Sauer Danfoss Series 90 Hydraulic Axial Piston Pump

90R030, 90R042, 90R055, 90R075, 90R100, 90R130, 90R180, 90R250

90L030, 90L042, 90L055, 90L075, 90L100, 90L130, 90L180, 90L250

Series 90 – advanced technology

Seven sizes of variable displacement pumps

Proven reliability and performance

Compact, lightweight

Worldwide sales and service

PLUS+1™ compliant controls and sensors

Series 90 variable displacement pump is compact, high power density units. All models utilize the parallel axial piston/slipper concept in conjunction with a tilt able swash plate to vary the pump's displacement. Reversing the angle of the swash plate reverses the flow of oil from the pump and thus reverses the direction of rotation of the motor output.

Series 90 pumps include an integral charge pump to provide system replenishing and cooling oil flow, as well as control fluid flow. They also feature a range of auxiliary mounting pads to accept auxiliary hydraulic pump for use in complementary hydraulic systems. A complete family of control options is available to suit a variety of control systems (mechanical, hydraulic, electric).

Series 90 motor also use the parallel axial piston/slipper design in conjunction with a fixed or tilt able swash plate. They can intake/discharge fluid through either port; they are bidirectional. They also include an optional loop flushing feature that provides additional cooling and cleaning of fluid in the working loop.

Series 90 hydraulic pump and motor can be applied together or combined with other products in a system to transfer and control hydraulic power. They are intended for closed circuit applications.

Series 90 pumps can be used together in combination with other Sauer-Danfoss pump and motor in the overall hydraulic system. Sauer-Danfoss hydraulic products are designed with many different displacement, pressure and load-life capabilities.

General Specifications

Design	Axial piston pump of cradle swash plate design with variable displacement
Direction of rotation	Clockwise, counterclockwise
Pipe connections	Main pressure ports: ISO split flange boss
	Remaining ports: SAE straight thread O-ring boss
Recommended installation position	Pump installation position is discretionary; however the recommended control position is on the top or at the side, with the top position preferred. Vertical input shaft installation is acceptable. If input shaft is at the top 1 bar case pressure must be maintained during operation. The pump housing must be filled with hydraulic fluid under all conditions; including after a long period of shutdown. Before operating the machine, ensure the pump housing and case drain lines are free of air. Recommended mounting for a multiple pump stack is to arrange the highest power flow towards the input source.
Auxiliary cavity pressure	Will be inlet pressure with internal charge pump. For reference see operating parameter on next page. Will be case pressure with external charge supply. Please verify mating pump shaft seal capability.

Technical Information: Overview

This section defines the operating parameters and limitations for Series 90 pumps with regard to input speeds and pressures. For actual parameters, refer to the Operating parameters for each displacement.

Input Speed:

Minimum speed is the lowest input speed recommended during engine idle condition. Operating below minimum speed limits the pump's ability to maintain adequate flow for lubrication and power transmission.

Rated speed is the highest input speed recommended at full power condition. Operating at or below this speed should yield satisfactory product life.

Maximum speed is the highest operating speed permitted. Exceeding maximum speed reduces product life and can cause loss of hydrostatic power and braking capacity. Never exceed the maximum speed limit under any operating conditions. Operating conditions between Rated speed and Maximum speed should be restricted to less than full power and to limited periods of time. For most drive systems, maximum unit speed occurs during downhill braking or negative power conditions. During hydraulic braking and downhill conditions, the prime mover must be capable of providing sufficient braking torque in order to avoid pump over speed. This is especially important to consider for turbocharged and Tier 4 engines.

System Pressure

System pressure is the differential pressure between high pressure system ports. It is the dominant operating variable affecting hydraulic unit life. High system pressure, which results from high load, reduces expected life. Hydraulic unit life depends on the speed and normal operating, or weighted average, pressure that can only be determined from a duty cycle analysis.

Application pressure is the high pressure relief or pressure limiter setting normally defined within the order code of the pump. This is the applied system pressure at which the drive-line generates the maximum calculated pull or torque in the application.

Maximum working pressure is the highest recommended Application pressure. Maximum working pressure is not intended to be a continuous pressure. Propel systems with application pressures at, or below, this pressure should yield satisfactory unit life given proper component sizing. Maximum pressure is the highest allowable Application pressure under any circumstance. Application pressures above maximum working Pressure will only be considered with duty cycle analysis and factory approval. Pressure spikes are normal and must be considered when reviewing maximum working pressure. Minimum low loop pressure must be maintained under all operating conditions to avoid cavitations. All pressure limits are differential pressures referenced to low loop (charge) pressure. Subtract low loop pressure from gauge readings to compute the differential.

Servo Pressure

Servo pressure is the pressure in the Servo-system needed to position and hold the pump on stroke. It depends on system pressure and speed. At minimum servo pressure the pump will run at reduced stroke depending on speed and pressure. Minimum servo pressure at corner power holds the pump on full stroke at max speed and max pressure.

Maximum servo pressure is the highest pressure typically given by the charge pressure setting.

Charge Pressure

An internal charge relief valve regulates charge pressure. Charge pressure supplies the control with pressure to operate the swash plate and to maintain a minimum pressure in the low side of the transmission loop. The charge pressure setting listed in the order code is the set pressure of the charge relief valve with the pump in neutral, operating at 1800

min-1 [rpm], and with a fluid viscosity of 32 mm2/s [150 SUS]. Pumps configured with no charge pump (external charge supply) are set with a charge flow of 30 l/min. [7.93 US gal/min.] and a fluid viscosity of 32 mm2/s [150 SUS].

The charge pressure setting is referenced to case pressure. Charge pressure is the differential pressure above case pressure.

Minimum charge pressure is the lowest pressure allowed to maintain a safe working condition in the low side of the loop. Minimum control pressure requirements are a function of speed, pressure, and swash plate angle, and may be higher than the minimum charge pressure shown in the Operating parameters tables.

Maximum charge pressure is the highest charge pressure allowed by the charge relief adjustment, and which provides normal component life. Elevated charge pressure can be used as a secondary means to reduce the swash plate response time. At normal operating temperature charge inlet pressure must not fall below rated charge inlet pressure (vacuum).

Minimum charge inlet pressure is only allowed at cold start conditions. In some applications it is recommended to warm up the fluid (e.g. in the tank) before starting the engine and then run the engine at limited speed. Maximum charge pump inlet pressure may be applied continuously.

Case Pressure

Under normal operating conditions, the rated case pressure must not be exceeded. During cold start case pressure must be kept below maximum intermittent case pressure. Size drains plumbing accordingly.

Auxiliary Pad Mounted Pumps. The auxiliary pad cavity of S90 pumps configured without integral charge pumps is referenced to case pressure. Units with integral charge pumps have auxiliary mounting pad cavities referenced to charge inlet (vacuum).

External Shaft Seal Pressure

In certain applications the input shaft seal may be exposed to external pressure. In order to prevent damage to the shaft seal the maximum differential pressure from external sources must not exceed 0.4 bar (5.8 psi) over pump case pressure. The case pressure limits of the pump must also be followed to ensure the shaft seal is not damaged.

Temperature and Viscosity

Temperature: The high temperature limits apply at the hottest point in the transmission, which is normally the motor case drain. The system should generally be run at or below the quoted rated temperature.

The maximum intermittent temperature is based on material properties and should never be exceeded.

Cold oil will generally not affect the durability of the transmission components, but it may affect the ability of oil to flow and transmit power; therefore temperatures should remain 16 °C [30 °F] above the pour point of the hydraulic fluid. The minimum temperature relates to the physical properties of component materials. Size heat exchangers to keep the fluid within these limits. Sauer-Danfoss recommends testing to verify that these temperature limits are not exceeded.

Viscosity: For maximum efficiency and bearing life, ensure the fluid viscosity remains in the recommended range.

The minimum viscosity should be encountered only during brief occasions of maximum ambient temperature and severe duty cycle operation. The maximum viscosity should be encountered only at cold start.

Filtration System

To prevent premature wear, ensure only clean fluid enters the hydrostatic transmission circuit. A filter capable of controlling the fluid cleanliness to ISO 4406 class 22/18/13

(SAE J1165) or better, under normal operating conditions, is recommended. These cleanliness levels cannot be applied for hydraulic fluid residing in the component housing/case or any other cavity after transport.

The filter may be located on the pump (integral) or in another location (remote).

The integral filter has a filter bypass sensor to signal the machine operator when the filter requires changing. Filtration strategies include suction or pressure filtration. The selection of a filter depends on a number of factors including the contaminant ingression rate, the generation of contaminants in the system, the required fluid cleanliness, and the desired maintenance interval. Filters are selected to meet the above requirements using rating parameters of efficiency and capacity. Filter efficiency can be measured with a Beta ratio[1] (βX). For simple suction-filtered closed circuit transmissions and open circuit transmissions with return line filtration, a filter with a β-ratio within the range of β35-45 = 75 (β10 ≥ 2) or better has been found to be satisfactory.

For some open circuit systems, and closed circuits with cylinders being supplied from the same reservoir, a considerably higher filter efficiency is recommended. This also applies to systems with gears or clutches using a common reservoir.

For these systems, a charge pressure or return filtration system with a filter β-ratio in the range of β15-20 = 75 (β10 ≥ 10) or better is typically required.

Technical Data

Table of values (theoretical values)

Feature		Unit	90R030 90L030	90R042 90L042	90R055 90L055	90R075 90L075	90R100 90L100	90R130 90L130	90R180 90L180	90R250 90L250
Displacement		cm^3/rev.	30	42	55	75	100	130	180	250
		in^3	1.83	2.56	3.35	4.57	6.1	7.93	10.98	15.25
Input speed	Minimum	min-1 (rpm)	500	500	500	500	500	500	500	500
	Rated	min-1 (rpm)	4200	4200	3900	3600	3300	3100	2600	2 300
	Maximum	min-1 (rpm)	4600	4600	4250	3950	3650	3400	2850	2 500
	Max. Attainable	min-1 (rpm)	5000	5000	4700	4300	4000	3700	3150	2 750
Theoretical		Nm/bar	0.48	0.67	0.88	1.19	1.59	2.07	2.87	3.97
Torque		in lb/1000 psi	290	410	530	730	970	1260	1750	2433
Mass moment of inertia of the int. rotating parts		kg m2	0.0023	0.0039	0.006	0.0096	0.015	0.023	0.038	0.065
		lb • ft2	0.0546	0.0926	0.1424	0.228	0.356	0.546	0.902	1.543
Weight (with MA Control)		kg	28	34	40	49	68	88	136	154
		lb	62	75	88	108	150	195	300	340

Series 90 Axial Piston Pumps
Technical Information
Master Model Code

Series 90 Master Model Code

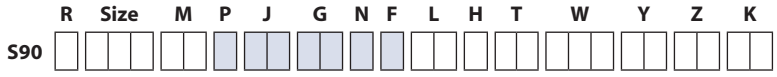
R	Type and Rotation	042	055	075	100	130	180	250
R	Right Hand [CW]	O	O	O	O	O	O	O
L	Left Hand [CCW]	O	O	O	O	O	O	O

	Size	042	055	075	100	130	180	250
042	42 cc [2.56 in^3] max. displacement per revolution	O						
055	55 cc [3.36 in^3] max. displacement per revolution		O					
075	75 cc [4.58 in^3] max. displacement per revolution			O				
100	100 cc [6.10 in^3] max. displacement per revolution				O			
130	130 cc [7.93 in^3] max. displacement per revolution					O		
180	180 cc [10.98 in^3] max. displacement per revolution						O	
250	250 cc [15.26 in^3] max. displacement per revolution							O

M	Controls	042	055	075	100	130	180	250
CA	cover plate without feedback link, no control	O	O	O	O	O	O	
DC	3 positon F-N-R solenoid control (12 V , DC) DIN- connector	O	O	O	O	O	O	
DD	3 positon F-N-R solenoid control (24 V , DC) DIN- connector	O	O	O	O	O	O	O
HF	HDC 2, std. porting, 3,0 - 11 BAR (44 - 160 PSI)	O	O	O	O	O	O	O
KA	EDC, MS connector, std. porting, dual coil (14 - 85 mA)	O	O	O	O	O	O	O
KN	EDC, MS connector, std. porting, 643 Ohm single coil (4 - 20 mA)	O	O	O	O	O	O	O
KT	EDC, Deutsch connector, std porting, dual coil (14 - 85 mA)		O	O	O	O	O	O
KP	EDC, Weatherpack connector, std. porting, dual coil (14 - 85mA)	O	O	O	O	O	O	O
MA	MDC	O	O	O	O	O	O	O
MB	MDC with neutral start switch	O	O	O	O	O	O	O
FA	electrohydraulic displacement control without feedback link, 12V with AMP Minitimer connector, proportional solenoid with pressure reducing valve (25 bar) (NFPE control)	O	O		O			
FB	electrohydraulic displacement control without feedback link, 24V with AMP Minitimer connector, proportional solenoid with pressure reducing valve (25 bar) (NFPE control)	O	O		O			
FC	electrohydraulic displacement control without feedback link, 12V with AMP Minitimer connector, proportional solenoid with pressure reducing valve (32 bar) (NFPE control)	O	O		O			
FD	electrohydraulic displacement control without feedback link, 24V with AMP Minitimer connector, proportional solenoid with pressure reducing valve (32 bar) (NFPE control)	O	O		O			
FG	electrohydraulic displacement control without feedback link, 12V with AMP Minitimer connector, proportional solenoid with pressure reducing valve (32 bar) fast response (NFPE control)			O	O	O	O	
FH	electrohydraulic displacement control without feedback link, 24V with AMP Minitimer connector, proportional solenoid with pressure reducing valve (32 bar) fast response (NFPE control)			O	O	O	O	
FK	electrohydraulic displacement control without feedback link, 12V with AMP Minitimer connector, proportional solenoid with pressure reducing valve (25 bar) (NFPE control)			O				
FL	electrohydraulic displacement control without feedback link, 24V with AMP Minitimer connector, proportional solenoid with pressure reducing valve (25 bar) (NFPE control)			O				
FM	electrohydraulic displacement control without feedback link, 12V with AMP Minitimer connector, proportional solenoid with pressure reducing valve (32 bar) fast response (NFPE control)			O				
FN	electrohydraulic displacement control without feedback link, 24V with AMP Minitimer connector, proportional solenoid with pressure reducing valve (32 bar) fast response (NFPE control)			O				

Master Model Code

Series 90 Master Model Code (continued)



P	*High Pressure Regulation*	042	055	075	100	130	180	250
1	pressure limiter for port A and B (140-450 bar)	O	O	O	O	O	O	O
2	high pressure relief valves for port A and B (90-450 bar)	O	O	O	O	O	O	O

J	*Auxiliary Mounting Pad*	042	055	075	100	130	180	250
AB	SAE-A with sealed cover, 9 teeth coupling	O	O	O	O	O	O	O
BB	SAE-BB with sealed cover, 15 teeth coupling	O	O	O	O	O	O	O
BC	SAE-B with sealed cover, 13 teeth coupling	O	O	O	O	O	O	O
CD	SAE-C with sealed cover, 4 bolt adapter, 14 teeth coupling, (2) ½-13 UNC		O	O	O	O	O	O
DE	SAE-D with sealed cover, 13 teeth coupling					O	O	O
EF	SAE-E with sealed cover, 13 teeth coupling						O	O
NN	no auxiliary mounting pad	O	O	O	O	O	O	O

G	*Endcap Ports*	042	055	075	100	130	180	250
60	Side Ports		O	O	O			
80	Twin Ports	O	O	O	O	O	O	O

N	*Filtration*	042	055	075	100	130	180	250
D	external charge pump	O	O	O	O	O	O	O
L	pressure integral (long filter)	O	O	O	O	O		
P	pressure integral (short filter)	O	O	O	O	O		
R	remote pressure		O	O	O	O		
T	remote pressure with SAE 1 1/16 thread ports for high flow						O	O
S	suction filtration	O	O	O	O	O	O	O

F	*Displacement Limitation*	042	055	075	100	130	180	250
C	no limiters, only for 180 cc						O	
M	limitation both sides, only for 180 cc						O	
3	no limiters	O	O	O	O	O		O
4	limitation both sides	O	O	O	O	O		O
7	no limiters, spec. servo cylinder at side 1 with hard spring (only for pumps with NFPE-controls)	O	O	O	O	O	O	

Series 90 Axial Piston Pumps
Technical Information
Master Model Code

Series 90 Master Model Code (continued)

L	*Shaft Options*	042	055	075	100	130	180	250
C3	splined shaft, 15 teeth, pitch = 16 / 32	O						
C6	splined shaft, 21 teeth, pitch = 16 / 32		O	O	O			
C7	splined shaft, 23 teeth, pitch = 16 / 32			O	O			
C8	splined shaft, 27 teeth, pitch = 16 / 32					O	O	O
F1	splined shaft, 13 teeth, pitch = 8 / 16				O	O	O	O
S1	splined shaft, 14 teeth, pitch = 12/24		O	O	O			
G1	splined shaft , 25 teeth, pitch = 20 / 40			O	O			
T1	tapered shaft diameter = 34,925 MM		O	O				
T6	tapered shaft diameter = 38,100 MM			O	O			
T8	tapered shaft diameter = 25,400 MM	O						
T4	tapered shaft diameter = 44,450 MM					O		

H	*Charging System*	042	055	075	100	130	180	250
B	nominal flow = 11 cc / rev	O	O					
C	nominal flow = 14 cc / rev	O	O	O				
D	nominal flow = 17 cc / rev		O	O	O			
E	nominal flow = 20 cc / rev			O	O			
F	nominal flow = 26 cc / rev				O	O		
H	nominal flow = 34 cc / rev					O	O	
J	nominal flow = 47 cc / rev						O	O
K	nominal flow = 65 cc / rev							O
L	external charge pump with internal charge pressure relief valve for units with auxiliary mounting pad	O	O	O	O	O	O	O
N	external charge pump with internal charge pressure relief valve for units with no auxiliary mounting pad	O		O	O	O	O	O

Series 90 Master Model Code (continued)

	R	Size		M		P	J		G		N	F	L		H	T		W			Y		Z		K	
S90																										

T *Control Orifice Options*

MDC

	inlet P	drain TA	drain TB	servo A	servo B	042	055	075	100	130	180	250
00	n/o	1.6 *)	1.6 *)	n/o	n/o	O	O	O	O	O	O	O
03	0.81	1.6 *)	1.6 *)	n/o	n/o	O	O	O	O	O	O	O
05	1.37	1.6 *)	1.6 *)	n/o	n/o	O	O	O	O	O	O	O
C5	0.81	1.4	1.4	n/o	n/o	O	O	O	O	O	O	O
C6	1.02	1.4	1.4	n/o	n/o	O	O	O	O	O	O	O

*) No orifice installed in control, orifice hole in contro spool

If further orifice options are needed, please contact your Sauer-Danfoss representative

EDC

	inlet P	drain TA	drain TB	servo A	servo B	042	055	075	100	130	180	250
00 (1)	n/o	1.3	1.3	n/o	n/o	O	O	O	O	O	O	O
03 (1)	0.81	1.3	1.3	n/o	n/o	O	O	O	O	O	O	O
05 (1)	1.37	1.3	1.3	n/o	n/o	O	O	O	O	O	O	O
33	0.81	n/o	n/o	n/o	n/o	O	O	O	O	O	O	O

FNR

	inlet P		drain T	servo A	servo B	042	055	075	100	130	180	250
G1	n/o		1.2	n/o	n/o	O	O	O	O	O	O	O
G4	0.46		1.2	n/o	n/o	O	O	O	O	O	O	O
G8	0.66		1.2	n/o	n/o	O	O	O	O	O	O	O
GB	0.81		1.2	n/o	n/o	O	O	O	O	O	O	O
GD	1.57		1.2	n/o	n/o	O	O	O	O	O	O	O

HDC

	inlet P	drain TA	drain TB	servo A	servo B	042	055	075	100	130	180	250
00 (1)	n/o	1.3	1.3	n/o	n/o	O	O	O	O	O	O	O
03 (1)	0.81	1.3	1.3	n/o	n/o	O	O	O	O	O	O	O
05 (1)	1.37	1.3	1.3	n/o	n/o	O	O	O	O	O	O	O

NFPE

	inlet P		drain T	servo A	servo B	042	055	075	100	130	180	250
B1	n/o		1.5	n/o	n/o	O	O	O	O	O	O	O
B2	n/o		n/o	1.2	1.2	O	O	O	O	O	O	O
B6	n/o		n/o	n/o	n/o			O				

Series 90 Master Model Code (continued)

	R	Size	M	P	J	G	N	F	L	H	T	W	Y	Z	K
S90															

W	*Special Hardware Features*	042	055	075	100	130	180	250
EEG	speedring, no sensor, CP30 +4,3° valve plate	O	O	O	O	O		
EFC	speed sensing, Turck connector (KPPx156), CP15° +0,5° valve plate	O		O	O	O		
EFI	speed sensing, Turck connector (KPPx156), CP30° +4,3° valve plate	O	O	O	O	O	O	O
FAC	nested t- bar springs, CP15 +1,5° valve plate	O	O	O	O		O	
FAD	nested t- bar springs, CP15 +0,5° valve plate	O	O	O	O	O		
GBA	CP15 +0,5° valve plate	O	O	O	O	O		
GCA	CP15 +1,5° valve plate	O	O	O	O	O	O	
GLA	CP30 +4,3° valve plate, CP30 valve plate	O	O	O	O	O	O	O
NNN	180cc: CP15 +0,5° valve plate 250cc: CP15 +0,5° valve plate , nested T- bar springs						O	O

Y	*High Pressure Setting* **A**	042	055	075	100	130	180	250
26	260 bar	O	O	O	O	O	O	O
32	320 bar	O	O	O	O	O	O	O
35	350 bar	O	O	O	O	O	O	O
38	380 bar	O	O	O	O	O	O	O
40	400 bar	O	O	O	O	O	O	O
42	420 bar	O	O	O	O	O	O	O

Z	*High Pressure Setting* **B**	042	055	075	100	130	180	250
26	260 bar	O	O	O	O	O	O	O
32	320 bar	O	O	O	O	O	O	O
35	350 bar	O	O	O	O	O	O	O
38	380 bar	O	O	O	O	O	O	O
40	400 bar	O	O	O	O	O	O	O
42	420 bar	O	O	O	O	O	O	O

K	*Charge Pressure Setting*	042	055	075	100	130	180	250
20	20 bar	O	O	O	O	O	O	O
22	22 bar	O	O	O	O	O	O	O
24	24 bar	O	O	O	O	O	O	O
26	26 bar	O	O	O	O	O	O	O
28	28 bar	O	O	O	O	O	O	O
30	30 bar	O	O	O	O	O	O	O
32	32 bar	O	O	O	O	O	O	
34	34 bar		O	O	O	O	O	