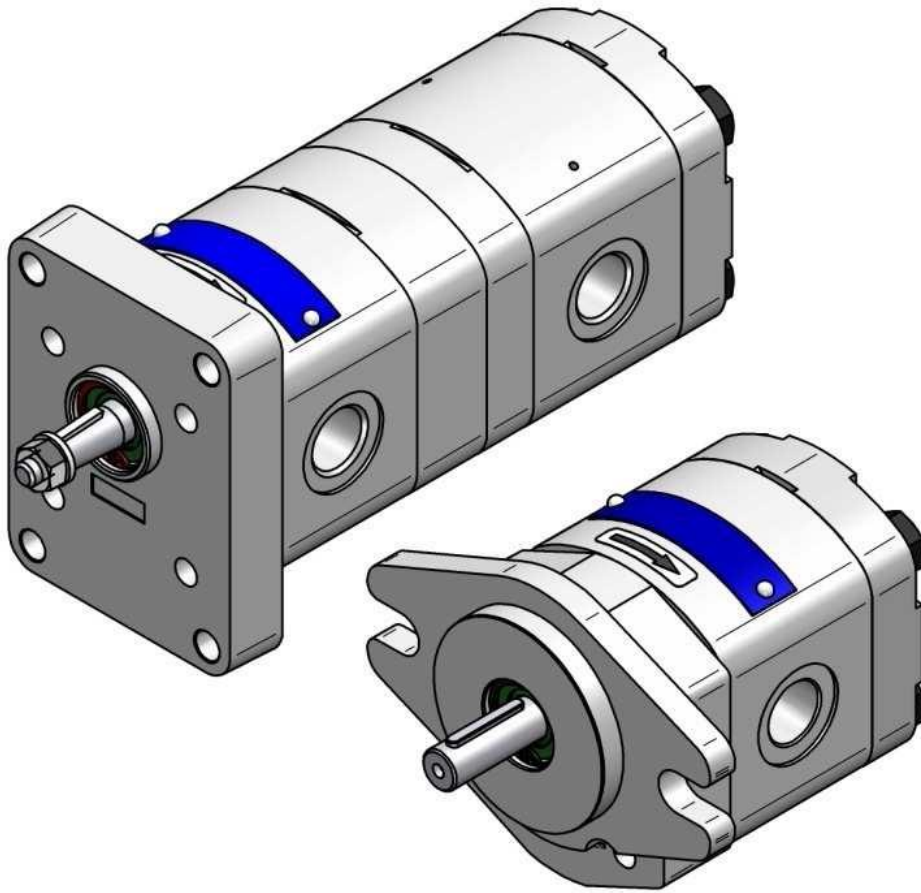# Service manual

Gear pumps - series P23

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AERO TECHNOLOGY & HYDRAULICS

1. Basic description

The gear pumps serve for changing the mechanical energy into pressure head of the liquid. Pumps P23 are intended for the use in hydraulic systems of the smaller power capacities (approximately un to 10 kW). They are manufactured in the one-way and reverse design with internal or external drainage. They are also manufactured in the multiple designs with independent inlets of the working liquid into individual sections or, with one common inlet. In case of the standard design, the individual sections are not mutually sealed. Therefore, the different liquids cannot be used for individual sections, and the common tank must be used. The sealed sections can be produced on the special request of the customer.

2. Table of parameters

Parameters Nominal sizes		Marking	Unit	P23-0,8	P23-1,2	P23-1,6	P23-2,1	P23-2,5	P23-3,3	P23-3,6
Nominal geometric volume		V_g	[cm^3]	0,8	1,2	1,6	2,1	2,5	3,3	3,6
Speed	nominal	n_n	[min^{-1}]	1500						
	minimum	n_{min}	[min^{-1}]	800		600		500		
	maximum	n_{max}	[min^{-1}]	5000		4500		4000		
Inlet pressure	minimum	$p1_{min}$	[bar]	-0,3						
	maximum	$p1_{max}$	[bar]	0,5						
Outlet pressure	max. permanent	p_{2n}	[bar]	280						260
	maximum	p_{2max}	[bar]	300						280
	peak	p_3	[bar]	310						290
Nominal outlet flow (min.) at nn and p2n		Q_n	[dm^3.min^{-1}]	1,07	1,60	2,13	2,71	3,35	4,54	4,98
Maximum flow at nmax and p2max		Q_{max}	[dm^3.min^{-1}]	4,23	6,22	8,34	9,29	11,20	14,30	17,37
Input - nominal (max.) at nn and p2n		P_n	[kW]	0,70	1,04	1,39	1,72	2,07	2,97	3,35
Maximum input at nmax and p2max		P_{max}	[kW]	2,51	3,70	4,96	5,52	6,65	7,80	7,93
Weight		m	[kg]	0,82	0,84	0,85	0,87	0,89	0,92	0,93
Driving torque by multiple pumps must not exceed 22 Nm.										

Parameters Nominal sizes		Marking	Unit	P23-4,4	P23-4,8	P23-5,8	P23-6,2	P23-7,9	P23-11,8
Nominal geometric volume		V_g	[cm^3]	4,4	4,8	5,8	6,2	7,9	11,8
Speed	nominal	n_n	[min^{-1}]	1500					
	minimum	n_{min}	[min^{-1}]	500					
	maximum	n_{max}	[min^{-1}]	4000	3800		3500	3000	1800
Inlet pressure	minimum	p_{1min}	[bar]	-0,3					
	maximum	p_{1max}	[bar]	0,5					
Outlet pressure	max. permanent	p_{2n}	[bar]	250	230	200	180	160	100
	maximum	p_{2max}	[bar]	270	250	220	200	180	150
	peak	p^3	[bar]	280	260	230	210	190	160
Nominal outlet flow (min.) at nn and p2n		Q^n	[dm^3.min^{-1}]	6,06	6,61	8,00	8,56	10,90	16,30
Maximum flow at nmax and p2max		Q^{max}	[dm^3.min^{-1}]	17,38	18,01	21,83	21,50	23,43	21,02
Input - nominal (max.) at nn and p2n		P^n	[kW]	3,23	3,24	3,41	3,29	3,71	3,47
Maximum input at nmax and p2max		P^{max}	[kW]	9,29	8,29	9,51	8,52	8,35	2,64
Weight		m	[kg]	0,96	0,98	1,02	1,04	1,10	1,25
Driving torque by multiple pumps must not exceed 22 Nm.									

Parameters Nominal sizes		Marking	Unit	P23-1,0	P23-2,3	P23-2,65	P23-6,4	P23-7,0	P23-10,0
Nominal geometric volume		V_g	[cm^3]	1	2,3	2,65	6,4	7	10
Speed	nominal	n_n	[min^{-1}]	1500					
	minimum	n_{min}	[min^{-1}]	800	500				
	maximum	n_{max}	[min^{-1}]	5000	4500	3500	3000	1800	
Inlet pressure	minimum	p_{1min}	[bar]	-0,3					
	maximum	p_{1max}	[bar]	0,5					
Outlet pressure	max. permanent	p_{2n}	[bar]	280			180	170	100
	maximum	p_{2max}	[bar]	300			200	190	150
	peak	p_3	[bar]	310			210	200	160
Nominal outlet flow (min.) at nn and p2n		Q_n	[dm^3.min^{-1}]	1,28	3,12	3,62	8,85	9,65	13,90
Maximum flow at nmax and p2max		Q_{max}	[dm^3.min^{-1}]	5,03	10,25	11,90	22,24	20,81	17,83
Input - nominal (max.) at nn and p2n		P_n	[kW]	0,84	1,89	2, 20	3,40	3,50	2,94
Maximum input at nmax and p2max		P_{max}	[kW]	2,99	6,09	7,08	8,81	7,83	5,30
Weight		m	[kg]	0,83	0,88	0,90	1,05	1,08	1,20
Driving torque by multiple pumps must not exceed 22 Nm.									

3. Working liquid

- Mineral oils for hydraulic drives
- Hydraulic liquids based on vegetable oils, suitable for hydrostatic drives

3.1 Liquid temperature

t = -20 ÷ +80 [°C] for NBR sealing material

t = -20 ÷ +120 [°C] for FKM sealing material

t= -30 ÷ +120 [°C] for CR sealing material

3.2 Kinematic viscosity of liquid $[m^2 .s^{-1}]$

The range at permanent operation $\qquad$ 20.10-6 up to 100.10^{-6}

Maximum when put in operation (at kinematic viscosity $\qquad$ 1200.10^{-6}
>1000, the allowed service pressure is <10 bar, speed < 1500.min^{-1})

minimum (for a short term, for maximum 10 minutes) $\qquad$ 10.10^{-6}

3.3 Filtration coefficient β_α

$\beta_{25}75 \geq$ (for pressure $p2 < \square 200$ bar)
$\beta_{10}75 \geq$ (for pressure $p2 > \square 200$ bar)

3.4 Contamination level – class of liquid ISO 4406
19/16 (for pressure $p2 < \square 200$ bar)
17/14 (for pressure $p2 > \square 200$ bar)

3.5 Contamination level – class of liquid NAS 1638
10 (for pressure $p2 < 200$ bar)
8 (for pressure $p2 > \square 200$ bar)

4. Pump drive

Driving mechanism must cause neither the axial nor radial load of the pump shaft. In case of the operation with the load of the driving shaft, the pump must be equipped with the front-end bearing. The driving mechanism must meet the specified tolerances of the position, see the Figure No. 1. The usage of flexible coupling is recommended.
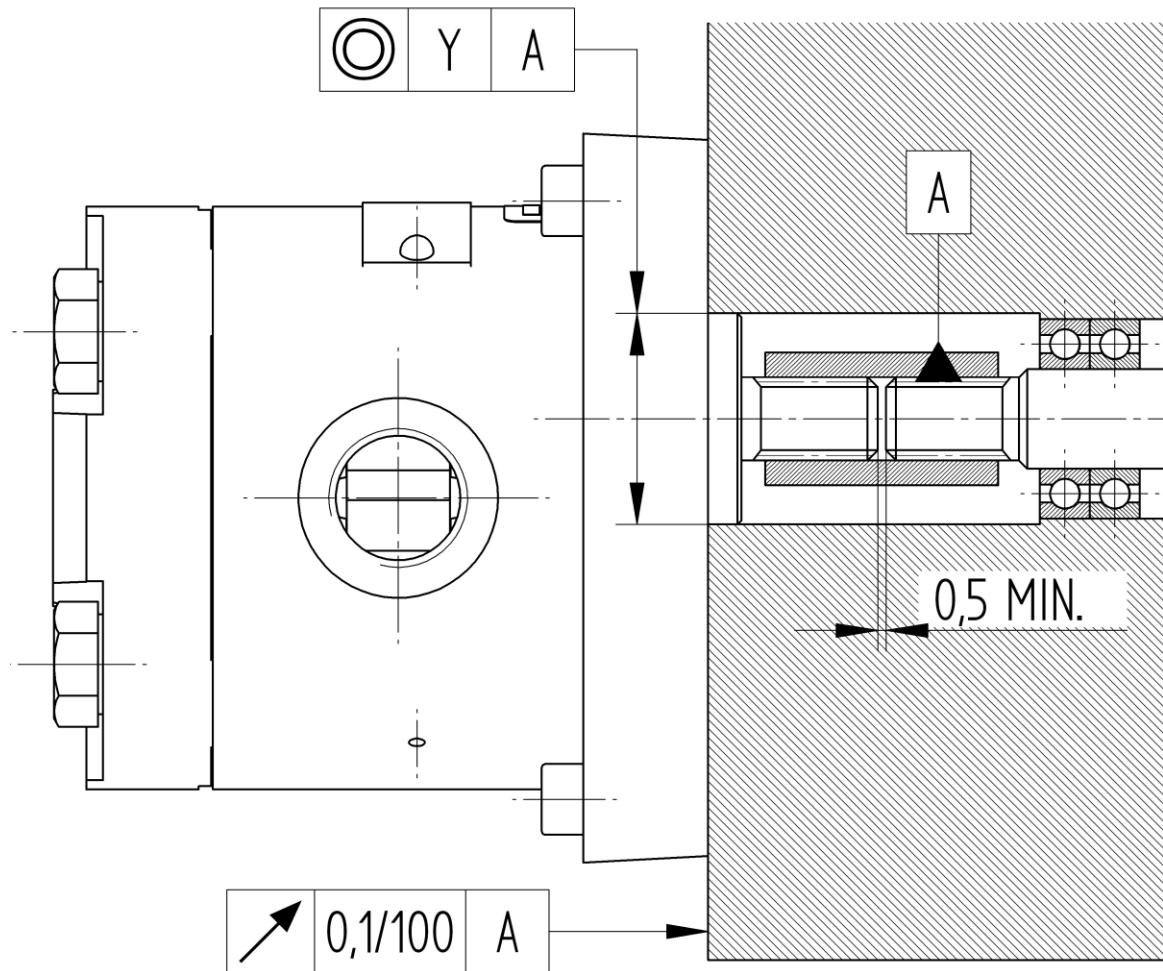
The tolerance of the driving mechanism position:

Figure 1

Coupling used for the of the torque transmission	flexible	solid
Y (mm)	0,1	0,04

5. Assembly / disassembly and service instructions

The gear pump can be installed on the final product in the arbitrary position. The external check of the pump must be done before its installation on the driving unit.

During handling, it is necessary to avoid damage of the flange seating face, of the spigot, of the end of driving shaft, possibly of the sealing faces at inlet and outlet.

The end of the driving shaft can be easily put into the catch cam until the pump flange face seats on the counterpart. If the pump´s shaft has the spline end or claw where the permanent lubrication is not secured during operation, we recommend to lubricate it by the suitable grease on the assembly occasion.

Fix the pump to the counterpart by tightening the screws (nuts) after the pump´s flange face has seated completely on the seating face of the counterpart (casing).

Remove the safety plugs of the inlet and outlet holes of all sections before connecting the pump to the hydraulic circuit. Check, whether the threads for connecting the hydraulic line are not damaged. During assembly, please, avoid the entering of impurities into the pump.

The seal on the flange face must be such arranged to prevent the oil leakage from the driving mechanism area through the pump´s binder screws.

After connection, let the pump run at least 2 minutes without pressure at minimum speed and monitor whether it runs smoothly, without excessive heating. When hot oil enters the cold pump, do not load it before the whole unit is warmed up completely.

When dismantling the final product, protect the internal area by covering the connecting holes immediately.

The safety valve must be installed in the pump hydraulic circuit. The valve must be proteced against incompetent manipulation. The valve is adjusted at the most on maximal permanent pump pressure . The peak pressure in the circuit must not exceed the allowed value. In case of multiple pumps, the safety valve must be installed in the circuit of each section.

The used oil quality must meet the relevant oil standard for the whole operation period and its specified cleaning must be ensured.

It must be ensured that the oil quantity in the hydraulic circuit will not drop under the value when, in the inlet branch area, the oil turbulence appears as well as the air intake and the temperature increase above the allowed limit. After pump installation into hydraulic circuit, and after any circuit dismantling, it is necessary to vent the whole system perfectly.

Hydraulic line – the intake line should have the nominal diameter specified such that at the viscosity 100.10^{-6} m^2 $.s^{-1}$ and at maximum flow, the pressure intake does not exceed the allowed values. The pressure line should have such nominal diameter that the liquid speed does not exceed 8 $m.s^{-1}$.

Operation – the gear pumps do not need, during the operation, the special maintenance or service except the care of the working liquid and the regular inspections for detecting the possible leakage in joints and the checks of the pump binder screws (nuts) tightening. The oil change must be done with regard on the correct functioning of the whole hydraulic circuit. The working liquid change interval will be specified by the finalist on the base of the operation test.

At the pump assembly, with the help of two screws M8 coming through the pump, the screws tightening torque 20 ± 3 Nm is specified.

2x M8
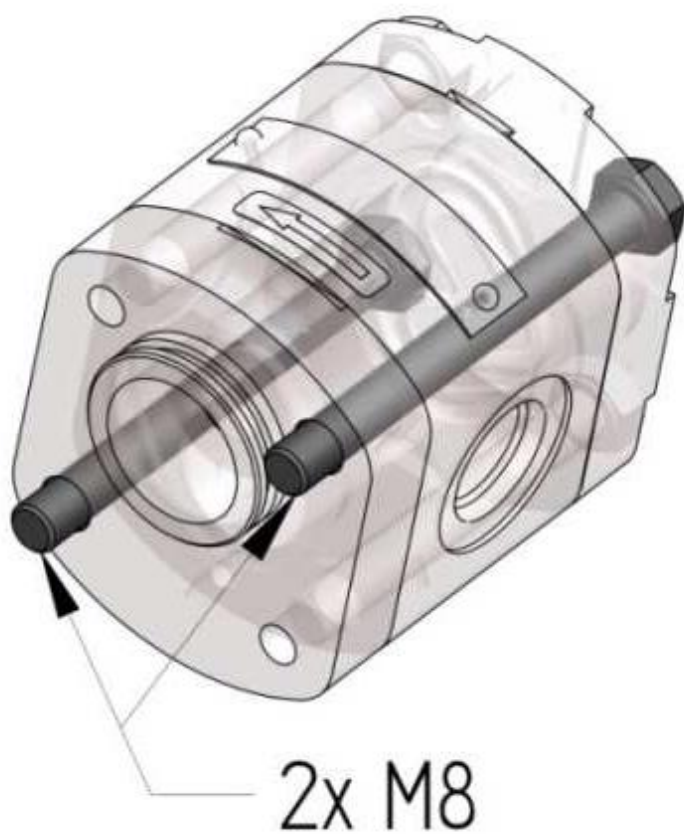
The pump conversion or other modifications are not allowed.
The manufacturer disclaims responsibility for any damage resulting from the incorrect installation and exploitation.