3

APF Series

High Pressure Gear Pumps.

3.1 MAIN CHARACTERISTICS AND NOMINAL FLOW RATES

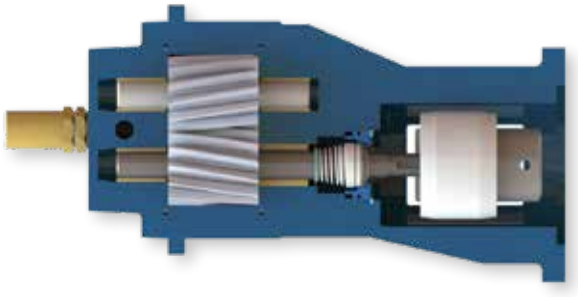
APF pumps are volumetric gear pumps suitable for transferring lubricant viscous liquids without any suspended solids or abrasive substances. They are self-priming pumps used for a wide range of liquids with a viscosity from 1 to 1000 cSt (when driven by a standard industrial electric motor). The speed of rotation is chosen according to the viscosity of the liquid. Flowrate range is from 5 to 80 L/min. These pumps are designed to reach a maximum pressure of 25 bar.

The standard construction consists of pump housing and cover in cast iron, shafts and gears in carbon steel, O-rings in Viton, sleeve bushings in sintered bronze and mechanical seal in ceramic-graphite-Viton. APF pumps are supplied with a pressure relief valve in brass.

Nozzles in inlet and outlet are of the same diameter and positioned on the same axis.

A short and straight alignment of the flow channels provides for a good suction capability and a quiet running. The helical gears result in extremely low noise levels and reduced pressure pulsation.

Fig. 301 – APF pump, standard version



APF are bare shaft pumps designed to be coupled to an IEC electric motor IMB34 by means of coupling.

The electric motor can be supplied on request.
Standard flanges are listed as follows:

Tab. 301 - Standard flanges IM B34 on APF pumps

PUMP SIZE (APF)	IEC Frame size				
	71	80	90	100	112
	Flange [mm]				
	105	120	140	160	160
5					
10					
15					
20					
25					
30					
40					
50					
60					
70					
80					

Table 302 shows the possible flow rates for non-pressurized pumping (Δp=0) and a 46 cSt fluid.
The flow rate of gear pumps is virtually proportional to their speed. The selected speeds are the most common speeds at rated power of industrial electric motors at 50 and 60Hz.

Tab. 302 – Nominal flow rates

PUMP SIZE (APF)	Geometrical displacement V_{geo} [cm³/rev]	Nominal flow rate Q_{teo} [L/min] at Speed n [1/min]					
		690	830	950	1150	1450	1750
5	4.6	3.1	3.8	4.3	5.2	6.6	8.0
10	9.1	6.3	7.5	8.6	10.5	13.2	15.9
15	13.6	9.4	11.3	12.9	15.7	19.8	23.9
20	15.9	11.0	13.2	15.1	18.3	23.1	27.8
25	18.2	12.5	15.1	17.3	20.9	26.4	31.8
30	23.4	16.2	19.4	22.2	26.9	33.9	41.0
40	28.1	19.4	23.3	26.7	32.3	40.7	49.1
50	36.3	25.1	30.1	34.5	41.8	52.7	63.6
60	43.6	30.1	36.2	41.4	50.1	63.2	76.3
70	50.9	35.1	42.2	48.3	58.5	73.7	89.0
80	58.1	40.1	48.2	55.2	66.8	84.3	101.7

3.2 MAIN OPTIONS

The main options available are:

- Clockwise rotation (see paragraph 3.3)
- Special seals according to liquids and temperatures (see paragraph 3.4)
- Options on relief valve (see paragraph 3.5)
- Motors (see paragraph 3.6)
- Accessories (see paragraph 3.7)

3.3 SENSE OF ROTATION AND FLOW DIRECTION

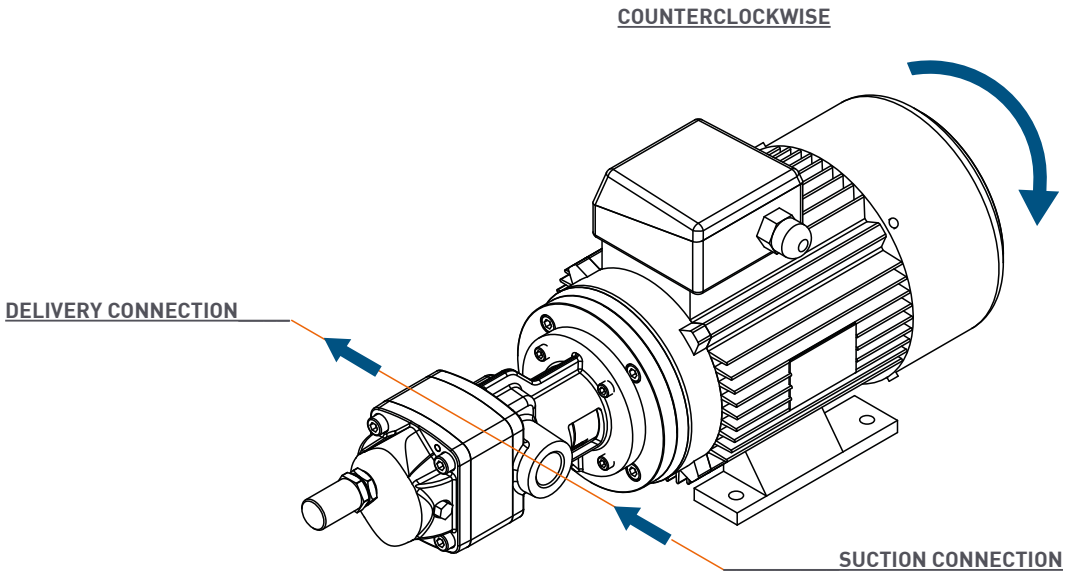
The standard version of APF pumps can operate only in one direction of rotation: counterclockwise watching the pump shaft end.

The direction of the fluid flow is shown by an arrow placed nearby the piping connections.

A proper mounting will keep the nameplate on the top side. In this case the flow direction will be from the left side to the right side watching the pump shaft end and the pressure side (delivery) will be at the right-hand side.

On request a clockwise version can be supplied.

Fig. 302 – Sense of rotation and flow direction on APF Serie



3.4 SHAFT-END SEALS

The standard version is fitted with mechanical seal in ceramic-graphite-FPM. A number of different seals materials can be supplied for different liquids and operating temperatures.

On request:

- Radial lip-type seal in FPM (Viton), NBR or PTFE (Teflon)
- Seal for high temperatures up to 200°C
- Reversible mechanical seal

Fig. 303 – Mechanical seal

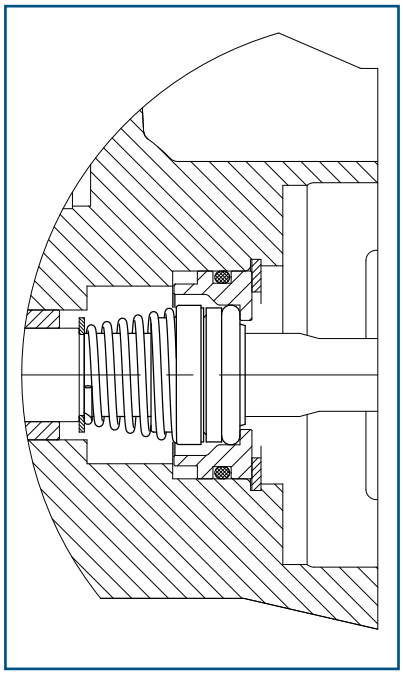
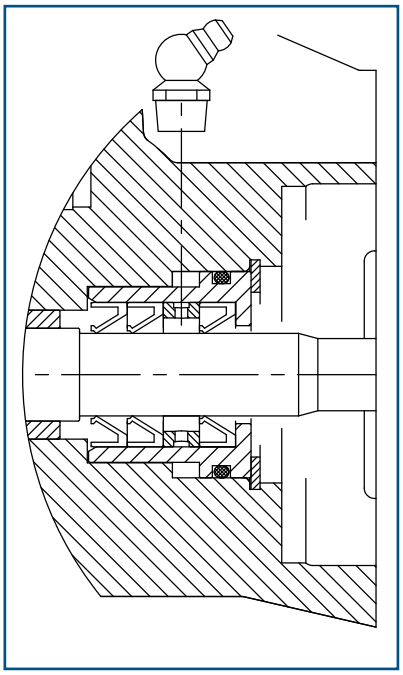


Fig. 304 – Lip seal



3.5 PRESSURE RELIEF VALVE

APF pumps are supplied with a brass pressure relief valve as a standard. It works only on outlet, in one direction.

It may be used as a safety valve only for short-term operations. When a partial discharge flow has to be drained over a prolonged period of time, a separate by-pass valve with return to the suction tank has to be installed into the piping.

The pressure relief valve is designed as a spring-preloaded piston valve. It is integrated into the pump's end cover.

The spring pretension and the relative opening pressure can be adjusted by means of a screw. Different springs are also available to reach the desired adjustment range.

As an option the pumps can be supplied without relief valve.

3.6 MOTORIZATION

The most common installed electric motors have the following characteristics:

- Standard motors in IP55, insulation class F available at 4, 6 and 8 poles
- Standard voltages for Three-phase motors ≤ 4kW 230/400V 50Hz - 265/460V 60Hz
- Standard voltages for Three-phase motors ≥ 5.5kW 400/690V 50Hz - 460/795V 60Hz
- Standard voltages for Single-phase motors 230V 50Hz

Special options on electric motors:

- Atex motors
- Motors with built-in frequency converter
- Motors suitable for frequency converter connection
- Motor with forced ventilation
- Tropicalization
- Special voltages
- Protection IP56/IP65
- Protection IP67/IP68
- Thermistors PTC
- Special treatment for corrosive and saline environment
- Motors according to UL-CSA, NEMA, cURus and Marine regulations
- Insulation class H

Special motors available:

- Internal combustion engines
- Gearmotor
- Mechanical variator
- DC motors at 12V and 24V

3.7 ACCESSORIES

- Pump on trolley
- Control panel
- ON/OFF switches
- Reversing switches
- Piping
- Heated piping
- Valves
- Pressure gauge and pressure switch
- Electric cables

3.8 SOUND LEVEL

The sound level has been measured in dB(A) at 1m distance, at 1450 1/min with a gear oil (viscosity 46 cSt).

Tab. 303 – Sound level

PUMP SIZE (APF)	Sound level dB(A) at pressure			
	5 bar	10 bar	15 bar	25 bar
5	72	73	74	80
10	72	73	74	80
15	72	73	74	80
20	72	73	74	80
25	72	73	74	80
30	74.5	75	77	80
40	74.5	75	77	80
50	74.5	75	77	80
60	74.5	75	77	80
70	74.5	75	77	80
80	74.5	75	77	80

3.9 PUMP SELECTION AND PERFORMANCE DATA

In table 304 are listed the actual delivery Q_{eff} and required power P_{mec} for each pump size at different speeds and pressures.

The data refers to a mineral oil ISO46 (Kinematic viscosity 46 cSt at 40°C).

The rated power for the drive motor should be 20% higher than the required power P_{mec}.

For different viscosities please ask the performances (delivery and power) to our technical department.

As a general rule the flow rate is approximately proportional to the speed.

A lower viscosity may lead to a loss of the net delivery and a higher viscosity may lead to an increase of the net delivery.

When dimensioning please consider the maximum viscosity, usually at the start-up phase.

Pump selection, delivery and required power at different speeds:

1) Given the project delivery Q_{pro} [L/min] and speed n_{pro} [1/min] calculate the project displacement V_{pro} [cm^3/rev]:

$$V_{pro} = 1000 \times Q_{pro} / n_{pro}$$

2) Select the Pump Type with the geometrical displacement V_{geo} closer to $V_{pro,}$

3) Read from the Performance Table the delivery at 1450 1/min and at the given pressure p:

$$Q_{1450,\,p}\ [L/min]$$

4) Calculate the actual delivery Q [L/min] at n_{pro} and p:

$$Q = Q_{1450,\,p} + V_{geo} \times (n_{pro} - 1450) / 1000$$

5) Read from the Performance Table the required power and actual delivery of the selected Pump Type at the closer speed nx to n_{pro} and at p:

$$P_{nx,\,p}\ [kW],\ Q_{nx,\,p}\ [L/min]$$

6) Calculate the actual required power P at n_{pro} and p [kW]:

$$P = P_{nx,\,p} \times Q / Q_{nx,\,p}$$

Tab. 304 - Performance data at 690, 830, 950, 1150, 1450, 1750 1/min and 46 cSt

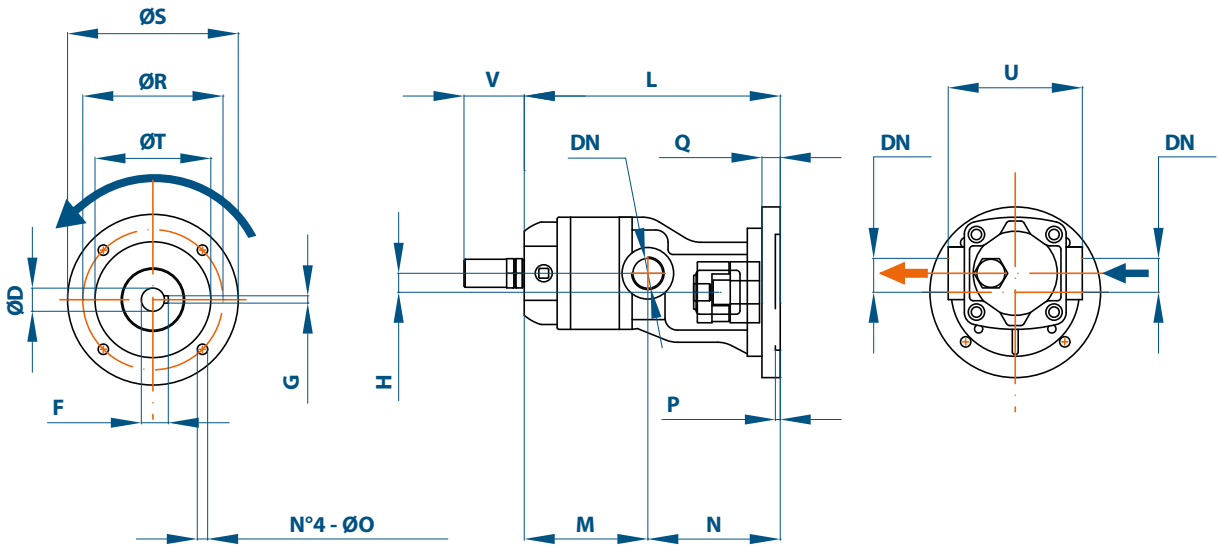
PUMP SIZE (APF)	Geometrical displacement V_{geo} [cm³/rev]	Pressure p [bar]	Speed n [1/min]											
			690		830		950		1150		1450		1750	
			Q_{eff} [L/min]	P_{mec} [kW]	Q_{eff} [L/min]	P_{mec} [kW]	Q_{eff} [L/min]	P_{mec} [kW]	Q_{eff} [L/min]	P_{mec} [kW]	Q_{eff} [L/min]	P_{mec} [kW]	Q_{eff} [L/min]	P_{mec} [kW]
5	4.6	5	2.9	0.09	3.5	0.11	4.0	0.12	4.9	0.14	6.2	0.2	7.5	0.2
		10	2.7	0.2	3.2	0.2	3.7	0.2	4.6	0.3	5.8	0.4	7.1	0.5
		15	2.4	0.2	3.0	0.3	3.4	0.3	4.2	0.4	5.4	0.5	6.7	0.7
		25	1.9	0.4	2.4	0.5	2.8	0.6	3.6	0.7	4.7	0.9	5.8	1.1
10	9.1	5	5.8	0.2	7.1	0.2	8.1	0.2	9.8	0.3	12.5	0.3	15.1	0.4
		10	5.4	0.3	6.6	0.3	7.6	0.4	9.2	0.5	11.8	0.6	14.3	0.8
		15	5.0	0.4	6.1	0.5	7.0	0.6	8.6	0.7	11.0	0.9	13.5	1.1
		25	4.1	0.7	5.1	0.8	6.0	1.0	7.4	1.2	9.6	1.5	11.9	1.9
15	13.6	5	8.8	0.2	10.7	0.3	12.2	0.3	14.8	0.4	18.7	0.5	22.6	0.7
		10	8.3	0.3	10.0	0.4	11.5	0.5	13.9	0.6	17.7	0.9	21.4	1.1
		15	7.7	0.5	9.3	0.6	10.7	0.7	13.1	0.9	16.6	1.2	20.2	1.5
		25	6.6	0.7	8.0	0.9	9.2	1.0	11.3	1.3	14.5	1.8	17.7	2.2
20	15.9	5	10.2	0.2	12.3	0.3	14.1	0.3	17.2	0.4	21.8	0.5	26.5	0.7
		10	9.3	0.4	11.4	0.5	13.1	0.6	16.1	0.7	20.5	0.9	25.1	1.2
		15	8.5	0.6	10.5	0.7	12.1	0.8	15.0	1.0	19.3	1.3	23.7	1.7
		25	6.9	0.9	8.6	1.2	10.1	1.3	12.7	1.7	16.8	2.2	21.0	2.7
25	18.2	5	11.5	0.4	13.9	0.5	16.0	0.5	19.5	0.6	24.7	0.6	30.0	0.6
		10	10.5	0.7	12.7	0.8	14.7	0.9	18.1	1.0	23.1	1.1	28.2	1.2
		15	9.4	0.9	11.6	1.1	13.4	1.2	16.6	1.4	21.5	1.6	26.5	1.8
		25	7.3	1.4	9.2	1.7	10.9	1.9	13.8	2.2	18.3	2.7	22.9	3.1
30	23.4	5	14.8	0.5	18.0	0.5	20.7	0.6	25.3	0.6	32.3	0.8	39.4	1.0
		10	13.5	0.9	16.5	1.0	19.2	1.1	23.8	1.2	30.7	1.4	37.8	1.7
		15	12.1	1.3	15.1	1.5	17.7	1.6	22.2	1.8	29.1	2.1	36.3	2.4
		25	9.4	2.0	12.2	2.4	14.7	2.6	19.0	3.0	25.9	3.4	33.1	3.8
40	28.1	5	19.5	0.5	23.5	0.6	27.0	0.8	32.8	1.0	41.5	1.4	50.1	1.8
		10	19.0	1.0	23.0	1.2	26.4	1.4	32.1	1.7	40.8	2.2	49.4	2.6
		15	18.4	1.4	22.4	1.7	25.8	1.9	31.5	2.4	40.1	3.0	48.7	3.5
		25	17.3	2.3	21.2	2.7	24.5	3.1	30.2	3.7	38.8	4.6	47.3	5.3
50	36.3	5	22.5	0.6	27.7	0.7	32.3	0.8	40.0	1.0	51.5	1.4	62.2	1.7
		10	19.9	0.8	25.2	1.1	30.0	1.3	38.3	1.7	50.4	2.3	60.8	2.9
		15	17.3	1.1	22.8	1.5	27.8	1.8	36.5	2.5	49.2	3.3	59.5	4.0
		25	12.1	1.5	17.9	2.2	23.3	2.8	33.0	3.9	46.9	5.3	56.8	6.2
60	43.6	5	29.1	0.6	35.1	0.7	40.3	0.9	48.8	1.1	61.6	1.5	74.3	1.9
		10	28.2	1.0	34.1	1.2	39.1	1.4	47.4	1.8	59.9	2.4	72.4	3.0
		15	27.2	1.5	33.1	1.7	38.0	2.0	46.1	2.5	58.3	3.3	70.5	4.2
		25	25.3	2.3	31.0	2.7	35.7	3.2	43.4	4.0	55.0	5.2	66.6	6.5
70	50.9	5	33.4	0.7	40.3	0.8	46.3	1.0	56.3	1.3	71.4	1.7	86.5	2.1
		10	31.7	1.2	38.5	1.4	44.3	1.7	54.1	2.1	69.0	2.7	84.0	3.4
		15	30.0	1.6	36.6	2.0	42.3	2.4	51.9	2.9	66.6	3.7	81.5	4.6
		25	26.6	2.6	32.8	3.2	38.3	3.7	47.6	4.6	61.8	5.8	76.4	7.0
80	58.1	5	39.4	0.8	47.5	1.0	54.3	1.2	65.8	1.5	83.0	2.0	100.3	2.6
		10	38.7	1.3	46.7	1.6	53.5	1.9	64.8	2.4	81.8	3.3	98.9	4.1
		15	38.1	1.8	45.9	2.3	52.6	2.7	63.8	3.4	80.6	4.5	97.4	5.6
		25	36.7	2.9	44.3	3.6	50.8	4.2	61.7	5.3	78.1	6.9	94.6	8.7

Different viscosities, working pressure, rotational speed and ambient conditions can change performance data shown in the table.

3.10 OVERALL DIMENSIONS AND WEIGHTS

3.10.1 APF

Fig. 305 - APF dimensional drawing



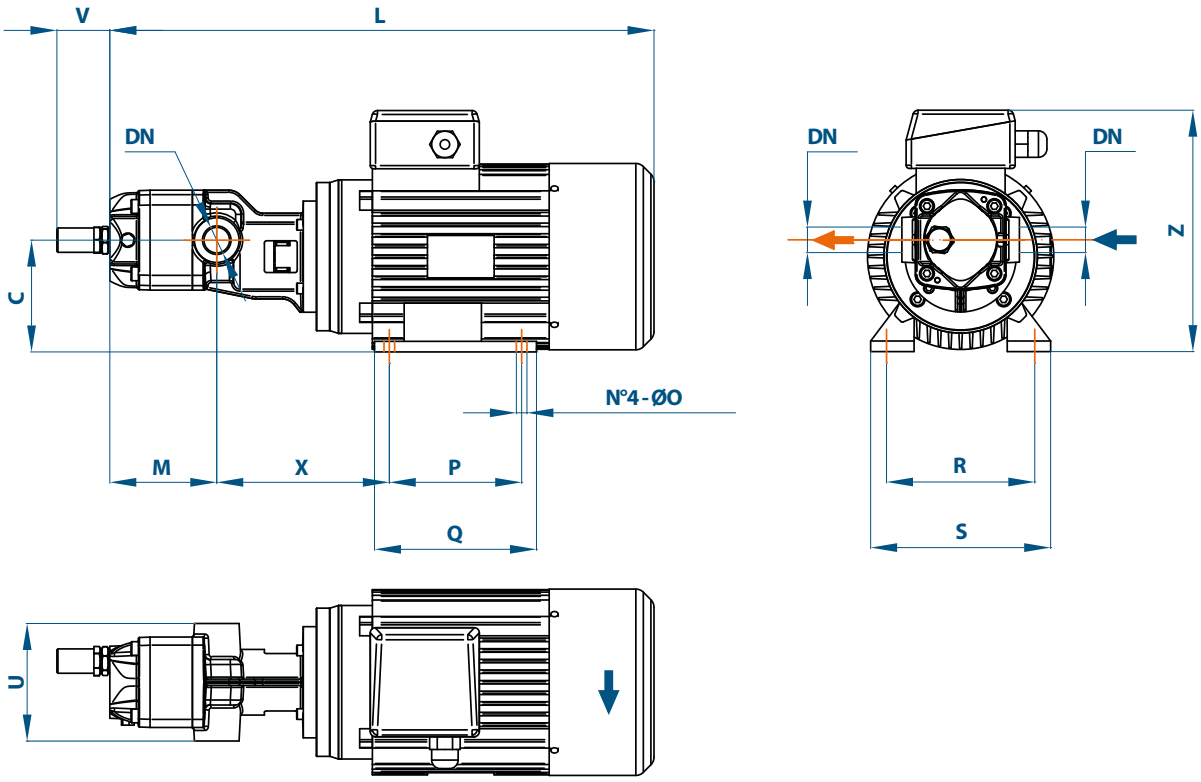
Tab. 305 – APF overall dimensions and weight

PUMP SIZE (APF)	for IEC electric motor		DN ISO 228-1	D	F	G	H	L	M	N	O	P	Q	R	S	T	U	V	Weight [kg]
	Frame size	IM																	
5	71	B34	G 1/2"	14	16.3	5	16	166	72	94	7	4	13	85	105	70	110	50	5.8
	80	B34	G 1/2"	19	21.8	6	16	166	72	94	7	4	13	100	120	80	110	50	6
10	71	B34	G 3/4"	14	16.3	5	16	176	82	94	7	4	13	85	105	70	110	50	5.9
	80	B34	G 3/4"	19	21.8	6	16	176	82	94	7	4	13	100	120	80	110	50	6.1
15	80	B34	G 3/4"	19	21.8	6	16	185	91	94	7	4	13	100	120	80	110	50	6.5
	90	B34	G 3/4"	24	27.3	8	16	198	91	107	8.5	4	13	115	140	95	110	50	7.3
20	80	B34	G 3/4"	19	21.8	6	16	190	96	94	7	4	13	100	120	80	110	50	6.7
	90	B34	G 3/4"	24	27.3	8	16	203	96	107	8.5	4	13	115	140	95	110	50	7.6
25	80	B34	G 3/4"	19	21.8	6	16	195	101	94	7	4	13	100	120	80	110	50	6.9
	90	B34	G 3/4"	24	27.3	8	16	208	101	107	8.5	4	13	115	140	95	110	50	7.8
30	80	B34	G 1"	19	21.8	6	21	249	104.5	144.5	6.5	4	15	100	120	80	120	50	11.4
	90	B34	G 1"	24	27.3	8	21	249	104.5	144.5	9	4	15	115	140	95	120	50	11.4
	100	B34	G 1"	28	31.3	8	21	259	104.5	154.5	9	4	15	130	160	110	120	50	11.9
	112	B34	G 1"	28	31.3	8	21	259	104.5	154.5	9	4	15	130	160	110	120	50	11.9
40	80	B34	G 1"	19	21.8	6	21	258	113.5	144.5	6.5	4	15	100	120	80	120	50	12.1
	90	B34	G 1"	24	27.3	8	21	258	113.5	144.5	9	4	15	115	140	95	120	50	12.1
	100	B34	G 1"	28	31.3	8	21	268	113.5	154.5	9	4	15	130	160	110	120	50	12.6
	112	B34	G 1"	28	31.3	8	21	268	113.5	154.5	9	4	15	130	160	110	120	50	12.6
50	90	B34	G 1 1/4"	24	27.3	8	21	267	122.5	144.5	9	4	15	115	140	95	120	50	12.9
	100	B34	G 1 1/4"	28	31.3	8	21	277	122.5	154.5	9	4	15	130	160	110	120	50	13.4
	112	B34	G 1 1/4"	28	31.3	8	21	277	122.5	154.5	9	4	15	130	160	110	120	50	13.4
60	90	B34	G 1 1/4"	24	27.3	8	21	286	131.5	154.5	9	4	15	115	140	95	120	50	13.5
	100	B34	G 1 1/4"	28	31.3	8	21	286	131.5	154.5	9	4	15	130	160	110	120	50	14
	112	B34	G 1 1/4"	28	31.3	8	21	286	131.5	154.5	9	4	15	130	160	110	120	50	14
70	90	B34	G 1 1/4"	24	27.3	8	21	295	140.5	154.5	9	4	15	115	140	95	120	50	14.3
	100	B34	G 1 1/4"	28	31.3	8	21	295	140.5	154.5	9	4	15	130	160	110	120	50	14.8
	112	B34	G 1 1/4"	28	31.3	8	21	295	140.5	154.5	9	4	15	130	160	110	120	50	14.8
80	90	B34	G 1 1/4"	24	27.3	8	21	304	149.5	154.5	9	4	15	115	140	95	120	50	15
	100	B34	G 1 1/4"	28	31.3	8	21	304	149.5	154.5	9	4	15	130	160	110	120	50	15.5
	112	B34	G 1 1/4"	28	31.3	8	21	304	149.5	154.5	9	4	15	130	160	110	120	50	15.5

Dimensions in mm; tolerances allowed.

3.10.2 APF with IEC electric motor

Fig. 306 - APF dimensional drawing with motor



Tab. 306 – APF with motor overall dimensions and weight

PUMP SIZE (APF)	with IEC electric motor		DN ISO 228-1	C	L (*)	M	O	P	Q (*)	R	S (*)	U	V	X	Z (*)	Weight [kg]
	Frame size	IM														
5	71	B34	G 1/2"	87	344	72	10	90	116	112	142	110	50	139	182	11,8
	80	B34	G 1/2"	96	382	72	10	100	130	125	160	110	50	144	200	17,9
10	71	B34	G 3/4"	87	354	82	10	90	116	112	142	110	50	139	182	11,9
	80	B34	G 3/4"	96	392	82	10	100	130	125	160	110	50	144	200	18
15	80	B34	G 3/4"	96	401	91	10	100	130	125	160	110	50	144	200	18,4
	90	B34	G 3/4"	106	449	91	10	125	153	140	170	110	50	165	220	25,8
20	80	B34	G 3/4"	96	406	96	10	100	130	125	160	110	50	144	200	18,6
	90	B34	G 3/4"	106	454	96	10	125	153	140	170	110	50	165	220	26,1
25	80	B34	G 3/4"	96	411	101	10	100	130	125	160	110	50	144	200	18,8
	90	B34	G 3/4"	106	459	101	10	125	153	140	170	110	50	165	220	26,3
30	80	B34	G 1"	101	465	104,5	10	100	130	125	160	120	50	194,5	200	23,3
	90	B34	G 1"	111	498	104,5	10	125	153	140	170	120	50	200,5	220	29,9
	100	B34	G 1"	121	572	104,5	12	140	172	160	200	120	50	217,5	240	36,9
	112	B34	G 1"	133	573	104,5	12	140	174	190	230	120	50	224,5	276	47,4
40	80	B34	G 1"	101	474	113,5	10	100	130	125	160	120	50	194,5	200	24
	90	B34	G 1"	111	507	113,5	10	125	153	140	170	120	50	200,5	220	30,6
	100	B34	G 1"	121	581	113,5	12	140	172	160	200	120	50	217,5	240	37,6
	112	B34	G 1"	133	582	113,5	12	140	174	190	230	120	50	224,5	276	48,1
50	90	B34	G 1 1/4"	111	516	122,5	10	125	153	140	170	120	50	200,5	220	31,4
	100	B34	G 1 1/4"	121	590	122,5	12	140	172	160	200	120	50	217,5	240	38,4
	112	B34	G 1 1/4"	133	591	122,5	12	140	174	190	230	120	50	224,5	276	48,9
60	90	B34	G 1 1/4"	111	525	131,5	10	125	153	140	170	120	50	200,5	220	32
	100	B34	G 1 1/4"	121	599	131,5	12	140	172	160	200	120	50	217,5	240	39
	112	B34	G 1 1/4"	133	600	131,5	12	140	174	190	230	120	50	224,5	276	49,5
70	90	B34	G 1 1/4"	111	534	140,5	10	125	153	140	170	120	50	200,5	220	32,8
	100	B34	G 1 1/4"	121	608	140,5	12	140	172	160	200	120	50	217,5	240	39,8
	112	B34	G 1 1/4"	133	609	140,5	12	140	174	190	230	120	50	224,5	276	50,3
80	90	B34	G 1 1/4"	111	543	149,5	10	125	153	140	170	120	50	200,5	220	33,5
	100	B34	G 1 1/4"	121	617	149,5	12	140	172	160	200	120	50	217,5	240	40,5
	112	B34	G 1 1/4"	133	618	149,5	12	140	174	190	230	120	50	224,5	276	51

Dimensions in mm; tolerances allowed; (*) = depends on the motor manufacturer.

3.11 SPARE PARTS

Fig. 307 – APF pumps (mechanical seal version)

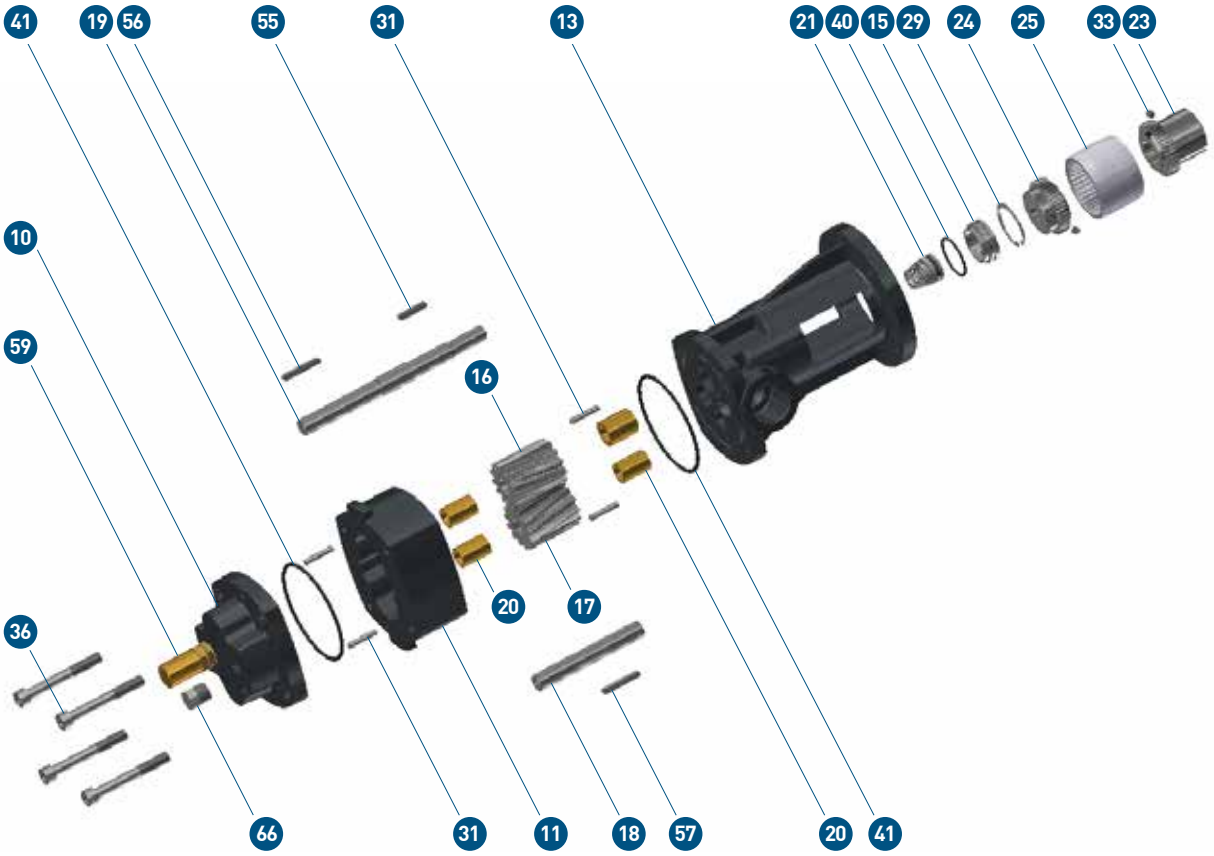


Fig. 308 – Pressure relief valve details

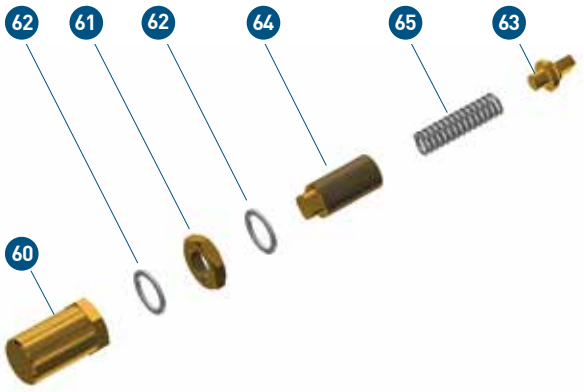
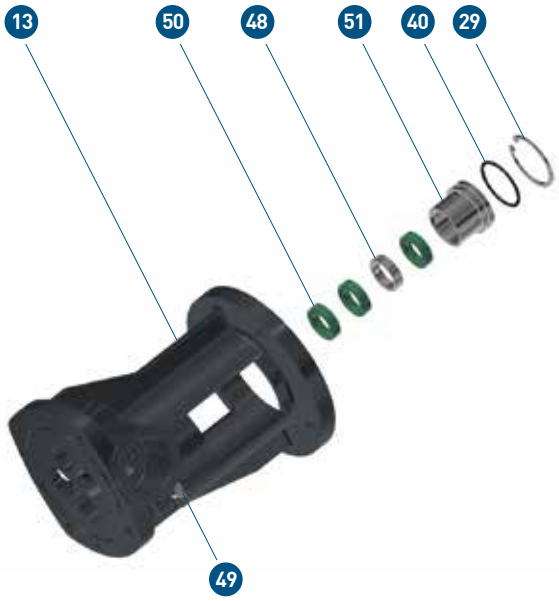


Fig. 309 - Lip seal details



Tab. 307 – APF spare parts list

Ref.	Description	Ref.	Description	Ref.	Description	Ref.	Description
10	Pump rear cover	21	Mechanical seal	41	O-ring	60	Valve cap
11	Pump housing	23	Half-coupling motor side	48	Lantern ring	61	Valve locknut
13	Pump flanged cover	24	Half-coupling pump side	49	Greaser	62	Valve washer
15	Mechanical seal housing	25	Toothed sleeve	50	Lip seals	63	Valve poppet
16	Driving gear	29	Locking ring	51	Lip seal housing	64	Valve adjusting screw
17	Driven gear	31	Dowel pin	55	Feather key	65	Valve spring
18	Driven shaft	33	Grub screw	56	Feather key	66	Threaded cap
19	Driving shaft	36	Screw	57	Feather key		
20	Sleeve bushings	40	O-ring	59	Kit valve		