Rexroth
Bosch Group

Аксиально-поршневой насос с постоянным рабочим объемом A2FO

R-RS 91401/06.2012 1/34
Заменяет: 03.08

Технический паспорт

Серия 6

Номинальный размер	Номинальное/максимальное давление
5	315/350 бар
от 10 до 200	400/450 бар
от 250 до 1000	350/400 бар

Открытый контур

Содержание

Особенности

- Аксиально-поршневой насос с постоянным рабочим объемом в исполнении с наклонным блоком для гидростатических приводов с открытой системой циркуляции рабочей жидкости
- Используется в мобильном и стационарном оборудовании
- Объемный расход насоса пропорционален частоте вращения приводного вала и рабочему объему насоса
- Подшипниковая опора приводного вала рассчитана на стандартные для таких сфер применения требования к сроку службы подшипников
- Высокая удельная мощность
- Компактные размеры
- Высокий суммарный КПД
- Экономичное техническое решение
- Цельный конусный поршень с поршневыми кольцами для герметизации

Код заказа для стандартной программы поставок

	A2F		O		/	6			–	V				
01	02	03	04	05		06	07	08		09	10	11	12	13

Рабочая жидкость

01	Минеральное масло и рабочие жидкости HFD HFD для NG250 до 1000 только в комбинации с подшипниковой опорой длительного срока службы "L" (без индекса)		
	Рабочие жидкости HFB и HFC	от NG5 до 200 (без индекса)	
		от NG250 до 1000 (только в комбинации с подшипниковой опорой длительного срока службы "L")	**E-**

Аксиально-поршневой агрегат

02	Исполнение с наклонным блоком, постоянный рабочий объем	**A2F**

Подшипник приводного вала		**от 5 до 200**	**от 250 до 500**	**от 710 до 1000**	
03	Стандартная подшипниковая опора (без индекса)	●	●	–	
	Подшипниковая опора длительного срока службы	–	●	●	**L**

Режим работы

04	Насос, открытый контур	**O**

Номинальные размеры (NG)

05	Геометрический объем насоса, см. таблицу параметров на странице 7																				
	5	**10**	**12**	**16**	**23**	**28**	**32**	**45**	**56**	**63**	**80**	**90**	**107**	**125**	**160**	**180**	**200**	**250**	**355**	**500**	**710**	**1000**

Серия

06		**6**

Индекс

07		от NG10 до 180	**1**
		NG200	**3**
		от NG5 и 250 до 1000	**0**

Направления вращения

08	Если смотреть на приводной вал	вправо	**R**
		влево	**L**

Уплотнения

09	FKM (фторкаучук)	**V**

Приводные валы		**5**	**10**	**12**	**16**	**23**	**28**	**32**	**45**	**56**	**63**	**80**	**90**	**107**	**125**	**160**	**180**	**200**	**от 250 до 1000**	
10	Шлицевой вал DIN 5480	–	●	●	●	●	●	●	–	●	●	●	●	●	●	●	●	●	–	**A**
		–	●	●	–	●	●	–	●	●	–	●	–	●	–	●	–	–	●	**Z**
	Цил. вал с призматической шпонкой, DIN 6885	●	●	●	●	●	●	●	–	●	●	●	●	●	●	●	●	●	–	**B**
		–	●	●	–	●	●	–	●	●	–	●	–	●	–	●	–	–	●	**P**
	Конический вал[1)]	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**C**

Монтажные фланцы			**от 5 до 250**	**от 355 до 1000**	
11	ISO 3019-2	4 отверстия	●	–	**B**
		8 отверстий	–	●	**H**

● = поставляется m = по запросу – = не поставляется ▭ = стандартная программа

1) Конический вал с резьбовой цапфой и сегментной шпонкой DIN 6888. Крутящий момент должен передаваться через коническое прессовое соединение.

Код заказа для стандартной программы поставок

	A2F		O		/	6			–	V				
01	02	03	04	05		06	07	08		09	10	11	12	13

	Присоединения рабочих линий[2)]	**5**	**от 10 до 16**	**от 23 до 250**	**от 355 до 1000**	
12	Фланцевое соединение SAE A/B сбоку и фланцевое соединение SAE S сзади	–	–	●	–	05
	Резьбовое соединение A/B сбоку и резьбовое соединение S сзади	–	●	–	–	06
	Фланцевые соединения SAE A/B и S сзади	–	–	–	●	11
	Резьбовые соединения A/B и S сбоку	●	–	–	–	07

	Стандартное/специальное исполнение	
13	Стандартное исполнение (без индекса)	
	Стандартное исполнение с вариантами монтажа, например каналы T открыты или закрыты в отличие от стандартного исполнения	–Y
	Специальное исполнение	–S

● = поставляется m = по запросу – = не поставляется = стандартная программа

2) Крепежная резьба или резьбовые соединения, метрические

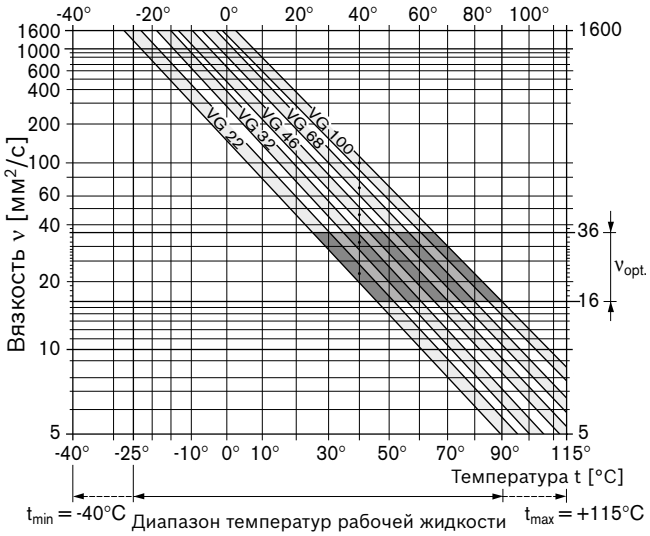
Технические характеристики

Рабочая жидкость

Для получения подробной информации об условиях применения и выборе рабочей жидкости рекомендуем перед проектированием ознакомиться с техническими паспортами R-RS 90220 (минеральное масло), R-RS 90221 (экологически безопасные рабочие жидкости), R-RS 90222 (рабочие жидкости типа HFD) и R-RS 90223 (рабочие жидкости типа HFA, HFB, HFC).

Насос с постоянным рабочим объемом A2FO не предназначен для работы с рабочими жидкостями типа HFA. При эксплуатации насоса с рабочими жидкостями типа HFB, HFC и HFD или экологически безопасными рабочими жидкостями требуется ограничение технических характеристик или использование других уплотнений.

Диаграмма выбора



Пояснения для выбора рабочей жидкости

Для правильного выбора гидравлической жидкости необходимо знать рабочую температуру в зависимости от окружающей температуры: в открытой гидросистеме температуру бака.

Выбор гидравлической жидкости должен производиться таким образом, чтобы в диапазоне рабочих температур величина вязкости жидкости находилась в оптимальном диапазоне (ν_{opt}, см. диаграмму выбора, заштрихованную область). Рекомендуется выбирать жидкость с более высоким коэффициентом вязкости.

Пример. При окружающей температуре X °C устанавливается рабочая температура, равная 60 °C. В оптимальном диапазоне вязкости ($\nu_{opt.}$, заштрихованная область) это соответствует классам вязкости VG 46 и VG 68; следует выбрать: VG 68.

Внимание

Температура жидкости в дренажном канале, подверженная влиянию давления и скорости вращения, может превышать температуру в баке. Ни в одной точке компонента гидросистемы температура рабочей жидкости не должна превышать 115 °C. Для определения вязкости в подшипнике следует учитывать указанный ниже перепад температур.

Если выполнение описанных выше условий в режиме предельной рабочей нагрузки невозможно, рекомендуем производить промывку корпуса через канал U (номинальный размер от 250 до 1000).

Вязкость и температура рабочей жидкости

	Вязкость [мм²/с]	Температура	Примечание
Транспортировка и хранение при температуре окружающей среды		$T_{min} \geq -50$ °C T_{opt} = от +5 °C до +20 °C	заводская консервация: до 12 месяцев стандартная, до 24 месяцев длительная
(Холодный) пуск[1]	ν_{max} = 1600	$T_{St} \geq -40$ °C	t ≤ 3 мин, без нагрузки (p ≤ 50 бар), n ≤ 1000 об/мин (для NG5 до 200), n ≤ 0,25 • n_{nom} (для NG250 до 1000)
допустимый перепад температур		ΔT ≤ 25 K	между аксиально-поршневым агрегатом и рабочей жидкостью
Период прогрева	ν < 1600 до 400	T = от –40 °C до –25 °C	для p ≤ 0,7 • p_{nom}, n ≤ 0,5 • n_{nom} и t ≤ 15 мин
Рабочий этап			
Перепад температур		ΔT = ок. 12 K	между рабочей жидкостью в подшипнике и в канале T.
Максимальная температура		115 °C	в подшипнике
		103 °C	измеренная в канале T
Непрерывный режим эксплуатации	ν = 400 до 10 ν_{opt} = 36 до 16	T = от –25 °C до +90 °C	измеренная в канале T, без ограничений в пределах допустимых параметров
Кратковременный режим эксплуатации[2]	$\nu_{min} \geq 7$	T_{max} = +103 °C	измеренная в канале T, t < 3 мин, p < 0,3 • p_{nom}
Уплотнительное кольцо вала FKM[1]		T ≤ +115 °C	см. стр. 5.

1) При температурах ниже –25 °C требуется уплотнительное кольцо вала NBR (допустимый диапазон температур: от –40 °C до +90 °C).

2) Номинальный размер от 250 до 1000, необходимо согласование.

Технические характеристики

Фильтрация рабочей жидкости

Чем тоньше фильтрация, тем выше класс чистоты рабочей жидкости и, соответственно, тем дольше срок службы аксиально-поршневого агрегата.

Для обеспечения надежной работы аксиально-поршневого агрегата необходимо провести гравиметрический анализ рабочей жидкости, чтобы определить степень загрязнения твердыми частицами и класс чистоты согласно ISO 4406. Как минимум должен соблюдаться класс чистоты 20/18/15.

При очень высокой температуре рабочей жидкости (от +90 °C до максимум +115 °C) требуется класс чистоты не ниже 19/17/14 по ISO 4406.

При невозможности соблюдения указанных выше классов обратитесь к нам за консультацией.

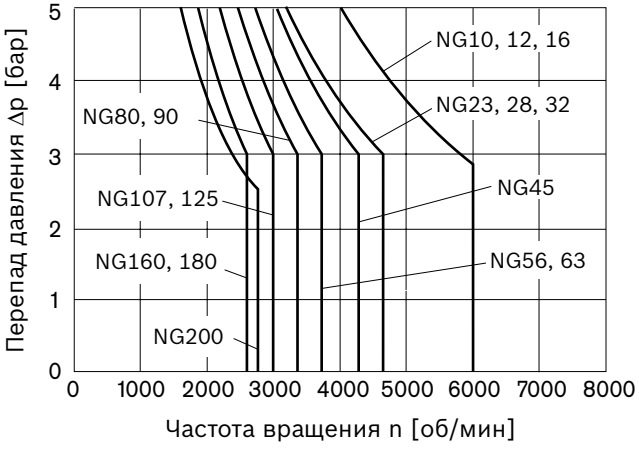
Уплотнительное кольцо вала

Допустимая нагрузка давлением

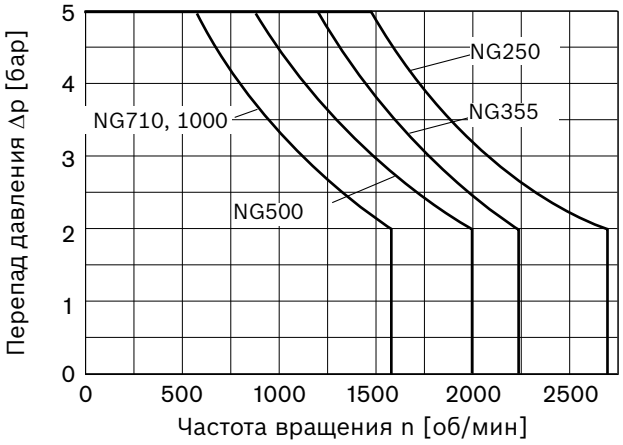
Срок службы уплотнительного кольца вала зависит от частоты вращения аксиально-поршневого агрегата и давления в дренажном канале (давления в корпусе). В непрерывном режиме при рабочей температуре средний перепад давлений не должен превышать 2 бар между давлением в корпусе и внешним давлением. Более высокий перепад давлений при сниженной частоте вращения показан на диаграмме. При этом допускаются кратковременные (t < 0,1 с) пики давления до 10 бар.
Чем чаще возникают пики давления, тем меньше срок службы уплотнительного кольца вала.

Давление в корпусе должно быть равно внешнему давлению или больше него.

Номинальный размер от 10 до 200



Номинальный размер от 250 до 1000



Значения действительны при внешнем давлении p_{abs} = 1 бар.

Диапазон температур

Уплотнительное кольцо вала FKM допускается использовать при температурах жидкости в дренажном канале от –25 °C до +115 °C.

Указание
Для применения при температурах ниже –25 °C требуется уплотнительное кольцо вала NBR (допустимый диапазон температур: от –40 °C до +90 °C). При заказе открытым текстом указывать уплотнительное кольцо вала NBR.
Требуется согласование.

Направление потока

Направление вращения, если смотреть на приводной вал	
вправо	**влево**
S после **B**	**S** после **A**

Подшипниковая опора длительного срока службы

Номинальный размер от 250 до 1000
Для длительного срока службы и применения с рабочими жидкостями типа HF. Одинаковые наружные размеры как у двигателя со стандартной подшипниковой опорой. Возможно дополнительное переоборудование на подшипниковую опору длительного срока службы. Промывку подшипника и корпуса рекомендуется выполнять через точку подключения U.

Рекомендуемый расход для промывки

NG	250	355	500	710	1000
$q_{v\ промыв}$ (л/мин)	10	16	16	16	16

Технические характеристики

Диапазон рабочего давления

(при использовании минерального масла)

Давление в канале рабочей линии A или B

Номинальный размер 5

Номинальное давление p_{nom} _____ 315 бар абс.

Максимальное давление p_{max} _____ 350 бар абс.
Отдельный период работы_____10 с
Общая продолжительность работы _____ 300 ч

Номинальный размер от 10 до 200

Номинальное давление p_{nom} _____ 400 бар абс.

Максимальное давление p_{max} _____ 450 бар абс.
Отдельный период работы_____10 с
Общая продолжительность работы _____ 300 ч

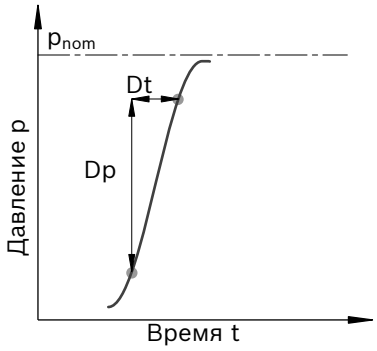
Номинальный размер от 250 до 1000

Номинальное давление p_{nom} _____ 350 бар абс.

Максимальное давление p_{max} _____ 400 бар абс.
Отдельный период работы_____10 с
Общая продолжительность работы _____ 300 ч

Минимальное давление
(сторона высокого давления)_____25 бар абс.

Скорость изменения давления $R_{A\,max}$
без предохранительного клапана _____16 000 бар/с



Давление во всасывающей линии S (вход)

Минимальное давление $p_{S\,min}$ _____ 0,8 бар абс.

Максимальное давление $p_{S\,max}$ _____30 бар абс.

Указание
Для получения значений для других гидравлических жидкостей необходимо согласование.

Определение

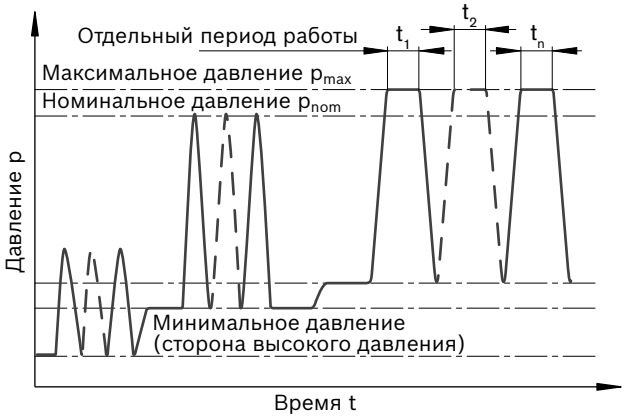
Номинальное давление p_{nom}
Номинальное давление соответствует максимальному расчетному давлению.

Максимальное давление p_{max}
Максимальное давление соответствует пиковому рабочему давлению в течение отдельного периода работы. Сумма отдельных периодов работы не должна превышать общую продолжительность работы.

Минимальное давление
(сторона высокого давления)
Требуемое минимальное давление в напорном канале высокого давления (A или B), необходимое для предотвращения повреждений аксиально-поршневого агрегата.

Минимальное давление (вход)
Минимальное давление во всасывающей линии S (вход), которое необходимо для предотвращения повреждения аксиально-поршневого агрегата. Минимальное давление зависит от частоты вращения аксиально-поршневого агрегата (см. диаграмму на стр. 7).

Скорость изменения давления R_A
Максимально допустимая скорость нагнетания и сброса давления при изменении давления в пределах всего диапазона.



Общая продолжительность работы = $t_1 + t_2 + ... + t_n$

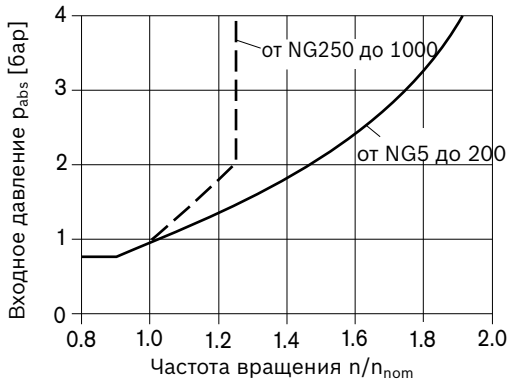
Технические характеристики

Таблица значений (теоретические значения, без КПД и допусков; значения округлены)

Номинальный размер		NG		5	10	12	16	23	28	32	45	56	63	80
Объем насоса геометрический, на один оборот		V_g	см³	4,93	10,3	12	16	22,9	28,1	32	45,6	56,1	63	80,4
Частота вращения, макс.[1]		n_{nom}	об/мин	5600	3150	3150	3150	2500	2500	2500	2240	2000	2000	1800
		n_{max}[2]	об/мин	8000	6000	6000	6000	4750	4750	4750	4250	3750	3750	3350
Объемный расход при n_{nom}		q_V	л/мин	27,6	32	38	50	57	70	80	102	112	126	145
Мощность при	Δp = 350 бар	P	кВт	14,5[4]	19	22	29	33	41	47	60	65	74	84
	Δp = 400 бар	P	кВт	–	22	25	34	38	47	53	68	75	84	96
Крутящий момент[3] при V_g и	Δp = 350 бар	T	Н•м	24,7[4]	57	67	89	128	157	178	254	313	351	448
	Δp = 400 бар	T	Н•м	–	66	76	102	146	179	204	290	357	401	512
Жесткость на скручивание		c	кН•м/рад	0,63	0,92	1,25	1,59	2,56	2,93	3,12	4,18	5,94	6,25	8,73
Момент инерции Силовая установка		J_{TW}	кгм²	0,00006	0,0004	0,0004	0,0004	0,0012	0,0012	0,0012	0,0024	0,0042	0,0042	0,0072
Угловое ускорение, максимальное		α	рад/с²	5000	5000	5000	5000	6500	6500	6500	14 600	7500	7500	6000
Объем корпуса		V	L		0,17	0,17	0,17	0,20	0,20	0,20	0,33	0,45	0,45	0,55
Масса (ок.)		м	кг	2,5	6	6	6	9,5	9,5	9,5	13,5	18	18	23

Номинальный размер		NG		90	107	125	160	180	200	250	355	500	710	1000
Объем насоса геометрический, на один оборот		V_g	см³	90	106,7	125	160,4	180	200	250	355	500	710	1000
Частота вращения, макс.[1]		n_{nom}	об/мин	1800	1600	1600	1450	1450	1550	1500	1320	1200	1200	950
		n_{max}[2]	об/мин	3350	3000	3000	2650	2650	2750	1800	1600	1500	1500	1200
Объемный расход при n_{nom}		q_V	л/мин	162	171	200	233	261	310	375	469	600	852	950
Мощность при	Δp = 350 бар	P	кВт	95	100	117	136	152	181	219	273	350	497	554
	Δp = 400 бар	P	кВт	108	114	133	155	174	207	–	–	–	–	–
Крутящий момент[3] при V_g и	Δp = 350 бар	T	Н•м	501	594	696	893	1003	1114	1393	1978	2785	3955	5570
	Δp = 400 бар	T	Н•м	573	679	796	1021	1146	1273	–	–	–	–	–
Жесткость на скручивание		c	кН•м/рад	9,14	11,2	11,9	17,4	18,2	57,3	73,1	96,1	144	270	324
Момент инерции Силовая установка		J_{TW}	кгм²	0,0072	0,0116	0,0116	0,0220	0,0220	0,0353	0,061	0,102	0,178	0,55	0,55
Угловое ускорение, максимальное		α	рад/с²	6000	4500	4500	3500	3500	11 000	10 000	8300	5500	4300	4500
Объем корпуса		V	L	0,55	0,8	0,8	1,1	1,1	2,7	2,5	3,5	4,2	8	8
Масса (ок.)		м	кг	23	32	32	45	45	66	73	110	155	325	336

1) Значения действительны:
   – при абсолютном давлении p_{abs} = 1 бар во всасывающей линии S;
   – для оптимального диапазона вязкости ν_{opt} = от 16 до 36 мм²/с;
   – для рабочей жидкости на основе минерального масла.
2) Максимальная частота вращения (предельная частота вращения) при увеличении входного давления p_{abs} во всасывающей линии S, см. диаграмму.
3) Крутящий момент без радиального усилия, с радиальным усилием, см. на стр. 8
4) Крутящий момент при Δp = 315 бар



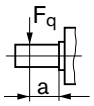
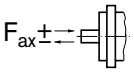
Указание

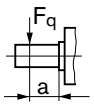
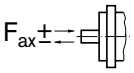
Выход за максимальные или минимальные значения может привести к потере работоспособности, сокращению срока службы или разрушению аксиально-поршневого агрегата. Другие допустимые предельные значения для колебаний скорости вращения, пониженного углового ускорения в зависимости от частоты и допустимого пускового углового ускорения (ниже максимального углового ускорения) представлены в техническом паспорте R-RS 90261.

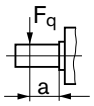
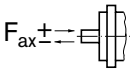
Технические характеристики

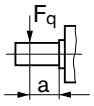
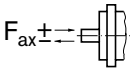
Допустимая радиальная и осевая нагрузка на приводные валы

(шлицевой вал и цилиндрический вал с призматической шпонкой)

Номинальный размер	**NG**		**5**	**5**[3]	**10**	**10**	**12**	**12**	**16**	**23**	**23**
Приводной вал	ø	мм	12	12	20	25	20	25	25	25	30
Радиальное усилие, максимальное[1] для расстояния a (от буртика вала) 	$F_{q\,max}$	кН	1,6	1,6	3,0	3,2	3,0	3,2	3,2	5,7	5,4
	a	мм	12	12	16	16	16	16	16	16	16
при этом допустимый крутящий момент	T_{max}	Н•м	24,7	24,7	66	66	76	76	102	146	146
≙ допустимое давление Δp	$\Delta p_{доп.}$	бар	315	315	400	400	400	400	400	400	400
Осевое усилие, максимальное[2] 	$+F_{ax\,max}$	N	180	180	320	320	320	320	320	500	500
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0	0	0
Допуст. осевое усилие на каждый бар раб. давления	$\pm F_{ax\,доп./бар}$	Н/бар	1,5	1,5	3,0	3,0	3,0	3,0	3,0	5,2	5,2

Номинальный размер	**NG**		**28**	**28**	**32**	**45**	**56**	**56**[4]	**56**	**63**	**80**
Приводной вал	ø	мм	25	30	30	30	30	30	35	35	35
Радиальное усилие, максимальное[1] для расстояния a (от буртика вала) 	$F_{q\,max}$	кН	5,7	5,4	5,4	7,6	9,5	7,8	9,1	9,1	11,6
	a	мм	16	16	16	18	18	18	18	18	20
при этом допустимый крутящий момент	T_{max}	Н•м	179	179	204	290	357	294	357	401	512
≙ допустимое давление Δp	$\Delta p_{доп.}$	бар	400	400	400	400	400	330	400	400	400
Осевое усилие, максимальное[2] 	$+F_{ax\,max}$	N	500	500	500	630	800	800	800	800	1000
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0	0	0
Допуст. осевое усилие на каждый бар раб. давления	$\pm F_{ax\,доп./бар}$	Н/бар	5,2	5,2	5,2	7,0	8,7	8,7	8,7	8,7	10,6

Номинальный размер	**NG**		**80**[4]	**80**	**90**	**107**	**107**	**125**	**160**	**160**	**180**
Приводной вал	ø	мм	35	40	40	40	45	45	45	50	50
Радиальное усилие, максимальное[1] для расстояния a (от буртика вала) 	$F_{q\,max}$	кН	11,1	11,4	11,4	13,6	14,1	14,1	18,1	18,3	18,3
	a	мм	20	20	20	20	20	20	25	25	25
при этом допустимый крутящий момент	T_{max}	Н•м	488	512	573	679	679	796	1021	1021	1146
≙ допустимое давление Δp	$\Delta p_{доп.}$	бар	380	400	400	400	400	400	400	400	400
Осевое усилие, максимальное[2] 	$+F_{ax\,max}$	N	1000	1000	1000	1250	1250	1250	1600	1600	1600
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0	0	0
Допуст. осевое усилие на каждый бар раб. давления	$\pm F_{ax\,доп./бар}$	Н/бар	10,6	10,6	10,6	12,9	12,9	12,9	16,7	16,7	16,7

Номинальный размер	**NG**		**200**	**250**	**355**	**500**	**710**	**1000**
Приводной вал	ø	мм	50	50	60	70	90	90
Радиальное усилие, максимальное[1] для расстояния a (от буртика вала) 	$F_{q\,max}$	кН	20,3	1,2[6]	1,5[6]	1,9[6]	3,0[6]	2,6[6]
	a	мм	25	41	52,5	52,5	67,5	67,5
при этом допустимый крутящий момент	T_{max}	Н•м	1273	[5]	[5]	[5]	[5]	[5]
≙ допустимое давление Δp	$\Delta p_{доп.}$	бар	400	[5]	[5]	[5]	[5]	[5]
Осевое усилие, максимальное[2] 	$+F_{ax\,max}$	N	1600	2000	2500	3000	4400	4400
	$-F_{ax\,max}$	N	0	0	0	0	0	0
Допуст. осевое усилие на каждый бар раб. давления	$\pm F_{ax\,доп./бар}$	Н/бар	16,7	[5]	[5]	[5]	[5]	[5]

1) В режиме периодической эксплуатации
2) Максимально допустимое осевое усилие в состоянии остановки или безнапорной циркуляции аксиально-поршневого агрегата.
3) Конический вал с резьбовой цапфой и сегментной шпонкой DIN 6888.
4) Ограниченные технические характеристики для шлицевого вала
5) Требуется согласование
6) В состоянии остановки или безнапорной циркуляции аксиально-поршневого агрегата. Под давлением допускаются большие усилия, требуется согласование.

Внимание

Направление действия допустимого осевого усилия:

+ $F_{ax\,max}$ = увеличение срока службы подшипников

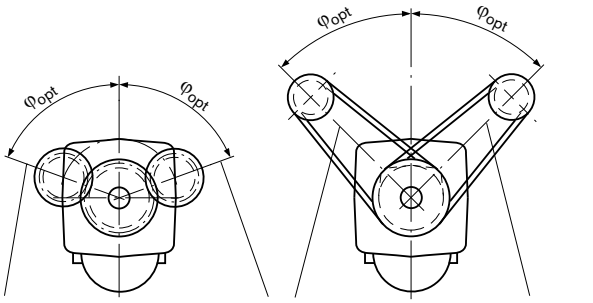
– $F_{ax\,max}$ = сокращение срока службы подшипников (избегать)

Технические характеристики

Влияние радиального усилия F_q на срок службы подшипников

Выбор подходящего направления действия F_q позволяет снизить нагрузку на подшипники, обусловленную внутренними усилиями роторной группы, и за счет этого добиться оптимального срока службы подшипников. Рекомендуемое положение сопряженного колеса в зависимости от направления вращения на примере:

	Отбор мощности посредством шестерни	**Отбор мощности посредством клиноременного привода**
NG	**$\varphi_{opt.}$**	**$\varphi_{opt.}$**
от 5 до 180	±70°	±45°
от 200 до 1000	±45°	±70°



Направление вращения "вправо"
Давление в канале **B**

Направление вращения "влево"
Давление в канале **A**

Направление вращения "вправо"
Давление в канале **B**

Определение технических данных

Объемный расход $q_V = \frac{V_g \cdot n \cdot \eta_v}{1000}$ [л/мин]

Крутящий момент $T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$ [Н•м]

Мощность $P = \frac{2 \pi \cdot T \cdot n}{60\,000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t}$ [кВт]

V_g = Объем насоса на оборот в $см^3$

Δp = Перепад давления в бар

n = Частота вращения в об/мин

η_v = Объемный КПД

η_{mh} = Механико-гидравлический КПД

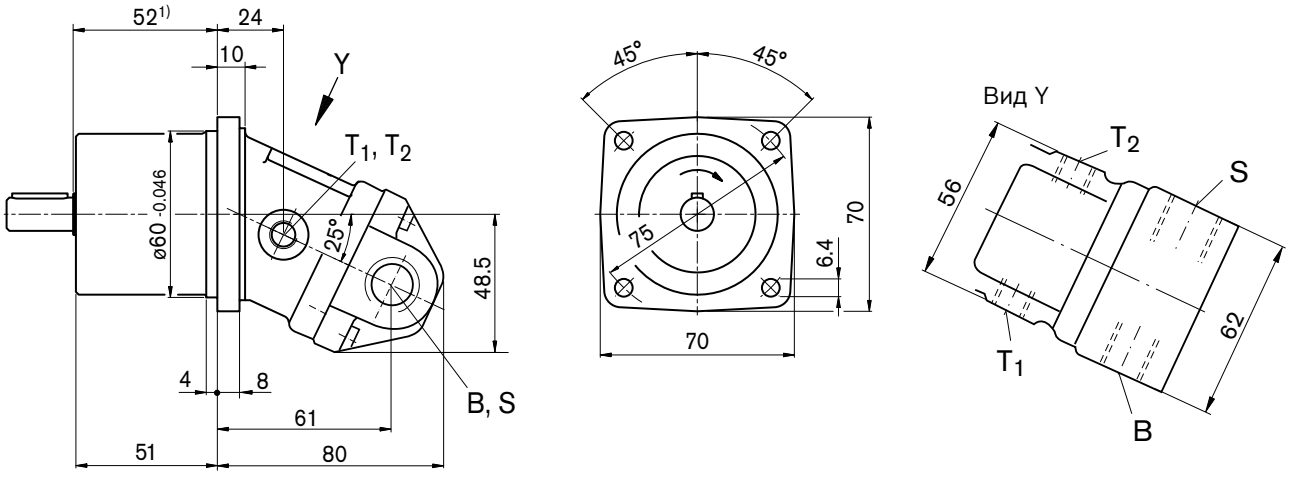
η_t = Суммарный КПД ($\eta_t = \eta_v \cdot \eta_{mh}$)

Размеры, номинальный размер 5

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

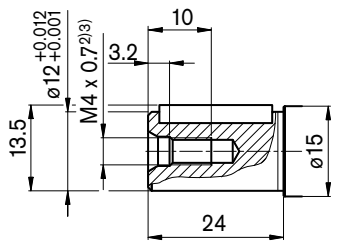
Присоединение рабочих линий 07 – резьбовые соединения A/B и S сбоку

Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)

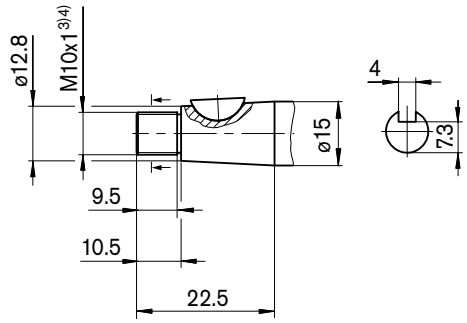


Приводные валы

B Цил. вал с призматической шпонкой, DIN 6885, A4x4x20



C Конический вал с резьбовой цапфой и сегментной шпонкой 3x5 DIN 6888 (конус 1:10)



Точки подключения

Наименование	Подключение для	Стандарт[6)]	Размер[3)]	Максимальное давление [бар][5)]	Состояние[7)]
B (A)	Рабочая линия	DIN 3852	M18 x 1,5; глубина 12	350	O
S	Линия всасывания	DIN 3852	M22 x 1,5; глубина 14	30	O
T_1	Дренажный трубопровод	DIN 3852	M10 x 1; глубина 8	3	O
T_2	Дренажный трубопровод	DIN 3852	M10 x 1; глубина 8	3	O

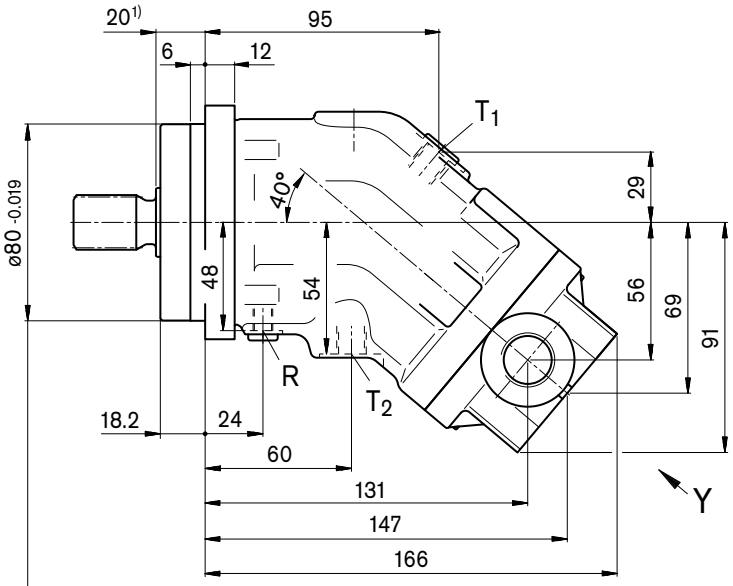
1) До буртика вала
2) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
3) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
4) Резьба согласно DIN 3852, максимальный момент затяжки: 30 Н•м
5) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
6) Зенковка может быть глубже, чем предусмотрено стандартом.
7) O = требуется присоединение (при поставке заглушено)

Размеры, номинальный размер 10, 12, 16

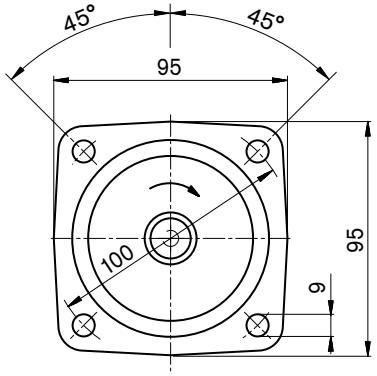
Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Присоединение рабочих линий 06 – резьбовое соединение A/B сбоку и резьбовое соединение S сзади

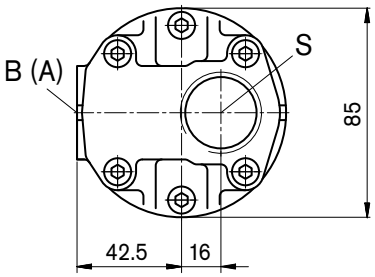
Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)



Фланец согласно ISO 3019-2



Вид Y



1) До буртика вала

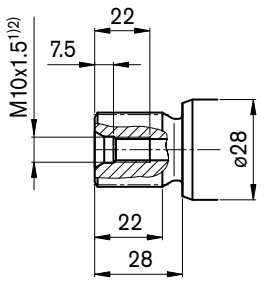
Размеры, номинальный размер 10, 12, 16

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Приводные валы

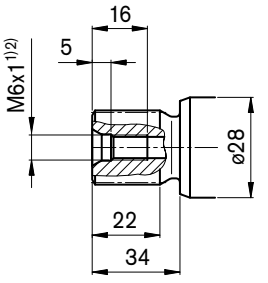
NG10, 12, 16

A Шлицевой вал DIN 5480 W25x1.25x18x9g



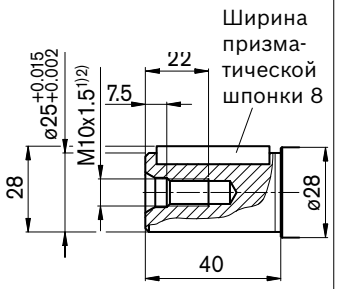
NG10, 12

Z Шлицевой вал DIN 5480 W20x1.25x14x9g



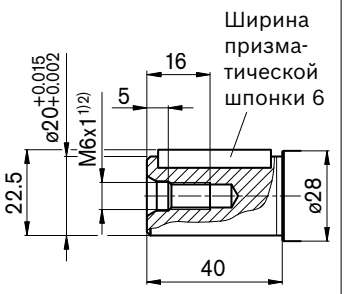
NG10, 12, 16

B Цил. вал с призматической шпонкой, DIN 6885, AS8x7x32



NG10, 12

P Цил. вал с призматической шпонкой, DIN 6885, AS6x6x32



Точки подключения

Наименование	Подключение для	Стандарт[5]	Размер[2]	Максимальное давление [бар][3]	Состояние[6]
B (A)	Рабочая линия	DIN 3852	M22 x 1,5; глубина 14	450	O
S	Линия всасывания	DIN 3852	M33 x 2; глубина 18	30	O
T_1	Дренажный трубопровод	DIN 3852	M12 x 1,5; глубина 12	3	X[4]
T_2	Дренажный трубопровод	DIN 3852	M12 x 1,5; глубина 12	3	O[4]
R	Удаление воздуха	DIN 3852	M8 x 1; глубина 8	3	X

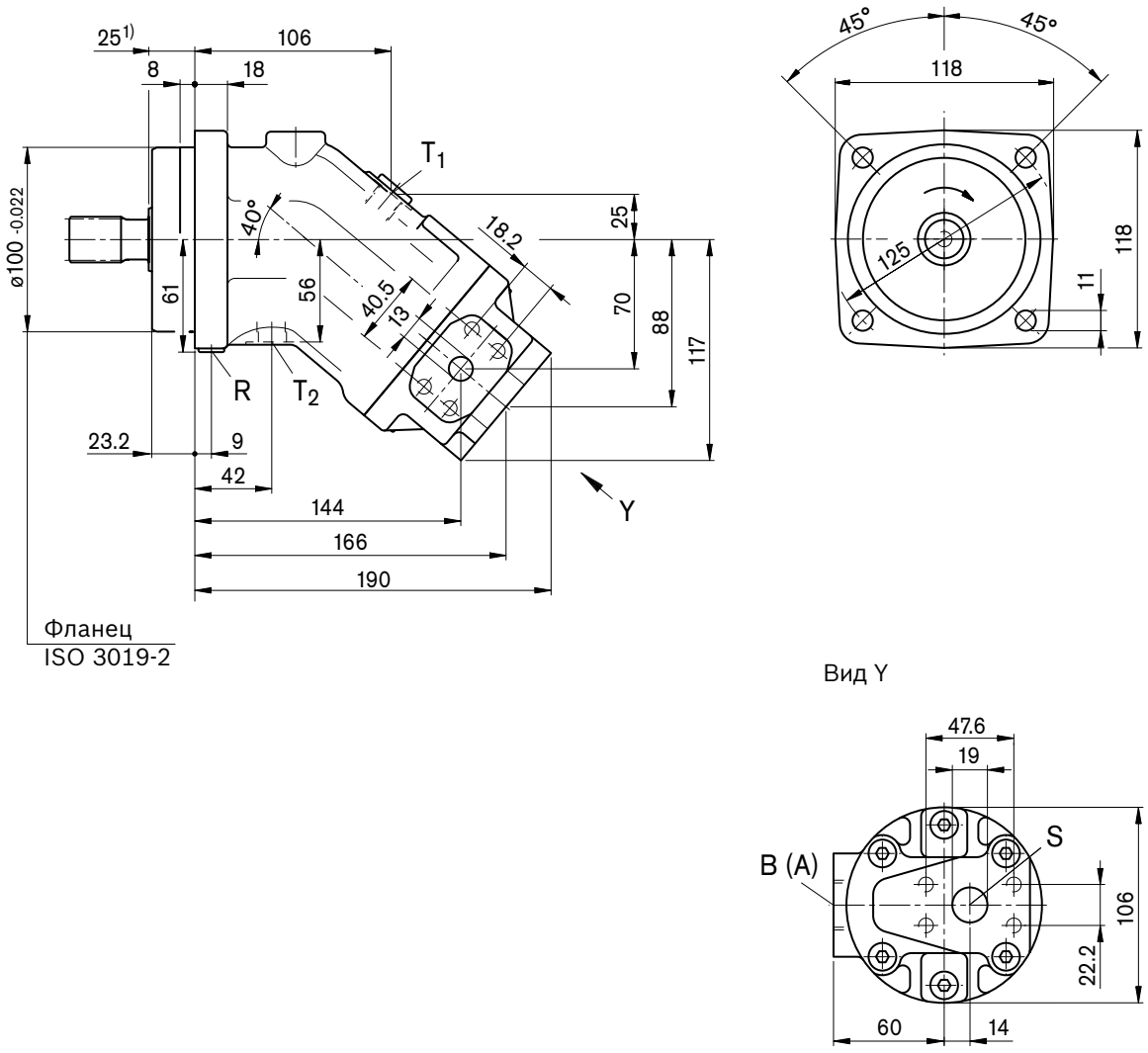
1) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
2) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
3) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
4) В зависимости от монтажного положения требуется присоединение T_1 или T_2 (см. также "Указания по монтажу" на стр. 32 и 33).
5) Зенковка может быть глубже, чем предусмотрено стандартом.
6) O = требуется присоединение (при поставке заглушено)
X = заглушено (в нормальном режиме работы)

Размеры, номинальный размер 23, 28, 32

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Присоединение рабочих линий 05 – фланцевое соединение SAE A/B сбоку и фланцевое соединение SAE S сзади

Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)



1) До буртика вала

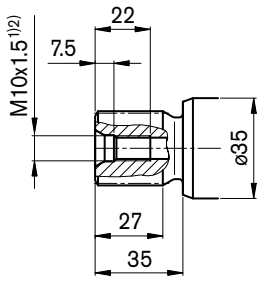
Размеры, номинальный размер 23, 28, 32

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Приводные валы

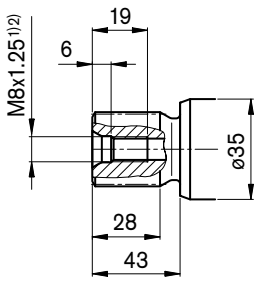
NG23, 28, 32

A Шлицевой вал DIN 5480 W30x2x14x9g



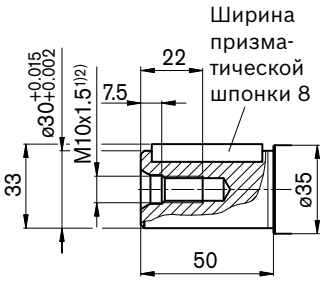
NG23, 28

Z Шлицевой вал DIN 5480 W25x1.25x18x9g



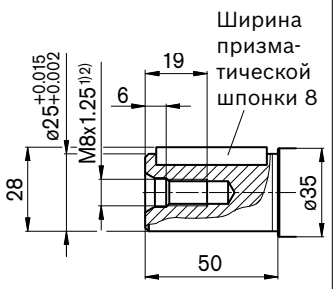
NG23, 28, 32

B Цил. вал с призматической шпонкой, DIN 6885, AS8x7x40



NG23, 28

P Цил. вал с призматической шпонкой, DIN 6885, AS8x7x40



Точки подключения

Наименование	Подключение для	Стандарт	Размер[2)]	Максимальное давление [бар][3)]	Состояние[7)]
B (A)	Рабочая линия Крепежная резьба A/B	SAE J518[5)] DIN 13	1/2 дюйма M8 x 1,25; глубина 15	450	O
S	Линия всасывания Крепежная резьба	SAE J518[5)] DIN 13	3/4 дюйма M10 x 1,5; глубина 17	30	O
T_1	Дренажный трубопровод	DIN 3852[6)]	M16 x 1,5; глубина 12	3	X[4)]
T_2	Дренажный трубопровод	DIN 3852[6)]	M16 x 1,5; глубина 12	3	O[4)]
R	Удаление воздуха	DIN 3852[6)]	M10 x 1; глубина 12	3	X

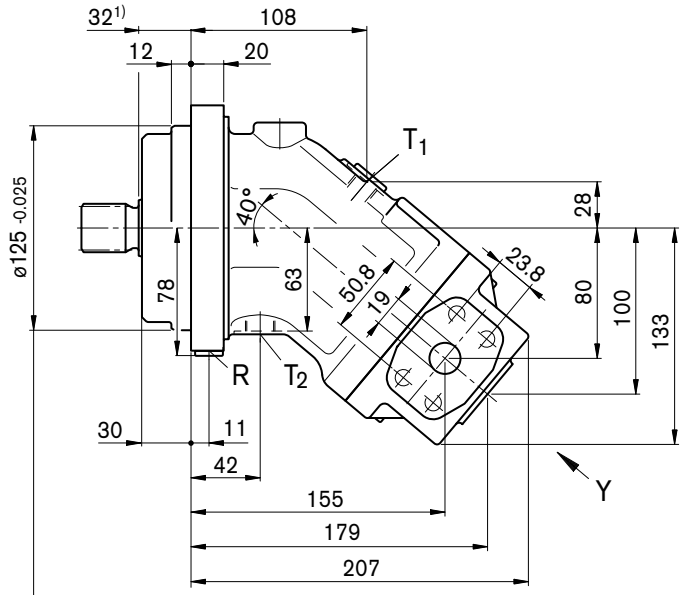
1) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
2) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
3) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
4) В зависимости от монтажного положения требуется присоединение T_1 или T_2 (см. также "Указания по монтажу" на стр. 32 и 33).
5) Только размеры согласно SAE J518, метрическая крепежная резьба отличается от стандарта.
6) Зенковка может быть глубже, чем предусмотрено стандартом.
7) O = требуется присоединение (при поставке заглушено)
X = заглушено (в нормальном режиме работы)

Размеры, номинальный размер 45

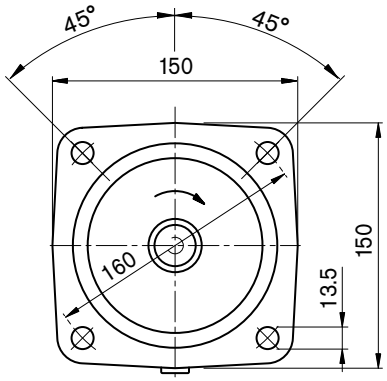
Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Присоединение рабочих линий 05 – фланцевое соединение SAE A/B сбоку и фланцевое соединение SAE S сзади

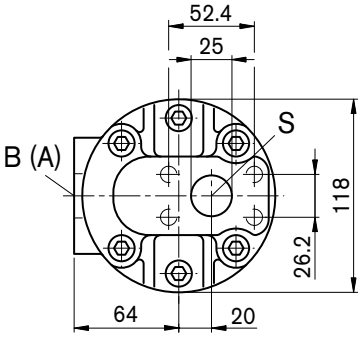
Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)



Фланец
ISO 3019-2



Вид Y



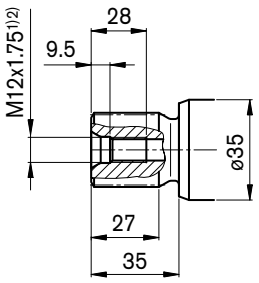
1) До буртика вала

Размеры, номинальный размер 45

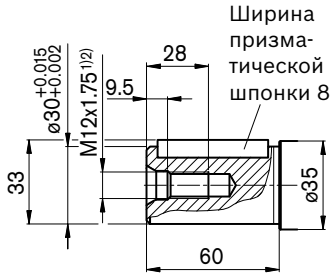
Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Приводные валы

Z Шлицевой вал DIN 5480 W30x2x14x9g



P Цил. вал с призматической шпонкой, DIN 6885, AS8x7x50



Точки подключения

Наименование	Подключение для	Стандарт	Размер[2)]	Максимальное давление [бар][3)]	Состояние[7)]
B (A)	Рабочая линия Крепежная резьба A/B	SAE J518[5)] DIN 13	3/4 дюйма M10 x 1,5; глубина 17	450	O
S	Линия всасывания Крепежная резьба	SAE J518[5)] DIN 13	1 дюйм M10 x 1,5; глубина 17	30	O
T_1	Дренажный трубопровод	DIN 3852[6)]	M18 x 1,5; глубина 12	3	X[4)]
T_2	Дренажный трубопровод	DIN 3852[6)]	M18 x 1,5; глубина 12	3	O[4)]
R	Удаление воздуха	DIN 3852[6)]	M12 x 1,5; глубина 12	3	X

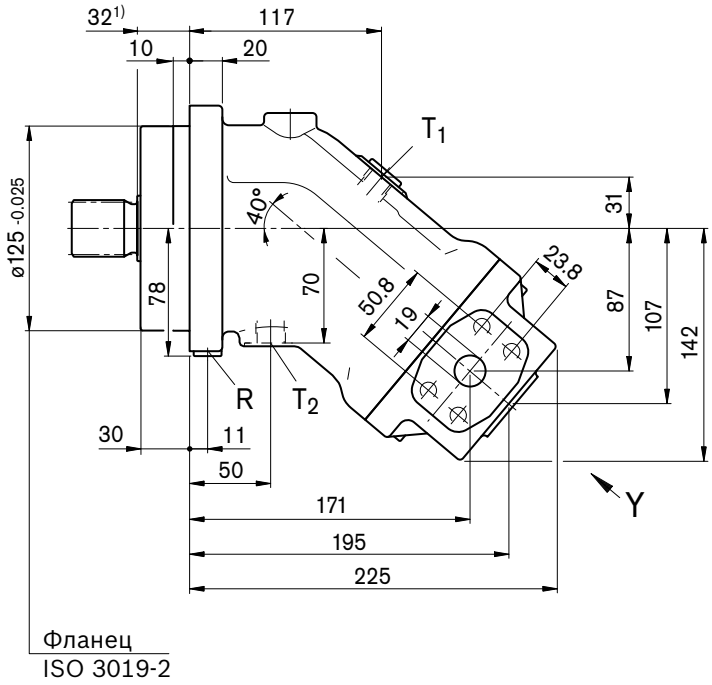
1) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
2) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
3) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
4) В зависимости от монтажного положения требуется присоединение T_1 или T_2 (см. также "Указания по монтажу" на стр. 32 и 33).
5) Только размеры согласно SAE J518, метрическая крепежная резьба отличается от стандарта.
6) Зенковка может быть глубже, чем предусмотрено стандартом.
7) O = требуется присоединение (при поставке заглушено)
X = заглушено (в нормальном режиме работы)

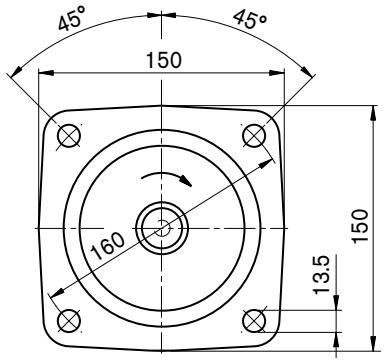
Размеры, номинальный размер 56, 63

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

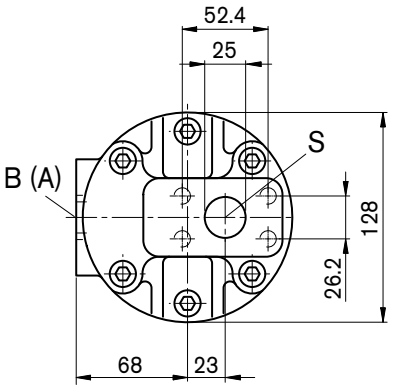
Присоединение рабочих линий 05 – фланцевое соединение SAE A/B сбоку и фланцевое соединение SAE S сзади

Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)





Вид Y



1) До буртика вала

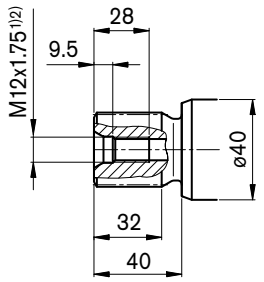
Размеры, номинальный размер 56, 63

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Приводные валы

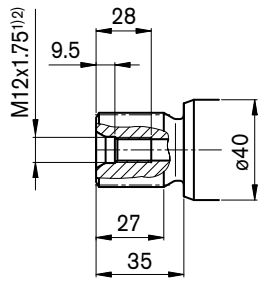
NG56, 63

A Шлицевой вал DIN 5480 W35x2x16x9g



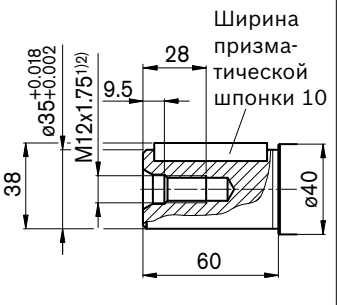
NG56

Z Шлицевой вал DIN 5480 W30x2x14x9g



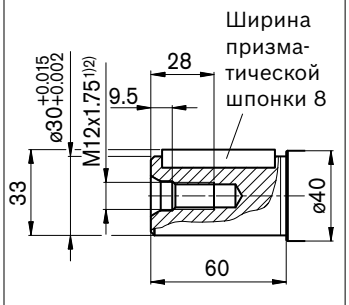
NG56, 63

B Цил. вал с призматической шпонкой, DIN 6885, AS10x8x50



NG56

P Цил. вал с призматической шпонкой, DIN 6885, AS8x7x50



Точки подключения

Наименование	Подключение для	Стандарт	Размер[2)]	Максимальное давление [бар][3)]	Состояние[7)]
B (A)	Рабочая линия Крепежная резьба A/B	SAE J518[5)] DIN 13	3/4 дюйма M10 x 1,5; глубина 17	450	O
S	Линия всасывания Крепежная резьба	SAE J518[5)] DIN 13	1 дюйм M10 x 1,5; глубина 17	30	O
T_1	Дренажный трубопровод	DIN 3852[6)]	M18 x 1,5; глубина 12	3	X[4)]
T_2	Дренажный трубопровод	DIN 3852[6)]	M18 x 1,5; глубина 12	3	O[4)]
R	Удаление воздуха	DIN 3852[6)]	M12 x 1,5; глубина 12	3	X

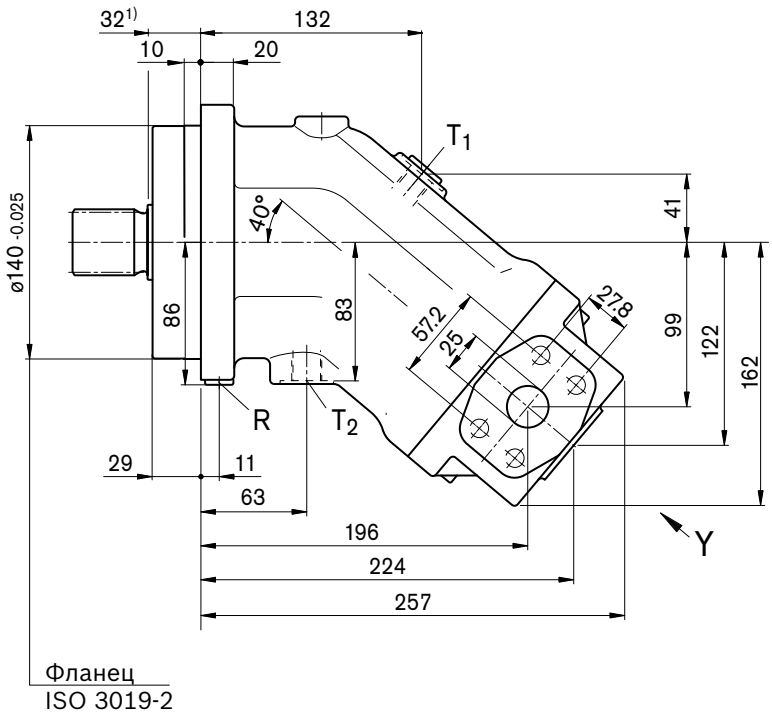
1) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
2) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
3) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
4) В зависимости от монтажного положения требуется присоединение T_1 или T_2 (см. также "Указания по монтажу" на стр. 32 и 33).
5) Только размеры согласно SAE J518, метрическая крепежная резьба отличается от стандарта.
6) Зенковка может быть глубже, чем предусмотрено стандартом.
7) O = требуется присоединение (при поставке заглушено)
X = заглушено (в нормальном режиме работы)

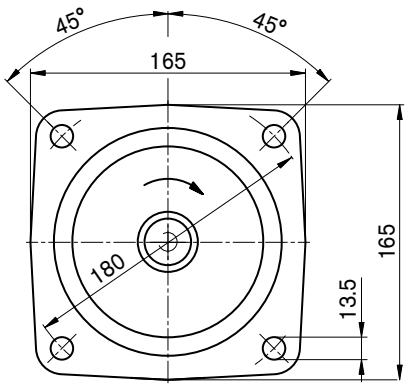
Размеры, номинальный размер 80, 90

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

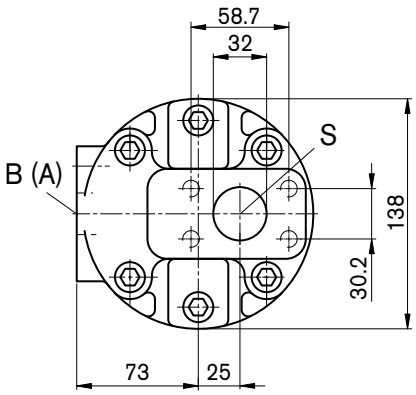
Присоединение рабочих линий 05 – фланцевое соединение SAE A/B сбоку и фланцевое соединение SAE S сзади

Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)





Вид Y



1) До буртика вала

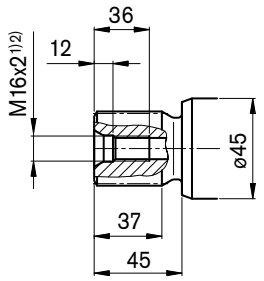
Размеры, номинальный размер 80, 90

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Приводные валы

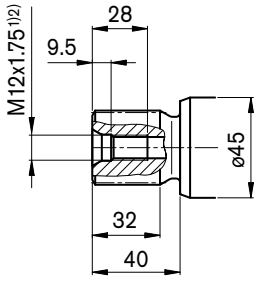
NG80, 90

A Шлицевой вал DIN 5480 W40x2x18x9g



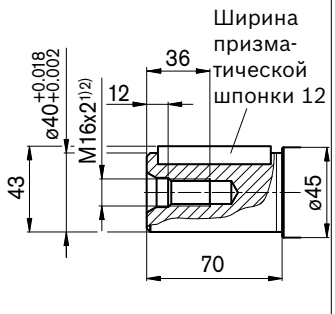
NG80

Z Шлицевой вал DIN 5480 W35x2x16x9g



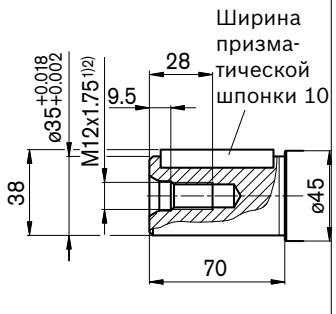
NG80, 90

B Цил. вал с призматической шпонкой, DIN 6885, AS12x8x56



NG80

P Цил. вал с призматической шпонкой, DIN 6885, AS10x8x56



Точки подключения

Наименование	Подключение для	Стандарт	Размер[2)]	Максимальное давление [бар][3)]	Состояние[7)]
B (A)	Рабочая линия Крепежная резьба A/B	SAE J518[5)] DIN 13	1 дюйм M12 x 1,5; глубина 17	450	O
S	Линия всасывания Крепежная резьба	SAE J518[5)] DIN 13	1 1/4 дюйма M10 x 1,5; глубина 17	30	O
T_1	Дренажный трубопровод	DIN 3852[6)]	M18 x 1,5; глубина 12	3	X[4)]
T_2	Дренажный трубопровод	DIN 3852[6)]	M18 x 1,5; глубина 12	3	O[4)]
R	Удаление воздуха	DIN 3852[6)]	M12 x 1,5; глубина 12	3	X

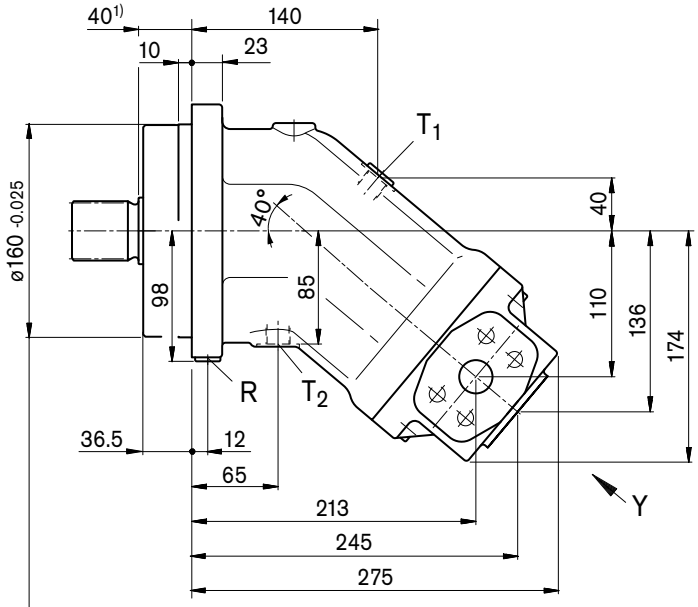
1) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
2) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
3) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
4) В зависимости от монтажного положения требуется присоединение T_1 или T_2 (см. также "Указания по монтажу" на стр. 32 и 33).
5) Только размеры согласно SAE J518, метрическая крепежная резьба отличается от стандарта.
6) Зенковка может быть глубже, чем предусмотрено стандартом.
7) O = требуется присоединение (при поставке заглушено)
X = заглушено (в нормальном режиме работы)

Размеры, номинальный размер 107, 125

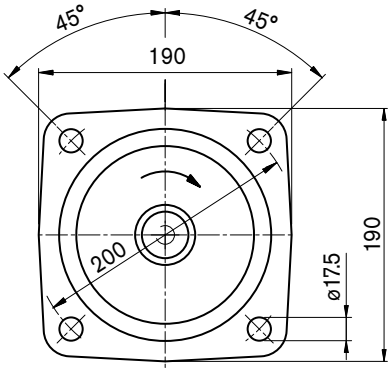
Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Присоединение рабочих линий 05 – фланцевое соединение SAE A/B сбоку и фланцевое соединение SAE S сзади

Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)

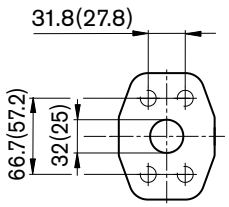


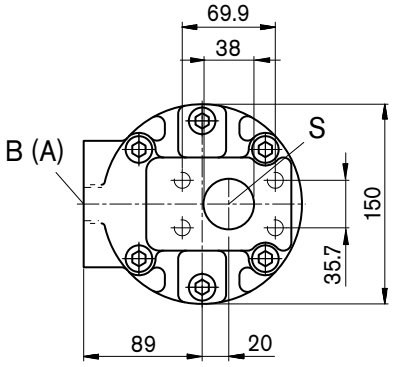
Фланец
ISO 3019-2



Вид Y

Местный вид, точка подключения A/B
(размеры скобы для NG107)





1) До буртика вала

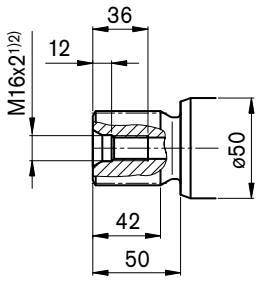
Размеры, номинальный размер 107, 125

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Приводные валы

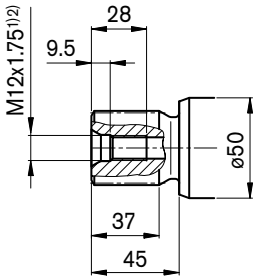
NG107, 125

A Шлицевой вал DIN 5480 W45x2x21x9g



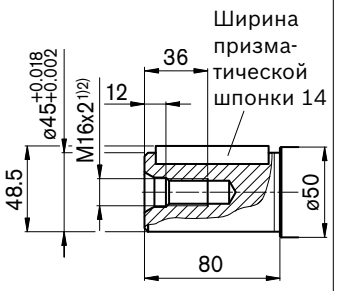
NG107

Z Шлицевой вал DIN 5480 W40x2x18x9g



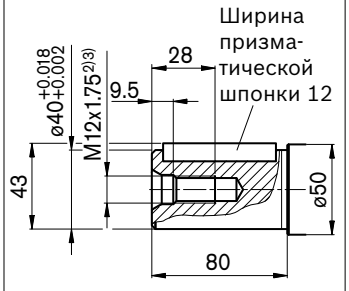
NG107, 125

B Цил. вал с призматической шпонкой, DIN 6885, AS14x9x63



NG107

P Цил. вал с призматической шпонкой, DIN 6885, AS12x8x63



Точки подключения

Наименование	Подключение для	Стандарт	Размер[2)]	Максимальное давление [бар][3)]	Состояние[7)]
B (A)	Рабочая линия	SAE J518[5)]	1 дюйм (NG107) 1 1/4 дюйма (NG125)	450	O
	Крепежная резьба A/B	DIN 13	M12 x 1,75; глубина 17 (NG107) M14 x 2; глубина 19 (NG125)		
S	Линия всасывания Крепежная резьба	SAE J518[5)] DIN 13	1 1/2 дюйма M12 x 1,75; глубина 20	30	O
T_1	Дренажный трубопровод	DIN 3852[6)]	M18 x 1,5; глубина 12	3	X[4)]
T_2	Дренажный трубопровод	DIN 3852[6)]	M18 x 1,5; глубина 12	3	O[4)]
R	Удаление воздуха	DIN 3852[6)]	M14 x 1,5; глубина 12	3	X

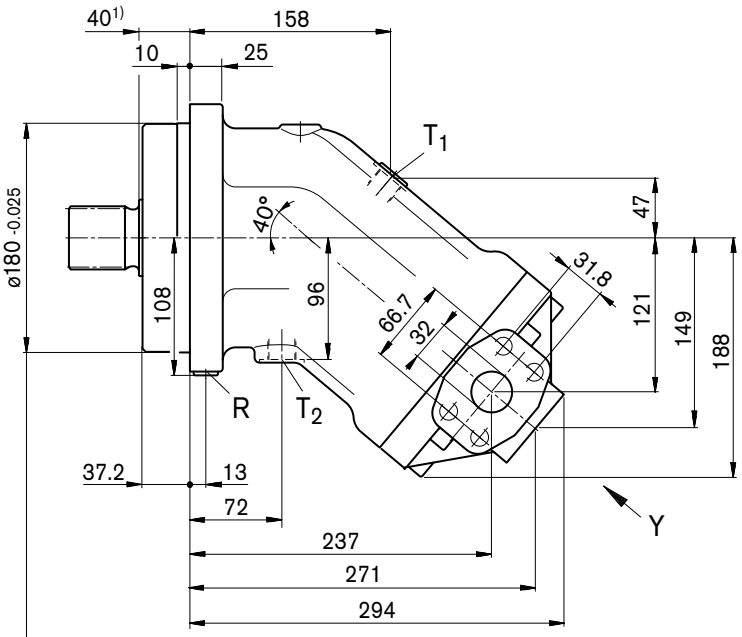
1) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
2) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
3) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
4) В зависимости от монтажного положения требуется присоединение T_1 или T_2 (см. также "Указания по монтажу" на стр. 32 и 33).
5) Только размеры согласно SAE J518, метрическая крепежная резьба отличается от стандарта.
6) Зенковка может быть глубже, чем предусмотрено стандартом.
7) O = требуется присоединение (при поставке заглушено)
X = заглушено (в нормальном режиме работы)

Размеры, номинальный размер 160, 180

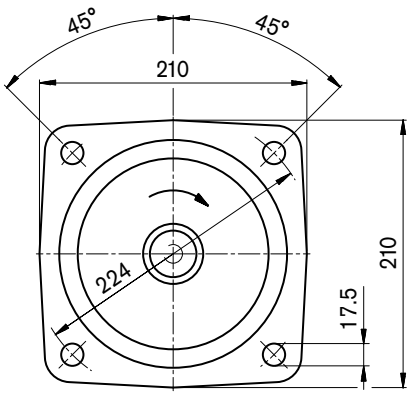
Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Присоединение рабочих линий 05 – фланцевое соединение SAE A/B сбоку и фланцевое соединение SAE S сзади

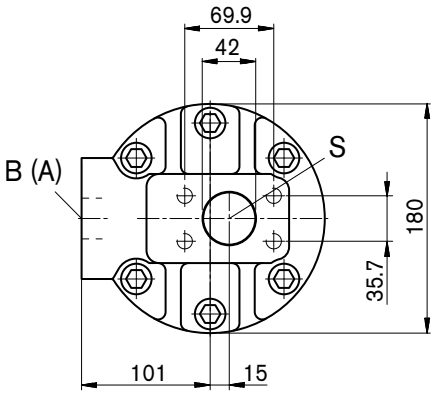
Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)



Фланец
ISO 3019-2



Вид Y



1) До буртика вала

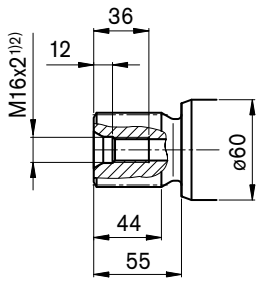
Размеры, номинальный размер 160, 180

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Приводные валы

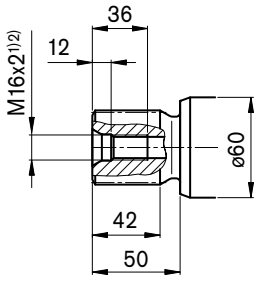
NG160, 180

A Шлицевой вал DIN 5480 W50x2x24x9g



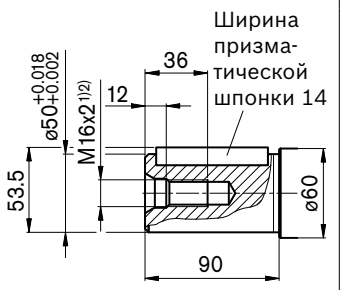
NG160

Z Шлицевой вал DIN 5480 W45x2x21x9g



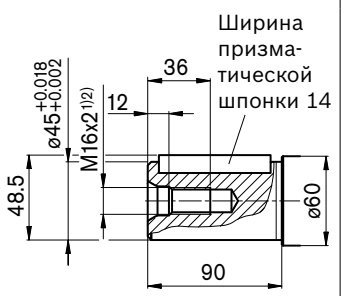
NG160, 180

B Цил. вал с призматической шпонкой, DIN 6885, AS14x9x70



NG160

P Цил. вал с призматической шпонкой, DIN 6885, AS14x9x70



Точки подключения

Наименование	Подключение для	Стандарт	Размер[2)]	Максимальное давление [бар][3)]	Состояние[7)]
B (A)	Рабочая линия Крепежная резьба A/B	SAE J518[5)] DIN 13	1 1/4 дюйма M14 x 2; глубина 19	450	O
S	Линия всасывания Крепежная резьба	SAE J518[5)] DIN 13	1 1/2 дюйма M12 x 1,75; глубина 20	30	O
T_1	Дренажный трубопровод	DIN 3852[6)]	M22 x 1,5; глубина 14	3	X[4)]
T_2	Дренажный трубопровод	DIN 3852[6)]	M22 x 1,5; глубина 14	3	O[4)]
R	Удаление воздуха	DIN 3852[6)]	M14 x 1,5; глубина 12	3	X

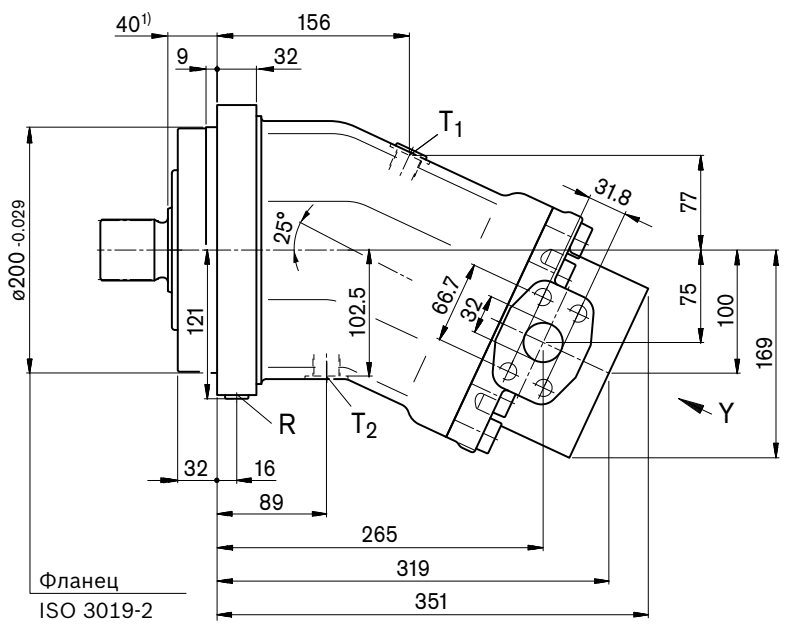
1) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
2) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
3) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
4) В зависимости от монтажного положения требуется присоединение T_1 или T_2 (см. также "Указания по монтажу" на стр. 32 и 33).
5) Только размеры согласно SAE J518, метрическая крепежная резьба отличается от стандарта.
6) Зенковка может быть глубже, чем предусмотрено стандартом.
7) O = требуется присоединение (при поставке заглушено)
X = заглушено (в нормальном режиме работы)

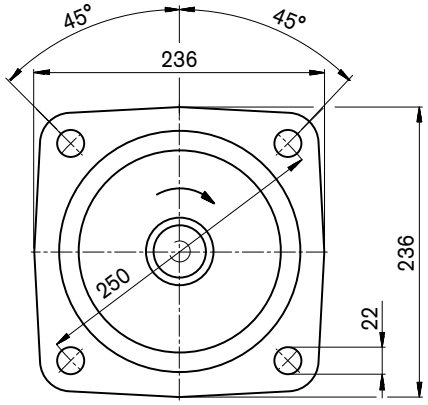
Размеры, номинальный размер 200

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

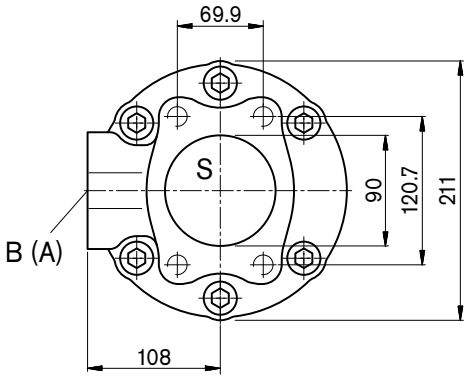
Присоединение рабочих линий 05 – фланцевое соединение SAE A/B сбоку и фланцевое соединение SAE S сзади

Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)



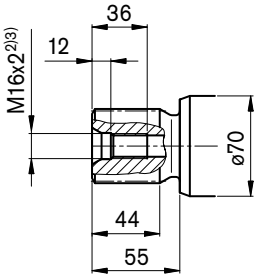


Местный вид Y

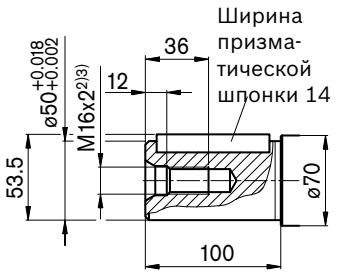


Приводные валы

A Шлицевой вал
DIN 5480
W50x2x24x9g



B Цил. вал с призматической шпонкой, DIN 6885, AS14x9x80



Точки подключения

Наименование	Подключение для	Стандарт	Размер[3)]	Максимальное давление [бар][4)]	Состояние[8)]
B (A)	Рабочая линия Крепежная резьба A/B	SAE J518[6)] DIN 13	1 1/4 дюйма M14 x 2; глубина 19	450	O
S	Линия всасывания Крепежная резьба	SAE J518[6)] DIN 13	3 1/2 дюйма M16 x 2; глубина 24	30	O
T_1	Дренажный трубопровод	DIN 3852[7)]	M22 x 1,5; глубина 14	3	X[5)]
T_2	Дренажный трубопровод	DIN 3852[7)]	M22 x 1,5; глубина 14	3	O[5)]
R	Удаление воздуха	DIN 3852[7)]	M14 x 1,5; глубина 12	3	X

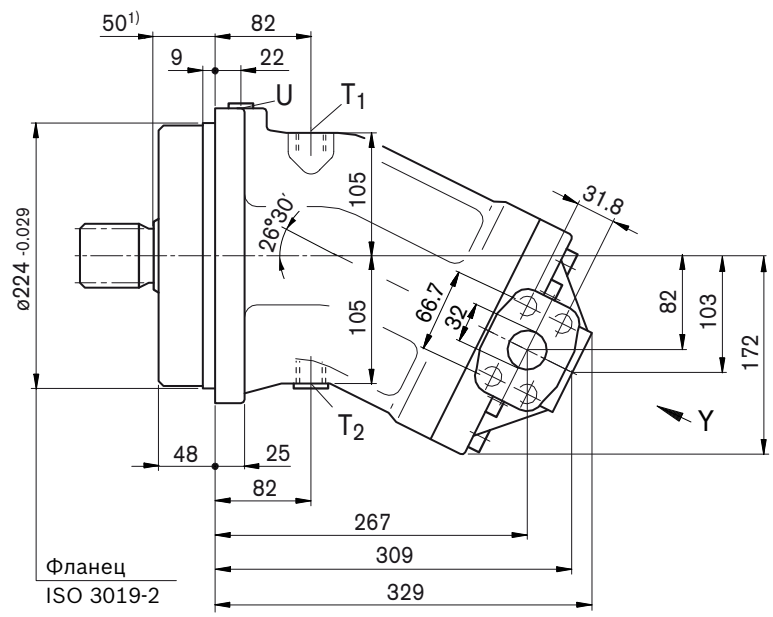
1) До буртика вала
2) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
3) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
4) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
5) В зависимости от монтажного положения требуется присоединение T_1 или T_2 (см. также "Указания по монтажу" на стр. 32 и 33).
6) Только размеры согласно SAE J518, метрическая крепежная резьба отличается от стандарта.
7) Зенковка может быть глубже, чем предусмотрено стандартом.
8) O = требуется присоединение (при поставке заглушено)
X = заглушено (в нормальном режиме работы)

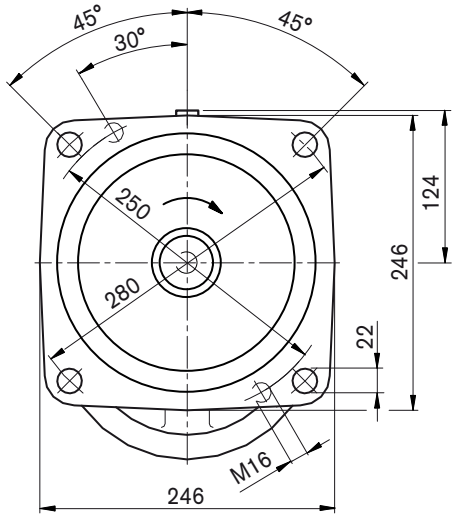
Размеры, номинальный размер 250

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Присоединение рабочих линий 05 – фланцевое соединение SAE A/B сбоку и фланцевое соединение SAE S сзади

Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)

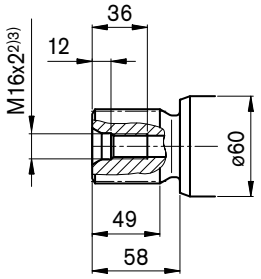




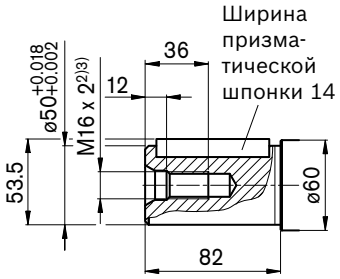
Местный вид Y

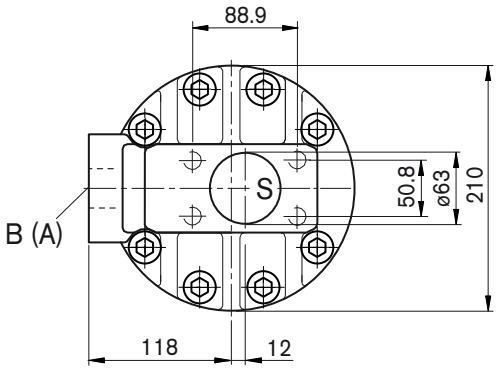
Приводные валы

Z Шлицевой вал
DIN 5480
W50x2x24x9g



P Цил. вал с призматической шпонкой
DIN 6885, AS14x9x80





Точки подключения

Наименование	Подключение для	Стандарт	Размер[3)]	Максимальное давление [бар][4)]	Состояние[8)]
B (A)	Рабочая линия Крепежная резьба A/B	SAE J518[6)] DIN 13	1 1/4 дюйма M14 x 2; глубина 19	400	O
S	Линия всасывания Крепежная резьба	SAE J518[6)] DIN 13	2 1/2 дюйма M12 x 1,75; глубина 17	30	O
T_1	Дренажный трубопровод	DIN 3852[7)]	M22 x 1,5; глубина 14	3	O[5)]
T_2	Дренажный трубопровод	DIN 3852[7)]	M22 x 1,5; глубина 14	3	X[5)]
U	Промывка подшипника	DIN 3852[7)]	M14 x 1,5; глубина 12	3	X

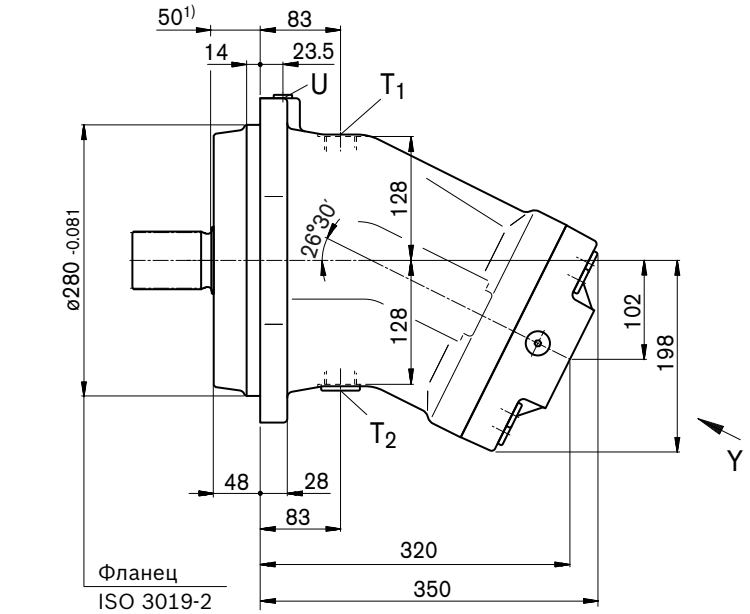
1) До буртика вала
2) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
3) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
4) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
5) В зависимости от монтажного положения требуется присоединение T_1 или T_2 (см. также "Указания по монтажу" на стр. 32 и 33).
6) Только размеры согласно SAE J518, метрическая крепежная резьба отличается от стандарта.
7) Зенковка может быть глубже, чем предусмотрено стандартом.
8) O = требуется присоединение (при поставке заглушено)
X = заглушено (в нормальном режиме работы)

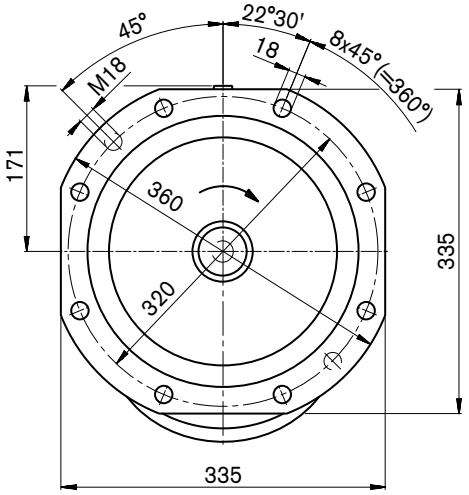
Размеры, номинальный размер 355

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Присоединение рабочих линий 11 – фланцевые соединения SAE A/B и S сзади

Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)

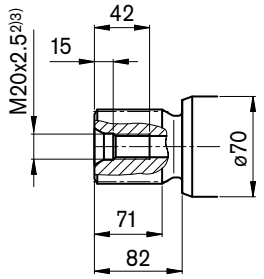




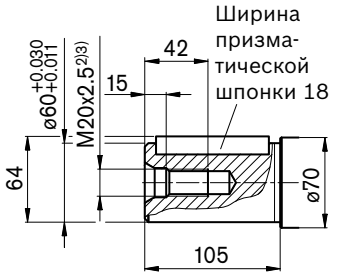
Местный вид Y

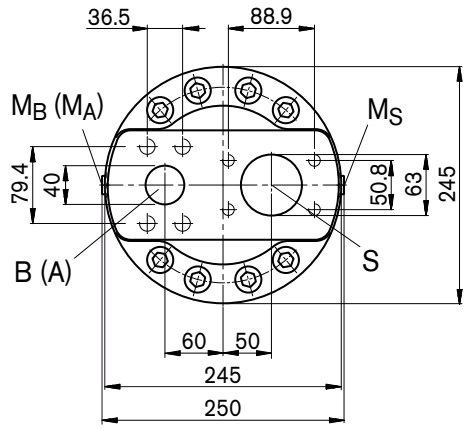
Приводные валы

Z Шлицевой вал
DIN 5480
W60x2x28x9g



P Цил. вал с призматической шпонкой
DIN 6885, AS18x11x100





Точки подключения

Наименование	Подключение для	Стандарт	Размер[3)]	Максимальное давление [бар][4)]	Состояние[8)]
B (A)	Рабочая линия Крепежная резьба A/B	SAE J518[6)] DIN 13	1 1/2 дюйма M16 x 2; глубина 21	400	O
S	Линия всасывания Крепежная резьба	SAE J518[6)] DIN 13	2 1/2 дюйма M12 x 1,75; глубина 17	30	O
T_1	Дренажный трубопровод	DIN 3852[7)]	M33 x 2; глубина 18	3	O[5)]
T_2	Дренажный трубопровод	DIN 3852[7)]	M33 x 2; глубина 18	3	X[5)]
U	Промывка подшипника	DIN 3852[7)]	M14 x 1,5; глубина 12	3	X
M_A, M_B	Измерение рабочего давления	DIN 3852[7)]	M14 x 1,5; глубина 12	400	X
M_S	Измерение давления всасывания	DIN 3852[7)]	M14 x 1,5; глубина 12	30	X

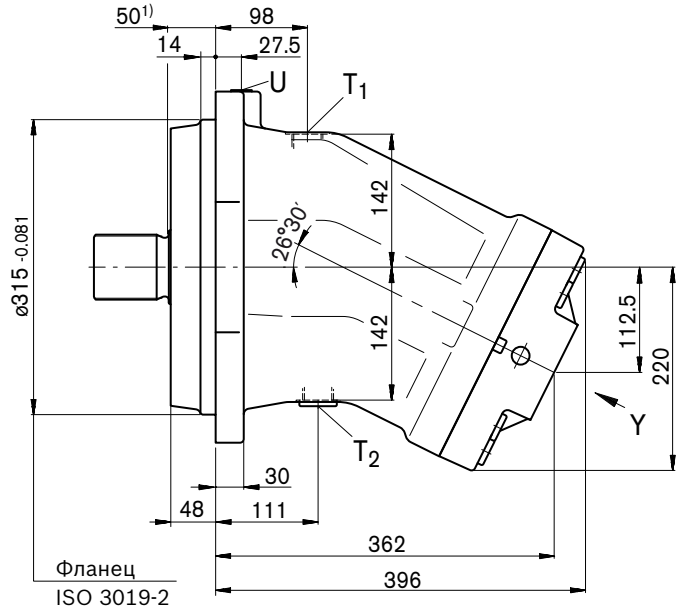
1) До буртика вала
2) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
3) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
4) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
5) В зависимости от монтажного положения требуется присоединение T_1 или T_2 (см. также "Указания по монтажу" на стр. 32 и 33).
6) Только размеры согласно SAE J518, метрическая крепежная резьба отличается от стандарта.
7) Зенковка может быть глубже, чем предусмотрено стандартом.
8) O = требуется присоединение (при поставке заглушено)
X = заглушено (в нормальном режиме работы)

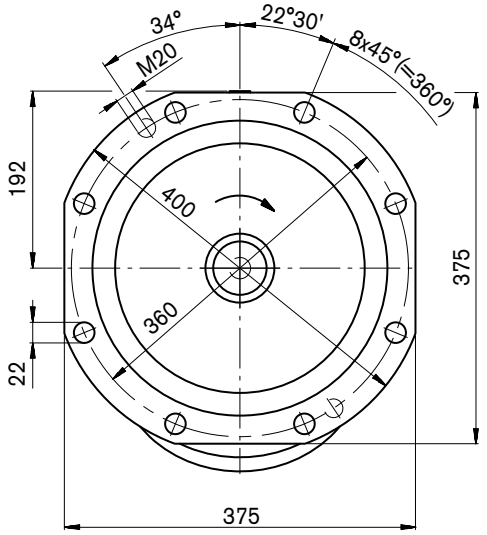
Размеры, номинальный размер 500

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

Присоединение рабочих линий 11 – фланцевые соединения SAE A/B и S сзади

Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)

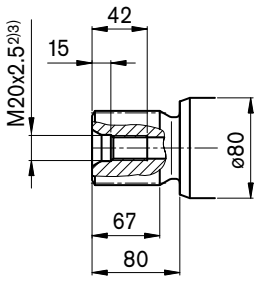




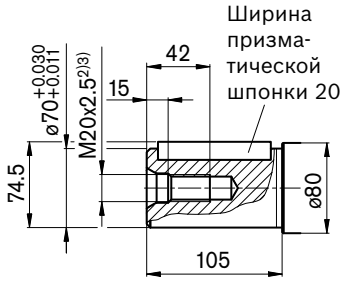
Местный вид Y

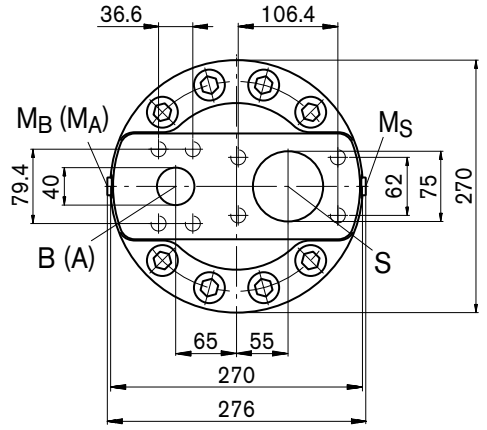
Приводные валы

Z Шлицевой вал
DIN 5480
W70x3x22x9g



P Цил. вал с призматической шпонкой
DIN 6885, AS20x12x100





Точки подключения

Наименование	Подключение для	Стандарт	Размер[3)]	Максимальное давление [бар][4)]	Состояние[8)]
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S	Линия всасывания Крепежная резьба	SAE J518[6)] DIN 13	3 дюйма M16 x 2; глубина 24	30	O
T_1	Дренажный трубопровод	DIN 3852[7)]	M33 x 2; глубина 18	3	O[5)]
T_2	Дренажный трубопровод	DIN 3852[7)]	M33 x 2; глубина 18	3	X[5)]
U	Промывка подшипника	DIN 3852[7)]	M18 x 1,5; глубина 12	3	X
M_A, M_B	Измерение рабочего давления	DIN 3852[7)]	M14 x 1,5; глубина 12	400	X
M_S	Измерение давления всасывания	DIN 3852[7)]	M14 x 1,5; глубина 12	30	X

1) До буртика вала
2) Центрирующее отверстие согласно DIN 332 (резьба согласно DIN 13)
3) Для максимальных моментов затяжки соблюдайте общие указания на странице 34.
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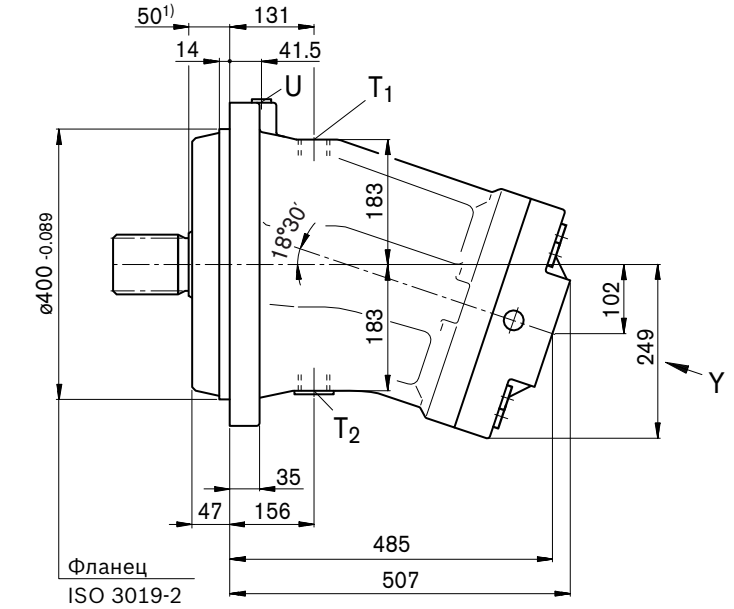
7) Зенковка может быть глубже, чем предусмотрено стандартом.
8) O = требуется присоединение (при поставке заглушено)
X = заглушено (в нормальном режиме работы)

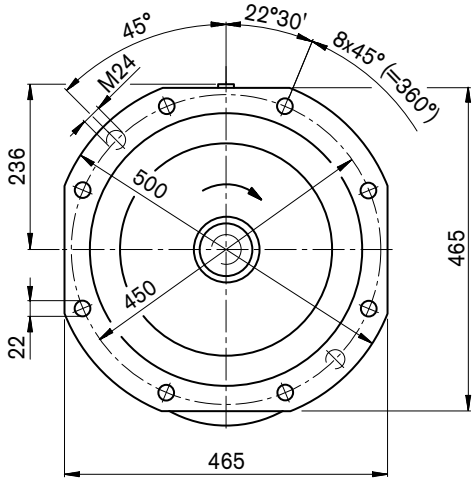
Размеры, номинальный размер 710

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

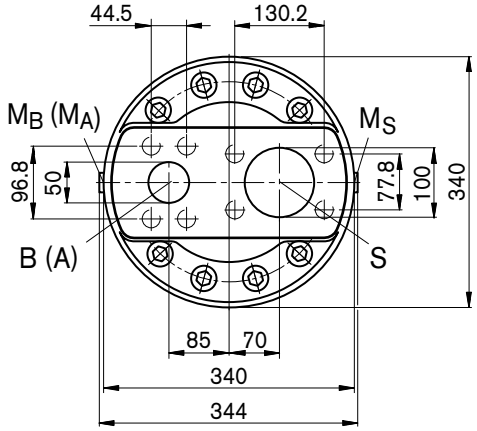
Присоединение рабочих линий 11 – фланцевые соединения SAE A/B и S сзади

Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)



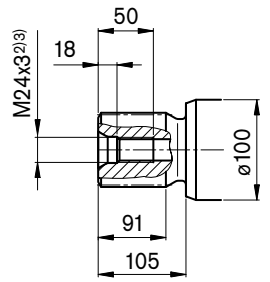


Местный вид Y

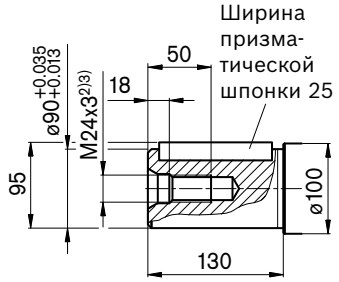


Приводные валы

Z Шлицевой вал
DIN 5480
W90x3x28x9g



P Цил. вал с призматической шпонкой
DIN 6885, AS25x14x125



Точки подключения

Наименование	Подключение для	Стандарт	Размер[3)]	Максимальное давление [бар][4)]	Состояние[8)]
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S	Линия всасывания Крепежная резьба	SAE J518[6)] DIN 13	4 дюйма M16 x 2; глубина 24	30	O
T_1	Дренажный трубопровод	DIN 3852[7)]	M42 x 2; глубина 20	3	O[5)]
T_2	Дренажный трубопровод	DIN 3852[7)]	M42 x 2; глубина 20	3	X[5)]
U	Промывка подшипника	DIN 3852[7)]	M18 x 1,5; глубина 12	3	X
M_A, M_B	Измерение рабочего давления	DIN 3852[7)]	M14 x 1,5; глубина 12	400	X
M_S	Измерение давления всасывания	DIN 3852[7)]	M14 x 1,5; глубина 12	30	X

1) До буртика вала
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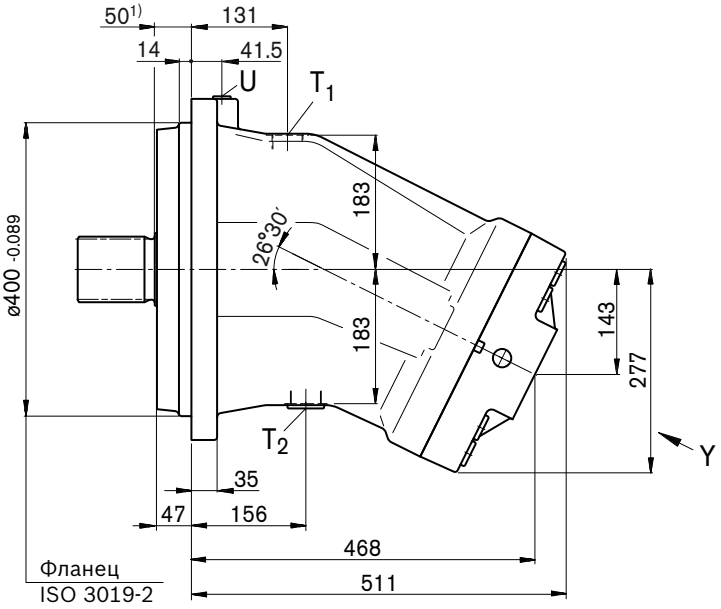
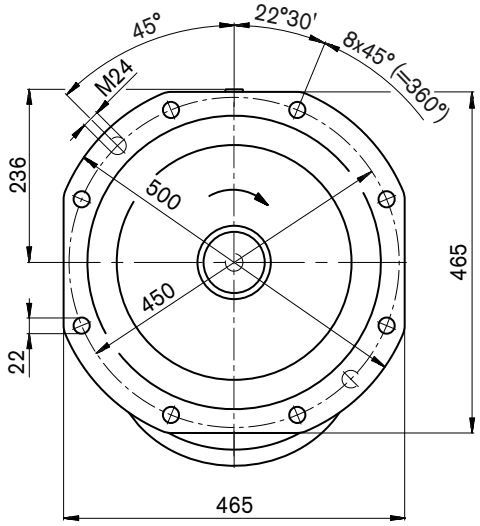
Размеры, номинальный размер 1000

Перед утверждением собственной конструкции следует запросить обязательную к соблюдению схему монтажа. Размеры в мм

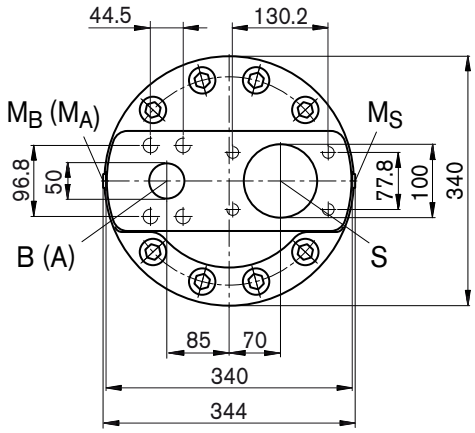
Присоединение рабочих линий 11 – фланцевые соединения SAE A/B и S сзади

Изображение. Направление вращения вправо (для исполнения "направление вращения влево" присоединение рабочих линий повернуто на 180°)



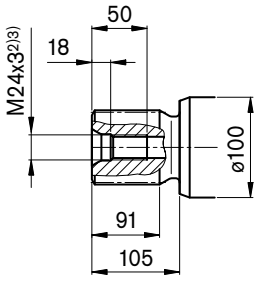


Местный вид Y

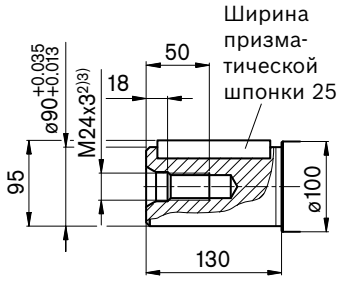


Приводные валы

Z Шлицевой вал
DIN 5480
W90x3x28x9g



P Цил. вал с призматической шпонкой
DIN 6885, AS25x14x125



Точки подключения

Наименование	Подключение для	Стандарт	Размер[3)]	Максимальное давление [бар][4)]	Состояние[8)]
B (A)	Рабочая линия Крепежная резьба A/B	SAE J518[6)] DIN 13	2 дюйма M20 x 2,5; глубина 30	400	
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T_1	Дренажный трубопровод	DIN 3852[7)]	M42 x 2; глубина 20	3	O[5)]
T_2	Дренажный трубопровод	DIN 3852[7)]	M42 x 2; глубина 20	3	X[5)]
U	Промывка подшипника	DIN 3852[7)]	M18 x 1,5; глубина 12	3	X
M_A, M_B	Измерение рабочего давления	DIN 3852[7)]	M14 x 1,5; глубина 12	400	X
M_S	Измерение давления всасывания	DIN 3852[7)]	M14 x 1,5; глубина 12	30	X

1) До буртика вала
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4) В зависимости от области применения возможно возникновение кратковременных пиков давления. Это следует учитывать при выборе измерительных приборов и оборудования.
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6) Только размеры согласно SAE J518, метрическая крепежная резьба отличается от стандарта.
7) Зенковка может быть глубже, чем предусмотрено стандартом.
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X = заглушено (в нормальном режиме работы)

Указания по монтажу

Общие положения

При вводе в эксплуатацию и во время нее аксиально-поршневой агрегат должен быть заполнен рабочей жидкостью, а воздух из него должен быть удален. На это также нужно обращать внимание при длительном простое, т. к. рабочая жидкость может вытечь из аксиально-поршневого агрегата через гидравлические трубопроводы.

За полным заполнением и удалением воздуха необходимо особо следить при монтажном положении "приводным валом вверх", поскольку в данном случае существует опасность работы всухую.

Дренажную жидкость в корпусе необходимо сливать в бак через расположенный в крайней верхней точке канал для присоединения бака (T_1, T_2).

При комбинировании нескольких устройств необходимо следить за тем, чтобы не превышалось соответствующее давление в корпусе. При перепадах давлений в дренажных каналах устройств конструкцию общего дренажного канала необходимо изменить таким образом, чтобы ни при каких обстоятельствах не превышалось минимально допустимое давление в корпусе всех подключенных устройств. Если это невозможно, при необходимости следует проложить отдельные дренажные трубопроводы для соединения с баком.

Чтобы обеспечить низкий уровень шума, все соединительные трубопроводы должны быть гибкими. Также следует избегать установки оборудования над баком.

Линии всасывания и дренажные трубопроводы должны в любом эксплуатационном состоянии входить в бак ниже минимального уровня жидкости. Допустимая высота всасывания h_S определяется суммарным падением давления, однако она не должна превышать значения $h_{S\ макс.}$ = 800 мм. Давление всасывания в точке подключения S во время эксплуатации и при холодном пуске не должно падать ниже минимальной отметки, равной 0,8 бар.

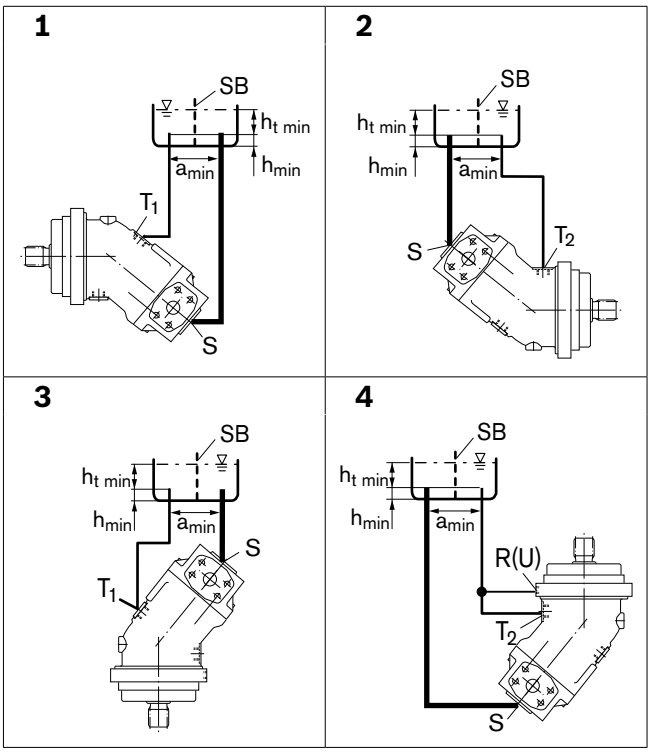
Монтажное положение

См. следующие примеры с 1 по 8.
Другие монтажные положения возможны по запросу.

Рекомендованное монтажное положение: 1 и 2.

Установка под баком (стандартное исполнение)

Установка под баком подразумевает, что аксиально-поршневой агрегат установлен ниже минимального уровня жидкости вне бака.



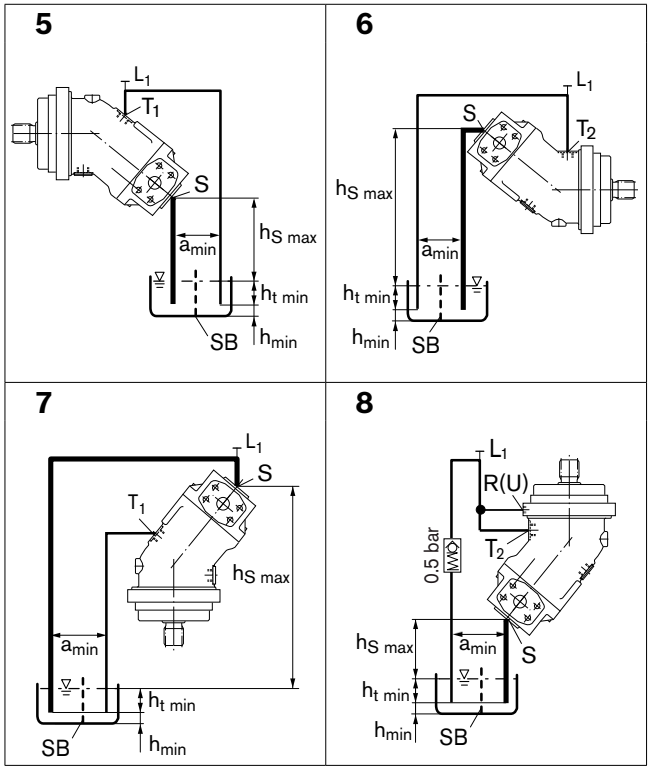
Монтажное положение	Удаление воздуха	Заполнение
1	–	T_1
2	–	T_2
3	–	T_1
4	R (U)	T_2

Указания по монтажу

Установка над баком

Установка над баком подразумевает, что аксиально-поршневой агрегат установлен выше минимального уровня жидкости бака.

Рекомендация для монтажного положения 8 (приводной вал вверху): обратный клапан в дренажном трубопроводе (давление открытия 0,5 бар) может предотвратить слив рабочей жидкости из корпуса мотора.



Монтажное положение	Удаление воздуха	Заполнение
5	L_1	T_1 (L_1)
6	L_1	T_2 (L_1)
7	L_1	T_1 (L_1)
8	R (U)	T_2 (L_1)

L1 Заполнение / удаление воздуха

R Канал удаления воздуха

U Промывка подшипника / канал удаления воздуха

S Всасывающая линия

T1, T2 Дренажный канал

$h_{t\ min}$ Минимально необходимая глубина погружения (200 мм)

h_{min} Минимально необходимое расстояние до дна бака (100 мм)

SB Стабилизационная перегородка (перегородка-волнорез)

$h_{S\ max}$ Максимально допустимая высота всасывания (800 мм)

a_{min} При выборе расположения бака следите за тем, чтобы было обеспечено достаточное расстояние между линией всасывания и дренажным каналом. Это позволит предотвратить прямое всасывание нагретой жидкости обратно в линию всасывания.

Общие указания

– Насос A2FO предназначен для эксплуатации в системе с открытым контуром.

– Проектирование, монтаж и ввод аксиально-поршневого агрегата в эксплуатацию предполагают привлечение обученных специалистов.

– Перед применением аксиально-поршневого агрегата полностью и внимательно прочитайте соответствующую инструкцию по эксплуатации. При необходимости можно заказать ее в компании Bosch Rexroth.

– Во время эксплуатации аксиально-поршневого агрегата и некоторое время после его остановки существует опасность ожога. Необходимо соблюдать меры безопасности (например, надевать защитную одежду).

– В зависимости от эксплуатационного состояния аксиально-поршневого агрегата (рабочее давление, температура жидкости) возможны сдвиги графической характеристики.

– Рабочие присоединения

- Присоединения и крепежная резьба рассчитаны на указанное максимальное давление. Производитель машины или установки должен обеспечить соответствие соединительных элементов и трубопроводов предусмотренным условиям применения (давление, объемный расход, рабочая жидкость, температура) с учетом необходимых факторов безопасности.
- Рабочие и технологические присоединения предусмотрены только для подключения гидравлических линий.

– Необходимо соблюдать все приведенные данные и указания.

– Изделие не допущено к применению в качестве компонента в рамках концепции безопасности общей машины согласно ISO13849.

– В составе гидравлической системы предусмотрен предохранительный клапан.

– Необходимо соблюдать следующие моменты затяжки.

- Арматура: по моментам затяжки применяемой арматуры соблюдайте указания производителя.
- Крепежные винты: для крепежных винтов с метрической резьбой ISO согласно DIN 13 или резьбой согласно ASME B1.1 рекомендуется производить проверку момента затяжки в каждом отдельном случае в соответствии со стандартом VDI 2230.
- Резьбовое отверстие аксиально-поршневого агрегата: максимально допустимые моменты затяжки $M_{G\ max}$ – это максимальные значения для резьбовых отверстий, и их превышение недопустимо. Значения см. в следующей таблице.
- Резьбовые заглушки: для поставляемых в комплекте с аксиально-поршневым агрегатом металлических резьбовых заглушек действительны необходимые моменты затяжки резьбовых заглушек M_V. Значения см. в следующей таблице.

Точки подключения		**Максимально допустимый момент затяжки для резьбовых отверстий $M_{G\ max}$**	**Необходимый момент затяжки для резьбовых заглушек M_V[1)]**	**Размер под ключ внутреннего шестигранника резьбовых заглушек**
Стандарт	**Размер резьбы**			
DIN 3852	M8 x 1	10 Н•м	7 Н•м	3 мм
	M10 x 1	30 Н•м	15 Н•м[2)]	5 мм
	M12 x 1,5	50 Н•м	25 Н•м[2)]	6 мм
	M14 x 1,5	80 Н•м	35 Н•м	6 мм
	M16 x 1,5	100 Н•м	50 Н•м	8 мм
	M18 x 1,5	140 Н•м	60 Н•м	8 мм
	M22 x 1,5	210 Н•м	80 Н•м	10 мм
	M33 x 2	540 Н•м	225 Н•м	17 мм
	M42 x 2	720 Н•м	360 Н•м	22 мм

1) Моменты затяжки действительны для состояния при поставке "без смазки", а также для состояния "слегка смазанного маслом" при сборке.

2) В "слегка смазанном маслом" состоянии M_V уменьшается для M10 x 1 до 10 Н•м и для M12 x 1.5 до 17 Н•м.

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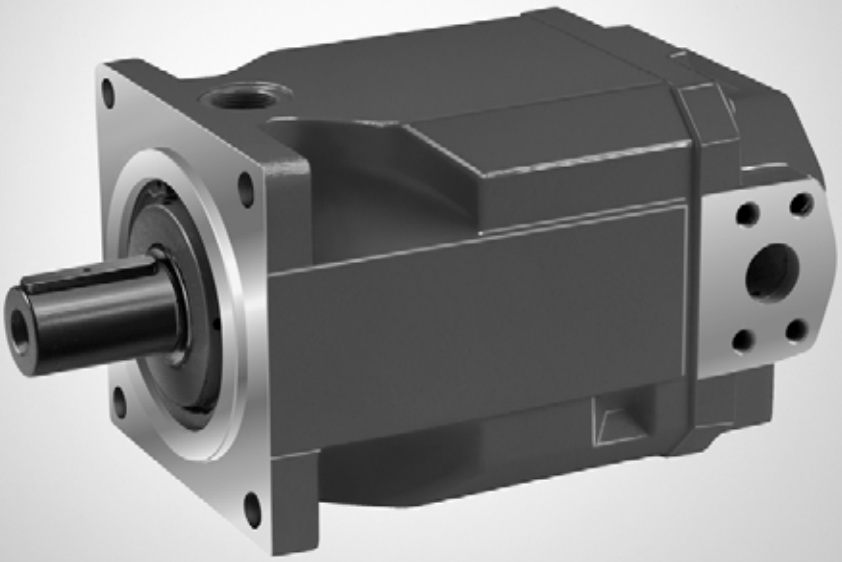
Rexroth
Bosch Group

Axial Piston Fixed Pump A4FO

Series 1 and 3

RE 91455-01-B/06.2011
Replaces: –.–
English

Instruction manual



The data specified above serve to describe the product. Should information be provided on use, these are only examples of applications and suggestions. Information from the catalog are not assured properties. The information given does not release the user from the obligation of own judgment and verification. Our products are subject to a natural wear and aging process.

The cover shows an example application. The product delivered may differ from the image on the cover.

The original instruction manual was created in the German language.

Contents

Contents

1 About this manual

1.1 Validity of the documentation

This documentation is valid for the following product:

- Axial piston fixed pump A4FO Series 1 and 3

This documentation is intended for machine/system manufacturers, fitters and service technicians.

This documentation contains important information on the safe and appropriate installation, transport, commissioning, operation, maintenance, removal and simple troubleshooting of the axial piston unit.

▶ Read this documentation completely and in particular chapter 2 ”Safety instructions“ and chapter 3 ”General instructions on damage to equipment and the product“, before working with the axial piston unit.

1.2 Required and supplementary documentation

▶ Only commission the axial piston unit if the documentation marked with the book symbol 🕮 is available to you and you have understood and observed it.

Table 1: Required and supplementary documentation

	Title	Document number	Document type
🕮	**Order confirmation** Contains the order-related technical data of your axial piston fixed pump A4FO.	–	Order confirmation
🕮	**Installation drawing** Contains the outer dimensions, all connections and the hydraulic circuit diagram for your axial piston fixed pump A4FO.	Please request the installation drawing via your contact person at Bosch Rexroth.	Installation drawing
🕮	**Axial piston fixed pump A4FO** Contains the permissible technical data.	RE 91455	Data sheet
🕮	**Mineral-oil based hydraulic fluid and related hydrocarbons** Describes the requirements on a mineral-oil based hydraulic fluid and related hydrocarbons for the operation with Rexroth hydraulic components, and assists you in selecting a hydraulic fluid for your hydraulic system.	RE 90220	Data sheet
🕮	**Environmentally acceptable hydraulic fluids** Describes the requirements on an environmentally acceptable hydraulic fluid for operation with Rexroth hydraulic components and assists you in selecting a hydraulic fluid for your hydraulic system.	RE 90221	Data sheet
🕮	**Axial piston units for operation with HF hydraulic fluids** Contains additional information on the use of Rexroth axial piston units with HF hydraulic fluids.	RE 90223	Data sheet
	Information of the use of hydrostatic drives at low temperatures Contains additional information on the use of Rexroth axial piston units at low temperatures.	RE 90300-03-B	Manual
	Storage and preservation of axial piston units Contains additional information on storage and preservation.	RE 90312	Data sheet

1.3 Display of information

Standardized safety instructions, symbols, terms and abbreviations are used so that you can use this documentation to work quickly and safely with your axial piston unit. To give you a better understanding they are explained in the sections below.

1.3.1 Safety instructions

Safety instructions are contained in this documentation in chapter 2.6 ”Product-specific safety instructions“ and chapter 3 ”General instructions on damage to equipment and the product“ as well as before a sequence or instruction whenever there is a risk of injury to persons or damage to equipment. The described danger prevention measures must be observed.

Safety instructions are set out as follows:

⚠ SIGNAL WORD

Type and source of danger

Consequences with noncompliance

- Measure for danger prevention
- <List>

- **Safety sign:** draws attention to the danger
- **Signal word:** identifies the degree of the danger
- **Type and source of danger:** identifies the type and source of the danger
- **Consequences:** describes what occurs if the safety instructions are not complied with
- **Precautions:** states how the danger can be avoided

Table 2: Danger classes in accordance with ANSI Z535.6-2006

Safety sign, signal word	Meaning
⚠ DANGER	Identifies a dangerous situation that will result in death or serious injuries if it is not avoided.
⚠ WARNING	Identifies a dangerous situation that may result in death or serious injuries if it is not avoided.
⚠ CAUTION	Identifies a dangerous situation that may result in minor to moderate injuries if it is not avoided.
NOTE	Damage to equipment: the product or the environment may be damaged.

1.3.2 Symbols

The following symbols mark notes that are not safety-relevant but which increase the understanding of the documentation.

Table 3: Meaning of the symbols

Symbol	Meaning
	If this information is disregarded, the product can not be used and/or operated to the optimum extent.
▶	Single, independent step
1. 2. 3.	Numbered instruction: The numbers specify that the steps are completed one after the other.

1.3.3 Designations

This documentation uses the following designations:

Table 4: Designations

Designation	Meaning
A4FO	Axial piston fixed pump, open circuit
Screw plug	Metal screw, pressure-resistant
Protective plug	Made out of plastic, not pressure-resistant, only for transportation

As umbrella term for ”Axial piston fixed pump A4FO“, the designation ”axial piston unit“ will be used in the following.

1.3.4 Abbreviations

This documentation uses the following abbreviations:

Table 5: Abbreviations

Abbreviation	Meaning
DIN	**D**eutsche **I**ndustrie **N**orm (German Institute for Standardization)
ISO	**I**nternational **O**rganization for **S**tandardization
RE	**R**exroth document in the **E**nglish language
VDI 2230	Directive for the systematic calculation of high duty bolted joints and joints with one cylindrical bolt from the VDI (**V**erein **D**eutscher **I**ngenieure – Association of German Engineers)

2 Safety instructions

2.1 About this chapter

The axial piston unit has been manufactured according to the generally accepted rules of current technology. There is, however, still a danger of personal injury or damage to equipment if this chapter and the safety instructions in this documentation are not complied with.

- Read this documentation completely and thoroughly before working with the axial piston unit.
- Keep this documentation in a location where it is accessible to all users at all times.
- Always include the required documentation when you pass the axial piston unit on to third parties.

2.2 Intended use

Axial piston units are hydraulic components, meaning that in their application they are classified neither as complete nor as incomplete machines in the sense of the EU machine directive 2006/42/EC. A component is exclusively intended to form an incomplete or a complete machine together with other components. The component may only be commissioned after it has been installed in the machine/ system for which it is intended and the safety of the entire system has been established in accordance with the machine directive.

The product is intended for the following use:

The axial piston unit is only approved as a pump for hydrostatic drives in open circuit.

- Observe the technical data, application and operating conditions and performance limits as specified in data sheet RE 91455 and in the order confirmation. Information about approved hydraulic fluids can be found in data sheet RE 91455.

The axial piston unit is only intended for professional use and not for private use.

Intended use includes having completely read and understood this documentation, especially chapter 2 ”Safety instructions“.

2.3 Improper use

Any use other than that described as intended use shall be considered as improper and is therefore impermissible.

Bosch Rexroth AG shall accept no liability whatsoever for damage resulting from improper use. The user shall bear all risks arising from improper use.

Similarly, the following foreseeable faulty usages are also considered to be not as intended:

- Using outside the operating parameters approved in the data sheet (unless customer-specific approval has been granted)
- Use for non-approved fluids, e.g. water or polyurethane components
- Modification of factory settings by non-authorized persons
- Use of add/on parts (e.g. mountable filter, control unit, valves) that are not specified Rexroth components
- Using the axial piston unit under water at a depth of more than 10 meters without necessary additional measures, e.g. pressure equalization

- Using the axial piston unit when the exterior pressure is greater than the interior pressure (case pressure)
- Using the axial piston unit in explosive environments unless the component or machine/system has been certified as compliant with the ATEX directive 94/9/EC
- Using the axial piston unit in an aggressive atmosphere
- Using the axial piston unit in aircraft or space craft

2.4 Personnel qualifications

The activities described in this documentation require basic mechanical, electrical and hydraulic knowledge, as well as knowledge of the associated technical terms. For transporting and handling the product, additional knowledge is necessary with regard to working with a lifting device and the corresponding attachment equipment. In order to ensure safe use, these activities may therefore only be carried out by appropriate qualified personnel or an instructed person under the direction and supervision of qualified personnel.

Qualified personnel are those who can recognize possible hazards and institute the appropriate safety measures due to their professional training, knowledge, and experience, as well as their understanding of the relevant regulations pertaining to the work to be done. Qualified personnel must observe the rules relevant to the subject area and have the necessary hydraulic knowledge.

Hydraulic knowledge means, for instance:

- reading and fully understanding hydraulic plans,
- fully understanding in particular the interrelationships regarding safety devices, and
- having knowledge on the function and assembly of hydraulic components.

Bosch Rexroth offers training support for special fields. You can find an overview of the training contents on the Internet at: http://www.boschrexroth.de/didactic.

2.5 General safety instructions

- Observe the applicable accident prevention and environmental protection regulations.
- Observe the safety regulations and provisions of the country in which the product is used/operated.
- Use Rexroth products only when they are in good technical order and condition.
- Observe all notes on the product.
- Persons who install, operate, remove or maintain Rexroth products must not consume any alcohol, drugs or pharmaceuticals that may affect their ability to respond.
- Only use Rexroth original accessories and spare parts to ensure there is no risk to persons from unsuitable spare parts.
- Conform to the technical data and ambient conditions specified in the product documentation.
- If unsuitable products are installed or used in applications that are of relevance to safety, unexpected operating conditions may occur in the application which could result in injury to persons or property damage. For this reason, only use the product in a safety-relevant application if this use is expressly specified and permitted in the product documentation, for example in ex-protection applications or in safety-related parts of a control system (functional safety).

- You may only commission the product if it has been determined that the end product (e.g. machinery or a system) into which the Rexroth products are installed complies with the country-specific provisions, safety regulations and standards of the application.
- A separate pressure relief valve is to be provided in the hydraulic system.

2.6 Product-specific safety instructions

The following safety instructions apply for chapters 6 to 14.

⚠WARNING

Danger from suspended loads!

Danger to life or risk of injury, damage to equipment!

Improper transportation may cause the axial piston unit to fall down lead to injuries e.g. crushing or broken bones or damage to the product.

- Make certain that the forklift truck or lifting device has adequate lifting capacity.
- Never stand under or put you hands under suspended loads.
- Ensure your position is stable during transportation.
- Use your personal protective equipment (e.g. safety glasses, safety gloves, suitable working clothes, safety shoes).
- Use suitable lifting devices for transportation.
- Observe the prescribed position of the lifting strap.
- Observe the national laws and regulations on work and health protection and transportation.

Pressurized machine/system!

Danger to life or risk of injury, serious injuries when working on machines/systems not shutdown! Damage to equipment!

- Protect the complete system against being energized.
- Make sure that the machine/system is depressurized. Please follow the machine/system manufacturer's instructions.
- Do not disconnect any line connections, connections and components when the machine/system is pressurized.
- Switch off all power-transmitting components and connections (electric, pneumatic, hydraulic) in accordance with the manufacturer's instruction and secure them against being switched back on.

Escaping oil mist!

Danger of explosion, danger of fire, allergic reactions, environmental pollution!

- Depressurize the machine/system and repair the leak.
- Only perform welding work then the machine/system is depressurized.
- Keep open flames and ignition sources away from the axial piston unit.
- If axial piston units are to be situated in the vicinity of ignition sources or powerful thermal radiators, a shield must be erected to ensure that any escaped hydraulic fluid can not ignite, and to protect hose lines from premature aging.

Electrical voltage!

Risk of injury due to electric shock or damage to equipment!

- Always set up the relevant part of the machine/system so that it is free of electrical voltage before you install the product or when connecting and disconnecting plugs. Protect the machine/system against being energized.

⚠CAUTION

High noise development in operation!

Danger of hearing damage, deafness!

The noise emission of axial piston units depends on speed, operating pressure and installation conditions. The sound pressure level may rise above 70 dBA during normal application conditions.

- Always wear hearing protection when in the vicinity of the operating axial piston unit.

Hot surfaces on the axial piston unit!

Risk of burns!

- Allow the axial piston unit to cool down sufficiently before touching it.
- Wear heat-resistant protective clothing, e.g. gloves.

Improper routing of cables and lines!

Tripping hazard and damage to equipment!

- Lay cables and lines so that they can not be damaged and nobody can trip over them.

Contact with hydraulic fluid!

Hazard to health/health impairment e.g. eye injuries, skin damage, toxication during inhalation!

- Avoid contact with hydraulic fluids.
- When working with hydraulic fluids, strictly observe the safety instructions provided by the lubricant manufacturer.
- Use your personal protective equipment (e.g. safety glasses, safety gloves, suitable working clothes, safety shoes).
- If hydraulic fluid should, nevertheless, come into contact with your eyes or bloodstream or is swallowed, consult a doctor immediately.

Escaping hydraulic fluid due to machine/system leakage!

Risk of burns and risk of injury due to escaping oil jet!

- Depressurize the machine/system and repair the leak.
- Never attempt to block or seal the leak or oil jet with a cloth.

2.7 Personal protective equipment

The personal protective equipment is the responsibility of the user of the axial piston unit. Observe the safety regulations and provisions of your country.

All components of the personal protective equipment must be intact.

3 General instructions on damage to equipment and the product

The following notes apply for chapters 6 to 14.

NOTE

Danger from improper handling!

Product can be damaged!

- Do not expose the product to an impermissible mechanical load.
- Never use the product as a handle or step.
- Do not place/lay any objects on the product.
- Do not strike the drive shaft of the axial piston unit.
- Do not set/place the axial piston unit on the drive shaft.
- Do not strike sensitive fittings (e.g. sensors or valves).
- Do not strike sealing surfaces (e.g. service line ports).
- Leave the protective covers on the axial piston unit until shortly before the lines are connected.

Damage to equipment due to improper lubrication!

Product can be damaged or destroyed!

- Never operate the axial piston unit with insufficient hydraulic fluid. Make sure in particular that the rotary group has sufficient lubrication.
- When commissioning a machine/system, make sure that the case interior and the service lines of the axial piston unit are filled with hydraulic fluid and remain filled during operation. Air intrusions in the forward drive shaft bearing are to be prevented, especially with the installation position ”drive shaft upwards“.
- Check the hydraulic fluid level in the case interior regularly; if necessary, recommission. With above-reservoir installation, the case interior may drain via the reservoir line after longer standstill periods (air enters via the shaft seal) or via the service line (gap leakage). The bearings are thus insufficiently lubricated at switch on.
- Make certain that the suction line is always filled with hydraulic fluid during commissioning and operation.

Mixing of hydraulic fluids!

Product can be damaged!

- Before installation, remove all fluids from the axial piston unit to prevent mixing with the hydraulic fluid used in the machine/system.
- Any mixing of hydraulic fluids of different manufacturers or different types of the same manufacturer is not permissible in general.

NOTE

Contamination of the hydraulic fluid!

The cleanliness of the hydraulic fluid has a considerable impact on the cleanliness and service life of the hydraulic system. Premature wear and malfunctions!

- Make sure that the working environment at the installation site is fully free of dust and foreign substances in order to prevent contaminants, such as welding beads or metal cuttings, from getting into the hydraulic lines and causing product wear or malfunctions. The axial piston unit must be installed in a clean condition.
- Use only clean connections, hydraulic lines and attachments (e.g. measuring equipment).
- No contaminants may enter the connections when they are plugged.
- Before commissioning, make certain that all hydraulic connections are tight and that all of the connection seals and plugs are installed correctly to ensure that they are leakproof and fluids and contaminants are prevented from penetrating the product.
- Use a suitable filter system to filter hydraulic fluids during filling to minimize solid impurities and water in the hydraulic system.

Improper cleaning!

Product can be damaged!

- Plug all openings with the appropriate protective equipment in order to prevent detergents from entering the hydraulic system.
- Never use solvents or aggressive detergents. Use only water and, if necessary, a mild detergent to clean the axial piston unit.
- Do not point the power washer at sensitive components, e.g. shaft seal, electrical connections and components.
- Use lint-free cloths for cleaning.

Environmental pollution due to incorrect disposal!

Careless disposal of the axial piston unit, the hydraulic fluid and the packaging material could lead to pollution of the environment!

- Dispose of the axial piston unit, hydraulic fluid and packaging in accordance with the national regulations in your country.
- Dispose of the hydraulic fluid in accordance with the applicable safety data sheet for the hydraulic fluid.

Escaping or spilling hydraulic fluid!

Environmental pollution and contamination of the ground water!

- When filling and draining the hydraulic fluid, always place a drip tray under the axial piston unit.
- Use an oil binding agent if hydraulic fluid is spilt.
- Observe the information in the safety data sheet for the hydraulic fluid and the specifications provided by the system manufacturer.

- The warranty only applies to the delivered configuration.
- The entitlement under warranty is rendered void if the product is incorrectly installed, commissioned or operated, as well as in the case of improper use and/or handling.

4 Delivery contents

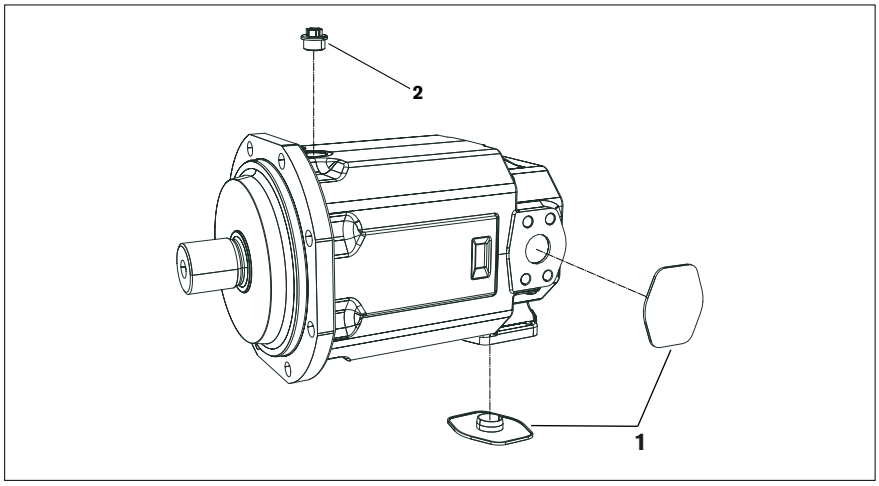


Fig. 1: Axial piston unit

Included in the delivery contents are:

- Axial piston unit as per order confirmation

The following parts are also installed on delivery:

- Protective covers made of plastic (**1**) (metal protective covers are used for painted axial piston units)
- Protective plug/threaded plug (**2**)
- On version with through drive, metallic protective cover and fixing screws (**not illustrated**)

5 Product description

5.1 Performance description

The axial piston fixed pump generates a hydraulic fluid flow. It is designed for mobile and stationary applications.

Refer to data sheet RE 91455 and the order confirmation for the technical data, operating conditions and operating limits of the axial piston unit.

5.2 Product description

The A4FO is a fixed pump with axial piston rotary group in swashplate design for hydrostatic drives in open circuits. Flow is proportional to drive speed and displacement. For axial piston units with swashplate design, the pistons are arranged axially with respect to the drive shaft.

Open circuit

In an open circuit, the hydraulic fluid flows from the reservoir to the hydraulic pump from where it is fed via a directional valve to the consumer, e.g. hydraulic motor. From the consumer, the hydraulic fluid flows back to the reservoir via the directional valve.

5.2.1 Assembly of the axial piston unit

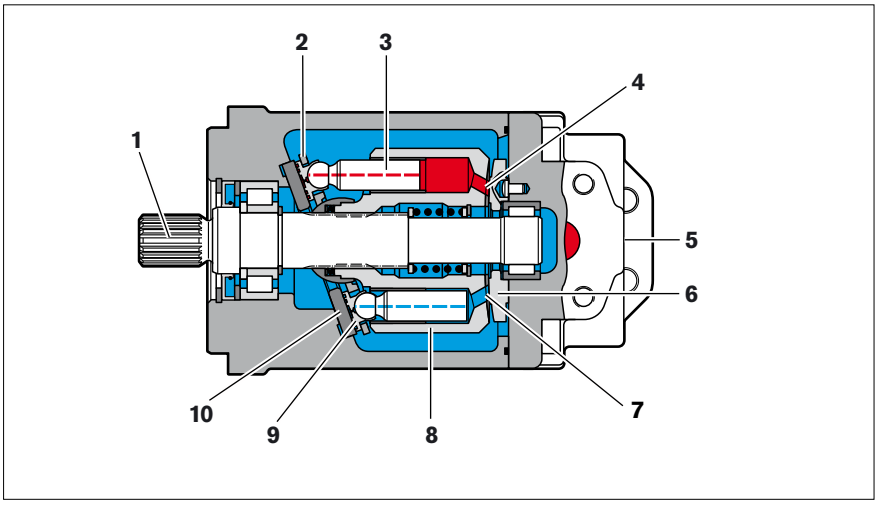


Fig. 2: Assembly of the A4FO

1	Drive shaft	**5**	Port plate	**9**	Slipper pad
2	Retaining plate	**6**	Control plate	**10**	Swashplate
3	Piston	**7**	Suction side		
4	High-pressure side	**8**	Cylinder		

5.2.2 Functional description

Pump

Torque and rotational speed are applied to the drive shaft (**1**) by an engine. The drive shaft is connected by splines to the cylinder (**8**) to set this in motion. With every revolution, the pistons execute one stroke in the cylinder bores. The pistons hold the slipper pads (**9**) onto the glide surface of the swashplate with the retaining plate (**2**) and guide them along. The swashplate setting during a rotation causes each piston to move over the bottom and top dead centers and back to its initial position. Here, hydraulic fluid is fed in and drained out through the two control slots in the control plate (**6**) according to the stroke displacement. On the suction side (**7**) hydraulic fluid flows into the piston chamber as the piston recedes. At the same time, on the high-pressure side (**4**) the fluid is pushed out of the cylinder chamber into the hydraulic system by the pistons.

5.3 Product identification

The axial piston unit can be identified from the name plate. The following example shows an A6VM name plate: A4FO

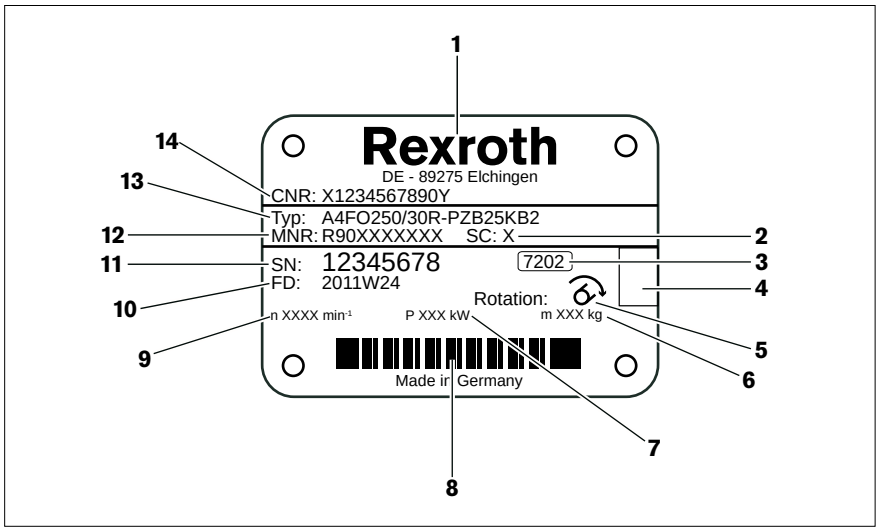


Fig. 3: A4VSO name plate A4FO

1 Manufacturer
2 Sample category (optional)
3 Internal plant designation
4 Specified area for test stamp
5 Direction of rotation (viewed on drive shaft) – here: clockwise
6 Ground (optional)
7 Power
8 Bar code
9 Speed
10 Production date
11 Serial number
12 Material number of the axial piston unit
13 Ordering code
14 Customer material number

6 Transport and storage

- Make sure you conform to the required ambient conditions during transportation and storage, see chapter 6.2 ”Storing the axial piston unit“.

You can find unpacking notes in chapter 7.1 ”Unpacking“.

6.1 Transporting the axial piston unit

The transportation options below exist depending on the weight and duration of the transport:

- Transporting by hand
- Transporting with lifting device (ring screw or lifting strap)

Dimensions and weights

Table 6: Dimensions and weights

Size		16	22	28	40	71	125	250	500
Ground	kg	13.5	13.5	13.5	16.5	34	61	120	220
Width	mm	The dimensions vary with the unit type. The values applicable for your axial piston unit can be found in the installation drawing (request if necessary).							
Height	mm								
Depth	mm								

The weight specifications may vary depending on the unit type.

6.1.1 Transporting by hand

Axial piston units with a weight of up to 15 kg can be transported manually for a short time if necessary.

CAUTION! Danger from heavy loads!

There is a danger of health damage when carrying axial piston units.

- Use suitable lifting, placement and relocation equipment.
- Use your personal protective equipment (e.g. safety glasses, safety gloves, suitable working clothes, safety shoes).
- Do not transport the axial piston unit at sensitive attachment parts (e.g. sensors or valves).
- Carefully place the axial piston unit on the seating to prevent it from being damaged.

6.1.2 Transporting with lifting device

For transporting, the axial piston unit can be connected to a lifting device via a ring screw or a lifting strap.

Transport with ring screw

The axial piston unit can be transported suspended from a ring screw screwed into the drive shaft as long as only outward (pulling) axial forces are applied.

- For all female threads, use a threaded plug from the same system of units and of the correct size.
- To do this, screw a ring screw completely into the thread on the drive shaft. The thread sizes is stated in the installation drawing.
- Make sure that the ring screw can bear the total weight of the axial piston unit plus 20%.

You can hoist the axial piston unit as shown in Fig. 4 with the ring screw screwed into the drive shaft.

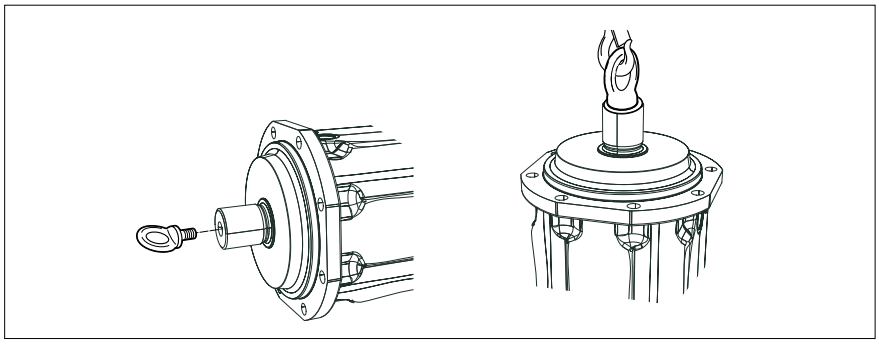


Fig. 4: Fixing the ring screw

Transport with lifting strap

WARNING! Danger from suspended loads!

During transport with a lifting device, the axial piston unit can fall out of the lifting strap and cause injuries.

- Use the widest possible lifting strap.
- Make sure that the axial piston unit is securely fixated with the lifting strap.
- Only guide the axial piston unit by hand for fine positioning and to avoid oscillations.
- Never stand under or put you hands under suspended loads.
- Place the lifting strap around the axial piston unit in such a way that it passes over neither the attachment parts (e.g. valves) nor such that the axial piston unit is hung from attachment parts (see Fig. 5).

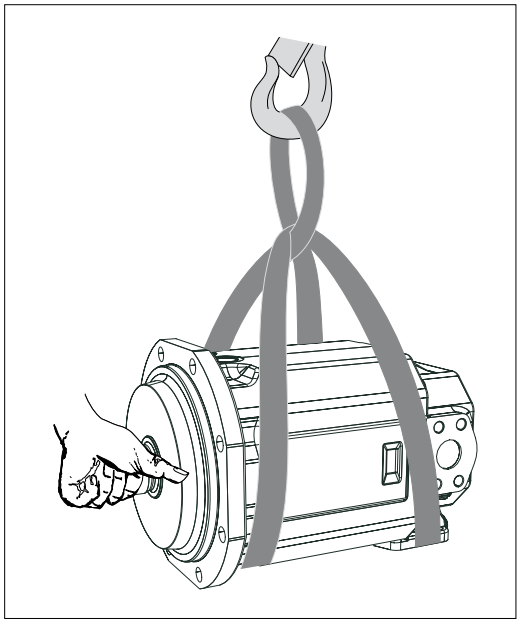


Fig. 5: Transport with lifting strap

6.2 Storing the axial piston unit

Requirement

- The storage areas must be free from corrosive materials and gases.
- To prevent damage to the seals, ozone-forming equipment (e.g. mercury-vapor lamps, high voltage equipment, electric motors, sources of electrical sparks or electrical discharges) must not be operated in storage areas.
- The storage areas must be dry.
- Ideal storage temperature: +5 °C to +20 °C.
- Minimum storage temperature: -50 °C.
- Maximum storage temperature: +60 °C.
- Avoid high light irradiation (e.g. bright windows or direct fluorescent lighting).
- Do not stack axial piston units and store them shock-proof.
- Do not store the axial piston unit on sensitive attachment parts, e.g. speed sensors.
- For other storage conditions, see table 7.

▶ Check the axial piston unit monthly to ensure proper storage.

After delivery

The axial piston units are provided ex-works with corrosion protection packaging (corrosion protection film).

The following table lists the maximum permissible storage times for an originally packed axial piston unit as per data sheet RE 90312.

Table 7: Storage time with factory corrosion protection

Storage conditions	Standard corrosion protection	Long-term corrosion protection
Closed, dry room, uniform temperature between +5 °C and +20 °C. Undamaged and closed corrosion protection film.	Maximum 12 months	Maximum 24 months

The entitlement under warranty is rendered void if the requirements and storage conditions are not adhered to or after expiration of the maximum storage time (see table 7).

Procedure after expiration of the maximum storage time:

1. Check the entire axial piston unit for damage and corrosion prior to installation.
2. Check the axial piston unit for proper function and leaks during a test run.
3. If the storage time exceeds 24 months, the shaft seal ring must be replaced.

After expiry of the maximum storage time, we recommend that you have the axial piston unit inspected by your responsible Bosch Rexroth Service partner.

In the event of questions regarding repair and spare parts, contact your responsible Bosch Rexroth Service partner or the service department of the manufacture's plant for the axial piston unit, see chapter "10.5 Spare parts" for further information.

After removal

If a dismounted axial piston unit is to be stored, it must be preserved against corrosion for the duration of the storage.

The following instructions only refer to axial piston units which are operated with a mineral-oil based hydraulic fluid. Other hydraulic fluids require preservation methods that are specifically designed for them. In such a case, consult with Bosch Rexroth Service, see chapter 10.5 ”Spare parts“ for address.

Bosch Rexroth recommends the following procedure:

1. Clean the axial piston unit, see chapter 10.1 ”Cleaning and care“.
2. Empty the axial piston unit.
3. For storage time up to 12 months: Moisten the inside of the axial piston unit with mineral oil and fill with approx. 100 ml mineral oil.
   For storage time up to 24 months: Fill the axial piston unit with corrosion protection medium VCI 329 (20 ml).
   Fill via the reservoir port **R(L)**, $\mathbf{T_1}$ or $\mathbf{T_2}$, see chapter 7.4 ”Installing the axial piston unit“, Fig. 15 to 17.
4. Seal all ports airproof.
5. Moisten the unpainted surfaces of the axial piston unit with mineral oil or a suitable, easily removed corrosion protection agent, e.g. acid-free grease.
6. Package the axial piston unit airproof together with desiccant in corrosion protection film.
7. Store the axial piston unit so that it is protected against jolts, see ”Requirement“ in this chapter.

7 Installation

Prior to installation, the following documents must be available:

- Installation drawing for axial piston unit (can be obtained from your responsible contact person at Bosch Rexroth)
- Hydraulic circuit diagram for the axial piston unit (in the installation drawing)
- Hydraulic circuit diagram for the machine/system (available from the machine/system manufacturer)
- Order confirmation (contains the order-related technical data for your axial piston unit)
- Data sheet of the axial piston unit (contains the permissible values of technical data)

7.1 Unpacking

The axial piston unit is delivered in a corrosion protection film made of polyethylene material (PE).

CAUTION! Danger from parts falling out!

If the packaging is not opened correctly, parts may fall out and damage the parts or even cause injuries!

- ▶ Place the packaging on a flat and solid surface.
- ▶ Only open the packaging from the top.
- ▶ Remove the packaging from the axial piston unit.
- ▶ Check the axial piston unit for transport damage and completeness, see chapter 4 ”Delivery contents“.
- ▶ Dispose of the packaging according to the environmental regulations of your country.

7.2 Installation conditions

The installation location and position of the axial piston unit essentially determine the procedures during installation and commissioning (such as when filling and air bleeding the axial piston unit).

- ▶ Fix the axial piston unit so that the expected forces and torques can be transferred without any danger. The machine/system manufacturer is responsible for dimensioning the fasteners.
- ▶ Observe the permissible radial forces on the drive shaft when transferring output drive with radial loading (belt drives). If necessary, the belt pulley must be separately mounted.
- ▶ Make certain that the axial piston unit is air bled and filled with hydraulic fluid during commissioning and operation. This is also to be observed following relatively long standstill periods as the axial piston unit may empty via the hydraulic lines.
- ▶ The case drain fluid in the case interior must be directed to the reservoir via the highest reservoir port. Use the line size which is appropriate for the port.
- ▶ Avoid using a check valve in the reservoir line.
  Exception: above-reservoir installation, shaft upward.
  A check valve in the reservoir line (cracking pressure 0.5 bar) can prevent draining via the reservoir line. Note the correct flow direction.
- ▶ To achieve favorable noise values, decouple all connecting lines from all vibration-capable components (e.g. reservoir) using elastic elements.

- Make sure that the suction, reservoir and return lines lead into the reservoir below the minimum fluid level in all operating conditions. This will prevent air from being drawn in and foam from being formed.

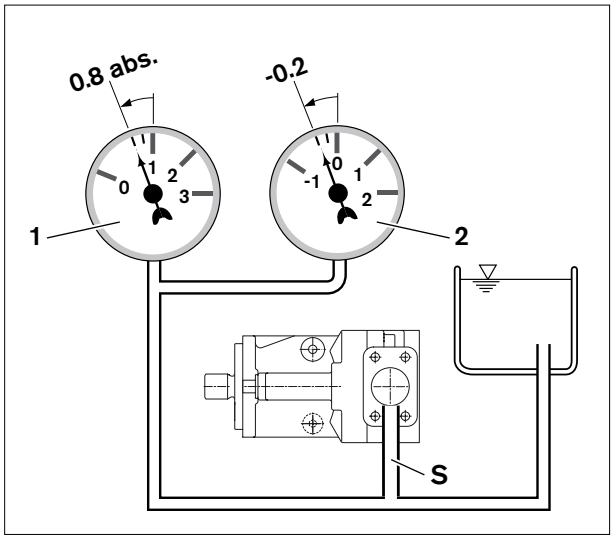


Fig. 6: Suction pressure

1 Absolute pressure gauge

2 Standard pressure gauge

Make sure that a minimum suction pressure of 0.8 bar absolute is present at port "**S**" during operation for all installation positions and installation locations of the axial piston pump; see Fig. 6. See data sheet for pressure values.

The suction conditions improve with below- and inside-reservoir installation.

- Make sure that the working environment at the installation site is fully free of dust and foreign substances. The axial piston unit must be installed in a clean condition. Dirt contamination in the hydraulic fluid can seriously impair the function and service life of the axial piston unit.
- Use lint-free cloths for cleaning.
- Use suitable mild detergents to remove lubricants and other difficult-to-remove contamination. Cleaning agents must not enter the hydraulic system.

7.3 Installation position

The following installation positions are permissible. The shown piping layout illustrates the basic layout.

For sizes 16 to 40, the case drain chamber is internally connected to the suction chamber. A reservoir line from the case to the reservoir is not required.

A reservoir line is required for size 71 to 500.

7.3.1 Below-reservoir installation for size 16 to 40 (standard)

Below-reservoir installation is when the axial piston unit is installed outside of the reservoir below the minimum fluid level.

Recommendation: Fill suction line

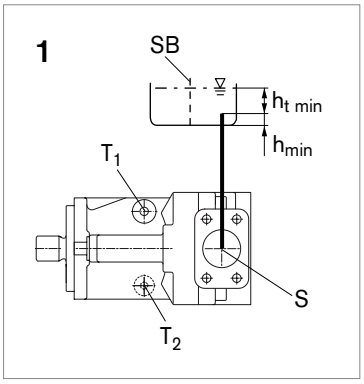


Fig. 7: Below-reservoir installation for size 16 to 40 with installation position 1

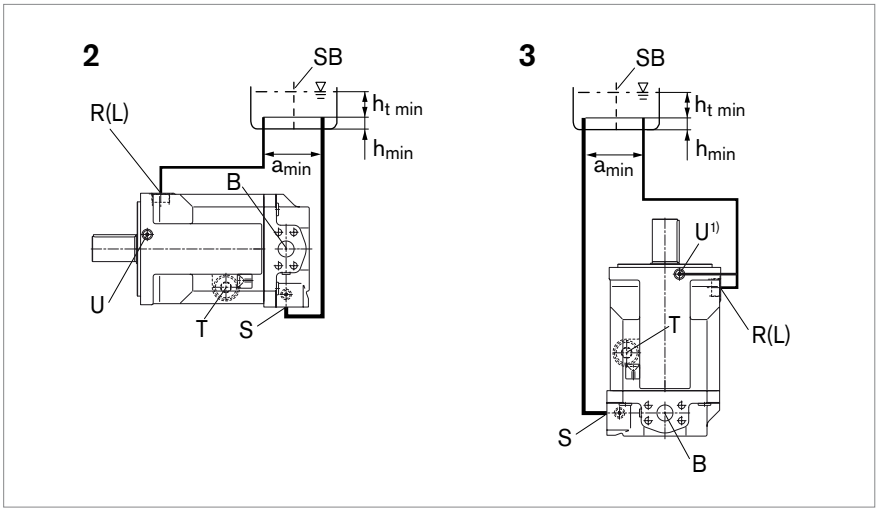
T_1, T_2	Highest reservoir port (case drain)	**$h_{t\ min}$**	Minimum necessary immersion depth (200 mm)
S	Suction port	**h_{min}**	Minimum required distance to reservoir base (100 mm)
SB	Baffle (baffle plate)		

Table 8: Below-reservoir installation for size 16 to 40

Installation position	Air bleed	Filling
1 (drive shaft, horizontal)	Above the highest reservoir port T_1 or T_2	S

7.3.2 Below-reservoir installation for size 71 to 500 (standard)

Below-reservoir installation is when the axial piston unit is installed outside of the reservoir below the minimum fluid level.



[1)] U port not present on size 71. Installation position 3 therefore not permissible.

Fig. 8: Below-reservoir installation for size 71 to 500 with installation position 2–3

R (L)	Fluid filling	$\mathbf{h_{t\ min}}$	Minimum necessary immersion depth (200 mm)
T	Fluid drain	$\mathbf{h_{min}}$	Minimum required distance to reservoir base (100 mm)
S	Suction port	$\mathbf{a_{min}}$	When designing the reservoir, provide for sufficient clearance between the suction line and the reservoir line. This will prevent the heated, return flow from being drawn directly back into the suction line.
U	Flow port		
SB	Baffle (baffle plate)		

Table 9: Below-reservoir installation for size 71 to 500

Installation position	Air bleed	Filling
2 (drive shaft, horizontal)	R (L)	S + R(L)
3 (drive shaft vertically upward)	R(L), U	S + R(L)

7.3.3 Inside-reservoir installation for size 16 to 40

Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid.

If the minimum fluid level is equal to or below the upper edge of the pump, see chapter ”7.3.5 Above-reservoir installation for size 16 to 40“.

NOTE
Danger due to contaminants in reservoir! Product can be damaged! ▶ Remove all plastic parts (e.g. protective caps, covers) before you install the axial piston unit in the reservoir. Make certain that no pieces of these parts remain in the reservoir.

We recommend fitting a suction pipe to the suction port **S**. In such cases, the other ports must be plugged. The axial piston unit case must be filled before fitting the piping and filling the reservoir with hydraulic fluid.

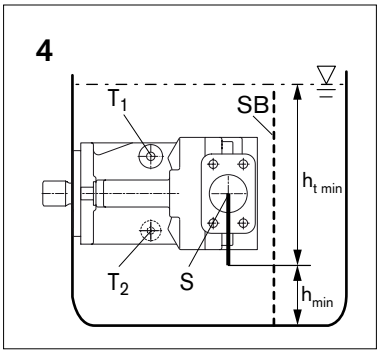


Fig. 9: Inside-reservoir installation for size 16 to 40 with installation position 4

T_1, T_2	Highest reservoir port (case drain)	**$h_{t\ min}$**	Minimum necessary immersion depth (200 mm)
S	Suction port	**h_{min}**	Minimum required distance to reservoir base (100 mm)
SB	Baffle (baffle plate)		

Table 10: Inside-reservoir installation for size 16 to 40

Installation position	Air bleed	Filling
4 (drive shaft, horizontal)	Above the highest reservoir port T_1 or T_2	With piping: The axial piston unit must be filled before fitting the piping. Without piping: Automatically via all open ports, by position below hydraulic fluid level

7.3.4 Inside-reservoir installation for size 71 to 500

Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid.

If the minimum fluid level is equal to or below the upper edge of the pump, see chapter ”7.3.6 Above-reservoir installation for size 71 to 500“.

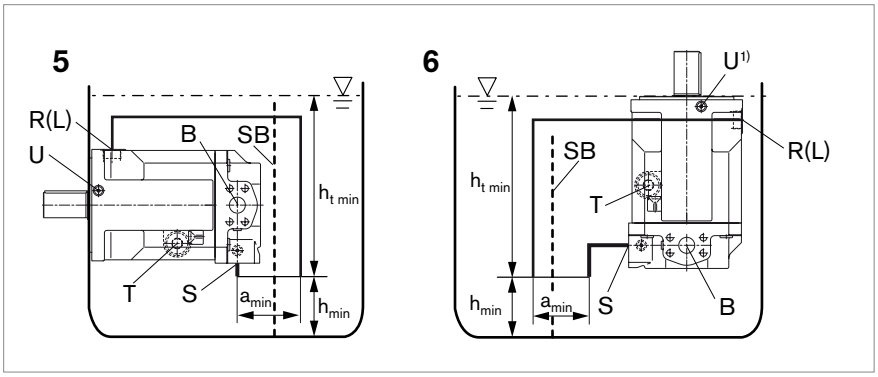
NOTE

Danger due to contaminants in reservoir!

Product can be damaged!

- Remove all plastic parts (e.g. protective caps, covers) before you install the axial piston unit in the reservoir. Make certain that no pieces of these parts remain in the reservoir.

We recommend fitting a suction pipe to the suction port **S** and to fit a pipe to the highest port **R(L)** or **T**. In this case, the other ports must be plugged, except the bearing flushing **U** with the installation position ”drive shaft upward“. The axial piston unit case must be filled before fitting the piping and filling the reservoir with hydraulic fluid.



[1)] U port not present on size 71. Installation position 6 therefore not permissible.

Fig. 10: Inside-reservoir installation for size 71 to 500 with installation position 5–6

R (L)	Fluid filling	$\mathbf{h_{min}}$	Minimum required distance to reservoir base (100 mm)
T	Fluid drain	$\mathbf{a_{min}}$	When designing the reservoir, ensure adequate distance between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.
S	Suction port		
U	Flow port		
SB	Baffle (baffle plate)		
$\mathbf{h_{t\,min}}$	Minimum necessary immersion depth (200 mm)		

Table 11: Inside-reservoir installation for size 71 to 500

Installation position	Air bleed	Filling
5 (drive shaft, horizontal)	via the highest open port R(L)	With piping: The axial piston unit must be filled before fitting the piping. Without piping: Automatically via all open ports, by position below hydraulic fluid level

Installation position	Air bleed	Filling
6 (drive shaft vertically upward)	Via the highest open port R(L) and the bearing flushing U	With piping: The axial piston unit must be filled before fitting the piping. Without piping: Automatically via all open ports, by position below hydraulic fluid level

7.3.5 Above-reservoir installation for size 16 to 40

Above-reservoir installation is when the axial piston unit is installed above the minimum fluid level of the reservoir.

Observe the maximum permissible suction height $\mathbf{h_{S\ max}}$ = 800 mm.
The permissible suction height $\mathbf{h_s}$ is derived from the total pressure loss.

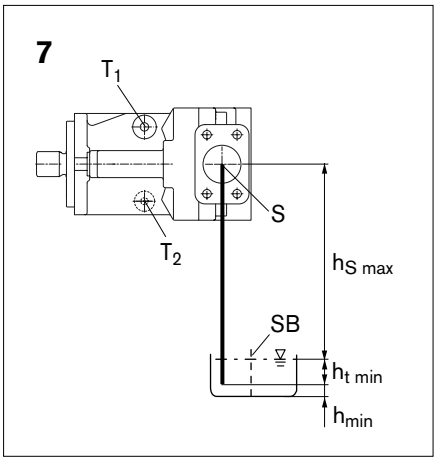


Fig. 11: Above-reservoir installation for size 16 to 40 with installation position 7

T_1, T_2	Highest reservoir port (case drain)	**$h_{t\ min}$**	Minimum necessary immersion depth (200 mm)
S	Suction port	**h_{min}**	Minimum required distance to reservoir base (100 mm)
SB	Baffle (baffle plate)	**$h_{S\ max}$**	Maximum permissible suction height (800 mm)

Table 12: Above-reservoir installation for size 16 to 40

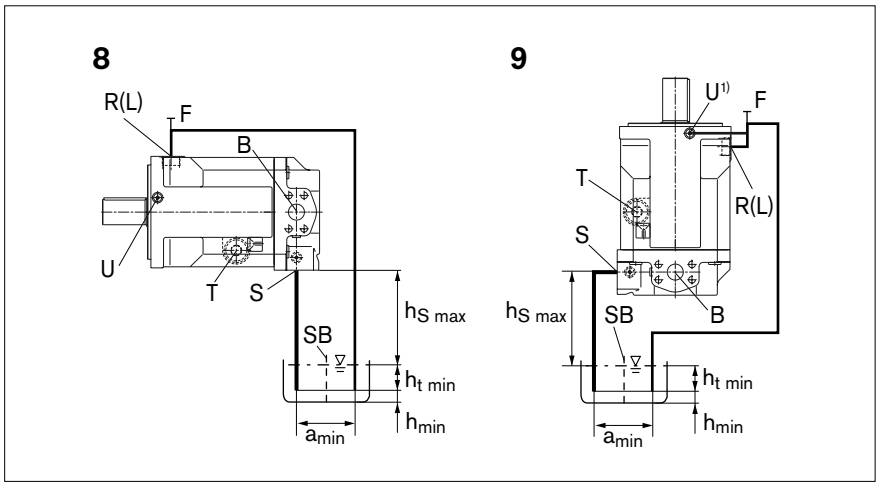
Installation position	Air bleed	Filling
7 (drive shaft, horizontal)	–	T_1

7.3.6 Above-reservoir installation for size 71 to 500

Above-reservoir installation is when the axial piston unit is installed above the minimum fluid level of the reservoir.

For vertical installation (shaft end upward), Rexroth recommends the use of a bearing flushing at port **U** in order to ensure lubrication of the front bearing and of the shaft seal ring.

Observe the maximum permissible suction height $\mathbf{h_{S\ max}}$ = 800 mm.
The permissible suction height $\mathbf{h_s}$ is derived from the total pressure loss.



1) U port not present on size 71. Installation position 9 therefore not permissible.

Fig. 12: Above-reservoir installation for size 71 to 500 with installation position 8–9

F	Filling / air bleeding	$\mathbf{h_{min}}$	Minimum required distance to reservoir base (100 mm)
R (L)	Fluid filling	$\mathbf{h_{S\ max}}$	Maximum permissible suction height (800 mm)
T	Fluid drain	$\mathbf{a_{min}}$	When designing the reservoir, ensure adequate distance between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.
S	Suction port		
U	Flushing port for bearing flushing		
SB	Baffle (baffle plate)		
$\mathbf{h_{t\ min}}$	Minimum necessary immersion depth (200 mm)		

Table 13: Above-reservoir installation for size 71 to 500

Installation position	Air bleed	Filling
8 (drive shaft, horizontal)	F (R(L))	F (R(L))
9 (drive shaft vertically upward)	F (U)	F (R(L))

7.4 Installing the axial piston unit

7.4.1 Preparation

1. Compare the material number and designation (ordering code) with the details in the order confirmation.

If the material number for the axial piston unit does not correspond to the one in the order confirmation, contact Bosch Rexroth Service for clarification, see chapter ”10.5 Spare parts“ for address.

2. Before installation, completely empty the axial piston unit to prevent mixing with the hydraulic fluid used in the machine/system.

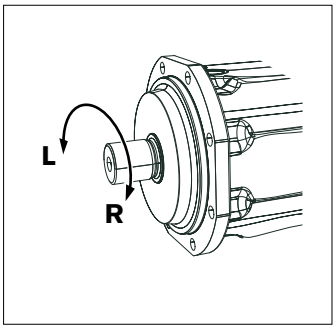


Fig. 13: Direction of rotation

L Counter-clockwise

R Clockwise

3. Check the direction of rotation of the axial piston unit (on the name plate) and make sure that this corresponds to the direction of rotation of the engine.

The direction of rotation as specified on the name plate, see chapter 5.3 ”Identification of the product“, is the direction of rotation of the axial piston unit as viewed to the drive shaft. For information on the direction of rotation of the engine, please refer to the engine manufacturer’s operating instructions.

7.4.2 Dimensions

The installation drawing contains the dimensions for all connections and ports on the axial piston unit. Also observe the manuals provided by the manufacturers of the other hydraulic components when selecting the required tools.

7.4.3 General instructions

Please keep in mind the following general notes for installation of the axial piston unit:

- Note that you can expect certain installation positions to affect the control device. Because of gravity, dead weight and case pressure, minor characteristic displacements and actuating time changes may occur.
- After a short operating time, toothed belts lose a major portion of their pre-tension and thus cause speed variations and torsional vibrations. Torsional vibrations may cause leakages on the shaft seal or increased rotary

angle accelerations of the rotary group of the axial piston unit. Particularly at risk are diesel drives with a small number of cylinders and low flywheel mass.

- V-belt drives without automatic clamper are also critical with regard to speed variations and torsional vibrations. These can also lead to leakages on the shaft seal ring.
  An automatic clamper can lessen the speed variations and vibrations and thus avoid consequential damage.
  – When using toothed belts or v-belts to transfer the input or output drive, always use an automatic tensioning device.
- On the input or output drive of an axial piston unit, a cardan shaft may cause vibrations and impermissible rotary angle accelerations. Depending on the frequency and temperature, they may result in leakage on the shaft seal and damage to the rotary group.
- When multiple units are combined, make sure that the case pressure of each unit is not exceeded. If there are pressure differences at the reservoir ports of the units, the complete reservoir line must be changed so that the lowest permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate reservoir lines must be laid as required.

How to install the axial piston unit depends on the connecting elements to the drive side. The following descriptions explain the installation of the axial piston unit:

- with a coupling
- on a gearbox

7.4.4 Installation with coupling

The method for installing the axial piston unit with a coupling is described below:

NOTE! Danger from improper handling!

Product can be damaged!

▶ Do not install the coupling hub onto the drive shaft of the axial piston unit by striking it.

1. Install the specified coupling half onto the drive shaft of the axial piston unit according to the instructions of the coupling manufacturer.

The drive shaft of the axial piston unit is equipped with a threaded bore. Use this threaded bore to pull the coupling element onto the drive shaft. The size of the threaded bore can be seen in the installation drawing.

2. Remove dirt and contaminants from the installation location.
3. Clamp the coupling hub onto the drive shaft or ensure permanent lubrication of the drive shaft. This prevents the formation of frictional corrosion and the associated wear.
4. Transport the axial piston unit to the installation location.
5. Install the coupling on the drive shaft of the machine/system in accordance with the specifications provided by the coupling manufacturer.

The axial piston unit may not be bolted down until the coupling has been correctly installed.

6. Fix the axial piston unit at the installation location.

7. Align the drive shaft of the axial piston unit and the drive shaft of the machine or system so that there is no angular deviation.
8. Make certain that no impermissible axial and radial forces act on the drive shaft.
9. For bell housing installation, check the coupling axial play through the bell window according to the manufacturer's instructions.
10. Details on the required tools and tightening torques for the fixing screws are available from the machine/system manufacturer.
11. When using flexible couplings, check that the output drive is free of resonance after completing the installation.

7.4.5 Installation on a gearbox

The installation layout for the axial piston unit on a gearbox is described below.

After installing on a gearbox, the axial piston unit is covered and is difficult to access:

- Therefore, before installing, make sure that the centering diameter centers the axial piston unit (observe tolerances) and that no impermissible axial or radial forces act on the drive shaft of the axial piston unit (installation length).
- Protect the drive shaft against frictional corrosion by providing permanent lubrication.
- Fix the axial piston unit at the installation location.

For attachment via gear wheel or helically-toothed shaft

No gearing forces higher than the permissible axial and radial forces are to act on the shaft, if necessary the gear wheel must be supported separately at the gearbox output.

7.4.6 Installation with cardan shaft

To connect the axial piston unit to the engine via a cardan shaft:

1. Position the axial piston unit close to the specified installation location. It should allow enough space for the cardan shaft to fit through on both sides.
2. Position the cardan shaft on the output shaft of the engine.
3. Push the axial piston unit to the cardan shaft and join the cardan shaft to the drive shaft of the axial piston unit.
4. Bring the axial piston unit to the installation position and secure. Details on the required tools and breakaway torques for the fixing screws can be obtained from the system manufacturer if required.

7.4.7 Completing installation

1. Remove any mounted transport screws.

CAUTION! Operation with protective plug!

Operating the axial piston unit with protective plugs may result in injuries or damage to the axial piston unit.

- Before commissioning, remove all protective plugs and replace them with suitable, pressure-proof, metal threaded plugs.

2. Remove the transport protection.
   The axial piston unit is delivered with protective covers (**1**) and protective plug (**2**). They are not pressure-resistant, therefore they have to be removed prior to connection. Use a suitable tool for this to prevent damage to the sealing and functional surfaces. If sealing or functional surfaces are damaged, contact your responsible Bosch Rexroth Service partner or the service department of the manufacture's plant for the axial piston unit.

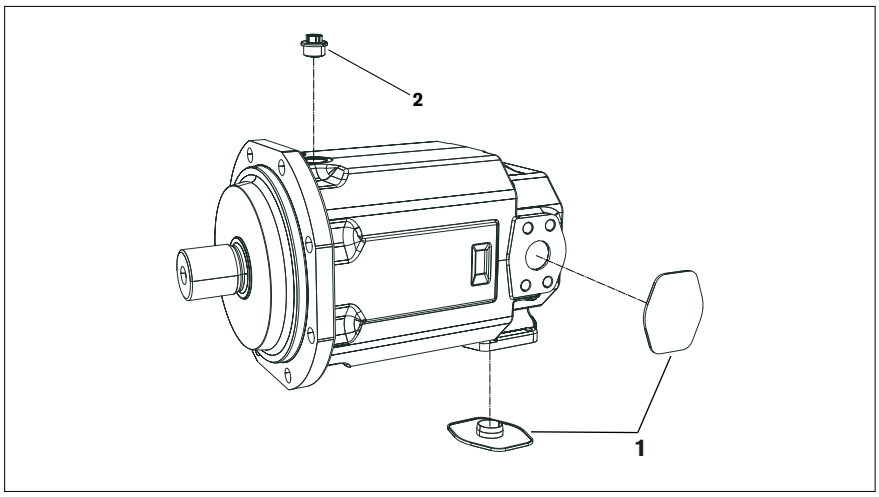


Fig. 14: Removing transport protection

1 Protective covers made of plastic (metallic protective covers are used for painted axial piston units)

2 Protective plug/threaded plug

Ports intended for connecting lines are covered by protective plugs or threaded plugs, which serve as transport protection. All ports required for functional operation must be connected (see table 14 "Ports A4FO Series 1 and 3"). If this requirement is disregarded, malfunction or damage may result. If a port is not connected, it must be plugged with a threaded plug because protective plugs are not pressure-resistant.

3. For versions with through drive, install the auxiliary pump according to the pump manufacturer's instructions.

7.4.8 Hydraulically connecting the axial piston unit

NOTE

Insufficient suction pressure!

Generally, a minimum permissible suction pressure at port "**S**" is specified for axial piston pumps in all installation positions. If the pressure at port "**S**" drops below the specified values, damage may occur which may lead to the axial piston pump being damaged beyond repair!

- Make certain that the necessary suction pressure is not undercut. This is influenced by:
  - the piping (e.g. suction cross-section, pipe diameter, length of suction line)
  - the position of the reservoir
  - the viscosity of the hydraulic fluid
  - if fitted, a filter cartridge or check valve in the suction line (regularly check the level of soiling of the filter cartridge)

The machine/system manufacturer is responsible for dimensioning the lines. The axial piston unit must be connected to the rest of the hydraulic system in accordance with the hydraulic circuit diagram of the machine/system manufacturer.

The ports and fixing threads are designed for the maximum pressure specified in the data sheet. The machine/system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

Connect only hydraulic lines that are appropriate for the axial piston unit port (pressure level, size, system of units).

Notes on routing the lines

Observe the following notes when routing the suction, pressure and reservoir lines.

- Lines and hoses must be installed without pre-charge pressure, so that no further mechanical forces are applied during operation that will reduce the service life of the axial piston unit and, if applicable, the entire machine/system.
- Use suitable seals as sealing material.
- Suction line (pipe or hose)
  - The suction line should be as short and straight as possible.
  - Measure the line cross section of the suction line so that the pressure at the suction port does not drop below the minimum permissible pressure. Make sure that the maximum suction pressure is not exceeded (e.g. when pre-filling).
  - Make sure the connections and connecting elements are air-tight.
  - The hose must be pressure-resistant, also for external air pressure.
- Pressure line
  - For the pressure lines, use only pipes, hoses and connecting elements rated for the operating pressure range specified in data sheet RE 91455 (see table 14).
- Reservoir line
  - Always route the reservoir lines so that the case is constantly filled with hydraulic fluid and to ensure that no air gets through the shaft seal even during extended standstill periods.
  - The case internal pressure must not exceed the limit values listed for the axial piston unit in the data sheet under any operating conditions.
  - The reservoir line joint in the reservoir must always be below the minimum fluid level under all conditions (see chapter "7.3 Installation position").

Risk of mix-ups with threaded connections

The axial piston units are used in application areas with metric as well as with the Anglo-American (inch) system of units.

Both the system of units as well as the size of threaded hole and threaded plug (e.g. locking screw) must match.

Due to the limited options for visually detecting differences, there is a risk of mix-ups.

WARNING! Leaking or popped-out threaded plugs!

If a threaded plug which is of a different measurement system and size with respect to the female thread is pressurized, the threaded plug may loosen itself or even be ejected from the hole in a projectile-like manner. This can result in serious injury and damage to equipment. Hydraulic fluid can be discharged from this leakage point.

- Use the drawings (installation drawing/data sheet) to determine the required threaded plug for each fitting.
- Make certain that there are no mix-ups when installing fittings, fixing screws and threaded plugs.
- For all female threads, use a threaded plug from the same system of units and of the correct size.

Port overview

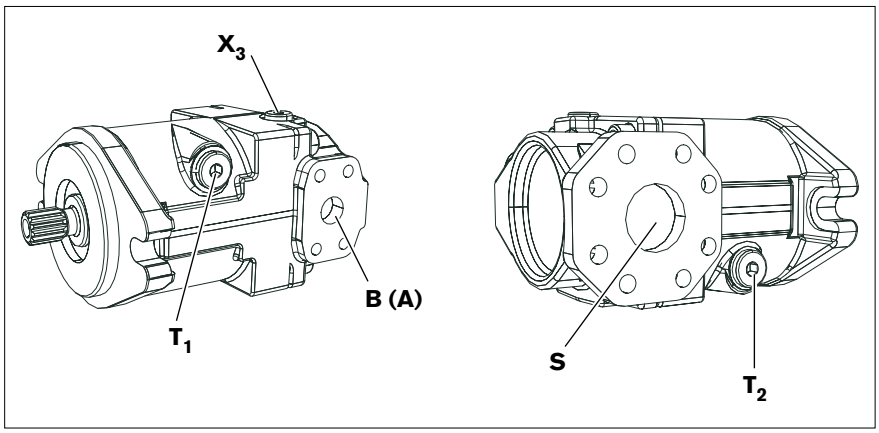


Fig. 15: Port overview A4FO size 16 to 40

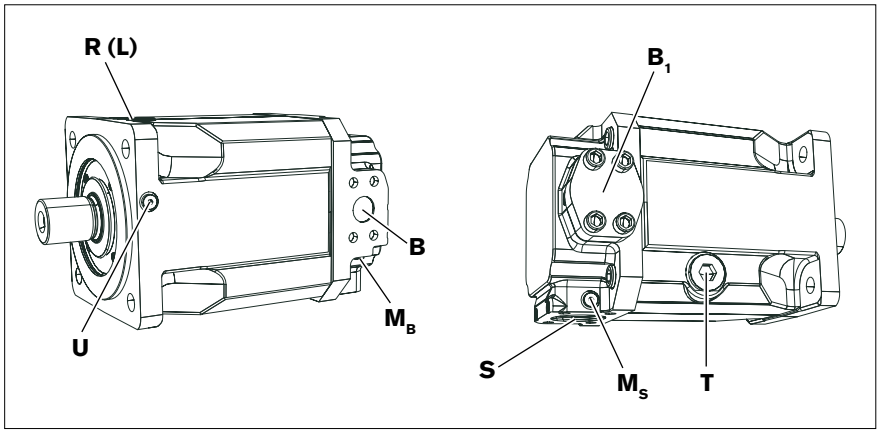


Fig. 16: Port overview A4FO size 250

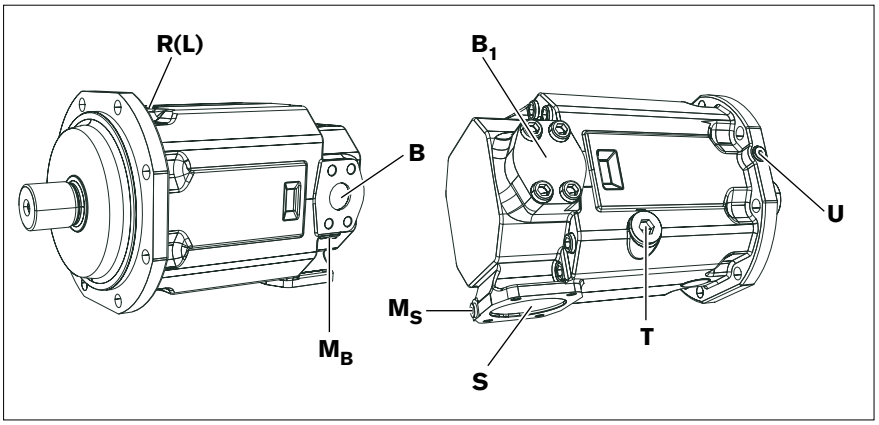


Fig. 17: Port overview A4FO size 500

Table 14: Ports A4FO Series 1 and 3

Designation	Port for	Standard	Maximum pressure [bar][1]		State
			NG 16 to 40	NG 71 to 500	
(A-B)	Service line (high pressure series) Fixing thread B (A)	SAE J518[2] DIN 13	450	400	O
S	Suction line (standard series) Fixing thread S	SAE J518[2] DIN 13	2	30	O
B_1	Service line (high pressure series) Fixing thread B_1	SAE J518[2] DIN 13	–	400	X
R (L)	Fluid filling	DIN 3852[3]	–	4	X
T	Fluid drain	DIN 3852[3]	–	4	X
T_1, T_2	Reservoir line (case drain fluid)	DIN 3852[3]	2	–	O[4]
X_3	Measuring pressure B (A)	DIN 3852[3]	450	–	X
M_B	Measuring, pressure B	DIN 3852[3]	–	400	X
M_S	Measuring pressure S	DIN 3852[3]	–	30	X
U	Flushing port for bearing flushing	DIN 3852[3]	–	4	X

[1] Short term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring equipment and fittings.

[2] Metric fixing thread, deviating from standard.

[3] The countersink may be deeper that specified in the standard.

[4] Depending on installation position, R(L), T_1 or T_2 must be connected, (see chapter "7.3 Installation position")

O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Tightening torques

The following tightening torques apply:

- Threaded hole of the axial piston unit:
  The maximum permissible tightening torques $M_{G\,max}$ are maximum values of the threaded holes and must not be exceeded. For values, see the following table.
- Fittings:
  Observe the manufacturer's instructions regarding the tightening torques of the fittings used.
- Fixing screws:
  For fixing screws with metric ISO thread according to DIN 13 or with thread according to ASME B1.1, we recommend checking the tightening torque in individual cases as per VDI 2230.

- Threaded plugs:
  For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Table 15: Tightening torques of the female threads and threaded plugs

Ports		Maximum permissible tightening torque of the threaded holes $M_{G\ max}$	Required tightening torque of the threaded plugs M_V	WAF hexagon socket for the threaded plugs
Standard	Thread size			
DIN 3852	M14 x 1.5	80 Nm	35 Nm	6 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M27 x 1.5	330 Nm	135 Nm	12 mm
	M33 x 2	540 Nm	225 Nm	17 mm
	M42 x 2	720 Nm	360 Nm	22 mm
	M48 x 2	900 Nm	400 Nm	24 mm

Procedure To connect the axial piston unit to the hydraulic system:

1. Remove the threaded plugs at the ports at which the connections are to be made according to the hydraulic circuit diagram.
2. Make certain that the sealing surfaces of the hydraulic ports and functional surfaces are not damaged.
3. Use only clean hydraulic lines or flush them before installation. (Observe chapter 7.5 ”Perform flushing cycle“ when you flush the entire system.)
4. Connect the lines in accordance with the installation drawing and the machine or system circuit diagram. Check whether all ports are piped up or plugged with threaded plugs. With inside-reservoir installation, the axial piston unit case must be filled before fitting the piping and filling the reservoir with hydraulic fluid.
5. Correctly tighten the union nuts for the fittings and flanges (observe tightening torques!). Mark all correctly tightened fittings, e.g. with a permanent marker.
6. Check all pipes and hose lines and every combination of connecting pieces, couplings or connecting points with hoses or pipes to ensure they are in condition for safe working.

Relationship between direction of rotation and flow direction:
Clockwise rotation: **S** to **B**
Counter-clockwise rotation: **S** to **A** (size 16 to 40)
S to **B** (size 71 bis 500)

7.5 Performing flushing cycle

In order to remove foreign particles from the system, Bosch Rexroth recommends a flushing cycle for the entire system. To avoid internal contamination, the axial piston unit must not be included in the flushing cycle.

The flushing cycle must be performed with an additional flushing unit. Follow the instructions of the flushing unit’s manufacturer for the exact procedure during the flushing cycle.

8 Commissioning

WARNING

Danger while working in the danger zone of a machine/system!

Danger to life, risk of injury or serious injuries!

- Pay attention to and rectify potential danger sources before operating the axial piston unit.
- Nobody may stand in the danger zone of the machine/system.
- The emergency stop button for the machine/system must be within the operator's reach.
- Always follow the instructions of the machine/system manufacturer during commissioning.

CAUTION

Commissioning of an incorrectly installed product!

Risk of injury and damage to equipment!

You can injure yourself on incorrectly installed products or damage the product.

- Make sure that all electrical and hydraulic ports are connected or plugged.
- Only commission a completely installed product.

8.1 First commissioning

During all work for commissioning the axial piston unit, observe the general safety instructions and intended use in chapter 2 "Safety instructions".

- Connect the gauge for the operating pressure, case pressure and suction pressure to the specified measuring points on the axial piston unit or in the hydraulic system, to check the technical data at first operation.
- During the commissioning process, monitor the temperature of the hydraulic fluid in the reservoir to ensure that it lies within the permissible viscosity limits.

8.1.1 Filling the axial piston unit

Professional filling and air bleeding is necessary to prevent damage to the axial piston unit and to maintain correct function.

The axial piston unit should be filled with a filling unit (10 μm filter grade). The axial piston unit must not be operated while it is being filled by the filling unit.

Use only a hydraulic fluid that conforms to the following requirements:

You can find details of the minimum requirements on hydraulic fluids in Bosch Rexroth data sheets RE 90220, RE 90221 and RE 90223. You can find the title of the data sheets in table 1 "Required and supplementary documentation". You can find details of permissible and optimal viscosity in data sheet RE 91455.

To ensure the functional reliability of the axial piston unit, cleanliness level 20/18/15 according to at least ISO 4406 is necessary for the hydraulic fluid. At very high hydraulic fluid temperatures (+90 °C to maximum +115 °C), cleanliness level 19/17/14 according to at least ISO 4406 is necessary. For permissible temperatures, see data sheet RE 91455.

1. Place a drip tray under the axial piston unit to collect any hydraulic fluid that may escape.

NOTE! Contaminated hydraulic fluid!

The cleanliness levels of hydraulic fluids on delivery do not normally conform to the requirements for our components.

- Use a suitable filter system to filter hydraulic fluids during filling to minimize solid impurities and water in the hydraulic system.

2. Fill and air bleed the axial piston unit via the appropriate ports, see chapter ”7.3 Installation position“. The hydraulic lines of the system must also be filled.

NOTE! Damage to equipment due to improper lubrication!

Product can be damaged or destroyed!

- When using a shut-off valve in the suction and/or reservoir line, make sure that the input of the axial piston unit can only be started when the shut-off valves are open.

3. When using a shut-off valve in the suction and/or reservoir line, only operate the axial piston unit when the shut-off valves are open.
4. Test the direction of rotation of the engine. To do this, rotate the engine briefly at the lowest rotational speed (inching). Make sure that direction of rotation of the axial piston unit matches the details on the name plate, see also chapter ”5.3 Product identification“, Fig. 3: Name plate.
5. Operate the axial piston pump at a lower speed (starter speed for internal combustion engines or inching operation for electric motors) until the hydraulic system is completely filled and bled. To inspect, drain the hydraulic fluid at the reservoir port and wait until it drains without bubbles.

8.1.2 Testing the hydraulic fluid supply

The axial piston unit must always have a sufficient supply of hydraulic fluid. For this reason, the supply of hydraulic fluid must be ensured at the start of the commissioning process.

When you test the hydraulic fluid supply, constantly monitor the noise development and check the hydraulic fluid level in the reservoir. If the axial piston unit becomes louder (cavitation) or the case drain fluid is discharged with bubbles, this is an indication that the axial piston unit is not being sufficiently supplied with hydraulic fluid.

Notes on troubleshooting can be found in chapter 14 ”Troubleshooting“.

To test the hydraulic fluid supply:

1. Allow the engine to run at the lowest speed. The axial piston unit must be operated without load. Pay attention to leakage and noise.
2. Check the axial piston unit’s reservoir line during the test. The case drain fluid should not contain any bubbles.
3. Increase the load and check whether the operating pressure rises as expected.
4. Carry out a leak test to ensure that the hydraulic system is sealed and can withstand the maximum pressure.
5. Check the suction pressure at port ”**S**“ of the axial piston pump at nominal speed. Refer to data sheet RE 91455 for the permissible value.
6. At maximum pressure, check the case drain pressure at port **R (L)**, $\mathbf{T_1}$ or $\mathbf{T_2}$. Refer to data sheet RE 91455 for the permissible value.

8.1.3 Performing functional test

WARNING

Incorrectly connected axial piston unit!

Mixing up the ports will lead to malfunctions (e.g. lift instead of lower) and thus to corresponding danger to persons and equipment!

- Before the functional test, check whether the piping specified in the hydraulic circuit diagram has been installed.

Once you have tested the hydraulic fluid supply, you must perform a functional test on the machine/system. The functional test should be performed according to the instructions of the machine/system manufacturer.

The axial piston unit is checked for functional capability before delivery according to the technical data. During commissioning, it must be ensured that the axial piston unit was installed properly in the machine/system.

- After starting the engine, check in particular the specified pressures, e.g. system pressure and case pressure.
- If necessary, disconnect the gauge and plug the ports with threaded plugs.

8.2 Running-in phase

NOTE

Damage to equipment by insufficient viscosity!

An increased hydraulic fluid temperature may reduce the viscosity values by too much and damage the product!

- Monitor the operating temperature during the running-in phase, e.g. by measuring the case drain temperature.
- Reduce the loading (pressure, rpm) of the axial piston unit if impermissible operating temperatures and/or viscosities occur.
- Operating temperatures that are too high indicate faults that have to be analyzed and cleared.

The bearings and sliding surfaces are subject to a running-in phase. The increased friction at the start of the running-in phase results in increased heat development which decreases with increasing operating hours. The volumetric and mechanical-hydraulic efficiency increases as well through the conclusion of the running-in phase of approx. 10 operating hours.

To ensure that contamination in the hydraulic system does not damage the axial piston unit, Bosch Rexroth recommends the following procedure after the running-in phase:

- After the running-in phase, have a hydraulic fluid specimen analyzed for the required cleanliness level.
- Change the hydraulic fluid if the required cleanliness level is not reached. If a laboratory test is not carried out after the running-in phase, Bosch Rexroth recommends the hydraulic fluid be changed.

8.3 Recommissioning after standstill

Depending on the installation conditions and ambient conditions, changes may occur in the hydraulic system which make recommissioning necessary.

Among others, the following criteria may make recommissioning necessary:

- Air and/or water in the hydraulic system
- Old hydraulic fluid
- Other contamination

▶ Before recommissioning, proceed as described in chapter 8.1 ”First commissioning“.

9 Operation

The product is a component which requires no settings or changes during operation. For this reason, this chapter of the manual does not contain any information on adjustment options. Use the product only within the performance range provided in the technical data. The machine/system manufacturer is responsible for the proper project planning of the hydraulic system and its control.

10 Maintenance and repair

NOTE
Inspection and maintenance work carried out too late! Damage to equipment! ▶ Carry out the specified inspection and maintenance work at the intervals described in this manual.

10.1 Cleaning and care

NOTE
Damage to seals and electrical system by mechanical effects! The water jet of a power washer may damage the seals and electrical system of the axial piston unit! ▶ Do not point the power washer at sensitive components, e.g. shaft seal, electrical connections and components.

For cleaning and care of the axial piston unit, observe the following:

- Check whether all seals and fittings on the connections are securely seated to ensure that no moisture can penetrate into the axial piston unit during cleaning.
- Use only water and, if necessary, a mild detergent to clean the axial piston unit. Never use solvents or aggressive detergents.
- Remove coarse external dirt and keep sensitive and important components, such as solenoids, valves, indicators and sensors, clean.

10.2 Inspection

In order to enable long and reliable operation of the axial piston unit, Bosch Rexroth recommends testing the hydraulic system and axial piston unit on a regular basis, and documenting and archiving the following operating conditions:

Table 16: Inspection schedule

Task to be carried out		Interval
Hydraulic system	Check level of hydraulic fluid in the reservoir.	Daily
	Check the operating temperature at a comparable load condition at the reservoir port and in the reservoir.	Weekly
	Conduct analysis of hydraulic fluid: viscosity, aging and dirt contamination	Yearly or every 2000 operating hours (whichever occurs first)
Axial piston unit	Check axial piston unit for leakage. Early detection of hydraulic fluid loss can help to find errors on the machine/system and to rectify them. For this reason, Bosch Rexroth recommends that the axial piston unit and system are always kept in a clean condition.	Daily
	Check axial piston unit for unusual noise development.	Daily
	Check fasteners for tight seating. All fasteners have to be checked when the hydraulic system is switched off, depressurized and cooled down.	Monthly

10.3 Maintenance

The axial piston unit is low maintenance when used properly.

The service life of the axial piston unit is heavily dependent on the quality of the hydraulic fluid. For this reason, we recommend changing the hydraulic fluid at least once per year or every 2000 operating hours (which ever occurs first) or having it analyzed by the hydraulic fluid manufacturer or a laboratory to determine its suitability for further use.

The service life of the axial piston unit is limited by the service life of the bearings fitted. The service life based on the load cycle can be requested from the responsible Bosch Rexroth Service partner, see chapter 10.5 ”Spare parts“ for address. Based on these details, a maintenance period is to be determined by the system manufacturer for the replacement of the bearings and included in the maintenance schedule of the hydraulic system.

10.4 Repair

Bosch Rexroth offers a comprehensive range of services for the repair of Rexroth axial piston units.

Repairs on the axial piston unit may only be performed by service centers certified by Bosch Rexroth.

- Use exclusively original spare parts from Rexroth to repair the Rexroth axial piston units, otherwise the functional reliability of the axial piston unit can not be assured and you lose your entitlement under warranty.

In the event of questions regarding repair, contact your responsible Bosch Rexroth Service partner or the service department of the manufacture’s plant for the axial piston unit, see chapter ”10.5 Spare parts“ for further information.

10.5 Spare parts

⚠CAUTION

Use of unsuitable spare parts!

Spare parts that do not meet the technical requirements specified by Bosch Rexroth may cause personal injury or property damage!

- Use exclusively original spare parts from Rexroth to repair the Rexroth axial piston units, otherwise the functional reliability of the axial piston unit can not be assured and you lose your entitlement under warranty.

The spare parts lists for axial piston units are order specific. When ordering spare parts, quote the material and serial number of the axial piston unit as well as the material numbers of the spare parts.

Address all questions regarding spare parts to your responsible Bosch Rexroth Service partner or the service department of the manufacture's plant for the axial piston unit.

Details on the manufacture's plant are available on the axial piston unit's name plate.

Bosch Rexroth AG
Glockeraustraße 4
D-89275 Elchingen, Germany
Tel. +49-7308-82-0
Fax +49-711-811-513-9382
svm.support@boschrexroth.de

Bosch Rexroth AG
An den Kelterwiesen 14
72160 Horb a.N., Germany
Tel. +49 (0) 74 51-92-0
Fax +49 (0) 711-811-513-93 82
svm.support@boschrexroth.de

For the addresses of foreign subsidiaries, please refer to
`www.boschrexroth.com/addresses`

11 Removal and replacement

11.1 Required tools

Removal can be performed using standard tools. No special tools are necessary.

11.2 Preparing for removal

1. Decommission the entire system as described in the instruction manual for the machine or system.
   - Relieve pressure in the hydraulic system according to the instructions of the machine or system manufacturer.
   - Make certain that the relevant system components are not under pressure or voltage.
2. Protect the complete system against being energized.

11.3 Removing the axial piston unit

Proceed as follows to remove the axial piston unit:

1. Check whether the hydraulic system is depressurized.
2. Allow the axial piston unit to cool down until it can be removed without danger.
3. For below-reservoir installation, before removing the axial piston unit from the complete system, seal the connection to the reservoir or drain the reservoir.
4. Place a drip tray under the axial piston unit to collect any hydraulic fluid that may escape.
5. Loosen the lines and collect the escaping hydraulic fluid in the drip tray.
6. Remove the axial piston unit. Use a suitable lifting device.
7. Completely empty the axial piston unit.
8. Plug all openings.

11.4 Preparing the components for storage or further use

▶ Proceed as described in chapter ”6.2 Storing the axial piston unit“.

12 Disposal

Careless disposal of the axial piston unit, the hydraulic fluid and the packaging material could lead to pollution of the environment.

Observe the following points when disposing of the axial piston unit:

1. Completely empty the axial piston unit.
2. Dispose of the axial piston unit and packaging material in accordance with the national regulations in your country.
3. Dispose of the hydraulic fluid according to the national regulations of your country. Also observe the applicable safety data sheet for the hydraulic fluid.
4. Remove the axial piston unit into its individual parts and properly recycle these parts.
5. Separate according to, for instance:
   - Cast parts
   - Steel
   - Aluminum
   - Non-ferrous metal
   - Electronic waste
   - Plastic
   - Seals

13 Extension and conversion

Do not modify the axial piston unit.

The Bosch Rexroth warranty only applies for the delivered configuration. In case of conversion or extension, the entitlement under warranty will be rendered void.

14 Troubleshooting

The following table may assist you in troubleshooting. The table makes no claim for completeness.

In practical use, problems which are not listed here may also occur.

14.1 How to proceed for troubleshooting

- Always act systematically and targeted, even under pressure of time. Random and imprudent removal and a readjustment of settings could result in the inability to ascertain the original failure cause.
- First obtain a general overview of how your product works in conjunction with the entire system.
- Try to determine whether the product worked properly in conjunction with the entire system before the error occurred.
- Try to determine any changes of the entire system in which the product is integrated
  - Were there any changes to the product's application conditions or operating range?
  - Has maintenance work recently been carried out? Is there an inspection or maintenance log?
  - Were changes (e.g. conversions) or repairs made to the complete system (machine/system, electrics, control) or on the product? If yes, which?
  - Has the hydraulic fluid been changed?
  - Was the product or machine operated as intended?
  - How did the malfunction appear?
- Try to get a clear idea of the error cause. Directly ask the (machine) operator.
- Document the work carried out.
- If you cannot rectify the error, contact one of the contact addresses which can be found under:
  www.boschrexroth.com/addresses.

14.2 Malfunction table

Table 17: Axial piston unit malfunction table

Fault	Possible cause	Remedy
Unusual noises	Drive speed too high.	Machine/system manufacturer.
	Wrong direction of rotation.	Ensure correct direction of rotation.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed axial piston unit, fill suction line with hydraulic fluid.
		Remove contaminants from the suction line.
	Improper fixing of the axial piston unit.	Check the fixing of the axial piston unit according to the specifications of the machine/ system manufacturer. Observe tightening torques.
	Improper fixing of the attachment parts, e.g. coupling and hydraulic lines.	Fix attachment parts according to the information provided by the coupling or fitting manufacturer.
	Mechanical damage to the axial piston unit (e.g. bearing damage).	Exchange axial piston unit, contact Bosch Rexroth Service.
No or insufficient flow	Faulty mechanical drive (e.g. defective coupling).	Machine/system manufacturer.
	Drive speed too low.	Machine/system manufacturer.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed axial piston unit, fill suction line with hydraulic fluid.
		Remove contaminants from the suction line.
	Hydraulic fluid not in optimum viscosity range.	Use suitable hydraulic fluid (machine/system manufacturer).
	Wear of axial piston unit.	Exchange axial piston unit, contact Bosch Rexroth Service.
	Mechanical damage to the axial piston unit.	Exchange axial piston unit, contact Bosch Rexroth Service.
No or insufficient pressure	Faulty mechanical drive (e.g. defective coupling).	Machine/system manufacturer.
	Drive power too low.	Machine/system manufacturer.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed axial piston unit, fill suction line with hydraulic fluid.
		Remove contaminants from the suction line.
	Hydraulic fluid not in optimum viscosity range.	Use suitable hydraulic fluid (machine/system manufacturer).
	Wear of axial piston unit.	Exchange axial piston unit, contact Bosch Rexroth Service.
	Mechanical damage to the axial piston unit (e.g. bearing damage).	Exchange axial piston unit, contact Bosch Rexroth Service.
	Output unit defective (e.g. hydraulic motor or cylinder).	Machine/system manufacturer.

Table 17: Axial piston unit malfunction table

Fault	Possible cause	Remedy
Pressure/flow fluctuations	Axial piston unit not or insufficiently air bled.	Completely air bleed axial piston unit.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed axial piston unit, fill suction line with hydraulic fluid.
		Remove contaminants from the suction line.
Excessive hydraulic fluid temperature and case temperature	Excessive inlet temperature at the axial piston unit.	Machine or system manufacturer: inspect system, e.g malfunction of the cooler, insufficient hydraulic fluid in the reservoir.
	Malfunction of the pressure control valves (e.g. high-pressure relief valve, pressure cut-off, pressure controller).	Contact Bosch Rexroth Service.
	Wear of axial piston unit.	Exchange axial piston unit, contact Bosch Rexroth Service.
Instability/vibrations	Target value not stable.	Machine/system manufacturer.
	Resonance in the reservoir line.	Machine/system manufacturer.
	Malfunction of the control devices or the controller.	Contact Bosch Rexroth Service.

15 Technical data

The permissible values of the technical data of your axial piston unit can be found in data sheet RE 91455.

The data sheet can be found on the internet at

www.boschrexroth.com/axial-piston-pumps

The order-related technical data of your axial piston unit can be found in the order confirmation.

16 Appendix

16.1 Address directory

For the addresses of foreign subsidiaries, please refer to
www.boschrexroth.com/addresses

17 Alphabetical index

T

U

W

Rexroth
Bosch Group

Bosch Rexroth AG
Axial piston units
Glockeraustrasse 4
89275 Elchingen
Germany
Tel. +49 (0) 73 08-82-0
Fax +49 (0) 73 08-72 74
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www.boschrexroth.com/axial-piston-pumps

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info.brm-ak@boschrexroth.de
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Rexroth
Bosch Group

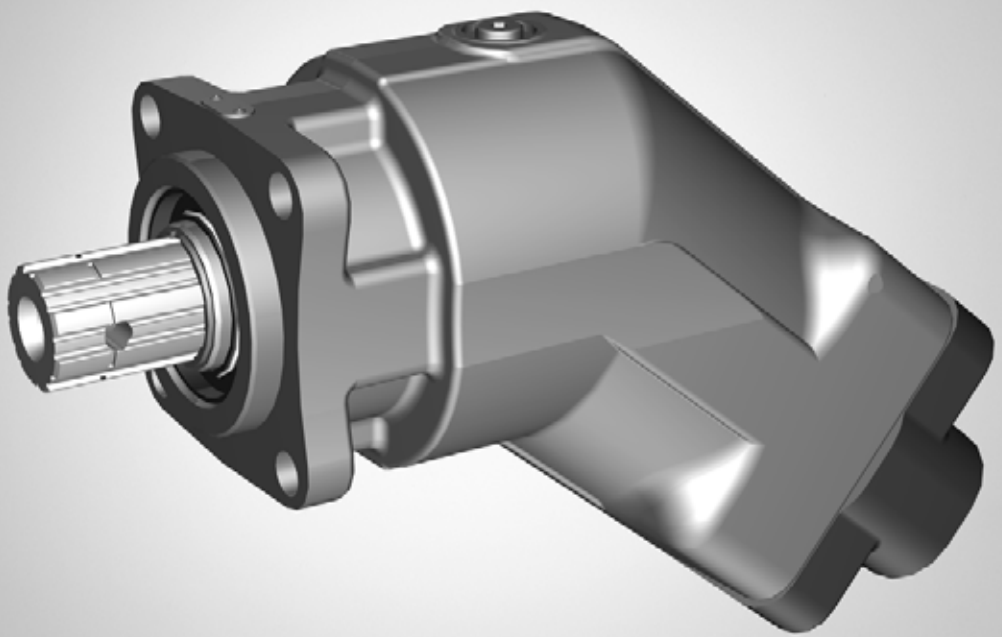
Axial Piston Fixed Pump A17FO/A17FNO

Series 10

RE 91520-01-B/02.11

Replaces: RE 91501-01-B/07.09
English

Instruction manual



The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

The cover shows an example application. The product delivered may differ from the image on the cover.

The original operating instructions were created in the German language.

Contents

1 About this manual

This manual contains important information on the safe and appropriate installation, transport, commissioning, maintenance, removal and simple troubleshooting of the axial piston fixed pump A17FO/A17FNO Series 10.

- Read this manual completely, especially chapter "2 General safety instructions", before working with the axial piston fixed pump A17FO/A17FNO.

1.1 Related documents

The axial piston fixed pump A17FO/A17FNO is a system component. Also observe the manuals for the other system components.

Further information on the axial piston fixed pump A17FO/A17FNO, its installation and operation can be found in the Rexroth documents listed in the following table.

Table 1: Related documents

Related documents	Contents
Order confirmation	Contains the technical data of the A17FO/A17FNO axial piston fixed pump .
Installation drawing	Contains the outer dimensions, all connections and the hydraulic circuit diagram for the A17FO/A17FNO axial piston fixed pump . The installation drawings can be requested from your responsible contact person at Rexroth.
Data sheet RE 91510	Contains the permissible technical data for the A17FNO axial piston fixed pump Series 10.
Data sheet RE 91520	Contains the permissible technical data for the A17FO axial piston fixed pump Series 10.
Data sheet RE 90220	Describes the requirements on a mineral-oil based hydraulic fluid and related hydrocarbons for the operation with Rexroth hydraulic components, and assists you in selecting a hydraulic fluid for your system.
Data sheet RE 90221	Describes the requirements on an environmentally acceptable hydraulic fluid for operation with Rexroth hydraulic components and assists you in selecting a hydraulic fluid for your system.
Data sheet RE 90312	Contains additional information about storing and preserving axial piston units.

Also observe the generally applicable, legal or otherwise binding regulations of the European and national legislation and the rules for the prevention of accidents and for environmental protection applicable in your country.

1.2 Abbreviations used

As umbrella term for "A17FO/A17FNO axial piston fixed pump", the designation "axial piston unit" will be used in the following.

Table 2: Abbreviations

Abbreviation	Meaning
A17FO/A17FNO	Axial piston fixed pump, open circuit
DIN	**D**eutsche **I**ndustrie **N**orm (German Institute for Standardization)
ISO	International Organization for Standardization
RE	Rexroth document in the English language
VDI 2230	Directive for the systematic calculation of high duty bolted joints and joints with one cylindrical bolt from the VDI (**V**erein **D**eutscher **I**ngenieure - Association of German Engineers)

2 General safety instructions

The axial piston unit has been manufactured according to the generally accepted rules of current technology. There is, however, still a danger of personal injury or damage to equipment if the following general safety instructions and the warnings before the steps contained in this manual are not complied with.

- Read this manual completely and thoroughly before starting work with the axial piston unit.
- Keep this manual in a location where they are accessible to all users at all times.
- Always include the instruction manual when you pass the axial piston unit on to third parties.

2.1 Intended use

Axial piston units are hydraulic components, meaning that in their application they are classified neither as complete nor as incomplete machines in the sense of the EU machine directive 2006/42/EC. A component is exclusively intended to form an incomplete or a complete machine together with other components.

The component may only be commissioned after it has been installed in the machine/system for which it is intended.

The product is intended for the following use:

The axial piston unit is only approved as a pump for hydrostatic drives in open circuit.

- Observe the technical data, application and operating conditions and performance limits as specified in data sheet RE 91510 and RE 91520 and in the order confirmation. Information about approved hydraulic fluids can be found in data sheet RE 91510 and RE 91520.

The axial piston unit is only intended for professional use and not for private use.

Intended use includes having read and understood this documentation, especially the chapter "2 General safety instructions".

2.2 Improper use

Any use other than that described as intended use shall be considered as improper and is therefore impermissible.

If unsuitable products are installed or used in applications that are of relevance to safety, unexpected operating conditions may occur in the application which could result in injury to persons or property damage. For this reason, products should only be used in safety-relevant applications if this usage is expressly specified and approved in the documents related to the product. For example, in ex-protection areas or in safety-related parts of a control system (functional safety).

Bosch Rexroth AG shall accept no liability whatsoever for damage resulting from improper use. The user shall bear all risks arising from improper use.

Similarly, the following predictable faulty usages are also considered to be not as intended:

- Using the axial piston unit in explosive environments unless the component or system has been certified as compliant with the ATEX directive 94/9/EC
- Pumping non-approved fluids compliant with data sheet RE 92260, e.g. water or polyurethane components.
- Modification of factory settings by non-authorized persons
- Use of add/on parts (e.g. mountable filter, control unit, valves) that are not specified Rexroth components
- Using the axial piston unit under water at a depth of more than 10 meters without necessary additional measures, e.g. pressure equalization
- Using the axial piston unit in aircraft or space craft
- Using the axial piston unit when the exterior pressure is greater than the interior pressure (case pressure)
- Using the axial piston unit in an aggressive atmosphere
- Using outside the operating parameters approved in the data sheet (unless special approval has been granted)

2.3 Personnel qualifications

Installation, commissioning and operation, removal, care and maintenance require basic mechanical, hydraulic and electrical knowledge, as well as knowledge of the appropriate technical terms. For transporting and handling the product, additional knowledge is necessary with regard to working with a lifting device and the corresponding attachment equipment. In order to ensure operating safety, these activities may therefore only be carried out by qualified personnel or an instructed person under the direction and supervision of qualified personnel.

Qualified personnel are those who can recognize possible hazards and institute the appropriate safety measures due to their professional training, knowledge, and experience, as well as their understanding of the relevant conditions pertaining to the work to be done. Qualified personnel must observe the rules relevant to the subject area.

2.4 Safety instructions in this manual

In this manual, there are safety instructions before the steps whenever there is a danger of personal injury or damage to equipment. The measures described to avoid these hazards must be observed.

Safety instructions are set out as follows:

SIGNAL WORD! 	**Type of danger!** Consequences ▶ Precautions

- **Safety signs:** (warning triangle): draw attention to danger
- **Signal word:** identifies the degree of the danger
- **Type of danger:** identifies the type or source of the danger
- **Consequences:** describes what occurs if the safety instructions are not complied with
- **Precautions:** states how the danger can be avoided.

The signal words have the following meaning:

Signal word	Application
DANGER! 	Indicates an **imminently** hazardous situation which, if not avoided, will certainly result in death or serious injury.
WARNING! 	Indicates a **potentially** hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION! 	Indicates a **potentially hazardous** situation which, if not avoided, could result in minor or moderate injury or damage to equipment.
	If this information is disregarded, the operating procedure may be impaired.

2.5 Adhere to the following instructions

General instructions

- Observe the regulations for accident prevention and environmental protection for the country where the product is used and at the workplace.
- Only use Rexroth axial piston units in good technical order and condition.
  - Inspect the product for obvious defects.
- Do not modify or convert the axial piston unit. You are only authorized to exchange the pressure connection on the service line ports. For further information, please refer to chapter "6.4.2 Direction of rotation and changing direction".
- Use the product only within the performance range provided in the technical data.
- Persons who install, commission, operate, remove or maintain Rexroth products must not consume any alcohol, drugs or pharmaceuticals that may affect their ability to respond.
- The warranty applies only to the delivered configuration.
- The warranty is rendered void if the product is incorrectly installed, commissioned or operated, and also if not used as intended and/or handled improperly.
- Do not expose the product to any mechanical loads under any circumstances. Never use the product as a handle or step. Do not place/lay any objects on it.
- The noise emission of axial piston units depends on speed, operating pressure and installation conditions. The sound pressure level may rise above 70 dBA during normal application conditions. This can cause hearing damage.
  - Always wear hearing protection while working in the vicinity of the operating axial piston unit.
- The axial piston unit can heat up so much during operation that you can burn yourself on it.
  - Allow the axial piston unit to cool down sufficiently before touching it.
  - Wear heat-resistant protective clothing, e.g. gloves.
- Hydraulic fluid is easily flammable.
  - Keep open flames and ignition sources away from the axial piston unit.

- Contact with hydraulic fluid may cause health damage.
  - When working with hydraulic fluids, strictly observe the safety instructions provided by the hydraulic fluids manufacturer.

During transport

- Make certain that the lifting device has adequate lifting capacity. The weight can be found in chapter "5 Transport and storage".

During installation

- Before installation, make sure that all fluids have been removed from the axial piston unit to prevent mixing with the hydraulic fluid used in the system.
- Always set up the relevant part of the system so that it is depressurized before you install the product. Protect the system against being energized.
- Before commissioning, ensure that all of the hydraulic connections are leakproof and that all seals are undamaged to prevent fluids and contaminants from penetrating the product.
- During installation, provide for absolute cleanliness in order to prevent contaminants, such as welding beads or metal cuttings, from getting into the hydraulic lines and causing product wear or malfunctions.

During commissioning

- Ensure that all hydraulic connections and ports are connected or plugged. Only commission a completely installed product.

During cleaning

- Plug all openings with the appropriate protective equipment in order to prevent detergents from penetrating the system.
- Never use solvents or aggressive detergents. Use only water and, if necessary, a mild detergent to clean the axial piston unit.
- Do not point a power washer at sensitive components, such as e.g. shaft seal ring.

During maintenance and repair

- Perform the prescribed maintenance work at the intervals specified in the instruction manual (see chapter "9.3 Maintenance").
- Make certain that no lines, connections or components are disconnected as long as the system is under pressure. Protect the system against being energized.

During disposal

- Dispose of the product and the hydraulic fluid in accordance with the currently applicable national regulations in your country.

2.6 Operator's obligations

The operator of the Rexroth axial piston unit must provide personnel training on a regular basis regarding the following subjects:

- Observation and use of the instruction manual and the legal regulations
- Intended use and operation of the axial piston unit
- Observation of the instructions from the factory security offices and of the work instructions from the operator

Rexroth offers training support for special fields. You can find an overview of the training contents on the Internet at:
`http://www.boschrexroth.de/didactic.`

3 Delivery contents

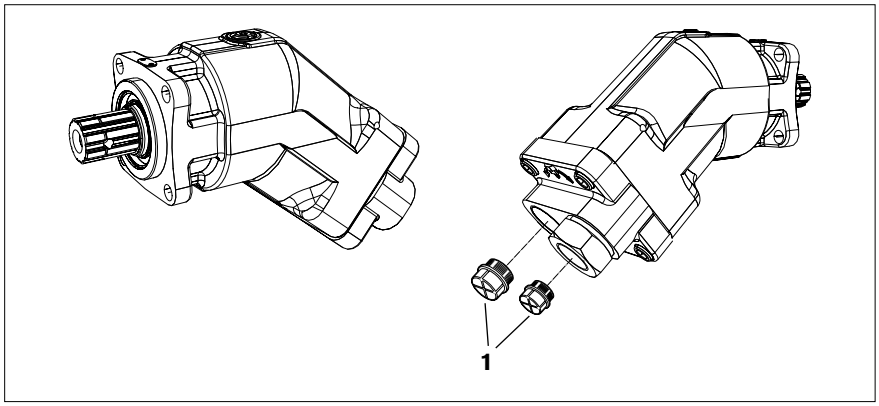


Fig. 1: Axial piston unit

Included in the delivery contents are:

- Axial piston unit as per order confirmation

The following parts are also installed on delivery:

- Plastic plugs / threaded plugs (**1**).

▶ Check the delivery contents for completeness and transport damages.

4 Product description

4.1 Performance description

The axial piston fixed pump generates a hydraulic fluid flow. It is designed for use in commercial vehicles.

Refer to the data sheet and order confirmation for the technical data, operating conditions and operating limits of the axial piston unit.

4.2 Device description

The A17FO/A17FNO is a fixed pump with axial tapered piston rotary group in bent-axis design for hydrostatic drives in open circuits. Flow is proportional to drive speed and displacement. For axial piston units with bent-axis design, the pistons are arranged diagonally with respect to the drive shaft.

Open circuit

In an open circuit, the hydraulic fluid flows from the reservoir to the hydraulic pump from where it is fed via a directional valve to the consumer, e.g. cylinder. From the consumer, the hydraulic fluid flows back to the reservoir via the directional valve.

4.2.1 Assembly of the axial piston unit

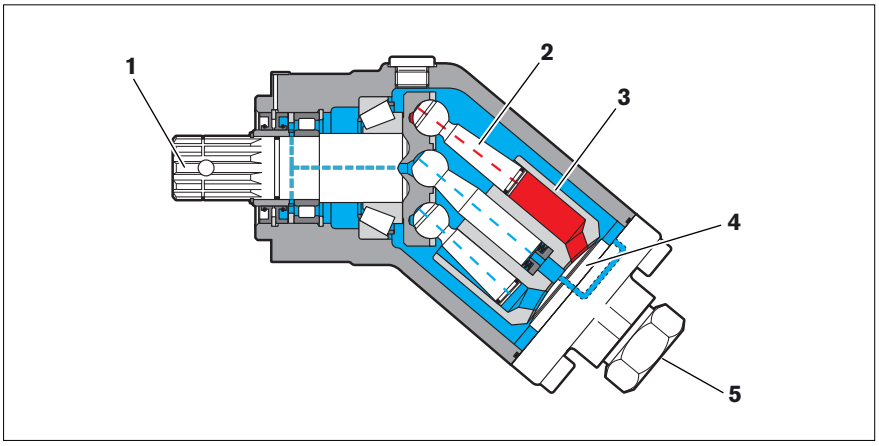


Fig. 2: Assembly of the A17FO/A17FNO Series 10

1 Drive shaft
2 Piston
3 Cylinder
4 Control plate
5 Pressure connection

4.2.2 Functional description

Pump

Torque and a rotational speed are applied to the drive shaft (**1**) by an engine. The drive shaft and cylinder (**3**) pick up and turn the piston (**2**). The cylinder then glides on the control plate (**4**). With every revolution, the pistons execute one stroke in the cylinder bores. During a revolution, each piston moves over the bottom and top dead centers back to its initial position. Here, hydraulic fluid is fed into and out through two control slots in the control plate according to the displacement. On the suction side, hydraulic fluid flows into the enlarging piston chamber. At the same time, on the high-pressure side the hydraulic fluid is pushed out of the cylinder chamber into the hydraulic system by the pistons. The drive direction of the axial piston fixed pump is defined via a pressure connection screwed into the service line port **(5)** and can easily be changed (see chapter "6.4.2 Direction of rotation and changing the direction of rotation").

Circuit diagram

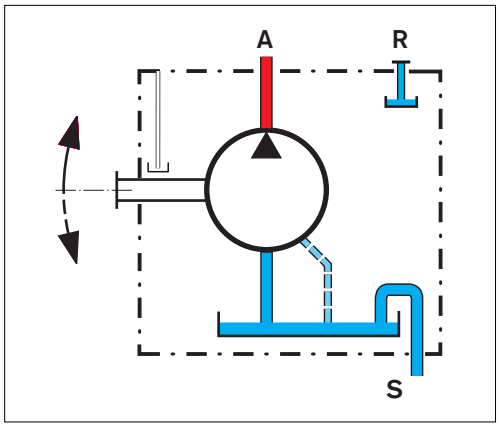


Fig. 3: Circuit diagram A17FO/A17FNO Series 10

4.3 Product identification

The axial piston unit can be identified from the name plate. The following example shows a A17FO name plate:

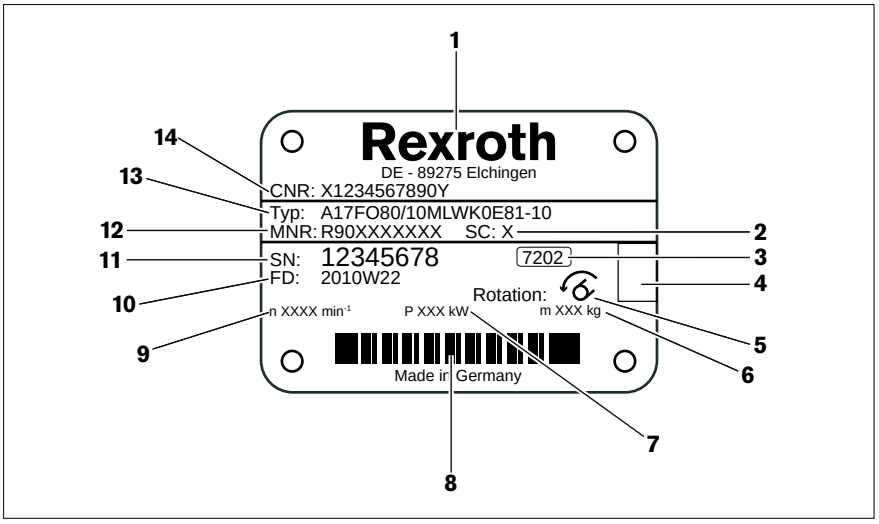


Fig. 4: A17FO name plate

1 Manufacturer

2 Sample category (optional)

3 Internal plant designation

4 Specified area for test stamp

5 Direction of rotation (viewed on drive shaft)
– here: clockwise (as delivered)

6 Ground (optional)

7 Power

8 Bar code

9 Speed

10 Production date

11 Serial number

12 Material number of the axial piston unit

13 Ordering code

14 Customer material number

5 Transport and storage

5.1 Transporting the axial piston unit

CAUTION!

Risk of damage!

Striking or impulsive forces could damage the axial piston unit.

- Do not strike the drive shaft of the axial piston unit.
- Do not set/place the axial piston unit on the drive shaft.
- Do not strike sensitive fittings (e.g. sensors or valves).
- Do not strike sealing surfaces (e.g. service line ports).

Axial piston units can be transported with a forklift truck or with a lifting device.

- Make certain that the forklift truck or lifting device has adequate lifting capacity.

Dimensions and weights

Table 3: Dimensions and weights

Size	A17FO	23	32	45	63	80	107	
	A17FNO							125
Ground	kg	5.8	5.8	8.0	9.0	11.6	14.5	14.5
Width	mm	The dimensions vary with the unit type. The values applicable for your axial piston unit can be found in the installation drawing (request if necessary).						
Height	mm							
Depth	mm							

The weight specifications may vary depending on the unit type.

Carrying the axial piston unit

Axial piston units with a weight of up to 15 kg can be transported by hand if necessary.

5.1.1 Transporting with lifting device

For transporting, the axial piston unit can be connected to a lifting device via a ring screw or a lifting strap.

Transport with ring screw

The drive shaft can be used to transport the axial piston unit as long as only outward (pulling) axial forces occur. Thus, you can suspend the axial piston unit from the drive shaft.

- For all female threads, use a threaded plug from the same system of units and of the correct size.
- To do this, screw a ring screw completely into the thread on the drive shaft. The thread sizes is stated in the installation drawing.
- Make sure that each ring screw can bear the total weight of the axial piston unit plus approx. 20%.

You can hoist the axial piston unit as shown in Fig. 5 with the ring screw screwed into the drive shaft.

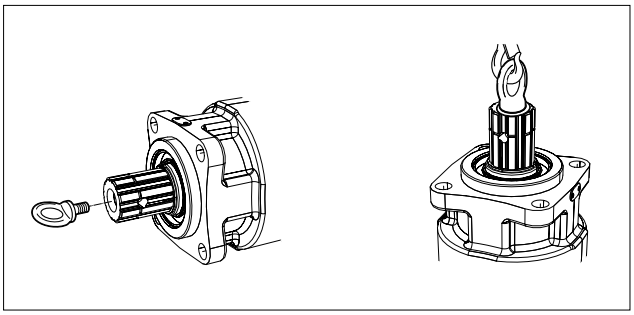


Fig. 5: Fixing the ring screw

Transport with lifting strap

- Place the lifting strap around the axial piston unit in such a way that it passes over neither the attachment parts (e.g. valves) nor such that the axial piston unit is hung from attachment parts (see Fig. 6).

WARNING!

Risk of injury!

During transport with a lifting device, the axial piston unit can fall out of the lifting strap and cause injuries.

- Use the widest possible lifting strap.
- Make sure that the axial piston unit is securely fixated with the lifting strap.
- Only guide the axial piston unit by hand for fine positioning and to avoid oscillations.
- Never stand under or put you hands under suspended loads.

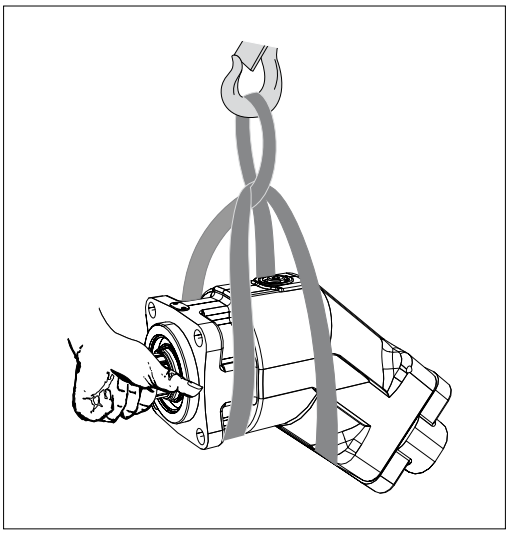


Fig. 6: Transport with lifting strap

5.2 Storing the axial piston unit

Requirement

- The storage areas must be free of corrosive materials and gasses.
- The storage areas must be dry.
- Ideal storage temperature: +5 °C to +20 °C.
- Minimum storage temperature: -50 °C.
- Maximum storage temperature: +60 °C.
- Avoid intense lights.
- Do not stack axial piston units and store them shock-proof.
- Do not store the axial piston unit on sensitive attachment parts.
- For other storage conditions, see Table 4.

▶ Check the axial piston unit monthly to ensure proper storage.

After delivery

The axial piston units are provided ex-works with corrosion protection packaging (corrosion protection film).

The following table lists the maximum permissible storage times for an originally packed axial piston unit as per data sheet RE 90312.

Table 4: Storage time with factory corrosion protection

Storage conditions	Standard corrosion protection	Long-term corrosion protection
Closed, dry room, uniform temperature between +5 °C and +20 °C. Undamaged and closed corrosion protection film.	Maximum 12 months	Maximum 24 months

The warranty is rendered void if the requirements and storage conditions are not adhered to or after expiration of the maximum storage time (see Table 4).

Procedure after expiration of the maximum storage time:

1. Check the entire axial piston unit for damage and corrosion prior to installation.
2. Check the axial piston unit for proper function and leaks during a test run.
3. If the storage time exceeds 24 months, both shaft seal rings must be replaced.

After expiry of the maximum storage time, we recommend that you have the axial piston unit inspected by your responsible Rexroth Service partner.

In the event of questions regarding repair and spare parts, contact your responsible Rexroth Service partner or the service department of the manufacture's plant for the axial piston unit, see chapter "9.5 Spare parts" for further information.

After removal

If a dismounted axial piston unit is to be stored, it must be preserved against corrosion for the duration of the storage.

The following instructions only refer to axial piston units which are operated with a mineral-oil based hydraulic fluid. Other hydraulic fluids require preservation methods that are specifically designed for them. In such a case, consult with Rexroth Service (see chapter "9.5 Spare parts" for address).

Rexroth recommends the following procedure:

1. Clean the axial piston unit, see chapter "9.1 Cleaning and care".
2. Completely empty the axial piston unit.
3. For storage time up to 12 months: Moisten the inside of the axial piston unit with mineral oil and fill with approx. 100 ml mineral oil.
   For storage time up to 24 months: Fill the axial piston unit with corrosion protection medium VCI 329 (20 ml).
   Filling is performed via port "**R**", see chapter "6.4 Installing the axial piston unit", Fig. 13.
4. Seal all ports airproof.
5. Moisten the unpainted surfaces of the axial piston unit with mineral oil or a suitable, easily removed corrosion protection agent, e.g. acid-free grease.
6. Package the axial piston unit airproof together with desiccant in corrosion protection film.
7. Store the axial piston unit so that it is protected against jolts. See "Requirement" in this chapter for further conditions.

6 Installation

Prior to installation, the following documents must be available:

- Installation drawing for axial piston unit (can be obtained from your responsible contact person at Rexroth)
- Hydraulic circuit diagram for the axial piston unit (in the installation drawing)
- Hydraulic circuit diagram for the system (available from the system manufacturer)
- Order confirmation (contains the data of the axial piston unit)
- Data sheet for the axial piston unit (contains the technical data)

6.1 Unpacking

The axial piston unit is delivered in a corrosion protection film made of polyethylene material (PE).

▶ Dispose of the packaging according to the environmental regulations of your country.

CAUTION!

Risk of parts falling out!

If the packaging is not opened correctly, parts may fall out and damage the parts or even result in injury.

▶ Place the packaging on a flat and solid surface.

▶ Only open the packaging from the top.

6.2 Installation conditions

- The installation location and position of the axial piston unit essentially determine the procedures during installation and commissioning (such as when filling and air bleeding the axial piston unit).
- Correct filling and air bleeding is necessary to prevent damage to the axial piston unit and to maintain correct function.

▶ Observe all data specified in the data sheet, e.g. temperature, viscosity, purity of the hydraulic fluid and direction of rotation.

▶ Make sure that the axial piston unit is air bled and filled with hydraulic fluid during commissioning and operation. This is also to be observed following relatively long standstill periods as the axial piston unit may empty via the hydraulic lines.

▶ To achieve favorable noise values, decouple all connecting lines from all vibration-capable components (e.g. reservoir) using elastic elements.

- Make certain that the suction line flows into the reservoir below the minimum fluid level in all operational states. This will prevent air from being drawn in and foam from being formed.

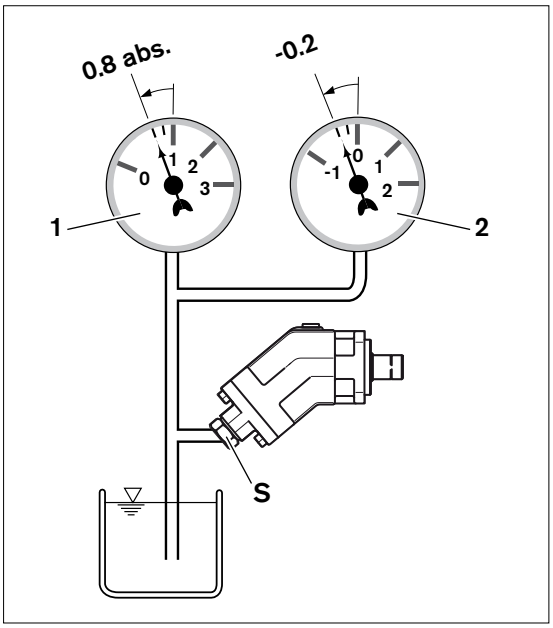


Fig. 7: Suction pressure

1 Absolute pressure gauge

2 Standard pressure gauge

- Make sure that a minimum suction pressure of 0.8 bar absolute is present at port "**S**" during operation and on cold starts in all installation positions and installation locations for the axial piston pump, see Fig. 7. See data sheet for additional values.

  The suction conditions improve with below-reservoir installation.

- Absolute cleanliness is required. The axial piston unit must be installed in a clean condition. Dirt contamination in the hydraulic fluid can seriously impair the function and service life of the axial piston unit.
- Do not use any cotton waste or linty cloths for cleaning.
- Use suitable liquid detergents to remove lubricants and other difficult-to-remove contamination. Cleaning agents must not penetrate the hydraulic system.

CAUTION!

Risk of damage due to lack of lubrication!

Sufficient lubrication must be guaranteed to prevent damage to the axial piston unit.

- During installation make sure that the case is fully filled with hydraulic fluid for commissioning and operation (e.g. no air intrusion).
- Make sure that the suction line is always filled with hydraulic fluid during commissioning and operation.

6.3 Installation position

The following installation positions are permissible. The shown piping layout illustrates the basic layout.

The case drain chamber is internally connected to the suction chamber. A separate case drain line from the case to the reservoir is not required.

6.3.1 Below-reservoir installation (standard)

Below-reservoir installation is when the axial piston unit is installed outside of the reservoir below the minimum fluid level.

Recommended installation positions: 1 and 2.

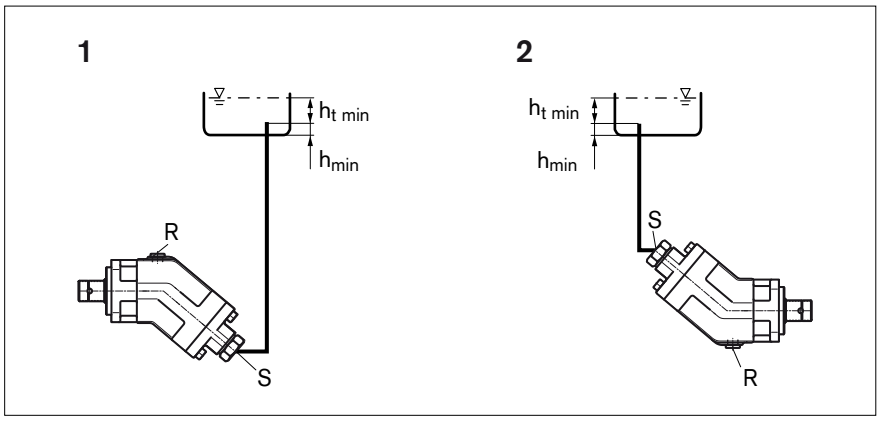


Fig. 8: Below-reservoir installation with installation positions 1–2

R	Air bleed port	**$h_{t\ min}$**	Minimum necessary immersion depth (200 mm)
S	Suction port	**h_{min}**	Minimum necessary spacing from suction port to reservoir base (100 mm)

Table 5: Below-reservoir installation

Installation position	Air bleed	Filling
1	R	S
2	-	S

6.3.2 Above-reservoir installation

Above-reservoir installation is when the axial piston unit is installed above the minimum fluid level of the reservoir.

CAUTION!

Risk of damage due to lack of lubrication!

Sufficient lubrication must be guaranteed to prevent damage to the axial piston unit.

- When installing, make sure that the case is fully filled with hydraulic fluid for commissioning and operation (e.g. no air intrusion).
- Check the hydraulic fluid level in the case interior regularly; if necessary, recommission. With above-reservoir installation, the case interior may drain after longer standstill periods via the service line (gap leakage). The bearings are thus insufficiently lubricated for recommissioning.
- Make sure that the suction line is always filled with hydraulic fluid during commissioning and operation.

Observe the maximum permissible suction height $\mathbf{h_{S\ max}}$ = 800 mm. The permissible suction height h_s is derived from the total pressure loss.

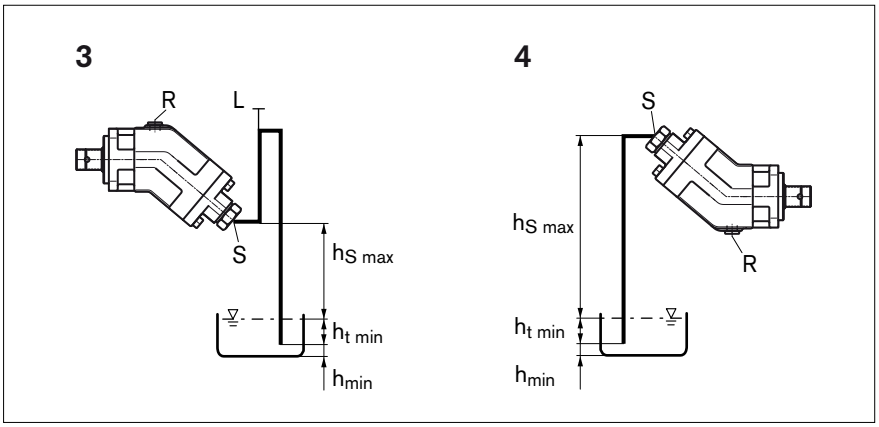


Fig. 9: Above-reservoir installation with installation positions 3–4

L	Filling / air bleeding	$\mathbf{h_{t\ min}}$	Minimum necessary immersion depth (200 mm)
R	Air bleed port	$\mathbf{h_{min}}$	Minimum necessary spacing from suction port to reservoir base (100 mm)
S	Suction port	$\mathbf{h_{S\ max}}$	Maximum permissible suction height (800 mm)

Table 6: Above-reservoir installation

Installation position	Air bleed	Filling
3	R	L
4	S	S

6.4 Installing the axial piston unit

DANGER!

Systems which are in operation pose a risk of injury!

Working on operating systems poses a danger to life and limb. The work steps described in this chapter must only be performed on systems which are at a standstill. Before beginning work:

- Ensure that the engine cannot be switched on.
- Ensure that all power-transmitting components and connections (electric, pneumatic, hydraulic) are switched off according to the manufacturer's instructions and are secured against being switched on again. If possible, remove the main fuse for the system.
- Ensure that the system is completely hydraulically relieved and depressurized. Please follow the system manufacturer's instructions.
- Only qualified personnel (see chapter "2.3 Personnel qualifications") are authorized to install the axial piston unit.

6.4.1 Preparation

1. Check the delivery contents for completeness and transport damages.
2. Compare the material number and designation (ordering code) with the details in the order confirmation.

If the material number for the axial piston unit does not correspond to the one in the order confirmation, contact Rexroth Service for clarification, see chapter "9.5 Spare parts" for address.

3. Before installing, completely empty the axial piston unit to prevent mixing with the hydraulic fluid used in the system.
4. Check the direction of rotation of the axial piston unit and make sure that this corresponds to the direction of rotation of the power take-off.

6.4.2 Direction of rotation and changing the direction of rotation

The pressure connection is pre-installed upon delivery and must be tightened with the torque stipulated for the appropriate thread size prior to installation.

CAUTION!

Risk of property damage!

Operating in the wrong direction of rotation can damage the axial piston unit.

- Before installing the pump, check the direction of rotation of the pump and of the power take-off.

The direction of rotation of the axial piston unit is defined by means of a pressure connection screwed into the service line port and can easily be changed.

By changing the pressure connection, the service line port and the suction port are exchanged. As a result, the permissible drive direction is changed.

Direction of rotation on delivery

On delivery, the pressure connection (**1**) is pre-installed in the right-hand service line port of the axial piston unit. The permissible drive direction of the pump looking at the drive shaft: counter-clockwise. The power take-off turns clockwise.

- Tighten the pressure connection (**1**) with the torque stipulated for the appropriate thread size, before you install the axial piston unit (for tightening torques, see Table 7).

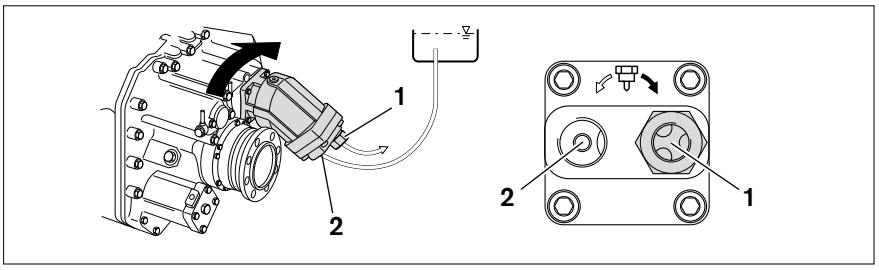


Fig. 10: Pressure connection on delivery – for clockwise rotation of the power take-off (= pump rotates counter-clockwise)

1 Pressure connection (in right port)

2 Suction port

Changing the direction of rotation

For power take-offs with counter-clockwise rotation, the direction of rotation of the axial piston unit must be changed.

- To change the direction of rotation of the axial piston unit, you must convert the pressure connection (**1**) from the right port to the left port, see Fig. 11 (for tightening torques, see Table 7).

CAUTION!

Risk of property damage!

If the pump drive shaft moves during conversion, the axial piston unit may be damaged.

- After unscrewing the pressure connection, do not turn the drive shaft of the pump!

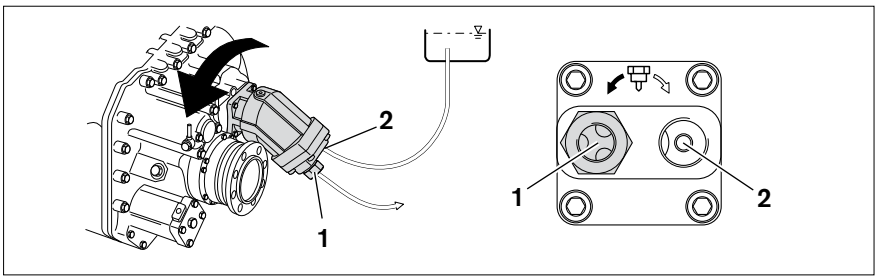


Fig. 11: Pressure connection after conversion – for counter-clockwise rotation of the power take-off (= pump rotates clockwise)

1 Pressure connection (in left port)

2 Suction port

Tightening torques

The following tightening torques apply:

Table 7: Tightening torque M_D of the pressure connection

Size	A17FO	NG	23, 32	45, 63	80, 107
	A17FNO	NG			125
Tightening torque M_D		Nm	145	270	525
Size WAF		mm	36	41	50

6.4.3 Dimensions

The installation drawing contains the dimensions for all connections and ports on the axial piston unit. Also observe the manuals provided by the manufacturers of the other components when selecting the required tools.

6.4.4 General instructions

During installation (and disassembly) of the axial piston unit, observe the following general instructions and handling instructions:

- When driving the input or output drive of an axial piston unit with the aid of a cardan shaft, vibrations may occur which may result in leakages on the shaft seal rings of the axial piston unit depending on the temperature and frequency.

▶ Fix the axial piston unit so that the expected forces and torques can be transferred without any danger.

▶ The permissible axial loading of the drive shaft, the permissible torsional vibration, the optimum direction of load force, as well as the limit speeds can be found in the data sheet.

Radial forces on the drive shaft are not permissible.

CAUTION!

Risk of damage!

Striking or impulsive forces could damage the axial piston unit.

▶ Do not install the coupling hub onto the drive shaft of the axial piston unit by striking it.

▶ Do not set/place the axial piston unit on the drive shaft.

▶ Do not strike sensitive fittings (e.g. sensors or valves).

▶ Do not strike sealing surfaces (e.g. suction port or through drive).

How to install the axial piston unit depends on the connecting elements to the drive side. The following descriptions explain the installation of the axial piston unit:

- with a clutch
- on a gearbox

6.4.5 Installation with clutch

The installation procedure for the axial piston unit with a coupling is described in detail in the following:

1. Install the specified coupling half onto the drive shaft of the axial piston unit according to the instructions of the coupling manufacturer.

The drive shaft of the axial piston unit is equipped with a threaded bore. Use this threaded bore to pull the coupling element onto the drive shaft. Refer to the installation drawing for the dimensions of the threaded bore.

2. Make certain that the installation location is clean and free from dirt and contaminants.
3. Clamp the coupling hub onto the drive shaft or ensure permanent lubrication of the drive shaft. This prevents the formation of frictional corrosion and the associated wear.
4. Transport the axial piston unit to the installation location.
5. Install the coupling onto the input according to the instructions of the coupling manufacturer.

The axial piston unit may not be bolted down until the coupling has been correctly installed.

6. Fix the axial piston unit at the installation location.
7. If necessary, details on the required tools and tightening torques for the fixing screws are available from the machine or system manufacturer.
   - For bell housing installation, check the coupling axial play through the bell window according to the manufacturer's instructions.
   - For flange installation, align the support for the axial piston unit with the input.
8. When using flexible couplings, check that the input is free of resonance after completing the installation.

6.4.6 Installation on a gearbox

The installation layout for the axial piston unit on a gearbox is described in detail in the following:

After installing on a gearbox, the axial piston unit is covered and is difficult to access:

- Therefore, before installing, make sure that the centering spigot centers the axial piston unit (observe tolerances) and that no impermissible axial or radial forces act on the drive shaft of the axial piston unit (installation length).
- Protect the spline of the drive shaft from frictional corrosion by providing permanent lubrication.

6.4.7 Completing installation

1. Remove any mounted transport screws.
2. Remove the transport protection.
   The axial piston unit was delivered with protective covers and plastic plugs or threaded plugs. These must be removed before connecting. Use appropriate tools.
3. Make certain that the sealing and functional surfaces are not damaged. If sealing or functional surfaces are damaged, contact your responsible Rexroth Service partner or the service department of the manufacture's plant for the axial piston unit.

Ports which are intended for connecting lines are provided with plastic plugs or threaded plugs, which serve as transport protection.

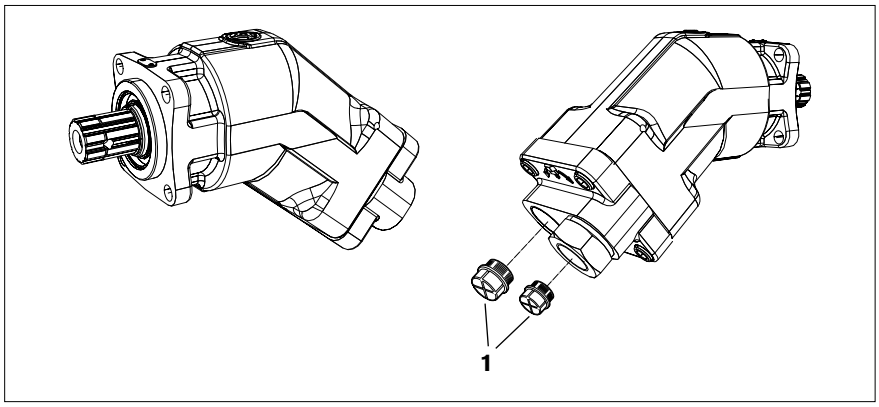


Fig. 12: Removing transport protection

1 Plastic plugs / threaded plugs

6.4.8 Hydraulically connecting the axial piston unit

The machine or system manufacturer is responsible for dimensioning the lines. The axial piston unit must be connected to the rest of the hydraulic system in accordance with the hydraulic circuit diagram of the machine or system manufacturer.

CAUTION!

Damage to the axial piston unit!

Hydraulic lines and hoses that are installed under mechanical stress generate additional mechanical forces during operation, which will reduce the service life of the axial piston unit and the entire machine or system.

- Install hydraulic lines and hoses without mechanical stress.

CAUTION!

Risk of damage!

Generally, a minimum permissible suction pressure at port "**S**" is specified for axial piston pumps in all installation positions. If the pressure at port "**S**" drops below the specified values, damage may occur which may lead to the axial piston pump being damaged beyond repair.

- Make certain that the necessary suction pressure is not undercut.
  This is influenced by:
  - the piping (e.g. suction cross-section, pipe diameter, length of suction line)
  - the position of the reservoir
  - the viscosity of the hydraulic fluid
  - if fitted, a filter cartridge or check valve in the suction line (regularly check the level of soiling of the filter cartridge)

Only connect suitable hydraulic lines to the service and function ports.

CAUTION!

Wear and malfunctions

The cleanliness of the hydraulic fluid has a considerable impact on the cleanliness and service life of the hydraulic system. Any contamination of the hydraulic fluid will lead to wear and malfunctions. In particular, contaminants, such as welding beads or metal cuttings in the hydraulic lines, may damage the axial piston unit.

- Absolute cleanliness is required.
- The axial piston unit must be installed in a clean condition.
- Make sure that all ports, hydraulic lines and add-on units (e.g. measuring equipment) are clean.
- Make certain that no contaminants enter when sealing the ports.
- Make certain that no detergents enter the hydraulic system.
- Do not use any cotton waste or linty cloths for cleaning.
- Do not use hemp as a sealant under any circumstances.

Notes on routing the lines

Observe the following notes when routing the suction and pressure lines.

- Make certain that the suction line (pipe or hose) is as short and straight as possible.
- The line cross section of the suction line is to be sized so that the minimum permissible pressure at the suction port and the maximum permissible pressure are not exceeded.
- On the suction line, make sure that all junctions are air-tight and that the pressure capability of all hoses meets specifications, including with respect to the external air pressure.
- With the pressure lines, make certain that the pipes, hoses and connecting elements are approved for the operating pressure range.

The ports and fixing threads are designed for the maximum pressure specified in the data sheet. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

Procedure

To connect the axial piston unit to the hydraulic system:

1. Remove the threaded plugs at the ports at which the connections are to be made according to the hydraulic circuit diagram.
2. Only use clean hydraulic lines or rinse out the hydraulic system with a flushing unit before commissioning. Follow the instructions of the flushing unit manufacturer.
3. Connect the lines in accordance with the installation drawing and the machine or system circuit diagram. Make sure that all ports are piped up or plugged with suitable threaded plugs.

The installation drawing contains the dimensions for all connections and ports on the axial piston unit. Also observe the manuals provided by the manufacturers of the other hydraulic components when selecting the required tools.

4. Make certain that the union nuts on the fittings and flanges are tightened correctly (observe the manufacturer's tightening torques!). Mark all checked fittings using e.g. a permanent marker.
5. Make certain that the pipes and hose lines and every combination of connecting piece, coupling or connecting point with hoses or pipes have been inspected by a technically qualified person for safe working condition.

Connecting the line to the pressure connection

- If the tightening torque required for connecting the fittings used exceeds the tightening torque of the pressure connection (see Table 7), the pressure connection must be counterheld.
  The maximum permissible tightening torque of the female thread (see Table 9) must not be exceeded.

Port overview

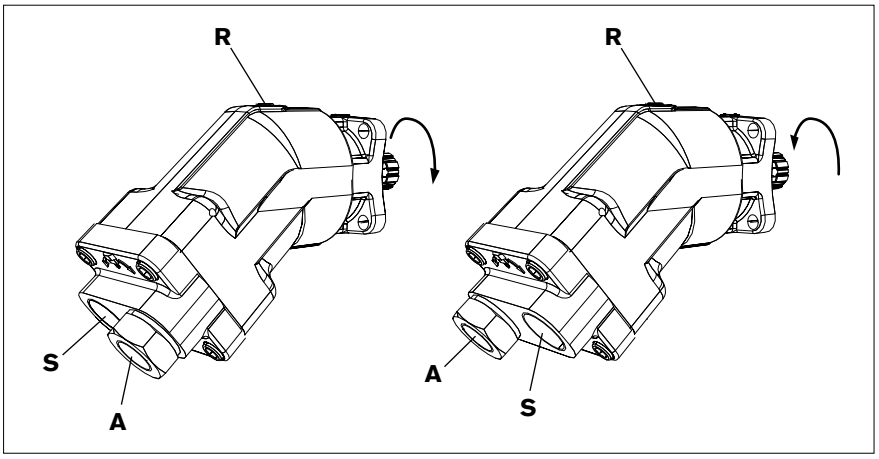


Fig. 13: Port overview A17FO/A17FNO Series 10

Table 8: Ports A17FO/A17FNO Series 10

Designation	Port for	Standard	Maximum pressure [bar][1)]	State
A	Service line Fixing threads	DIN ISO 228	350[2)]	O
S	Suction	DIN ISO 228	2	O
R	Air bleed	DIN 3852[3)]	2	X[4)]

[1)] Short term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring equipment and fittings.

[2)] 300 bar for size 125 (A17FNO).

[3)] The countersink may be deeper that specified in the standard.

[4)] Only open port "R" for filling and air bleeding.

O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Tightening torques

The following tightening torques apply:

- Female thread of the axial piston unit:
  The maximum permissible tightening torque M_{Gmax} are maximum values of the female threads and must not be exceeded. For values, see the following table.
- Fittings:
  Observe the manufacturer's instructions regarding the tightening torques of the fittings used.
- Fixing screws:
  For fixing screws with metric ISO thread according to DIN 13 or thread according to ASME B1.1, we recommend checking the tightening torque individually according to VDI 2230.
- Threaded plugs:
  For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Table 9: Tightening torques of the female threads and threaded plugs

Ports		Maximum permissible tightening torque of the female threads M_{Gmax}	Required tightening torque of the threaded plugs M_V	WAF hexagon socket for the threaded plugs
Standard	Thread size			
DIN 3852	M10 x 1	13 Nm	12 Nm	5 mm
DIN ISO 228	G1/2	200 Nm	–	–
	G3/4	330 Nm	–	–
	G1	480 Nm	–	–
	G1 1/4	720 Nm	–	–

Risk of mix-ups with threaded connections

The axial piston units are used in application areas with metric as well as with Imperial systems of units.

Both the system of units as well as the size of female thread and threaded plug (e.g. threaded plug) must match.

Due to the limited options for visually detecting differences, there is a risk of mix-ups.

WARNING!

Risk of damage to persons and property!

If a threaded plug which is of a different measurement system and size with respect to the female thread is pressurized, the threaded plug may loosen itself or even be ejected from the hole in a projectile-like manner.
This can result in serious injury and damage to equipment. Hydraulic fluid can be discharged from this leakage point.

- Use the drawings (installation drawing/data sheet) to determine the required threaded plug for each fitting.
- Make certain that there are no mix-ups when installing fittings, fixing screws and threaded plugs.
- For all female threads, use a threaded plug from the same system of units and of the correct size.

---

7 Commissioning

WARNING!

Danger while working in the danger zone of a machine or system!

It is not permissible to work in the danger zone of a machine or system.

- The machine or system may only be commissioned if safe working is ensured.
- Pay attention to and rectify potential danger sources before commissioning the machine or system.
- Nobody may stand in the danger zone of the machine or system.
- The emergency stop button for the machine or system must be within the operator's reach.
- Always follow the instructions of the machine or system manufacturer during commissioning.

CAUTION!

Risk of damage to persons and property!

Commissioning of the axial piston unit requires basic mechanical and hydraulic knowledge.

- Only qualified personnel (see chapter "2.3 Personnel qualifications") are authorized to commission the axial piston unit.

WARNING!

Risk of toxication and injury!

Contact with hydraulic fluids may cause health damage
(e.g. eye injury, skin damage, toxication upon inhalation.

- Always check the lines for wear and damage before each commissioning.
- While performing these checks, wear safety gloves, safety glasses and suitable working clothes.
- If hydraulic fluid should, nevertheless, come into contact with your eyes or penetrate your skin, consult a doctor immediately.
- When working with hydraulic fluids, strictly observe the safety instructions provided by the hydraulic fluid manufacturer.

WARNING!

Fire hazard!

Hydraulic fluid is easily flammable.

- Keep open flames and ignition sources away from the axial piston unit.

CAUTION!

Missing seals and connections lead to noncompliance with the protection class!

Fluids and contaminants may penetrate and damage the product beyond repair.

- Prior to installation, make sure that all seals and connectors are tight.

7.1 First commissioning

CAUTION!

Risk of damage to the product!

Any contamination of the hydraulic fluid will lead to wear and malfunctions. In particular, contaminants, such as welding beads or metal cuttings in the hydraulic lines, may damage the axial piston unit.

- Ensure utmost cleanliness during commissioning.
- Make sure that no contaminants may penetrate when sealing the gauge ports.

CAUTION!

Risk of damage to the product!

If you commission the axial piston unit without hydraulic fluid or with insufficient hydraulic fluid, the axial piston unit could be damaged immediately, possibly beyond repair.

- When commissioning or recommissioning a machine or system, make sure that the case interior and the suction and service lines of the axial piston unit are filled with hydraulic fluid and remain filled during operation.

When commissioning the axial piston unit, observe the basic safety instructions and intended use provided in chapter "2 General safety instructions".

- Connect the pressure gauge to the measurement points provided for operating pressure, case pressure and suction pressure to allow the technical data to be checked during initial operation.

7.1.1 Filling the axial piston unit

You will require an approved hydraulic fluid:

The machine or system manufacturer can provide you with exact details of the hydraulic fluid. Details on minimum requirements for mineral-oil based hydraulic fluids and environmentally acceptable hydraulic fluids for the axial piston unit are available in the Rexroth publications RE 90220 and RE 90221, respectively.

To ensure the functional reliability of the axial piston unit, at least cleanliness level 20/18/15 according to ISO 4406 is necessary for the hydraulic fluid. At very high hydraulic fluid temperatures (+90 °C to maximum +115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary. For permissible temperatures, see the data sheet.

CAUTION!

Risk of damage due to lack of lubrication!

Sufficient lubrication must be guaranteed to prevent damage to the axial piston unit.

- Make sure that the case is fully filled with hydraulic fluid for commissioning and operation (e.g. no air intrusion.
- Make sure that the suction line is always filled with hydraulic fluid during commissioning and operation.

The axial piston unit should be filled with a filling unit (10 μm filter grade). The axial piston unit must not be operated while it is being filled with the filing unit.

CAUTION!

Danger of environmental contamination!

The discharge or spillage of hydraulic fluid while filling the axial piston unit can lead to environmental pollution and contamination of the groundwater.

- When filling and changing the hydraulic fluid, always place a drip tray under the axial piston unit.
- Observe the information in the safety data sheet for the hydraulic fluid and the specifications provided by the system manufacturer.

1. Fill and air bleed the axial piston unit via the appropriate ports, see chapter "6.3 Installation position". The hydraulic lines of the system must also be filled.
2. Test the direction of rotation of the engine. To do this, rotate the engine briefly at the lowest rotational speed (inching). Make sure that the direction of rotation of the axial piston unit agrees with the direction of rotation of the power take-off, e.g. PTO turns clockwise, direction of rotation of the pump drive, viewed onto the drive shaft is counter-clockwise, see chapter "6.4.2 Direction of rotation and changing direction".
3. Operate the axial piston pump at a lower speed (starter speed for internal combustion engines or inching operation for electric motors) until the pump system is completely filled and bled.
4. Make certain that all ports are either piped up or plugged according to the general circuit diagram.
5. If a shut-off valve is used in the suction and/or case drain line, make sure that the axial piston unit is not operated with the shut-off valves closed.

7.1.2 Testing the hydraulic fluid supply

The axial piston unit must always have a sufficient supply of hydraulic fluid. For this reason, the supply of hydraulic fluid must be ensured at the start of the commissioning process.

When you test the hydraulic fluid supply, constantly monitor the noise development and check the hydraulic fluid level in the reservoir. If the axial piston unit becomes louder (cavitation), this indicates that the axial piston unit is not adequately supplied with hydraulic fluid.

Notes on troubleshooting can be found in chapter "14 Troubleshooting".

To test the hydraulic fluid supply:

1. Allow the engine to run at the lowest speed. The axial piston unit must be operated without load. Pay attention to leakage and noise.
2. Increase the load and check whether the operating pressure rises as expected.
3. Check the suction pressure at port "**S**" of the axial piston pump at nominal speed and maximum flow. Refer to data sheet RE 91510 and RE 91520 for the permissible value.

7.1.3 Performing functional test

WARNING!

Risk of injury in case of incorrectly connected machine or system!

Any change of the connections will lead to malfunctions (e.g. lift instead of lower) and thus represents a corresponding danger to persons and equipment.

- When connecting hydraulic components, observe the specified piping according to the hydraulic circuit diagram of the machine or system manufacturer.

Once you have tested the hydraulic fluid supply, you must perform a functional test on the machine or system. The functional test should be performed according to the instructions of the machine or system manufacturer.

The axial piston unit is checked for functional capability before delivery according to the technical data. During commissioning, it must be ensured that the axial piston unit was installed as intended in the machine or system.

- In particular, check whether the axial piston unit builds up pressure after the engine is started and that the case pressure does not rise to an impermissible level.
- If necessary, remove the pressure gauge and plug the ports so that they are pressure-proof.

7.1.4 Performing flushing cycle

In order to remove foreign particles from the system, Rexroth recommends a flushing cycle for the entire system.

The flushing cycle must be performed with an additional flushing unit. Follow the instructions of the flushing unit's manufacturer for the exact procedure during the flushing cycle. To avoid internal contamination, the axial piston unit must not be included in the flushing cycle.

7.2 Recommissioning after standstill

Depending on the installation conditions and ambient conditions, changes may occur in the system which make recommissioning necessary.

Among others, the following criteria may make recommissioning necessary:

- Air in the hydraulic system
- Water in the hydraulic system
- Aged hydraulic fluid
- Other contamination

- Before recommissioning, proceed as described in chapter "7.1 First commissioning".

7.3 Running-in phase

The bearings and sliding surfaces are subject to a running-in phase. The increased friction at the start of the running-in phase results in increased heat development which decreases with increasing operating hours. The volumetric and mechanical-hydraulic efficiency increases as well through the conclusion of the running-in phase of approx. 10 operating hours.

CAUTION!

Risk of damage by insufficient viscosity!

Increased temperature of the hydraulic fluid can cause the viscosity to move out of the permissible range.

- Monitor the operating temperature during the running-in phase.
- Reduce the loading (pressure, rpm) of the axial piston unit if impermissible operating temperatures and/or viscosities occur.

8 Operation

The product is a component which requires no settings or changes during operation. For this reason, this chapter of the manual does not contain any information on adjustment options. Use the product only within the performance range provided in the technical data. The machine or system manufacturer is responsible for the proper project planning of the hydraulic system and its control.

9 Maintenance and repair

9.1 Cleaning and care

CAUTION!

Damage to the surface caused by solvents and aggressive detergents!

Aggressive detergents may damage the seals on the axial piston unit and cause them to age faster.

- Never use solvents or aggressive detergents.

CAUTION!

Damage to the hydraulic system and the seals!

The water pressure of a power washer could damage the seals of the axial piston unit.

- Do not point a power washer at sensitive components, such as e.g. shaft seal ring.

For cleaning and care of the axial piston unit, observe the following:

- Plug all openings with suitable protective caps/devices.
- Check whether all seals and fittings on the connections are securely seated to ensure that no moisture can penetrate into the axial piston unit during cleaning.
- Use only water and, if necessary, a mild detergent to clean the axial piston unit.

9.2 Inspection

In order to enable long and reliable operation of the axial piston unit, Rexroth recommends testing the hydraulic system and axial piston unit on a regular basis and documenting the following operating conditions:

Table 10: Inspection schedule

Task to be carried out		Interval
Hydraulic system	Check level of hydraulic fluid in the reservoir.	Daily
	Check the operating temperature (comparable load conditions) at the case drain port and in the reservoir.	Weekly
	Perform a hydraulic fluid analysis Viscosity, aging, contamination	Yearly or every 2000 h (which ever occurs first)
Axial piston unit	Check axial piston unit for leakage. Early detection of hydraulic fluid loss can help to identify and eliminate faults on the machine or system. For this reason, Rexroth recommends that the axial piston unit and system always be kept in a clean condition.	Daily
	Check axial piston unit for noise development.	Daily
	Check fasteners for tight seating. All fasteners have to be checked when the system is switched off, non-pressurized and cooled down.	Monthly

9.2.1 Checking the inspection hole

CAUTION!

Risk of property damage!

If hydraulic fluid leaks from the inspection hole, both the axial piston unit and the power take-off may drain and be damaged.

- Check the inspection hole daily for leakage.

- Check the inspection hole (**1**) of the axial piston unit daily for leakage.

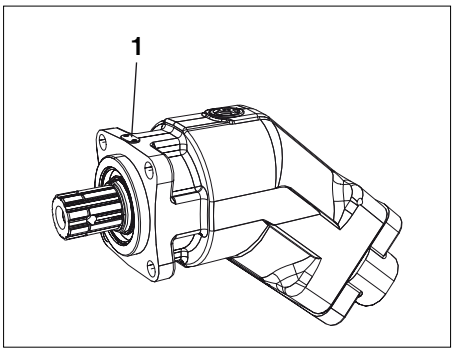


Fig. 14: Inspection hole

The inspection hole is protected against external contamination with a cover. The cover must not be removed.

- If hydraulic fluid leaks from the inspection hole, at least one of the two shaft seal rings is leaky. Both shaft seal rings of the axial piston unit must be replaced.

In the event of questions regarding repair and spare parts, contact your responsible Rexroth Service partner or the service department of the manufacture's plant for the axial piston unit, see chapter "9.5 Spare parts" for further information.

9.3 Maintenance

The axial piston unit is low maintenance when used as intended.

The service life of the axial piston unit is heavily dependent on the quality of the hydraulic fluid. For this reason, we recommend changing the hydraulic fluid at least once per year or every 2000 operating hours (which ever occurs first) or having it analyzed by the hydraulic fluid manufacturer or a laboratory to determine its suitability for further use.

The service life of the axial piston unit is limited by the service life of the bearings fitted. The service life can be requested from the responsible Rexroth Service partner, see "9.5 Spare parts" for address. Based on these details, a maintenance period is to be determined by the system manufacturer for the replacement of the bearings and included in the maintenance schedule of the hydraulic system.

9.4 Repair

Rexroth offers a comprehensive range of services for the repair of Rexroth axial piston units.

Repairs to the axial piston unit may only be performed by authorized, skilled and instructed personnel.

- Only use genuine spare parts from Rexroth for repairing the Rexroth axial piston units.

Tested and pre-installed original Rexroth assembly groups allow for successful repair requiring only little time.

9.5 Spare parts

CAUTION!

Personal injury and property damage due to faulty spare parts!

Spare parts that do not meet the technical requirements specified by Rexroth may cause personal injury or property damage.

- Use only original spare parts from Rexroth.

The spare parts lists for axial piston units are order specific. When ordering spare parts, quote the material and serial number of the axial piston unit as well as the material numbers of the spare parts.

Address all questions regarding spare parts to your responsible Rexroth Service partner or the service department of the manufacture's plant for the axial piston unit.

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service.elchingen@boschrexroth.de

For the addresses of foreign subsidiaries, please refer to
`www.boschrexroth.com/addresses`

10 Decommissioning

The axial piston unit is a component that does not require decommissioning. For this reason, this chapter of the manual does not contain any information.

For details about how to remove or replace your axial piston unit, please refer to chapter "11 Removal and replacement".

11 Removal and replacement

11.1 Required tools

Removal can be performed using standard tools. No special tools are necessary.

11.2 Preparing for removal

WARNING!

Risk of injuries due to remove under pressure and voltage!

If you do not switch off the pressure and power supply before removing the product, you may get injured or the device or system components may be damaged.

- Make certain that the relevant system components are not under pressure or voltage.

1. Decommission the entire system as described in the overall manual for the machine or system.
2. Protect the complete system against being energized.
3. Relieve the hydraulic system according to the instructions of the machine or system manufacturer.

11.3 Removing the axial piston unit

Proceed as follows to remove the axial piston unit:

1. Make sure that the hydraulic system is non-pressurized.
2. Check whether the axial piston unit has cooled down far enough so that it can be removed without danger.
3. For below-reservoir installation, before removing the axial piston unit from the complete system, seal the connection to the reservoir or drain the reservoir.
4. Place a drip tray under the axial piston unit to collect any hydraulic fluid that may escape.

CAUTION!

Danger of environmental contamination!

The discharge or spillage of hydraulic fluid while removing the axial piston unit can lead to environmental pollution and contamination of the groundwater.

- When draining the hydraulic fluid, always place a drip tray under the axial piston unit.
- Observe the information in the safety data sheet for the hydraulic fluid and the specifications provided by the system manufacturer.

5. To do this, loosen the lines and collect the escaping hydraulic fluid in the drip tray.
6. Remove the axial piston unit. Use a suitable lifting device.
7. Completely empty the axial piston unit.
8. Plug all openings.

11.4 Preparing the components for storage or further use

- Proceed as described in section "5.2 Storing the axial piston unit".

12 Disposal

Observe the following points when disposing of the axial piston unit:

1. Completely empty the axial piston unit.
2. Dispose of the hydraulic fluid according to the national regulations of your country.
3. Remove the axial piston unit into its individual parts and properly recycle these parts.
4. Separate parts by:
   - Cast parts
   - Steel
   - Aluminum
   - Non-ferrous metal
   - Electronic waste
   - Plastic
   - Seals.

12.1 Environmental protection

Careless disposal of the axial piston unit, the hydraulic fluid and the packaging material could lead to pollution of the environment.

- Therefore, dispose of the axial piston unit, the hydraulic fluid and the packaging material in accordance with the currently applicable regulations in your country.
- Dispose of residual hydraulic fluid in accordance with the applicable safety data sheets for these hydraulic fluids.

13 Extension and conversion

Do not convert the axial piston unit. You are only authorized to change the pressure connection on the service line ports according to the instructions in chapter "6.4.2 Direction of rotation and changing the direction of rotation".

The Rexroth warranty only applies to the delivered configuration. In case of extensions or conversions, the warranty will become void.
Exception: Converting the pressure connection

14 Troubleshooting

The following table may assist you in troubleshooting. The table makes no claim for completeness.

In practical use, problems which are not listed here may also occur.

14.1 How to proceed for troubleshooting

- Always act systematically and targeted, even under pressure of time. Random and imprudent removal and readjustment of settings could result in the inability to ascertain the original error cause.
- First obtain a general overview of how your product works in conjunction with the entire system.
- Try to determine whether the product worked properly in conjunction with the entire system before the error occurred.
- Try to determine any changes of the entire system in which the product is integrated.
  - Were there any changes to the product's application conditions or operating range?
  - Were there any changes or repair works on the complete system (machine / system, electrics, control) or on the product? If yes, which?
  - Has the hydraulic fluid been changed?
  - Was the product or machine operated as intended?
  - How did the malfunction appear?
- Try to get a clear idea of the error cause. Directly ask the (machine) operator.
- If you cannot rectify the error, contact one of the contact addresses which can be found under:
  www.boschrexroth.com/addresses.

14.2 Malfunction table

Table 11: Malfunction table - fixed pump

Malfunction	Possible cause	Remedy
Unusual noises	Drive speed too high.	Machine or system manufacturer.
	Wrong direction of rotation.	For how to convert the pressure connection, see chapter "6.4.2 Direction of rotation and changing the direction of rotation".
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed the axial piston unit, fill the suction line with hydraulic fluid.
		Remove contaminants from the suction line.
	Improper fixing of the axial piston unit.	Check fixing of the axial piston unit according to the specifications of the machine or system manufacturer. Observe tightening torques.
	Improper fixing of the attachment parts, e.g. coupling and hydraulic lines.	Fix attachment parts according to the information provided by the coupling or fitting manufacturer.
	Mechanical damage to the axial piston unit (e.g. bearing damage).	Exchange axial piston unit, contact Rexroth Service.
No or insufficient flow	Faulty mechanical drive (e.g. defective coupling).	Machine or system manufacturer.
	Drive speed too low.	Machine or system manufacturer.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed the axial piston unit, fill the suction line with hydraulic fluid.
		Remove contaminants from the suction line.
	Hydraulic fluid not in optimum viscosity range.	Use suitable hydraulic fluid (machine or system manufacturer).
	Wear of axial piston unit.	Exchange axial piston unit, contact Rexroth Service.
	Mechanical damage to the axial piston unit.	Exchange axial piston unit, contact Rexroth Service.
No or insufficient pressure	Faulty mechanical drive (e.g. defective coupling).	Machine or system manufacturer.
	Drive power too low.	Machine or system manufacturer.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed the axial piston unit, fill the suction line with hydraulic fluid.
		Remove contaminants from the suction line.
	Hydraulic fluid not in optimum viscosity range.	Use suitable hydraulic fluid (machine or system manufacturer).
	Wear of axial piston unit.	Exchange axial piston unit, contact Rexroth Service.
	Mechanical damage to the axial piston unit (e.g. bearing damage).	Exchange axial piston unit, contact Rexroth Service.
	Output unit defective (e.g. hydraulic motor or cylinder).	Machine or system manufacturer.

Table 11: Malfunction table - fixed pump

Malfunction	Possible cause	Remedy
Pressure/flow fluctuations	Axial piston unit not or insufficiently air bled.	Completely air bleed axial piston unit.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed the axial piston unit, fill the suction line with hydraulic fluid.
		Remove contaminants from the suction line.
Excessive hydraulic fluid and case temperature	Excessive inlet temperature at the axial piston unit.	Machine or system manufacturer: inspect system, e.g. malfunction of the cooler, insufficient hydraulic fluid in the reservoir.
	Wear of axial piston unit.	Exchange axial piston unit, contact Rexroth Service.
Instability/vibrations	Setpoint value not stable.	Machine or system manufacturer.

15 Technical data

The technical data of your axial piston unit can be found in data sheet RE 91510 (A17FNO) and RE 91520 (A17FO).

The data sheet can be found on the internet at

www.boschrexroth.com/axial-piston-pumps

The technical data of your axial piston unit can be found in the order confirmation.

16 Appendix

16.1 Address directory

For the addresses of foreign subsidiaries, please refer to www.boschrexroth.com/addresses

17 Index

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T

U

W

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