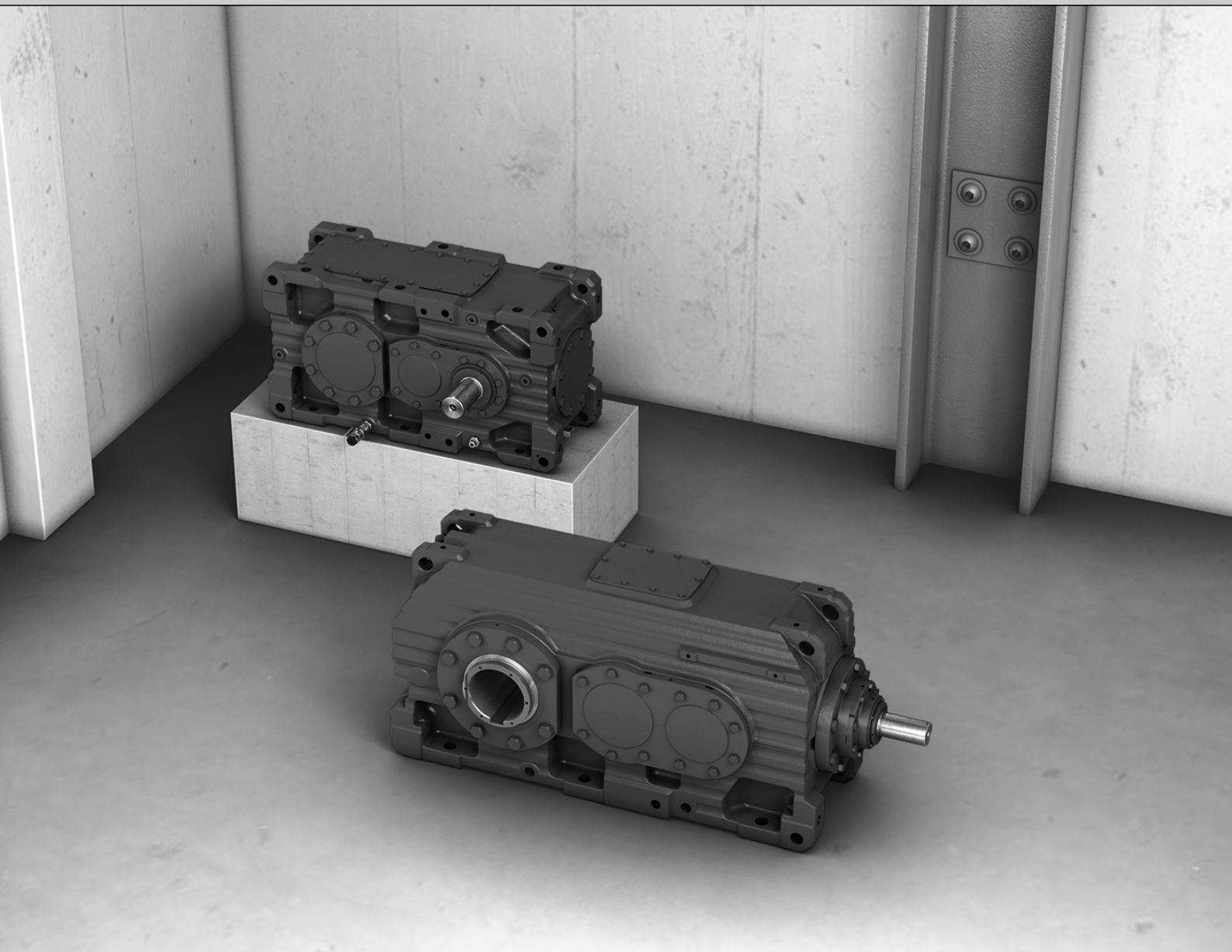




SEW
EURODRIVE

Instrucciones de montaje y funcionamiento



Reductores industriales

**Reductores de engranajes cilíndricos y de engranajes
cilíndricos con grupo cónico serie X..**

Refrigerador de aceite por aire con lubricación por barboteo o baño
de aceite /OAC1



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1 Refrigerador de aceite por aire con lubricación por barboteo / OAC1

1.1 Estructura/funcionamiento

1.1.1 Estructura

Se puede utilizar un refrigerador de aceite por aire si no son suficientes la potencia térmica límite del reductor refrigerado de forma natural o la refrigeración mediante ventilador montado en el eje de entrada.

NOTA



Las siguientes versiones son válidas para reductores con lubricación por barboteo o baño de aceite.

Las siguientes figuras muestran los reductores en la posición de montaje M1 con las superficies de montaje estándar para la bomba de aceite y el intercambiador de calor aceite-aire.

NOTA

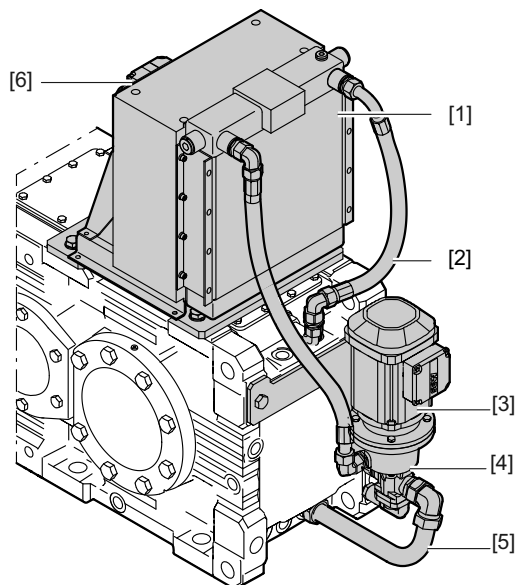


Para utilizar otras superficies de montaje distintas del estándar se precisa un nuevo diseño. En caso dado, esto puede tener incidencia en la viscosidad mínima del aceite. Es necesaria una comprobación individual exhaustiva. Consulte con SEW-EURODRIVE.

SEW-EURODRIVE utiliza un refrigerador de aceite por aire con motores separados para la bomba de aceite y el ventilador.

1.1.2 Posición de montaje M1 - superficie de montaje: Intercambiador de calor aceite-aire F2/ bomba de aceite F6

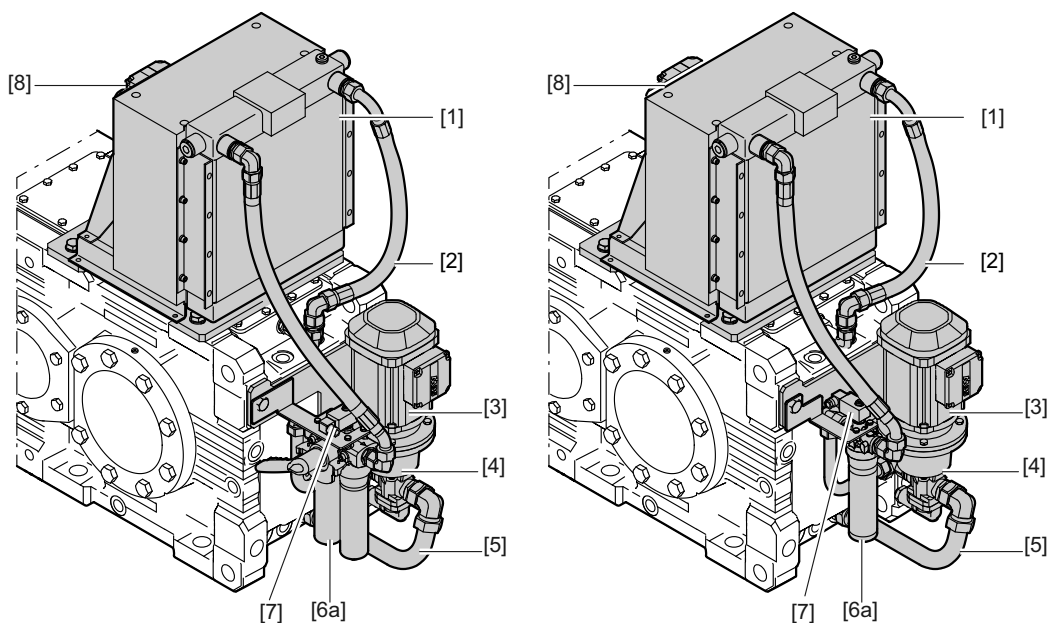
OAC1 sin filtro



18014419341386379

- | | |
|---|--------------------------|
| [1] Intercambiador de calor aceite-aire | [4] Bomba de aceite |
| [2] Tubería de impulsión | [5] Tubo de aspiración |
| [3] Motor de bomba | [6] Motor del ventilador |

OAC1 con filtro simplex y dúplex



9007224125128203

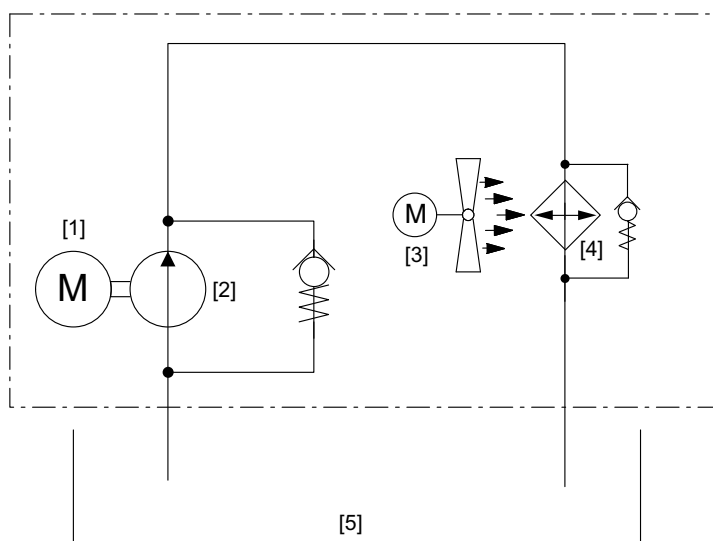
- | | |
|---|---------------------------|
| [1] Intercambiador de calor aceite-aire | [6a] Filtro dúplex |
| [2] Tubería de impulsión | [6b] Filtro simplex |
| [3] Motor de bomba | [7] Indicador de suciedad |

[4] Bomba de aceite
[5] Tubo de aspiración

[8] Motor del ventilador

1.1.3 Esquema hidráulico sin filtro

La siguiente imagen muestra un ejemplo de estructura de unidad estándar de los sistemas de suministro de aceite.



36028817946814475

[1] Motor de bomba

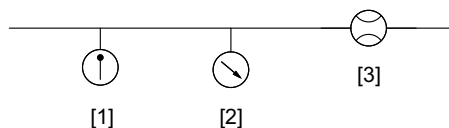
[4] Intercambiador de calor aceite-aire

[2] Bomba de aceite

[5] Reductor

[3] Motor del ventilador

La siguiente imagen muestra un resumen de las posibles opciones que se pueden adosar.



9007220078214923

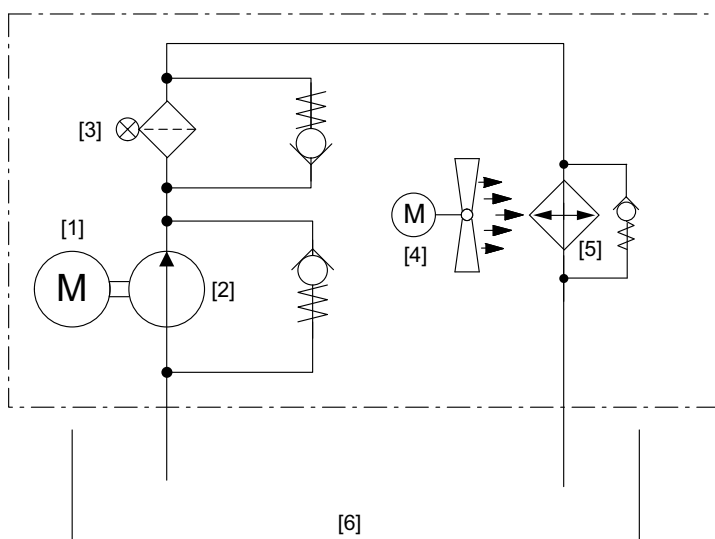
[1] Termómetro

[2] Manómetro

[3] Sensor de caudal

1.1.4 Esquema hidráulico filtro símplex

La siguiente imagen muestra un ejemplo de estructura de unidad estándar de los sistemas de suministro de aceite.



36028817842422155

[1] Motor de bomba

[4] Motor del ventilador

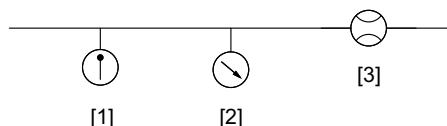
[2] Bomba de aceite

[6] Intercambiador de calor aceite-aire

[3] Filtro símplex

[6] Reductor

La siguiente imagen muestra un resumen de las posibles opciones que se pueden adosar.



9007220078214923

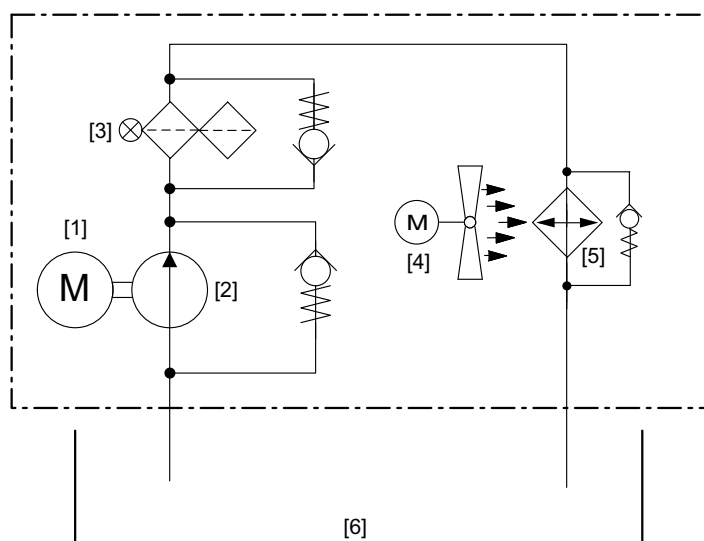
[1] Termómetro

[2] Manómetro

[3] Sensor de caudal

1.1.5 Esquema hidráulico filtro dúplex

La siguiente imagen muestra un ejemplo de estructura de unidad estándar de los sistemas de suministro de aceite.



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[1] Motor de bomba

[4] Motor del ventilador

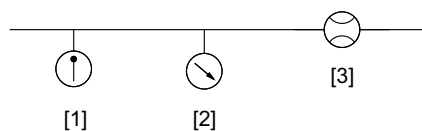
[2] Bomba de aceite

[5] Intercambiador de calor aceite-aire

[3] Filtro dúplex

[6] Reductor

La siguiente imagen muestra un resumen de las posibles opciones que se pueden adosar.



18014419333304715

[1] Termómetro

[2] Manómetro

[3] Sensor de caudal

1.1.6 Generalidades

El sistema de refrigeración de aceite se monta de forma estándar como unidad completa directamente en el reductor. El sistema de refrigeración de aceite se suministra en este caso sin cableado eléctrico pero con los tubos montados.

Opcionalmente, el sistema de refrigeración de aceite se puede suministrar como unidad completa sobre bastidor de base para colocación por separado, pero sin cableado eléctrico ni tubos.

El contenido del suministro de la versión básica del sistema de refrigeración de aceite incluye en función de la variante de equipamiento:

Variante de equipamiento con motores separados para elevador y bomba de aceite

El volumen de suministro de la versión básica del sistema de refrigeración de aceite incluye:

- Bomba de aceite con motor asíncrono adosado directamente
- Ventilador con motor asíncrono adosado directamente
- Intercambiador de calor aceite-aire
- Interruptor térmico /TSK2 con 2 puntos de conmutación para
 - Arranque controlado de los motores para bomba de aceite e intercambiador de calor aceite-aire a una temperatura de aceite > 60 °C
 - Vigilancia del refrigerador de aceite por aire, es decir, aviso o desconexión del reductor a una temperatura de aceite > 90 °C

Equipamiento opcional

Opcionalmente, el sistema de refrigeración de aceite puede estar equipado con los siguientes componentes:

- Sonda térmica PT100
- Filtro de aceite con indicador de suciedad eléctrico/óptico
 - Filtro símplex
 - Filtro dúplex
- Para el montaje en el bloque de medición se dispone de:
 - Sensor de caudal
 - Manómetro
 - Termómetro

1.1.7 Función

Tenga en cuenta las siguientes instrucciones de manejo para los distintos componentes.

Bomba de aceite/intercambiador de calor aceite-aire

Los motores de accionamiento de la bomba de aceite y del intercambiador de calor aceite-aire se conectan y se desconectan en función de la temperatura.

Durante el funcionamiento de la bomba de aceite, la presión del sistema es limitada por una válvula limitadora de presión integrada en el intercambiador de calor aceite-aire.

NOTA



No se debe cambiar el ajuste de la válvula de la bomba de aceite.

Interruptor térmico /TSK2

La temperatura de la instalación se vigila mediante un interruptor térmico con puntos de conmutación fijos.

- $A T > 60^{\circ}\text{C}$ → **Motores del refrigerador de aceite por aire – ON**
- $A T < 50^{\circ}\text{C}$ → **Motores del refrigerador de aceite por aire – OFF**
- $A T > 90^{\circ}\text{C}$ → **PARADA REDUCTOR/AVISO**

Sonda térmica PT100 (opcional)

En lugar de un interruptor térmico /TSK2 se puede utilizar opcionalmente una sonda térmica PT100 para el control del sistema de refrigeración de aceite. La evaluación de la señal de temperatura y el control de los interruptores del usuario se realizan mediante el control del usuario.

- $A T > 60^{\circ}\text{C}$ → **Motores del refrigerador de aceite por aire – ON**
- $A T < 50^{\circ}\text{C}$ → **Motores del refrigerador de aceite por aire – OFF**
- $A T > 90^{\circ}\text{C}$ → **PARADA REDUCTOR / AVISO**

Filtro (opcional)

El filtro se vigila ópticamente mediante un indicador de presión diferencial y eléctricamente mediante un control de presión diferencial.

$A \Delta p > 2,2 \text{ bares}$ → **AVISO** (limpiar filtro)

1 Refrigerador de aceite por aire con lubricación por barboteo /OAC1

Estructura/funcionamiento

1.1.8 Normativa de bloqueo

Habilitación del reductor

Habilitación del reductor si se cumple la siguiente condición:

- Temperatura del aceite $T < 90\text{ }^{\circ}\text{C}$

PARADA reductor/aviso

PARADA reductor/aviso si se cumple la siguiente condición:

- Temperatura del aceite $T > 90\text{ }^{\circ}\text{C}$

1.1.9 Tamaños y selección

Los datos de potencia estandarizados de la bomba de aceite y del intercambiador de calor aceite-aire se resumen en las siguientes tablas.

Datos del motor: Bomba de aceite

Tamaño OAC1	Tamaño Bomba de aceite	Tipo de motor	Norma IEC	Número de polos	Global motor Hz	Caudal a 1500 min^{-1}	Global motor Hz
OAC1 06	KF 6	DRN	80MK	4	50/60	8.4	50/60
OAC1 10	KF 10	DRN	80M	4	50/60	13.7	
OAC1 16	KF 16	DRN	90S	4	50/60	21.8	
OAC1 20	KF 20	DRN	90L	4	50/60	27.1	
OAC1 32	KF 32	DRN	100L	4	50/60	43.8	
OAC1 50	KF 50	DRN	100L	4	50/60	68.2	
OAC1 63	KF 63	DRN	132S	4	50/60	86.2	

Datos del motor: Intercambiador de calor aceite-aire

Tamaño OAC1	Intercambiador de calor de aire	Tipo de motor	Norma IEC	Número de polos	Potencia del motor kW	Global motor Hz
OAC1 06	LKI-120	DRN	63M	4	0.18	50/60
OAC1 10	LKI-220	DRN	63M	4	0.18	
OAC1 16	LKI-320	DRN	71M	4	0.37	
OAC1 20	LKI-420	DRN	80M	4	0.75	
OAC1 32	LKI-420	DRN	80M	4	0.75	
	LKI-5204	DRN	90S	6	1.1	
OAC1 50	LKI-710	DRN	112M	6	1.1	
OAC1 63	LKI-810	DRN	132S	6	2.2	

Datos de rendimiento: Refrigerador de aceite por aire

Las potencias refrigeradoras indicadas son válidas cuando la temperatura del aire es $40\text{ }^{\circ}\text{C}$, la temperatura de aceite de $70\text{ }^{\circ}\text{C}$, cuando el caudal de aceite y el de agua refrigerante es igual, aceite mineral CLP-CC-320 y la frecuencia de red es de 50 Hz.

Tamaño OAC1	Potencia refrigerante a $40\text{ }^{\circ}\text{C}$ aire/ $70\text{ }^{\circ}\text{C}$ aceite kW/ $^{\circ}\text{C}$	Potencia refrigerante especificada a $40\text{ }^{\circ}\text{C}$ aire/ $70\text{ }^{\circ}\text{C}$ aceite kW/ $^{\circ}\text{C}$	Ruido dB(A)
OAC1 06	4	0.13	64
OAC1 10	4.8	0.16	64
OAC1 16	9.4	0.31	73
OAC1 20	10.8	0.36	75
OAC1 32	13	0.43	75
	20.3	0.68	80
OAC1 50	27.7	0.92	77

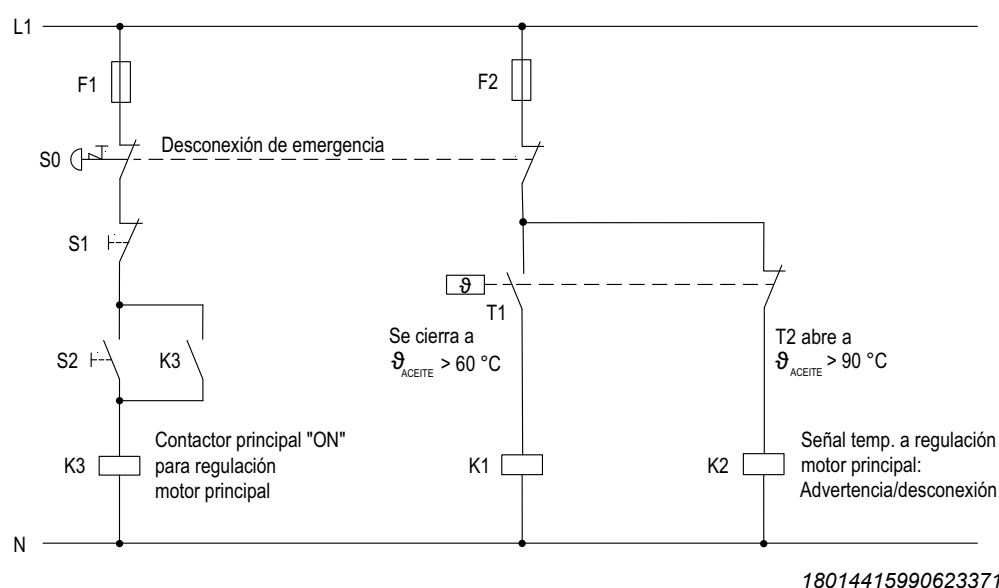
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Tamaño OAC1	Potencia refrigerante a 40 °C aire/70 °C aceite kW/°C	Potencia refrigerante específica a 40 °C aire/70 °C aceite kW/°C	Ruido dB(A)
OAC1 63	40.4	1.35	79

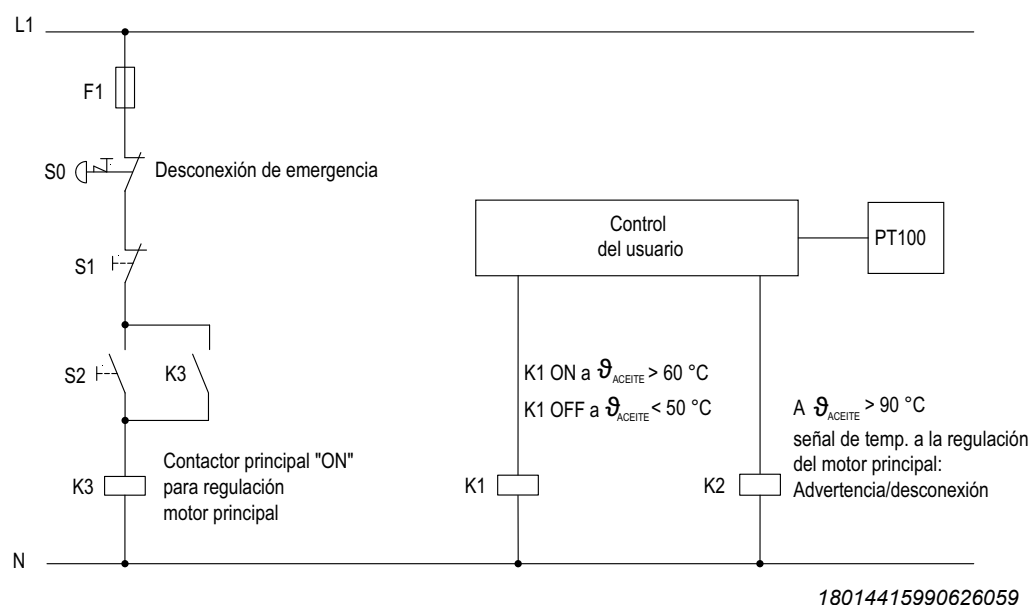
1.2 Esquema eléctrico (representación de principio)

Los esquemas de conexiones muestran a modo de ejemplo una posible estructura del control para el sistema de refrigeración utilizando un interruptor térmico /TSK2 y opcionalmente una sonda térmica PT100. Utilice los esquemas de conexiones según la estructura del sistema de refrigeración.

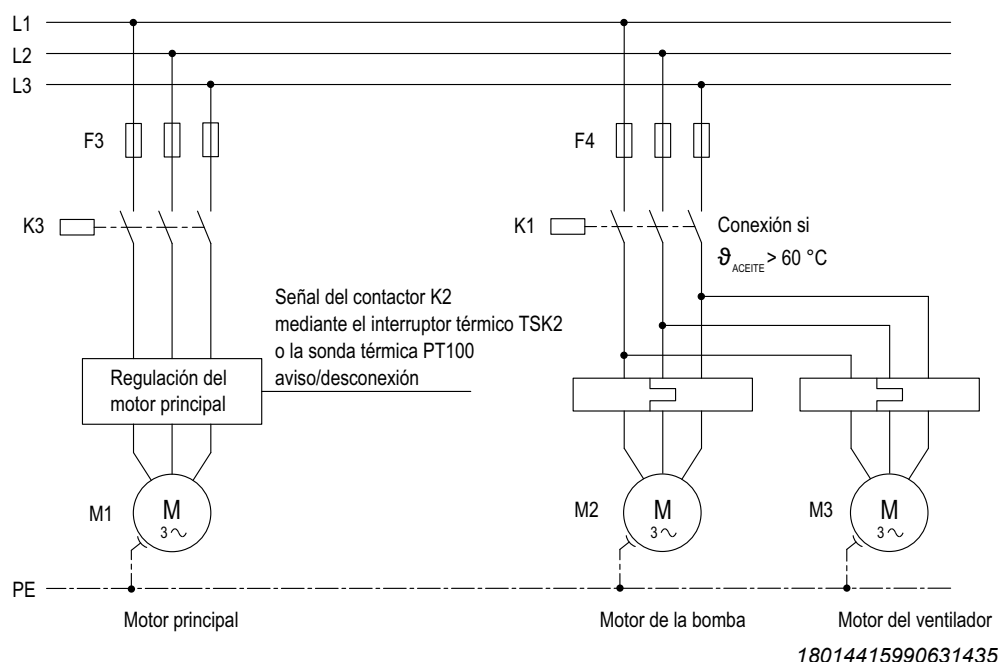
1.2.1 Circuito de control con control mediante interruptor térmico /TSK2



1.2.2 Circuito de control con control mediante sonda térmica PT100



1.2.3 Circuito principal con motores separados para bomba y ventilador



1.3 Instalación y montaje

NOTA



Lea primero las instrucciones de funcionamiento del fabricante del sistema de suministro de aceite.

1.3.1 Indicaciones para la colocación y conexión

El sistema de refrigeración de aceite está montado de serie directamente en el reductor.

Opcionalmente, el intercambiador de calor aceite-aire se puede montar separado del reductor. El sistema de refrigeración de aceite de aceite se suministra en este caso sin cableado eléctrico y sin entubado.

Procure que el lugar de instalación sea de baja vibración. Coloque el sistema de refrigeración de aceite al mismo nivel o más bajo que el reductor, en caso de que no sea posible, consulte con SEW-EURODRIVE.

Emplace el sistema de refrigeración de aceite de forma que la alimentación y la evacuación de aire no queden obstruidas. Asegúrese de que la ventilación y la protección frente a la suciedad son suficientes.

NOTA



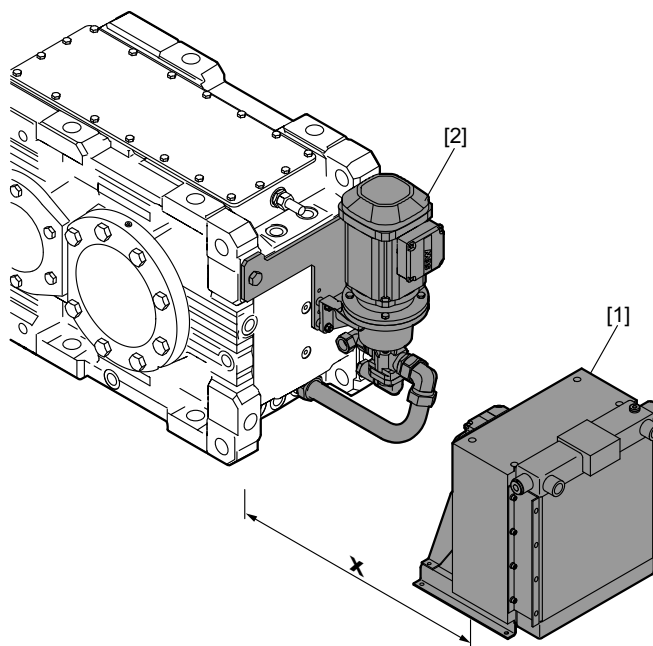
Para las dimensiones del refrigerador, así como datos técnicos detallados, véanse las instrucciones de funcionamiento del fabricante del sistema de refrigeración.

SEW-EURODRIVE distingue entre las siguientes versiones para la instalación separada.

Bomba de aceite montada en el reductor

La bomba de aceite [2] está montada en el reductor. El intercambiador de calor aceite-aire [1] se monta separado del reductor. La longitud de conducto máxima **X** entre la bomba de aceite y el intercambiador de calor aceite-aire se la proporcionará SEW-EURODRIVE previa solicitud.

SEW-EURODRIVE recomienda tubos flexibles entre la bomba de aceite y el intercambiador de calor aceite-aire.

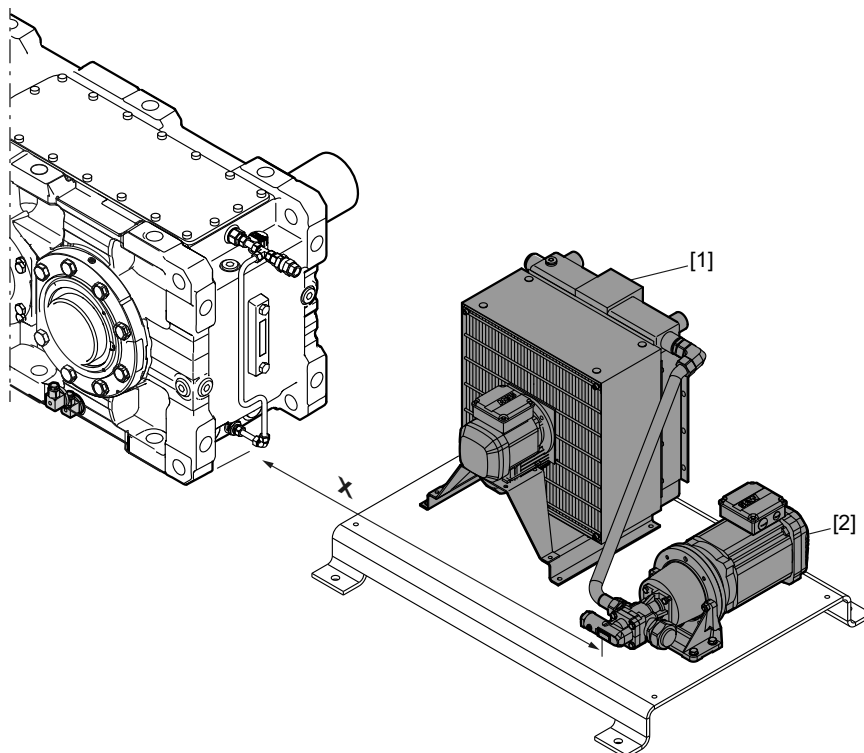


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Bomba de aceite montada en el intercambiador de calor aceite-aire

La bomba de aceite [2] está montada en el intercambiador de calor aceite-aire [1]. La longitud de conducto máxima **X** entre el reductor y la bomba de aceite en el intercambiador de calor aceite-aire se la proporcionará SEW-EURODRIVE previa solicitud.

SEW-EURODRIVE recomienda tubos flexibles entre el reductor y la bomba de aceite.



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1.3.2 Conexión mecánica

Conecte el sistema de refrigeración de aceite al reductor respetando las marcas de identificación, teniendo en cuenta las prescripciones nacionales vigentes.

Tenga en cuenta las siguientes condiciones:

- Una reducción de las secciones de conducto especificadas no está permitida.
- Tenga en cuenta el grosor de pared y el material adecuados a la hora de seleccionar tubos, tubos flexibles y racores. Utilice preferentemente racores con junta de material blando.

1.3.3 Conexión eléctrica

Tenga en cuenta las normativas específicas del país para las conexiones eléctricas.

En la versión estándar, conecte los siguientes componentes:

- Motor del ventilador
- Motor de la bomba
- Interruptor térmico/sonda térmica

Tenga en cuenta al respecto las siguientes notas.

- Compruebe particularmente el correcto sentido de giro de la bomba de aceite y el intercambiador de calor aceite-aire.
- Tenga en cuenta la hoja de datos del motor.
- En caso de usar un interruptor térmico /TSK2, deberá integrarlo en el circuito de modo que
 - en el primer punto de conmutación (a una temperatura del aceite de 60 °C) se conecten la bomba de aceite y el intercambiador de calor aceite-aire,
 - en el segundo punto de conmutación (a una temperatura del aceite de 90 °C) se active una señal de aviso o se desconecte el accionamiento principal.
- En caso de usar una sonda térmica PT100, tiene que integrarla en el circuito de tal modo que
 - al alcanzar una temperatura del aceite de 60 °C se conecten la bomba de aceite y el intercambiador de calor aceite-aire,
 - cuando no se alcance una temperatura del aceite de 50 °C se desconecten la bomba de aceite y el intercambiador de calor aceite-aire,
 - al alcanzar una temperatura del aceite de 90 °C se dispare una señal de aviso o se desconecte el accionamiento principal.
- El indicador de suciedad del filtro de aceite indica la necesidad de cambiar un elemento filtrante sucio.

En caso de usar opciones:

- Conecte el sensor de caudal volumétrico al control del usuario.

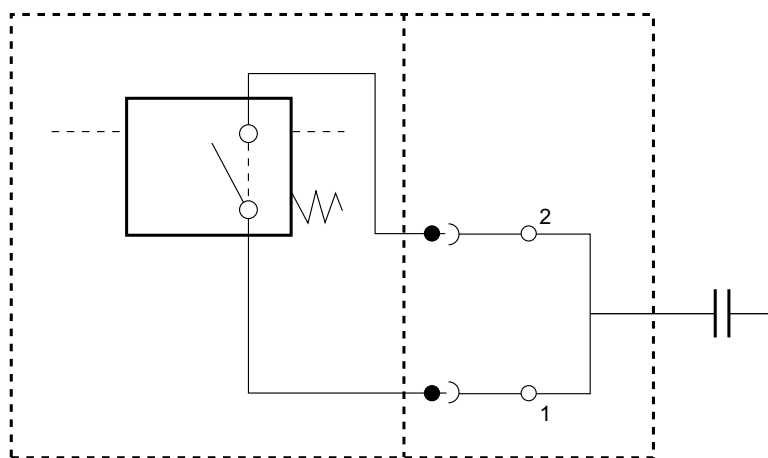
1.3.4 Temperatura límite para el arranque del sistema de suministro de aceite

Para garantizar un funcionamiento correcto del sistema de suministro de aceite, el aceite del reductor debe tener una viscosidad mínima. La viscosidad depende del aceite utilizado y de la temperatura del aceite en los tubos/tubos flexibles conductores de aceite y en la bomba de aceite. Tenga en cuenta el capítulo "Lubricantes admitidos" (→ 23).

Cuando el sistema de suministro de aceite se utiliza a temperaturas ambiente frías, puede ser necesario adaptar el sistema de suministro de aceite. En caso necesario, póngase en contacto con SEW-EURODRIVE.

1.3.5 Datos técnicos del indicador de suciedad eléctrico/óptico

La siguiente imagen muestra el esquema de conexiones:



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La siguiente tabla muestra los datos técnicos:

Tensión máx.	250 V CA / 200 V CC
Corriente de conmutación máx.	1.0 A
Capacidad de conmutación máx.	70 W
Grado de protección	IP 65 en estado enchufado y asegurado
Tipo de contacto	Contacto NA/contacto NC

1.4 Indicación para el control del nivel de aceite

El uso de un sistema de refrigeración de aceite puede afectar al nivel de aceite. Las cantidades de llenado indicadas en la placa de características son valores aproximados y se refieren exclusivamente al reductor. La cantidad de aceite a llenar viene determinada por la marca de la varilla del nivel de aceite, la mirilla del nivel de aceite o la mirilla de aceite.

Observe en las instrucciones de funcionamiento del reductor el capítulo "Comprobación del nivel de aceite".

1.4.1 Mayor cantidad de aceite de reductor

La cantidad de llenado de lubricante necesaria del sistema de refrigeración de aceite que debe llenarse adicionalmente en el reductor se indica en la siguiente tabla.

Los datos se refieren a secciones transversales estándar de las tuberías con una longitud del tubo de aspiración de 1.5 m y del tubo de impulsión de 2.5 m.

Tamaño	Aceite necesario adicional en el reductor en l
OAC1 5	4.5
OAC1 8	4.5
OAC1 10	5.0
OAC1 16	5.5
OAC1 20	8.0
OAC1 25	10.0
OAC1 32	14.0
OAC1 40	15.0
OAC1 80	16.0

1.5 Puesta en marcha

1.5.1 Notas



¡IMPORTANTE!

Una puesta en marcha incorrecta puede dañar el reductor o el sistema de suministro de aceite.

Posibles daños materiales.

- Tenga en cuenta las siguientes indicaciones.

- Antes de la puesta en marcha, compruebe la capacidad de funcionamiento de los dispositivos de control. (En función del diseño, presostato, caudalómetro, interruptor térmico/sonda térmica, indicador de mantenimiento, etc.)
- Tenga en cuenta que el sistema de refrigeración de aceite por aire debe funcionar como mínimo durante 10 minutos antes de la primera puesta en marcha del reductor y después de cada cambio de aceite para que todas las cámaras de aceite estén llenas. A continuación, vuelva a desconectar la bomba de aceite y corrija el nivel de aceite, si fuese necesario.
- Tenga en cuenta que el sistema de suministro de aceite con temperaturas ambiente muy bajas debe funcionar sólo con calefacción del aceite. Encontrará más información en el capítulo "Temperatura límite para el arranque del sistema de suministro de aceite" (→ 18).

1.5.2 Purgar el aire de la bomba de aceite



⚠ ¡ADVERTENCIA!

Peligro por salida y salpicaduras del aceite de reductor.

Lesiones graves.

- Es obligatorio utilizar gafas protectoras.
- Purgue la bomba con mucho cuidado.

Respete el siguiente procedimiento si la bomba después del arranque de la bomba no bombease aceite inmediatamente:

- Llene la bomba de aceite con aceite.
- Purgue el aire del sistema de suministro de aceite durante el arranque en la parte de impulsión, a ser posible, en el punto más alto.

1.5.3 Sensor de caudal

Respete el siguiente modo de proceder:

1. Ponga la unidad en marcha.
2. Conecte el sensor de caudal.
3. Realice el ajuste high flow, tenga en cuenta las notas en la documentación del fabricante (véase anexo).
4. Ponga el punto de desconexión en el sensor de caudal a LED 4 ó 5, tenga en cuenta las notas en la documentación del fabricante.
5. Integre el punto de conmutación de tal modo en el sistema que se produzca una desconexión del reductor al quedar por debajo.

1.6 Inspección/mantenimiento

NOTA



Lea primero las instrucciones de funcionamiento del fabricante del sistema de refrigeración.

1.6.1 Intervalos de inspección y de mantenimiento

Cumpla los siguientes intervalos de inspección y mantenimiento.

Intervalo de tiempo	¿Qué hacer?
• En función de las condiciones de funcionamiento, a más tardar cada 12 meses	• Comprobar el estado de la motobomba, si fuese preciso, sustituir el elemento filtrante
• Depende (en función de las influencias externas)	• Comprobar la estanqueidad de los tubos flexibles existentes. El tiempo de uso de los tubos flexibles no debe exceder de seis años después de la fecha de fabricación impresa.

1.6.2 Comprobar tubos flexibles

¡IMPORTANTE!

Aun en caso de un almacenamiento adecuado y esfuerzo permitido, las mangueras y los tubos flexibles están sometidos a un envejecimiento natural. Por este motivo, su vida útil está limitada.

- El tiempo de uso de los tubos flexibles no debe exceder de seis años después de la fecha de fabricación impresa.
- El usuario de la instalación tiene que asegurar que los tubos flexibles se sustituyan en intervalos de tiempo adecuados aun cuando no se puedan percibir deficiencias técnicas de seguridad en los tubos flexibles.
- Encomiende la comprobación de los tubos flexibles al menos una vez al año a un experto en cuanto al estado de funcionamiento seguro de los mismos.

1.7 Fallo de funcionamiento

Fallo	Causa posible	Medida
Bomba de aceite no aspira	- Aire en los tubos - Falta aceite en el reductor - Tipo de aceite equivocado en el reductor - El motor no gira - Sentido de giro del motor erróneo	- Llenar con aceite el tubo de aspiración y la bomba de aceite - Purgar el aire del tubo de impulsión durante el arranque - Comprobar el nivel de aceite en el reductor - Comprobar el tipo de aceite (sobre todo a bajas temperaturas) - Comprobar las conexiones eléctricas - Cambio del sentido de giro
Caudal de la bomba de aceite insuficiente	- Circuito de aceite obturado - Tipo de aceite equivocado - Velocidad errónea del motor - Depresión de aspiración excesiva	- Abrir válvulas y grifos - Comprobar el tipo de aceite (sobre todo a bajas temperaturas) - Comprobar la velocidad del motor de la bomba - Aumentar la sección del tubo de aspiración - Reducir la altura de aspiración
Bomba de aceite hace mucho ruido	Depresión de aspiración excesiva	- Aumentar la sección del tubo de aspiración - Reducir la altura de aspiración - Evitar acodados bruscos en el tubo de aspiración - Evitar reducciones en el tubo de aspiración
Bomba de aceite transporta espuma	- Falta aceite en el reductor - Tubo de aspiración tiene fuga	- Comprobar el nivel de aceite en el reductor - Comprobar la estanqueidad de los racores
No se alcanza la potencia refrigeradora	Temperatura de aire superior que en el diseño	Utilizar refrigerador mayor
Corriente de aire insuficiente	- Láminas obturadas - Obstáculos en la cercanía	- Limpiar registro de refrigeración - Mantener la distancia mínima

1.8 Lubricantes admitidos

En este capítulo se describen los lubricantes admitidos y las temperaturas admisibles durante el uso de los reductores industriales de SEW-EURODRIVE.

NOTA



- Decisivo para la viscosidad y el tipo de aceite es el tipo de aceite seleccionado por SEW-EURODRIVE para el pedido específico (véase confirmación del pedido y placa de características).
- En caso de usar lubricantes biodegradables y aptos para uso alimentario, así como aceites de poliglicol, consulte con SEW-EURODRIVE.
- Compruebe la compatibilidad de la grasa y el aceite utilizados.
- Las tablas contienen los lubricantes autorizados por SEW-EURODRIVE.
- Los aceites de las mismas clases de viscosidad y diferentes fabricantes no tienen las mismas propiedades. Particularmente las temperaturas del baño de aceite mínimas admisibles son específicas del fabricante. Estas temperaturas se representan en las tablas de lubricantes.
- Las temperaturas del baño de aceite mínimas admisibles dependen del tipo de lubricación utilizado. Estas temperaturas se representan en las tablas de lubricantes. Los valores corresponden a la viscosidad máxima de cada uno de los lubricantes.
- Los valores que se indican en las tablas de lubricantes tienen validez en el momento de la impresión de este documento. Los datos de los lubricantes están sometidos a un cambio dinámico por parte del fabricante del lubricante. Las informaciones actuales sobre los lubricantes se encuentran en: www.sew-eurodrive.de/schmierstoffe

1.8.1 Estructura de las tablas y abreviaturas

[2]	DIN (ISO) API	ISO,SAE NLGI				
			-20	+65	-20	+65
[1]	CLP	VG 150 ¹⁾	-5		-5	
			+5		+5	
			Optigear BM 150		Alpha SP 150	
			S0		S0	
		VG 220	-15		-15	
			0	+75	0	+75
			+10		+10	
			Optigear BM 220		Alpha SP 220	
			S0		S0	
		VG 320	-10		-10	
			+5	+85	+5	+80
			+15		+15	
			Optigear BM 320		Alpha SP 320	
			S0		S0	

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- [1] Tipo de lubricante
[2] Clase de viscosidad

25829238/ES – 11/2018

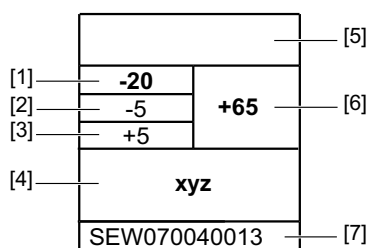
1 Refrigerador de aceite por aire con lubricación por barboteo /OAC1

Lubricantes admitidos

Abreviaturas

Símbolos	Designación
CLP	= Aceite mineral
CLP HC	= Polialfaolefinas sintéticas (PAO)
E	= Aceite en base a ésteres
	= Lubricante mineral
	= Lubricante sintético
	= Lubricante para la industria alimentaria (conforme a NSF H1)
	= Aceite biodegradable (lubricante para agricultura, silvicultura y gestión de recursos hidráulicos)
1)	= Se pueden utilizar lubricantes únicamente con el factor de servicio $F_s \geq 1.3$

1.8.2 Explicaciones para cada lubricante



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- [1] Temperatura de arranque en frío más baja en °C para lubricación por barboteo*
- [2] Temperatura de arranque en frío más baja en °C para accionamientos con bombas hasta una viscosidad máx. del aceite de 5.000 cSt*
- [3] Temperatura de arranque en frío más baja en °C para accionamientos con bombas hasta una viscosidad máx. del aceite de 2.000 cSt*
- [4] Nombres comerciales
- [5] Fabricante
- [6] ¡Máxima temperatura de baño de aceite en °C! ¡NO SE DEBE EXCEDER!
- [7] Aprobaciones

*Si el aceite tiene una temperatura más baja, se debe calentar a la temperatura mínima indicada mediante una calefacción de aceite, por ejemplo. La viscosidad del aceite máxima admisible en función del tipo de bomba se puede consultar en el capítulo siguiente.

1.8.3 Explicaciones para sistemas de suministro de aceite y viscosidad del aceite

La motobomba está diseñada para una viscosidad del aceite de **5 000 cSt**.

25829238/ES – 11/2018

1.8.4 Tablas de lubricantes

La tabla de lubricantes es válida en la fecha de impresión de este documento, consulte la tabla actual en www.sew-eurodrive.de/schmierstoffe.

[1]	[2]	SEW EURODRIVE	Castrol	FUCHS	Mobil®	KLÜBER LUBRICATION	Shell	TOTAL
CLP	VG 150 ¹⁾	SEW GearOil Base 150 E1	Optigear BM 150	Renolin CLP 150 Plus	Renolin HighGear 150	Kluberoil GEM 1-150 N		
		SEW070040013						
	VG 220	SEW GearOil Base 220 E1	Optigear BM 220	Renolin CLP 220 Plus	Renolin HighGear 220	Kluberoil GEM 1-220 N		
		SEW070040013						
	VG 320	SEW GearOil Base 320 E1	Optigear BM 320	Renolin CLP 320 Plus	Renolin HighGear 320	Kluberoil GEM 1-320 N		
		SEW070040013						
	VG 460	SEW GearOil Base 460 E1	Optigear BM 460	Renolin CLP 460 Plus	Renolin HighGear 460	Kluberoil GEM 1-460 N		
		SEW070040013						
	VG 680	SEW GearOil Base 680 E1	Optigear BM 680	Renolin CLP 680 Plus	Renolin HighGear 680	Kluberoil GEM 1-680 N		
		SEW070040013						
	VG 1000		Optigear BM 1000					

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1 Refrigerador de aceite por aire con lubricación por barboteo /OAC1

Lubricantes admitidos

La tabla de lubricantes es válida en la fecha de impresión de este documento, consulte la tabla actual en www.sew-eurodrive.de/schmierstoffe.

[1]	[2]									
CLP HC	VG 32 ¹⁾									
	VG 68 ¹⁾									
	VG 150 ¹⁾									
	VG 220									
	VG 320									
	VG 460									
	VG 680									
	VG 1000									

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La tabla de lubricantes es válida en la fecha de impresión de este documento, consulte la tabla actual en www.sew-eurodrive.de/schmierstoffe.

[1]	[2]	[3]				
	CLP HC NSF H1	VG 68 ¹⁾	-35 -20 -10 +45 Cassida Fluid HF 68 S0	-40 -25 -15 +45 Optileb HY 68 S0		-35 -20 -10 +45 Klüberoil 4UH1-68 N S0
			-20 -5 +5 +75 Cassida Fluid GL 220 S0	-25 -5 +5 +75 Optileb GT 220 S0		-25 -5 +5 +75 Klüberoil 4UH1-220 N S0
			-15 +5 +20 +90 Cassida Fluid GL 460 S0	-15 +5 +20 +95 Optileb GT 460 S0		-15 +5 +15 +95 Klüberoil 4UH1-460 N S0
					-15 +5 +15 +95 Plantogear 460 S S0	-15 +5 +15 +95 Klüberbio CA2-460 S0
	E	VG 460				

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2 Documentación de proveedores

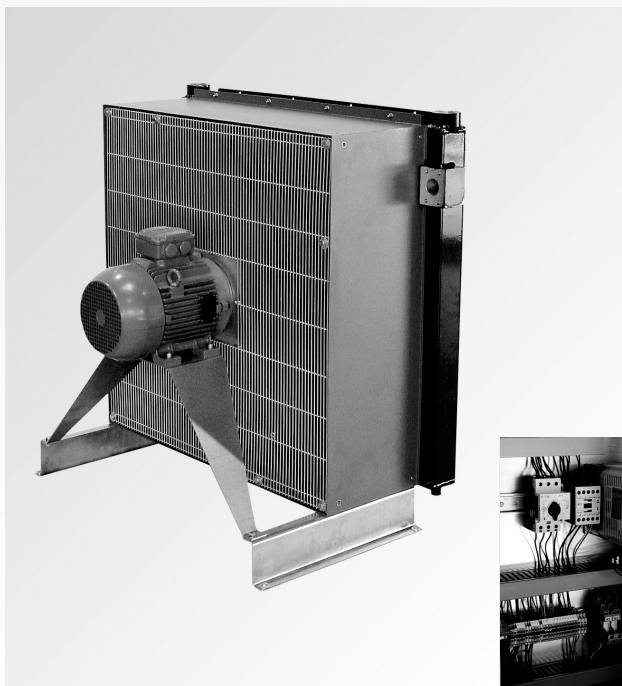
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**Öl/Luft-Wärmetauscher
Oil/air heat exchangers
Echangeur thermique huile/air**



Serie

LKI

Für den industriellen Einsatz

For industrial use

A usage industriel



NEU:

- Jetzt auch als Baukastensystem mit Steuerung erhältlich! Auf die Leistung angepasste Drehzahlregelung für optimierten Energieverbrauch und verringerte Lärmemission
- Atex-Zertifikat
- US-Version (NEMA-Motor)
- Edelstahlversion

NEW:

- Now also available in a modular system with a power control! Speed control attuned to the power in order to reduce noise level and energy consumption
- ATEX certificate
- US-version (NEMA-motor)
- Stainless steel version

NOUVEAU:

- Maintenant aussi disponible en tant que système modulaire avec commande! A la puissance une régulation de vitesse adaptée pour une consommation d'énergie optimisée et une réduction de bruit
- Certificat ATEX
- Version US (Moteur NEMA)
- Version acier inoxydable



Produktbeschreibung / Product description / Description du produit

Mit dieser neuen Generation der Universal Hydraulik LKI Ölkühler ist es gelungen, den Geräuschpegel zu reduzieren. Diese Kühler sind sehr gut für stationäre Installationen geeignet - für die Kühlung von Hydraulik- oder Schmieröl. Das Programm ist mit langsam laufenden Lüftern ausgebaut worden, bzw. wurde gehäuseoptimiert, was den sehr niedrigen Geräuschpegel gewährleistet. Um das Kühlerprogramm so komplett wie möglich zu bekommen, können die kleinen Typen sowohl in einer eingängigen als in einer zweigängigen Konstruktion geliefert werden. Dadurch wird der Bedarf für Ölkühlung sowohl bei niedrigen als auch bei hohen Öldurchströmungen gedeckt.

With this new generation of Universal Hydraulik LKI oil-coolers, the manufacturers have succeeded in reducing the noise level. These coolers are ideally suited for stationary installations - for the cooling of hydraulic or lubricating oils. The range has been extended to include slow-running ventilators, and the housings have been optimised, in order to produce the very low noise level. In order to make the cooler range as comprehensive as possible, the smaller models are also available as single or dual versions, thus covering oil-cooling requirements for both low and high oil throughflow volumes.

Avec sa nouvelle génération de refroidisseurs d'huile LKI, Universal Hydraulik a réussi à réduire le niveau de bruit. Ces refroidisseurs conviennent parfaitement pour l'huile hydraulique ou de graissage dans des installations stationnaires. La gamme a été complétée avec des ventilateurs à fonctionnement lent, et les boîtiers ont été optimisés pour réduire le niveau de bruit. Les modèles de petite taille peuvent être livrés en version une ou deux voies, couvrant ainsi toutes les applications selon que le débit d'huile est faible ou élevé.

Produktmerkmale

- Testdruck: 25 bar statisch nach DIN 50104
- Arbeitsdruck: 16 bar (mind. 2 Mill. Zyklen von 0-16 bar bei 2 Hz und 60 °C)
- Kompakte Ölkühler
- Große Kühlleistung
- Niedriger Druckverlust
- Max. Betriebstemperatur: 120 °C
- Hohe Flexibilität
- 2" SAE-Flansch zusätzlich ab LKI 700 aufwärts
- Kühlung von: Öl, HFA, HFB, HFC, HFD-Flüssigkeiten bis $v = 100 \times 10^{-6} \text{ m}^3/\text{s}$, Wasser/Glycol mind. 65:35 - keinesfalls Wasser ohne Korrosionsschutzmittel
- Kühlmittel: Luft
- Variabler Motor; Hydro / 12/24V

Option

- Testdruck 40 bar
- Filtermatte auf Anfrage
- Thermo-Bypass
- Thermoschalter
- Seewasser-Ausführung (off-shore)

Product highlights

- Testing pressure: 25 bar static according to DIN 50104
- Operating pressure: 16 bar (min. 2 Mill. Cycles from 0-16 bar at 2 Hz and 60 °C)
- Compact oil-cooler
- High cooling performance
- Low pressure loss
- Max. operating temperature: 120 °C
- High flexibility
- 2" SAE flange from LKI 700 upward
- Cooling of: Oil, HFA, HFB, HFC, HFD-fluids up to $v = 100 \times 10^{-6} \text{ m}^3/\text{s}$, water/glycol min. 65:35 - under no circumstances water without corrosion prevention
- Coolant: air
- Variable motor; Hydro / 12/24V

Option

- Testing pressure 40 bar
- Filter pad available on request
- Thermo-bypass
- Thermo-switch
- Seawater version also available (off-shore)

Caractéristiques produit

- Pression de test: 25 bar statique après DIN 50104
- Pression de service: 16 bar (min. 2 Mill. Cycles de 0-16 bar à 2 Hz et 60 °C)
- Refroidisseur d'huile compact
- Grande capacité de refroidissement
- Faible perte de pression
- Faible niveau de bruit
- Température max. de service: 120 °C
- Bride SAE 2" à partir de la version LKI 700
- Refroidissement de: Huile, HFA, HFB, HFC, HFD-liquides jusqu'à $v = 100 \times 10^{-6} \text{ m}^3/\text{s}$, eau/glycol 65:35 du moins - point du tout eau sans anticorrosifs
- Medium de refroidissement: air
- Moteur variable, hydro / 12/24V

Options

- Pression de test 40 bar
- Matelas filtrant sur demande
- By-pass thermique
- Interrupteur thermique
- Version eau de mer (off-shore)

Berechnungsbeispiel / Example calculation / Exemple de calcul

Beispiel 1:

(wenn die Kühlleistung bekannt ist)

Kühlleistung = 65 kW
Max. Öltemperatur = 70°C
Umgebungstemperatur = 30°C
Öldurchströmung = 250 l/min
Spez. Kühlleistung:

$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{65}{70 - 30} = 1,63 \text{ kW/}^{\circ}\text{C}$$

Wahl: LKI-710-400-6 oder LKI 810-400-8.
Die Wahl hängt von eventuellen Geräuschbegrenzungen ab.

Beispiel 2:

(wenn die Kühlleistung nicht bekannt ist)
Normalerweise gibt es eine Wärmeabgabe zum Öl von 25-30% der Motorleistung (Dieselmotor oder E-Motor)

Motorleistung = 30 kW
Kühlleistung (0,3 x 30kW) = 9,0 kW
Max. Öltemperatur = 60°C
Umgebungstemperatur = 30°C
Öldurchströmung = 250 l/min
Spez. Kühlleistung:

$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{9}{60 - 30} = 0,3 \text{ kW/}^{\circ}\text{C}$$

Wahl: LKI-210-400-2 oder LKI 310-400-6.
Die Wahl hängt von eventuellen Geräuschbegrenzungen ab.

Ölabkühlung:

$$\Delta t_{\text{Öl}} = \frac{36 \times Q}{V_{\text{Öl}}} = \frac{36 \times 9}{35} = 9,26 \text{ }^{\circ}\text{C}$$

Q = Kühlleistung [kW]
T_{Öl} = max. Öltemperatur [°C]
T_{umg} = Umgebungstemperatur [°C]
V_{Öl} = Öldurchströmung [l/min]

Example 1:

(if required cooling performance is known)

Cooling performance = 65 kW
Max. oil temperature = 70°C
Ambient temperature = 30°C
Oil throughflow = 250 l/min
Special cooling performance:

$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{65}{70 - 30} = 1,63 \text{ kW/}^{\circ}\text{C}$$

Options: LKI-710-400-6 or LKI 810-400-8.
The choice depends on any possible noise restrictions.

Example 2:

(if the required cooling performance is not known). Normally there is a heat transfer to the oil of 25-30% of the motor performance (diesel motor or electric motor)

Motor performance = 30 kW
Cooling performance (0,3 x 30kW) = 9,0 kW
Max. oil temperature = 60°C
Ambient temperature = 30°C
Oil throughflow = 250 l/min
Special cooling performance:

$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{9}{60 - 30} = 0,3 \text{ kW/}^{\circ}\text{C}$$

Options: LKI-210-400-2 or LKI 310-400-6.
The choice depends on any possible noise restrictions.

Oil cooling:

$$\Delta t_{\text{Öl}} = \frac{36 \times Q}{V_{\text{Öl}}} = \frac{36 \times 9}{35} = 9,26 \text{ }^{\circ}\text{C}$$

Q = Cooling performance [kW]
T_{Öl} = max. oil temperature [°C]
T_{umg} = Ambient temperature [°C]
V_{Öl} = Oil throughflow [l/min]

Exemple 1:

(la capacité de refroidissement est connue)

Capacité de refroidissement = 65 kW
Température d'huile max. = 70 °C
Température ambiante = 30 °C
Débit d'huile = 250 l/min
Capacité de refroidissement spéc.:

$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{65}{70 - 30} = 1,63 \text{ kW/}^{\circ}\text{C}$$

Modèle: LKI-710-400-6 ou LKI 810-400-8.
Le choix dépend du niveau de bruit requis.

Exemple 2:

(la capacité de refroidissement n'est pas connue). En règle générale, le dégagement de chaleur vers l'huile est de 25-30% du rendement du moteur (moteur diesel ou moteur électrique)

Rendement moteur = 30 kW
Capacité de refroidissement (0,3 x 30 kW) = 9,0 kW
Température d'huile max. = 60 °C
Température ambiante = 30 °C
Débit d'huile = 250 l/min
Capacité de refroidissement spéciale:

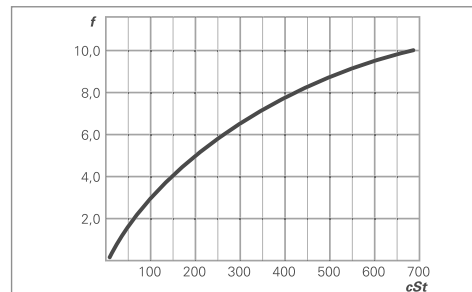
$$\frac{Q}{T_{\text{Öl}} - T_{\text{umg}}} = \frac{9}{60 - 30} = 0,3 \text{ kW/}^{\circ}\text{C}$$

Modèle: LKI-210-400-2 ou LKI 310-400-6.
Le choix dépend du niveau de bruit requis.

Refroidissement d'huile:

$$\Delta t_{\text{Öl}} = \frac{36 \times Q}{V_{\text{Öl}}} = \frac{36 \times 9}{35} = 9,26 \text{ }^{\circ}\text{C}$$

Q = Refroidissement de l'huile [kW]
T_{Öl} = Température d'huile max. [°C]
T_{umg} = Température ambiante [°C]
V_{Öl} = Débit d'huile [l/min]



Korrekturfaktor für den Druckverlust bei anderen Viskositäten:

$$\Delta p_{\text{Öl}} = \Delta p_{30\text{cSt}} \times f$$

Correction factor for the pressure loss for other viscosities:

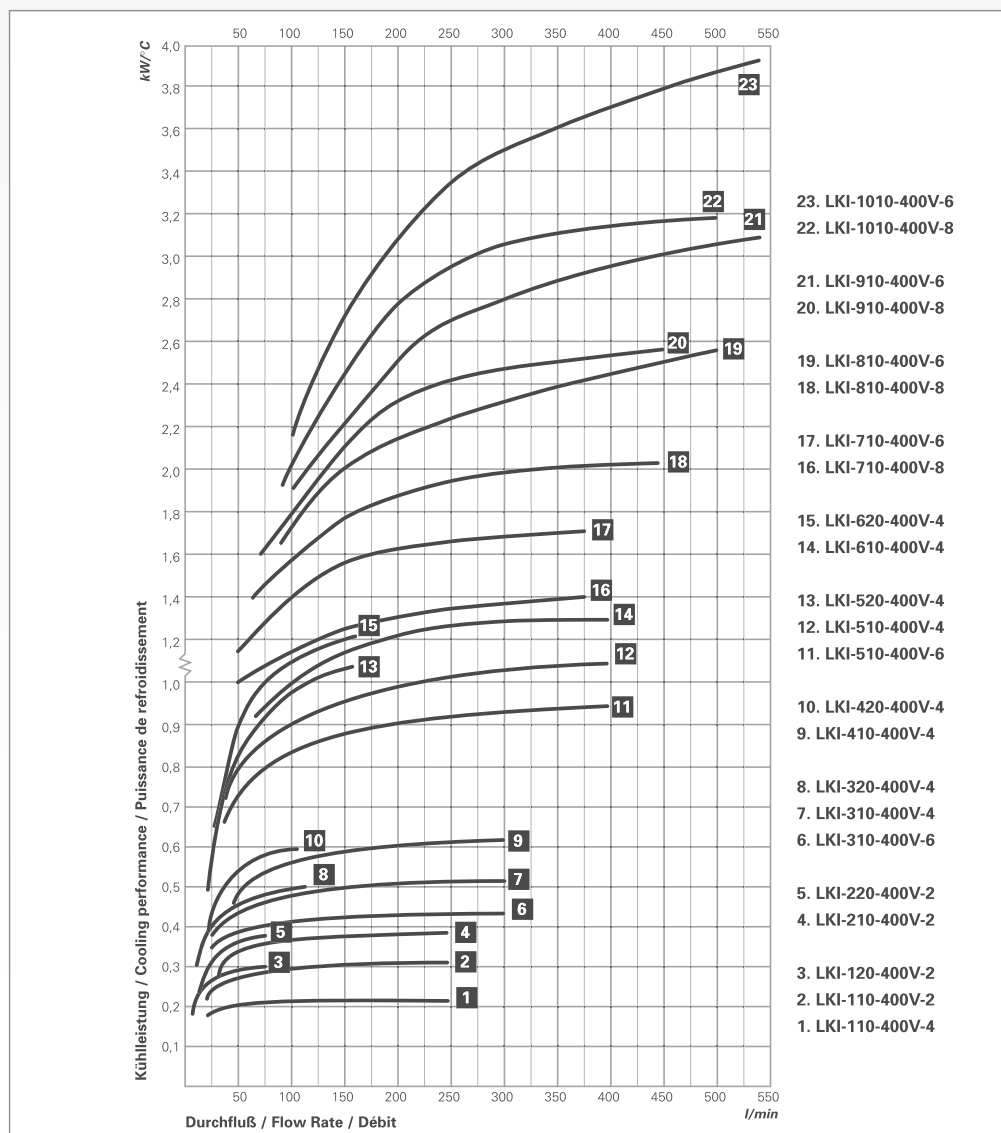
$$\Delta p_{\text{Öl}} = \Delta p_{30\text{cSt}} \times f$$

Facteur de correction de la perte de pression pour d'autres viscosités:

$$\Delta p_{\text{Öl}} = \Delta p_{30\text{cSt}} \times f$$

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Kennlinien / Performance Data / Courbes caractéristiques LKI 110 - 1010



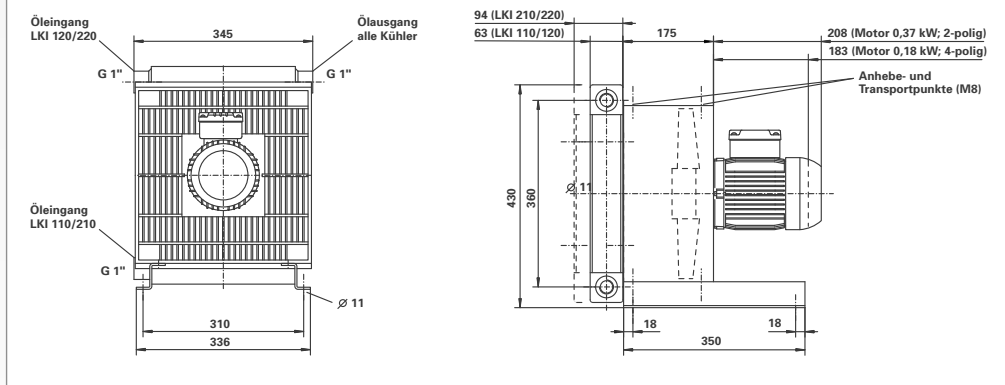
Die Berechnung der spezifischen Kühlleistungen gründet auf einer Öltemperatur von 60°C, einer Umgebungstemperatur von 20°C – und damit einem Temperaturunterschied von 40°C. Die Werte gelten für Hydrauliköl ISO VG32 mit 30 cSt. Für Abweichungen wird Δp mit dem Korrekturfaktor f aus dem Diagramm auf Seite 3 multipliziert.

The calculation of the specific cooling performance is based on an oil temperature of 60°C, an ambient temperature of 20°C – and therefore a temperature difference of 40°C. The figures apply to ISO VG32 hydraulic oil with 30 cSt. For variances, Δp is multiplied by the correction factor f from the diagram on Page 3.

Le calcul des capacités de refroidissement est basé sur une température d'huile de 60° C et une température ambiante de 20° C, soit une différence de température de 40°C. Les valeurs correspondent à l'utilisation d'huile hydraulique ISO VG32, viscosité 30 cSt. Pour d'autres valeurs, on multiplie Δp par le facteur de correction f du diagramme de la page 3.

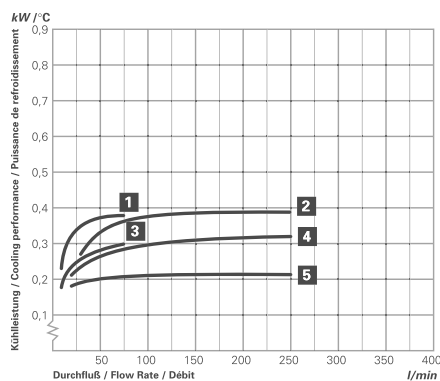
LKI-100/200

Abmessungen / Dimensions



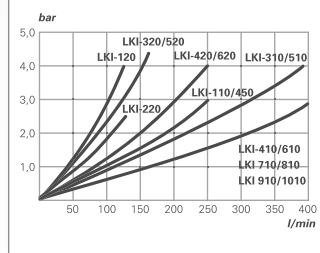
LKI 100 - 600: Öl-Anschlüsse Innengewinde seitlich / lateral internal-thread oil connections / Raccordements d'huile à filetage intérieur latéral

Kühlleistung / Cooling performance / Puissance de refroidissement



1. LKI-220-400V-2
2. LKI-210-400V-2
3. LKI-120-400V-2
4. LKI-110-400V-2
5. LKI-110-400V-4

Druckabfall / Pressure loss / Baisse de pression



Technische Daten / Technical data / Données techniques

Typ model modele	Motorleistung Motor performance Moteur puissance kW	Stromaufnahme Power consumption Puissance absorbée A	Drehzahl Revolutions Vitesse rotation min ⁻¹	Luftdurchsatz Air throughflow Débit d'air m ³ /s	Schallpegel* Noise level* Niveau acoustique* 1m/7m (dBA)	Gewicht Weight Poids kg
LKI-110-400V-2	0,37	0,88	3000	1,29	77/62	17
LKI-120-400V-2	0,37	0,88	3000	1,29	77/62	17
LKI-110-400V-4	0,18	0,58	1500	0,49	64/50	17
LKI-120-400V-4	0,18	0,58	1500	0,49	64/50	17
LKI-210-400V-2	0,37	0,88	3000	1,18	79/64	20
LKI-220-400V-2	0,37	0,88	3000	1,18	79/64	20
LKI-210-400V-4	0,18	0,58	1500	0,50	64/50	20
LKI-220-400V-4	0,18	0,58	1500	0,50	64/50	20

* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ± 3 dB(A) variieren.

* may vary by ± 3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.

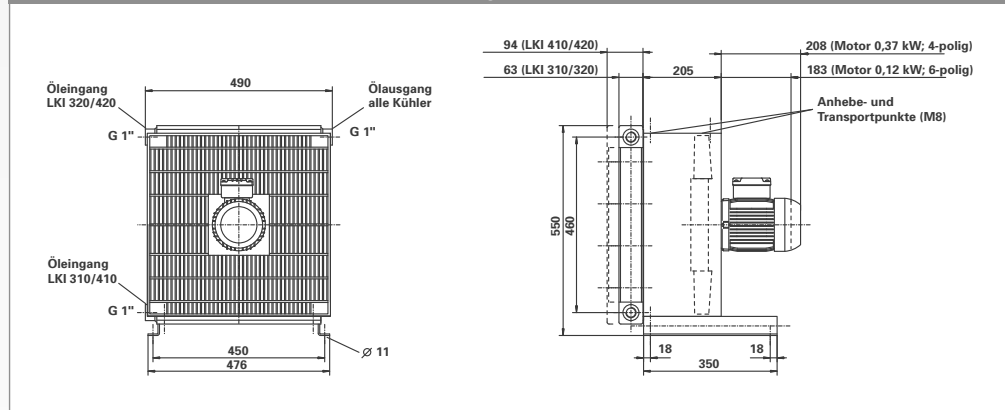
* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ± 3 dB(A).

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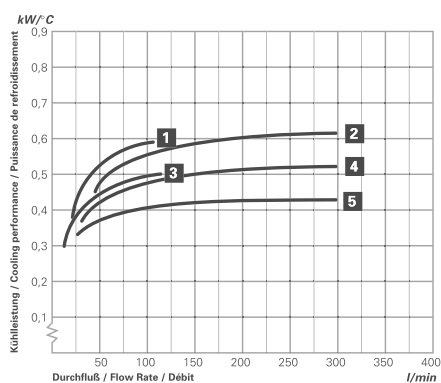
LKI-300/400

Abmessungen / Dimensions



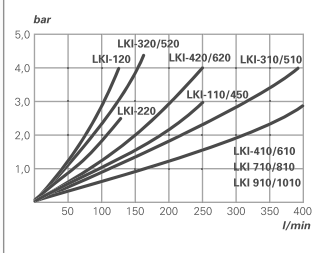
LKI 100 - 600: Öl-Anschlüsse Innengewinde seitlich / lateral internal-thread oil connections / Raccordements d'huile à filetage intérieur latéral

Kühlleistung / Cooling performance / Puissance de refroidissement



1. LKI-420-400V-4
2. LKI-410-400V-4
3. LKI-320-400V-4
4. LKI-310-400V-4
5. LKI-310-400V-6

Druckabfall / Pressure loss / Baisse de pression



Technische Daten / Technical data / Données techniques

Typ model modele	Motorleistung Motor performance Moteur puissance kW	Stromaufnahme Power consumption Puissance absorbée A	Drehzahl Revolutions Vitesse rotation min ⁻¹	Luftdurchsatz Air throughflow Débit d'air m ³ /s	Schallpegel* Noise level* Niveau acoustique* 1m/7m (dBA)	Gewicht Weight Poids kg
LKI-310-400V-4	0,37	0,89	1500	0,74	73/58	25
LKI-320-400V-4	0,37	0,89	1500	0,74	73/58	25
LKI-310-400V-6	0,12	0,48	1000	0,59	65/51	26
LKI-320-400V-6	0,12	0,48	1000	0,59	65/51	26
LKI-410-400V-4	0,37	0,48	1500	0,76	75/63	32
LKI-420-400V-4	0,37	0,48	1500	0,76	75/63	32
LKI-410-400V-6	0,12	0,48	1000	0,55	67/53	33
LKI-420-400V-6	0,12	0,48	1000	0,55	67/53	33

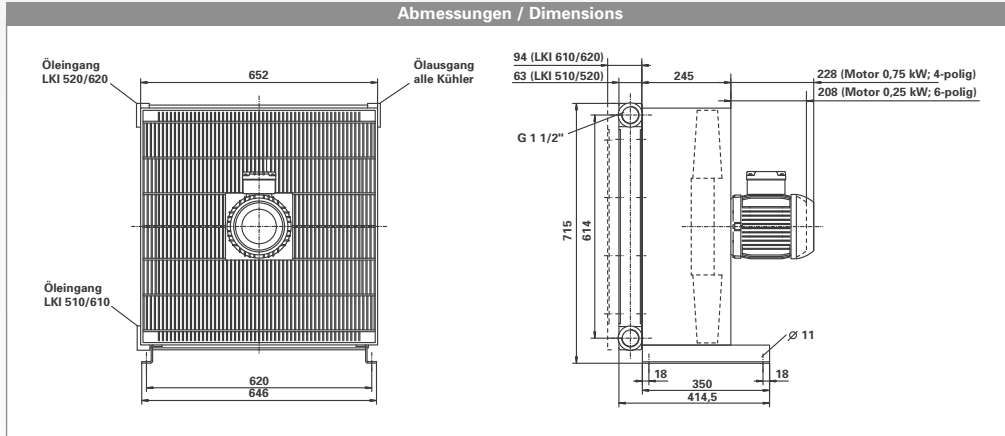
* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ± 3 dB(A) variieren.

* may vary by ± 3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.

* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ± 3 dB(A).

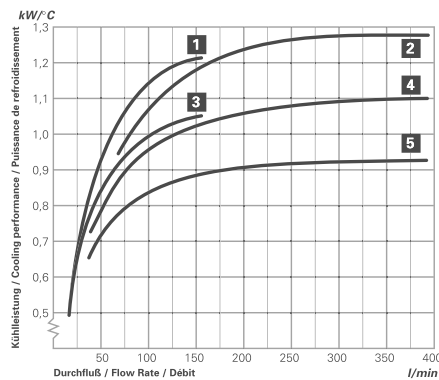
LKI - 500 / 600

Abmessungen / Dimensions



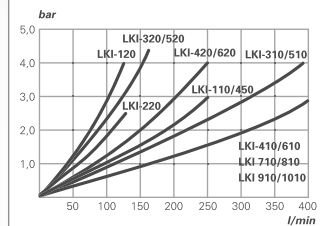
LKI 100 - 600: Öl-Anschlüsse Innengewinde seitlich / lateral internal-thread oil connections / Raccordements d'huile à filetage intérieur latéral

Kühlleistung / Cooling performance / Puissance de refroidissement



1. LKI-620-400V-4
2. LKI-610-400V-4
3. LKI-520-400V-4
4. LKI-510-400V-4
5. LKI-510-400V-6

Druckabfall / Pressure loss / Baisse de pression



Technische Daten / Technical data / Données techniques

Typ model modele	Motorleistung Motor performance Moteur puissance kW	Stromaufnahme Power consumption Puissance absorbée A	Drehzahl Revolutions Vitesse rotation min ⁻¹	Luftdurchsatz Air throughflow Débit d'air m ³ /s	Schallpegel* Noise level* Niveau acoustique* 1m/7m (dBA)	Gewicht Weight Poids kg
LKI-510-400V-4	0,75	1,71	1500	1,70	80/70	40
LKI-520-400V-4	0,75	1,71	1500	1,70	80/70	40
LKI-510-400V-6	0,25	0,99	1000	1,06	70/57	37
LKI-520-400V-6	0,25	0,99	1000	1,06	70/57	37
LKI-610-400V-4	0,75	1,71	1500	1,50	80/70	49
LKI-620-400V-4	0,75	1,71	1500	1,50	80/70	49
LKI-610-400V-6	0,25	0,99	1000	0,95	70/57	49
LKI-620-400V-6	0,25	0,99	1000	0,95	70/57	49

* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ±3 dB(A) variieren.

* may vary by ±3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.

* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ±3 dB(A).

LKI-700

Abmessungen / Dimensions

LKI 700 - 1000: Öl-Anschlüsse Innengewinde seitlich und SAE -Flansch hinten oder vorne / lateral internal-thread oil connections and SAE flange at front or rear / Raccordements d'huile à filetage intérieur latéral et bride SAE avant ou arrière

Kühlleistung / Cooling performance / Puissance de refroidissement

Druckabfall / Pressure loss / Baisse de pression

Technische Daten / Technical data / Données techniques

Typ model modele kW	Motorleistung Motor performance Moteur puissance kW	Stromaufnahme Power consumption Puissance absorbée A	Drehzahl Revolutions Vitesse rotation min ⁻¹	Luftdurchsatz Air throughflow Débit d'air m ³ /s	Schallpegel* Noise level* Niveau acoustique* 1m/7m (dBA)	Gewicht Weight Poids kg
LKI-710-400V-6	1,1	2,56	1000	2,14	77/64	91
LKI-710-400V-8	0,55	2,56	750	1,56	69/56	91

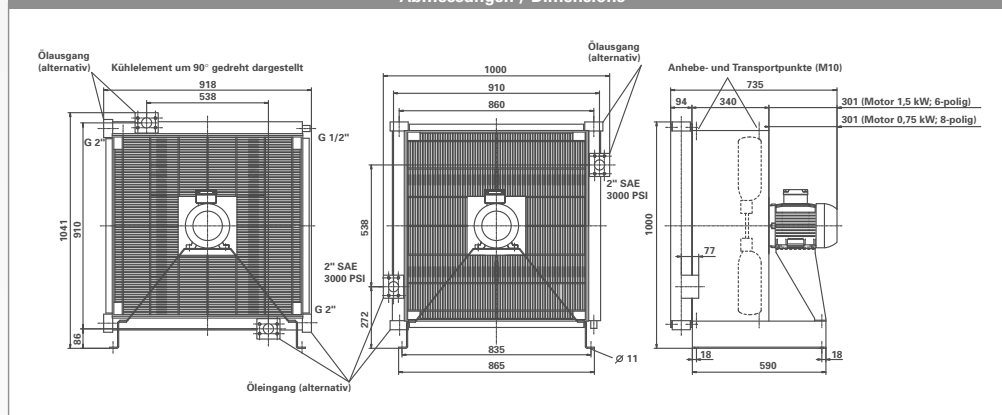
* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ±3 dB(A) variieren.

* may vary by ±3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.

* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ±3 dB(A).

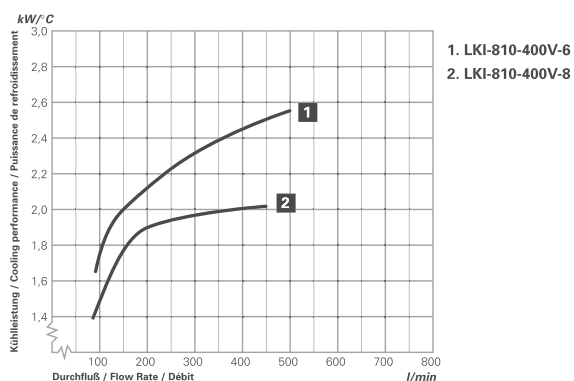
LKI-800

Abmessungen / Dimensions

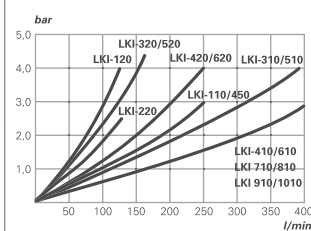


LKI 700 - 1000: Öl-Anschlüsse Innengewinde seitlich und SAE -Flansch hinten oder vorne / lateral internal-thread oil connections and SAE flange at front or rear / Raccordements d'huile à filetage intérieur latéral et bride SAE avant ou arrière

Kühlleistung / Cooling performance / Puissance de refroidissement



Druckabfall / Pressure loss / Baisse de pression



Technische Daten / Technical data / Données techniques

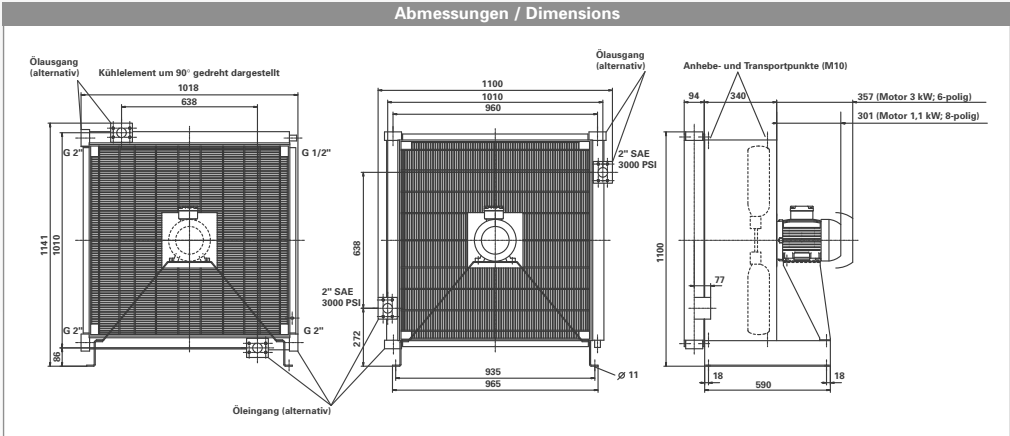
Type model modele	Motorleistung Motor performance Moteur puissance <i>kW</i>	Stromaufnahme Power consumption Puissance absorbée <i>A</i>	Drehzahl Revolutions Vitesse rotation <i>min⁻¹</i>	Luftdurchsatz Air throughflow Débit d'air <i>m³/s</i>	Schallpegel* Noise level* Niveau acoustique* <i>1m/7m (dBA)</i>	Gewicht Weight Poids <i>kg</i>
LKI-810-400V-6	1,5	3,78	1000	3,38	79/68	111
LKI-810-400V-8	0,75	2,42	750	2,64	72/60	111

* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ± 3 dB(A) variieren.

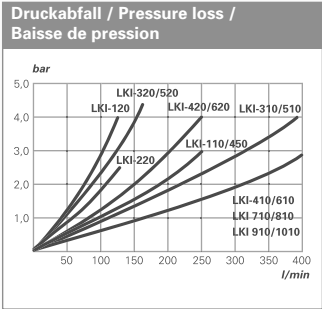
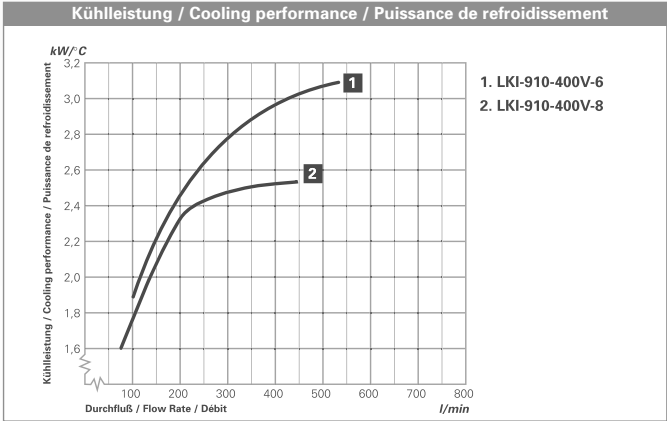
* may vary by ± 3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.

* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ± 3 dB(A).

LKI-900



LKI 700 - 1000: Öl-Anschlüsse Innengewinde seitlich und SAE -Flansch hinten oder vorne / lateral internal-thread oil connections and SAE flange at front or rear / Raccordements d'huile à filetage intérieur latéral et bride SAE avant ou arrière



Technische Daten / Technical data / Données techniques

Type	Motorleistung	Stromaufnahme	Drehzahl	Luftdurchsatz	Schallpegel*	Gewicht
model	Motor performance	Power consumption	Revolutions	Air throughflow	Noise level*	Weight
modele	Moteur puissance	Puissance absorbée	Vitesse rotation	Débit d'air	Niveau acoustique*	Poids
kW	kW	A	min ⁻¹	m ³ /s	1m/7m (dBA)	kg
LKI-910-400V-6	3	7,2	1000	4,32	85/72	137
LKI-910-400V-8	1,1	3,78	750	3,07	76/64	131

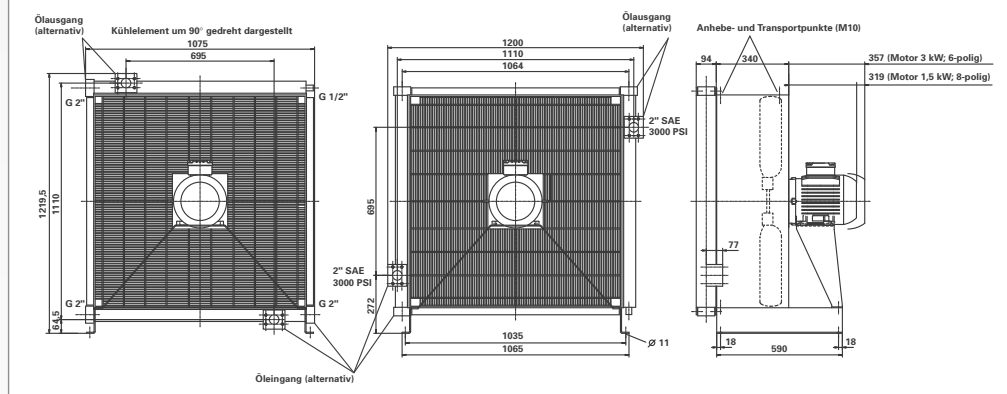
* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ±3 dB(A) variieren.
 * may vary by ±3 dB(A) due to room characteristics, own frequencies, oil connections, viscosity etc.
 * en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ±3 dB(A).

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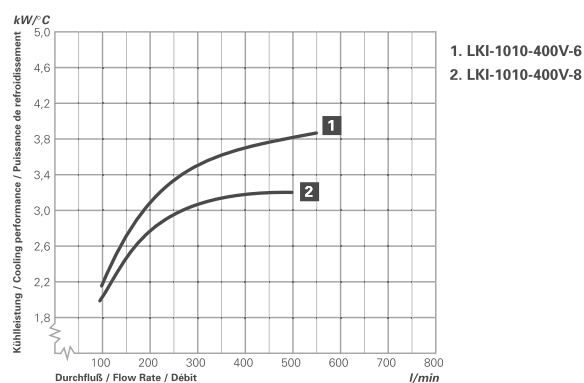
LKI-1000

Abmessungen / Dimensions

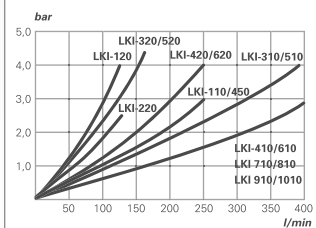


LKI 700 - 1000: Öl-Anschlüsse Innengewinde seitlich und SAE -Flansch hinten oder vorne / lateral internal-thread oil connections and SAE flange at front or rear / Raccordements d'huile à filetage intérieur latéral et bride SAE avant ou arrière

Kühlleistung / Cooling performance / Puissance de refroidissement



Druckabfall / Pressure loss / Baisse de pression



Technische Daten / Technical data / Données techniques

Type model modele	Motorleistung Motor performance Moteur puissance	Stromaufnahme Power consumption Puissance absorbée	Drehzahl Revolutions Vitesse rotation	Luftdurchsatz Air throughflow Débit d'air	Schallpegel* Noise level* Niveau acoustique*	Gewicht Weight Poids
<i>kW</i>	<i>kW</i>	<i>A</i>	<i>min⁻¹</i>	<i>m³/s</i>	<i>1m/7m (dBA)</i>	<i>kg</i>
LKI-1010-400V-6	3	7,2	1000	5,38	84/71	157
LKI-1010-400V-8	1,5	3,78	750	3,84	76/64	151

* kann aufgrund von Raumcharakteristik, Eigenfrequenzen, Öl-Verbindungen, Viskositäten etc. um ± 3 dB(A) variieren.

* may vary by ± 3 dB(A) due to room characteristics, own frequencies, oil connections, viscosities etc.

* en raison des caractéristiques spatiales, des résonances propres, des composés d'huile, des viscosités etc., peut varier de ± 3 dB(A).

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Bestellschlüssel / Ordering key / Code de commande

LKI - 110 - 400V - 2 - G - L

Anwendung / Application / Application

Industriekühler /
Cooler for industrial use /
refroidisseur a usage industrielles = **LKI**
Kühler mit Hydraulikmotor* /
Cooler with hydraulic motor* /
refroidisseur avec moteur
hydraulique* = **LKI-HYD**
*(auf Anfrage / on request /
sur demande)

- = Standard
L = Liegende Version, ohne Füße,
mit Haltebügel / flat version,
no feet, with mounting /
Version, sans pieds,
avec fortification

- = Standard
G 90 = Kühlpaket 90° gedreht / Cooling block
turned 90° / Bloc refroidisseur
tourné 90°
G 180 = Kühlpaket 180° gedreht / Cooling block
turned 180° / Bloc refroidisseur
tourné 180°

Baugröße / Unit Size / Taille

1
2
3
4
5
6
7
8
9
10

Drehzahl / Revolutions per minute / Nombre de tours

2 = 2 polig / 3000 min⁻¹
4 = 4 polig / 1500 min⁻¹
6 = 6 polig / 1000 min⁻¹
8 = 8 polig / 750 min⁻¹

Motortyp / Motor type / Type de moteur

400 V = 400 V Mehrbereichsmotor / 400 V multi-stage
motor / Moteur multigrade 400 V

Motore mit Sonderspannungen, hydraulisch und
explosionsgeschützt auf Anfrage erhältlich.
Motors with special voltages, hydraulic and explosion
protection available on request.
Moteurs avec tensions particulières, hydrauliques et à
protection contre les explosions disponibles sur demande.

Ausführung / Version / Exposé

1 Wege / 1 Way / 1 Voie = **10**
2 Wege / 2 Way / 2 Voies = **20**

Materialien / Materials / Matériaux

	Standard	Seewasser / Sea water / Eau de mer
Kühlblock / Cooling block / Bloc refroidisseur	Aluminium, Edelstahl/Aluminum, Stainless Steel/Aluminium, Inox	Komponenten in Edelstahl und Sonderbeschichtungen möglich/ Components in Stainless and with special coating available/ Composants en Inox et avec de vernis spécial est possible
Gehäuse / Housing / Boîtier	Stahl / Steel / Acier	
Schutzgitter / Safety barrier / Grille de protection	Stahl, blau-chromatiert / Steel with blue-chrome finish / Acier, chromé bleu	
Füße / Feet / Pieds	Verzinkt / Galvanized / Zinguée	
Lüfter / Fan / Ventilateur	PPG	Schutzlackbeschichtung/ protective coating/verniss protecteur

Die technischen Angaben in diesem Datenblatt beziehen sich auf die beschriebenen Betriebsbedingungen und Einsatzfälle. Bei abweichenden Betriebsbedingungen und Einsatzfällen wenden Sie sich bitte an Universal Hydraulik.

Technische Änderungen vorbehalten. Bitte beachten Sie auch unsere Wartungs- und Bedienungsanleitung.

The technical data of this sheet is depending on the described operational conditions and individual cases. At different operational conditions and differing individual cases contact Universal Hydraulik.

Technical modifications reserved. Please also pay attention to our operation manuals and maintenance documentations.

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www.universalhydraulik.com

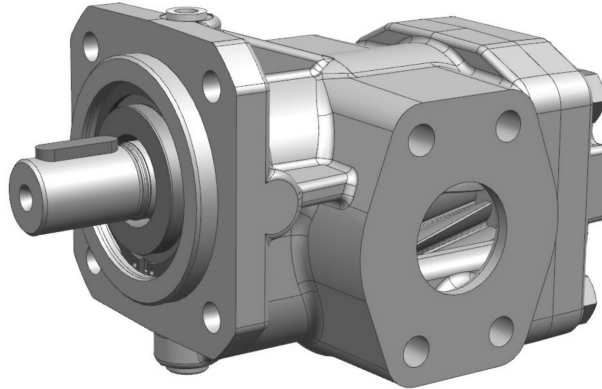
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Operating instructions (Translation)



Gear pump KF 2.5 - 630

88024710002-26

Englisch

2017-09-12

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1 General

1.1 About the documentation

These operating instructions describe the installation, operation and maintenance of the following device:

Gear pump KF 2.5 - 630

The device is manufactured in different versions. Information about the version concerned in the individual case can be found on the device's type plate.

These operating instructions are a component of the device and must be kept accessible for the personnel near the device at all times.

If you have any questions about these operating instructions, please contact the manufacturer.

1.2 Manufacturer's address

KRACHT GmbH
Gewerbestraße 20
DE 58791 Werdohl
phone: +49 2392 935-0
fax: +49 2392 935-209
email: info@kracht.eu
web: www.kracht.eu

1.3 Applicable documents

1. KTR Kupplungstechnik GmbH, DE 48407 Rheine
 - KTR-N 40210: Coupling operating/assembly instruction Rotex

Excerpts from these documents are included in these operating instructions.

If required, the original documents can be requested from the respective manufacturer.

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1.4 Symbolism

	 DANGER Identification of an immediate hazard, which would result in death or severe bodily injury if not avoided.
	 WARNING Identification of a potential medium risk hazard, which would lead to death or severe bodily injury if not avoided.
	 CAUTION Identification of a low risk hazard, which could lead to minor or medium bodily injury if not avoided.
	 NOTICE Flagging of notices to prevent property damage.
	Identification of basic safety instructions. Non-compliance can lead to hazards for people and the device.
	Flagging of special user tips and other especially useful or important information.

Gear pump KF 2.5 - 630

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2 Safety

2.1 Intended use

1. The device has been designed for operation with fluid. Dry operation is not permitted.
2. The device may be operated in filled condition only.
The medium must be compatible with the materials used in the device. The chemical competence is necessary for this. Be careful with ethylene oxide or other cathalytic or exothermic or self-decomposing materials. Please consult the manufacturer in cases of doubt.
3. The device may be operated only in usual industrial atmospheres. If there are any aggressive substances in the air, always ask the manufacturer.
4. Operation of the device is only permissible when complying with the operating instructions and applicable documents.
Deviating operating conditions require the express approval of the manufacturer.
5. In case of any use of the device not according to specification, any warranty is voided.

2.2 Personnel qualification and training

The staff designated to assemble, operate and service the device must be properly qualified. This can be through training or specific instruction. Personnel must be familiar with the contents of this operating instructions.



Read the operating instructions thoroughly before use.

2.3 Basic safety instructions



1. Comply with existing regulations on accident prevention and safety at work along with any possible internal operator regulations.
2. Pay attention to the greatest possible cleanliness.
3. Wear suitable personal protection equipment.
4. Do not remove, make illegible or obliterate type plates or other references on the device.
5. Do not make any technical changes on the device.
6. Maintain and clean the device regularly.
7. Use spare parts approved by the manufacturer only.

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Gear pump KF 2.5 - 630

2.4 Basic hazards

 DANGER
Hazardous fluids! Danger of death when handling hazardous fluids. 1. Comply with the safety data sheets and regulations on handling hazardous fluids. 2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.
 DANGER
Rotating parts! Danger of death due to body parts, hair or clothing getting trapped or entangled. 1. Before all work, ensure that existing drives are voltage-free and pressure-free. 2. Securely prevent restarting during all work.
 DANGER
Rotating parts! Danger of death due to body parts, hair or clothing getting trapped or entangled. 1. Take measures against accidental touching of rotating parts.
 WARNING
Rotating parts! Danger of injury from flying parts. 1. Enclose rotating parts so as to avoid any danger from flying parts in the event of breakage or malfunction.
 WARNING
Failure of load-carrying parts due to overload! Danger of injury from flying parts. Danger of injury from spurting fluids. 1. Depressurise the device and all connection lines before doing any work. 2. Securely prevent the restoration of pressure while working on the device.

Gear pump KF 2.5 - 630

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**WARNING****Failure of load-carrying parts due to overload!**

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Use only connections and lines approved for the expected pressure range.
2. Securely prevent exceeding the permissible pressure, e.g. by using pressure relief valves or rupture discs.
3. Design pipework so that no tensions, e.g. caused by changes in length due to fluctuations in temperature, are transmitted to the device.

**WARNING****Failure of load-carrying parts due to overload!**

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Do not operate the device against closed shut-off devices.
2. Do not operate the device in the false direction of rotation.

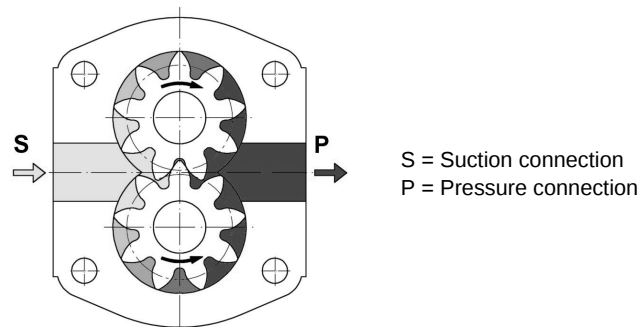
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Gear pump KF 2.5 - 630

3 Device description

3.1 Functional principle

KF/KFF series pumps are external gear pump types that work according to the positive displacement principle.



When rotated, two gearwheels meshing together produce a volume enlargement as a result of the opening of the tooth spaces on the suction side (S), so that medium can flow in and so that a corresponding volume is displaced simultaneously by immersion of the teeth into the filled tooth spaces on the pressure side (P). Fluid transport takes place through entrainment in the tooth gaps along the wall of the wheel chamber. The so-called geometric flow rate V_g is being displaced per wheel rotation. A value that is stated in technical documents as rated volume V_{gn} to specify the pump size.

The actually delivered amount of liquid does not correspond with the theoretical value, it is being reduced through losses due to the necessary tolerances. The losses are less the lower the operating pressure and the higher the viscosity of the medium.

Gear pumps are self-priming within wide limits. The displacement cycle describe initially takes place without exhibiting appreciable pressure build-up. Only after setting external loads, for example, through delivery heights, flow resistances, line elements, etc. will the required working pressure arise to overcome these resistances.

As usual with non-axial play compensated pumps, the lateral clearance between gear and front face has been set in such a way that the maximum allowable operating pressure is managed in an adequate and secure way.

Bearing and shaft seal of the device are lubricated by the media. The device's operating life will be reduced if the medium contains abrasive ingredients.

The shaft seal chamber is connected to the device's suction side. The pressure occurring at the shaft seal therefore corresponds to the pressure at the

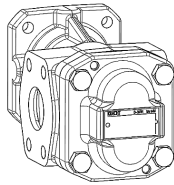
Gear pump KF 2.5 - 630

KRACHT

suction connection of the device. The permissible pressure is determined by the type of sealing.

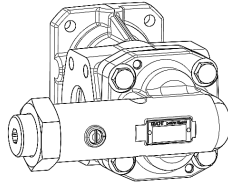
3.2 Possible versions

Gear pump with end cover



Standard

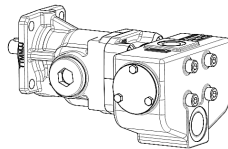
Gear pump with pressure relief valve



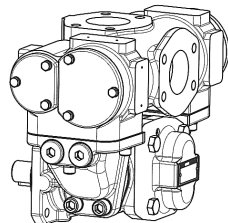
Directly attached pressure relief valves of the series "D" are used exclusively for protection of the gear pumps and may respond on a short-term basis only. Constant triggering of the valve can destroy the gear pump due to overheating.

Gear pump with universal valve

KF 2.5 - 25 U



KF 32 - 80 U



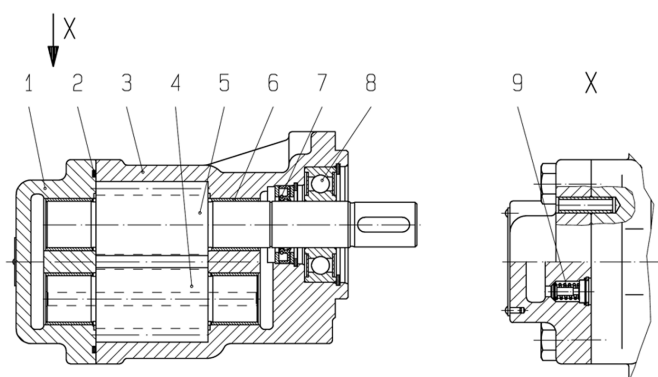
Pumps with universal valve pump to the same pressure connection even when the direction of rotation of the drive shaft changes. Because of the operating principle, the pressure and suction connections remain the same under any direction of rotation. Select the mounting position so that the piston is in a horizontal position and the pressure port is at the top.

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Gear pump KF 2.5 - 630

3.3 Basic design

3.3.1 KF 2.5 - 630 R/L/B (with end cover)



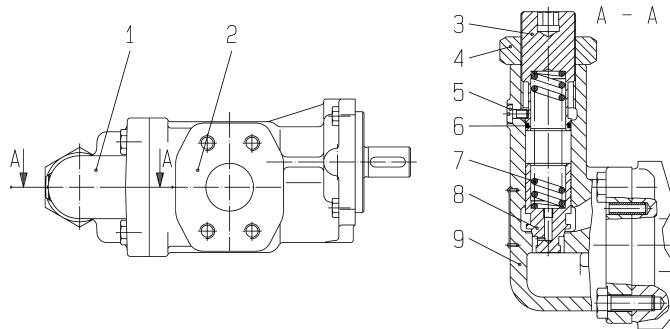
Explanation

- | | |
|-----------------------|---------------------------------|
| 1. End cover | 7. Shaft seal |
| 2. O-Ring | (see "Section: Seal types") |
| 3. Housing | 8. Outbord bearing |
| 4. Driven shaft | (Mounting only: G; X) |
| 5. Driving shaft | 9. Valve |
| 6. Plain bearing bush | (Direction of rotation only: B) |

Gear pump KF 2.5 - 630

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3.3.2 KF 2.5 - 630 R/L. -D. (with pressure relief valve)



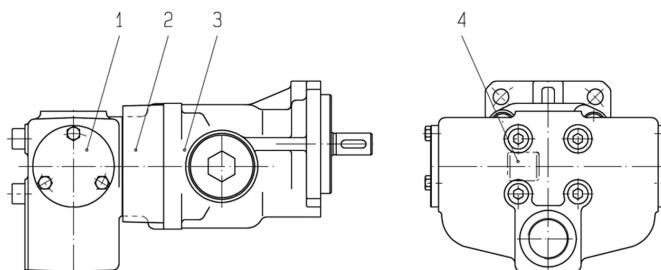
Explanation

- | | |
|--------------------------|-----------------------|
| 1. Pressure relief valve | 6. O-Ring |
| 2. Pump | 7. Compression spring |
| 3. Adjustment screw | 8. Valve cone |
| 4. Hexagonal nut | 9. Housing |
| 5. Retaining screw | |

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Gear pump KF 2.5 - 630

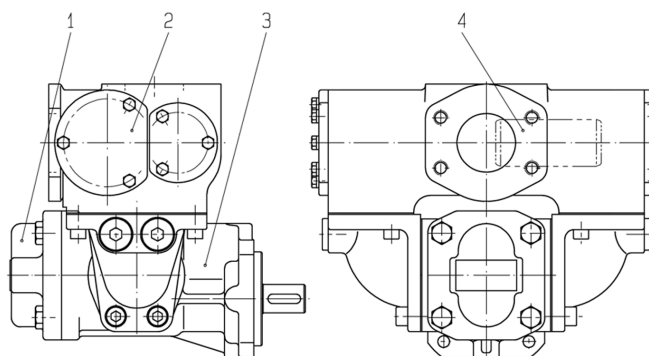
3.3.3 KF 2.5 - 25 U (with universal valve)



Explanation

- | | |
|--------------------|-----------|
| 1. Universal valve | 3. Pump |
| 2. Adapter | 4. Piston |

3.3.4 KF 32 - 80 U (with universal valve)



Explanation

- | | |
|--------------------|-----------|
| 1. End cover | 3. Pump |
| 2. Universal valve | 4. Piston |

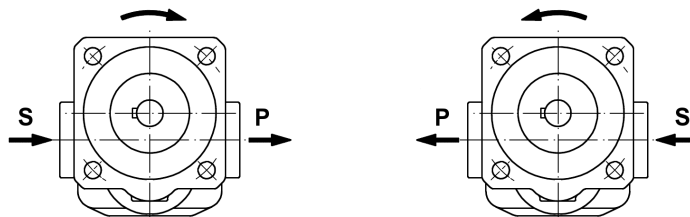
Gear pump KF 2.5 - 630

KRACHT**3.4 Rotation and delivery direction**

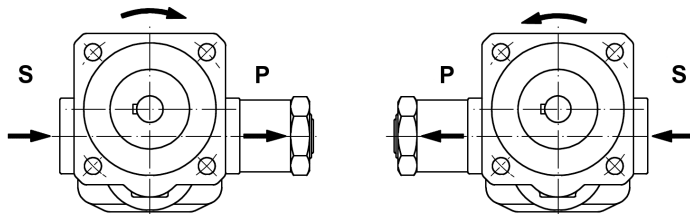
The following definition applies with respect to the rotation and delivery direction of external gear pumps for pump connections positioned below the drive shaft:

Looking at the pump shaft end, the pumping flow is from left to right when the shaft is moving clockwise.

Looking at the pump shaft end, the pumping flow is from right to left when the shaft is moving counter-clockwise.

Gear pump with end cover

S = Suction connection
P = Pressure connection

Gear pump with pressure relief valve

S = Suction connection
P = Pressure connection

The direction of rotation is indicated by the bent arrow.

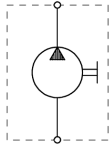
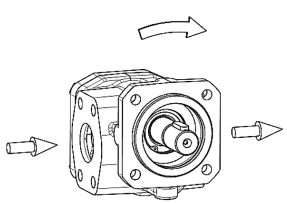
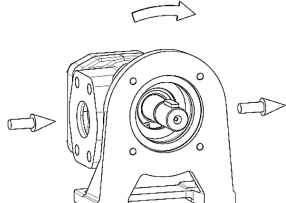
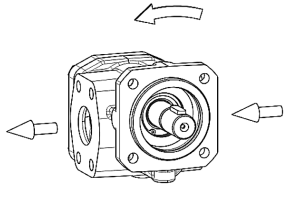
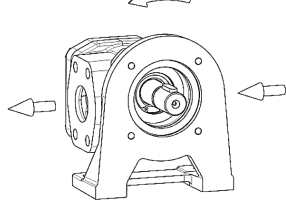
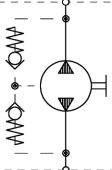
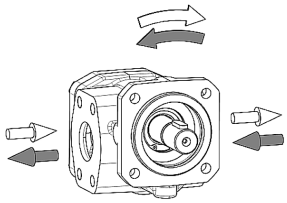
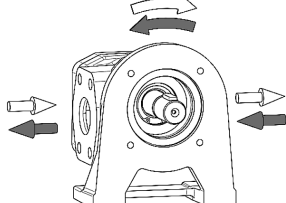
The flow direction is indicated by the straight arrows.

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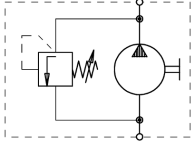
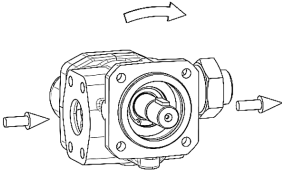
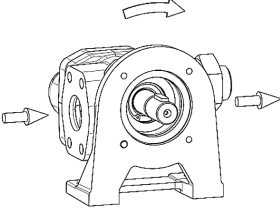
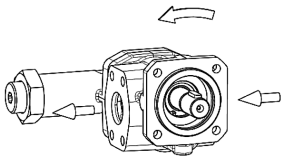
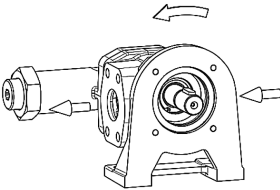
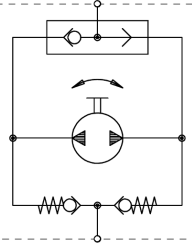
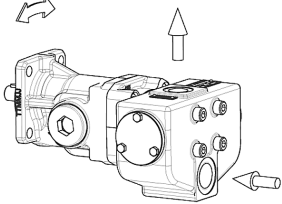
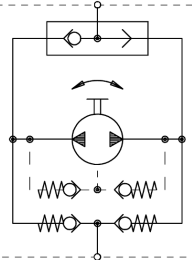
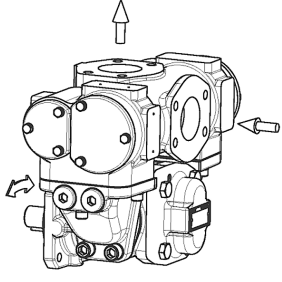
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Gear pump KF 2.5 - 630

Hydraulic symbol	Flange mounting	Foot mounting
	Gear pump with end cover	
		
	KF . R F/G	KF . R W/X
		
	KF . L F/G	KF . L W/X
		
	KF . B F/G	KF . B W/X

Gear pump KF 2.5 - 630

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Hydraulic symbol	Flange mounting	Foot mounting
	Gear pump with pressure relief valve	
		
	KF . R F/G. .-D.	KF . R W/X. .-D.
		
	Gear pump with universal valve	
		
	KF 2.5 - 25 U F/G	-
		
	KF 32 - 80 U F/G	-

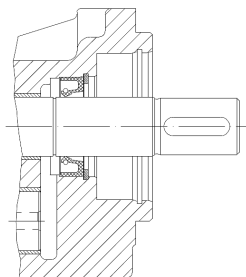
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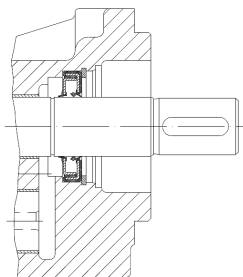
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Gear pump KF 2.5 - 630

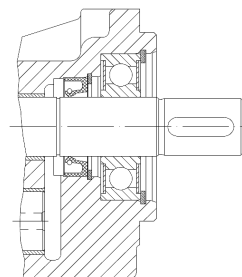
3.5 Types of seals



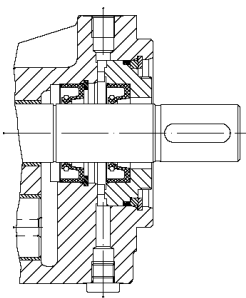
Rotary shaft seal
Seal type: 1; 2; 3; 9; 18; 31



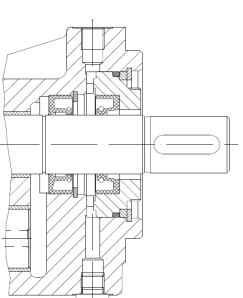
Rotary shaft seal
Seal type: 23



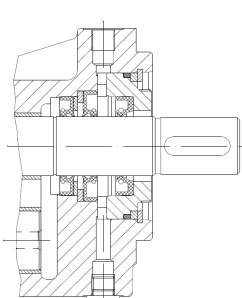
Rotary shaft seal
with outboard bearing
Seal type: 1; 2; 3; 9; 18; 31



Double rotary shaft seal
Connection borehole G1/8 (for
Quench) ⁽¹⁾
Seal type: 4; 7; 19; 32

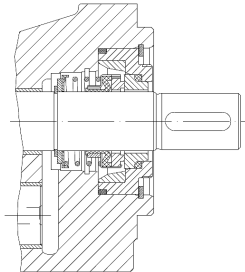


Double rotary shaft seal (for vac-
uum operation)
Connection borehole G1/8 (for
Quench) ⁽¹⁾
Seal type: 4; 7; 19; 32
Special number 74

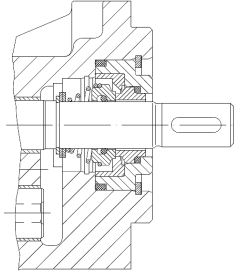


Triple rotary shaft seal (for vac-
uum operation + for normal oper-
ation)
Connection borehole G1/8 (for
Quench) ⁽¹⁾
Seal type: 7
Special number 322
(only KF 32 - 80)

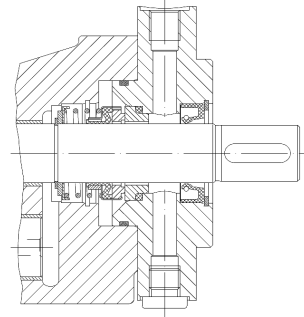
Gear pump KF 2.5 - 630

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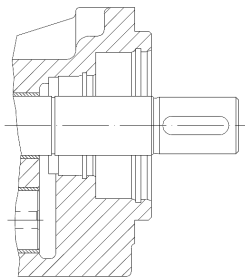
Mechanical seal
Seal type: 5; 40



Mechanical seal
Seal type: 6



Mechanical seal with Quench ⁽¹⁾
KF 2.5 - 25: Connection borehole
G1/8 (for Quench) ⁽¹⁾
KF 32 - 80: Connection borehole
G1/4 (for Quench) ⁽¹⁾
Seal type: 5
Special number 198



without shaft seal
(Leak oil drain through shaft seal-
ing chamber)
Seal type: 30; 36

⁽¹⁾ See section 3.6 "Quench"

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Gear pump KF 2.5 - 630

3.6 Quench

Versions with quench are used when absolute leak tightness is required on the shaft seal, e.g. when pumping media

- which cures upon contact with air.
- which crystallises upon contact with air humidity.
- the leakage of which must not be released into the environment.
- are under vacuum and their seal shall be gastight.

Select the mounting position so that the connection for the quench faces up.

Gear pump KF 2.5 - 630

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3.7 Type key

Ordering example KF 2.5 - 630												
KF		40		R	F		1	/...	-	D15	-	...
1.		2.		3.	4.		5.	6.		7.		8.
Explanation of type key KF 2.5 - 630												
1.	Product name											
2.	Nominal size (Rated volume)											
	V _{gn}	Size 1: 2.5; 4; 5; 6; 8; 10; 12; 16; 20; 25 Size 2: 32; 40; 50; 63; 80 Size 3: 100; 112; 125; 150; 180; 200 Size 4: 250; 315; 400; 500; 630										
3.	Direction of rotation											
	R	Clockwise						B	Clockwise and counterclockwise Flow direction alternating			
	L	Counterclockwise						U	Clockwise and counterclockwise Flow direction consistent			
4.	Fixing type											
	F	DIN flange without outboard bearing						W	Mounting angle without outboard bearing (KF 2.5 - 200)			
	G	DIN flange with outboard bearing						X	Mounting angle with outboard bearing (KF 2.5 - 200)			

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Gear pump KF 2.5 - 630

Explanation of type key KF 2.5 - 630				
5.	Seal type			
	1	Rotary shaft seal NBR (BABSL)	18	Rotary shaft seal FKM (BAUMX7)
	2	Rotary shaft seal FKM (BABSL)	19	Double rotary shaft seal NBR (BABSL)
	3	Rotary shaft seal PTFE (HN2390)	23	Rotary shaft seal FKM (MSS1) (Low temperature) (KF 2.5 - 80)
	4	Double rotary shaft seal PTFE (HN2390)	30	without shaft seal O-Ring FKM
	5	Mechanical seal with FKM second- ary seals (AX15) C2S2V1G3G1 (KF 2.5 - 200) B10SV1G3G1 (KF 250 - 630)	31	Rotary shaft seal FKM (BABSL) (Low temperature) (KF 32 - 200)
	6	Mechanical contact seal with FFKM secondary seals (AX30) Q2Q2K1G3 (KF 2.5 - 25) Q2B2K1G3 (KF 32 - 200)	32	Double rotary shaft seal EPDM (R02-R) (not resistant to mineral oil)
	7	Double rotary shaft seal FKM (BABSL)	36	without shaft seal O-Ring NBR
	9	Rotary shaft seal EPDM (R02-R) (not resistant to mineral oil)	40	Mechanical seal with FKM second- ary seals (L4) AQ2VFF
6. Special number for special versions				
	See section 3.8 "Important special numbers"			
7. Pressure relief valve (only for direction of rotation R or L)				
D15	Adjustable from 0 - 15 bar	D25	Adjustable from 15 - 25 bar	
D30	Adjustable from 15 - 30 bar			
8. Housing and cover material				
No specifi- cation	EN-GJL-250 (GG-25)			
GJS	EN-GJS-400-15 (GGG-40)			

Gear pump KF 2.5 - 630

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3.8 Important special numbers

Special number	Description
74	Double rotary shaft seal (for vacuum operation) Connection borehole G1/8 (for Quench)
158	Housing connection: KF 2.5 - 12: Flange connection SAE 3/4" KF 16 - 25: Flange connection SAE 1"
197	Noise-optimized version for aerated oils ⁽¹⁾
198	Mechanical seal with Quench
232	Housing connection: KF 50 - 80: Flange connection SAE 2" KF 100 - 112: Flange connection SAE 2 1/2" KF 125 - 150: Flange connection SAE 3" KF 180 - 200: Flange connection SAE 3 1/2"
277	Vertical mounting position (shaft end above) Separate lubrication for rotating shaft seal (reduced pumping rate) (Size 4: on request)
304	Plastic plain bearings Iglidur® X (non-ferrous metal-free), $\Delta p_{\max} = 10$ bar (Size 4: on request)
317	Noise-optimized version for aerated oils ⁽¹⁾ (197) Plastic plain bearings Iglidur® X (non-ferrous metal-free), $\Delta p_{\max} = 10$ bar (304)
322	Triple rotary shaft seal (for normal operation + for vacuum operation) Connection borehole G1/8 (for Quench) Plastic plain bearings Iglidur® X (non-ferrous metal-free), $\Delta p_{\max} = 10$ bar (304) Housing connection: KF 32; 40: Flange connection SAE 1 1/2" (Standard) KF 50 - 80: Flange connection SAE 2" (232)
353	Noise-optimized version for aerated oils ⁽¹⁾ (197) Multi layer friction bearings DP4 (lead free) (Size 4: on request)
359	Housing connection: KF 2.5 - 12: Flange connection SAE 3/4" (158) KF 16 - 25: Flange connection SAE 1" (158) Noise-optimized version for aerated oils ⁽¹⁾ (197)
363	Plastic plain bearings Iglidur® X (non-ferrous metal-free), $\Delta p_{\max} = 10$ bar (304) Housing connection: KF 2.5 - 12: Flange connection SAE 3/4" (158) KF 16 - 25: Flange connection SAE 1" (158)

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Gear pump KF 2.5 - 630

Special number	Description
391	Noise-optimized version for aerated oils ⁽¹⁾ (197) Housing connection: KF 50 - 80: Flange connection SAE 2" (232) KF 100 - 112: Flange connection SAE 2 1/2" (232) KF 125 - 150: Flange connection SAE 3" (232) KF 180 - 200: Flange connection SAE 3 1/2" (232)
402	Double rotary shaft seal (for vacuum operation) (74) Connection borehole G1/8 (for Quench) (74) Housing connection: KF 2.5 - 12: Flange connection SAE 3/4" (158) KF 16 - 25: Flange connection SAE 1" (158) KF 50 - 80: Flange connection SAE 2" (232) KF 100 - 112: Flange connection SAE 2 1/2" (232) KF 125 - 150: Flange connection SAE 3" (232) KF 180 - 200: Flange connection SAE 3 1/2" (232)
455	Noise-optimized version for aerated oils ⁽¹⁾ (197) Vertical mounting position (shaft end above) Separate lubrication for rotating shaft seal (reduced pumping rate) (277)
459	Double rotary shaft seal (for vacuum operation) (74) Connection borehole G1/8 (for Quench) (74) Noise-optimized version for aerated oils ⁽¹⁾ (197) Housing connection: KF 2.5 - 12: Flange connection SAE 3/4" (158) KF 16 - 25: Flange connection SAE 1" (158) KF 50 - 80: Flange connection SAE 2" (232) KF 100 - 112: Flange connection SAE 2 1/2" (232) KF 125 - 150: Flange connection SAE 3" (232) KF 180 - 200: Flange connection SAE 3 1/2" (232)
⁽¹⁾ Measures for noise optimisation are only possible for one rotational direction and only effective for aerated oils or vacuum (only in connection with seal versions that are suitable for vacuum operation). Can lead to a reduction of delivery rate.	

Gear pump KF 2.5 - 630

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4 Technical data

4.1 General

General information KF 2.5 - 630		
Design	External gear pump	
Fixing type	Flange similar DIN ISO 3019 or Foot mounting	
End of drive shaft	ISO R 775 short-cylindrical	
Housing connection ⁽¹⁾	KF 2.5 - 12	Whitworth pipe thread G3/4
	KF 2.5 - 12 .. /158	Flange connection SAE 3/4"
	KF 16 - 25	Whitworth pipe thread G1
	KF 16 - 25 .. /158	Flange connection SAE 1"
	KF 32 - 80	Flange connection SAE 1 1/2"
	KF 50 - 80 .. /232	Flange connection SAE 2"
	KF 100 - 112	
	KF 100 - 112 .. /232	Flange connection SAE 2 1/2"
	KF 125 - 150	
	KF 125 - 150 .. /232	Flange connection SAE 3"
	KF 180 - 200	
	KF 180 - 200 .. /232	Flange connection SAE 3 1/2"
	KF 250 - 315	Flange connection SAE 3"
	KF 400 - 630	Flange connection SAE 4"
	KF 2.5 - 25 U	Suction connection: Whitworth pipe thread G3/4
		Pressure connection: Whitworth pipe thread G1/2
Mounting position	KF . R/L/B without fluid buffer	Any ⁽²⁾
		Shaft end horizontal, fluid buffer connection top
	KF . U	Piston horizontal Pressure connection on top
External loads on shaft end		See section 4.2 "Overview nominal sizes"
Speed	n	See section 4.2 "Overview nominal sizes" + section 4.3 "Viscosity - Rotation speed assignment"

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Gear pump KF 2.5 - 630

General information KF 2.5 - 630		
Operating pressure	p_e p_b	See section 4.4 "Permissible pressure range"
Viscosity	v_{min}	See section 4.4.3 "Differential pressure - viscosity assignment"
	v_{max}	20000 mm ² /s
Fluid temperature	ϑ_m	See section 4.5 "Permissible temperature range"
Ambient temperature	ϑ_u	
Material		See section 4.6 "Material data"
Filtering		Filter porosity $\leq 60 \mu m$
Permissible media		Lubricating fluids without abrasive components. (Petrols, solvents, etc. are not permissible.)
⁽¹⁾ Pipe thread: ISO 228-1; Flange connection: ISO 6162-1 (SAE J518) ⁽²⁾ A reduced service life must be expected for the shaft seal in the case of vertical installation (shaft end top).		

Gear pump KF 2.5 - 630

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4.2 Overview nominal sizes

Nominal size V _{gn}	Geom. displacement V _g [cm³/rev.]	Speed n		Perm. radial force ⁽¹⁾ F _{radial} [N] (n = 1500 rpm)	Permissible axial force F _{axial} [N] (n = 1500 rpm)	Sound pressure level ⁽²⁾ L _{pA} [dBA]	Mass inertia x10 ⁻⁶ J [kg m²]
		n _{min} [rpm]	n _{max} [rpm] ⁽³⁾				
2,5	2.55	200	3600	700	-	≤ 67	14.0
4	4.03						15.9
5	5.05						17.8
6	6.38						20.5
8	8.05						24.0
10	10.11						28.4
12	12.58						33.7
16	16.09						42.3
20	20.1						50.8
25	25.1						61.7
32	32.12						≤ 68
40	40.21					254	
50	50.2					299	
63	63.18					368	
80	80.5					443	
100	101.5		≤ 69	741			
112	113.5			806			
125	129.4			≤ 65		1418	
150	155.6					1637	
180	186.6					1911	
200	206.2		2072				
250	245.1		2000	2500		≤ 75	4133
315	312.9						5011
400	399.5					≤ 77	6618
500	496.5						7830
630	622.5					≤ 80	9591

⁽¹⁾ Outside forces are only permissible in combination with an outboard bearing. *F_{radial}* on central shaft end.

⁽²⁾ *n* = 1500 rpm ; *v* = 34 mm²/s ; *p* = 5 - 25 bar.

⁽³⁾ Pay attention to the viscosity.

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4.3 Viscosity - Rotation speed assignment

Kinematic viscosity ν [mm²/s]									
100	200	300	500	1000	2000	3000	6000	10000	20000
3600	2900	2300	1800	1200	800	650	450	300	200
Recommended rpm n [rpm]									



Select the speed of rotation so that complete filling of the pump is ensured. This is given if the pressure on the suction side does not fall below the permissible pressure $p_{e \text{ min.}}$

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KRACHT**4.4 Permissible pressure range****4.4.1 Operating pressure of suction side and pressure side**

Seal type ⁽¹⁾		Special number	Operating pressure ⁽²⁾			
			Suction side		Pressure side	
			$p_{e \min}$ [bar abs.] ⁽³⁾	$p_{e \max}$ [bar]	p_b [bar] (perm. continuous pressure)	$p_{b \max}$ [bar] (Pressure peaks)
1	WDR (BABSL)	-	0.6 ⁽⁴⁾	See section 4.4.2 "Max. suction side operating pressure for sealing type 1, 2, 7 and 19"	25	40
2	WDR (BABSL)	-				
3	WDR (HN2390)	-		2		
4	DRWDR (HN2390)	-				
		74	0.1	0.2		
5	GLRD (AX15)	-	0.6 ⁽⁴⁾	10		
6	GLRD (AX30)	-				
7	DRWDR (BABSL)	-		See section 4.4.2 "Max. suction side operating pressure for sealing type 1, 2, 7 and 19"		
		74	0.1	0.2		
9	WDR (R02-R)	-	0.6 ⁽⁴⁾	0.5		
18	WDR (BAUMX7)	-				
19	DRWDR (BABSL)	-		See section 4.4.2 "Max. suction side operating pressure for sealing type 1, 2, 7 and 19"		
		74	0.1	0.2		

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Seal type ⁽¹⁾		Special number	Operating pressure ⁽²⁾			
			Suction side		Pressure side	
			$p_{e \min}$ [bar abs.] ⁽³⁾	$p_{e \max}$ [bar]	p_b [bar] (perm. continuous pressure)	$p_{b \max}$ [bar] (Pressure peaks)
23	WDR (MSS1)	-	0.6 ⁽⁴⁾	0.5	25 ⁽⁵⁾	-
30	-	-		25	25	40
31	WDR (BABSL)	-		0.5	25 ⁽⁵⁾	-
32	DRWDR (R02-R)	-		0.5	25	40
		74		0.2		
36	-	-		25		
40	GLRD (L4)	-		10		

⁽¹⁾ WDR: Rotary shaft seal, DRWDR: Double rotary shaft seal, GLRD: Mechanical seal
⁽²⁾ bar abs.: absolute pressure, bar: relative pressure
⁽³⁾ KF . U: $p_{e \min} = 0.65$ bar abs.
⁽⁴⁾ Start-up condition: 0.4 bar absolute (max. 30 minutes).
⁽⁵⁾ $\vartheta_m < -20$ °C: 16 bar (Housing material GJL).

4.4.2 Max. suction side operating pressure for sealing type 1, 2, 7 and 19

Speed n [rpm]	$p_{e \max}$ [bar]					
	KF 2.5 - 63	KF 80	KF 100 - 180	KF 200	KF 250 - 315	KF 400 - 630
≤ 750	6	6	6	6	5.5	5
≤ 1000	5	5	5	5	4.5	4
≤ 1500	4	4	3.5	3.5	3	2.5
≤ 2000	3	3	2.5	2.5	2	1.5
≤ 2500	2.5	2.5	2	2	-	-
≤ 3000	2	2	1.5	-	-	-
≤ 3600	1.5	-	-	-	-	-

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4.4.3 Differential pressure - viscosity assignment

Bearing	$\Delta p_{\max}$ [bar]		
	$v \geq 1.4 \text{ mm}^2/\text{s}$	$v \geq 6 \text{ mm}^2/\text{s}$	$v \geq 12 \text{ mm}^2/\text{s}$
Multi layer friction bearings contains lead (Standard) DU, P10	3	12	25
Multi layer friction bearings lead free DP4			
Plastic plain bearings Iglidur® G; X; H370	-	6	10
White-metalled bearing TEGO® V738			

4.5 Permissible temperature range

Sealing material	Fluid temperature ϑ_m ⁽¹⁾	
	$\vartheta_{m \text{ min}}$ [°C]	$\vartheta_{m \text{ max}}$ [°C]
NBR	-20	90
PTFE / FEP with FKM-core		200
EPDM		120
FKM		150
FFKM / FEP with FKM-core		200
FKM (Low temperature)	-30	150

⁽¹⁾ Comply with media-specific properties.

Sealing material	Ambient temperature ϑ_u	
	$\vartheta_{u \text{ min.}}$ [°C]	$\vartheta_{u \text{ max.}}$ [°C]
NBR	-20	60
PTFE / FEP with FKM-core		
EPDM		
FKM		
FFKM / FEP with FKM-core		
FKM (Low temperature)	-30	

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4.6 Material data

Seal type ⁽¹⁾		Material				
		Shaft seal	O-rings	Housing/End cover	Gears	Bearing
1	WDR (BABSL)	NBR	NBR	EN-GJL-250 (GG-25) - - - EN-GJS-400-15 (GGG-40)	Case-hardened steel (1.7139)	Multi layer friction bearings contains lead (Standard) DU, P10 (Steel, CuSn, PTFE, Pb) - - - Plastic plain bearings non-ferrous metal-free Iglidur® X - - - Multi layer friction bearings lead free DP4 (Steel, CuSn, PTFE) - - - White-metalled bearing TEGO® V738 (Steel, Cu, Sn, Sb, Cd, Ni, As) (only KF 2.5 - 80)
2	WDR (BABSL)	FKM	FKM			
3	WDR (HN2390)	PTFE	FEP with FKM-core			
4	DRWDR (HN2390)	PTFE	FEP with FKM-core			
5	GLRD with FKM secondary seals (AX15)	C2S2V1G3G1 ⁽²⁾ (KF 2.5 - 200)	FKM			
		B10SV1G3G1 ⁽³⁾ (KF 250 - 630)				
6	GLRD with FFKM secondary seals (AX30)	Q2Q2K1G3 ⁽⁴⁾ (KF 2.5 - 25)	FEP with FKM-core			
		Q2B2K1G3 ⁽⁵⁾ (KF 32 - 200)				
7	DRWDR (BABSL)	FKM	FKM			
9	WDR (R02-R)	EPDM	EPDM			
18	WDR (BAUMX7)	FKM	FKM			
19	DRWDR (BABSL)	NBR	NBR			
23	WDR (MSS1)	FKM (Low temperature)	FKM (Low temperature)			

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Seal type ⁽¹⁾		Material				
		Shaft seal	O-rings	Housing/End cover	Gears	Bearing
30	-	-	FKM	EN-GJL-250 (GG-25) --- EN-GJS-400-15 (GGG-40)	Case-hardened steel (1.7139)	Multi layer friction bearings contains lead (Standard) DU, P10 (Steel, CuSn, PTFE, Pb) ---
31	WDR (BABSL)	FKM (Low temperature)	FKM (Low temperature)			Plastic plain bearings non-ferrous metal-free Iglidur® X ---
32	DRWDR (R02-R)	EPDM	EPDM			Multi layer friction bearings lead free DP4 (Steel, CuSn, PTFE) ---
36	-	-	NBR			White-metalled bearing TEGO® V738 (Steel, Cu, Sn, Sb, Cd, Ni, As) (only KF 2.5 - 80)
40	GLRD with FKM secondary seals (L4)	AQ2VFF ⁽⁶⁾	FKM			

⁽¹⁾ WDR: Rotary shaft seal, DRWDR: Double rotary shaft seal, GLRD: Mechanical seal
⁽²⁾ Metal-impregnated carbon /CrMo-Steel, FKM, CrNiMo-Steel
⁽³⁾ Resin-impregnated carbon , Cr-casting, FKM, CrNiMo-Steel
⁽⁴⁾ SiC/SiC, FFKM, CrNiMo-Steel
⁽⁵⁾ SiC/Resin-impregnated carbon , FFKM, CrNiMo-Steel
⁽⁶⁾ Metal-impregnated carbon /SiC, FKM, CrNi-Steel

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4.7 Weight

Nominal size V_{gn}	Gear pump [kg]			Added weight Mounting angle [kg]
	with end cover	with D - valve	with universal valve	
2.5	2.9 (KF . /158: +1.3)	3.7 (KF . /158: +1.3)	6.9	1.3
4				
5				
6				
8				
10	3.5 (KF . /158: +1.3)	4.3 (KF . /158: +1.3)	7.5	
12				
16				
20				
25	7.7	9.5	27.5	1.6
32				
40				
50				
63				
80	9.4	11.2	29.5	
100				
112				
125				
150	22.2	26.5		3.3
180				
200				
250				
315				
400	44.2	47.2		
500				
630				
	54.7	57.9		-
	60.8	64.0		

4.8 Dimensions

Dimensions of the device can be found in the relevant technical data sheets.

Gear pump KF 2.5 - 630

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5 Transport and storage

5.1 General

- After receipt, check the device for transport damages.
- If transport damage is noticed, report this immediately to the manufacturer and the carrier. The device must then be replaced or repaired.
- Dispose of packing material and used parts in accordance with the local stipulations.

5.2 Transport



WARNING

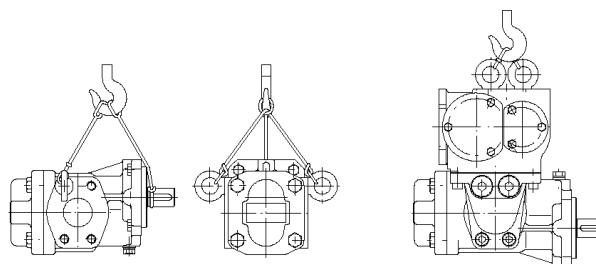
Falling or overturning loads!

Danger of injury while transporting large and heavy loads.

1. Use only suitable means of conveyance and lifting tackle with sufficient load-bearing capacity.
2. Attach lifting tackle only to suitable load points.
3. Attach the lifting tackle in such a manner that it cannot slip.
4. Pay attention to the load balance point.
5. Always avoid jerks, impacts and strong vibrations during transportation.
6. Never walk under suspended loads, never work under suspended loads.



To transport the device, eyebolts can be screwed into the flange connections.



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5.3 Storage

The device's function is tested in the plant with mineral hydraulic oil. Then all connections are closed. The remaining residual oil preserves the interior parts for up to 6 months.

Metallic exposed exterior parts are protected against corrosion by suitable conservation measures, also up to 6 months.

In case of storage, a dry, dust-free and low-vibration environment is to be ensured. The device is to be protected against influences from weather, moisture and strong fluctuations of temperature. The recommended storage conditions are to be adhered to.

Below the permissible ambient temperature ϑ_u , elastomer seals lose their elasticity and mechanical loading capacity, since the glass transition temperature is fallen below. This procedure is reversible. A force action on the device is to be avoided in case of storage below the permissible ambient temperature ϑ_u .

Devices with EPDM seals are not mineral-oil resistant and are not tested for their function. There is no preservation of the interior parts. If the device is not taken into operation immediately, all corrosion-prone surfaces are to be protected by suitable conservation measures. The same applies for devices which are not tested for other reasons.

When storing for a long period of time (> 6 months), treat all surfaces at risk of corrosion again with suitable preserving agents.

If high air humidity or aggressive atmospheres are expected, take additional corrosion-preventing measures.



Storage in corrosion protection bags (VCI) maximum of 6 months.

NOTICE

Corrosion/chemical impact

Improper storage can render the device useless.

1. Protect endangered surfaces by means of suitable conservation measures.
2. Comply with recommended storage conditions.

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**Recommended storage conditions**

1. Storage temperature: 5 °C - 25 °C
2. Relative air humidity: < 70 %
3. Protect elastomer parts from light, especially direct sunlight.
4. Protect elastomer parts from oxygen and ozone.
5. Comply with maximum storage times of elastomeric parts:
 - 5 Years: AU (Polyurethane rubber)
 - 7 Years: NBR, HNBR, CR
 - 10 Years: EPM, EPDM, FEP/PTFE, FEPM, FKM, FFKM, VMQ, FVMQ

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6 Installation

6.1 Safety instructions for installation


DANGER

Hazardous fluids!
 Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.


DANGER

Rotating parts!
 Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.


DANGER

Rotating parts!
 Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Take measures against accidental touching of rotating parts.


WARNING

Rotating parts!
 Danger of injury from flying parts.

1. Enclose rotating parts so as to avoid any danger from flying parts in the event of breakage or malfunction.


WARNING

Unshielded gearwheels!
 Gearwheels can trap and crush fingers and hands.

1. Do not engage gearwheels.

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**WARNING****Failure of load-carrying parts due to overload!**

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

6.2 Noise reduction**Measures for noise reduction**

1. Use suction and pressure hoses.
2. Use bell housings with high damping properties (plastic or cast iron).
3. Use of damping rings and damping rods for separation of structure-borne noise.

6.3 Mechanical installation**6.3.1 Preparation**

- Check the device for transport damage and dirt.
- Check the device for freedom of movement.
- Remove existing preservatives.
 - Use only those cleaning agents that are compatible with the materials used in the device.
 - Do not use cleaning wool.
- Compare the environmental and ambient conditions at the place of installation to the permissible conditions.
 - Ensure a sufficiently stable and level foundation.
 - Expose the device only to small vibrations, see IEC 60034-14.
 - Secure sufficient access for maintenance and repair.

6.3.2 Pumps with free shaft end

The prerequisite for trouble-free operation is suitable load transmission between the pump and the drive. By default a torsionally flexible claw coupling Type "R" is used for this.

- Pre-mount coupling parts as per manufacturer's specifications.



Torsionally flexible claw coupling type "R.": See section 6.3.3 "Coupling Type "R.""

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- Position the pumps and the drive with respect to each other.
 - Comply with the permissible mounting position.
 - Comply with the permissible direction of rotation.



Rotation and delivery direction: See chapter 3 "Device description"

- Tighten all fastening screws with the specified torque.
 - Keep to the permissible displacement values of the coupling.
 - Rule out any distortion of the device.
 - Pay attention to sufficient screw-in depth of the fastening screws.

Tightening torques [Nm]							
Thread size ⁽¹⁾	M6	M8	M10	M12	M16	M20	M24
Counter-thread Aluminium	4.6	11	22	39	95	184	315
Counter-thread Cast iron/Steel	10	25	49	85	210	425	730

⁽¹⁾ Screws/Nuts with min. strength class 8.8/8

- For devices without shaft seals, ensure that the leak oil from the shaft sealing chamber is specifically drained off and cannot get into the environment.
- Make sure no foreign bodies can get into the device.
- Take measures against accidental touching of rotating parts.
- Take measures against accidental touching of hot surfaces (> 60 °C).
- On devices with quench, mount a tank for the liquid seal.
 - Mount the tank above the device.
 - The connection on the device must point upward.
 - Checking the fluid level must be possible at any time.



A second port on the unit enables purging of the quench chamber and draining of the liquid seal.

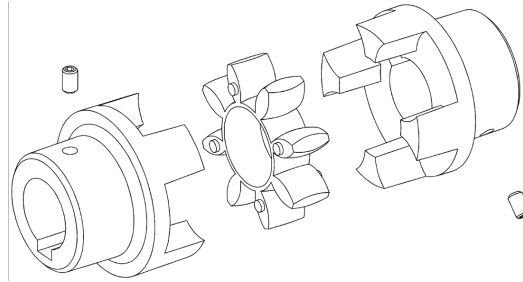
Gear pump KF 2.5 - 630

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6.3.3 Coupling Type "R."

Claw couplings Type "R." are torsionally flexible and transmit the torque positive. They are fail-safe. The vibrations and impacts that occur during operation are effectively dampened and reduced.

Claw coupling Type "R."



NOTICE

Coupling breakage or increased wear

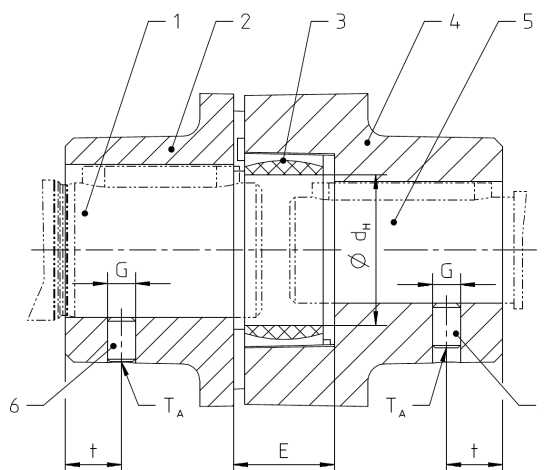
An overload can lead to premature failure of the coupling.

1. Ensure safe dimensioning when designing the coupling. Take vibrations, torque peaks and temperatures into account.

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Assembly data



Explanation

- | | |
|-------------------------------|---|
| 1. Shaft projects into spider | 4. Coupling halve |
| 2. Coupling halve | 5. Shaft with parallel key projects into spider |
| 3. Spider | 6. Setscrew |

When installing the coupling, maintain the "E" gap dimension so that the spider remains free during operation. If the shaft diameters are less than (also with parallel key) the dimension d_H of the spider, the shaft ends can protrude out into the spider.

Coupling size ⁽¹⁾	14	19	24	28	38	42	48	55	65	75
	-	19/24	24/28	28/38	38/45	42/55	48/60	55/70	65/75	75/90
Coupling clearance E [mm]	13	16	18	20	24	26	28	30	35	40
d_H [mm]	10	18	27	30	38	46	51	60	68	80
G	M4	M5	M5	M8	M8	M8	M8	M10	M10	M10
t [mm]	5	10	10	15	15	20	20	20	20	25
Tightening torque T_A [Nm]	1.5	2	2	10	10	10	10	17	17	17

⁽¹⁾ Example: R.19-Z25/14-Z25/19 or R.19/24-Z25/14-Z25/24.

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For assembly, the coupling halves can be heated to approx. 80 °C and pushed onto the shaft ends while warm.

**CAUTION****Hot surfaces!**

Burn injury to skin if touched.

1. Wear protective gloves at temperatures $\geq 48^{\circ}\text{C}$.

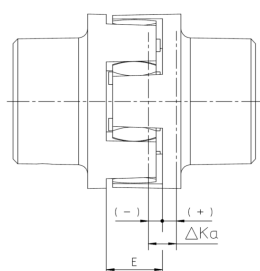
- Mount the coupling halves on the shaft ends but avoid impacts on the components.
- Position the coupling halves on the shaft ends so that in later operation the "E" gap dimension is maintained.
- Secure the coupling halves by tightening the setscrews.
- Insert the spider in a coupling half.

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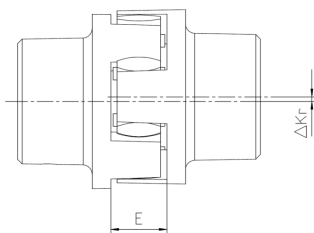
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Displacement values

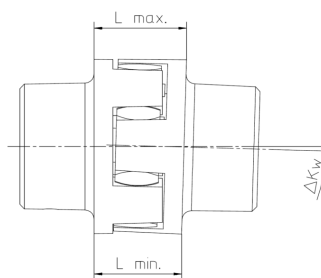
Axial displacement
 ΔK_a



Radial displacement
 ΔK_r



Angular displacement
 $\Delta K_w/\Delta K_L$



$$\Delta K_L \triangleq L_{\max} - L_{\min}$$

Coupling size		14	19	24	28	38	42	48	55	65	75
		-	19/24	24/28	28/38	38/45	42/55	48/60	55/70	65/75	75/90
Coupling clearance E [mm]		13	16	18	20	24	26	28	30	35	40
ΔK_a [mm]		+1.0 -0.5	+1.2 -0.5	+1.4 -0.5	+1.5 -0.7	+1.8 -0.7	+2.0 -1.0	+2.1 -1.0	+2.2 -1.0	+2.6 -1.0	+3.0 -1.5
ΔK_r [mm]	1500 rpm	0.11	0.13	0.15	0.18	0.21	0.23	0.25	0.27	0.30	0.34
	3000 rpm	0.08	0.09	0.1	0.13	0.15	0.16	0.18	0.19	0.21	0.24
ΔK_w [Degree]	1500 rpm	1.1	1.1	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1
	3000 rpm	1.0	1.0	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0
ΔK_L [mm]	1500 rpm	0.57	0.77	0.77	0.90	1.25	1.40	1.80	2.00	2.50	3.00
	3000 rpm	0.52	0.7	0.67	0.80	1.00	1.30	1.60	1.80	2.20	2.70

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Displacement combinations

Examples for displacement combinations shown in the photo opposite:

Example 1:

$\Delta K_r = 30\%$

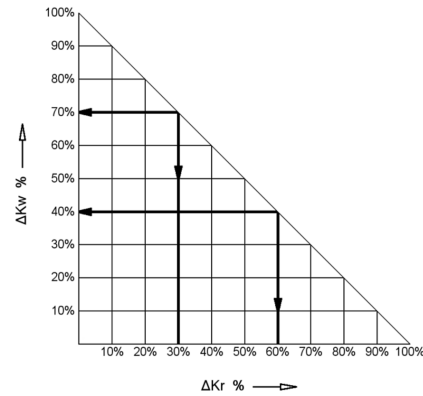
$\Delta K_w = 70\%$

Example 2:

$\Delta K_r = 60\%$

$\Delta K_w = 40\%$

$\Delta K_r + \Delta K_w \leq 100\%$



6.4 Connection lines

6.4.1 General



WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Use only connections and lines approved for the expected pressure range.
2. Securely prevent exceeding the permissible pressure, e.g. by using pressure relief valves or rupture discs.
3. Design pipework so that no tensions, e.g. caused by changes in length due to fluctuations in temperature, are transmitted to the device.



Additional connections

1. Provide measurement connections for pressure and temperature as close as possible to device.
2. If necessary, provide a facility to fill or empty the device and the line system.
3. If necessary, provide a facility to vent the device and the line system.

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6.4.2 Suction line

A less than optimally planned suction line can lead to increased noise emission, cavitation as well as reduction of the delivery rate (caused by not complete filling of the pump).

When designing the line, take the following points into consideration:

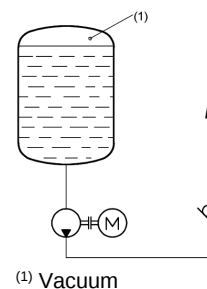
- The suction line must be piped as short as possible and in a straight line.
- Stipulate the nominal width of the suction line so that the permissible operating pressure $p_{e\ min}$ is not exceeded on the suction side.
- Avoid large suction heights.
- Avoid additional pressure loss through line resistances such as fittings, screwed connections, formed parts or suction filters/suction baskets. Ensure that all technically required suction filters/suction baskets are appropriately dimensioned.
- Make sure there is sufficient clearance of the suction port to the bottom and walls of the media container.
- Make sure that the suction opening lies underneath the lowest fluid level in all operating situations.
- When hose lines are used, ensure sufficient stability of the hoses so that they cannot become constricted through the sucking action.
- Comply with the recommended flow velocity in the suction line (max. 1.5 m/s).

Suction line at vacuum operation

If suction from a tank under vacuum is desired, the pump must be arranged approx. 1 m below the tank. The suction line must run in a straight line and without any resistances.

The tank may be subjected to vacuum only then when the pipework and the pump have been filled with liquid.

For this application, only pumps suitable for vacuum operation may be used.

**NOTICE****Cavitation damage**

Undercutting the permissible suction port pressure results in cavitation.

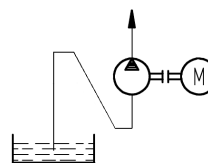
1. Design the suction line so that the pressure arising in operation on the suction side is always higher than the vapour pressure of the pumped medium. At the same time, comply with the installation altitude of the device above mean sea level.
2. For aqueous fluids, mount the device underneath the fluid level, set the operating temperature to 50 °C and limit the speed to 1500 rpm.

Gear pump KF 2.5 - 630

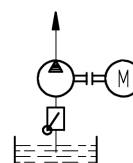
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Prevention of suction problems

If there is a possibility that the suction line can run dry if the pump stops, piping the suction line as siphon is an option to avoid suction problems. This way, the pump will remain permanently filled after initial commissioning.



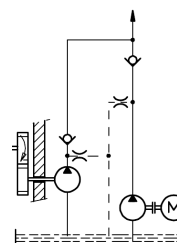
It is appropriate to employ a foot valve or a non-return valve in case of longer suction lines that can run dry while the pump is at rest. These must have been designed for use in suction lines and should offer as low a flow resistance as possible.



During operation of a pump that has to pump media via a non-return valve in a pressurized circuit (e.g. reserve pump in a lubricant circuit), suction problems can occur if the suction line is filled with air.

In this case the pressure pipe must be bled directly upstream of the non-return valve.

If no vent nozzle is used, the volume of the pressure pipe between the pump and the non-return valve must be at least 75 % of the suction line volume.

**6.4.3 Pressure line**

When designing the line, take the following points into consideration:

- Select the nominal width of the pressure line so that the maximum permissible pressures are not exceeded.
- If necessary, provide a vent nozzle to prevent suction problems.

6.4.4 Mounting Connection lines

Position of the device connections: See chapter 3 "Device description"

- Clean all lines.
 - Do not use cleaning wool.
 - Pickle and flush welded pipes.
- Remove the protective plugs.
- Mount the lines.
 - Comply with the manufacturer's information.
 - Do not use any sealing materials such as hemp, Teflon tape or putty.

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6.5 Change of the direction of rotation

For pump types KF . R and KF . L, a change of the direction of rotation is only possible by converting.

The manufacturer normally carries out the conversion work and the customer should do this only in exceptional cases. Please consult the manufacturer about this.



Gear pumps in noise-optimized version cannot be converted. (e.g. special number 197)

 DANGER

Rotating parts!
Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.

 WARNING

Failure of load-carrying parts due to overload!
Danger of injury from flying parts.
Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

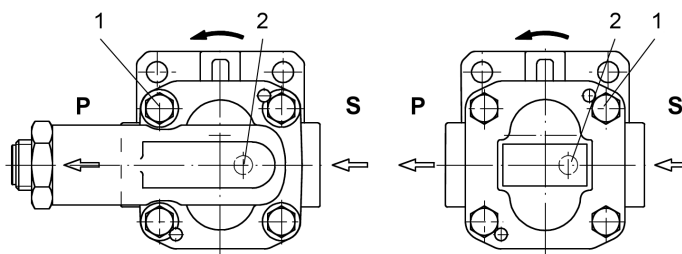
 NOTICE

Leaks or increased wear
Damaged sealing surfaces or supports lead to lack of sealing and/or faults in later operation.

1. When assembling or disassembling housing components, be sure not to damage the bearings, e.g. by tilting.
2. When disassembling housing components, do not use screwdrivers or the like as a lever to separate the joints.
3. Do not remove, damage or jam seals.

Gear pump KF 2.5 - 630

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S = Suction connection
P = Pressure connection

1. Fastening screws
2. Leak oil hole

To change the direction of rotation of the gear pump, turn the end cover or the pressure relief valve 180°.

- Loose fastening screws.
- Unscrew the end cover or the pressure relief valve of the pump housing and replace it rotated 180°.
- Tighten the fastening screws with the stated torque.

Fastening screws KF 2.5 - 630

Gear pump	KF 2.5 - 25	KF 32 - 80	KF 100 - 200	KF 250 - 630
Tightening torques [Nm]	25	49	85	215



For pumps with sealing type 6, the lip-type seal must be replaced in addition. During this process, the spring coiling direction must be observed.

When checking, pay attention to the following points:

1. For gear pumps without pressure relief valve, the leak oil hole in the end cover must be placed at the pump's suction side.
2. Gear pumps with pressure relief valve must have their pressure relief valve adjusting screw point toward the pump's pressure side.

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Gear pump KF 2.5 - 630

7 Operation start-up

7.1 Safety instructions for start-up

 DANGER
Hazardous fluids! Danger of death when handling hazardous fluids. 1. Comply with the safety data sheets and regulations on handling hazardous fluids. 2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.
 WARNING
Failure of load-carrying parts due to overload! Danger of injury from flying parts. Danger of injury from spurting fluids. 1. Do not operate the device against closed shut-off devices. 2. Do not operate the device in the false direction of rotation.
 CAUTION
Hot surfaces! Burn injury to skin if touched. 1. Wear protective gloves at temperatures $\geq 48^{\circ}\text{C}$.

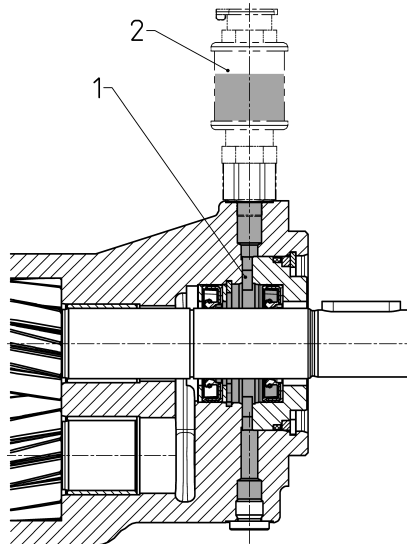
7.2 Preparation

- Before starting the system make sure that a sufficient quantity of the operating fluid is extant to avoid dry running.
Take this into consideration especially with high output volumes.
- Check all fastening screws on the device.
- Fill pump and the suction line with medium.

Gear pump KF 2.5 - 630

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7.3 Filling the quench chamber



1. Quench chamber
2. Container for quench-liquid (Accessories)

- For versions with quench, fill the quench chamber with a suitable quench liquid.
 - The filling is implemented through the tank provided for that.
 - Fill fluid until the quench chamber is completely full and the tank is half full.
- Do not apply pressure or vacuum to the quench chamber.

**NOTICE****Seal failure due to dry run**

A lack of quench liquid can lead to a failure of the seal.

1. Do not put pumps without quench liquid into operation.



A second port on the unit enables purging of the quench chamber and draining of the liquid seal.

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Gear pump KF 2.5 - 630

7.4 Pressure relief valve adjustment

Directly attached pressure relief valves of the series "D" are used exclusively for protection of the gear pumps and may respond on a short-term basis only.

The valves are factory set to the rated pressure of each pressure stage. Setting pressures that deviate from this are stated on the rating plate.

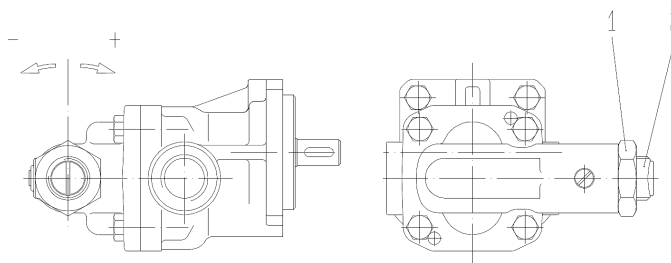


NOTICE

Failure of the pump

Long triggering of the valve can cause the pump to overheat.

1. Only allow intermittent triggering of the valve.



- Lower response pressure
+ Higher response pressure

1. Hexagonal nut
2. Adjustment screw

Pressure setting:

- Remove hexagon nut
- Set the response pressure using the adjusting screw
- Secure the adjusting screw with hexagon nut



WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Consider the permissible pressure setting range of the valve.
2. Check the pressure setting (the valve must not block).

Gear pump KF 2.5 - 630

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7.5 Further operation start-up

- Open existing shut-off elements upstream and downstream of the device.
- Adjust pressure relief valves in the system installed for lowest opening pressure.
- Allow the device start without or with a low pressure load (jog mode).
 - Flow should have developed after 30 s at the latest.
- Run the device for a few minutes depressurised or with low pressure.
- Vent the system at the highest possible point.
- Gradually increase the pressure load up to the desired operating pressure.
- Operate the system for so long until the final operating state is achieved.
- Check the operating data such as:
 - Discharge flow
 - Operating pressure (as close as possible to device)
 - Fluid temperature (as close as possible to device)
 - Device temperature (in particular in the area of the bearing points)
 - ...
- Document the operating data of the initial start-up for later comparison.
- Check the level of the operating medium in the system.
- Check the filling level of the liquid seal (if existing).
- Check the device for leaks.
- Check all threaded connections for leaks and retighten if necessary.



In order to ensure a constant and reliable function of the device, an initial maintenance of the device is recommended after several hours warm-up time (max. 24 h). Faults can thus be identified at an early stage.

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Gear pump KF 2.5 - 630

8 Removal

8.1 Safety instructions for removal

 DANGER Hazardous fluids! Danger of death when handling hazardous fluids. 1. Comply with the safety data sheets and regulations on handling hazardous fluids. 2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.
 DANGER Rotating parts! Danger of death due to body parts, hair or clothing getting trapped or entangled. 1. Before all work, ensure that existing drives are voltage-free and pressure-free. 2. Securely prevent restarting during all work.
 WARNING Unshielded gearwheels! Gearwheels can trap and crush fingers and hands. 1. Do not engage gearwheels.
 WARNING Failure of load-carrying parts due to overload! Danger of injury from flying parts. Danger of injury from spurting fluids. 1. Depressurise the device and all connection lines before doing any work. 2. Securely prevent the restoration of pressure while working on the device.
 CAUTION Hot surfaces! Burn injury to skin if touched. 1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

Gear pump KF 2.5 - 630

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**NOTICE****Blocking of the device through hardening medium**

Hardening medium can mechanically jam the device and make it unusable.

1. Clean device immediately after operating with a hardening medium.

8.2 Removal

- Depressurise and de-energize the system.
- Close existing shut-off elements upstream and downstream of the device.
- Open existing drain elements and loosen connection lines. Collect and dispose of discharging medium so that no hazard arises for persons or environment.
- Dismantle the device.
- Clean the device.
- Close the device connections and lines to prevent dirt penetration.

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Gear pump KF 2.5 - 630

9 Maintenance

9.1 Safety instructions for maintenance


DANGER

Hazardous fluids!
 Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.


DANGER

Rotating parts!
 Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.


WARNING

Failure of load-carrying parts due to overload!
 Danger of injury from flying parts.
 Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.


CAUTION

Hot surfaces!
 Burn injury to skin if touched.

1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

9.2 Maintenance work



Checking and documentation of the operating data

Regular checking and documentation of all operating data such as pressure, temperature, current consumption, degree of filter soiling, etc. contributes to early problem detection.

Gear pump KF 2.5 - 630

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- Perform maintenance according to specification.
- Replace defective and worn components.
- If required, request spare parts lists and assembly drawings from the manufacturer.
- Document the type and scope of the maintenance work along with the operating data.
- Compare the operating data with the values of the first commissioning. Determine the cause in case of major non-compliances (> 10 %).
- Dispose of packing material and used parts in accordance with the local stipulations.



Barriers and instructions

All barriers and warning signs removed during this must be attached to their original position on completing maintenance and/or repairs.

9.3 Maintenance instructions

The following information provides recommendations on maintenance work and maintenance intervals for the device being used.

Depending on the actually occurring loads in operation, the type, scope and interval of the maintenance work can deviate from the recommendations. The equipment builder/operator shall write an obligatory maintenance plan.



Within the framework of preventive maintenance, it is appropriate to replace wear parts before reaching the wear limit.

With corresponding expertise and sufficient equipment, the replacement can be carried out by the equipment builder/operator. Please consult the manufacturer about this.



Warranty

In case of improper implementation, any warranty is voided.

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Maintenance recommendations Gear pump			
Interval	Maintenance work	Employ-ees	Duration approx. [h]
Firstly: after max. 24 h	Inspection: Discharge flow	1	1
	Inspection: Operating pressure		
	Inspection: Fluid temperature		
	Inspection: Device temperature		
	Inspection: Add-on valve function (if existing)		
	Inspection: Check potential equalisation for firm seating and functionality (if existing)		
	Inspection: Condition of operating fluid		
Daily	Audiometric monitoring: Unusual noise	1	0.1
	Cleaning: Remove dust deposits and dirt with a moist cloth		
	Visual inspection: Leakages		
	Visual inspection: Filling level of liquid seal (if existing)		
3000 Operating hours	Inspection: Discharge flow	1	1
	Inspection: Operating pressure		
	Inspection: Fluid temperature		
	Inspection: Device temperature		
	Inspection: Add-on valve function (if existing)		
	Inspection: Check potential equalisation for firm seating and functionality (if existing)		
	Inspection: Condition of operating fluid		
6000 Operating hours	Visual inspection: Condition of gears	1	2
	Visual inspection: Condition of housing parts		
	Visual inspection: Condition of plain bearings		
	Visual inspection: Condition of shaft seal		
	Visual inspection: Condition of outboard bearings (if existing)		
As required	Replace: Plain bearings (only by manufacturer)	1	2
	Replace: Outboard bearing (if existing)		
	Replace: Shaft seal		
	Replace: Other seals		

Gear pump KF 2.5 - 630

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10 Repairs

10.1 Safety instructions for repair



DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.



DANGER

Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.



WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.



CAUTION

Hot surfaces!

Burn injury to skin if touched.

1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

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10.2 General

The repairs covers:

1. Troubleshooting
Determination of damage, pinpointing and localisation of the damage cause.
2. Elimination of damage
Elimination of the primary causes and replacement or repair of defective components. The repair is generally made by the manufacturer.

Repairs by manufacturer

- Before returning the device, fill in the *return notification* form. The form can be filled in online and is available as a pdf file download.

**Device contains hazardous material**

If the device was operated with dangerous liquids, it must be cleaned before the return. If this should not be possible, the safety data sheet of the hazardous material is to be provided beforehand.

Repair by equipment builder/operator

If corresponding expertise and sufficient equipment is available, the equipment builder/operator can also make the repairs. Please consult the manufacturer about this.

- If required, request spare parts lists and assembly drawings from the manufacturer.
- Use spare parts approved by the manufacturer only.
- Dispose of packing material and used parts in accordance with the local stipulations.

**Warranty**

In case of improper implementation, any warranty is voided.

**Barriers and instructions**

All barriers and warning signs removed during this must be attached to their original position on completing maintenance and/or repairs.

Gear pump KF 2.5 - 630

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10.3 Detecting and eliminating failures

Failure	Potential causes	Possible measures
1.1 Increased noise <i>Pump cavitation</i>	Excessive negative pressure (not complete filling of the pump)	Check suction line design Use noise-optimised pump
	Suction line plugged	Clean the suction line
	Suction filter plugged or too small	Clean suction filter or use a larger filter Replace filter element
	Suction basket plugged or too small	Clean intake strainer or dimension larger
	Fluid temperature too low	Adjust the temperature of medium
1.2 Increased noise <i>Foaming or air in medium</i>	Pump sucks air	Check oil level in the tank Check suction line Check the shaft seal
	Shaft seal defective	Replace shaft seal
	Suction connection leaking	Retighten or replace threaded connections Replace seals
	System not vented	Vent system
	Return line ends above the fluid level	Extend return line
	Heavy foaming in the system, e.g. in gears	Use noise-optimised pump
1.3 Increased noise <i>Mechanical vibrations</i>	Incorrectly aligned and/or loose coupling	Correct the alignment of the coupling and secure the coupling halves
	Incorrectly and/or insufficient line fastening	Fixate lines with suitable fastening material (e.g. pipe clamps)
	Wobbling pressure relief valve (if existing)	Increase valve opening pressure
	Not a noise-reducing setup	Use dampers

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Failure		Potential causes	Possible measures
2	Pump does not suck	Dry run	Fill pump and the suction line with medium.
		Minimum filling level in the supply tank undercut	Top up medium
		False direction of rotation of the pump	Correct the direction of rotation
		Closed shut-off element in the suction line	Open the shut-off element
		Suction line plugged	Clean the suction line
		The air in the suction line cannot be compressed in the pressure line	Reduce the start-up pressure
			Vent the pressure line
			Increase volume of the pressure line
		Speed of the pump is too low	Check the pump design
			During frequency inverter operation: Check the operation/line frequency
		Geodetic suction head too high	Check installation location
			Provide pre-filling pump

Gear pump KF 2.5 - 630

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Failure	Potential causes	Possible measures
3 Insufficient pressure Insufficient pumping flow rate	Excessive negative pressure (not complete filling of the pump)	Check suction line design
	Viscosity too high	Provide pre-filling pump
	Speed of the pump is too low	Check the pump design
		During frequency inverter operation: Check the operation/line frequency
	Throttled shut-off element in the suction line	Open the shut-off element
	Suction line plugged	Clean the suction line
	Suction filter plugged or too small	Clean suction filter or use a larger filter
		Replace filter element
	Suction bascet plugged or too small	Clean intake strainer or dimension larger
	Constant triggering of pressure relief valve (if existing)	Increase valve opening pressure
	Pump sucks air	Check oil level in the tank
		Check suction line
		Check the shaft seal
4 Excessive operating temperature	Wear	Replace the device
	Cooling and heat dissipation insufficient	Increase the cooling capacity
	Not sufficient oil in the system	Check the container layout
5 Impermissible pump heating	Excess fluid is being delivered into the supply tank via pressure relief valve under load	Check the pump design
	Constant triggering of a directly attached pressure relief valve (if existing)	Increase valve opening pressure
	Pressure too high in association with a media viscosity that is too low	Check the system design
	Speed too fast in connection with media viscosity that is too high	Check the system design
	Gland lid overtightened (for gland seal)	Unscrew gland lid and readjust leakage
	Suction pressure too high	Reduce the pressure
	Wear	Replace the device

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Failure	Potential causes	Possible measures
6 Leakages <i>Seal failure</i>	Poor maintenance	Comply with maintenance plan Replace seals
	Mechanical damage	Replace seals
	Thermal overload	Check the operating datas Replace seals
	Pressure too high	Check the operating datas Replace seals
	Gas content in medium too high	Check the operating datas Replace seals
	Corrosion/chemical impact	Check the material compatibility Replace seals
	Wrong direction of rotation	Correct the direction of rotation Replace seals
	Contaminated medium	Provide filtration Replace seals
	Gland lid not sufficiently tightened (for gland seal)	Retighten gland lid
	Loose threaded connections	Retighten or replace threaded connections
7.1 Coupling <i>Coupling wear</i>	Alignment error	Correct the alignment of the coupling and secure the coupling halves
	Spider overloaded	Check the operating datas Use harder spider
7.2 Coupling <i>Cam break</i>	Spider wear Torque transmission due to metal contact	Adapt maintenance intervals Replace coupling
7.3 Coupling <i>Premature spider wear</i>	Alignment error	Correct the alignment of the coupling and secure the coupling halves Replace spider
	Spider failure due to chemical corrosion	Check the material compatibility Replace spider

Gear pump KF 2.5 - 630

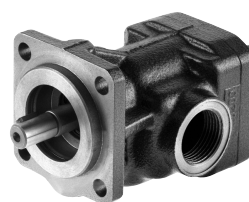
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Failure		Potential causes	Possible measures
8	Motor protection switch tripped	Driving power too low	Check the drive design
		Motor incorrectly connected	Check motor connection
		Phase failure	Check feed/supply
		Current consumption too high	Check the operating datas
			Check direction of rotation
	Motor circuit breaker incor- rectly designed	Check the operating datas	
Consult the manufacturer for all unidentifiable failures.			

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Transfer Gear Pumps

KF 2.5...200

Transfer Gear Pumps KF 2.5...200**KRACHT**

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Transfer Gear Pumps KF 2.5...200

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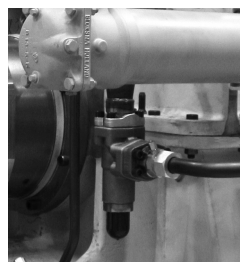
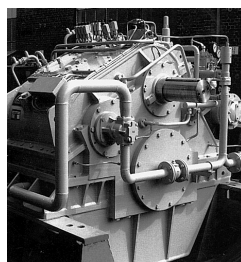
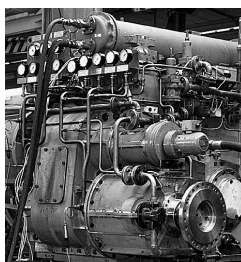
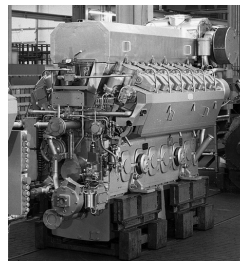
Transfer Gear Pumps KF 2.5...200

KRACHT**Applications, Suitable Fluids****Applications**

Centrifuge construction,
Coating machines, Compressors
Engine construction
Filling stations, Filter systems
Generator construction
Heat transfer systems, Heavy electrical machines
Lubricant manufacturers, Lubricating oil systems
Machine-building industry, Machine tools,
Manufacture of apparatus,
Marine engine construction,
Metal-forming machines, Metering systems
Paint industry, Plain metal bearing production,
Printing machines, PUR machinery
Refrigerators, Rubber and tire manufacturing
Tank plant construction,
Transmission building
Turbine construction
Vacuum machinery
Waste oil - disposal
- transport
- treatment

Suitable fluids

Adhesives, Antifreeze
Bore oils
Cutting oils
Diesel oils, Drawing compound
Emulsions
Fuel oils, L, EL, H
Gear oils, Grease
Hardening oils, Heat transfer media,
Heavy oils, Hydraulic fluids
Isocyanate
Lubricating oils, Lacquers
Motor oils
Paint, Paraffins, Plastics, Polyols
Printing inks, Processing oils
Resins, Rolling oils
Waste oils, Waxes

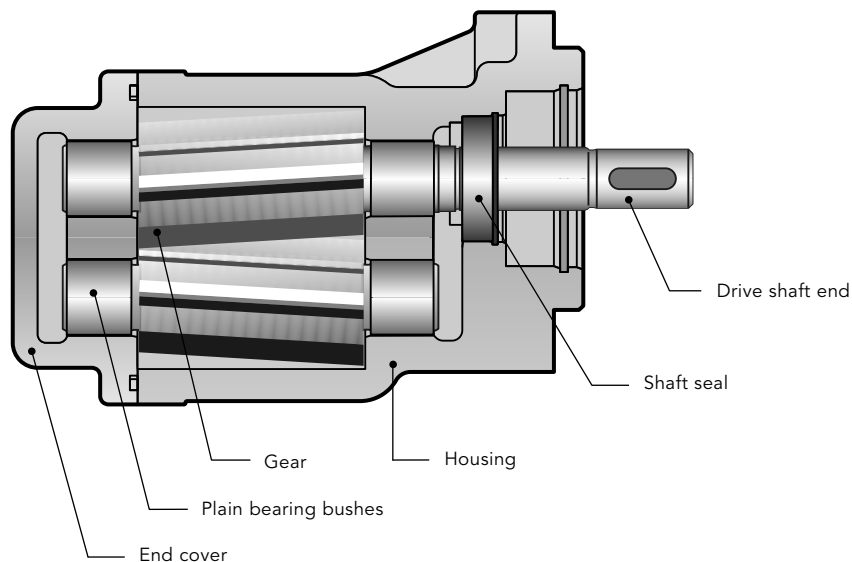


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Transfer Gear Pumps KF 2.5...200

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Construction



Product Features

Transfer gear pumps KF are used for pumping a wide variety of fluids.

Transfer gear pumps KF are distinguished especially by their wide range of variants which are assembled as required on the modular principle and also permit subsequent upgrade.

The pumps are also suitable for media with low lubricating properties.

The standard housing sections are of grey cast iron.

The gear units are manufactured from high-strength case-hardening steel, hardened and mounted in special multi-compound plain bearing bushes.

The standard drive shaft is sealed by rotary shaft lip-type seal.

All pump sizes incorporate helical tooth system. This feature, combined with special gear geometry, results in extremely low noise levels and reduced pressure pulsation.

Working Notes

- The fluids should ensure a certain minimum lubricating properties, should not contain solids and should be chemically compatible.
- Avoid dry operation.
- The pumps may only be operated in the specified direction of rotation, as otherwise the shaft seal will be destroyed.
- In order to prevent excessive overpressure, a safety valve should be provided in the system or on the pump.
- The pressure relief valve attached to the pump may only be used as safety valve for short-term operation.
- A separate pressure relief valve with return line to the reservoir must be foreseen, if a partial discharge flow has to be drained over a prolonged period.

Transfer Gear Pumps KF 2.5...200

KRACHT**Variants**

- Sealing of the drive shaft:
 - Rotary shaft lip-type seal
 - Double rotary shaft lip-type seal (Quench)
 - Mechanical seal
- Outboard bearing to take up input drive-side radial load
- Pressure relief valve for pump and system
- Uniform discharge flow direction with changing direction of rotation by means of flange-mounting valve combination (universal device).

Special Design

Various shafts ends and gear units, as well as flange mounted versions, bearing alternatives, multi-stage pump combinations for your special application are available on request.

Our Sales engineers will be pleased to advise you.

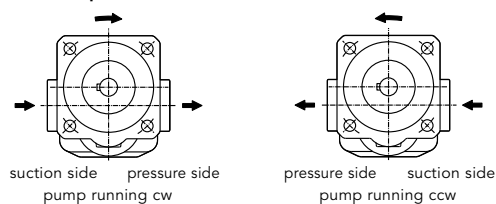
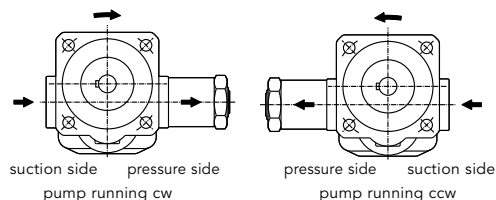
Accessories

- Connecting flanges
- Couplings
- Bell housing
- Quench tank
- Attenuation elements

Direction of Rotation

The following should be note for direction of rotation:

- when looking at the pump shaft end, the direction of pumping is from left to right if the shaft rotates **clockwise**.
- when looking at the pump shaft end, the direction of pumping is from right to left if the shaft rotates **counterclockwise**.

Without pressure relief valve**With pressure relief valve****With universal device**

Direction of rotation right and left

Direction of rotation consistent, see dimension sheets page 18 to 21.

ATEX-Version

	KF 2,5...112 with lip-type seal	KF 2,5...112 with double lip-type seal
In Ex-area max. suitable for category	EX II 2G T4 EX II 2D T135 °C	EX II 2G T4
Perm. working pressure inlet port in bar	– 0.4 ... + 0.5	– 0.4 ... + 0.5
Perm. working pressure outlet port in bar	25	25
Perm. viscosity in mm ² /s	12 ... 20 000	12 ... 20 000
Max. speed in 1/min (viscosity dependent)	3 000	3 000
Perm. mounting position	Horizontal or shaft end toward bottom	Horizontal quencher up
Perm. media temperatures in °C	– 10 ... + 80	– 10 ... + 80
Perm. ambient temperatures in °C	– 20 ... + 60	– 20 ... + 60
Comments	Vertical mounting with shaft end up on request. In executing with outboard bearing max. speed 1500 1/min. In dust Ex-area, permissible only with non-conductive dusts. Dust-proof capsuling of pump shaft and coupling required.	Not suitable for dust-Ex. Execution with quench feed and quencher.

Additional products available on request.

Transfer Gear Pumps KF 2.5...200

KRACHT

Materials

Housing and cover	EN-GJL-250 (GG 25) EN-GJS-400-15 (GGG 40) on request
Gear	Steel 1.7139
Plain bearing bushes	DU (multi-layer friction-type bearings P 10, DP 4) Bearings free of nonferrous metal on request
Shaft end seals	NBR, FKM, PTFE, EPDM (other sealing materials on request. E.g. HNBR / CR)
O-ring	NBR, FKM, PTFE, EPDM (other sealing materials on request. E.g. HNBR / CR)

Characteristics

Nominal sizes 2.5...200 cm ³	$V_g =$	2.5 / 4 / 5 / 6 / 8 / 10 / 12 / 16 / 20 / 25 / 32 / 40 / 50 / 63 / 80 / 100 / 112 / 125 / 150 / 180 / 200
Mounting position		KF... R/L/B ... without Quench optional KF... R/L/B ... with Quench horizontal, Quench connection above KF... U ... horizontal, Pressure connection above KF... U2...optional
Direction of rotation		right or left right and left
Fixing type		flange
Pipe connection	KF 2.5...25 KF 32...200	Whitworth pipe thread, SAE flange SAE flange
Drive shaft end		ISO R 775 short-cylindrical
Working pressure suction side		see chart page 8
Working pressure pressure side	P_n	25 bar (higher pressures on request)
Speed	KF 2.5... 63 KF 80... 180 KF 200	200 ... 3 600 1/min 200 ... 3 000 1/min 200 ... 2 500 1/min
Recommended speed		The speed of the pump must be chosen in such a way that complete pump filling is guaranteed. This is given if the relative pressure at the pump inlet does not fall below -0.4 bar (-0.6 bar briefly e.g. during cold start).
Viscosity (dependent on pressure and rotational speed)	V_{min} V_{max}	1.4... 12 mm ² /s (see table "permissible differential pressure") 20 000 mm ² /s
Fluid temperature		see chart page 8
Ambient temperature	$\vartheta_u =$	-20 °C ... 60 °C (-4 °F ... 140 °F) -30 °C... 60 °C Sealing type 23 (KF 2.5...80) -30 °C... 60 °C Sealing type 31 (KF 32...200)

Permissible Differential Pressure

Bearing	Δp_{max} [bar]		
	≥ 1.4 mm ² /s	≥ 6 mm ² /s	≥ 12 mm ² /s
Multi-layer plain bearing containing lead ⁽¹⁾ : DU®, P10	3	12	25
Multi-layer plain bearing lead-free ⁽²⁾ : DP4			
Polymer plain bearing ⁽²⁾ : Iglidur® X	–	3	10
White metal plain bearing ⁽²⁾			

⁽¹⁾ Standard ⁽²⁾ Is defined in the special number

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25829238/ES – 11/2018

Transfer Gear Pumps KF 2.5...200

KRACHT**Shaft End Seals**

	Sealing material	Pressure suction side* (bar)		Fluid temperature	
		KF 2,5...80	KF 100...200	°C	°F
Pump with single rotary shaft lip	NBR/ max. 750 1/min	-0.4...6.0	-0.4...6.0	-10...90-NBR	14...194-NBR
	FKM max. 1000 1/min	-0.4...5.0	-0.4...5.0		
	max. 1500 1/min	-0.4...4.0	-0.4...3.5	-10...150-FKM	14...302-FKM
	max. 2000 1/min	-0.4...3.0	-0.4...2.5		
	max. 3000 1/min	-0.4...2.0	-0.4...1.5		
	FKM (low temperature)	-0.4...0.5		-30**...150	-22**...302
Pump with outboard bearing and single rotary shaft lip	EPDM	-0.4...0.5		-10...120	14...248
	PTFE	-0.4...2.0		-10...200	14...392
	NBR/ max. 750 1/min	-0.4...6.0	-0.4...6.0	-10...90-NBR	14...194-NBR
	FKM max. 1000 1/min	-0.4...5.0	-0.4...5.0		
	max. 1500 1/min	-0.4...4.0	-0.4...3.5	-10...150-FKM	14...302-FKM
	max. 2000 1/min	-0.4...3.0	-0.4...5.5		
Pump with double rotary shaft seal with connection borehole for liquid seal (quench)	max. 3000 1/min	-0.4...2.0	-0.4...1.5		
	PTFE	-0.4...2.0		-10...200	14...392
	NBR/ max. 750 1/min	-0.4...6.0	-0.4...6.0	-10...90-NBR	14...194-NBR
	FKM max. 1000 1/min	-0.4...5.0	-0.4...5.0		
	max. 1500 1/min	-0.4...4.0	-0.4...3.5	-10...150-FKM	14...302-FKM
	max. 2000 1/min	-0.4...3.0	-0.4...2.5		
Pump with double rotary shaft seal for vacuum operation with connection borehole for liquid seal (quench)	max. 3000 1/min	-0.4...2.0	-0.4...1.5		
	PTFE	-0.4...2.0		-10...200	14...392
	NBR	-0.9...0.2		-10...90	14...194
Pump with triple rotary shaft seal for vacuum and normal operation with connection borehole for liquid seal (quench)	FKM	-0.9...0.2		-10...150	14...302
	PTFE	-0.9...0.2		-10...200	14...392
	NBR/ max. 750 1/min	-0.9...6.0	-0.9...6.0	-10...90-NBR	14...194-NBR
Pump with mechanical seal	FKM max. 1000 1/min	-0.9...5.0	-0.9...5.0		
	max. 1500 1/min	-0.9...4.0	-0.9...3.5	-10...150-FKM	14...302-FKM
	max. 2000 1/min	-0.9...3.0	-0.9...2.5		
	max. 3000 1/min	-0.9...2.0	-0.9...1.5		
	FKM	-0.4...10.0		-10...150	14...302
Pump with mechanical seal and connection borehole for liquid seal (quench)	PTFE	-0.4...10.0		-10...200	14...392
	EPDM	-0.4...10.0		-10...120	14...248
	FKM	-0.4...10.0		-10...150	14...302

Speed: KF 2.5... 63 200 ... 3 600 1/min
 KF 80... 180 200 ... 3 000 1/min
 KF 200 200 ... 2 500 1/min

* short term during start-up status: -0.6 bar

** only in connection with housing and cover material EN-GJS-400 (GGG 40)

The indicated maximum values are dependent upon the remaining working conditions.

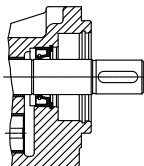
In case of universal devices, pay attention to limitation of $P_{e \text{ min}}$.

Other sealing materials on request.

Transfer Gear Pumps KF 2.5...200

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Variants Shaft End Seals



Pump with single rotary shaft lip

Fixing type: F/W

Sealing materials:

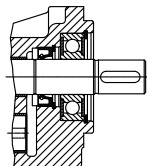
NBR = sealing type 1

FKM = sealing type 2

PTFE = sealing type 3

EPDM = sealing type 9

FKM low temperature
= sealing type 23/31



Pump with outboard bearing and single rotary shaft lip

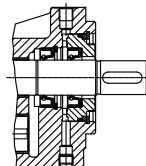
Fixing type: G/X

Sealing materials:

NBR = sealing type 1

FKM = sealing type 2

PTFE = sealing type 3



Pump with double rotary shaft seal with connection borehole for liquid seal (quench)

Fixing type: F/W

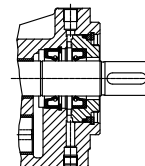
Sealing materials:

NBR = sealing type 19

FKM = sealing type 7

PTFE = sealing type 4

EPDM = sealing type 32



Pump with double rotary shaft seal for vacuum operation with connection borehole for liquid seal (quench)

Fixing type: F/W

Sealing materials:

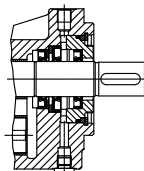
NBR = sealing type 19

FKM = sealing type 7

PTFE = sealing type 4

EPDM = sealing type 32

Special number: 74



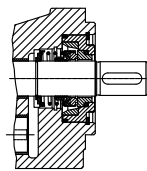
Pump with triple rotary shaft seal for vacuum and normal operation with connection borehole for liquid seal (quench)

Fixing type: F/W

Sealing materials:

NBR = on request

FKM = on request



Pump with mechanical seal

Fixing type: F/W

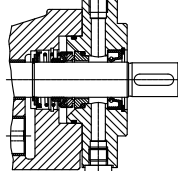
Sealing materials:

FKM = sealing type 5

PTFE = sealing type 6

mechanical seal

= sealing type 40



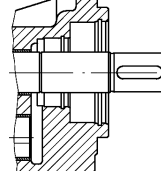
Pump with mechanical seal and connection borehole for liquid seal (quench)

Fixing type: F/W

Sealing materials:

FKM = sealing type 5

Special number: 198



Pump without shaft sealing

Fixing type: F/W

Sealing material:

FKM o-ring
= sealing type 30

Transfer Gear Pumps KF 2.5...200

KRACHT**KF 2.5...200 noise optimized for medias with increased air content**

The noise optimized pumps in the KF series are designed for conveying for medias with increased air content, predominantly for use as lubricating oil pumps in transmissions. Special measures prevent the otherwise normally increased noise present in auriferous transmission oil. The noise levels do not exceed or only barely exceed the measurements with non-auriferous oils. Also, there is no noise spectrum shift to higher, unpleasant frequencies. In applications without auriferous portions in the media, it is not recommended to use this version as it will not bring about noise reduction effects there.

The noise optimized version of the KF pump is marked with the special number **197** at the end of the type key. Pumps with the special number **197** are built as pumps in combination with an electric motor or as mounted pumps. The pump in combination with an electric motor (Fig. 1) does not have an outboard bearing, so it has to be driven via an elastic coupling. The mounted pump (Fig. 2) comes equipped with an outboard bearing to absorb the centrifugal forces such as those which arise when using a flying pinion. Pumps for electric motor drives and mounted pumps are sealed at the shaft end using a lip-type shaft seal.

Fig. 1

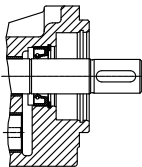
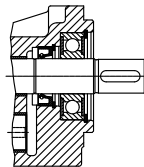


Fig. 2



Pump with
single rotary shaft lip

Fixing type: F/W

Sealing materials:

NBR = sealing type 1

FKM = sealing type 2

Special number: 197

Pump with outboard bearing
and single rotary shaft lip

Fixing type: G/X

Sealing materials:

NBR = sealing type 1

FKM = sealing type 2

Special number: 197

The noise optimized version is also available in a ductile cast iron version. We can supply these pumps in the ATEX version also.

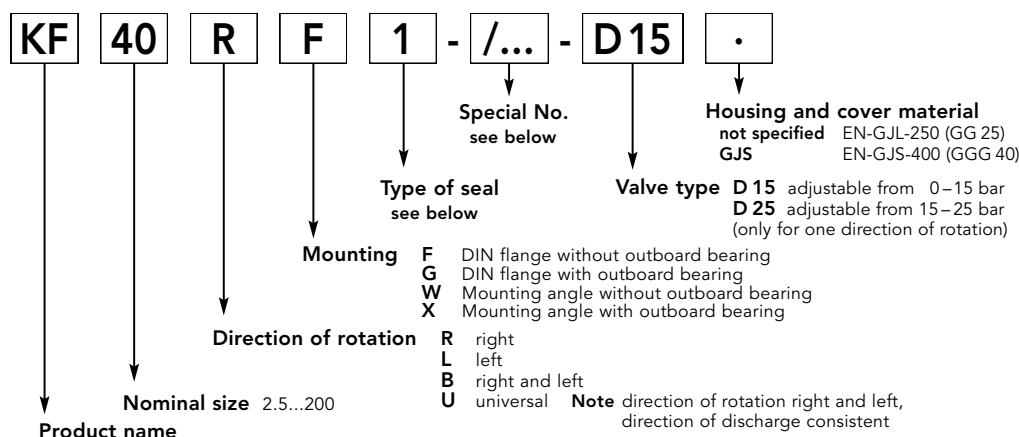
Note

Dimensions conformable standard pumps

Transfer Gear Pumps KF 2.5...200

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Type Key (Ordering example)



Type of seal

- 1 Rotary shaft seal BABSL NBR
- 2 Rotary shaft seal BABSL FKM
- 3 Rotary shaft seal PTFE
- 4 Double rotary shaft seal PTFE
- 5 Mechanical seal with FKM secondary seals (C2S2V1G3G1)
- 6 Mechanical seal with FFKM secondary seals
Q2Q2K1G3 (KF 2.5... 25) Q2B2K1G3 (KF 32... 200)
- 7 Double rotary shaft seal BABSL FKM
- 9 Rotary shaft seal EPDM (not resistant to mineral oils)
- 19 Double rotary shaft seal BABSL NBR
- 23 Rotary shaft seal MSS-1 FKM
(low temperature) (KF 2.5... 80)
- 30 Without shaft seal ⁽¹⁾ O-ring FKM
- 31 Rotary shaft seal BABSL FKM
(low temperature) (KF 32... 200)
- 32 Double rotary shaft seal EPDM
(not resistant to mineral oils)
- 36 Without shaft seal ⁽¹⁾ O-ring NBR
- 40 Mechanical seal with FKM secondary seals (AQ2VFF)

⁽¹⁾ Leak oil discharged through the gland pocket

Special No.

- 74 Double rotary shaft seal (for vacuum operation)
Connection bore G 1/8" (for liquid seal)
- 158 KF 2.5... 12: Flange connection SAE 3/4"
KF 16... 25: Flange connection SAE 1"
- 197 Noise-optimized version for aerated oils and vacuum⁽¹⁾
- 198 Mechanical seal
KF 2.5... 25: Connection bore G 1/8" (for liquid seal)
KF 32... 80: Connection bore G 1/4" (for liquid seal)
- 232 KF 50...80: Flange connection SAE 2"
KF 100...112: Flange connection SAE 2 1/2"
KF 125...150: Flange connection SAE 3"
KF 180...200: Flange connection SAE 3 1/2"
- 304 Polymer plain bearing iglidur®X
(free from non-ferrous metals), Δp_{max} = 10 bar
- 317 Noise-optimized version for aerated oils and vacuum⁽¹⁾
Polymer plain bearing iglidur®X
(free from non-ferrous metals), Δp_{max} = 10 bar
- 322 Triple rotary shaft seal (for normal operation + for vacuum operation)
Connection bore G 1/8" (for liquid seal)
Polymer plain bearing iglidur®X
(free from non-ferrous metals), Δp_{max} = 10 bar
KF 50... 80: Flange connection SAE 2"
- 353 Noise-optimized version for aerated oils and vacuum⁽¹⁾
Multi-layer plain bearing DP4 (lead-free)
- 355 Polymer plain bearing iglidur®X
(free from non-ferrous metals), Δp_{max} = 10 bar
Housing connection: KF 2.5... 25: as special number 158
- 363 Version for low-viscous media (housing and cover material = GJS)
Polymer plain bearing iglidur®X
(free from non-ferrous metals), Δp_{max} = 10 bar
Housing connection: KF 2.5... 25: as special number 158
KF 50... 200: as special number 232
- 391 Noise-optimized version for aerated oils and vacuum⁽¹⁾
Housing connection: KF 50... 200: as special number 232
- 425 Shaft end with centre hole DIN 322-D
Outboard bearing with steel cage

⁽¹⁾ There can be a reduction in pumping capacity. Measures for noise optimisation are only feasible for one rotational direction and only effective for aerated oils or vacuum.

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Transfer Gear Pumps KF 2.5...200

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Technical Data

Nominal size	geom. displacement	Working pressure *	Maximum pressure (pressure peaks)	Speed range		Permissible load ** (n = 1500 1/min)	Sound level dB (A)		
	V _g cm ³ /r			p _b bar	p _{max} bar		n _{min} 1/min	n _{max} 1/min	F _{radial} N
2.5	2.55	25	40	200	3600	700	≤ 65	≤ 66	≤ 67
4	4.03								
5	5.05								
6	6.38								
8	8.05								
10	10.11								
12	12.58								
16	16.09								
20	20.1								
25	25.1								
32	32.12				1500	≤ 67	≤ 68	≤ 68	
40	40.21								
50	50.2								
63	63.18								
80	80.5								
100	101.5								
112	113.5								
125	129.4								
150	155.6								
180	186.6								
200	206.2	3000	≤ 67	≤ 68	≤ 69				
		2500	≤ 65	≤ 65	≤ 65				

Remark

* Working pressure p_b = perm. sustained pressure (higher pressures on request)

** Permissible load only for version with outboard bearing. F_{radial} at centre of shaft end.

For certain working conditions, the minimum or maximum characteristics should not be used.

For example, the max. working pressure is not permissible in combination with low speed and low viscosity.

In such limit ranges, please consult us.

Sound level measured in dB(A) at 1 m distance

Sound level measured with drive motor, installation site:

Works hall, quiet sound level = 40 dB(A)

Pump assembly on rigid fastening angle,

Suction and pressure conduits: Hose

Measured with transmission oil,

Oil viscosity $\nu = 34 \text{ mm}^2/\text{s}$,

Speed $n = 1500 \text{ 1/min}$.

Transfer Gear Pumps KF 2.5...200

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Power Consumption

		Speed n = 950 1/min																			
		Pressure p _b in bar								Nominal size											
		2	4	6	8	10	15	20	25	2	4	6	8	10	15	20	25				
Discharge Q in l/min	2.5	2.4	2.4	2.3	2.2	2.1	2	1.8	2.5	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	Power consumption P in KW			
	3.7	3.7	3.6	3.6	3.6	3.5	3.4	3.3	4	0.04	0.05	0.07	0.08	0.09	0.13	0.16	0.2				
	4.6	4.6	4.5	4.5	4.4	4.2	4.1	3.9	5	0.04	0.06	0.08	0.1	0.11	0.16	0.2	0.25				
	5.8	5.7	5.6	5.5	5.5	5.3	5.1	4.9	6	0.05	0.07	0.09	0.12	0.14	0.19	0.25	0.3				
	7.3	7.3	7.2	7.1	7	6.8	6.6	6.4	8	0.06	0.09	0.11	0.14	0.17	0.24	0.31	0.38				
	9.2	9.1	9	8.9	8.8	8.5	8.2	7.9	10	0.07	0.1	0.14	0.17	0.21	0.29	0.38	0.47				
	11.4	11.3	11.2	11.1	11	10.8	10.5	10.3	12	0.08	0.12	0.16	0.21	0.25	0.36	0.47	0.58				
	14.2	14	13.8	13.6	13.4	12.9	12.3	11.8	16	0.09	0.15	0.2	0.26	0.31	0.45	0.6	0.74				
	18	17.6	17.3	16.9	16.6	15.7	14.9	14	20	0.1	0.18	0.25	0.32	0.39	0.56	0.74	0.92				
	22.8	22.5	22.3	22	21.7	21.1	20.4	19.8	25	0.12	0.21	0.3	0.39	0.48	0.7	0.92	1.14				
	29	28	27	27	26	25	23	22	32	0.16	0.3	0.4	0.5	0.6	0.9	1.2	1.5				
	36	36	35	34	34	32	30	28	40	0.25	0.4	0.5	0.6	0.8	1.1	1.5	1.8				
	45	44	43	42	41	39	36	34	50	0.3	0.5	0.6	0.8	1	1.4	1.9	2.3				
	57	56	54	53	52	50	46	43	63	0.4	0.6	0.8	1	1.2	1.8	2.4	2.9				
	74	73	72	71	70	67	65	62	80	0.6	0.8	1.1	1.4	1.6	2.3	3	3.7				
	92	90	88	86	84	79	73	67	100	0.7	1	1.3	1.6	1.9	2.7	3.6	4.5				
	102	99	97	94	91	84	77	70	112	0.9	1.2	1.6	2	2.4	3.3	4.3	5.2				
	114	112	109	106	103	96	89	82	125	1	1.4	1.8	2.3	2.8	3.9	5	6.1				
	139	137	134	132	129	123	116	110	150	1.1	1.6	2.1	2.6	3.2	4.5	5.8	7.2				
	169	166	163	160	156	148	140	132	180	1.2	1.8	2.4	3	3.6	5.1	6.6	8.1				
	187	184	180	177	174	167	159	151	200	1.4	2.1	2.8	3.4	4	5.7	7.3	9				
		Speed n = 1450 1/min																			
		Pressure p _b in bar								Nominal size											
		2	4	6	8	10	15	20	25	2	4	6	8	10	15	20	25				
Discharge Q in l/min	3.6	3.6	3.5	3.5	3.5	3.4	3.3	3.2	2.5	0.04	0.05	0.08	0.1	0.12	0.14	0.16	0.2	Power consumption P in KW			
	5.7	5.7	5.6	5.6	5.5	5.4	5.4	5.3	4	0.06	0.08	0.16	0.12	0.15	0.2	0.25	0.3				
	6.9	6.8	6.8	6.7	6.7	6.6	6.5	6.4	5	0.07	0.1	0.12	0.15	0.19	0.27	0.35	0.43				
	8.9	8.8	8.8	8.7	8.6	8.4	8.2	8	6	0.08	0.11	0.115	0.18	0.22	0.32	0.39	0.47				
	11.3	11.2	11.1	11	10.9	10.8	10.6	10.4	8	0.09	0.14	0.18	0.22	0.26	0.37	0.47	0.58				
	14.2	14.1	14.1	13.8	13.7	13.4	13.1	12.8	10	0.11	0.16	0.21	0.27	0.32	0.45	0.58	0.72				
	17.6	17.5	17.4	17.3	17.2	16.9	16.7	16.5	12	0.12	0.19	0.26	0.32	0.39	0.55	0.72	0.89				
	22.2	21.9	21.7	21.4	21.2	20.5	19.9	19.3	16	0.16	0.26	0.37	0.47	0.57	0.82	1.08	1.33				
	27.9	27.5	27.1	26.8	26.4	25.5	24.5	23.6	20	0.17	0.28	0.39	0.49	0.6	0.87	1.14	1.41				
	35.3	35	34.7	34.4	34.1	33.3	32.6	31.8	25	0.24	0.34	0.47	0.61	0.74	1.08	1.41	1.75				
	45	44	43	43	42	41	39	37	32	0.3	0.5	0.7	0.8	1	1.4	1.9	2.3				
	57	56	55	55	54	52	50	48	40	0.4	0.6	0.9	1.1	1.3	1.8	2.3	2.9				
	70	69	68	67	66	64	61	58	50	0.5	0.8	1.1	1.3	1.6	2.3	2.9	3.6				
	88	87	86	85	84	81	78	75	63	0.7	1	1.3	1.7	2	2.9	3.7	4.5				
	114	113	112	111	110	107	105	103	80	0.94	1.35	1.8	2.2	2.6	3.6	4.6	5.7				
	144	142	140	138	137	131	128	126	100	1.2	1.6	2	2.5	3	4.3	5.7	7				
	161	159	157	154	152	147	142	138	112	1.4	2	2.6	3.1	3.7	5.2	6.7	8.2				
	181	178	175	172	169	162	155	147	125	1.7	2.3	2.9	3.6	4.2	5.8	7.4	9				
	218	216	213	211	209	203	197	191	150	2	2.7	3.5	4.2	5	6.9	8.9	11				
	264	261	257	254	251	242	234	226	180	2.3	3.2	4.1	5	5.9	8.2	10.4	12.7				
	293	290	287	283	280	272	264	256	200	2.6	3.6	4.6	5.6	6.6	9.1	11.6	14				

The ratings refer to a mineral oil with a viscosity of 34 mm²/s.

Margin of error for the flow Q + 2.5 % ... - 5 % of the tabular value. For viscosity < 30 mm²/s, take a reduction of the rated flow Q into account.

The output of the drive motor should be selected 20 % higher than tabular value P.

For viscosity > 100 mm²/s, an increase in the required power is necessary, in this case proceed as per description on page 15.

Transfer Gear Pumps KF 2.5...200

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Discharge Flow / Input Power

Calculation

$$P_{1Pu} = P_{tab} \cdot \frac{n}{1450} + f_v \cdot Q$$

P_{1Pu} = pump power consumption (kW)
 P_{tab} = power consumption per table (kW) at 1450 1/min
 n = speed (1/min)
 dependent on viscosity!
 (see speed recommendation)
 f_v = viscosity factor $\left[\frac{\text{kW}}{\text{l/min}} \right]$
 (see diagram)
 Q = discharge flow (l/min) with $Q = \frac{V_g \cdot n}{1000}$
 V_g = geometrical displacement (cm³/r)

Example: Pump type KF 80

Viscosity $v = 3000 \text{ mm}^2/\text{s}$
 Working pressure $p = 15 \text{ bar}$
 at $P_{tab} = 3.6 \text{ kW}$
 $n = 500 \text{ 1/min}$
 $f_v = 0.017 \frac{\text{kW}}{\text{l/min}}$
 $Q = \frac{80.5 \cdot 500}{1000} = 40 \text{ l/min}$
 becomes
 $P_{1Pu} = \left(3.6 \cdot \frac{500}{1450} + 0.017 \cdot 40 \right) \text{ kW}$
 $P_{1Pu} = 1.92 \text{ kW}$
 Motorpower output: $P_{2Mot} = 1.2 \cdot P_{1Pu} = 2.3 \text{ kW}$
 Select helical geared motor with $P = 3.0 \text{ kW}$
 $n = 500 \text{ 1/min}$

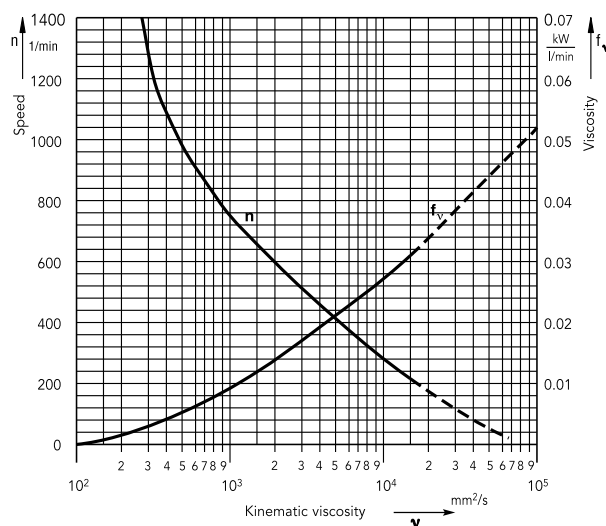
Conversion factors

$$1 \text{ bar} \triangleq 14.5 \frac{\text{lb}}{\text{in}^2} = 14.5 \text{ psi}$$

$$1 \frac{\text{l}}{\text{min}} \triangleq 0.220 \frac{\text{gal}}{\text{min}} = [\text{U.K.}]$$

$$1 \frac{\text{l}}{\text{min}} \triangleq 0.264 \frac{\text{gal}}{\text{min}} = [\text{US}]$$

Input Power

Diagramm: $n, f_v = f(v)$ **Note:**

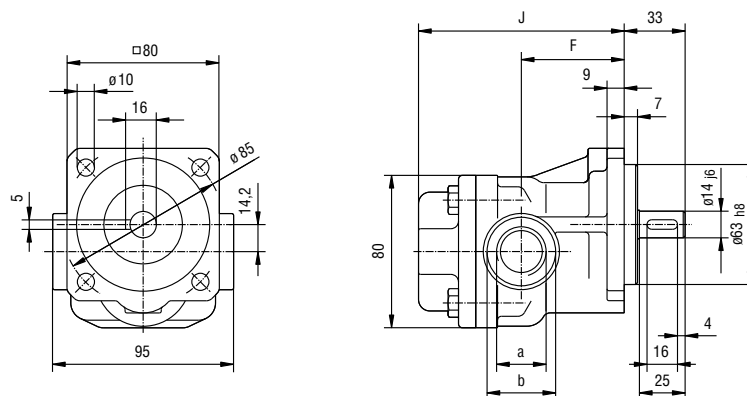
To determine the power consumption, always take the max. working viscosity at starting state into consideration. The power of the drive motor should be selected 20 % higher than the value determined.

Transfer Gear Pumps KF 2.5...200

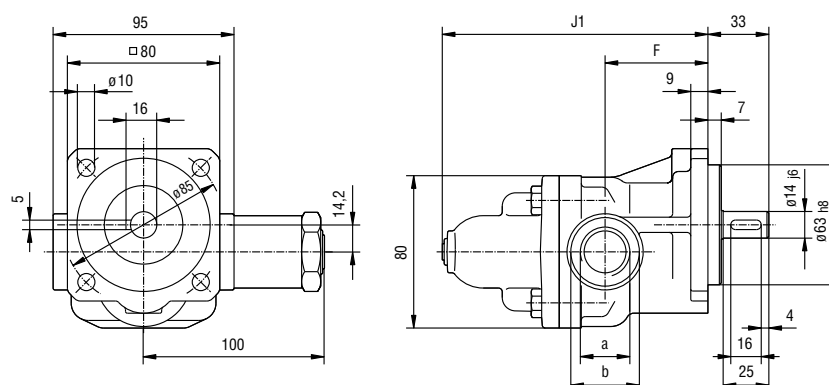
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Flange-Mounting Version with Pipe Thread

KF 2.5...25



KF 2.5...25 with pressure relief valve



Nominal size	Suction and pressure connection		F	J	J ₁	Weight in kg	
	a	b				without valve	with valve
2,5...12	G 3/4 17 deep	Ø 36	54	109	140	2.9	3.7
16...25	G 1 19 deep	Ø 42	63	131	161	3.5	4.3

(Dimensions in mm)

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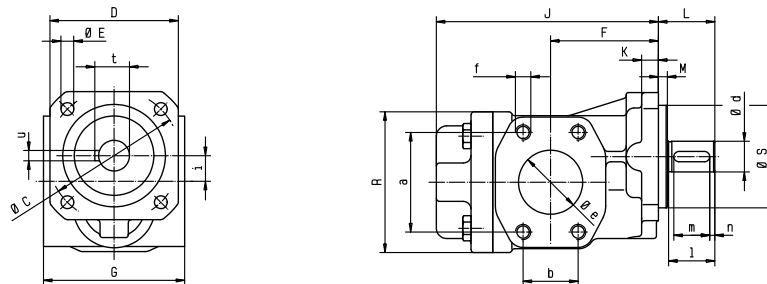
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Transfer Gear Pumps KF 2.5...200

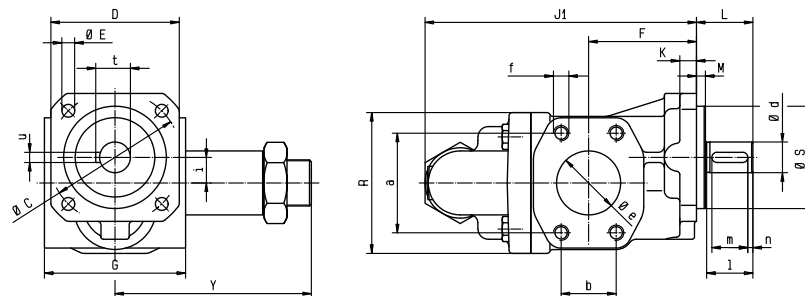
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Flange-Mounting Version with SAE-Connection

KF 2.5...200



KF 2.5...200 with pressure relief valve



Nominal size	Sp. No.	SAE	Seal	Suction- and pressure connection			Pump sizes														Shaft end						Weight in kg		
				a	b	e	f	C	D	E	F	G	J	J ₁	K	L	M	R	S _{h8}	i	Y	d _h	l	m	n	t	u	without valve	with valve
2.5...12	158	¾"	–	47.6	22.2	19.5	M10-15 deep	85	80	10	54	109	140	9	33	7	80	63	14,2	100	14	25	16	4	16	5	4.2	5.0	
16...25	158	1"	–	52.4	26.2	25.0	M10-17 deep				63	131	162														4.8	5.6	
32...50	–	1½"	–	69.9	35.7	38.0					84	110	173	212													7.7	9.5	
63/80	–	1½"	–					103	100	10	100	208	247	13	44	7	110	80	20	153	24	36	28	4	27	8	9.4	11.2	
50	232	2"	–			50.0					84	173	212														7.7	9.5	
63/80	232	2"	–	77.8	42.9						100	208	247														9.4	11.2	
100/112	–	2"	–			50.8	M12-20 deep								60						28	50	40	5	31				
100/112	–	2"	31												46						24	36	28	4	27				
100/112	232	2½"	–								102	130	220.5	262.5	17						28	50	40	5	31		16.0	18.7	
100/112	232	2½"	31	88.9	50.8	63.5									46						24	36	28	4	27				
125/150	–	2½"	–												60						28	50	40	5	31				
125/150	–	2½"	31												46						24	36	28	4	27				
125/150	232	3"	–					145	135	14	120	245.0	282.0		60						28	36	28	4	27		22.2	24.9	
125/150	232	3"	31	106.4	61.9	76.2					150			18	46		159				24	36	28	4	27				
180/200	–	3"	–																		28				31				
180/200	–	3"	31																		24				27				
180/200	232	3½"	–	120.7	69.9	88.9	M16-32 deep				130	262	299	60							28	50	40	5	31		24.8	27.5	
180/200	232	3½"	31																		24				27				

(Dimensions in mm)

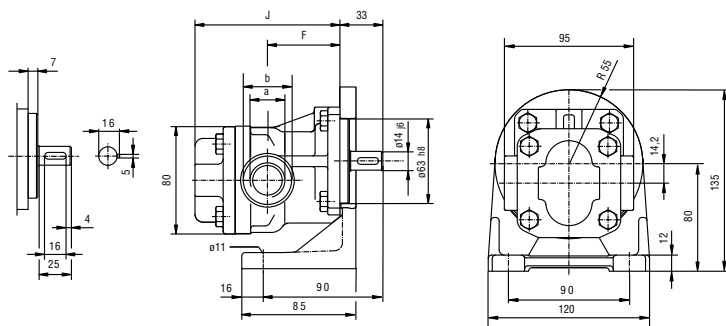
Documentación de proveedores

Transfer Gear Pumps KF 2.5...200

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Pump with Mounting Angle, Pipe Thread

KF 2,5...25

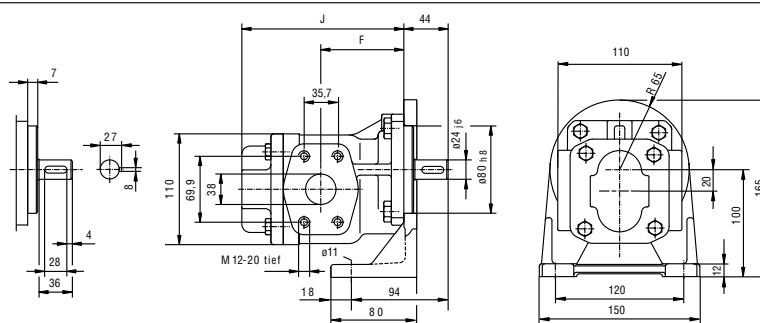


Nominal size	Suction and pressure connection		F	J	Weight in kg
	a	b			
2,5...12	G 3/4 17 deep	Ø 36	54	109	4,2
16...25	G 1 19 deep	Ø 42	63	131	4,8

(Dimensions in mm)

Pump with Mounting Angle, Pipe Thread, SAE 1 1/2-connection

KF 32...80



Nominal-size		F	J	Weight in kg
32...50	SAE 1½	84	173	9.5
63 / 80	SAE 1½	100	208	11.2

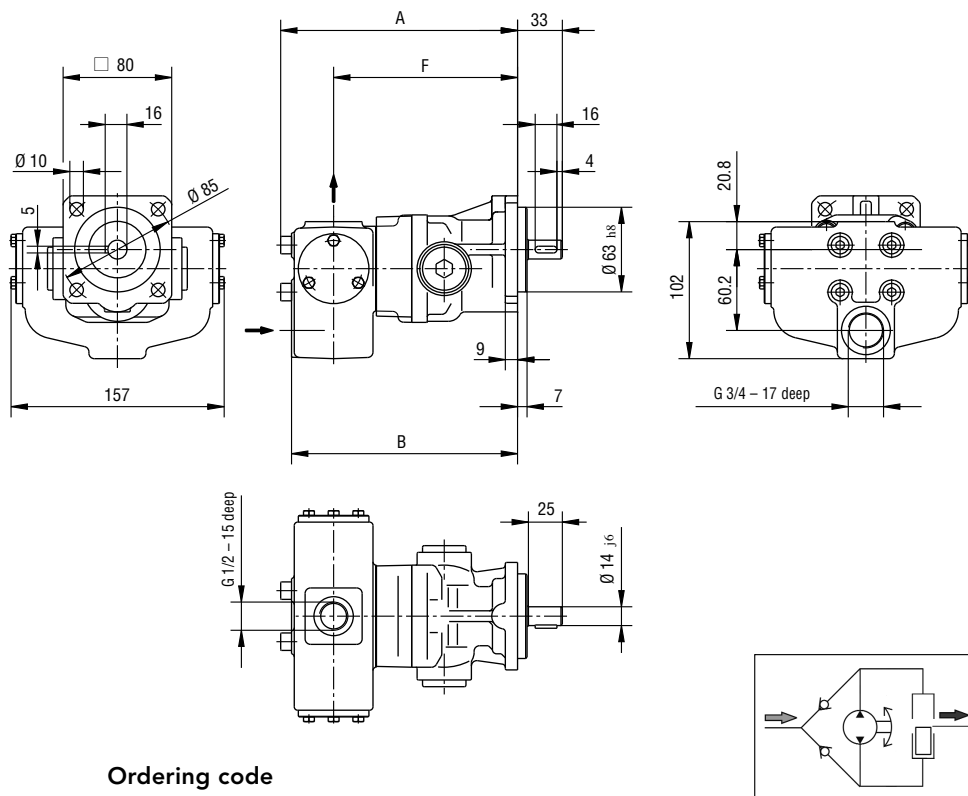
(Dimensions in mm)

Transfer Gear Pumps KF 2.5...200

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Flange-Mounting Version with Universal Arrangement

KF 2.5...25



Ordering code

KF . UF .
Seals 1/2

Nominal size	A	B	F	Weight in kg	Perm. manometr. low pressure at the pump suction connection p _e bar
2.5	174.5	166.5	135.5	6.9	0.35
4					
5					
6					
8					
10					
12	196.5	188.5	157.5	7.5	0.35
16					
20					
25					

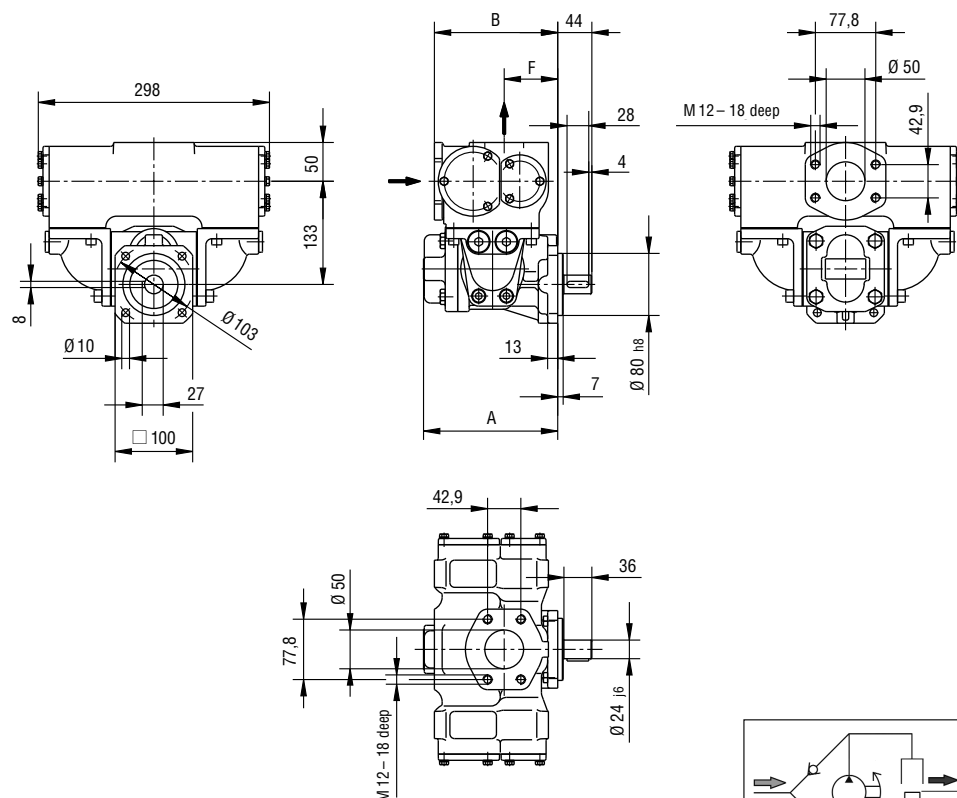
(Dimensions in mm)
Mounting position horizontal, Pressure connection above

Transfer Gear Pumps KF 2.5...200

KRACHT

Flange-Mounting Version with Universal Arrangement

KF 32 ... 80



Ordering code

KF . UF .

Seals $\frac{1}{2}$

Nominal size	A	B	F	Weight in kg	Perm. manometr. low pressure at the pump suction connection p_e bar
32 40 50	173	159	69	27.5	0.35
63 80	208	175	85	29.5	

(Dimensions in mm)

Mounting position horizontal, Pressure connection above

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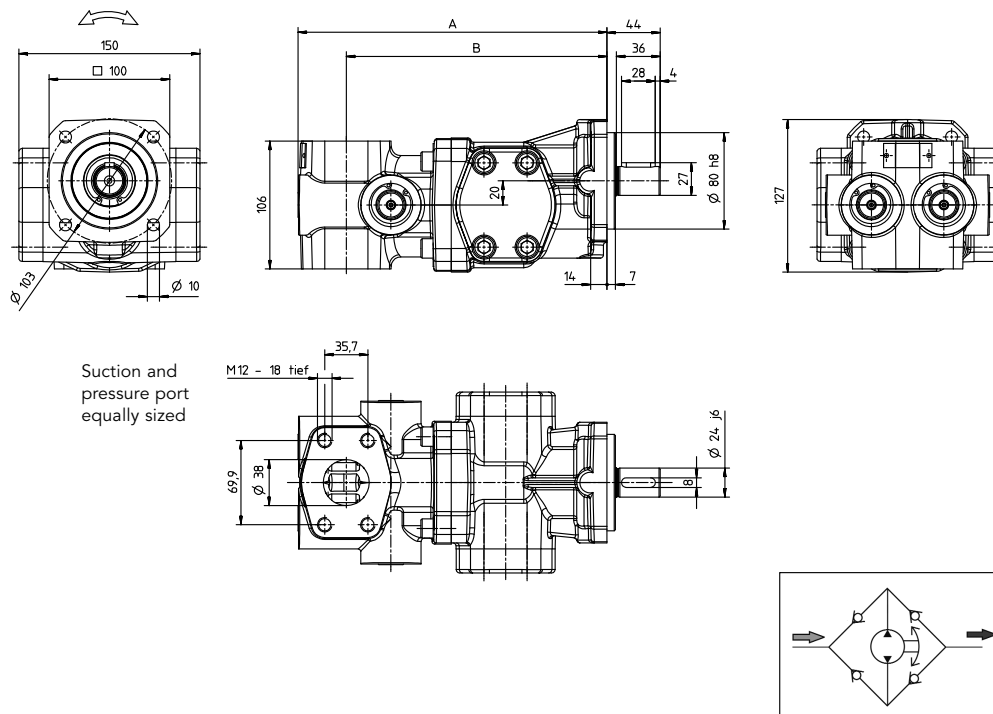
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Transfer Gear Pumps KF 2.5...200

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Flange-Mounting Version with Universal Arrangement U2

KF 32...80



Nominal displacement	A	B	Weight in kg
32 40 50	256	216	15.5
63 80	291	251	17.5

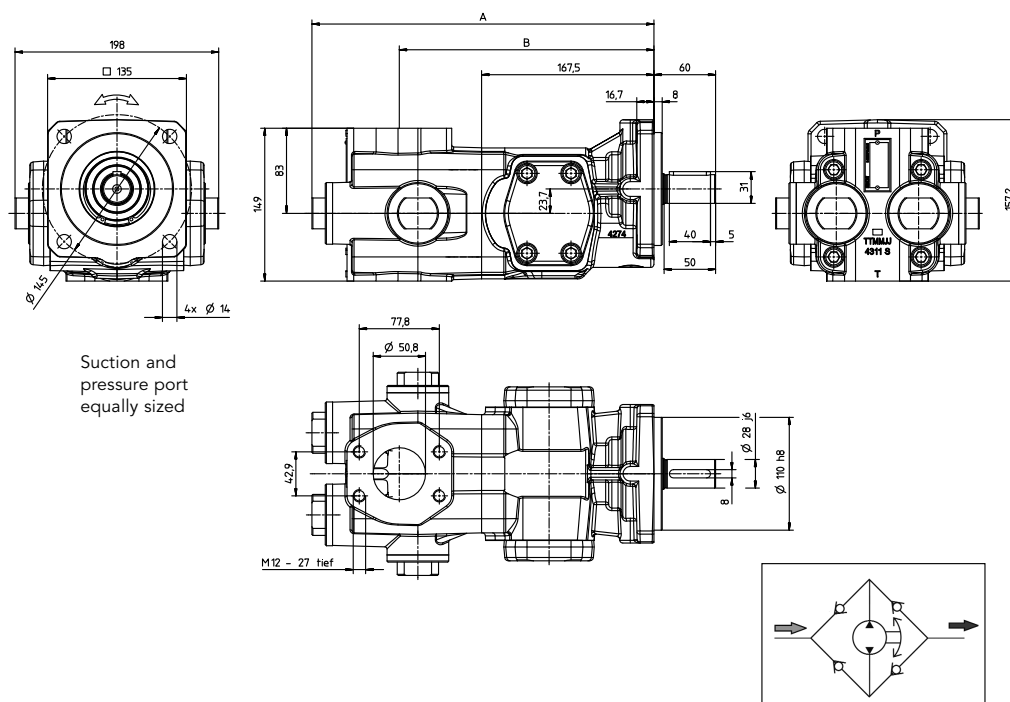
(Dimensions in mm)
Mounting position optional

Transfer Gear Pumps KF 2.5...200

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Flange-Mounting Version with Universal Arrangement U2

KF 100/112



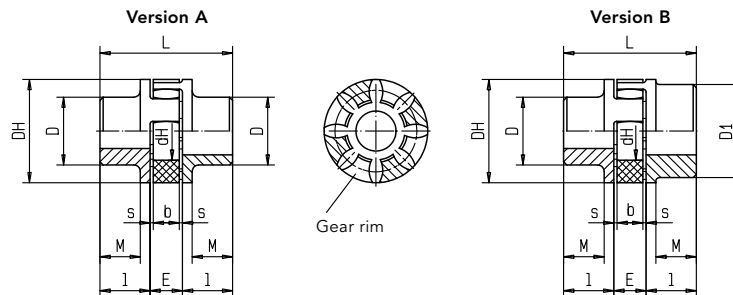
Nominal displacement	A	B	Weight in kg
100	312,5	247,5	21.6
112			

(Dimensions in mm)
Mounting position optional

Transfer Gear Pumps KF 2.5...200

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Accessory Couplings



	Ordering code	Coupling size	Weight kg	Moment of inertia kgm ²	Pre bore		Finished bore		Dimensions (in mm)													
					part 1	part 2	min.		max.		l	E	s	b	L	M	DH	D	D ₁	dh		
							part 1	part 2	part 1	part 2												
Version A	RA 19-Z25/...Z25/..	19	0.117	0.00003	4	–	6	–	19	–	25	16	2	12	66	20	40	32	–	18		
	RA 24-Z30/...Z30/..	24	0.24	0.00008	6	–	8	–	24	–	30	18	2	14	78	24	55	40	–	27		
	RA 28-Z30/...Z30/..	28	0.39	0.0002	8	–	10	–	28	–	30	20	2.5	15	80	28	65	48	–	30		
Version B	RA 19/24-Z25/...Z25/..	19/24	0.129	0.00004	4	17	6	19	19	24	25	16	2	12	66	20	40	32	–	18		
	RA 24/28-Z30/...Z30/..	24/28	0.26	0.0001	6	22	8	24	24	28	30	18	2	14	78	24	55	40	–	27		
	RA 28/38-Z35/...Z35/..	28/38	0.46	0.0003	8	26	10	28	28	38	35	20	2.5	15	90	28	65	48	–	30		
	RA 38/45-Z45/...Z45/..	38/45	0.89	0.0008	10	36	12	38	38	45	45	24	3	18	114	37	80	66	–	38		
	RA 42/55-Z50/...Z50/..	42/55	1.39	0.0018	12	40	14	42	42	55	50	26	3	20	126	40	95	75	–	46		
	RG 42/55-Z50/...Z75/..	42/55	3.57	0.005	12	40	14	42	42	55	50/75	26	3	20	151	40	95	75	–	46		

Type Key KF Coupling

Ordering example

R.* 38 - Z 45/38 - Z 45/38

↓ ↓ ↓
Coupling size Pump side Motor side
 cylindrical cylindrical
coupling hub length and hub bore

.*	Hub material
A	AL
G	GG

Working temperature:
–20 °C to +80 °C (–4 °F to 176 °F)
(short duration temperature peaks
up to 120 °C / 248 °F are permissible).

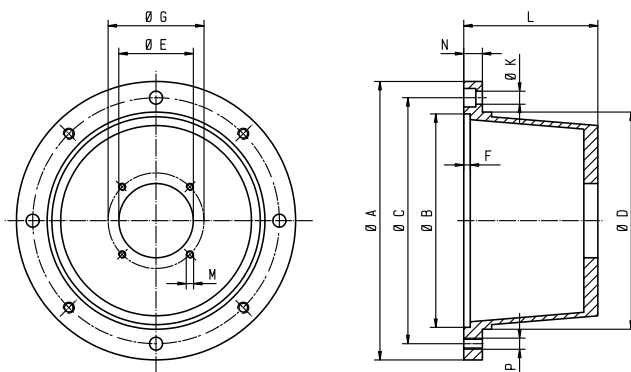
Weights and mass moments of inertia refer
to max. finish machined bore without slot.
Finish-machined bores to ISO Fit H7,
parallel key slots in accordance with DIN 6886 Sh.1.

Transfer Gear Pumps KF 2.5...200

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Bell Housing

KF 2,5 ... 25 Aluminum bell housing



	Motor size	Bell housing	Coupling	Dimensions (in mm)													Weight
				A	B	C	D	E	F	G	K	L	M	N	P	kg	
KF 2.5...25	71 S	PT160-A-063-80	RA19-Z25/14-Z25/14	160	110	130	110	63	7	85	9	80	M8	13	M8	1.01	
	71																
	80 S	PT200-A-063-100	RA19-Z25/14-Z25/19	200	130	165	145	63	7	85	11	100	M8	16	M10	1.06	
	80																
	90 S	PT200-A-063-100	RA19/24-Z25/14-Z25/24	200	130	165	145	63	7	85	11	100	M8	16	M10	1.06	
	90 L																
	100 L S	PT250-A-063-120	RA24/28-Z30/14-Z30/28	250	180	215	190	63	7	85	14	120	M8	19	M12	1.75	
100 L																	
	112 M																
KF 32...80	80 S	PT200-A-080-100	RA19/24-Z25/24-Z25/19	200	130	165	145	80	7	103	11	100	M8	16	M10	1.41	
	80																
	90 S	PT200-A-080-110	RA24-Z30/24-Z30/24	200	130	165	145	80	7	103	11	110	M8	16	M10	1.19	
	90 L																
	100 L S	PT250-A-080-124	RA24/28-Z30/24-Z30/28	250	180	215	190	80	7	103	14	124	M8	19	M12	1.42	
	100 L																
	112 M																
	132 S	PT300-A-080-144	RA28/38-Z35/24-Z35/38	300	230	265	234	80	7	103	14	144	M8	20	M12	2.10	
	132 M																
160 M	PT350-A-080-188	RA38/45-Z45/24-Z45/42	350	250	300	260	80	7	103	18	188	M8	26	M16	3.05		
160 L																	
KF 100...200	100 L	PT250-A-110-135	RA24/28-Z30/28-Z30/28 * RS24/28-Z30/24-Z30/28	250	180	215	190	110	7	145	14	135	M12	18	M12	1.4	
	112 M																
	132 S	PT300-A-110-168	RA28/38-Z35/28-Z35/38	300	230	265	234	110	7	145	14	168 * 144	M12	20	M12	2.0 * 1.6	
	132 M	* PT300-A-110-144	* RS28/38-Z35/24-Z35/38														
	132	** PT300-A-110-168	** RS28-Z35/24-Z60/38														
	160 M	PT350-A-110-188	RA38/45-Z45/28-Z45/42 * RS38/45-Z45/24-Z45/42	350	250	300	260	110	7	145	18	188	M12	26	M16	2.9	
	160 L																
	180 M	PT350-A-110-204	RA42/55-Z50/28-Z50/48 * RG42/55-Z50/24-Z75/48 ** RG42/55-Z50/24-Z50/48	350	250	300	260	110	7	145	18	204	M12	26	M16	3.0	
	180 L																
180																	

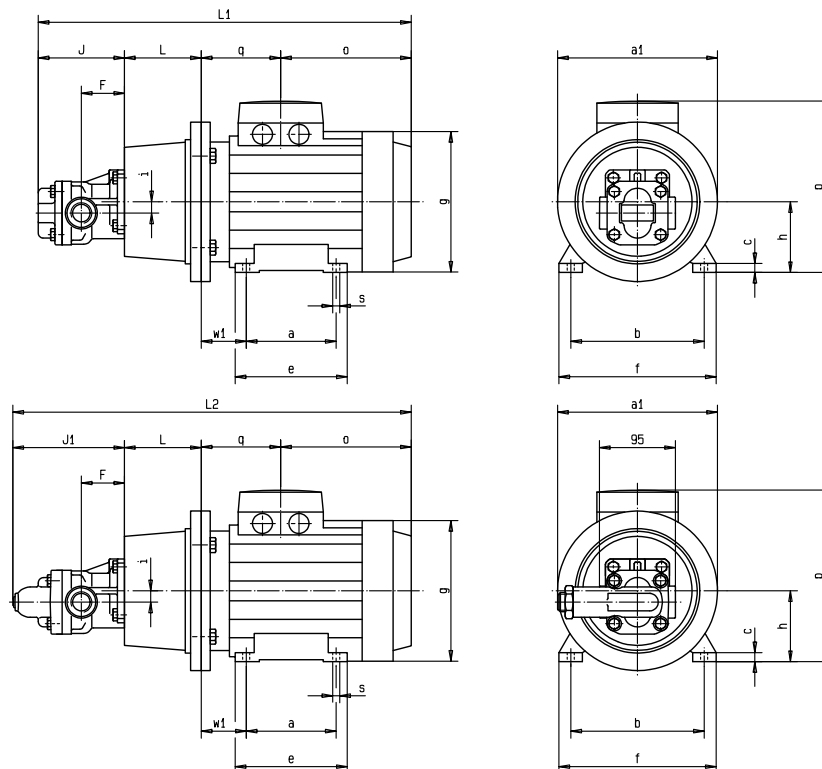
* Version seal 31 (KF 100... 150) ** Version seal 31 (KF 180... 200)

Transfer Gear Pumps KF 2.5...200

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Motor-Pump Assemblies with Pipe Thread

KF 2.5 ... 25



with pressure relief valve

KF 2.5 ... 25 Pump sizes (in mm)

Nominal size	Pump sizes		
	F	J	J ₁
2.5 ... 12	54	109	140
16 ... 25	63	131	162

Transfer Gear Pumps KF 2.5...200

KRACHT

Motor-Pump Assemblies with Pipe Thread

KF 2.5 ... 25

Frame size	Power Motor 6 pole		Speed 1/min		Bell housing	Coupling	Total weight * kg	
	kW	1/min	kW	1/min			Nominal size 4...12	16...25
71	0.18	880	0.25	1350	PT160-A-063-80	RA19-Z25/14-Z25/14	11.5	12.1
71	0.25	900	0.37	1370			11.5	12.1
80	0.37	900	0.55	1370	PT200-A-063-100	RA19-Z25/14-Z25/19	13.5	14.1
80	0.55	900	0.75	1420			15.5	16.1
90 S	0.75	935	1.1	1425	PT200-A-063-100	RA19/24-Z25/14-Z25/24	17.5	18.1
90 L	1.1	935	1.5	1420			20.5	21.1
100	1.5	940	2.2	1430	PT250-A-063-120	RA24/28-Z30/14-Z30/28	25.5	26.1
100	–	–	3	1430			28.5	29.1
112	2.2	940	4	1435			35	35.6

* with pressure relief valve add, weight 0.8 kg

KF 2.5 ... 25 Dimensions

Frame size	Dimensions (in mm)																			
	4...12 16...25		4...12 16...25																	
	L ₁ *	L ₁ *	L ₂ *	L ₂ *	L	i	a ₁	a	b	c*	e*	f*	g*	h	o*	p*	q*	ø s*	w ₁	
71	414	436	445	467	80	14.2	160	90	112	10	105	132	145	71	158	188	67	7	45	
80	459	481	490	512	100	14.2	200	100	125	10	130	160	165	80	170.5	217	79.5	10	50	
90 S	469	491	500	522	100	14.2	200	100	140	12	130	175	185	90	177.5	235	82.5	10	56	
90 L	494	516	525	547	100	14.2	200	125	140	12	155	175	185	90	202.5	235	82.5	10	56	
100	555	577	586	608	120	14.2	250	140	160	14	176	196	205	100	247.5	252	78.5	12	63	
112	564	586	595	617	120	14.2	250	140	190	14	180	220	230	112	247.0	292	88	12	70	

Note: Flange connection same outer dimensions as for pipe connection

Note

* Dimensions dependent on motor typ (drawing: manufacture ADDA).

Other manufactures motors can be supplied on request.

Motor frame sizes are based on DIN 42673/677.

All pump and motor sizes can be combined.

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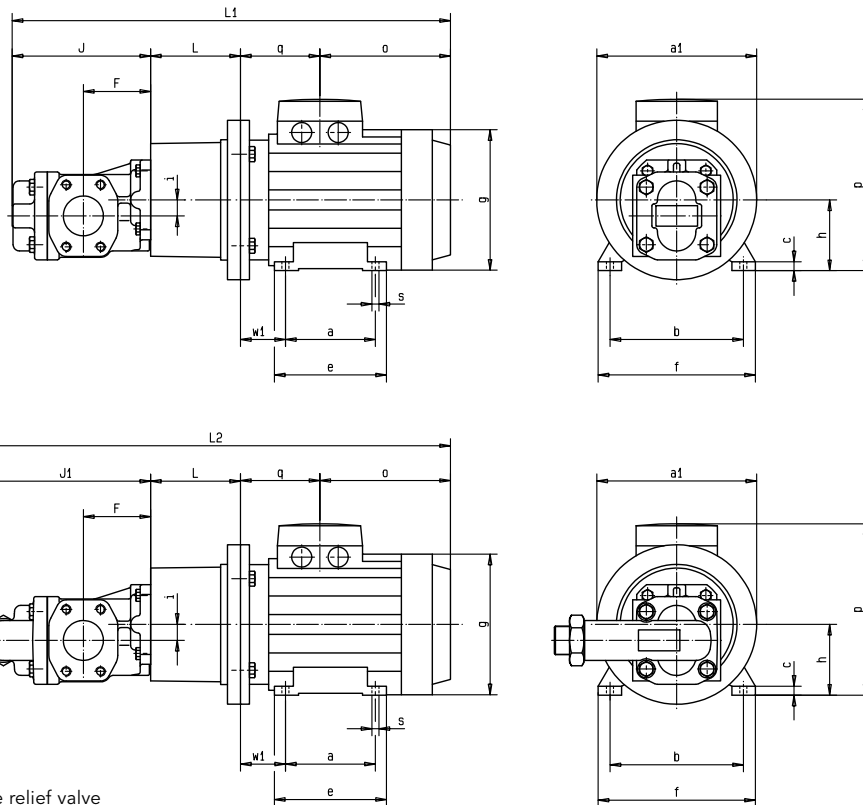
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Transfer Gear Pumps KF 2.5...200

KRACHT

Motor-Pump Assemblies with SAE-Connection

KF 32... 80



KF 32... 80 Pump sizes (in mm)

Nominal size	F	J	J ₁
32...50	84	173	212
63 / 80	100	208	247

Transfer Gear Pumps KF 2.5...200

KRACHT

Motor-Pump Assemblies with SAE-Connection

KF 32... 80

Frame size	Power Motor 6 pole		Speed Motor 4 pole		Bell housing	Coupling	Total weight * kg	
	kW	1/min	kW	1/min			Nominal size 32...50 63...80	
80	0.37	900	0.55	1370	PT200-A-080-100	RA19/24-Z25/24-Z25/19	18.5	19.5
80	0.55	900	0.75	1420			19.5	21
90 S	0.75	935	1.1	1425	PT200-A-080-110	RA24-Z30/24-Z30/24	21	23
90 L	1.1	935	1.5	1420			23.5	25.5
100	–	–	2.2	1430	PT250-A-080-124	RA24/28-Z30/24-Z30/28	29.5	31
100	1.5	940	3	1430			32	34
112	2.2	940	4	1435			38.5	40
132 S	3	940	5.5	1430	PT300-A-080-144	RA28/38-Z35/24-Z35/38	49.5	51.5
132 M	4	945	7.5	1430			59	60.5
132 L	5.5	945	–	–			61	62.5
160 M	7.5	955	11	1440	PT350-A-080-188	RA38/45-Z45/24-Z45/42	81	82.5
160 L	11	960	15	1445			101	102.5

* with pressure relief valve add. weight 1.8 kg

KF 32... 80 Dimensions

Frame size	Dimensions (in mm)																			
	32...50 63...80				32 - 80															
	L ₁ *	L ₁ *	L ₂ *	L ₂ *	L	i	a ₁	a	b	c*	e*	f*	g*	h	o*	p*	q*	ø s*	w ₁	
80	523	558	562	597	100	20	200	100	125	10	130	160	165	80	170.5	217	79.5	10	50	
90 S	543	578	582	617	110	20	200	100	140	12	130	175	185	90	177.5	235	82.5	10	56	
90 L	568	603	607	642	110	20	200	125	140	12	155	175	185	90	202.5	235	82.5	10	56	
100	623	658	662	697	124	20	250	140	160	14	176	196	205	100	247.5	252	78.5	12	63	
112	532	567	571	606	124	20	250	140	190	14	180	220	230	112	247	252	88	12	70	
132 S	673	708	712	747	144	20	300	140	216	16	176	252	270	132	262	325	94	12	89	
132 M	712	747	751	786	144	20	300	178	216	16	213	252	270	132	301	325	94	12	89	
160 M	891	926	930	965	188	20	350	210	254	17	262	290	320	160	394	390	136	14.5	108	
160 L	891	926	930	965	188	20	350	254	254	17	306	290	320	160	394	390	136	14.5	108	

Note

* Dimensions dependent on motor typ
(drawing: manufacture ADDA).
Other manufactures motors can be supplied on request.
Motor frame sizes are based on DIN 42673/677.

All pump and motor sizes can be combined.

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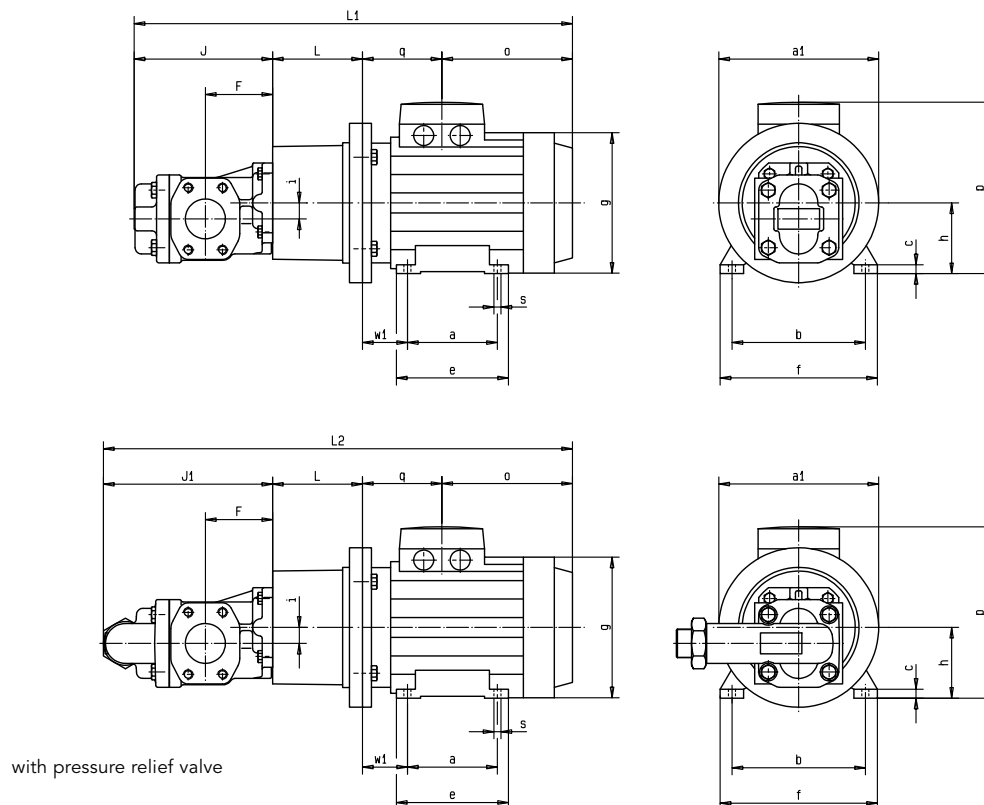
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Transfer Gear Pumps KF 2.5...200

KRACHT

Motor-Pump Assemblies with SAE-Connection

KF 100...200



KF 100...200 Pump sizes (in mm)

Nominal-size	F	J	J ₁
100/112	102	220.5	262.5
125/150	120	245	282
180/200	130	261.5	298.5

Transfer Gear Pumps KF 2.5...200

KRACHT

Motor-Pump Assemblies with SAE-Connection

KF 100...200

Frame size	Power Motor 6 pole	Speed 1/min	Power Motor 4 pole	Speed 1/min	Bell housing	Coupling	Total weight * kg		
	kW	1/min	kW	1/min			Nominal size		
							100/112	125/150	180/200
100 L	–	–	2.2	1430	PT250-A-110-135	RA24/28-Z30/28-Z30/28 **RA24/28-Z30/24-Z30/28	37.5	43.5	46.5
100 L	1.5	940	3	1430			40.5	46.5	49.5
112 M	2.2	940	4	1435			47.5	53.5	56.5
132 S	3	940	5.5	1430	PT300-A-110-168	RA28/38-Z35/28-Z35/38 **RA28/38-Z35/24-Z35/38	58	64	67
132 M	4	945	7.5	1430			67	73	76
132 L	5.5	945	–	–	**PT300-A-110-144		69	75	78
160 M	7.5	955	11	1430	PT350-A-110-188	RA38/45-Z45/28-Z45/42 **RA38/45-Z45/24-Z45/42	89	95	98
160 L	11	960	15	1140			109	115	118
180 M	–	–	18.5	1445	PT350-A-110-204	RA42/55-Z50/28-Z50/48 **RG42/55-Z50/24-Z50/48	129	135	138
180 L	15	960	22	1460			139	145	148

* * with pressure relief valve KF 100-200 add. weight 2.7 kg

** Sealing version 31

KF 100 ... 200 Dimensions

Frame size	Dimensions (in mm)																						
	100/112 125/150 180/200			100/112 125/150 180/200																			
	L ₁ *	L ₁ *	L ₁ *	L ₂ *	L ₂ *	L ₂ *	L	a ₁	a	b	c*	e*	f*	g*	h	o*	p*	q*	ø s*	w ₁			
100	670.5	695	711.5	712.5	754	770.5	124	250	140	160	14	176	196	205	100	247.5	252	78.5	12	63			
112	579.5	604	620.5	621.5	663	679.5	124	250	140	190	14	180	220	230	112	147	292	88	12	70			
132 S	720.5	745	761.5	762.5	804	820.5	144	300	140	216	16	176	252	270	132	262	325	94	12	89			
132 M	759.5	784	800.5	801.5	843	859.5	144	300	178	216	16	213	252	270	132	301	325	94	12	89			
160 M	938.5	963	979.5	980.5	1022	1038.5	188	350	210	254	17	262	290	320	160	394	390	136	14.5	108			
160 L	938.5	963	979.5	980.5	1022	1038.5	188	350	254	254	17	306	290	320	160	394	390	136	14.5	108			
180 M	1001.5	1026	1042.5	1043.5	1085	1101.5	204	350	279	279	27	300	348	360	180	336	450	241	15	121			
180 L	1039.5	1064	1080.5	1081.5	1123	1139.5	204	350	279	279	27	338	348	360	180	354	450	261	15	121			

Note

* Dimensions dependent on motor typ (drawing: manufacture ADDA).

Other manufactures motors can be supplied on request.

Motor frame sizes are based on DIN 42673/677.

All pump and motor sizes can be combined.

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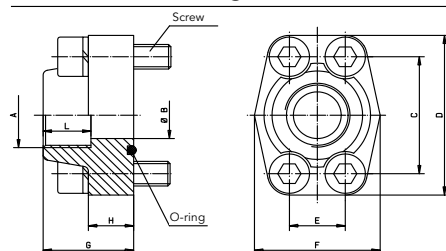
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Transfer Gear Pumps KF 2.5...200

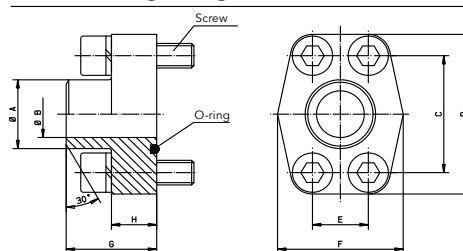
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Accessory Connections

SAE-Threaded Flange



SAE-Welding Flange



SAE-Threaded Flange Dimensions (in mm)

Nominal size SAE	DN	A	B max.	C	D*	E	F*	G	H*	L min.	Screws 10.9	O-ring	Working pressure max.**	Weight ca. [kg]
3/4"	13	G1/2"	13	47.63	65	22.23	50	36	18	14	M 10 x 35	24.99 x 3.53	350	0.54
	19	G3/4"	19							16				0.51
1"	13	G1/2"	13	52.37	70	26.19	55	38	18	14	M 10 x 35	32.92 x 3.53	315	0.64
	19	G3/4"	19							16				0.61
	25	G1"	25							18				0.58
1 1/4"	19	G3/4"	19	58.72	79	30.18	68	41	21	16	M 10 x 40	37.69 x 3.53	250	0.92
	25	G1"	25							18				0.88
	32	G1 1/4"	32							20				0.79
1 1/2"	25	G1"	25	69.85	93	35.71	78	45	25	18	M 12 x 45	47.22 x 3.53	200	1.36
	32	G1 1/4"	32							20				1.30
	38	G1 1/2"	38							22				1.25
2"	25	G1"	25	77.77	102	42.88	90	45	25	18	M 12 x 45	56.74 x 3.53	200	1.64
	32	G1 1/4"	32							20				1.60
	38	G1 1/2"	38							22				1.45
2 1/2"	51	G2"	51	88.90	114	50.80	105	50	25	26	M 12 x 45	69.44 x 3.53	160	1.39
	64	G2 1/2"	63							30				1.65
	76	G3"	73							30				1.60
3"	64	G2 1/2"	63	106.38	134	61.93	124	50	27	26	M 16 x 50	85.32 x 3.53	138	2.68
	76	G3"	73							30				2.58
3 1/2"	76	G3"	73	120.65	152	69.85	136	48	27	30	M 16 x 50	98.02 x 3.53	35	2.93
	89	G3 1/2"	89							30				2.83

SAE-Welding Flange Dimensions (in mm)

Nominal size SAE	DN	A*	B max.	C	D*	E	F*	G	H*	Screws 10.9	O-ring	Working pressure max.**	Weight ca. [kg]
3/4"	19	28.0	19	47.63	65	22.23	50	36	18	M 10 x 35	24.99 x 3.53	350	0.51
1"	25	34.0	25	52.37	70	26.19	55	38	18	M 10 x 35	32.92 x 3.53	315	0.58
1 1/4"	32	42.8	32	58.72	79	30.18	68	41	21	M 10 x 40	37.69 x 3.53	250	0.79
1 1/2"	38	48.6	38	69.85	93	35.71	78	44	25	M 12 x 45	47.22 x 3.53	200	1.25
2"	51	61.0	51	77.77	102	42.88	90	45	25	M 12 x 45	56.74 x 3.53	200	1.39
2 1/2"	64	77.0	63	88.90	114	50.80	105	50	25	M 12 x 45	69.44 x 3.53	160	1.60
3"	76	92.0	73	106.38	134	61.93	124	50	27	M 16 x 50	85.32 x 3.53	138	2.58
3 1/2"	89	103.0	89	120.65	152	69.85	136	48	27	M 16 x 50	98.02 x 3.53	35	2.83

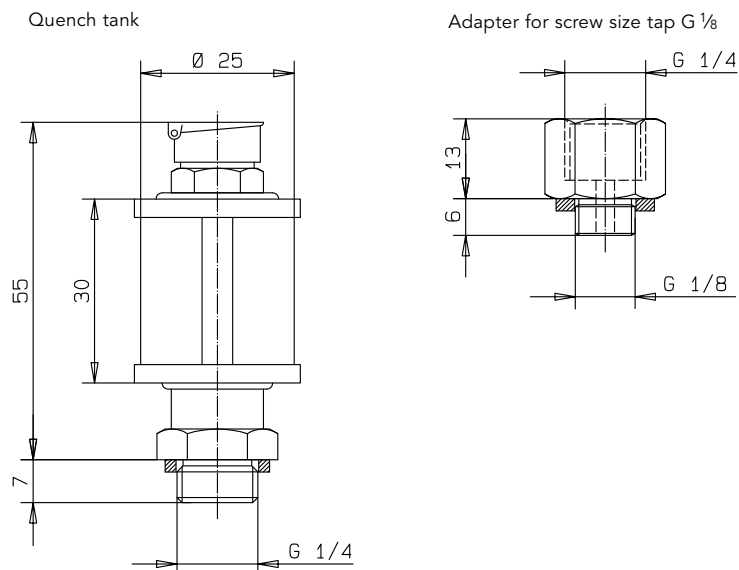
* Dimensions depending on the manufacturer
Material: Steel S355J2G3 or equivalent

** O-ring material with hardness 90 Shore A
Stainless steel 1.4404 or equivalent 316L

Transfer Gear Pumps KF 2.5...200

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Accessory Quench Chamber



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Product Portfolio

Transfer Pumps

Transfer pumps for lubricating oil supply equipment, low pressure filling and feed systems, dosing and mixing systems.

Mobile Hydraulics

Single and multistage high pressure gear pumps, hydraulic motors and valves for construction machinery, vehicle-mounted machines.

Flow Measurement

Gear and turbine flow meters and electronics for volume and flow metering technology in hydraulics, processing and laquering technology.

Industrial Hydraulics / Test Bench Construction

Cetop directional control and proportional valves, hydraulic cylinders, pressure, quantity and stop valves for pipe and slab construction, hydraulic accessories for industrial hydraulics (mobile and stationary use).

Technology Test benches / Fluid Test benches.



KF2.5...200/GB/06.14

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Mechanical temperature measurement

Bimetal thermometer Model 52, industrial series

WIKA data sheet TM 52.01



for further approvals
see page 6

Applications

- A wide range of applications in machine building, vessel, piping and apparatus construction
- Heating technology

Special features

- Scale ranges from -30 ... +500 °C
- Large choice of nominal sizes from 25 ... 160 mm
- Case and stem from stainless steel
- 5 different connection designs



Fig. left: model A52.100, back mount
Fig. right: model R52.100, lower mount

Description

The model 52 bimetal thermometer is the entry-level model among process thermometers. The target markets of this thermometer are air-conditioning and machine building.

Model 52 is manufactured in accordance with EN 13190 and already offers a stainless steel case and accuracy class 1 for nominal sizes > 60 mm.

Especially noteworthy is the large number of stem lengths and nominal sizes. This enables the individual adaptation to the target applications.

WIKA data sheet TM 52.01 · 01/2016

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Standard version

Measuring element

Bimetal coil

Nominal size in mm

25, 33, 40, 50, 63, 80, 100, 160

Connection designs

- S Standard (male threaded connection)
- 1 Plain stem (without thread)
- 2 Male nut ¹⁾
- 3 Union nut ¹⁾
- 4 Compression fitting (sliding on stem) ¹⁾

¹⁾ Not for NS 25, 33, 40, 50

Model overview

Model	NS	Design
A52.025	25	Back mount (axial)
A52.033	33	
A52.040	40	
A52.050	50	
A52.063	63	
A52.080	80	
A52.100	100	
A52.160	160	
R52.063	63	Lower mount (radial)
R52.080	80	
R52.100	100	
R52.160	160	

Accuracy class

NS 25, 33: ±5 % of scale range
 NS 40, 50: 2 per EN 13190
 NS 63, 80, 100, 160: 1 per EN 13190

Working range

Continuous loading: Measuring range per EN 13190
 Short time (24 h max.): Scale range per EN 13190

Case, bezel ring, stem, process connection and spacer

Stainless steel

Elbow behind the case

Aluminium, only with lower mount version

Dial

Aluminium, white, black lettering

Window

Instrument glass

NS 33: polycarbonate

Pointer

NS 25, 33, 40: Aluminium, black

NS 50, 63, 80, 100, 160: Aluminium, black, adjustable pointer

Permissible operating pressure at the stem

NS 25, 33, 40, 50: max. 6 bar, static

NS 63, 80, 100, 160: max. 25 bar, static

Ingress protection

NS 25, 33, 40: IP54 per EN 60529 / IEC 529

NS 50, 63, 80, 100, 160: IP43 per EN 60529 / IEC 529

Options

- Scale range °F, °C/°F (dual scale)
- Other scale ranges
- Other connection types

Scale ranges, measuring ranges ²⁾, error limit (EN 13190) Scale graduation per WIKA standard

Scale range in °C	Measuring range in °C	Scale spacing in °C		Error limit ±°C	
		up to NS 63	from NS 80	up to NS 50	from NS 63
-30 ... +50	-20 ... +40	1	1	2	1
-20 ... +60	-10 ... +50	1	1	2	1
0 ... 60	10 ... 50	1	1	2	1
0 ... 80	10 ... 70	1	1	2	1
0 ... 100	10 ... 90	2	1	2	1
0 ... 120	10 ... 110	2	1	4	2
0 ... 160	20 ... 140	2	2	4	2
0 ... 200 ³⁾	20 ... 180	5	2	4	2
0 ... 250 ³⁾	30 ... 220	5	2	5	2.5
0 ... 300 ⁴⁾	30 ... 270	5	2	-	5
0 ... 400 ⁴⁾	50 ... 350	5	5	-	5
0 ... 500 ⁴⁾	50 ... 450	5	5	-	5

2) The limits of the measuring range are indicated on the dial by two triangular marks.
Only within this range is the stated error limit valid per EN 13190.

3) Not for NS 33

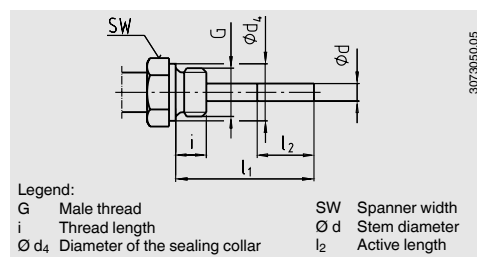
4) Not for NS 25 to NS 50

Connection designs

Standard design (male thread connection)

Standard insertion length l_1 = 63, 100, 160, 200, 250 mm

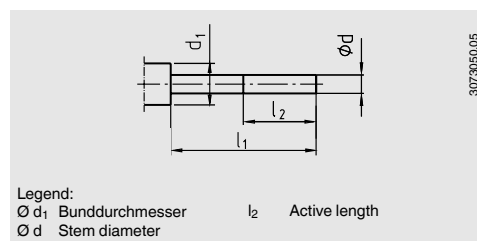
Nominal size	Process connection		Dimensions in mm			
	G	i	SW	Ø d ₄	Ø d	
25, 33	M8 x 1.25	8	12	-	4	
	G ½ B	8	12	-	4	
	G ¼ B	8	17	-	4	
40, 50	M8 x 1.25	8	12	-	4	
	G ½ B	8	17	-	4	
	G ¼ B	8	17	-	4	
	G ½ B	12	22	-	4	
63, 80, 100, 160	G ¼ B	12	19	18	6 or 8	
	G ½ B	14	27	26	6 or 8	
	M18 x 1.5	12	24	23	6 or 8	
	½ NPT	19	22	-	6 or 8	



Bauform 1, Anschluss glatt (ohne Gewinde)

Standard-Einbaulänge l_1 = 45, 63, 100, 140, 160, 200, 240, 290 mm

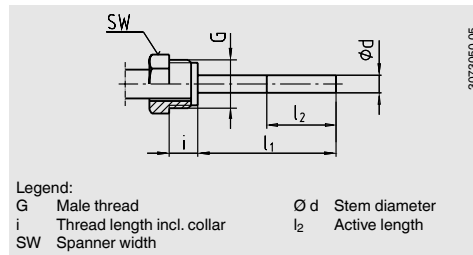
Nominal size	Dimensions in mm	
	d ₁	Ø d
25, 33	8	4
40, 50	12	4
63, 80, 100, 160	18	6 or 8



Design 2, male nut

Standard insertion length $l_1 = 80, 140, 180, 230$ mm

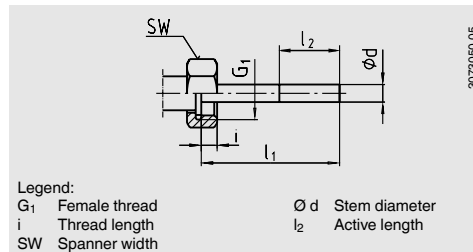
Nominal size	Process connection		Dimensions in mm		
NS	G	i	SW	$\varnothing d$	
63, 80, 100, 160	G $\frac{1}{2}$ B	20	27	6 or 8	
	M18 x 1.5	17	22	6 or 8	



Design 3, union nut

Standard insertion length $l_1 = 89, 126, 186, 226, 276$ mm

Nominal size	Process connection		Dimensions in mm		
NS	G	i	SW	$\varnothing d$	
63, 80, 100, 160	G $\frac{1}{2}$	8.5	27	6 or 8	
	G $\frac{3}{4}$	9.5	32	6 or 8	

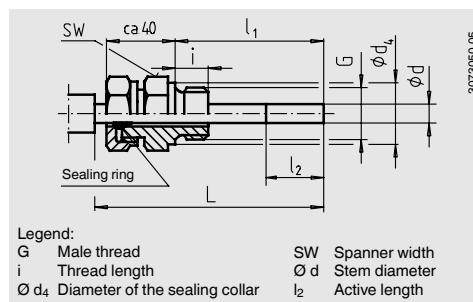


Design 4, compression fitting (sliding on stem)

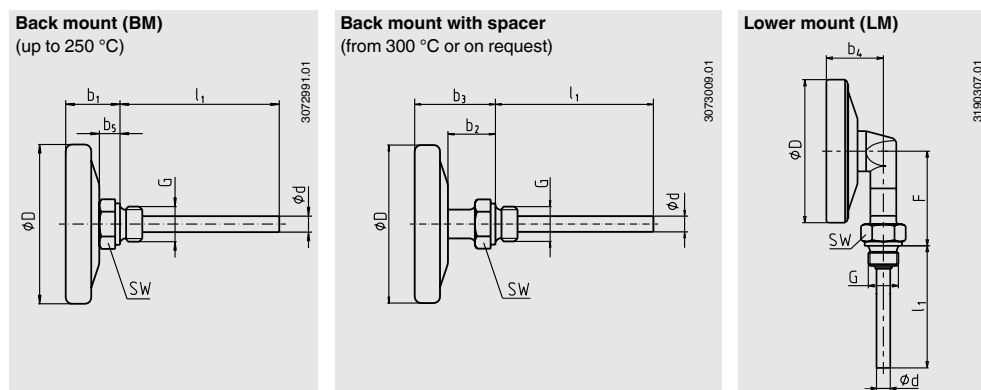
Insertion length l_1 = variable

Length $L = l_1 + 40$ mm

Nominal size	Process connection		Dimensions in mm		
NS	G	i	SW	$\varnothing d_4$	$\varnothing d$
63, 80, 100, 160	G $\frac{1}{4}$ B	8	22	18	6 or 8
	G $\frac{1}{2}$ B	14	27	26	6 or 8
	M18 x 1.5	12	24	23	6 or 8
	$\frac{1}{2}$ NPT	19	22	-	6 or 8
	G $\frac{3}{4}$ B	16	32	32	6 or 8
	$\frac{3}{4}$ NPT	20	30	-	6 or 8



Dimensions in mm



NS	Dimensions in mm							Weight in kg		
	b ₁	b ₂	b ₃	b ₄	b ₅	Ø D	F	R	RD	U
25	16	-	-	-	6	25	-	0.035	-	-
33	16	-	-	-	6	33	-	0.040	-	-
40	21	-	-	-	8	40	-	0.050	-	-
50	21	-	-	-	8	50	-	0.060	-	-
63	29	30 ¹⁾	46	34	13	63	47	0.160	0.200	0.220
80	30	30 ¹⁾	47	36	13	80	56	0.200	0.240	0.270
100	35	30 ¹⁾	52	40	13	100	66	0.250	0.290	0.330
160	39	30 ¹⁾	57	42.5	13	160	96	0.450	0.490	0.560

1) from 300 °C or on request
R Back mount (BM)
RD Back mount with spacer
U Lower mount (LM)

Thermowell

In principle, the operation of a mechanical thermometer without a thermowell with low process-side loading (low pressure, low viscosity and low flow velocities) is possible.

However, in order to enable exchanging the thermometer during operation (e.g. instrument replacement or calibration) and to ensure a better protection of the instrument and also the plant and the environment, it is advisable to use a thermowell from the extensive WIKA thermowell portfolio.

For further information on the calculation of the thermowell, see Technical information IN 00.15.

Approvals

Logo	Description	Country
	GOST (option) Metrology, measurement technology	Russia
-	CRN (option) Safety (e.g. electr. safety, overpressure, ...)	Canada

Certificates (option)

2.2 test report

Approvals and certificates, see website

Ordering information

Model / Connection design / Scale range / Process connection / Stem diameter, material / Insertion length / Options

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We reserve the right to make modifications to the specifications and materials.

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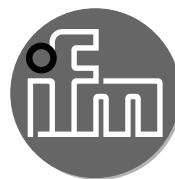
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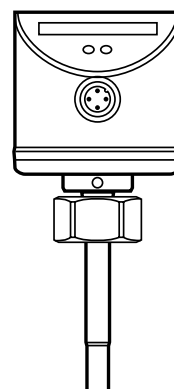
ifm electronic



Operating instructions
Flow monitors

efector300[®]**SI5000****SI5001****UK**

704056 / 03 08 / 2010



25829238/ES – 11/2018

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Preliminary note

- An instruction is indicated by "►":
Example: ► Check whether the unit operates correctly.
- A reaction to the action is indicated by ">":
Example: > LED 9 lights.

1 Safety instructions

- Please read the product description prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- The unit conforms to the relevant regulations and EC directives.
- Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application.
- That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.

UK

For the scope of validity cULus:

The device shall be supplied from an isolating transformer having a secondary Listed fuse rated as noted in the following table.

Overcurrent protection		
Control-circuit wire size		Maximum protective device rating Ampere
AWG	(mm ²)	
26	(0.13)	1
24	(0.20)	2
22	(0.32)	3
20	(0.52)	5
18	(0.82)	7
16	(1.3)	10

2 Functions and features

2.1 Application area

The unit monitors the flow of liquid and gaseous media.

2.2 Operating principle flow monitoring

- The unit detects the flow speed to the calorimetric measuring principle and switches the output:
 - output closed if medium is flowing / output open if no medium is flowing.This applies to the unit on delivery: output = normally open. In case of need you can change the output to normally closed (→ 7.2). It then applies: output open if medium is flowing.
- If the flow speed increases, the switching status changes when the switch point is reached.
- If the flow speed falls again, the switching status changes if the value "SP minus hysteresis" is reached.

The hysteresis changes with the flow speed and it is essentially influenced by the set monitoring range.

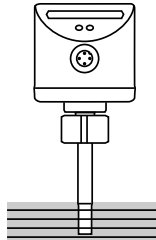
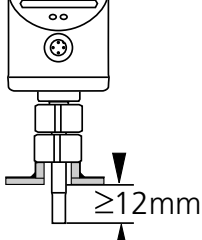
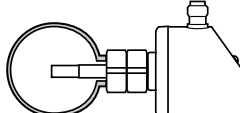
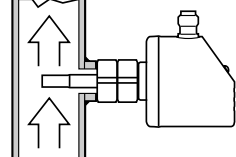
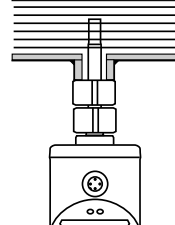
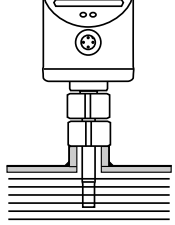
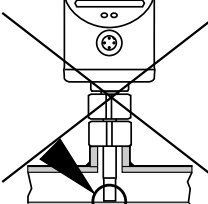
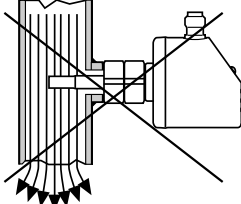
It is 2...5 cm/s for the setting 5...100 cm/s (= factory setting), it increases with higher flow speeds.
- The typical response time of the unit is 1...10 s. It can be influenced by the setting of the switch point:
 - Low switch point = quick reaction with rising flow.
 - High switch point = quick reaction with falling flow.

3 Installation

Using process adapters the unit can be adapted to different process connections.

- Adapters have to be ordered separately as accessories.
A correct fit of the unit and ingress resistance of the connection are only ensured using ifm adapters.
- For small flow rates ifm adapter blocks are available.

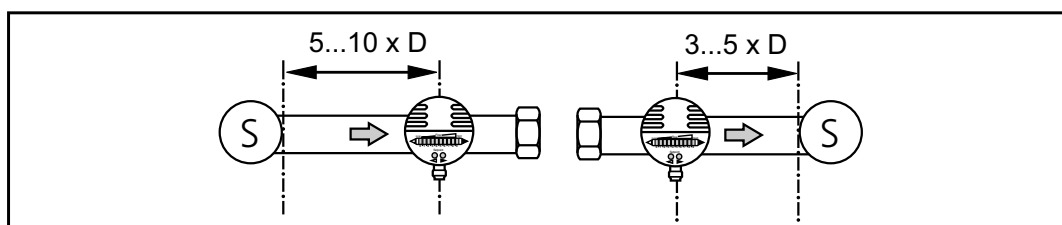
3.1 Installation location

General • The sensor tip is to be completely surrounded by the medium. • Insertion depth of the sensor: minimum 12 mm.			UK
Recommended • For horizontal pipes: mounting from the side. • For vertical pipes: mounting in the rising pipe.			
Conditional • Horizontal pipe /mounting from the bottom: if the pipe is free from build-up. • Horizontal pipe /mounting from the top: if the pipe is completely filled with medium.			
To avoid • The sensor tip must not be in contact with the pipe wall. • Do not mount in downpipes that are open at the bottom!			

3.2 Sources of interference in the pipe system

Components integrated in the pipes, bends, valves, reductions, etc. lead to turbulence of the medium. This affects the function of the unit.

Recommendation: Adhere to the distances between sensor and sources of interference:

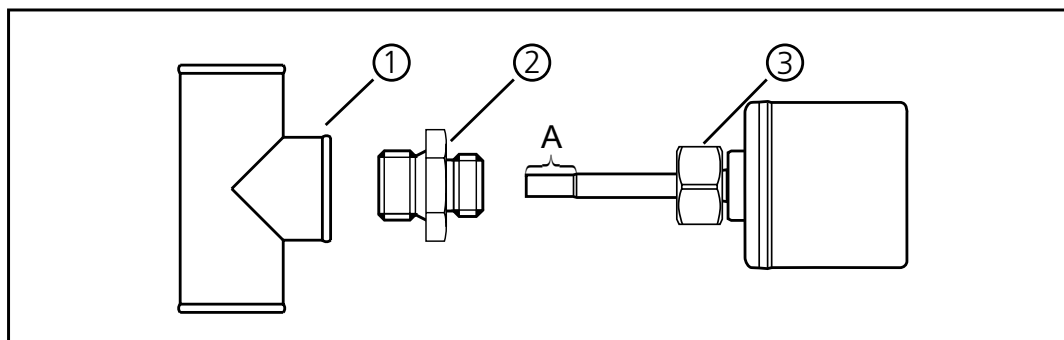


D = pipe diameter; S = sources of interference

3.3. Mounting operation



- Ensure that the system is free of pressure during installation.
- Ensure that no media can leak at the mounting location during installation.



- Grease the threads of the process connection (1), adapter (2) and nut (3).
Note: The sensor tip (A) must not be in contact with grease.
- Screw the suitable adapter into the process connection.
- Place the flow monitor onto the adapter and tighten the nut. Tightening torque 25 Nm. Ensure that the unit is correctly oriented.

4 Electrical connection

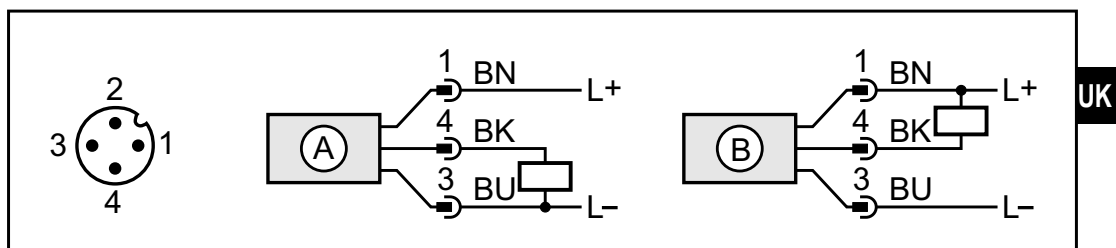


The unit must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

Voltage supply to EN 50178, SELV, PELV.

- ▶ Disconnect power.
- ▶ Connect the unit as follows:

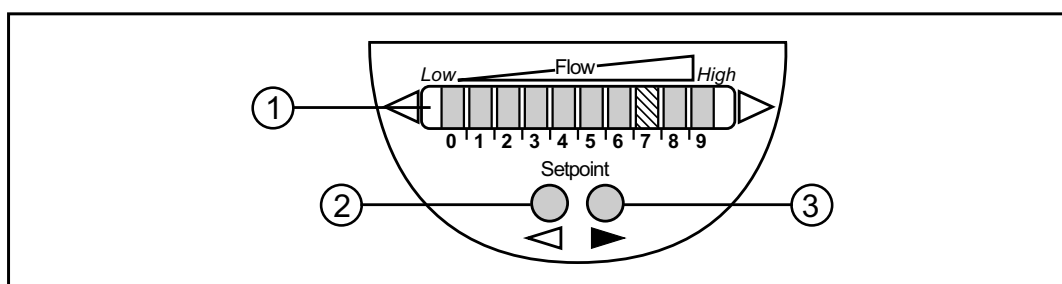


A: SI5000 (positive switching); B: SI5001 (negative switching)

Core colours of ifm sockets:

1 = BN (brown), 3 = BU (blue), 4 = BK (black)

5 Operating and display elements



1: Operation display

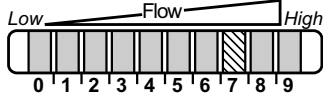
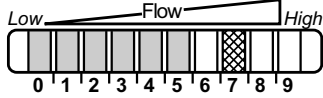
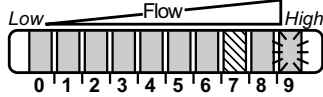
- The green LEDs indicate the current flow (the LEDs 0 to 9 represent the range between no flow and maximum flow).
- A lighting LED indicates the position of the switch point (orange = output closed, red = output open).

2, 3: Setting buttons for adjustment and configuration

6 Set-up and settings for water

(For media other than water → 7.1: Low flow adjustment).

- ▶ Switch on the supply voltage.
- > All LEDs light and go out again step by step. During this time the output is closed (if configured as normally open). The unit is in the operating mode.
- ▶ Let the normal flow circulate in the installation.
- ▶ Check the display and determine further actions.

1		The factory setting is suitable for the application. ▶ No further settings are required.
2		Your normal flow is below the representation range of the display. 2 setting options: ▶ Change the switch point (→ 6.1). ▶ Carry out high flow adjustment (→ 6.2).
3		Your normal flow exceeds the representation range of the display (LED 9 flashes). ▶ Carry out high flow adjustment (→ 6.2).

You can restore the factory setting any time. (→ 7.3).

6.1 Change the switch point (optional)

For the factory setting the switch point is at LED 7. A change makes sense if:

- the display shows example 2.
 - the flow fluctuates much or pulsates.
 - if a faster response time of the unit is requested (low switch point = fast response with rising flow, high switch point = fast response with falling flow).
- ▶ Briefly press the pushbutton ◀ or ▶.
 - > The switch point LED flashes.
 - ▶ Press the pushbutton ◀ or ▶ as often as required. Each press of the pushbutton shifts the LED by one position in the indicated direction.

Note: If no pushbutton is pressed for 2 s, the unit returns to the operating mode with the newly set value.

6.2 High flow adjustment (optional)

The unit determines the existing flow as normal flow and adapts the display representation (all LEDs except the switch point LED light green).

- ▶ Let the normal flow circulate in the installation.
- ▶ Press the pushbutton  and keep it pressed.
- > LED 9 lights, after approx. 5 s it flashes.
- ▶ Release the pushbutton.

The unit is now adapted to your flow conditions. It passes into the operating mode, the display should now show example 1.

UK

Note: The adjustment affects the switch point: It is increased proportionally (maximum up to LED 7).

7 Additional settings (optional)

7.1 Low flow adjustment

If the unit is used in media other than water, you should additionally adapt the unit to the minimum flow.

Note: The following adjustment must only be carried out after the high flow adjustment.

- ▶ Let the minimum flow circulate in the installation or ensure flow standstill.
- ▶ Press the pushbutton  and keep it pressed.
- > LED 0 lights, after approx. 5 s it flashes.
- ▶ Release the pushbutton. The unit adopts the new value and passes into the operating mode.

7.2 Configure the switching output

The unit is delivered as normally open. In case of need you can change the output to normally closed:

- ▶ Press the pushbutton  for at least 15 s.
- > LED 0 lights, after approx. 5 s it flashes.
- > After 10 s the current setting is displayed: LEDs 5...9 light orange (= output normally open).
- > After approx. 15 s LEDs 0...4 flash orange.
- ▶ Release the pushbutton. The output is changed to normally closed operation.

For a new changeover repeat the operation.

7.3 Restore the factory setting (reset)

- ▶ Press the pushbutton ► for at least 15 s.
- > LED 9 lights, after approx. 5 s it flashes.
- > After approx. 15 s LEDs 0...9 flash orange.
- ▶ Release the pushbutton. All settings are reset to the factory setting:
 - operating area: 5 ... 100 cm/s for water
 - switch point: LED 7
 - output function: NO
 - unlocked.

7.4 Lock / unlock the unit

The unit can be locked electronically to prevent unintentional settings.

- ▶ Press both setting pushbuttons simultaneously for at least 10 s in the operating mode.
- > The indication goes out, the unit locks or unlocks.

On delivery: unlocked.

8 Error during adjustment

If no adjustment is possible, all LEDs flash red. The unit then passes into the operating mode with unchanged values.

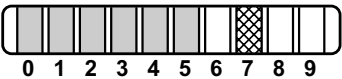
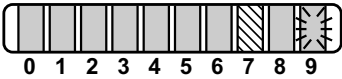
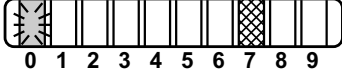
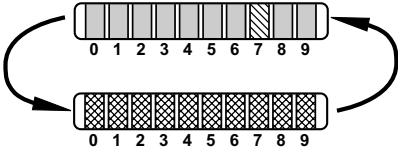
Possible cause /aid:

Error during installation.	▶ Read chapter 3 Installation. Check whether all requirements have been met.
The difference between maximum flow and minimum flow is too small.	▶ Increase the flow difference and carry out the adjustment once again.
The sequence high flow /low flow adjustment was not adhered to.	▶ Carry out the two adjustment operations again in the right sequence.

9 Operation

After every power on all LEDs light and go out again step by step (during this time the output is closed if configured as normally open). The unit is then ready for operation.

In case of power failure or interruption all settings remain.

Operating indicators	
	Green LED bar: Current flow within the representation range. Indication of the switch point (SP): - LED orange: output closed. - LED red: output open.
	LED 9 flashes: current flow above the representation range.
	LED 0 flashes: current flow far below the representation range.
Interference indicators	
	Short circuit at the switching output: The operating indicator and red LEDs light alternately. If the short circuit has been rectified, the unit immediately passes into the normal operating state. The current operating state is displayed.
Display OFF (no LED lights):	Operating voltage too low (< 19 V) or failed. Ensure a correct voltage supply.

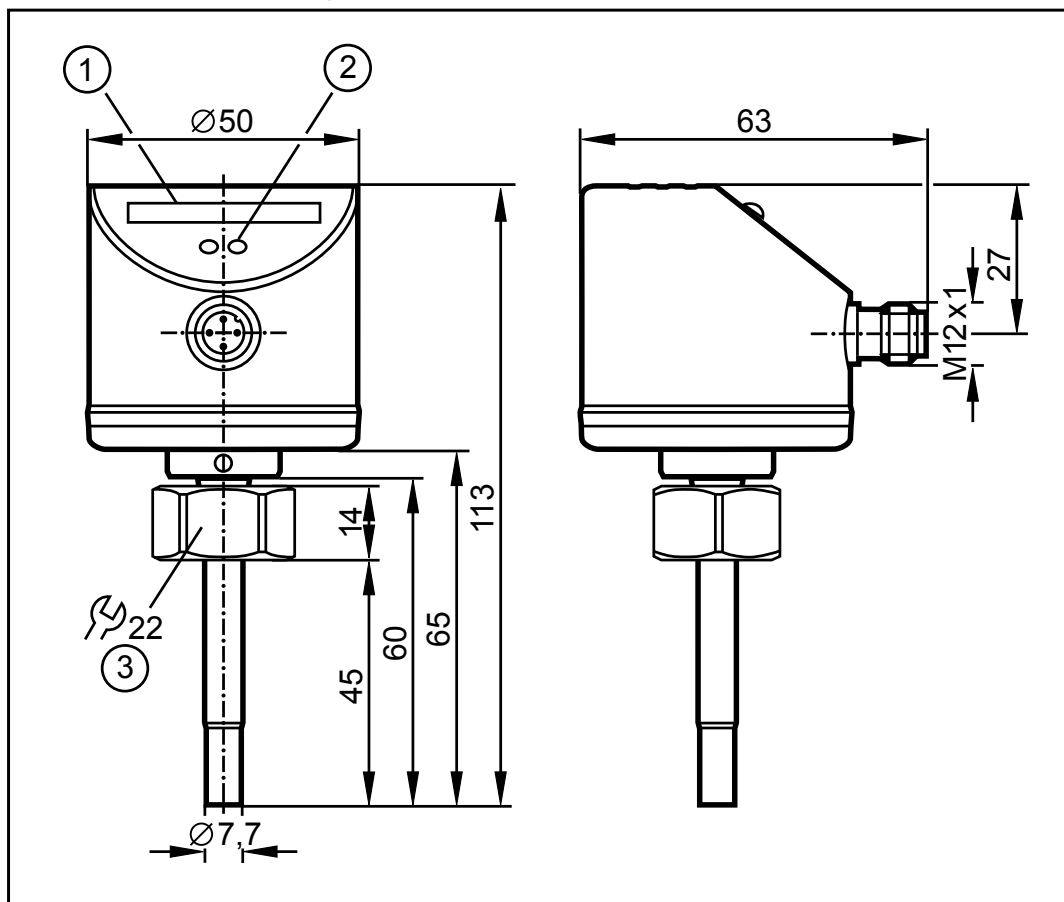
UK

10 Maintenance

Recommended maintenance:

- Check the sensor tip for build-up from time to time.
- Clean it using a soft cloth. Stubborn build-up (e.g. lime) can be removed using a common vinegar cleaning agent.

11 Scale drawing



- 1: LED bar display
 2: set button
 3: tightening torque 25 Nm

12 Technical data

Application area.....	Liquids and gases
Operating voltage [V].....	19 ... 36 DC ¹⁾
Current rating [mA]	250
Short-circuit protection, pulsed; reverse polarity / overload protection	
Voltage drop [V]	< 2.5
Current consumption [mA]	< 60
Power-on delay time [s].....	10, optically indicated

Liquids	
Medium temperature [°C]	-25 ... +80
Setting range [cm/s].....	3 ... 300
Greatest sensitivity [cm/s]	3...100
Temperature gradient [K/min]	300
Gases	
Medium temperature [°C]	-25 ... +80
Setting range [cm/s].....	200 ... 3000
Greatest sensitivity [cm/s].....	200 ... 800
Switch point accuracy [cm/s]	± 2...± 10 ²⁾
Hysteresis [cm/s]	2...5 ²⁾
Repeatability [cm/s]	1...5 ²⁾
Temperature drift [cm/s x 1/K].....	0.1 ³⁾
Response time [s].....	1 ... 10
Pressure resistance [bar].....	30
Operating temperature [°C]	-25 ... +80
Protection rating	IP 67
Protection class	III
Shock resistance [g]	50 (DIN / IEC 68-2-27, 11 ms)
Vibration resistance [g]	20 (DIN / IEC 68-2-6, 55-2000 Hz)
Housing materials.....	stainless steel 316L / 1.4404; stainless steel 304 / 1.4301; PC (Makrolon); PBT-GF 20; EPDM/X (Santoprene)
Materials (wetted parts).....	stainless steel 316L / 1.4404; O-ring: FPM 8x1.5 gr 80° Shore A
EMC	
EN 61000-4-2 ESD:	4 kV CD / 8 kV AD
EN 61000-4-3 HF radiated:	10 V/m
EN 61000-4-4 Burst:	2 kV
EN 61000-4-6 HF conducted:	10 V

UK

¹⁾ to EN50178, SELV, PELV;
²⁾ for water; 5...100 cm/s; 25°C (factory setting)
³⁾ for water; 5...100 cm/s; 10...70°C
The sensor conforms to the standard EN 61000-6-2

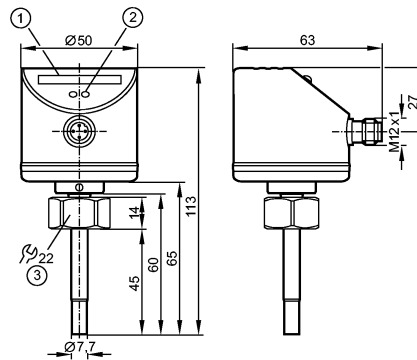
More information at www.ifm.com

efector300**SI5000**

SID10ABBFPG/US-100



Flow sensors



- 1: LED display
 2: setting pushbutton
 3: tightening torque 25 Nm

**Product characteristics**

Flow monitor	
Compact type for adapter	
Process connection: internal thread M18 x 1.5 for adapter	
Probe length: 45 mm	
Setting range: 3...300 cm/s (liquids)	

Application

Application	liquids and gases
Pressure rating [bar]	30
Medium temperature [°C]	-25...80

Electrical data

Electrical design	DC PNP
Operating voltage [V]	19...36 DC
Current consumption [mA]	< 60
Protection class	III
Reverse polarity protection	yes

Outputs

Output function	normally open / closed programmable
Current rating [mA]	250
Voltage drop [V]	< 2.5
Short-circuit protection	pulsed
Overload protection	yes

Measuring / setting range

Liquids	
Setting range [cm/s]	3...300
Greatest sensitivity [cm/s]	3...100
Gases	
Setting range [cm/s]	200...3000
Greatest sensitivity [cm/s]	200...800

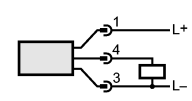
efector300

SI5000

SID10ABBFPG/US-100



Flow sensors

Accuracy / deviations		
Switch point accuracy	[cm/s]	± 2...± 10 *)
Hysteresis	[cm/s]	2...5 *)
Repeatability	[cm/s]	1...5 *)
Temperature drift	[cm/s x 1/K]	0.1 **)
Max. temperature gradient of medium	[K/min]	300
Reaction times		
Power-on delay time	[s]	10
Response time	[s]	1...10
Software / programming		
Adjustment of the switch point		pushbuttons
Environment		
Ambient temperature	[°C]	-25...80
Storage temperature	[°C]	-25...100
Protection		IP 67
Tests / approvals		
EMC	EN 61000-4-2 ESD:	4 kV CD / 8 kV AD
	EN 61000-4-3 HF radiated:	10 V/m
	EN 61000-4-4 Burst:	2 kV
	EN 61000-4-6 HF conducted:	10 V
Shock resistance	DIN IEC 68-2-27:	50 g (11 ms)
Vibration resistance	DIN EN 60068-2-6	20 g (55...2000 Hz)
MTTF	[Years]	298
Mechanical data		
Process connection		internal thread M18 x 1.5 for adapter
Materials (wetted parts)		stainless steel 316L / 1.4404; O-ring: FKM 8 x 1.5 gr 80° Shore A
Housing materials		stainless steel 316L / 1.4404; stainless steel / 301 / 1.4310; PC (polycarbonate); PBT-GF 20; EPDM/X
Probe length L	[mm]	45
Weight	[kg]	0.235
Displays / operating elements		
Function display	LED	10 LEDs, three-colour
Electrical connection		
Connection		M12 connector
Wiring  		
Remarks		
Remarks		*) for water; 5...100 cm/s; 25°C (factory setting) **) for water; 5...100 cm/s; 10...70°C
Pack quantity	[piece]	1

efector300**SI5000**

SID10ABBFPKG/US-100

**Flow sensors**

ifm electronic gmbh • Friedrichstraße 1 • 45128 Essen — We reserve the right to make technical alterations without prior notice. — GB — SI5000 — 09.07.2013

Mechanical pressure measurement

Bourdon tube pressure gauge Model 213.53, liquid filling, stainless steel case

WIKA data sheet PM 02.12



for further approvals
see page 2

Applications

- For measuring points with high dynamic pressure loads or vibrations
- For gaseous and liquid media that are not highly viscous or crystallising and will not attack copper alloy parts
- Hydraulics
- Compressors, shipbuilding

Special features

- Vibration and shock resistant
- Especially sturdy design
- NS 63 and 100 with German Lloyd and Gosstandart approval
- Scale ranges up to 0 ... 1,000 bar



Bourdon tube pressure gauge, model 213.53.100,
lower mount

Description

Design
EN 837-1

Nominal size in mm
50, 63, 100

Accuracy class
NS 50, 63: 1.6
NS 100: 1.0

Scale ranges
NS 50: 0 ... 1 to 0 ... 400 bar
NS 63, 100: 0 ... 0.6 to 0 ... 1,000 bar
or all other equivalent vacuum or combined pressure and vacuum ranges

Pressure limitation

NS 50, 63: Steady: 3/4 x full scale value
Fluctuating: 2/3 x full scale value
Short time: Full scale value
NS 100: Steady: Full scale value
Fluctuating: 0.9 x full scale value
Short time: 1.3 x full scale value

Permissible temperature

Ambient: -20 ... +60 °C
Medium: +60 °C maximum

Temperature effect

When the temperature of the measuring system deviates from the reference temperature (+20 °C):
Max. ±0.4 %/10 K of the span

Ingress protection

IP 65 per EN 60529 / IEC 60529

WIKA data sheet PM 02.12 · 03/2015

Page 1 of 3

Data sheets showing similar products:
Standard version with liquid filling; model 113.53; see data sheet PM 01.08



Standard version

Process connection

Copper alloy,
lower mount (LM) or back mount (BM),
NS 50, 63: G ¼ B (male), 14 mm flats
NS 100: G ½ B (male), 22 mm flats

Pressure element

NS 50:
Copper alloy, C-type or helical type

NS 63:
≤ 400 bar: Copper alloy, C-type or helical type
> 400 bar: Stainless steel 316L, helical type

NS 100:
< 100 bar: Copper alloy, C-type
≥ 100 bar: Stainless steel 316L, helical type

Movement

Copper alloy

Dial

NS 50, 63: Plastic ABS, white, with pointer stop pin
NS 100: Aluminium, white, black lettering

Pointer

NS 50, 63: Plastic, black
NS 100: Aluminium, black

Window

Plastic, crystal-clear

Case

Natural finish stainless steel, with blow-out device with
NS 50: in case back, 12 o'clock
NS 63, 100: at case circumference, 12 o'clock
O-ring seal between case and connection.
Scale ranges ≤ 0 ... 16 bar with compensating valve to vent case.

Bezel ring

Crimp ring, glossy finish stainless steel, triangular bezel

Filling liquid

Glycerine

Options

- Other process connection
- Sealings (model 910.17, see data sheet AC 09.08)
- Measuring system and movement from stainless steel (model 233.53)
- NS 100: Zero adjustment (in front)
- Increased medium temperature with special soft solder
 - NS 50, 63: 100 °C
 - NS 100: 150 °C
- Ambient temperature resistant -40 ... +60 °C with silicone oil filling
- NS 50: Higher scale ranges up to 0 ... 1,000 bar
- Panel mounting flange, stainless steel, for back connection
- Surface mounting flange, stainless steel (not NS 50)
- Mounting clamp (for back connection)

CE conformity

Pressure equipment directive

97/23/EC, PS > 200 bar, module A, pressure accessory

Approvals

- GL, ships, shipbuilding (e.g. offshore), Germany
- EAC, import certificate, customs union Russia/Belarus/Kazakhstan
- GOST, metrology/measurement technology, Russia
- KBA, automotive, European Community
- CRN, safety (e.g. electr. safety, overpressure, ...), Canada

Certificates ¹⁾

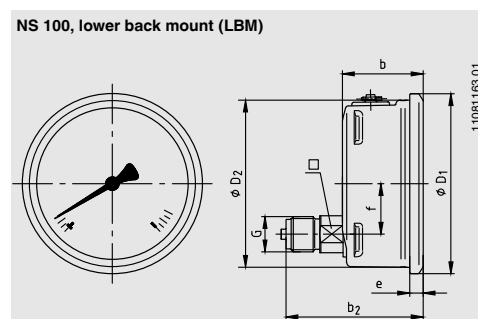
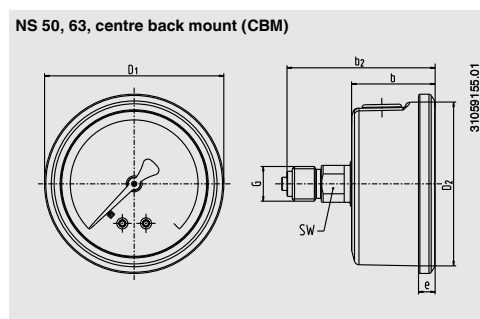
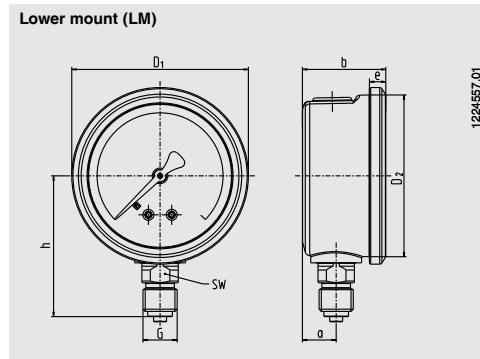
- 2.2 test report per EN 10204 (e.g. state-of-the-art manufacturing, material proof, indication accuracy)
- 3.1 inspection certificate per EN 10204 (e.g. indication accuracy)

¹⁾ Option

Approvals and certificates, see website

Dimensions in mm

Standard version



NS	Dimensions in mm										Weight in kg
	a	b ±0.5	b ₂ ±0.5	D ₁	D ₂	e	f	G	h ±1	SW	
50	12	30	55	55	50	5.5	-	G ¼ B	48	14	0.15
63	13	32	56	68	62	6.5	-	G ¼ B	54	14	0.21
100	15.5	48	81.5	107	100	8	30	G ½ B	87	22	0.80

Process connection per EN 837-1 / 7.3

Ordering information

Model / Nominal size / Scale range / Connection size / Connection location / Options

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The specifications given in this document represent the state of engineering at the time of publishing.
We reserve the right to make modifications to the specifications and materials.

03/2015 EN

WIKI data sheet PM 02.12 · 03/2015

Page 3 of 3



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25829238/ES – 11/2018

MAHLE

Industrial Filtration

Contamination Indicator

1. Features

Filter elements are economically used only if their dirt holding capacity is fully exploited. This is achieved by using filter housings with a contamination indicator.

MAHLE manufactures contamination indicators of the following designs:

- Differential pressure indicators
- Pressure indicators/Pressure switches
- Vacuum switches/manometers

With any filter element the collection of dirt particles continuously reduces the number of open pores or, in other words: The open cross section for allowing the liquid to flow continuously reduced. Thus the pressure on the upstream side of the element (dirt side) increases continuously.

With pressure filters, the pressure is measured upstream and downstream of the filter element (differential pressure). With return line filters the pressure is measured only on the upstream side because, depending on the tank design, atmospheric pressure exits on the downstream side of the filter element is measured analog.

A piston with attached magnet is moved against the force of a spring, with which the indicating point is determined by the piston surface.

A homopolar poled magnet is fitted in the outer part in the indicating button.

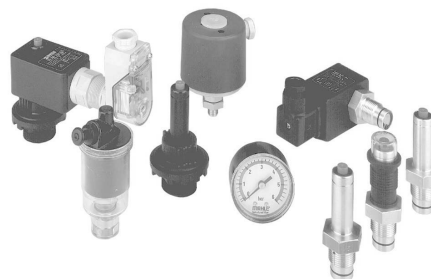
The closer the pole-springs move towards each other, the stronger is the force with the magnet mutually repel, until finally the red button on the indicator pops out.

This red button remains visible until it is pushed in during daily check which is to be performed while the plant is at operating temperature. If the red button pops out immediately after being pushed in, the filter element must be replaced after the end of the shift.

This optical function may also be used for generating contactless electrical signals. For this purpose an electrical upper part incorporates all electrical switching elements.

- Optical and electrical indicator with standard check function
- Normally open/normally closed combination - standard feature
- Electrical function, easy to install at a later time
- Two-step indication, at 75 % and 100 % optional
- Signal lock out up to approx. 30 °C optional
- Pressure resistance, up to 10 bar (pressure/differential pressure), up to 160 bar (differential pressure), up to 450 bar (differential pressure)
- Rugged, non-bypass design
- Optimal element exploitation

Worldwide distribution



2. Differential pressure indicator

Differential pressure indicator									
Operating pressure	Temperature resistance	Type	Order number	Indicator setting [bar]	Indication	Contact type*	Fig.	Material lower section	Material upper section
10	- 10 to + 120 °C	PiS 3087	77738990	1.2	opt.	-	1	Al	PA 6
		PiS 3086	77737513		opt./electr.	1	1 + 1a		
		PiS 3104	78236994		opt./electr.	4	1 + 3a		
160	- 10 to + 120 °C	PiS 3098	77669971	2.2	opt.	-	2 + 2a	Al	PA 6
		PiS 3097	77669948		opt./electr.	1	2 + 2a		
		PiS 3116	78308074		opt./electr.	3	2 + 2a		
		PiS 3119	78309122	1.7/2.2	opt./electr.	2	2 + 2a		
		PiS 3012	78308454		opt./electr.	4	3 + 3a		
		PiS 3124	78383655		opt./electr.	5	3 + 3a		
		PiS 3098	77938582	3.5	opt.	-	2		
		PiS 3097	78236648		opt./electr.	1	2 + 2a		
		PiS 3098	77669989	5.0	opt.	-	2 + 2a		
		PiS 3097	77669955		opt./electr.	1	2 + 2a		
		PiS 3116	78308082		opt./electr.	3	2 + 2a		
		PiS 3119	78309130	3.7/5.0	opt./electr.	2	2 + 2a		
		PiS 3012	78308447		opt./electr.	4	2 + 2a		
		PiS 3124	78383663		opt./electr.	5	2 + 2a		
400	- 10 to + 120 °C	PiS 3093	77669898	2.2	opt.	-	2 + 2a	CuZn	PA 6
		PiS 3092	77669856		opt./electr.	1	3 + 3a		
		PiS 3115	78308041		opt./electr.	3	3 + 3a		
		PiS 3105	77970387	1.7/2.2	opt./electr.	2	3 + 3a		
		PiS 3102	77942139		opt./electr.	4	3 + 3a		
		PiS 3122	78383630		opt./electr.	5	3 + 3a		
		PiS 3093	77669914	5.0	opt.	-	2		
		PiS 3092	77669864		opt./electr.	1	2 + 2a		
		PiS 3115	78308058		opt./electr.	3	2 + 2a		
		PiS 3105	77970395	3.7/5.0	opt./electr.	2	2 + 2a		
		PiS 3102	77942147		opt./electr.	4	3 + 3a		
		PiS 3122	78383648		opt./electr.	5	3 + 3a		
		PiS 3093	77669880	8.0	opt.	-	2		
		PiS 3092	77669872		opt./electr.	1	2 + 2a		
		PiS 3115	78308066		opt./electr.	3	2 + 2a		
450	- 10 to + 120 °C	PiS 3193	77844061	2.2	opt.	-	2	1.4301	PA 6
		PiS 3192	78308488		opt./electr.	1	2 + 2a		
		PiS 3193	78308538	5.0	opt.	-	2		
		PiS 3192	78308546		opt./electr.	1	2 + 2a		

* Contact type:

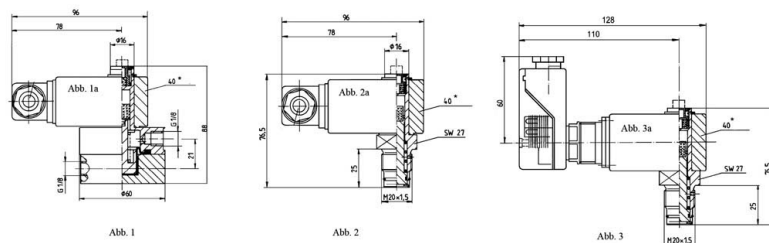
- 1) Normally open/normally closed, wiring box DIN EN 175301-803, max. 250 V AC/200 V DC, max. 1 A
- 2) Normally closed, 2 setting points (75 %/100 %); wiring box DIN EN 175301-803, max. 150 V, max. 1 A
- 3) Change over contact; wiring box DIN EN 175301-803, max. 150 V, max. 1 A
- 4) Change over contact; 2 setting points; LED; Mercedes-Benz-Norm DBL 9666 EA; wiring box DIN EN 175201-804, max. 150 V, max. 1 A
- 5) Normally closed; 2 setting points, signal suppression; wiring box DIN EN 175201-804, max. 10-30 V, max. 1 A

Contamination Indicator

2

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2. Differential pressure indicator



*wide

3. Pressure indicator/pressure switch

Pressure indicator/pressure switch									
Operating pressure	Temperature resistance	Type	Order number	Indicator setting [bar]	Indication	Contact type*	Fig.	Material Lower section	Material upper section
10	- 10 to + 80 °C	PiS 3084	77669781	1.2	opt.	-	4	PA 66	PA 6
		PiS 3085	77669807		opt./electr.	1	4 + 4a		
		PiS 3125	78308033		opt./electr.	3	4 + 4a		
		PiS 3106	78309155	0.9/1.2	opt./electr.	2	4 + 4a		
		PiS 3103	77942170		opt./electr.	4	4 + 3a		
		PiS 3123	78383671		opt./electr.	5	4 + 3a		
		PiS 3084	77737802	2.2	opt.	-	4		
		PiS 3085	77738032		opt./electr.	1	4 + 4a		
		PiS 3125	78308108		opt./electr.	3	4 + 4a		
		PiS 3106	78308850	1.7/2.2	opt./electr.	2	4 + 4a		
		PiS 3103	77970429		opt./electr.	4	4 + 3a		
		PiS 3123	78383689		opt./electr.	5	4 + 3a		
10	- 25 to + 85 °C	DSS/1.2	77863814	1.2	electr.	normally open	5	galvanized steel	delivered with protection cap
		DSO/1.2	77870587		electr.	normally closed	5		
		DSS/2.2	77845845	2.2	electr.	normally open	5		
		DSO/2.2	77870595		electr.	normally closed	5		
		DSS/5	77863822	5.0	electr.	normally open	5		
		DSO/5	77870603		electr.	normally closed	5		

*Contact type:

1) normally open/normally closed, wiring box DIN 43650, max. 230 V, max. 2.5 A

2) normally closed, 2 setting points (75 %/100 %); wiring box DIN 43650, max. 150 V, max. 1 A

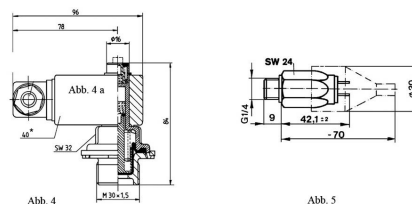
3) change over contact; wiring box DIN 43650, max. 150 V, max. 1 A

4) change over contact; 2 setting points (75 %/100 %); 3 LED; wiring

box DIN 43651, 10–30 V, max. 1 A

5) normally closed, 2 setting points (75 %/100 %), signal suppression;

wiring box DIN 43651, 10–30 V, max. 1 A

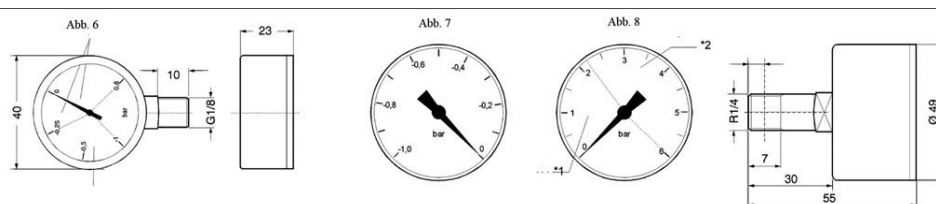


Contamination Indicator

3

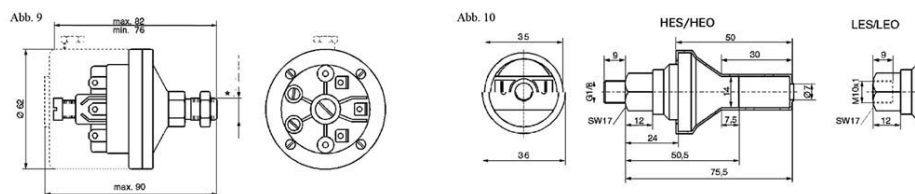
4. Vacuum meter/manometer

Vacuum meter/manometer							
Nominal size (NG) [mm]	Specification	Indicating range [bar]	Fig.	Connection size	Order-number	Class	Dial face
40	Vacuum meter	- 1 to + 1.5	6	R 1/8 (conical)	76388714	min 2.5	white
		- 1 to + 0.6		G 1/8	77545908		Red/Green area, sep. line 0.25 bar
50	Manometer	0 to - 1	7	R 1/4 (conical)	77617558		white
		0 to 6	8		78381998		Red/Green area, sep. line 0.25 bar



5. Vacuum switch

Vacuum switch									
Permissible over-pressure max.	Temperature resistance	Indicator setting	Contact type	Fig.	Connection size	Type	Order Number	Material lower section	Material upper section
0.5 bar	- 10 to + 70 °C	- 10 to - 80 mbar	single pole	9	G 1/4	PiS 3070	77669690	GD-Al	PA 6
1 bar		- 50 to - 600 mbar	double-throw cut-out switch		G 1/8		77669724	GD-Al	PA 6
0.1 bar	- 20 to + 80 °C, 120 °C	- 200 mbar ± 10	normally open	10	G 1/8 (outside)	HES 2200 BP	78308892	GD-ZnAl	Polycarbonat
		- 200 mbar ± 10	normally closed			HEO 2200 BP	78308900	GD-ZnAl	Polycarbonat
		- 50 mbar ± 4	normally open		M 10 x 1 (inside)	LES 250 I	78308918	GD-ZnAl	Polycarbonat
		- 50 mbar ± 4	normally closed			LEO 250 I	78308926	GD-ZnAl	Polycarbonat



* connection G

Types HES/HEO for hydraulic application, Types LES/LEO for air application

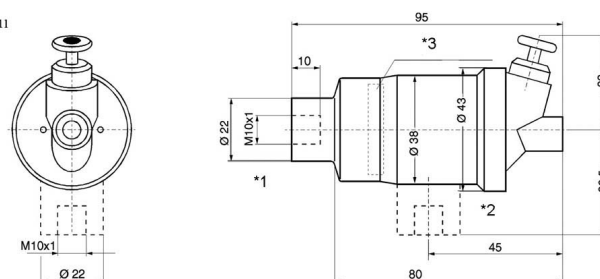
Contamination Indicator

4

6. Vacuum indicator/air filter

Vacuum indicator/air filter						
Indicator setting ± 10 %	Temperature resistance	Fig.	Execution	Type	Order-number	Indication
- 50 mbar	- 40 to + 110 °C	11	1	TB 745	78309056	optical indication - self locking -
- 65 mbar			2	TB 745/1	78309064	
				TB 746/1	78309049	

Abb. 11



*1 Execution 2

*2 Execution 1

*3 Indication: Position of display at nominal value in mbar

Standard sealing material: NBR

Sealing material types LES/LEO: Silicone rubber

7. Accessories

7.1 Seal kits			
Type	Order number NBR	Order number FPM	Order number EPDM
PiS 3092, 3093, 3102, 3105, 3115, 3122, 3192, 3193	77760275	77760283	77760291
PiS 3012, 3019, 3024, 3097, 3098, 3116	77760309	77760317	77760325
PiS 3084, 3085, 3103, 3106, 3123, 3125	78383382	78383390	78383408
PiS 3086, 3087, 3104	77760242	77760259	

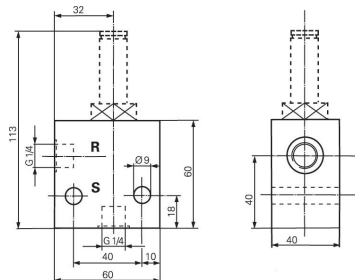
7.2 Electrical upper sections	
Specification	Order number
Electrical upper section normally open/ normally closed for PiS 3084, 3087, 3093, 3098, 3193 (Contact type 1)	7536550
Wiring box with lamp insert 12 - 230 V for electrical upper section normally open (according to DIN EN 175301-803)	8307548
Electrical upper section Change over contact for PiS 3084, 3087, 3093, 3098, 3193 (Contact type 3)	8308017
Wiring box with 2 LEDs 10 - 30 V for electrical upper section Change over contact (according to DIN EN 175301-803)	8308025
Electrical upper section normally closed with signal suppression PiS 3003	7765357

Contamination Indicator

5

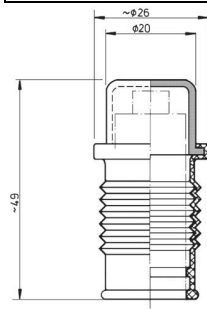
7. Accessories

7.3 Mounting block for differential pressure indicators (M 20 x 1,5)	
Specification	Order number
Mounting block (Material St)	77809098
Mounting block (Material 1.4301), 450 bar	77698517



R = clean side
S = dirt side

7.4 Protection cap	
Specification	Order number
Protection cap for all optical differential pressure and pressure indicators: Resistant to: gasoil, purifying agent, insolation, dust, salt, water, concret Temperature range: - 20 °C to + 80 °C	78285330

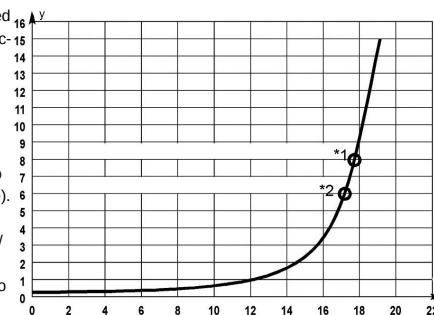


8. Function

The magnetic field as previously described, contactless operates reed contacts in the electrical upper part. The desired contact type is selected by inverting upper part. Another option keeping the electrical signal electronically suppressed up to 30 °C operating temperature is also available. This eliminates false electrical signal during the cold start phase.

For efficient servicing it is desirable to have a pre-warning device (so that the filter element can be replaced, e.g. with the next tool change). For this purpose electrical upper parts with two indicating points, i.e. at 75 % and at 100 % of the indicator setting are available. Pressure/vacuum manometers give an analog reading of the existing state of contamination of the filter elements. They require continuous control to ensure that the service time and reserve capacity are not unduly exceeded. If the contamination signal is disregarded, the filter element may collapse or, if a bypass valve is installed, part of the contamination fluid may reach the hydraulic components via the bypass valve and cause failure of the hydraulics.

Pressure/vacuum switches are provided with snap action switches, which ascertains that signal are issued only when the limit values have been fully reached.



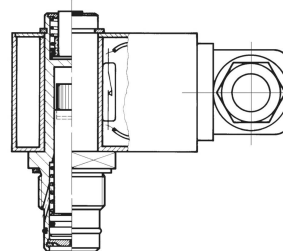
Dirt holding capacity - Δp curve

x = dirt holding capacity [g]

y = differential pressure Δp

*1 signal step contamination indicator 100 %

*2 signal step contamination indicator 75 %



Contamination Indicator

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9. Specifications

9.1 Contact type normally open/ normally closed

250 V AC/200 V DC

Types PiS 3085, 3086, 3092, 3097,
3192

Maximum voltage:

1 A

Maximum current on contact:

70 W

Maximum contact load:

Protection type:

IP 65 when inserted

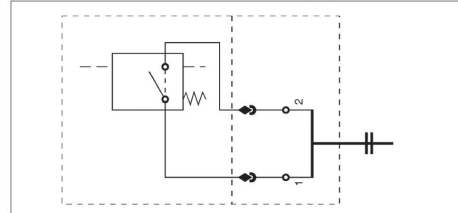
and secured

Contact type:

normally open/
normally closed

Cable connection:

M 20 x 1,5



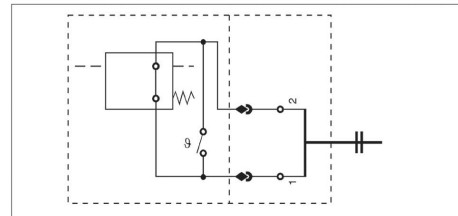
The switching function can be changed by turning the electric upper part by 180° (normally open contact or normally closed contact). The state on delivery is a normally closed contact. The use of quenching circuits must be checked in case of inductivity in the DC current circuit. Electrical parts are isolated (plastic casing).

9.2 Contact type normally closed/signal lock-out

Type PiS 3003

Signal lock-out by thermorelay.

Signal is released at + 30 °C,
for further technical detail see 9.1



9.3. Contact type normally closed 2 step

Types PiS 3105, 3106, 3199

1. Indicating at 75 %

2. Indicating at 100 % of the indica-
ting pressure

Maximum voltage:

150 V AC/DC

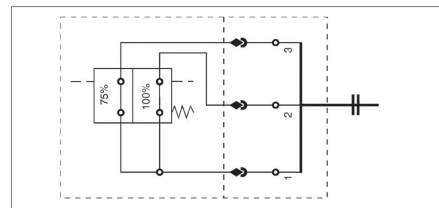
Maximum current on contact:

1 A

Maximum contact load:

20 VA/20 W

for further technical details see 9.1



9.4 Contact type normally closed 2 step/signal lock-out

Types PiS 3122, 3123, 3124

Maximum voltage:

10 - 30 V AC/DC

Maximum current on contact:

1 A

Maximum contact load:

20 W

Signal lock-out by thermorelay

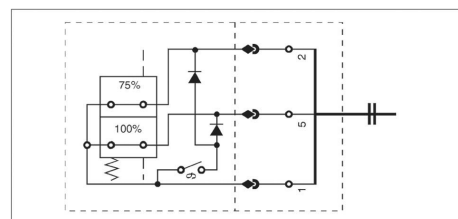
Signal is released at + 30 °C

Reset at + 20 °C

1. Indicating at 75 %

2. Indicating at 100 % of the indica-
ting pressure

for further details see 9.1



Contamination Indicator

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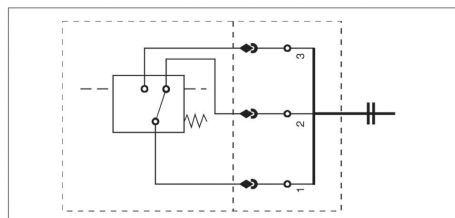
9. Technische Daten

9.5 Contact type change-over contact

Types PiS 3115, 3116, 3125

Maximum voltage:
Maximum current on contact:
Maximum contact load:
for further details see 9.1

150 V AC/DC
1 A
20 VA/20 W

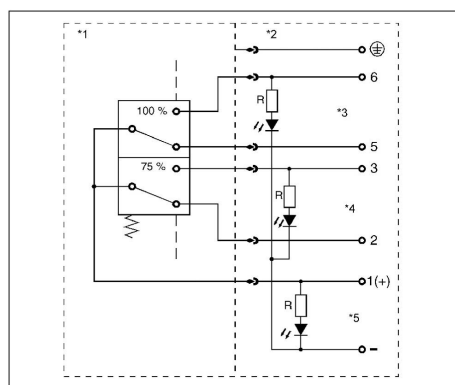


9.6 Contact type change-over contact/2step LED

Types PiS 3012, 3102, 3103

Maximum voltage:
Maximum current on contact:
Maximum contact load:
1. Indicating at 75 %
2. Indicating at 100 % of the indicating pressure
for further details see 9.1

10 - 30 V DC
1 A
20 VA/20 W

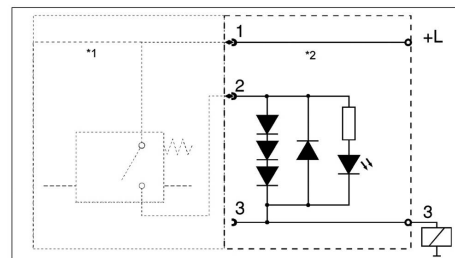


*1 switch over *2 connector
*3 indicator setting 100 % LED red
*4 indicator setting 75 % LED red
*5 stand-by indication LED green

9.7 Wiring box with lamp insert

Will be supplied instead of standard connection.
Voltage:
Not to combine with indicators with 2 setting points

12 - 230 V AC/DC

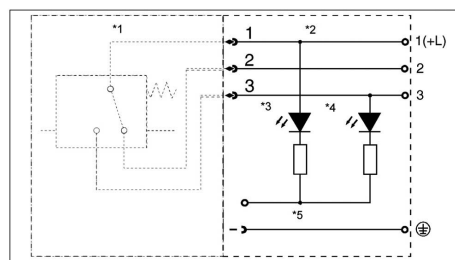


*1 switch cover
*2 connector

9.8 Wiring box with lamp insert

Will be supplied instead of standard connection plug.
Voltage:
To combine with PiS 3115, 3116, 3125

10 - 30 V DC



*1 switch cover
*2 connector
*3 green
*4 yellow
*5 screw clamp

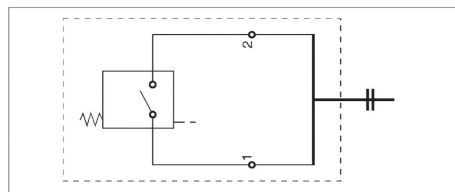
Contamination Indicator

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9. Specifications

9.9 Vacuum switch HES/LES

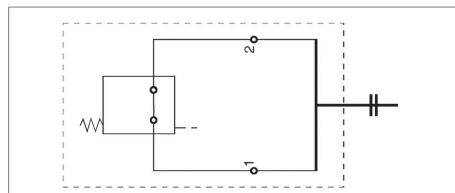
Contact type: normally open
 Contact load: HES: 42 V/6W at resistive load
 Maximum contact load: LES: 24 V/6W at resistive load
 Type of protection: IP 54 - with protecting cap
 Electrical connection: AMP 6.3 DIN 46248, DIN 46247



9.10 Vacuum switch HEO/LEO

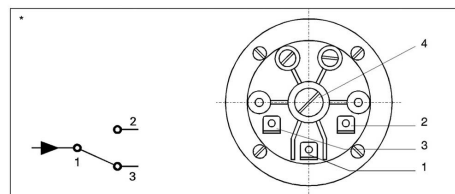
Contact type: normally closed
 Contact load: HEO: 42 V/6W at resistive load
 LEO: 24 V/6W at resistive load

for further technical detail see 9.9



9.11 Vacuum switch PiS 3070

Maximum voltage: 230 V AC/DC
 Maximum current on contact.: 6A
 Contact type: single pole changeover switch
 Electrical connection: AMP 6,3 DIN 46248, DIN 46247
 Position of installation: individual (with adjusted setting point, position of installation needs to be advised)
 Type of protection: IP 00 - without cover
 IP 54 - with cover



* Connection scheme:

1. Supply line
2. Operating contact
3. Normally closed contact
4. Adjusting screw

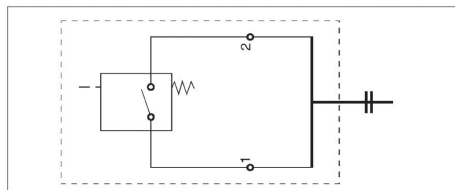
Contamination Indicator

9

9. Specification

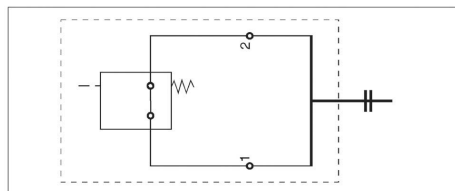
9.12 Pressure switch DSS

Contact type: normally open
 Maximum voltage: 42 V
 Maximum current on contact: 2 A
 Contact load: 100 VA
 Duty classification: 200 / min
 Type of protection: IP 65 - with protecting cap
 Electrical connections: AMP 6,3 DIN 46248
 for attachable sleeve
 according to DIN 46247,
 (switching mode bi-pole)



9.13 Pressure switch DSO

Contact type: normally closed
 for further information see 9.12



Contamination indicators PiS 3084, 3087, 3093, 3098, 3193 can be mounted in 45°.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application: Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

When using our filters in areas which are to be classified according to EU directive 94/9 EG (ATEX), we recommend prior discussion with us. The standard version can be used for liquids based on mineral oil /corresponding to the fluids in Group 2 of Directive 97/23 EG Articlel 9). Please consult with us if using other media.

Subject to technical alterations without prior notice.

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 industriefiltration@mahle.com
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 78357428.11/2006

Contamination Indicator

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MAHLE

Driven by performance

Low Pressure Filter Pi 200

Nominal pressure 32/63 bar (460/910 psi), nominal size up to 600

1. Features

High performance filters for modern hydraulic systems

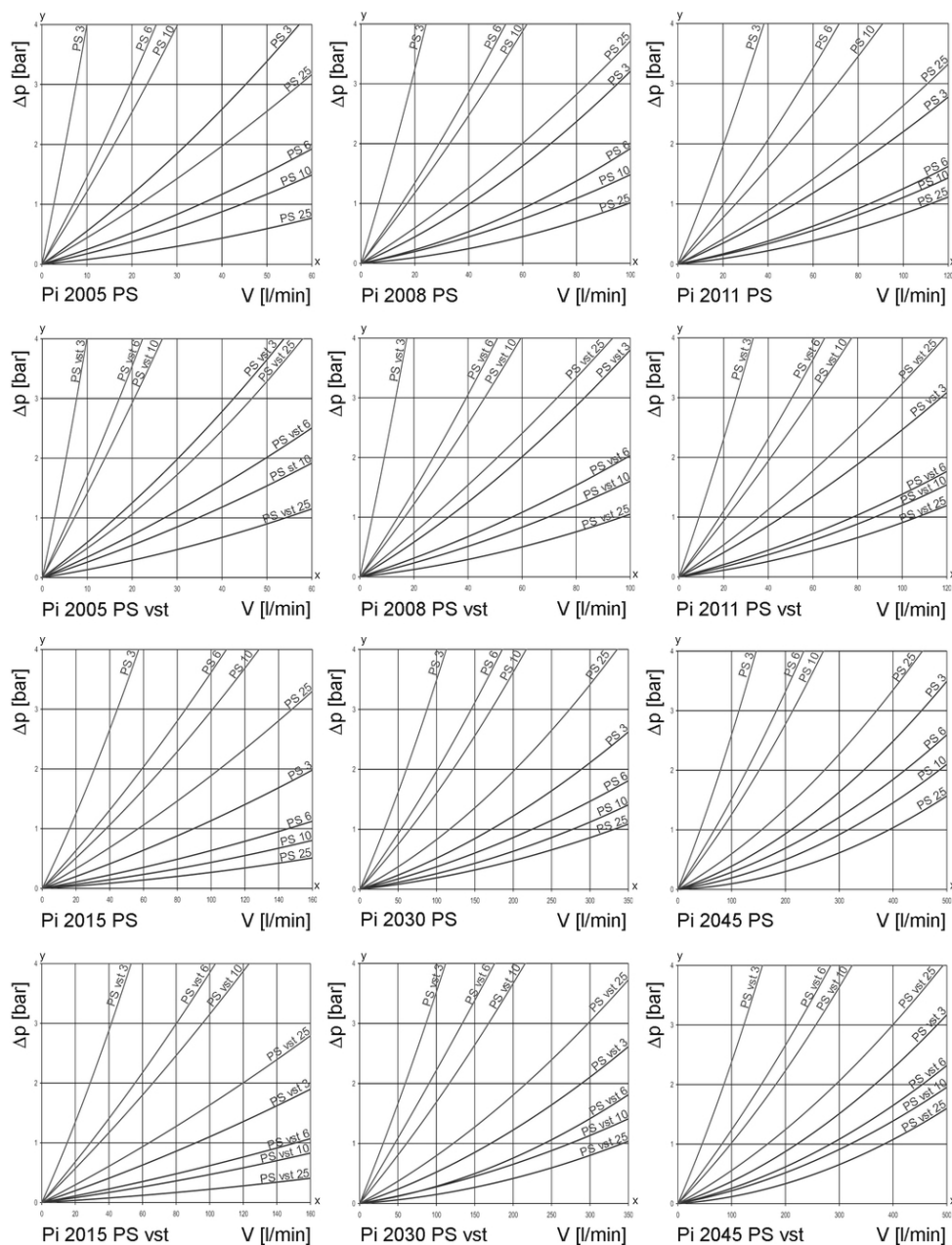
- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre PS filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Other connections on request
- Worldwide distribution



Documentación de proveedores

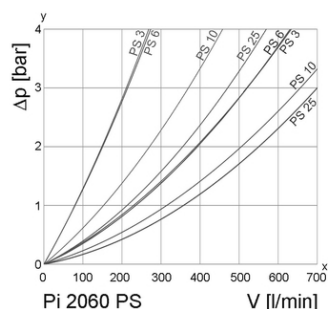
2. Flow rate/pressure drop curve (filter housing incl. element)

190 mm²/s
33 mm²/s



Low Pressure Filter Pi 200 up to NG 600

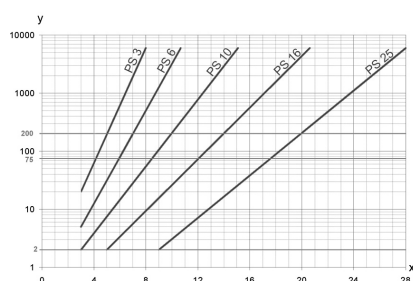
2



y = differential pressure Δp [bar]
x = flow rate V [l/min]

Calculation of individual filter under www.industrialfiltration-catalogue.mahle.com

3. Separation grade characteristics



y = beta-value
x = particle size μm

determined by multipass tests (ISO 16889)
calibration according to (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

PS elements with			PS vst elements with		
max. Δp 20 bar			max. Δp 210 bar		
PS	3	$\beta_{5(C)} \geq 200$	PS vst	3	$\beta_{5(C)} \geq 200$
PS	6	$\beta_{7(C)} \geq 200$	PS vst	6	$\beta_{7(C)} \geq 200$
PS	10	$\beta_{10(C)} \geq 200$	PS vst	10	$\beta_{10(C)} \geq 200$
PS	25	$\beta_{20(C)} \geq 200$	PS vst	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

values guaranteed up to
20 bar differential pressure

5. Quality assurance

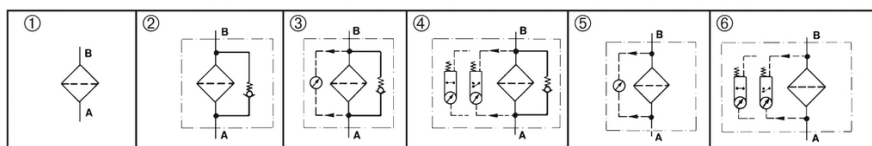
MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

Low Pressure Filter Pi 200 up to NG 600

3

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
V = 80 l/min and visual/electrical maintenance indicator Type: Pi 2008-069 Order number: 77665284	PS vst 3 Type: Pi 2208 PS vst 3 Order number: 77680200

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	① no options	② with bypass valve	③ with bypass valve and visual indicator	④ with bypass valve and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
50	77665144	Pi 2005-060						
	77665110	Pi 2005-056						
	77665128	Pi 2005-057						
	77665136	Pi 2005-058						
	77665169	Pi 2005-068						
	77665177	Pi 2005-069						
80	77665235	Pi 2008-060						
	77665201	Pi 2008-056						
	77665219	Pi 2008-057						
	77665227	Pi 2008-058						
	77665276	Pi 2008-068						
	77665284	Pi 2008-069						
110	78205114	Pi 2011-060						
	78205122	Pi 2011-056						
	78205130	Pi 2011-057						
	78205148	Pi 2011-058						
	78205155	Pi 2011-068						
	78205163	Pi 2011-069						
150	77840580	Pi 2015-060						
	76165203	Pi 2015-056						
	76165211	Pi 2015-057						
	79320748	Pi 2015-058						
	76165229	Pi 2015-068						
	78396616	Pi 2015-069						
300	77665474	Pi 2030-060						
	77665441	Pi 2030-056						
	77665458	Pi 2030-057						
	77665466	Pi 2030-058						
	77665516	Pi 2030-068						
	77665532	Pi 2030-069						

Low Pressure Filter Pi 200 up to NG 600

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7.1 Housing design								
Nominal size NG [l/min]	Order number	Type	① no options	② with bypass valve	③ with bypass valve and visual indicator	④ with bypass valve and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
450	77664881	Pi 2045-060						
	77664873	Pi 2045-056						
	77664865	Pi 2045-057						
	77664857	Pi 2045-058						
	77664923	Pi 2045-068						
	77664931	Pi 2045-069						
600	70576046	Pi 2060-060						
	70576045	Pi 2060-056						
	70534876	Pi 2060-057						
	79714171	Pi 2060-058						
	78205254	Pi 2060-068						
	70576047	Pi 2060-069						

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements (a wider range of element types is available on request)					
Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm²]
50	77680135	Pi 2105 PS 3	PS 3	20	590
	77943509	Pi 5105 PS 6	PS 6		590
	77680325	Pi 3105 PS 10	PS 10		590
	77680440	Pi 4105 PS 25	PS 25		590
	77680192	Pi 2205 PS vst 3	PS vst 3	210	425
	77943533	Pi 5205 PS vst 6	PS vst 6		425
	77680382	Pi 3205 PS vst 10	PS vst 10		425
	77680507	Pi 4205 PS vst 25	PS vst 25		425
80	77680143	Pi 2108 PS 3	PS 3	20	1150
	77943517	Pi 5108 PS 6	PS 6		1150
	77680341	Pi 3108 PS 10	PS 10		1150
	77680457	Pi 4108 PS 25	PS 25		1150
	77680200	Pi 2208 PS vst 3	PS vst 3	210	850
	77943541	Pi 5208 PS vst 6	PS vst 6		850
	77681190	Pi 3208 PS vst 10	PS vst 10		850
	77680515	Pi 4208 PS vst 25	PS vst 25		850
110	77680150	Pi 2111 PS 3	PS 3	20	1700
	77943525	Pi 5111 PS 6	PS 6		1700
	77680333	Pi 3111 PS 10	PS 10		1700
	77680465	Pi 4111 PS 25	PS 25		1700
	77680218	Pi 2211 PS vst 3	PS vst 3	210	1275
	77943558	Pi 5211 PS vst 6	PS vst 6		1275
	77680390	Pi 3211 PS vst 10	PS vst 10		1275
	77680523	Pi 4211 PS vst 25	PS vst 25		1275
150	77680168	Pi 2115 PS 3	PS 3	20	2425
	77955099	Pi 5115 PS 6	PS 6		2425
	77680358	Pi 3115 PS 10	PS 10		2425
	77680473	Pi 4115 PS 25	PS 25		2425

Low Pressure Filter Pi 200 up to NG 600

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7.2 Filter elements (a wider range of element types is available on request)					
Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm²]
150	77680226	Pi 2215 PS vst 3	PS vst 3	210	2010
	77955123	Pi 5215 PS vst 6	PS vst 6		2010
	77680408	Pi 3215 PS vst 10	PS vst 10		2010
	77680531	Pi 4215 PS vst 25	PS vst 25		2010
300	77680176	Pi 2130 PS 3	PS 3	20	4620
	77955107	Pi 5130 PS 6	PS 6		4620
	77680366	Pi 3130 PS 10	PS 10		4620
	77680481	Pi 4130 PS 25	PS 25		4620
	77680234	Pi 2230 PS vst 3	PS vst 3	210	3800
	77955131	Pi 5230 PS vst 6	PS vst 6		3800
	77680416	Pi 3230 PS vst 10	PS vst 10		3800
	77680549	Pi 4230 PS vst 25	PS vst 25		3800
450	77680184	Pi 2145 PS 3	PS 3	20	6865
	77955115	Pi 5145 PS 6	PS 6		6865
	77680374	Pi 3145 PS 10	PS 10		6865
	77680499	Pi 4145 PS 25	PS 25		6865
	77680242	Pi 2245 PS vst 3	PS vst 3	210	5600
	77955149	Pi 5245 PS vst 6	PS vst 6		5600
	77680424	Pi 3245 PS vst 10	PS vst 10		5600
	77680556	Pi 4245 PS vst 25	PS vst 25		5600
600	70346506	Pi 2160 PS 3	PS 3	20	9398
	76114318	Pi 5160 PS 6	PS 6		9398
	79393380	Pi 3160 PS 10	PS 10		9398
	79748047	Pi 4160 PS 25	PS 25		9398

8. Technical specifications

Design: in-line filter

Nominal pressure:

Pi 2005 - 2011 10⁷ load changes 63 bar (900 psi)

Pi 2015 - 2060 10⁷ load changes 25 bar (360 psi)

2x 10⁶ load changes 32 bar (460 psi)

Test pressure:

Pi 2005 - 2011 95 bar (1370 psi)

Pi 2015 - 2060 48 bar (690 psi)

Temperature range: -30 °C to +120 °C

survival temperature -40 °C (other temperature ranges on request)

Bypass setting: Δ p 3.5 bar ± 10 %

Filter head material: GDAL

Filter housing material: AL/St

Sealing material: NBR/AL

Maintenance indicator setting: Δ p 2.2 bar ± 10 %

Electrical data of maintenance indicator:

Max. voltage: 250 V AC/200 V DC

Max. current: 1 A

Max. current: 70 W

Type of protection: IP 65 in inserted and secured status

Contact: normally open/closed

Cable sleeve: M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

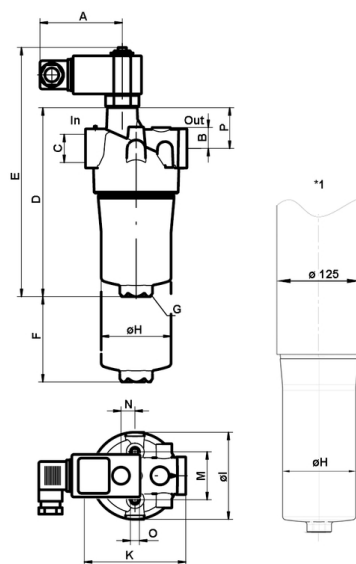
We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

Low Pressure Filter Pi 200 up to NG 600

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9. Dimensions



In Inlet

Out Outlet

*1 Housing design for NG 600

All dimensions except "C" in mm.

Type	A	B	C*	D	E	F	G SW	H	I	K	M	N	O	P	Weight [kg]
Pi 2005	78	19	G½	186	240	80	27	66	80	95	45	13.0	M8x10	37.5	0.9
Pi 2008	78	19	G¾	243	300	80	27	66	80	95	45	13.0	M8x10	37.5	1.0
Pi 2011	78	19	G¾	333	393	80	27	66	80	95	45	13.0	M8x10	37.5	1.1
Pi 2015	78	30	G1¼	268	326	110	32	109	128	150	60	24.5	M12x15	43.5	2.3
Pi 2030	78	30	G1¼	363	421	110	32	109	128	150	60	24.5	M12x15	43.5	2.5
Pi 2045	78	30	G1¼	509	566	110	32	109	128	150	60	24.5	M12x15	43.5	7.4
Pi 2060	78	30	G1¼	615	672	110	32	109	128	150	60	24.5	M12x15	43.5	5.5

* NPT and SAE connections on request

Low Pressure Filter Pi 200 up to NG 600

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10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing.

Preferably the filter should be installed with the filter housing pointing downwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

The state on delivery is a normally closed contact

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
- Remove element by pulling down carefully.
- Check O-ring on the filter housing for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.
- Lightly lubricate the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 50 to 110 = 60 Nm, for NG 150 to 600 = 100 Nm.

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Fax +49 7941 67-23429
industriefiltration@mahle.com
www.mahle.com
78356446.04/2015



11. Spare parts list

Order numbers of spare parts		
Position	Type	Order number
① - ②	Seal kit for filter	
	Pi 2005 - Pi 2011	
	NBR	77550213
	FPM	77845795
	EPDM	77845803
	Pi 2015 - Pi 2060	
	NBR	77550221
	FPM	77845811
③	Maintenance indicator	
	Visual PiS 3098/2,2	77669971
	Electrical PiS 3097/2,2	77669948
	Electrical upper section only	77536550
④	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325

MAHLE

Industry

Duplex Filter Pi 210

Nominal pressure 32/63 bar (460/900 psi), nominal size up to 600

1. Features

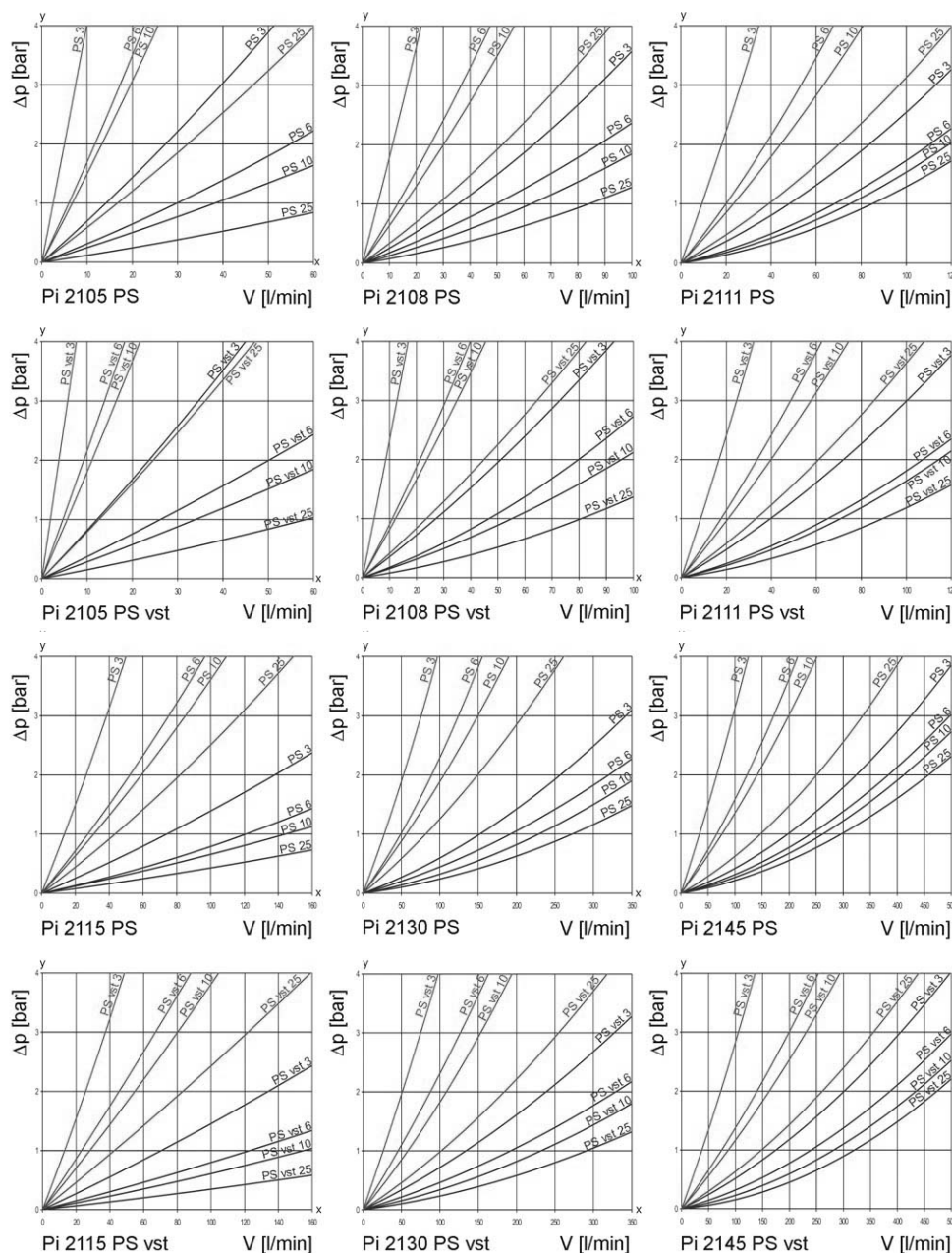
High performance filters for modern hydraulic systems

- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Change over valve on upstream side
- Ergonomic switch-over handle with safety lock and pressure compensation
- User-optimized one-hand-operation
- Equipped with highly efficient glass fibre PS filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Other connections on request
- Worldwide distribution



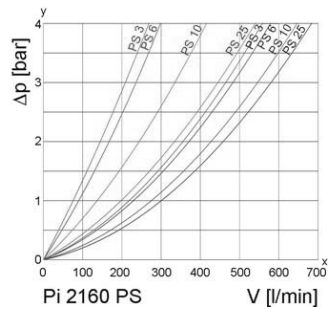
2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s



Duplex Filter Pi 210 up to NG 600

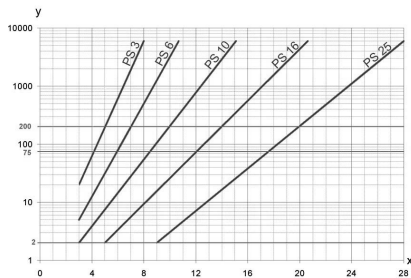
2



y = differential pressure Δp [bar]
x = flow rate V [l/min]

Calculation of individual filter under www.industrialfiltration-catalogue.mahle.com

3. Separation grade characteristics



y = beta-value
x = particle size μm

determined by multipass tests (ISO 16889)
calibration according to (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

PS elements with			PS vst elements with		
max. Δp 20 bar			max. Δp 210 bar		
PS	3	$\beta_{5(C)} \geq 200$	PS vst	3	$\beta_{5(C)} \geq 200$
PS	6	$\beta_{7(C)} \geq 200$	PS vst	6	$\beta_{7(C)} \geq 200$
PS	10	$\beta_{10(C)} \geq 200$	PS vst	10	$\beta_{10(C)} \geq 200$
PS	25	$\beta_{20(C)} \geq 200$	PS vst	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

values guaranteed up to
20 bar differential pressure

5. Quality assurance

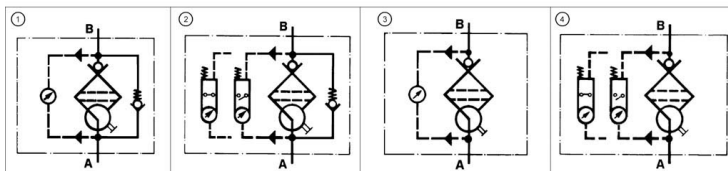
MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

Duplex Filter Pi 210 up to NG 600

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6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter element
V = 80 l/min and visual/electrical indicator Type: Pi 2108-069 Order number: 77810286	PS vst 3 Type: Pi 2208 PS vst 3 Order number: 77680200

7.1 Housing design						
Nominal size NG [l/min]	Order number	Type	① with bypass valve and visual indicator	② with bypass valve and electrical indicator	③ with visual indicator	④ with electrical indicator
50	77810211	Pi 2105-057				
	77810229	Pi 2105-058				
	77810237	Pi 2105-068				
	77810245	Pi 2105-069				
80	77810252	Pi 2108-057				
	77810260	Pi 2108-058				
	77810278	Pi 2108-068				
	77810286	Pi 2108-069				
110	78204083	Pi 2111-057				
	78204091	Pi 2111-058				
	78204109	Pi 2111-068				
	78204117	Pi 2111-069				
150	77774573	Pi 2115-057				
	77774565	Pi 2115-058				
	77774557	Pi 2115-068				
	77774540	Pi 2115-069				
300	77774532	Pi 2130-057				
	77774524	Pi 2130-058				
	77774516	Pi 2130-068				
	77774508	Pi 2130-069				
450	77774490	Pi 2145-057				
	77774482	Pi 2145-058				
	77774474	Pi 2145-068				
	77774466	Pi 2145-069				
600	70574769	Pi 2160-057				
	70574768	Pi 2160-058				
	70574767	Pi 2160-068				
	70574766	Pi 2160-069				

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

Duplex Filter Pi 210 up to NG 600

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7.2 Filter elements*					
Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
50	77680135	Pi 2105 PS 3	PS 3	20	590
	77943509	Pi 5105 PS 6	PS 6		590
	77680325	Pi 3105 PS 10	PS 10		590
	77680440	Pi 4105 PS 25	PS 25		590
	77680192	Pi 2205 PS vst 3	PS vst 3	210	425
	77943533	Pi 5205 PS vst 6	PS vst 6		425
	77680382	Pi 3205 PS vst 10	PS vst 10		425
	77680507	Pi 4205 PS vst 25	PS vst 25		425
80	77680143	Pi 2108 PS 3	PS 3	20	1150
	77943517	Pi 5108 PS 6	PS 6		1150
	77680341	Pi 3108 PS 10	PS 10		1150
	77680457	Pi 4108 PS 25	PS 25		1150
	77680200	Pi 2208 PS vst 3	PS vst 3	210	850
	77943541	Pi 5208 PS vst 6	PS vst 6		850
	77681190	Pi 3208 PS vst 10	PS vst 10		850
	77680515	Pi 4208 PS vst 25	PS vst 25		850
110	77680150	Pi 2111 PS 3	PS 3	20	1700
	77943525	Pi 5111 PS 6	PS 6		1700
	77680333	Pi 3111 PS 10	PS 10		1700
	77680465	Pi 4111 PS 25	PS 25		1700
	77680218	Pi 2211 PS vst 3	PS vst 3	210	1275
	77943558	Pi 5211 PS vst 6	PS vst 6		1275
	77680390	Pi 3211 PS vst 10	PS vst 10		1275
	77680523	Pi 4211 PS vst 25	PS vst 25		1275
150	77680168	Pi 2115 PS 3	PS 3	20	2425
	77955099	Pi 5115 PS 6	PS 6		2425
	77680358	Pi 3115 PS 10	PS 10		2425
	77680473	Pi 4115 PS 25	PS 25		2425
	77680226	Pi 2215 PS vst 3	PS vst 3	210	2010
	77955123	Pi 5215 PS vst 6	PS vst 6		2010
	77680408	Pi 3215 PS vst 10	PS vst 10		2010
	77680531	Pi 4215 PS vst 25	PS vst 25		2010
300	77680176	Pi 2130 PS 3	PS 3	20	4620
	77955107	Pi 5130 PS 6	PS 6		4620
	77680366	Pi 3130 PS 10	PS 10		4620
	77680481	Pi 4130 PS 25	PS 25		4620
	77680234	Pi 2230 PS vst 3	PS vst 3	210	3800
	77955131	Pi 5230 PS vst 6	PS vst 6		3800
	77680416	Pi 3230 PS vst 10	PS vst 10		3800
	77680549	Pi 4230 PS vst 25	PS vst 25		3800
450	77680184	Pi 2145 PS 3	PS 3	20	6865
	77955115	Pi 5145 PS 6	PS 6		6865
	77680374	Pi 3145 PS 10	PS 10		6865
	77680499	Pi 4145 PS 25	PS 25		6865
	77680242	Pi 2245 PS vst 3	PS vst 3	210	5600
	77955149	Pi 5245 PS vst 6	PS vst 6		5600
	77680424	Pi 3245 PS vst 10	PS vst 10		5600
	77680556	Pi 4245 PS vst 25	PS vst 25		5600

*a wider range of element types is available on request

Duplex Filter Pi 210 up to NG 600

5

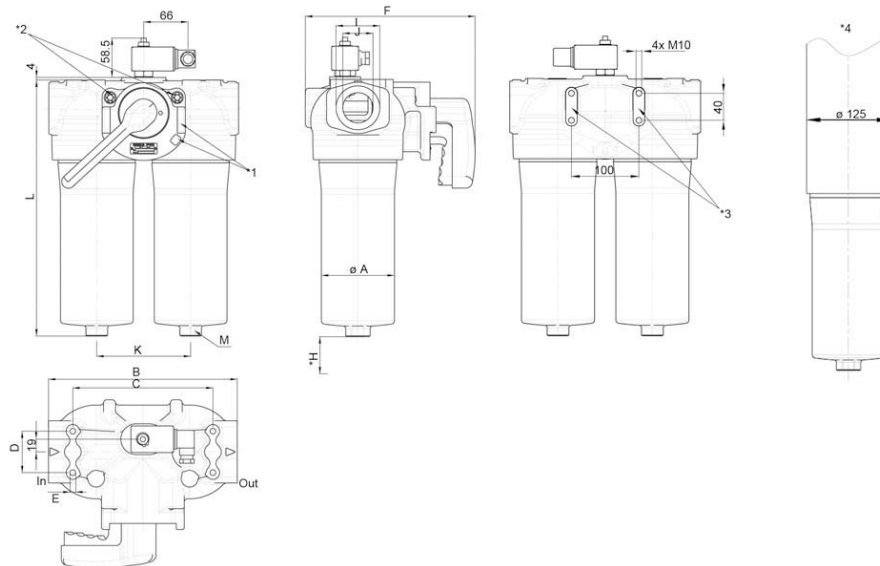
7.2 Filter elements*					
Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
600	70346506	Pi 2160 PS 3	PS 3	20	9398
	76114318	Pi 5160 PS 6	PS 6		9398
	79393380	Pi 3160 PS 10	PS 10		9398
	79748047	Pi 4160 PS 25	PS 25		9398

*a wider range of element types is available on request

8. Technical specifications

Design:	line mounting filter	The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.
Nominal pressure:		
Pi 2105 - Pi 2111	10 [^] 7 load changes 63 bar (900 psi)	
Pi 2115 - Pi 2160	10 [^] 7 load changes 25 bar (360 psi) 2x 10 [^] 6 load changes 32 bar (460 psi)	
Test pressure:		We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.
Pi 2105 - Pi 2111	95 bar (1370 psi)	
Pi 2115 - Pi 2160	48 bar (690 psi)	
Temperature range:	-10 °C to +120 °C survival temperature -40 °C (other temperature ranges on request)	
Bypass setting:	Δp 3.5 bar $\pm$ 10	We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Goup 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.
Filter head material:	GAL	
Filter housing material:	AL/St	
Sealing material:	NBR/AL	
Maintenance indicator setting:	Δp 2.2 bar $\pm$ 10 %	Subject to technical alteration without prior notice.
Electrical data of maintenance indicator:		
Max. voltage:	250 V AC/200 V DC	
Max. current:	1 A	
Contact load:	70 W	
Type of protection:	IP 65 in inserted and secured status	
Contact:	normally open/closed	
Cable connection:	M20x1.5	

9. Dimensions



In Inlet

Out Outlet

*H Minimum clearance required for element change

*1 Lever locking and arresting

*2 Venting screws

*3 Optional fixing for NG 150 to 600

*4 Housing version NG 600

All dimensions except "J" in mm

Type	øA	B	C	D	E	F	G	H	øI	J*	K	L	M SW	Wt. [kg]
Pi 2105	66	172	100	52	M8x16	189	130	80	47	G1	85	203	27	2.60
Pi 2108	66	172	100	52	M8x16	189	130	80	47	G1	85	261	27	2.90
Pi 2111	66	172	100	52	M8x16	189	130	80	47	G1	85	351	27	3.30
Pi 2115	109	283	210	62	M10x20	252	194	110	65	G1½	140	264	32	8.50
Pi 2130	109	283	210	62	M10x20	252	194	110	65	G1½	140	385	32	9.50
Pi 2145	109	283	210	62	M10x20	252	194	110	65	G1½	140	497	32	17.25
Pi 2160	109	283	210	62	M10x20	252	194	110	65	G1½	140	636	32	15.50

* SAE flange connections (3000 psi), NPT and SAE connections on request

Duplex Filter Pi 210 up to NG 600

7

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing downwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.

The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

The state on delivery is a normally closed contact

10.3 When should the filter element be replaced?

1. Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
2. Please always ensure that you have original MAHLE spare elements in stock: Disposable elements cannot be cleaned.

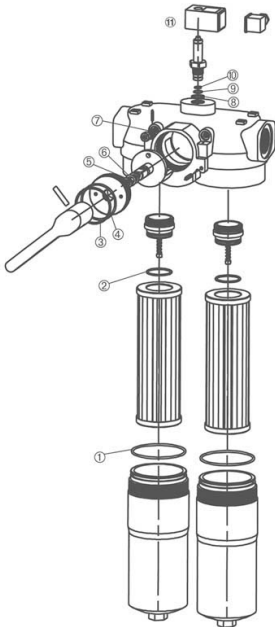
10.4 Element replacement

Note: Elements may only be replaced by people who are familiar with the function of the filter. When replacing elements, appropriate safety clothing (protective goggles, gloves, safety shoes) must be worn.

Note: The maintenance indicator monitors the filter side in operation, which is identified by the position of the switching lever catch. The change-over transfer valve must be switched prior filter servicing. Now the signal of the maintenance indicators cancelled and the red button can be repressed again.

1. Operate and hold pressure equalizing lever located behind switching lever. Pull catch knob and swivel switching lever. Engage the catch on the clear filter side. Place through or drip pan underneath to collect leaving oil.
2. Loosen vent screw of the filter side not in use by 2-3 turns; max. until contact is made with the safety stop.
3. Unscrew filter housing by rotating same counter-clockwise and clean with a suitable medium.
Warning: The shift lever may not, from now until the screwing back in of the filter housing (7.), be activated under any circumstances!
4. Remove filter element with a side-to-side motion.
5. Check O-ring on the filter house for damage. Replace, if necessary.
6. Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
7. Lightly lubricate the threads of the filter housing and screw into the filter head. Maximum tightening torque for NG 50 to 110 = 60 Nm, for NG 150 to 600 = 100 Nm.
8. To refill the filter chamber, operate only the pressure equalizing lever (leave the switching lever arrested in its catch) long enough for the medium to emerge bubble-free from the vent bore.
9. Tighten vent screw. Check filter for leaks by operating the pressure equalizing lever once again.

11. Spare parts list



Order number for spare parts		
Position	Type	Order number
① - ⑩	Seal kit for housing	
	Pi 2105 - Pi 2111	
	NBR	79761271
	FPM	79761289
	EPDM	79761297
	Pi 2115 - Pi 2160	
	NBR	79761230
	FPM	79761248
	EPDM	79761255
③ - ⑩	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325
⑪	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Electrical PiS 3097/2.2	77669948
	Electrical upper section only	77536550

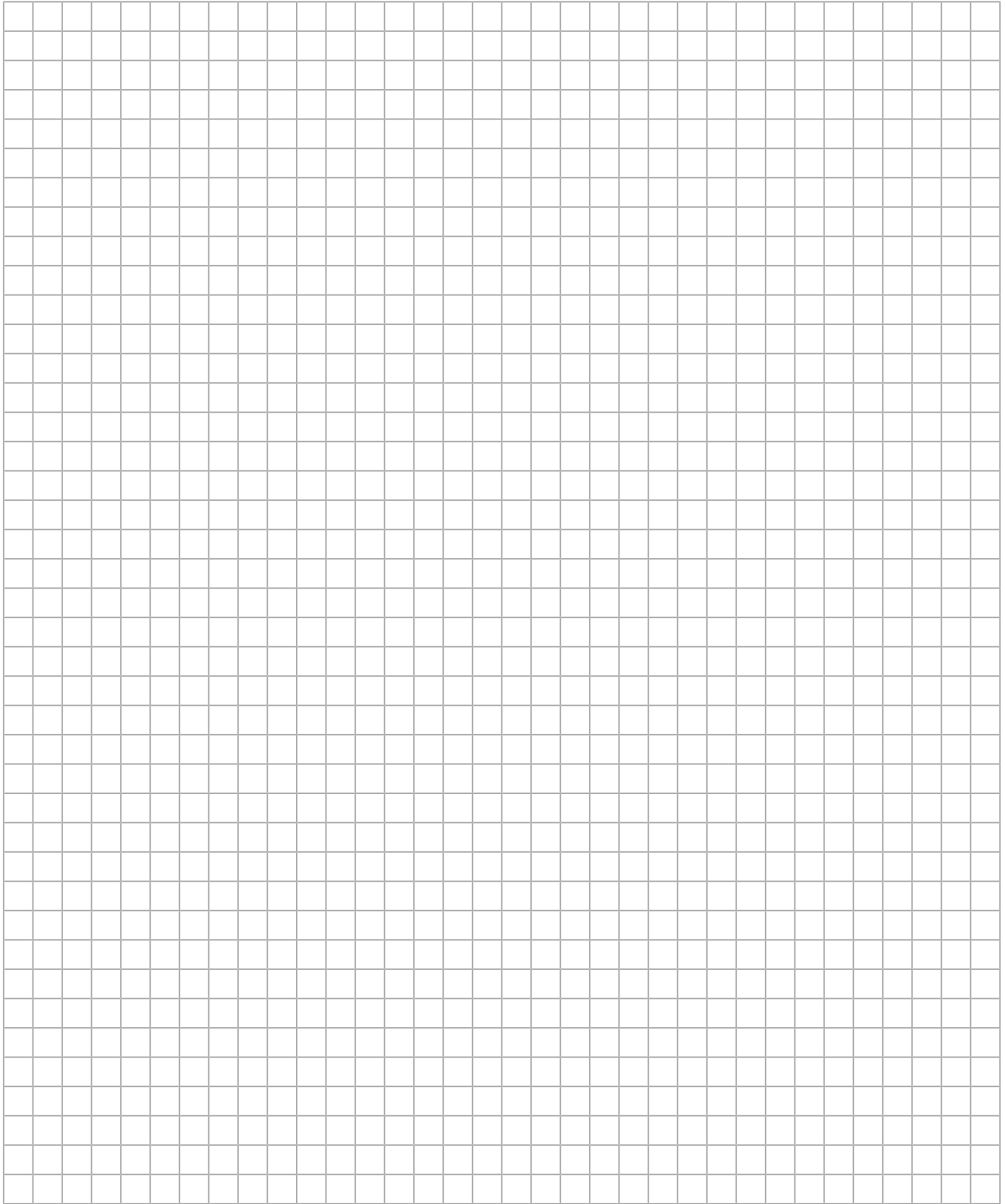


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Duplex Filter Pi 210 up to NG 600

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