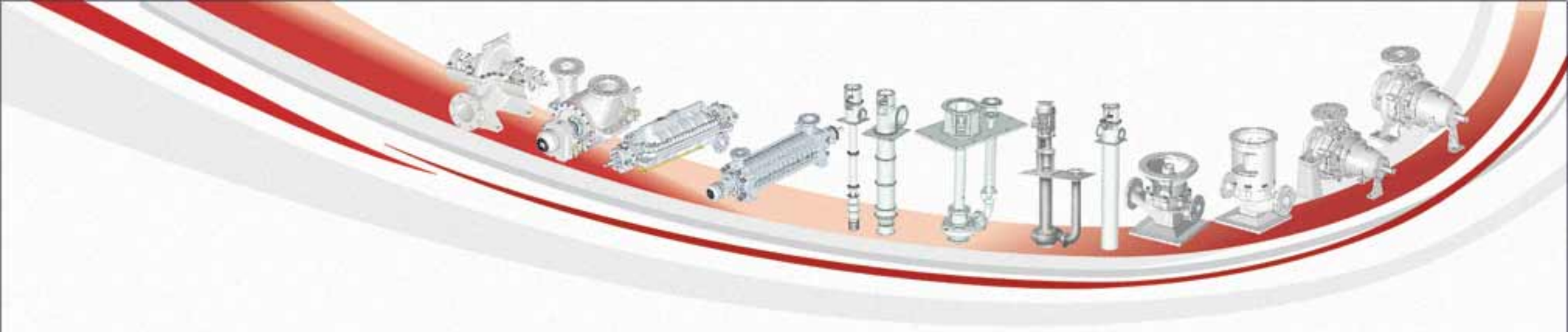
Pumps

High Technology Pumps
For the Oil, Gas, Petrochemical
And process Industries

API Standard 610



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Pumps

Berkeh Co. is a solution provider of pump products and services focused exclusively in the centrifugal API 610 pump market. We offer a portfolio of API products that covers most applications in the petroleum refinery, petrochemical gas processing, oil processing, offshore (platform) installation, hydrocarbon and crude oil pipeline.

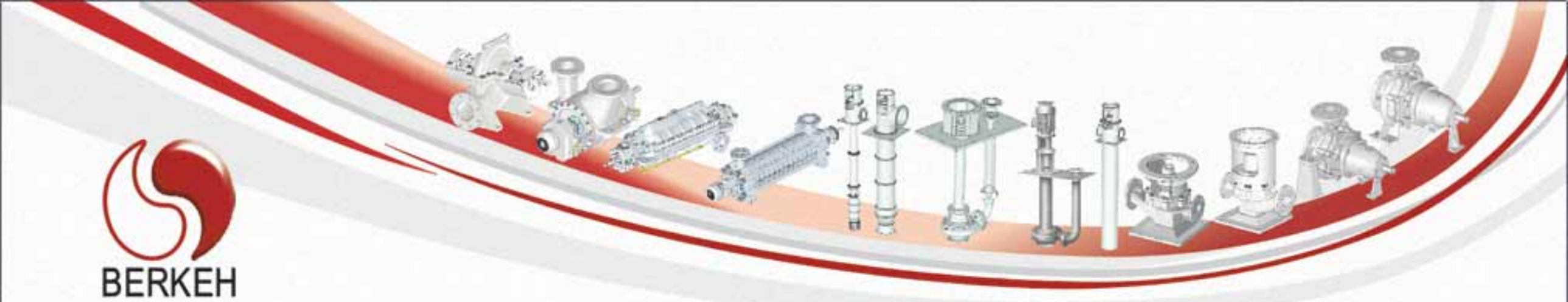
As the **Berkeh Co.** we have been dedicated to offering our services to those industries that value and need high performances.

- Oil and gas industry
- Chemical processing industry
- Water sewage resources
- Power plant
- General industry

Berkeh Co. give great value to the special request and needs of our esteemed customer. The satisfaction of our customer is just as important as the quality of our services. Combining vast experiences in the manufacture and supply of pumps and spare and a dedication to customer-oriented solution, our aim is to deliver innovative products and services that help our customer to meet and exceed their business goals.

Berkeh is a leading manufacturer of pumps for general industrial, chemical and petrochemical application. We provide engineered-to-order solution, customized to fit your exact requirement according to highest international industry standard and cutting edge technology.

Our pump features are designed to increase efficiency and the life of the pump. Optional features and material selection according to API 610 can be added to improve the design for higher temperature and corrosion resistance application.



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Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries

1-Pump classification type identification

Pump type			Orientation		Type code
Centrifugal pumps	Overhung	Flexibly coupled	Horizontal	Foot-mounted	OH1
				Centerline- supported	OH2
			Vertical in-line with bearing bracket		OH3
		Rigidly coupled	Vertical in-line		OH4
		Close- coupled	Vertical in-line		OH5
	Between-bearings	1-and 2- stage	Axially split		BB1
			Radially split		BB2
		Multistage	Axially split		BB3
			Radially split	Single casing	BB4
	Vertically suspended	Single casing	Discharge through column	Diffuser	VS1
				Axial flow	VS3
			Separate discharge	Line shaft	VS4
				Cantilever	VS5
		Double casing	Diffuser		VS6

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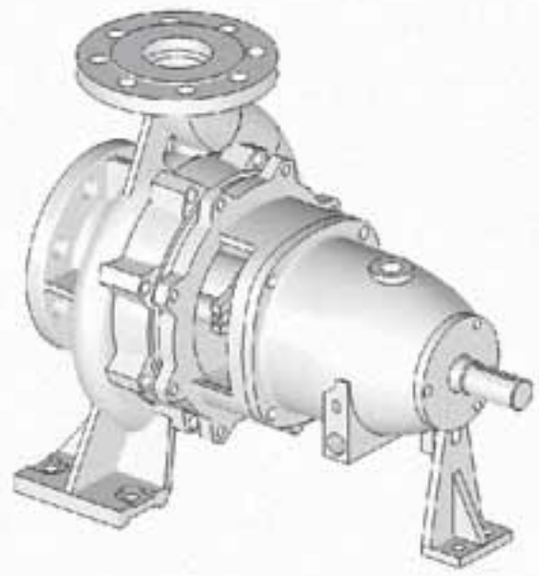
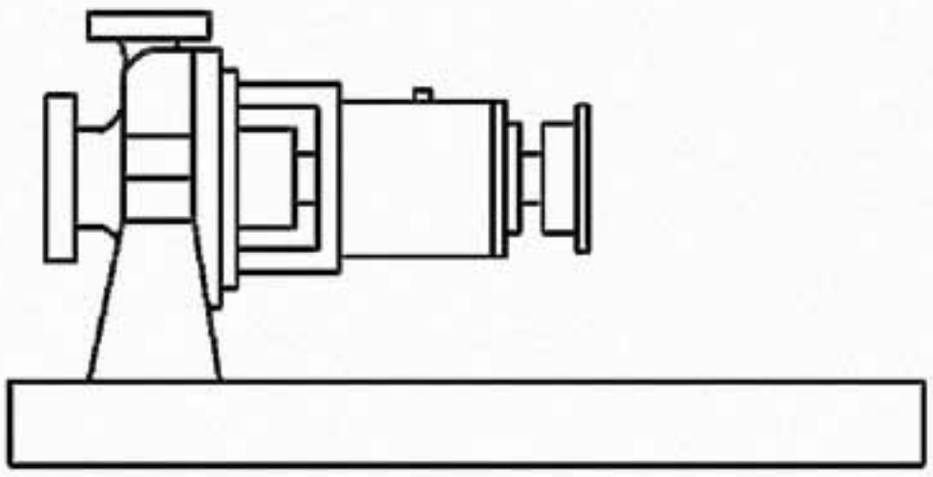
2- Pump designations

Pump type OH1

Foot-mounted single-stage overhung pumps shall be designated pump type OH1.

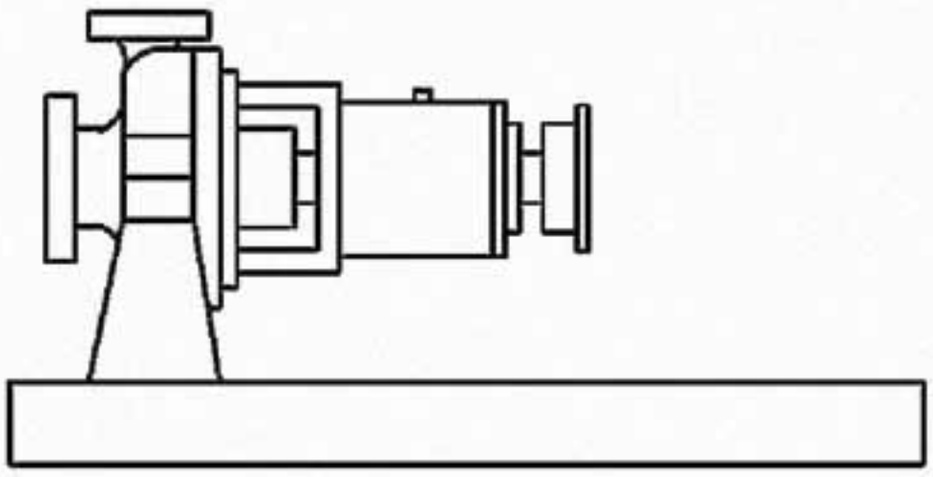




Flange Size:	1 ½" up to 12"
Head:	Up to 140 m
Capacity:	Up to 1600 m³/h

Pump type OH2

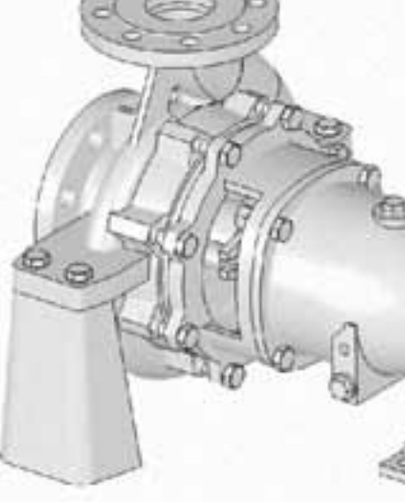
Centerline-mounted single-stage overhung pumps shall be designated pump type OH2. They have a single bearing housing to absorb all forces imposed upon the pump shaft and maintain rotor position during operation. The pumps are mounted on a base plate and are flexibly coupled to their drivers.

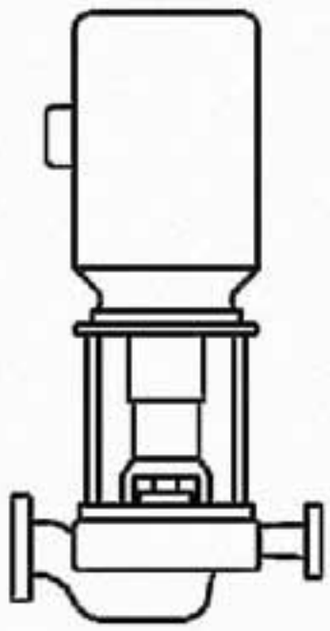


Flange Size:	1 ½" up to 12"
Head:	Up to 140 m
Capacity:	Up to 1600 m³/h

Pump type OH3

Vertical in-line single-stage overhung pumps with separate bearing brackets shall be designated pump type OH3. They have a bearing housing integral with the pump to absorb all pump loads The driver is mounted on a support integral to the pump. The pumps and their drivers are flexibly coupled.





Flange Size:	1 ½" up to 10"
Head:	Up to 140 m
Capacity:	Up to 800 m³/h

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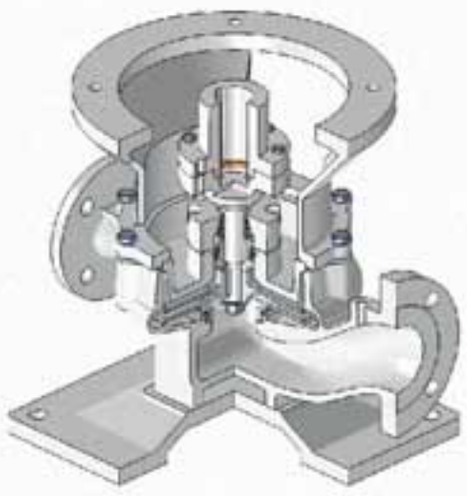
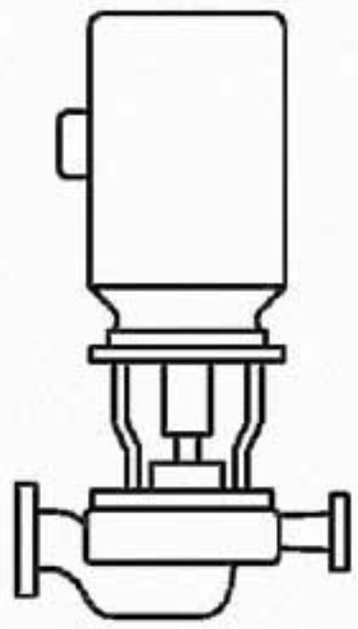
Pump type OH4

Rigidly coupled vertical in-line single-stage overhung pumps shall be designated pump type OH4. Rigidly coupled pumps have their shaft rigidly coupled to the driver shaft.

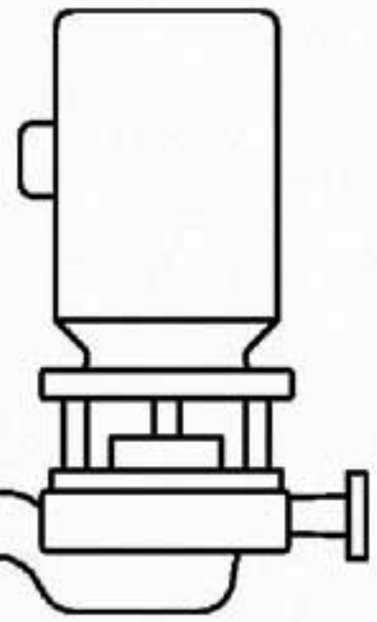




Flange Size:	1 ½" up to 10"
Head:	Up to 140 m
Capacity:	Up to 800 m³/h

Pump type OH5

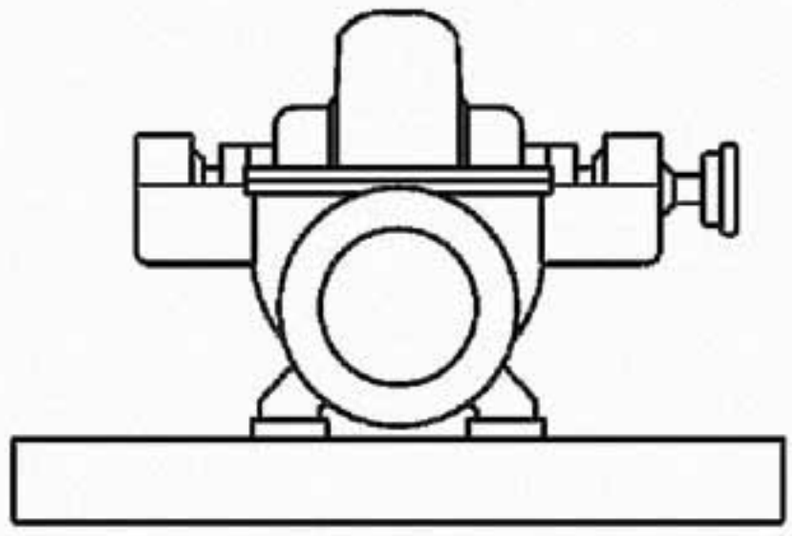
Close-coupled vertical in-line single-stage overhung pumps shall be designated pump type OH5. Close coupled pumps have their impellers mounted directly on the driver shaft.



Flange Size:	1 ½" up to 10"
Head:	Up to 140 m
Capacity:	Up to 800 m³/h

Pump type BB1

Axially split one- and two-stage between-bearings pumps shall be designated pump type BB1.



Flange Size:	3" up to 12"
Head:	Up to 300 m
Capacity:	Up to 2500 m³/h

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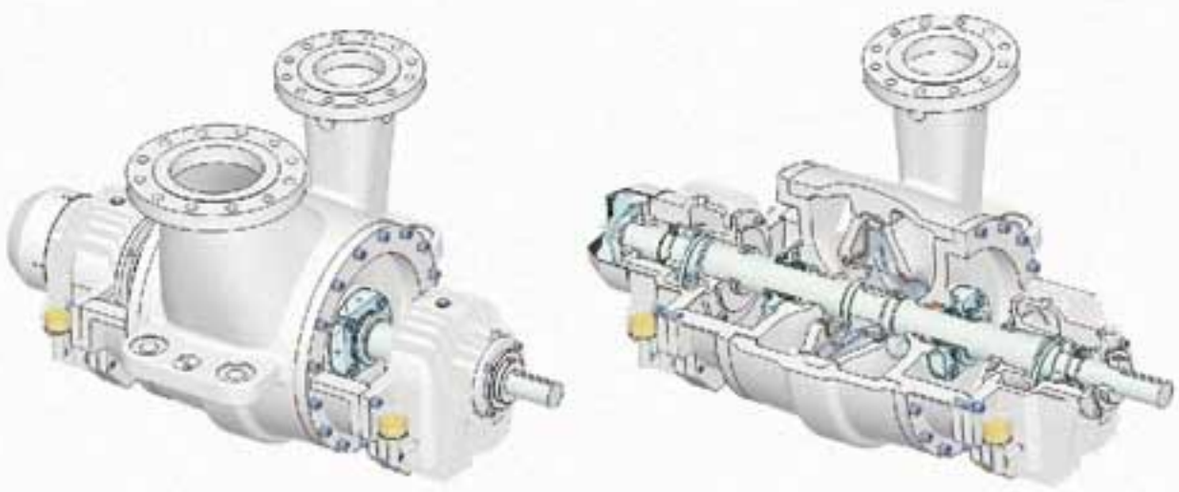
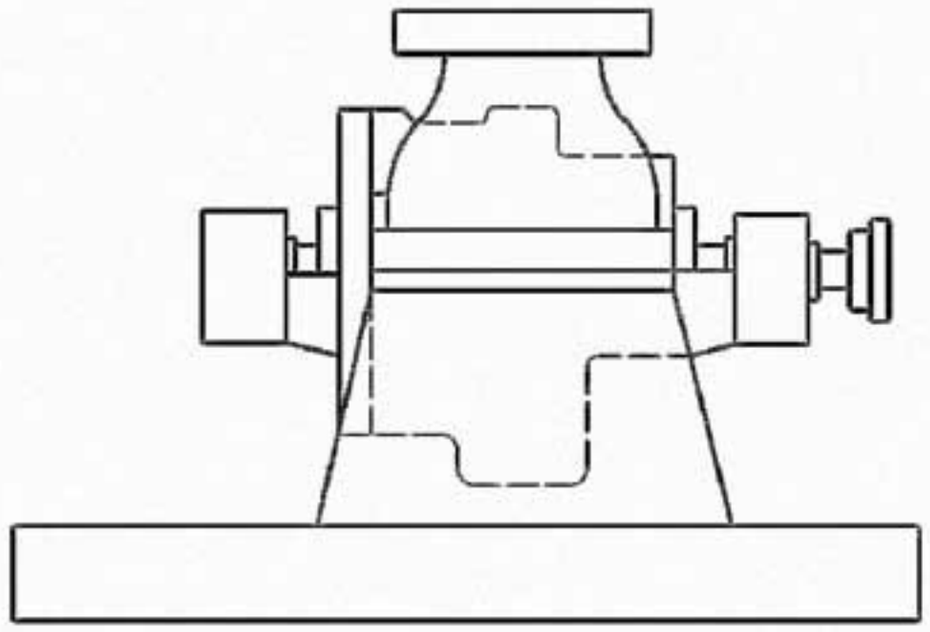
Pump type BB2

Radially split one- and two-stage between-bearings pumps shall be designated pump type BB2.

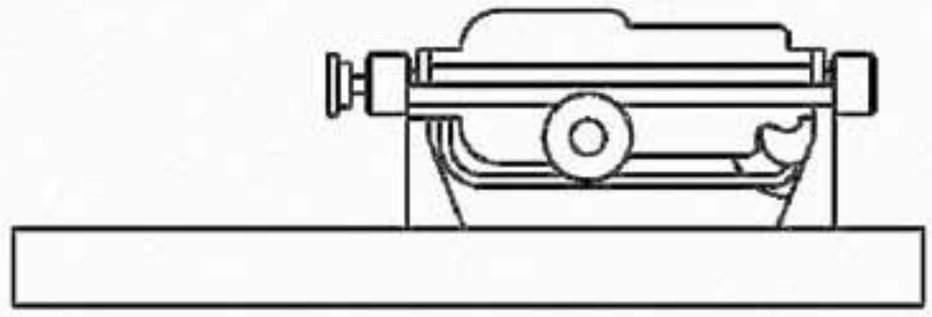




Flange Size:	3" up to 12"
Head:	Up to 300 m
Capacity:	Up to 2500 m³/h

Pump type BB3

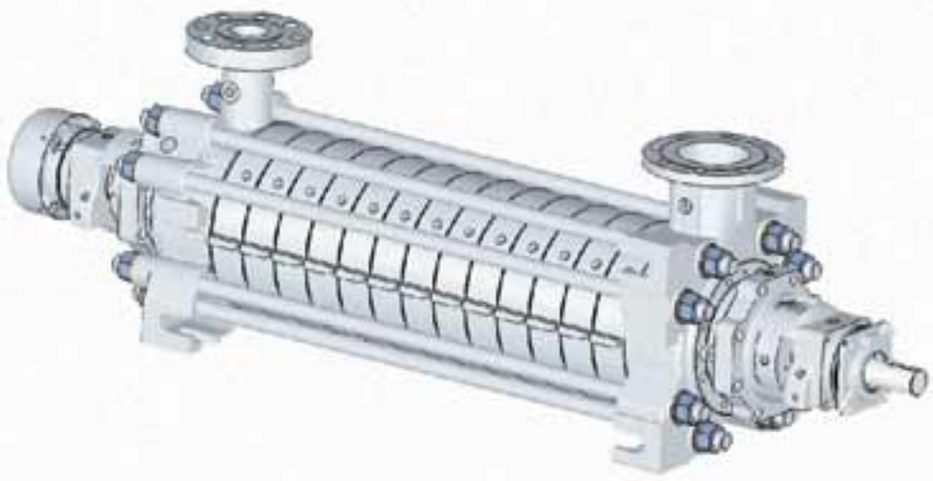
Axially split multistage between-bearings pumps shall be designated pump type BB3.

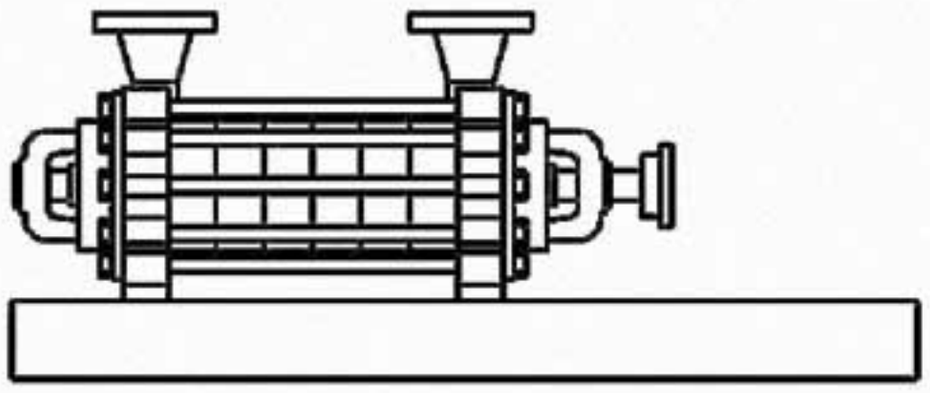


Flange Size:	1 1/2" up to 8"
Head:	Up to 800 m
Capacity:	Up to 500 m³/h

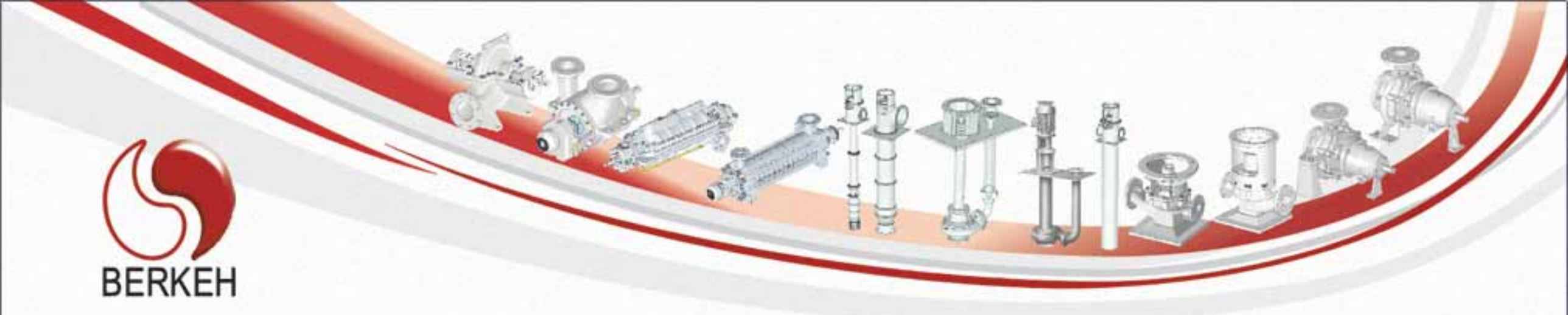
Pump type BB4

Single-casing radially split multistage between-bearings pumps shall be designated pump type BB4. These pumps are also called ring-section pumps, segmental-ring pumps or tie-rod pumps. These pumps have a potential leakage path between each segment.





Flange Size:	1 1/2" up to 8"
Head:	Up to 800 m
Capacity:	Up to 500 m³/h



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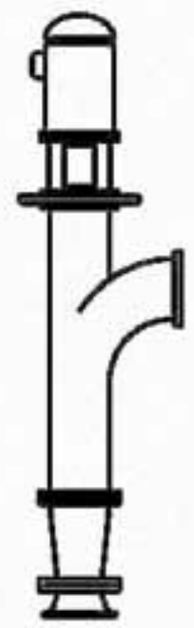
Pump type VS1

Wet pit, vertically suspended, single-casing diffuser pumps with discharge through the column shall be designated pump type VS1.

Flange Size:	4" up to 14"
Head:	Up to 120 m
Capacity:	Up to 1000 m³/h

Pump type VS3

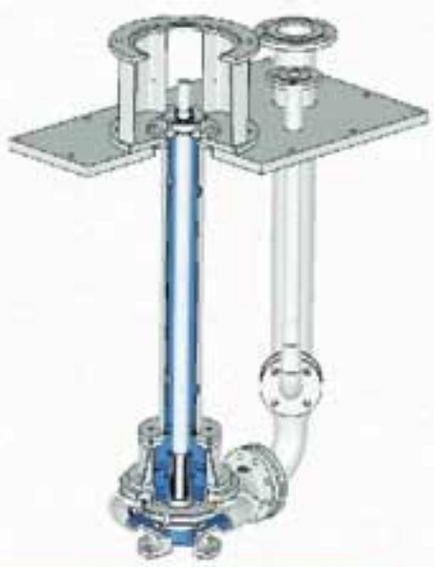
Wet pit, vertically suspended, single-casing axial-flow pumps with discharge through the column shall be designated pump type VS3.



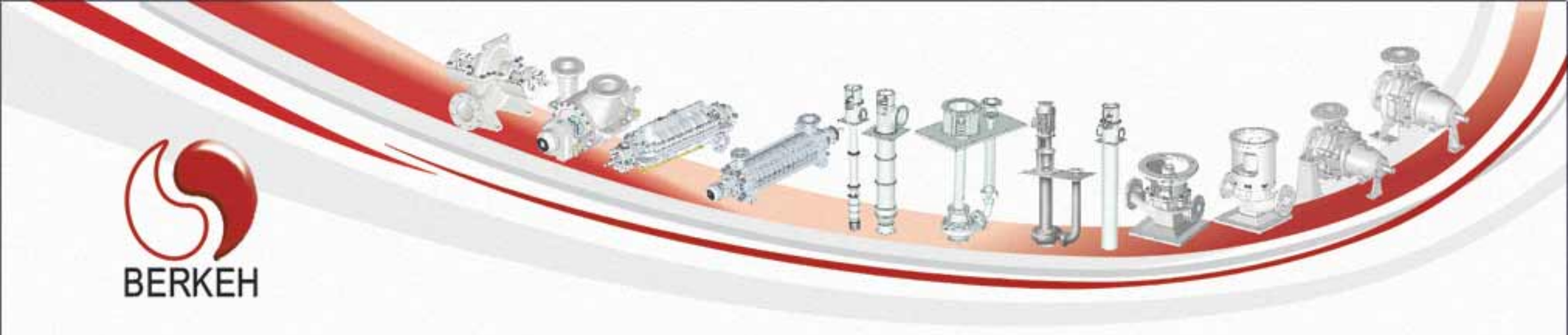
Flange Size:	12" up to 32"
Head:	Up to 25 m
Capacity:	Up to 6000 m³/h

Pump type VS4

Vertically suspended, single-casing volute line-shaft driven sump pumps shall be designated pump type VS4.



Flange Size:	1 1/2" up to 10"
Head:	Up to 90 m
Capacity:	Up to 1200 m³/h



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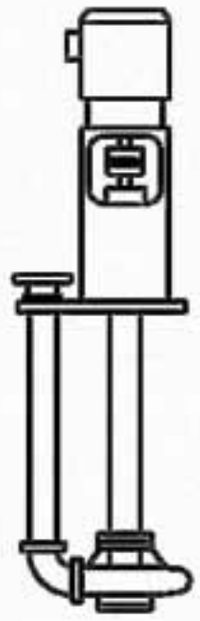
Pump type VS5

Vertically suspended cantilever sump pumps shall be designated pump type VS5.

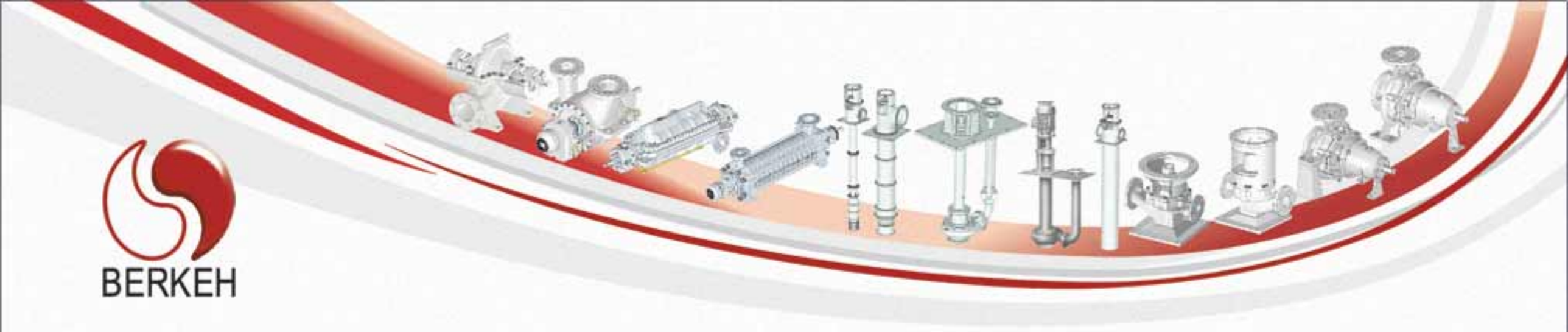


Flange Size:	1 1/2" up to 10"
Head:	Up to 90 m
Capacity:	Up to 1200 m³/h

Pump type VS6

Double-casing diffuser vertically suspended pumps shall be designated pump type VS6.

Flange Size:	1 1/2" up to 10"
Head:	Up to 90 m
Capacity:	Up to 1200 m³/h



3. Nozzles and pressure casing connections

3.1 Casing opening sizes

3.1.1 Openings for nozzles and other pressure casing connections shall be standard pipe sizes.
Openings of DN 32, 65, 90, 125, 175 and 225 (NPS 1 1/4, 2 1/2, 3 1/2, 5, 7 and 9) shall not be used.

3.1.2 Casing connections other than suction and discharge nozzles shall be at least DN 15 (NPS ½) for pumps with discharge nozzle openings DN 50 (NPS 2) and smaller. Connections shall be at least DN 20 (NPS 3/4) for pumps with discharge nozzle openings DN 80 (NPS 3) and larger, except that connections for seal flush piping and gauges may be DN 15 (NPS 1/2) regardless of pump size.

3.2 Suction and discharge nozzles

3.2.1 Suction and discharge nozzles shall be flanged, except those on pumps with forged casings, which shall be flanged or machined and studded. One- and two-stage pumps shall have suction and discharge flanges of equal rating.

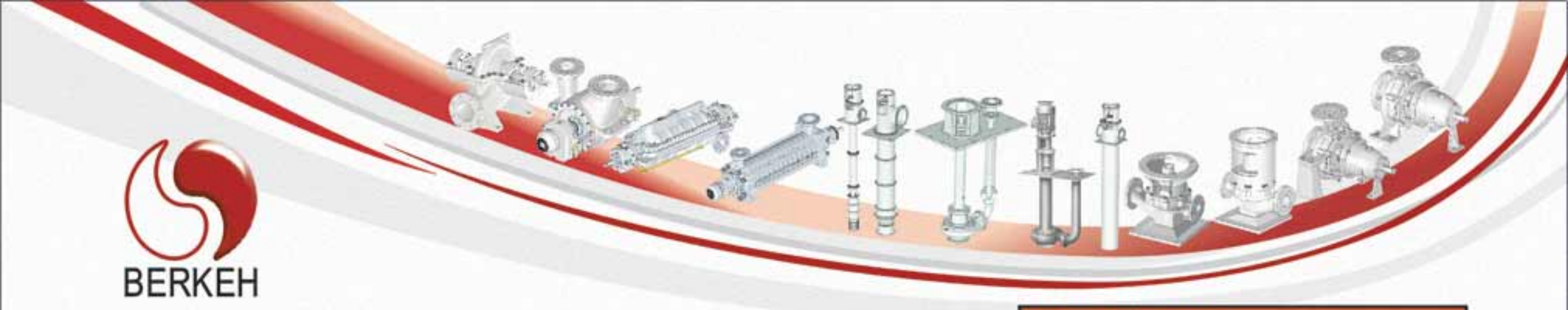
3.2.2 Cast iron flanges shall be flat-faced and, except as noted in 5.4.2.4, conform to the dimensional requirements of ISO 7005-2 and the flange finish requirements of ASME B16.1 or ASME B16.42. PN 20 (Class 125) flanges shall have a minimum thickness equal to that of PN 40 (Class 250) flanges for sizes DN 200 (NPS 8) and smaller.

3.2.3 Flanges other than cast iron shall, as a minimum requirement, conform to the dimensional requirements of ISO 7005-1 PN 50 except as noted in 5.4.2.4 and the flange finish requirements of ASME B16.5 or ASME B16.47.

NOTE For the purpose of this provision, ASME B16.5 Class 300 and ASME B16.47 Class 300 are equivalent to ISO 7005-1 PN 50.

3.2.4 Flanges in all materials that are thicker or have a larger outside diameter than required by the relevant ISO (ASME) standards in this International Standard are acceptable. Non-standard (oversized) flanges shall be completely dimensioned on the arrangement drawing. If oversized flanges require studs or bolts of non-standard length, this requirement shall be identified on the arrangement drawing.

3.2.5 Flanges shall be full faced or spot faced on the back and shall be designed for through bolting, except for jacketed casings.



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4. Mechanical Seal

Type of seal:

-Type A Pusher

-Type B Bellows

-Type C Bellows

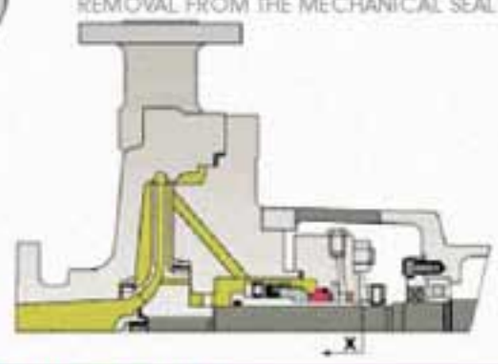
Mechanical seal code as per sta.: API 682

PLAN 01 SINGLE SEALS

VIEW X

INTERNAL CIRCULATION FROM THE PUMP DISCHARGE TO THE SEAL

PRODUCT PUMPED IS CLEAN, GOOD LUBRICATION PROPERTIES AND HEAT REMOVAL FROM THE MECHANICAL SEAL



PLAN 02 SINGLE SEALS

VIEW X

DEAD END SEAL CHAMBER WITH NO CIRCULATION. PLUGGED CONNECTIONS FOR POSSIBLE FUTURE CIRCULATION AND QUENCH

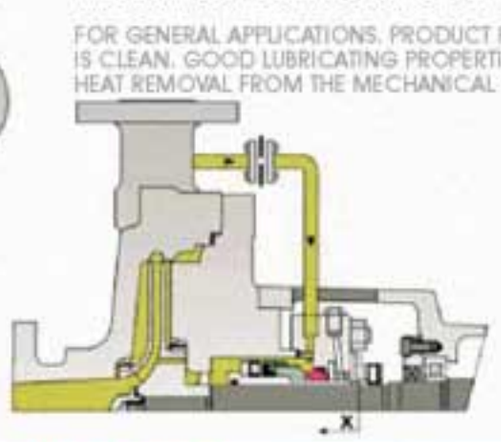
STUFFING BOX COOLING AND NECK BUSH ARE NECESSARY, UNLESS OTHERWISE SPECIFIED

PLAN 11 SINGLE SEALS

VIEW X

RECIRCULATION FROM PUMP DISCHARGE THROUGH FLOW CONTROL ORIFICE TO THE SEAL

FOR GENERAL APPLICATIONS. PRODUCT PUMP IS CLEAN. GOOD LUBRICATING PROPERTIES AND HEAT REMOVAL FROM THE MECHANICAL SEAL



PLAN 12 SINGLE SEALS

VIEW X

RECIRCULATION FROM PUMP DISCHARGE THROUGH A STRAINER AND FLOW CONTROL ORIFICE TO THE SEAL

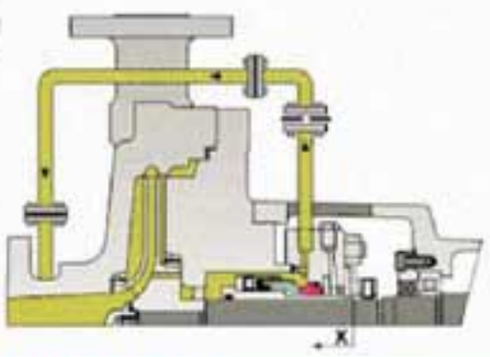
USED WHEN THE PRODUCT BEING PUMPED IS DIRTY (STRAINER CLOGS)

PLAN 13 SINGLE SEALS

VIEW X

RECIRCULATION FROM PUMP SEAL CHAMBER THROUGH A FLOW CONTROL ORIFICE AND BACK TO THE SEAL

USED WHERE THE STUFFING BOX PRESSURE IS AT DISCHARGE PRESSURE (MAINLY VERTICAL PUMPS)

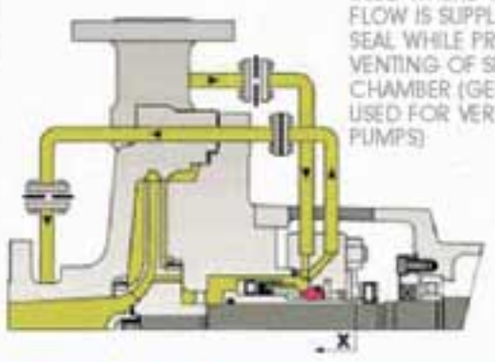


PLAN 14 SINGLE SEALS

VIEW X

RECIRCULATION FROM PUMP DISCHARGE THROUGH A FLOW CONTROL ORIFICE TO THE SEAL AND SIMULTANEOUSLY FROM THE SEAL CHAMBER THROUGH A CONTROL ORIFICE TO PUMP SUCTION

USED WHERE COOLING FLOW IS SUPPLIED TO SEAL WHILE PROVIDING VENTING OF SEAL CHAMBER (GENERALLY USED FOR VERTICAL PUMPS)

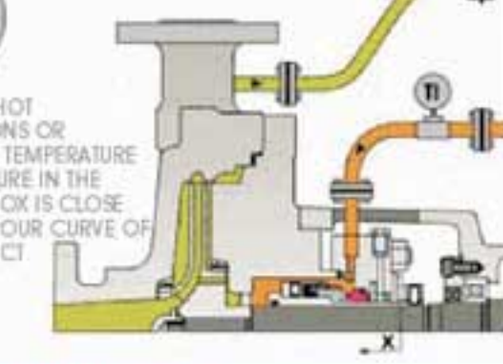


PLAN 21 SINGLE SEALS

VIEW X

RECIRCULATION FROM PUMP DISCHARGE THROUGH A FLOW CONTROL ORIFICE AND COOLER INTO THE SEAL CHAMBER

USED FOR HOT APPLICATIONS OR WHERE THE TEMPERATURE AND PRESSURE IN THE STUFFING BOX IS CLOSE TO THE VAPOUR CURVE OF THE PRODUCT

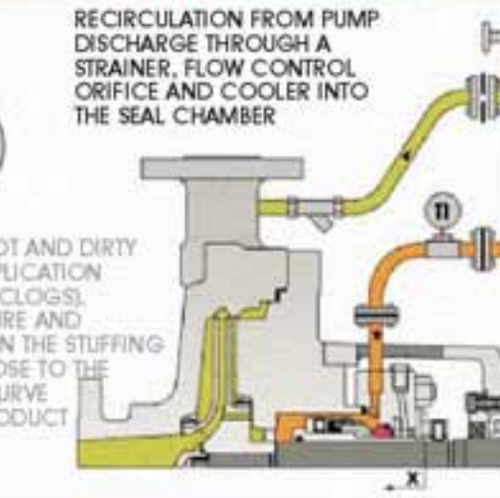


PLAN 22 SINGLE SEALS

VIEW X

RECIRCULATION FROM PUMP DISCHARGE THROUGH A STRAINER, FLOW CONTROL ORIFICE AND COOLER INTO THE SEAL CHAMBER

USED IN HOT AND DIRTY LIQUID APPLICATION (STRAINER CLOGS). TEMPERATURE AND PRESSURE IN THE STUFFING BOX IS CLOSE TO THE VAPOUR CURVE OF THE PRODUCT

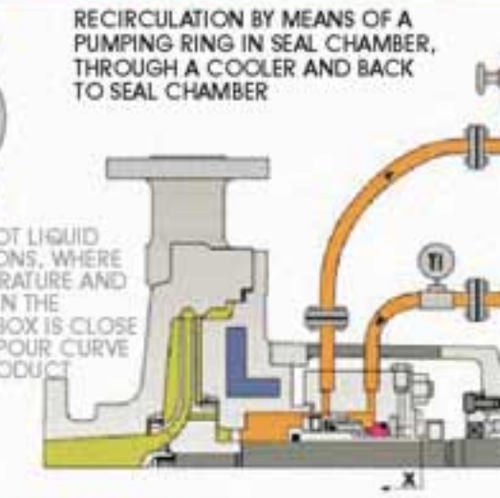


PLAN 23 SINGLE SEALS

VIEW X

RECIRCULATION BY MEANS OF A PUMPING RING IN SEAL CHAMBER, THROUGH A COOLER AND BACK TO SEAL CHAMBER

USED IN HOT LIQUID APPLICATIONS, WHERE THE TEMPERATURE AND PRESSURE IN THE STUFFING BOX IS CLOSE TO THE VAPOUR CURVE OF THE PRODUCT

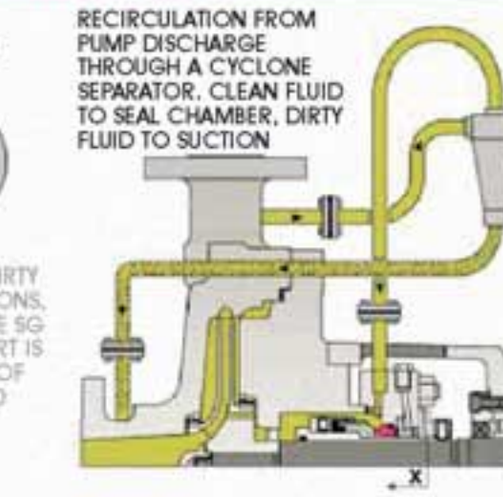


PLAN 31 SINGLE SEALS

VIEW X

RECIRCULATION FROM PUMP DISCHARGE THROUGH A CYCLONE SEPARATOR. CLEAN FLUID TO SEAL CHAMBER, DIRTY FLUID TO SUCTION

USED IN DIRTY APPLICATIONS, WHERE THE SG OF THE DIRT IS 2 X, THAT OF THE LIQUID

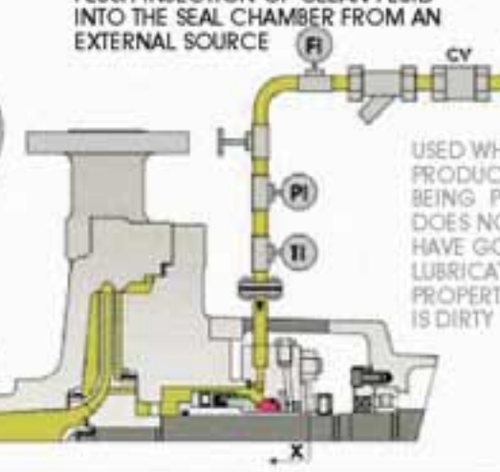


PLAN 32 SINGLE SEALS

VIEW X

FLUSH INJECTION OF CLEAN FLUID INTO THE SEAL CHAMBER FROM AN EXTERNAL SOURCE

USED WHEN THE PRODUCT BEING PUMPED DOES NOT HAVE GOOD LUBRICATION PROPERTIES OR IS DIRTY



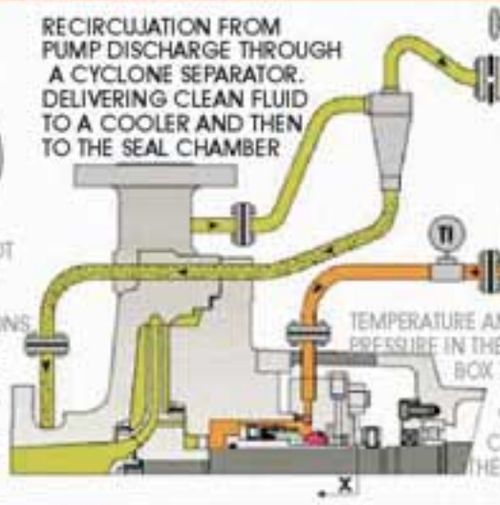
PLAN 41 SINGLE SEALS

VIEW X

RECIRCULATION FROM PUMP DISCHARGE THROUGH A CYCLONE SEPARATOR. DELIVERING CLEAN FLUID TO A COOLER AND THEN TO THE SEAL CHAMBER

USED IN HOT AND DIRTY LIQUID APPLICATIONS WHERE THE SG OF THE DIRT IS 2 X. THAT OF THE LIQUID

TEMPERATURE AND PRESSURE IN THE STUFFING BOX IS CLOSE TO THE VAPOUR CURVE OF THE PRODUCT

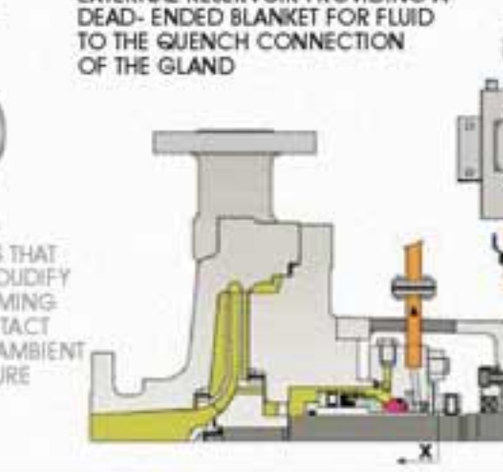


PLAN 51 SINGLE SEALS

VIEW X

EXTERNAL RESERVOIR PROVIDING A DEAD- ENDED BLANKET FOR FLUID TO THE QUENCH CONNECTION OF THE GLAND

USED WITH PRODUCTS THAT USUALLY SOLIDIFY WHEN COMING INTO CONTACT WITH AIR/ AMBIENT TEMPERATURE



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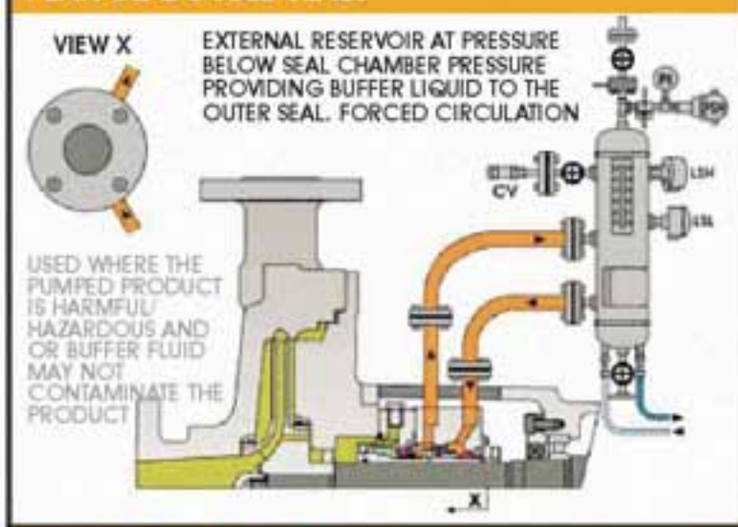
PLAN 52 DOUBLE SEALS

VIEW X

EXTERNAL RESERVOIR AT PRESSURE BELOW SEAL CHAMBER PRESSURE PROVIDING BUFFER LIQUID TO THE OUTER SEAL. FORCED CIRCULATION



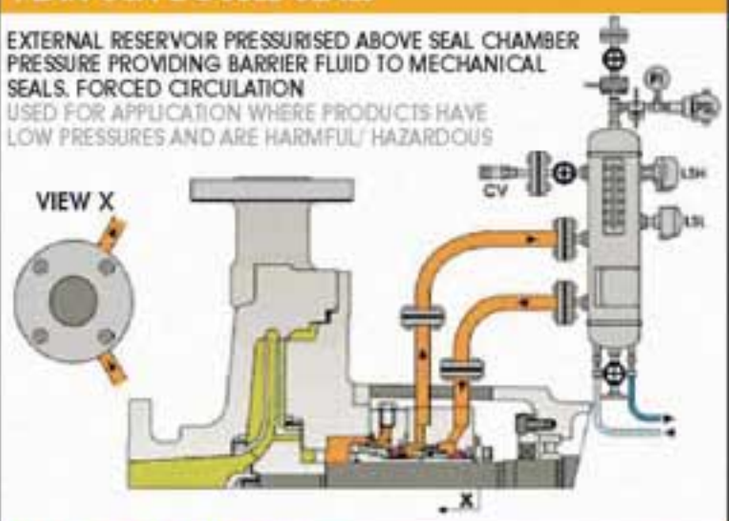
USED WHERE THE PUMPED PRODUCT IS HARMFUL/ HAZARDOUS AND OR BUFFER FLUID MAY NOT CONTAMINATE THE PRODUCT

PLAN 53A DOUBLE SEALS

EXTERNAL RESERVOIR PRESSURISED ABOVE SEAL CHAMBER PRESSURE PROVIDING BARRIER FLUID TO MECHANICAL SEALS. FORCED CIRCULATION

USED FOR APPLICATION WHERE PRODUCTS HAVE LOW PRESSURES AND ARE HARMFUL/ HAZARDOUS

VIEW X



PLAN 53B DOUBLE SEALS

VIEW X

PRE- PRESSURIZED BLADDER ACCUMULATOR PROVIDES PRESSURE TO CIRCULATION SYSTEM. HEAT REMOVED BY AIR/ WATER HEAT EXCHANGER. FORCED CIRCULATION

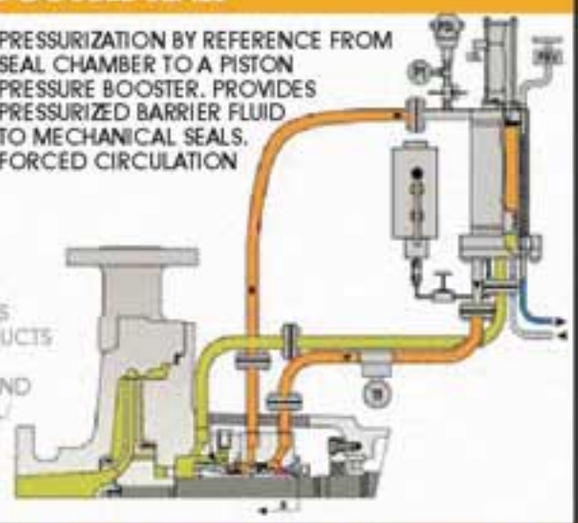
USED FOR APPLICATIONS WHERE PRODUCTS HAVE HIGH PRESSURES AND ARE HARMFUL/ HAZARDOUS

PLAN 53C DOUBLE SEALS

VIEW X

PRESSURIZATION BY REFERENCE FROM SEAL CHAMBER TO A PISTON PRESSURE BOOSTER. PROVIDES PRESSURIZED BARRIER FLUID TO MECHANICAL SEALS. FORCED CIRCULATION

USED FOR APPLICATIONS WHERE PRODUCTS HAVE HIGH PRESSURES AND ARE HARMFUL/ HAZARDOUS

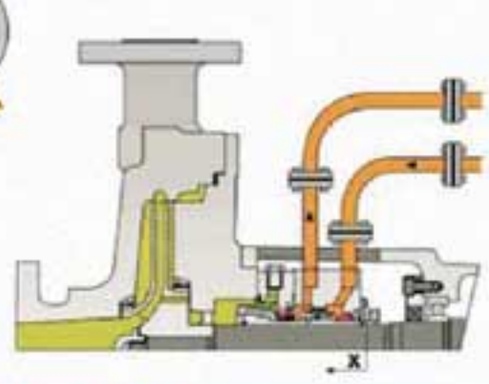


PLAN 54 DOUBLE SEALS

VIEW X

PRESSURIZED CLEAN BARRIER FROM AN EXTERNAL SYSTEM

USED IN HARMFUL/ HAZARDOUS APPLICATIONS

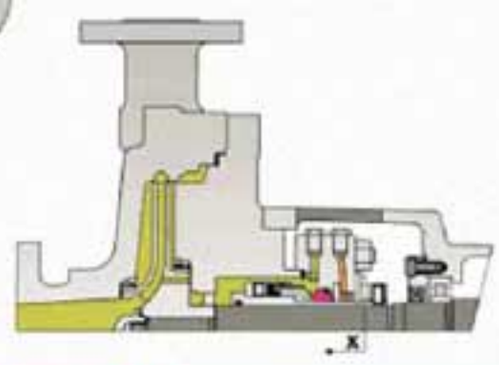


PLAN 61 QUENCH

VIEW X

TAPPED AND PLUGGED CONNECTIONS FOR PURCHASERS USE

USED TO KEEP ATMOSPHERIC SIDE OF SEAL CLEAN

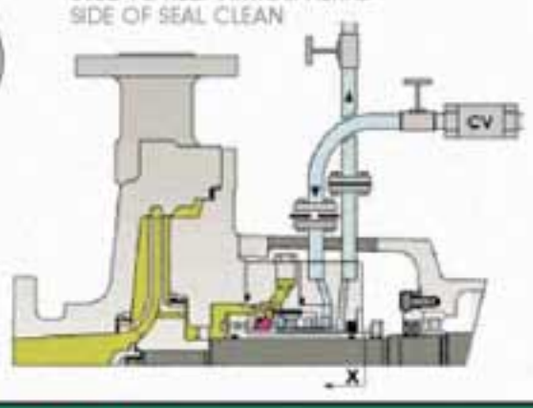


PLAN 62 CLOSING/SEALING OF THE "QUENCH"

VIEW X

EXTERNAL SOURCE PROVIDING A QUENCH TO ATMOSPHERIC SIDE

USED TO KEEP ATMOSPHERIC SIDE OF SEAL CLEAN

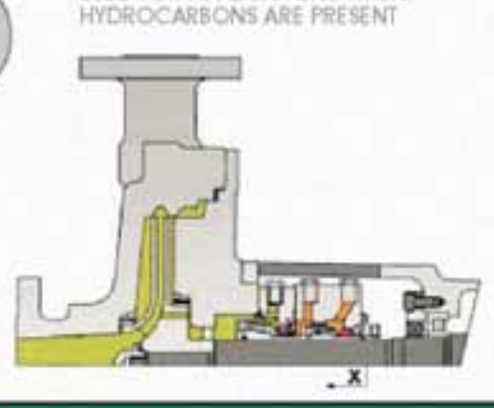


PLAN 71 GAS SEALS

VIEW X

TAPPED CONNECTION FOR PURCHASER'S USE FOR BUFFER GAS TO BE USED IN FUTURE

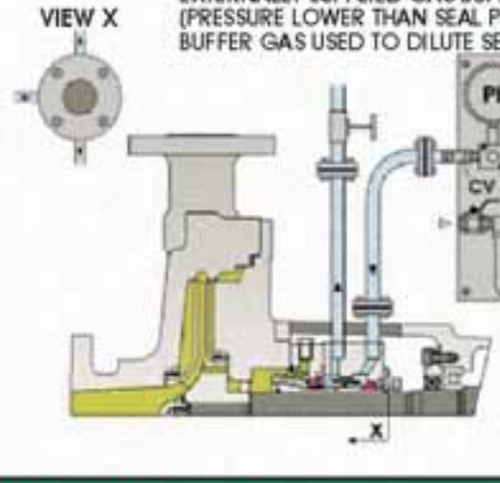
USED FOR APPLICATIONS WHEN HYDROCARBONS ARE PRESENT



PLAN 72 GAS SEALS

VIEW X

EXTERNALLY SUPPLIED GAS BUFFER (PRESSURE LOWER THAN SEAL PRESSURE). BUFFER GAS USED TO DILUTE SEAL LEAKAGE



APPLICABLE WITH HYDROCARBONS. NORMALLY USED IN CONJUNCTION WITH PLAN 75 OR PLAN 76

PLAN 74 GAS SEALS

VIEW X

EXTERNALLY SUPPLIED BARRIER GAS USED TO POSITIVELY PREVENT PROCESS FLUID FROM LEAKING TO ATMOSPHERE

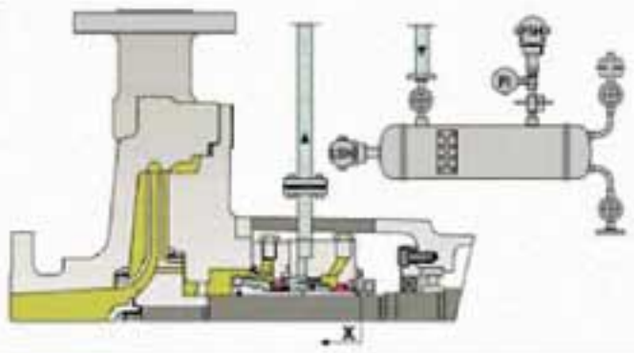
USED IN APPLICATIONS WHERE THE PRODUCT IS HARMFUL/ HAZARDOUS

PLAN 75 GAS SEALS

VIEW X

CONTAINMENT SEAL CHAMBER DRAIN. FOR CONDENSING LEAKAGE

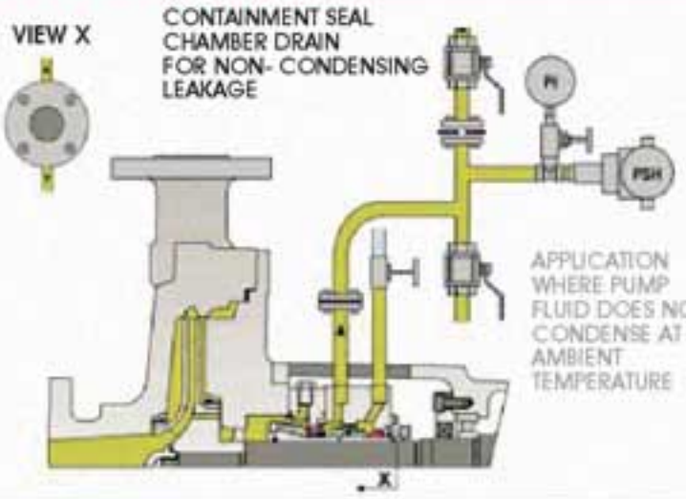
APPLICATION WHERE THE PRIMARY SEAL IS LIQUID AND CONDENSES AT AMBIENT TEMPERATURES



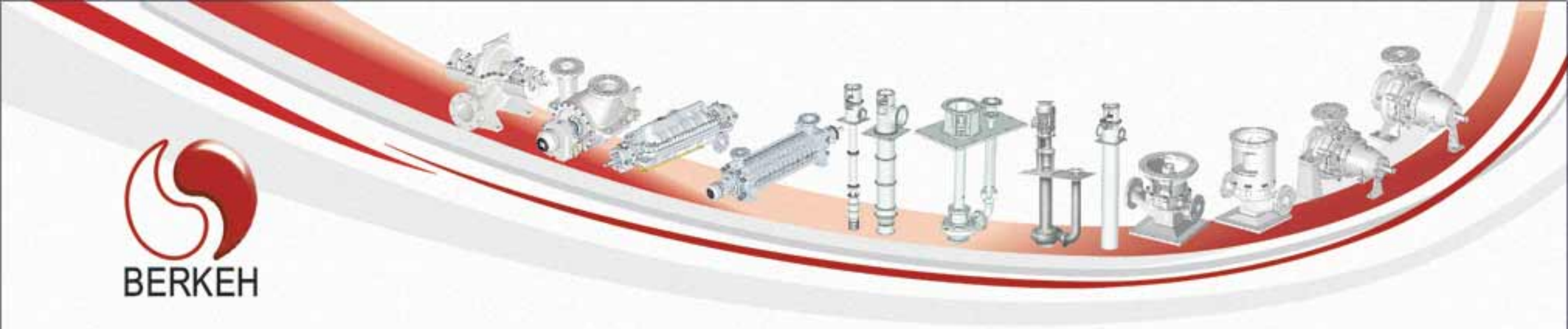
PLAN 76 GAS SEALS

VIEW X

CONTAINMENT SEAL CHAMBER DRAIN FOR NON- CONDENSING LEAKAGE



APPLICATION WHERE PUMP FLUID DOES NOT CONDENSE AT AMBIENT TEMPERATURE



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5- Lubrication

5.1 Unless otherwise specified, bearings and bearing housings shall be designed for oil lubrication using a mineral (hydrocarbon) oil.

5.2 The operation and maintenance manual shall describe how the lubrication system circulates oil.

5.3 If specified, provisions shall be made for either pure oil or purge oil-mist lubrication

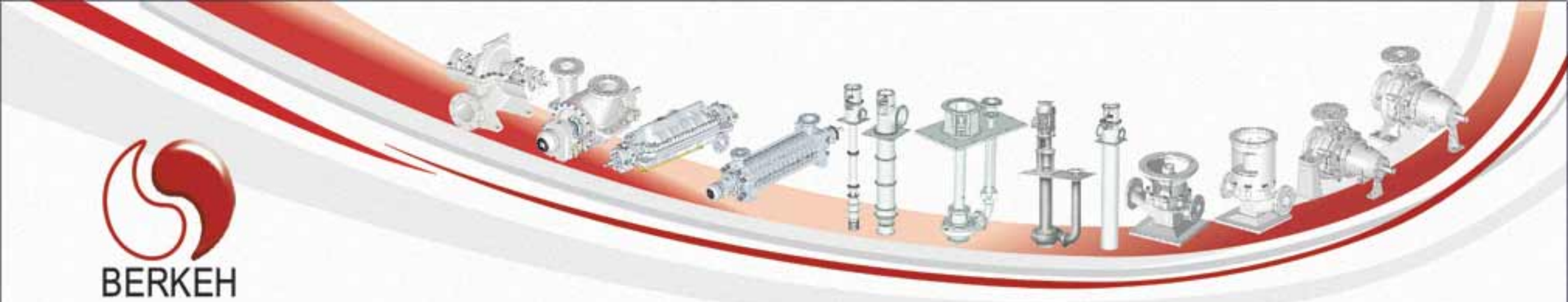
5.4 If specified, rolling-element bearings shall be grease-lubricated in accordance with a) through d) below.

a. Grease life (re-lubrication interval) shall be estimated using the method recommended by the bearing manufacturer or an alternative method approved by the purchaser.

b. Grease lubrication shall not be used if the estimated grease life is less than 2 000 h.

c. If the estimated grease life is 2 000 h or greater but less than25 000 h, provision shall be made for re-greasing the bearings in service and for the effective discharge of old or excess grease, and the vendor shall advise the purchaser of the required re-greasing interval.

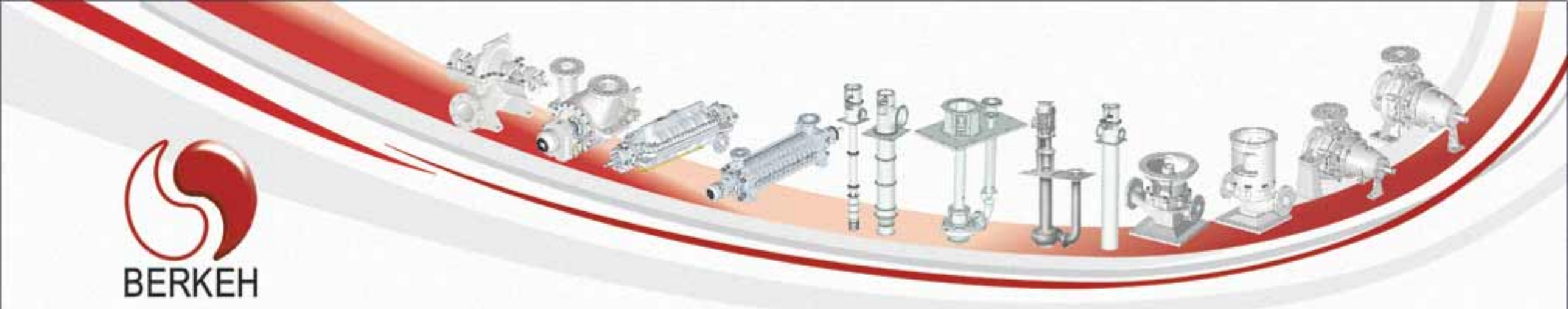
d.If the estimated grease life is 25 000 h or more, grease nipples or any other system for the addition of grease in service shall not be fitted.



6- Materials

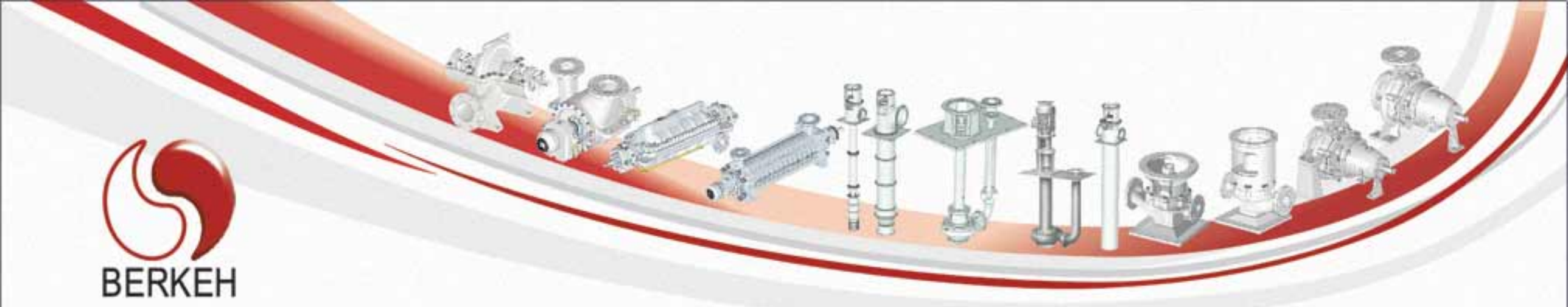
6.1Materials class selection guidance

Service	Temperature range °C	Temperature range (°F)	Pressure range	Materials class
Fresh water, condensate, cooling tower water	<100	<212	All	I-1 or I-2
Boiling water and process water	<120	<250	All	I-1 or I-2
	120 to 175	250 to 350	All	S-5
	>175	>350	All	S-6, C-6
Boiler feed water				
Axially split	>95	>200	All	C-6
Double-casing (barrel)	>95	>200	All	S-6
Boiler circulator	>95	>200	All	C-6
Foul water, reflux drum water, water draw, and hydrocarbons containing these waters, including reflux streams	<175	<350	All	S-3 or S-6
	>175	>350	All	C-6
Propane, butane, liquefied petroleum gas, ammonia, ethylene, low temperature services (minimum metal temperature)	230	<450	All	S-1
	>-46	>-50	All	S-1(LCB)
	>-73	>-100	All	S-1(LC2)
	>-100	>-150	All	S-1(LC3)
	>-196	>-320	All	A-7 or A-8
Diesel oil ; gasoline; naphtha; kerosene; gas oils;	<230	<450	All	S-1
light; medium and heavy lubricating oils; fuel oil;	230 to 370	450 to 700	All	S-6
residuum; crude oil; asphalt; synthetic crude bottoms	>370	>700	All	C-6
Non- corrosive hydrocarbons, e.g. catalytic reformate, isomaxate, desulfurized oils	230 to 370	450 to 700	All	S-4
Xylene, toluene, acetone, benzene, furfural, MEK, cumene	<230	<450	All	S-1
Sodium carbonate	<175	<350	All	I-1
Caustic(sodium hydroxide), concentration <20%	<100	<212	All	S-1
	>100	>200	All	---
Seawater	<95	<200	All	---
Sour water	<260	<470	All	D-1
Produced water, formation water and brine	All	All	All	D-1 or D-2
Sulfur (liquid state)	All	All	All	S-1
FCC slurry	<370	<700	All	C-6
Potassium carbonate	<175	<350	All	C-6
	<370	<700	All	A-8
MEA, DEA, TEA stock solutions	<120	<250	All	S-1
DEA, TEA-lean solutions	<120	<250	All	S-1 or S-8
MEA-lean solution (CO_2 only)	80 to 150	175 to 300	All	S-9
MEA-lean solution (CO_2 and H_2S)	80 to 150	175 to 300	All	S-8
MEA, DEA, TEA -, rich solutions	<80	175	All	S-1 or S-8
Sulfuric acid concentration > 85%	<38	<100	All	S-1
85% to < 1 %	<230	<450	All	A-8
Hydrofluoric acid concentration > 96%	<38	<100	All	S-9
MEA, DEA, TEA stock solutions	<120	<250	All	S-1
DEA, TEA-lean solutions	<120	<250	All	S-1 or S-8



6.2 Materials class for pump parts

PART	Full compliance materials	Materials classes and abbreviations												
		I-1	I-2	S-1	S-3	S-4	S-5	S-6	S-8 [l]	S-9 [l]	C-6	A-7	A-8	D-1 [j]	D-2 [j]
		CI [a]	CI	STL	STL	STL	STL	STL	STL	STL	12%CHR	AUS.	316 AUS	Duplex	Super Duplex
		CI	BRZ	CI	Ni-Resist	STL	STL 12%CHR	12%CHR	316 AUS	Ni-Cu Alloy	12%CHR	AUS. [C,d]	316 AUS [d]	Duplex	Super Duplex
pressure casing	Yes	Cast iron	Cast iron	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	12%CHR	AUS.	316 AUS	Duplex	Super Duplex
Inner case part:(bowls, diffusers diaphragms)	No	Cast iron	Bronze	Cast iron	Ni-Resist	Cast iron	Carbon steel	12%CHR	316 AUS	Ni-Cu Alloy	12%CHR	AUS.	316 AUS	Duplex	Super Duplex
Impeller	Yes	Cast iron	Bronze	Cast iron	Ni-Resist	Carbon steel	Carbon steel	12%CHR	316 AUS	Ni-Cu Alloy	12%CHR	AUS.	316 AUS	Duplex	Super Duplex
Case wear rings [k]	No	Cast iron	Bronze	Cast iron	Ni-Resist	Cast iron	12%CHR Hardened	12%CHR Hardened	Hard-faced 316 AUS [e]	Ni-Cu Alloy	12%CHR Hardened	Hard-faced AUS [e]	Hard-faced 316 AUS [e]	Hard-faced Duplex [e]	Hard-faced Super Duplex [e]
Impeller wear rings [k]	No	Cast iron	Bronze	Cast iron	Ni-Resist	Cast iron	12%CHR Hardened	12%CHR Hardened	Hard-faced 316 AUS [e]	Ni-Cu Alloy	12%CHR Hardened	Hard-faced AUS [e]	Hard-faced 316 AUS [e]	Hard-faced Duplex [e]	Hard-faced Super Duplex [e]
Shaft [d]	Yes	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	AISI 4140	AISI 4140 [f]	316 AUS	Ni-Cu Alloy	12%CHR	AUS.	316 AUS	Duplex	Super Duplex
Throat bushings [k]	No	Cast iron	Bronze	Cast iron	Ni-Resist	Cast iron	12%CHR Hardened	12%CHR Hardened	316 AUS	Ni-Cu Alloy	12%CHR Hardened	AUS.	316 AUS	Duplex	Super Duplex
Interstage sleeves [k]	No	Cast iron	Bronze	Cast iron	Ni-Resist	Cast iron	12%CHR Hardened	12%CHR Hardened	Hard-faced 316 AUS [e]	Ni-Cu Alloy	12%CHR Hardened	Hard-faced AUS [e]	Hard-faced 316 AUS [e]	Hard-faced Duplex [e]	Hard-faced Super Duplex [e]
Interstage bushings [k]	No	Cast iron	Bronze	Cast iron	Ni-Resist	Cast iron	12%CHR Hardened	12%CHR Hardened	Hard-faced 316 AUS [e]	Ni-Cu Alloy	12%CHR Hardened	Hard-faced AUS [e]	Hard-faced 316 AUS [e]	Hard-faced Duplex [e]	Hard-faced Super Duplex [e]
Case and gland studs	Yes	Carbon steel	Carbon steel	AISI 4140 steel	AISI 4140 steel	AISI 4140 steel	AISI 4140 steel	AISI 4140 steel	AISI 4140 steel	Ni-Cu Alloy Hardened [i]	AISI 4140 steel	AISI 4140 steel	AISI 4140 steel	Duplex [i]	Super Duplex [i]
case gasket	No	AUS. Spiral wound [g]	AUS. Spiral wound [g]	AUS. Spiral wound [g]	AUS. Spiral wound [g]	AUS. Spiral wound [g]	AUS. Spiral wound [g]	AUS. Spiral wound [g]	316 AUS Spiral wound [g]	Ni-Cu Alloy Spiral wound PTFE filled [g]	AUS. Spiral wound [g]	AUS. Spiral wound [g]	316 AUS Spiral wound [g]	Duplex SS Spiral wound [g]	Duplex SS Spiral wound [g]



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PART	Full compliance materials	Materials classes and abbreviations													
		I-1	I-2	S-1	S-3	S-4	S-5	S-6	S-8[l]	S-9[l]	C-6	A-7	A-8	D-1[j]	D-2[j]
		Cl [a]	Cl	STL	STL	STL	STL	STL	STL	STL	12%CHR	AUS	316 AUS	Duplex	Super Duplex
		Cl	BRZ	Cl	Ni-Resist	STL	STL 12%CHR	12%CHR	316 AUS	Ni-Cu Alloy	12%CHR	AUS[C,d]	316 AUS[d]	Duplex	Super Duplex
Discharge hard/suction can	Yes	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	AUS	AUS	316 AUS	Duplex	Super Duplex
Column/bowl shaft bushings	No	Nitrile butadiene[h]	Bronze	Filled carbon	Nitrile butadiene[h]	Filled carbon	Filled carbon	Filled carbon	Filled carbon	Filled carbon	Filled carbon	Filled carbon	Filled carbon	Filled carbon	Filled carbon
Wetted fasteners (bolts)	Yes	Carbon steel	Carbon steel	Carbon steel	Ni-Resist	Carbon steel	316 AUS	316 AUS	316 AUS	Ni-Cu Alloy	316 AUS	316 AUS	316 AUS	Duplex	Super Duplex

a The abbreviations in the upper part of the second row indicate the case material; the abbreviations in the lower part of the second row indicate trim material.
Abbreviations are as follows: BRZ = bronze, STL = steel,12%, CHR = 12 % chromium, AUS = austenitic stainless steel, Cl = cast iron, 316 AUS= type 316 austenitic stainless steel

b See 5.12.1.4

c Austenitic stainless steels include ISO Types 683-13-10/19 (AISI Standard Types 302, 303, 304, 316, 321, and 347).

d For vertically suspended pump with shafts exposed to liquid and running in bushings, the standard shaft material is 12% chrome , except for classes S-9, A7, A-8, and D-1. the standard shaft material for cantilever pumps (Types VS5) is AISI 4140 where the service liquid allows (see Annex G , table G .1).

e Unless otherwise specified, the need for hard-facing and the specific hard-facing material for each application is determined by the vendor and described in the proposal. Alternatives to hard-facing may include opening running clearances (5.7.4) or the use of non-galling materials or non-metallic materials, depending on the corrosiveness of the pumped liquid.

f For class S-6, the standard shaft material for boiler feed service and for liquid temperatures above 175 °C (350 °F) is 12% chrom (See Annex G, table G.1).

g If pumps with axially split casings are furnished , a sheet Gasket suitable for the service is acceptable. Spiral-wound gaskets should contain a filler material suitable for the service.
gaskets other than spiral wound, may be proposed and furnished if proven suitable for service and specifically approved by the purchaser.

h Alternative materials may be substituted for liquid temperatures greater than 45 °C(110 °F) or for other special services.

i Unless otherwise specified, AISI 4140 steel may be used for non-wetted case and gland studs.

j Some applications may require alloy grades higher than the Duplex materials given in Table H.2.
"Super Duplex" material grades with pitting resistance equivalency (PRE)values greater than 40 may be necessary.
PRE 40, where PRE is based on actual chemical analysis.
PRE $=\%Cr_{free} + (3{,}3\times \%\text{molybdenum}) + (2\times \%\text{copper}) + (2\times \%\text{tungsten}) + (16\times \%\text{nitrogen})$
$=[(\%\text{chromium} - (14{,}5\times \%\text{ carbon})] + (3{,}3\times \%\text{ molybdenum}) + (2\times \%\text{ copper }) + (16\times \%\text{ nitrogen})$
Note that alternative materials such as "super austenitic" may also be considered.

k Non-metallic wear part materials, proven to be compatible with the specified process fluid, may be proposed within the applicable limits shown in Table H.4.Also see 5.7.4.c).

l The vendor shall consider the effects of differential material expansion between casing and rotor and confirm suitability if operating temperatures are to exceed 95 °C (200 °F).

7- Drivers

Motor driver design code: ATEX 94/9/EC

7.1 The purchaser shall specify the type and specification of driver required.

7.2 The driver shall

a. Be suitable for satisfactory operation under the site conditions specified,
b. Be suitable for the specified utility conditions,
c. Be sized to accommodate all specified process variations such as changes in pressure, temperature or properties of the liquid handled,
d. Be sized to accommodate all plant start-up conditions,
e. Be sized to meet the maximum specified operating conditions, accounting for all losses (e.g. bearing, mechanical seal, external gear and coupling losses).

7.3 Motors shall have power ratings, including the service factor (if any), at least equal to the percentages of power at pump rated conditions given in Table below. However, the power at rated conditions shall not exceed the motor nameplate rating. If it appears that this procedure will lead to unnecessary over sizing of the motor, an alternative proposal shall be submitted for the purchaser's approval.

Power ratings for motor drives

Motor nameplate rating KW	(Hp)	Percentage of rated pump power %
< 22	(< 30)	125
22 to 55	(30 to 75)	115
> 55	(> 75)	110

7.4 The purchaser shall specify the type of motor, its characteristics and the accessories, including the following:

a. Electrical characteristics;
b. Starting conditions (including the expected voltage drop on starting);
c. Type of enclosure;
d. Sound pressure level;
e. Area classification;
f. Type of insulation;
g. required service factor;
h. Ambient temperature and elevation above sea level;
i. Transmission losses;
j. Temperature detectors, vibration sensors and heaters, if these are required;
k. Vibration acceptance criteria;
l. Applicability of IEC 60034, API 541 or IEEE 841. 6.1.5 The driver's starting-torque capabilities shall exceed the speed-torque requirements of the driven equipment. Unless otherwise specified, the motor shall be capable of accelerating the pump to rated speed at 80 % voltage against a closed discharge valve. Some pumps are equipped with bypasses, in which case alternative starting conditions should be used.

7.5 The driver's starting-torque capabilities shall exceed the speed-torque requirements of the driven equipment. Unless otherwise specified, the motor shall be capable of accelerating the pump to rated speed at 80 % voltage against a closed discharge valve.
Some pumps are equipped with bypasses, in which case alternative starting conditions should be used.

7.6 Rolling-element bearings in the drive systems designed for radial or axial loads transmitted from the pump shall meet the following requirements.

a. Bearings shall be selected to give a basic rating life, in accordance with ISO 281, equivalent to at least 25 000 h with continuous operation at pump rated conditions.
b. Bearings shall be selected to give a basic rating life equivalent to at least 16 000 h when carrying the maximum loads (radial or axial or both) imposed with internal pump clearances at twice the design values and when operating at any point between minimum continuous stable flow and rated flow. Vertical motors of 750 kW (1 000 hp) and larger that are equipped with spherical or taper roller bearings may have less than16 000 h life at worst conditions to avoid
skidding in normal operation. In such cases, the vendor shall state the shorter design life in the proposal.
c. For vertical motors and right-angle gears, the thrust bearing shall be in the nondrive end and shall limit axial float to 125 µm (0,005 in).
d. Single-row deep-groove ball bearings shall have radial internal clearance in accordance with ISO 5753 Group 3 [larger than "N" (Normal) internal clearance]. Single- or double-row bearings shall not have filling slots (Conrad type).
NOTE For the purpose of this provision, ABMA 20 Group 3 is equivalent to ISO 5753 Group 3.
e. Thrust bearings shall be designed to carry the maximum thrust the pump may develop while starting, stopping, or operating at any flow rate.
f. Hydrodynamic thrust bearings shall be selected at no more than 50 % of the bearing manufacturer's rating at twice the pump internal clearances specified in 5.7.4.

7.7 Unless otherwise specified, motors for vertical pumps shall have solid shafts. If the pump thrust bearings are in the motor, the motors shall meet the shaft and base tolerances shown in Figure 31.

7.8 Unless otherwise specified, steam turbine drivers shall conform to ISO 10436 or API 611. Steam turbine drivers shall be sized to deliver continuously 110 % of the pump rated power at normal steam conditions.

7.9 Unless otherwise specified, gears shall conform to API 677.

7.10 For drive train components that have a mass greater than 225 kg (500 lb), the equipment feet shall be provided with vertical jackscrews.

8- Couplings and guards

Coupling design code: API 671

8.1Couplings and guards between drivers and driven equipment shall be supplied and mounted by the manufacturer of the pump.

8.2 All-metal flexible element, spacer-type couplings in accordance with AGMA 9000 Class 9 shall be provided. Additionally, couplings shall comply with the following.

a. Flexible elements shall be of corrosion-resistant material.
b. Couplings shall be designed to retain the spacer if a flexible element ruptures.
c. Coupling hubs shall be steel.
d. The spacer nominal length shall be at least 125 mm (5 in) and shall permit removal of the coupling, bearings, seal and rotor, as applicable, without disturbing the driver or the suction and discharge piping.
e. Couplings operating at speeds in excess of 3 800 r/min shall meet the requirements of ISO 10441 or API 671 for component balancing and assembly balance check.

8.3 If specified, couplings shall be balanced to ISO 1940-1 grade G6.3.

8.4 If specified, couplings shall meet the requirements of ISO 14691, ISO 10441 or API 671.

8.5 Information on shafts, keyway dimensions (if any), and shaft end movements due to end play and thermal effects shall be furnished to the vendor supplying the coupling.

8.6 Unless a proprietary clamping device is specified (see 6.2.11), flexible couplings shall be keyed to the shaft. Keys, keyways and fits shall conform to AGMA 9002, Commercial Class.

8.7 Couplings and coupling to shaft junctures shall be rated for at least the maximum driver power, including the service factor.

8.8 For shaft diameters greater than 60 mm (2,5 in) and if it is necessary to remove the coupling hub to service the mechanical seal, the hub shall be mounted with a taper fit. The coupling fit taper for keyed couplings shall be 1 in 16 [60 mm/m (0,75 in/ft), diametral]. Other mounting methods and tapers shall be agreed upon by the purchaser and the vendor. Coupling hubs with cylindrical bores may be supplied with slip fits to the shaft and set screws that bear on the key.

Appropriate assembly and maintenance procedures should be used to assure that taper fit couplings have an interference fit. Slip fits on cylindrical bores allow adjustment of the coupling axial position in the field without application of heat.

8.9 Coupling hubs designed for interference fits to the shaft shall be furnished with tapped puller holes sat least 10 mm (0,38 in) in diameter to aid in removal.

8.10 If specified, couplings shall be fitted hydraulically.

8.11 If specified, couplings shall be fitted with a proprietary clamping device. Acceptable clamping devices may include tapered bushes, frictional locking assemblies and shrink discs. The vendor responsible for the final machining of the hub bores shall select a suitable rating/size device to suit the coupling and the application.

Care should be exercised in the selection of these devices, as some are not inherently self-centring and may introduce eccentricity and unbalance into the coupling assembly. This effect shall be evaluated and allowed for when determining coupling potential unbalance.

8.12 Provision shall be made for the attachment of alignment equipment without the need to remove the spacer or dismantle the coupling in any way.

Note: One way of achieving this is to provide at least 25 mm (1 in) of bare shaft between the coupling hub and the bearing housing where alignment brackets may be located.

8.13 If the vendor is not required to mount the driver, the fully machined half-coupling shall be delivered to the driver manufacturer's plant or any other designated location, together with the necessary instructions for mounting the half-coupling on the driver shaft.

8.14 Each coupling shall have a coupling guard which is removable without disturbing the coupled elements and shall meet the following requirements.

a) Coupling guards shall enclose the coupling and the shafts to prevent personnel from contacting moving parts during operation of equipment train. Allowable access dimensions shall comply with specified standards, such as ISO 14120, EN 953 or ASME B15.1.

b) Guards shall be constructed with sufficient rigidity to withstand a 900 N (200 lbf) static point load in any direction without the guard contacting moving parts.

c) Guards shall be fabricated from solid sheet or plate with no openings. Guards fabricated from expanded metal or perforated sheets may be used if the size of the openings does not exceed 10 mm (0,375 in). Guards shall be constructed of steel, brass or non-metallic (polymer) materials.
Guards of woven wire shall not be used. If specified, non-sparking guards of agreed material shall be supplied.

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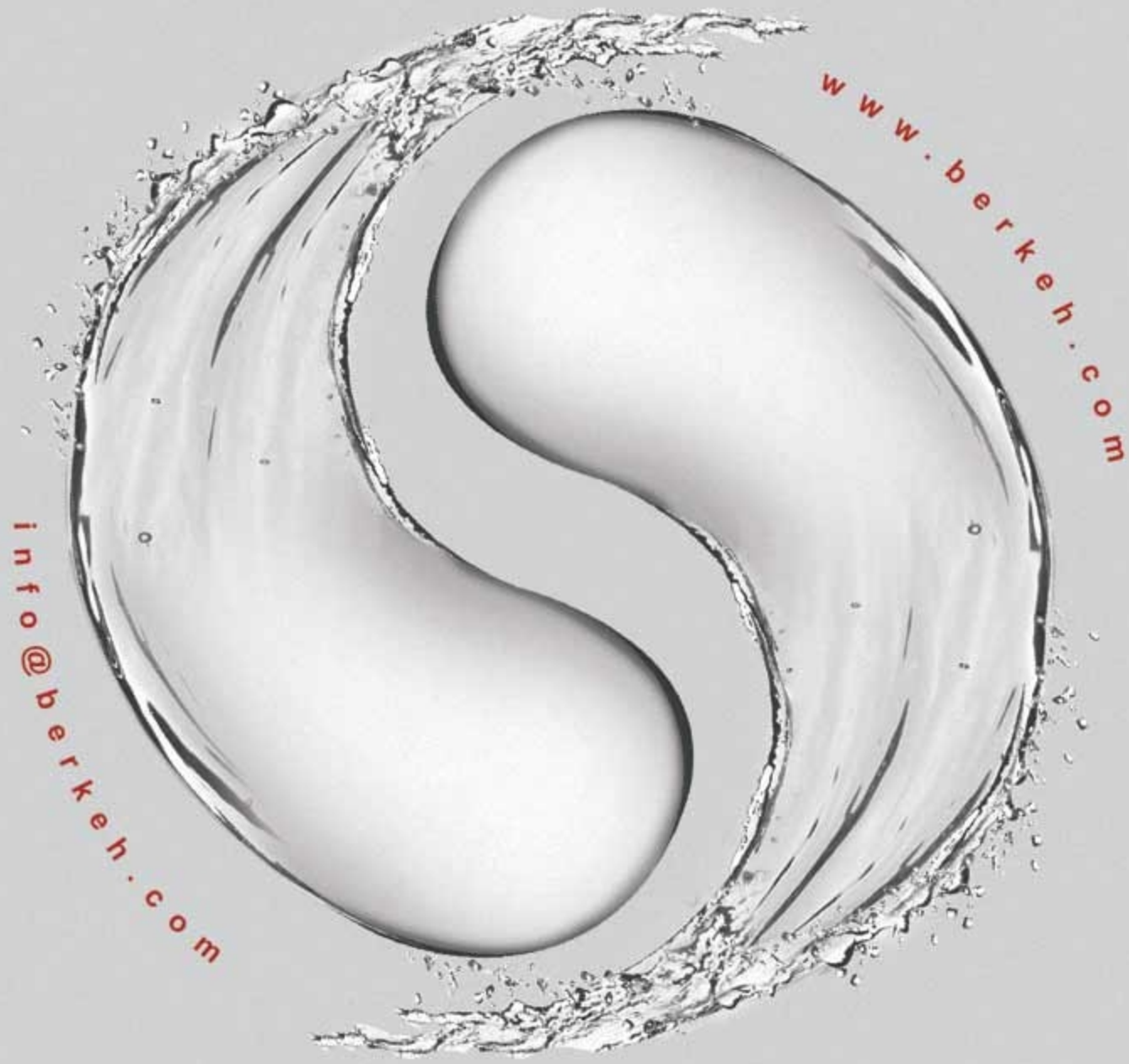

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پلاک ۶۸ تلفکس: ۷ ـ ۵۶۵۴۶۸۹۴