

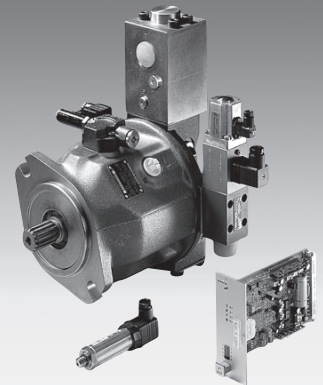
# Closed-loop pressure and flow control system

RA 30024/11.03  
Replaces: 10.02

1/12

## Model SYDFE1

Series 2X



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### Features

- The DFE1 control system is used for the electrohydraulic pressure and flow control of a variable displacement axial piston pump
- The SYDFE1 control system consists of the following components:
  - A10VSO axial piston pump with built-on VT-DFP-2X proportional valve as pilot valve, including inductive position transducers for the acquisition of swivel angle and valve displacement
  - HM 12 or HM 13 pressure transducer for the acquisition of the system pressure (optional)
  - VT 5041-2X analogue amplifier for realising all the electrical functions that are required by the DFE1 control system
  - Pump preload valve (optional)
  - Pump combinations possible

#### Additional information about this system:

- Component description of A10VSO pump
  - RE 92712 for size 18
  - RE 92711 for sizes 28 to 140
- Component description of VT 5041-2X analogue amplifier
  - RE 30241
- Component description of HM 12-1X / HM 13-1X pressure transducers
  - RE 29933
- Component description of VT-DFP.-2X/... pilot valve
  - RE 29016
- Component description of SYDZ 0001-1X pump preload valve
  - RE 29255

#### In addition, the following information is available about the SYDFE1 system:

- Sales information (engineering aids)
  - RE 30030-01-V

**Ordering code**

SYDFE1	- 2X /		- P			12	-	- A	0	0				*
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Single pump <sup>1)</sup>  
 Pump combination <sup>2)</sup>

Series 20 to 29 = 2X  
 (20 to 29: unchanged installation and connection dimensions)

**A10VSO pump**

Size 18	= 018
Size 28	= 028
Size 45	= 045
Size 71	= 071
Size 100	= 100
Size 140	= 140

**Direction of rotation**  
 Clockwise (preferred types for through-drive pumps) = R  
 Anti-clockwise = L

**Hydraulic fluid**  
 Mineral oil to DIN 51 524 (HL / HLP) = P

**Shaft end**  
 (▲ = Preferred types for through-drive pumps)

Size	18	28	45	71	100	140	
3)	-	Ø22	Ø25	Ø32	Ø40	Ø45	= P
4)	3/4"	-	-	-	1 1/2"	1 3/4"	= S
5)	-	7/8"	1"	1 1/4"	-	-	= R

**Connection flange** (● = available)

Size	18	28	45	71	100	140	
ISO 2-hole	-	●	●	●	●	-	= A
ISO 4-hole	-	-	-	-	-	●	= B
SAE 2-hole	●	-	-	-	-	-	= C

**Connection for service lines**  
 Pressure port B ] SAE on opposite sides = 12  
 Pressure port S ] Mounting thread, metric

**Through-drive** (see table on page 3)  
 Without through-drive = N00  
 Through-drive without hub for mounting:  
 (any built-on pumps with SAE splined shaft profile)

Center diameter	Built-on pump	
Ø82.55 mm (3.25 in.)	A10VSO18	= KC1 <sup>6)</sup>
Ø100 mm (3.94 in.)	A10VSO28/45	= KD3 <sup>6)</sup>
Ø125 mm (4.92 in.)	A10VSO71/100	= KD5 <sup>6)</sup>
Ø180 mm (7.09 in.)	A10VSO140	= KD7 <sup>6)</sup>
Ø101.6 mm (4.00 in.)	Gear pump	= KC3 <sup>6)</sup>
Ø127 mm (5.00 in.)	Gear pump	= KC5 <sup>6)</sup>

For single pumps, the hub must be ordered separately, if required  
 For double pumps, the hub is included in the scope of supply.

Further details in clear text

**Preload valve**  
 1 = Pressure limitation 200 bar (2900 PSI)  
 2 = Pressure limitation 250 bar (3626 PSI)  
 3 = Pressure limitation 300 bar (4350 PSI)  
 X = Without preload valve

**Pressure transducer**  
 HM 12 (4 to 20 mA)  
 C = Measuring range 315 bar (4568 PSI)  
 HM 13 (0 to 10 V)  
 G = Measuring range 315 bar (4568 PSI)  
 X = Without pressure transducer

Electronic assembly, VT 5041-2X with switch-able actual pressure value signal (from series 25)  
 P = 4-20 mA / 0-10 V / 0-5 V / 1-10 V  
 X = Without amplifier

Additional function, VT 5041-2X with power limiter and swivel angle indicator  
 X = Without amplifier  
 1 = Amplifier without additional function  
 3 = Amplifier with additional function

**Valve, installation orientation**  
 0 = Plug-in connector installed radially to pump axis

**Valve, spool variant**  
 A =

**Basic pump version**  
 0000 = Standard (internal pilot oil supply)  
 0479 = External supply (sizes 18 ... 100)  
 0487 = External supply (size 140)

1) See order example at the top of page 3  
 2) See order example at the top of page 3  
 3) Cylindrical with keyed shaft DIN 6885  
 4) Splined shaft profile SAE  
 5) Splined shaft profile SAE (higher through-drive torque)  
 6) Through-drive is fitted with an operationally safe blind cover

## Ordering code

### Order example

1) **Order example of single pump**

SYDFE1-2X/100R-PSA12N00-0479-A0X0XCX

2) **Order example of pump combination**

Both type designations must be connected with "+" (material number of 1st pump + material number of 2nd pump)

SY2DFE1-2X/100-100/

R900709794 +

R900709794

SY2DFE1-2X/100-100/ SYDFE1-2X/100R-PSA12KD5-0000-A010PCX + SYDFE1-2X/100R-PSA12KD5-0000-A010PCX

Double pump	
Size of front pump	
Size of rear pump	
Material number of front pump (or details in clear text, if material number is not known)	
Material number of rear pump (or details in clear text, if material number is not known)	

## Standard types

### Single pumps

Type	Material no.
SYDFE1-2X/018R-PSC12N00-0000-A010PCX	<b>R900783410</b>
SYDFE1-2X/028R-PPA12N00-0000-A010PCX	<b>R900708517</b>
SYDFE1-2X/045R-PPA12N00-0000-A010PCX	<b>R900708518</b>
SYDFE1-2X/071R-PPA12N00-0000-A010PCX	<b>R900708519</b>
SYDFE1-2X/100R-PPA12N00-0000-A010PCX	<b>R900708520</b>
SYDFE1-2X/140R-PPB12N00-0000-A010PCX	<b>R900708521</b>

### Through-drive pumps for pump combinations

Type	Material no.
SYDFE1-2X/028R-PRA12KD3-0000-A010PCX	<b>R900709782</b>
SYDFE1-2X/045R-PRA12KD3-0000-A010PCX	<b>R900709786</b>
SYDFE1-2X/071R-PRA12KD5-0000-A010PCX	<b>R900709792</b>
SYDFE1-2X/100R-PSA12KD5-0000-A010PCX	<b>R900709794</b>
SYDFE1-2X/140R-PSB12KD7-0000-A010PCX	<b>R900709795</b>

### Through-drive (● = available)

			Size						
			18	28	45	71	100	140	
Without through-drive			●	●	●	●	●	●	N00
With through-drive for building on an axial piston unit, a gear pump or a radial piston pump									
Mounting flange	Shaft/coupling (separate order)	for mounting:							
ISO 100, 2-hole	Splined shaft 7/8" 22-4 (SAE B)	A10VSO 28 (shaft S or R)	-	●	●	●	●	●	KD3
ISO 100, 2-hole	Splined shaft 1" 25-4 (SAE B-B)	A10VSO 45 (shaft S or R)	-	-	●	●	●	●	KD3
ISO 125, 2-hole	Splined shaft 1 1/4" 32-4 (SAE C)	A10VSO 71 (shaft S or R)	-	-	-	●	●	●	KD5
ISO 125, 2-hole	Splined shaft 1 1/2" 38-4 (SAE C-C)	A10VSO 100 (shaft S)	-	-	-	-	●	●	KD5
ISO 180, 4-hole	Splined shaft 1 3/4" 44-4 (SAE D)	A10VSO 140 (shaft S)	-	-	-	-	-	●	KD7
82-2 (SAE A, 2-hole)	Splined shaft 5/8" 16-4 (SAE A)	1PF2G2, PGF2	●	●	●	●	●	●	KC1
82-2 (SAE A, 2-hole)	Splined shaft 3/4" 19-4 (SAE A-B)	A10VSO 10, 18 (shaft S)	●	●	●	●	●	●	KC1
101-2 (SAE B)	Splined shaft 7/8" 22-4 (SAE B)	A10VO 28 (shaft S), PGF3	-	●	●	●	●	●	KC3
101-2 (SAE B)	Splined shaft 1" 25-4 (SAE B-B)	A10VO 45 (shaft S), PGH4	-	●	●	●	●	●	KC3
127-2 (SAE C)	Splined shaft 1 1/4" 32-4 (SAE C)	A10VO 71 (shaft S)	-	-	-	●	●	●	KC5
127-2 (SAE C)	Splined shaft 1 1/2" 38-4 (SAE C-C)	A10VO 100 (shaft S), PGH5	-	-	-	-	●	●	KC5
152-4 (SAE D)	Splined shaft 1 3/4" 44-4 (SAE D)	A10VO 140 (shaft S)	-	-	-	-	-	●	KC6

## Function, section

The pressure and swivel angle of A10VSO...DFE1 variable displacement pumps are controlled via an electrically controlled proportional valve (2). The proportional valve determines the position of swashplate (1) via actuating piston (4). The displaced flow is proportional to the position of the swashplate. The opposing piston (3) that is preloaded by spring (5) is continuously pressurised with pump pressure.

When the pump is not rotating and the control system is depressurised, the swashplate is held at position + 100 % by spring (5). With a driven pump and a de-energised proportional solenoid (8) the system swivels to zero stroke pressure, since valve spool (9) is pushed by spring (10) to the basic position and thus pump pressure  $p$  is applied to actuating piston (4) via valve port A. A balance between pump pressure at the actuating piston and spring force (5) is achieved at 8 to 12 bar (116 to 174 PSI). The system returns to this basic position (= zero stroke operation) when the control electronics is inactive (e.g. controller enable missing).

The VT 5041-2X controller card that belongs to the system controls the proportional valve. This controller card processes all the closed-loop control signals that are required for operating the A10VSO...DFE1 variable displacement pump.

The VT 5041-2X analogue amplifier is designed as plug-in card in Euro-format. As a standard, it is provided with a command value input each for pressure and swivel angle (input for power command value optional). The actual pressure value is acquired by a pressure transducer. Position transducer (7) on the pump acquires the actual swivel angle value. The acquired actual values are processed in the amplifier and compared with the selected command values. The minimum value generator ensures that always the controller that is assigned to the relevant working

point is automatically active. Here, a system variable (pressure, swivel angle or [optional] power) is corrected exactly while the other two system variables are below the given command values. The output signal of the minimum value generator becomes the command value for the valve control loop.

The actual value of the valve spool position is acquired by means of inductive position transducer (6). The output value of the valve position controller determines the current through proportional solenoid (8) via the amplifier output stage. As soon as the working point is reached is control spool (9) of the proportional valve held in the central position.

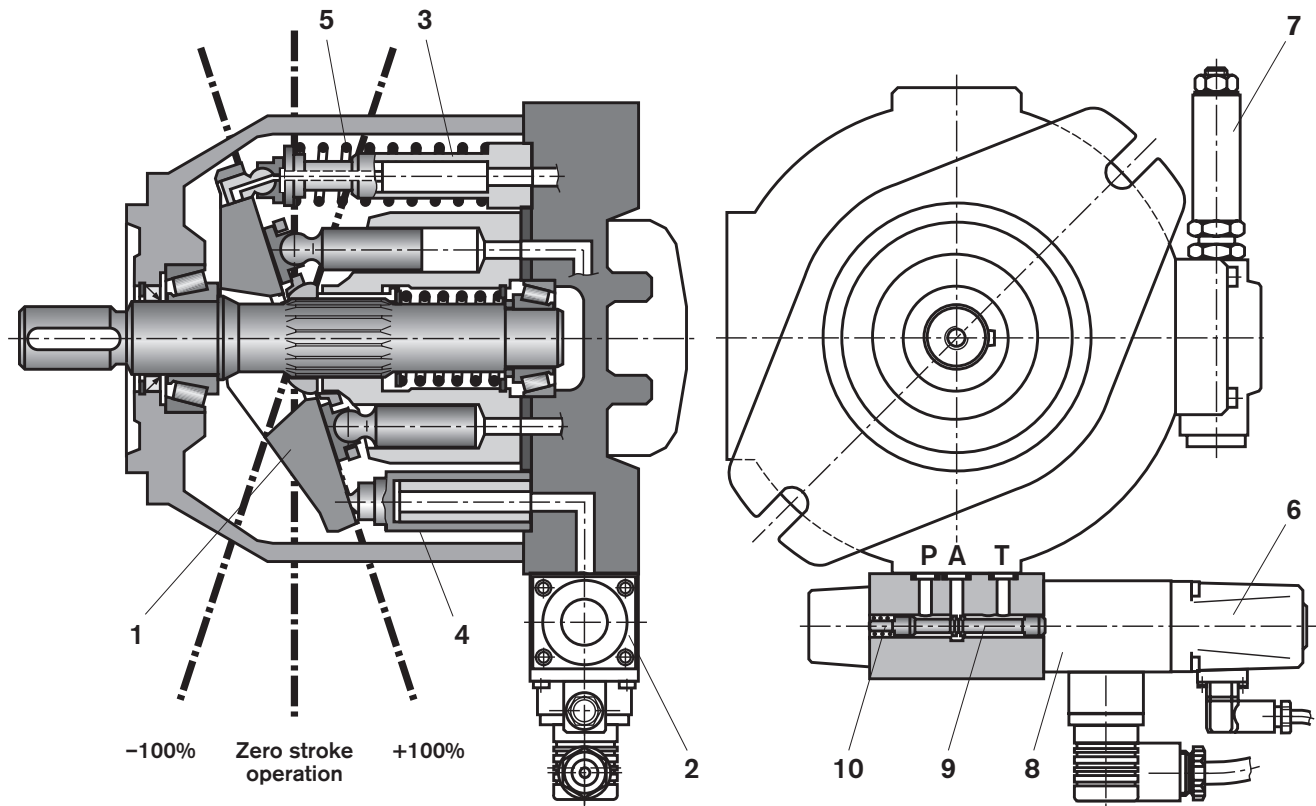
If the higher-level controllers demand an increase in the swivel angle (increase in flow), valve spool (9) must be moved from the central position (connection of actuating piston (4)  $A \rightarrow T$ ) until the swivel angle reaches the required value. The movement of the valve spool against the force of spring (10) is achieved by a corresponding increase in the electrical current through proportional solenoid (8).

A reduction of the swivel angle (reduction of flow) is achieved through the connection of the actuating piston (4) from  $P \rightarrow A$ .

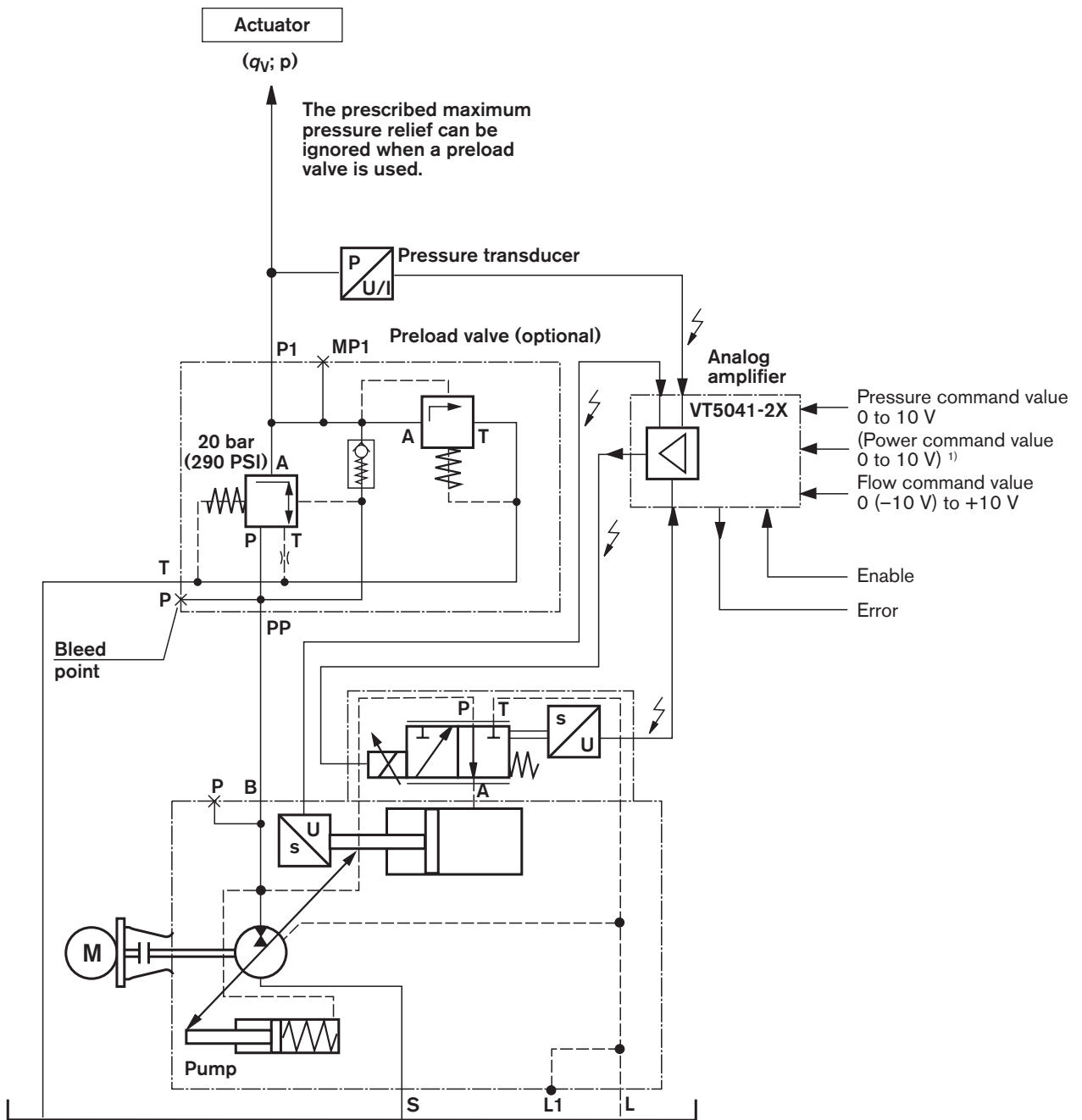
### Control system supply

There are three possibilities of supplying the hydraulic control system of the pump with pilot oil:

1. Internal, without preload valve (only possible with system pressures  $> 20$  bar (290 PSI))
2. Internal, with preload valve (system pressure 0 ... 100%)
3. External supply via shuttle valve – automatic changeover internal / external through shuttle valve sandwich plate) (observe sales information RE 30030-01-V!)



**Schematic diagram: Control system with internal supply (self-supply)**



<sup>1)</sup> Optional



**Technical data** (for applications outside these parameters, please consult us!)**General**

Ambient temperature range for the pump	°C (°F)	-20 to +70 (+4 to +158)					
Ambient temperature range for the controller card	°C (°F)	0 to 50 (+32 to +122)					
Drive speed	$n$	See RE 92711 (sizes 28 – 140) and RE 92712 (size 18)					
Size	Size	18	28	45	71	100	140
Weight – Pump without through-drive, incl. pilot valve	kg (lbs.)	14 (30.9)	17 (37.5)	23 (50.7)	35 (77.1)	47 (103.6)	62 (136.6)
– Additionally, preload valve	kg (lbs.)	3.3 (7.3)	3.3 (7.3)	3.3 (7.3)	6.3 (13.9)	6.3 (13.9)	6.3 (13.9)
– Additionally, with external control system supply	kg (lbs.)	2 (4.4)	2 (4.4)	2 (4.4)	2 (4.4)	2 (4.4)	2 (4.4)

**Hydraulic**

Max. permissible operating pressure – $p_{max}$	bar (PSI)	250 (3625) <sup>1)</sup> (280 bar [4060] after consultation)					
Actuating pressure $p_{min}$	bar (PSI)	≥ 20 (290)					
$p_{max}$ with external pilot oil supply	bar (PSI)	≤ 30 (45)					
Hydraulic fluid temperature range	°C (°F)	-20 to +70 (+4 to +158)					
Hydraulic fluid		Mineral oil (HL, HLP) to DIN 51 524					
Contamination with solid particles		Max. permissible degree of contamination of the hydraulic fluid according to ISO 4406 class 18/16/13 (for particle sizes 2/5/15 $\mu\text{m}$ ) <sup>2)</sup>					
<b>Electrical</b> <sup>3)</sup>							
Power consumption of the controller card	P	35 W ( $U_B = 24$ V)					
Type of protection of the pump to DIN 40 050		IP 65 with plug-in connector mounted and locked					

<sup>1)</sup> For supplementary information, see sales information (engineering aids RE 30030-01-V)

<sup>2)</sup> The cleanliness classes specified for the components must be complied with in hydraulic systems. Effective filtration prevents malfunction and at the same time increases the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076 and RE 50081.

<sup>3)</sup> For additional information, see data sheet RE 30241



**Note:** For details on Environment simulation tests in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 30024-U (declaration on environmental compatibility).

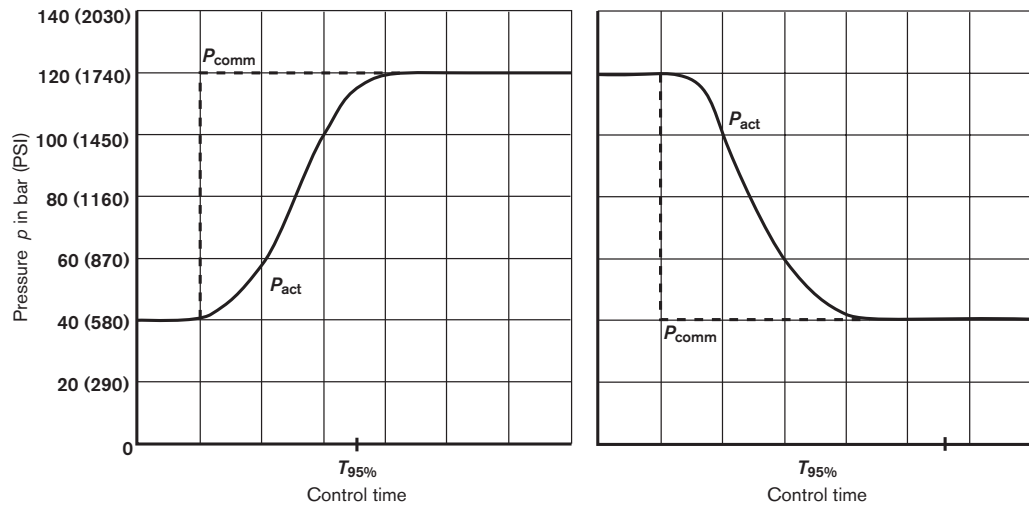
**Control loop quality SYDFE1** (the specified values are valid only when system-related components are used in accordance with the type code!)

	Closed-loop swivel angle control	Closed-loop pressure control <sup>4)</sup>
Linearity tolerance	≤ 1.0 %	≤ 1.5 %
Temperature drift	≤ 0.5 %/10 K	≤ 0.5 %/10 K
Hysteresis	≤ 0.2 %	≤ 0.2 %
Repeatability	≤ 0.2 %	≤ 0.2 %

<sup>4)</sup> Without consideration of pump pulsation

### Transient function at pressure command value step change, SYDFE1 with 360° spool (version "A")

The curve shapes and control times given can only be achieved with an optimized pressure controller.



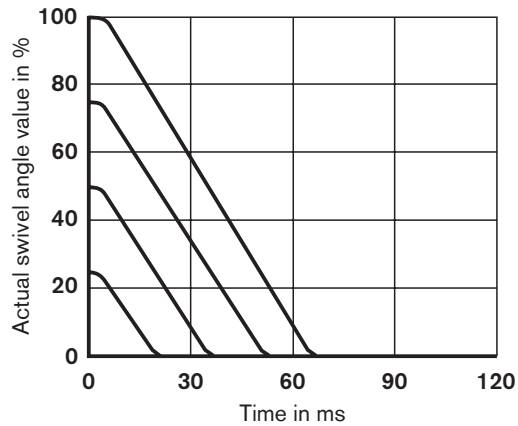
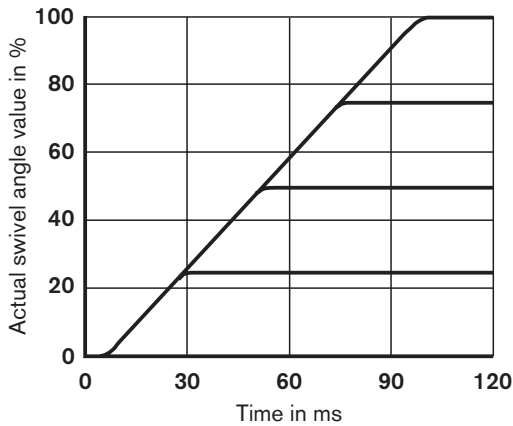
$T_{95\%}$  in ms with hydraulic fluid volume being connected (lines and actuators)

< 5 L (1.3 gal)	150 ms
5 – 10 L (1.3–2.6 gal)	200 ms
15 – 25 L (4.0–6.6 gal)	250 ms

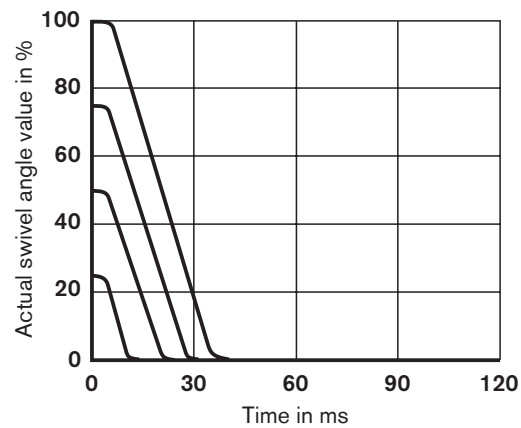
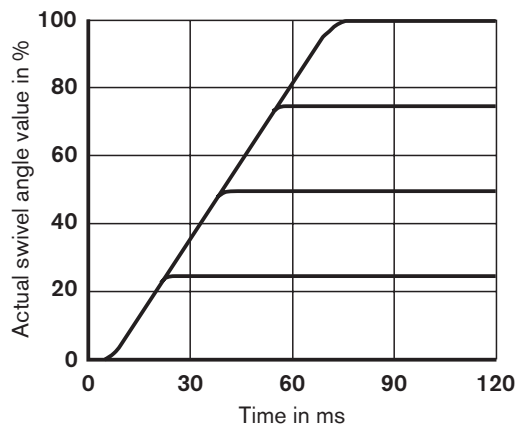
At pressures up to 40 bar (580 PSI) the response time values are higher.

### Transient function with swivel angle command value step-change with 360° spool (version "A")

Sizes 18, 28, 45, 71  $p = 20$  bar (290 PSI)

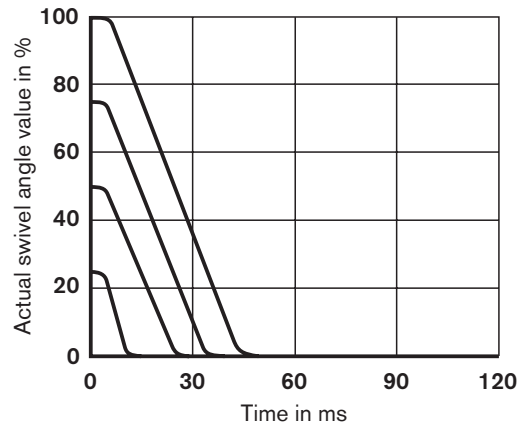
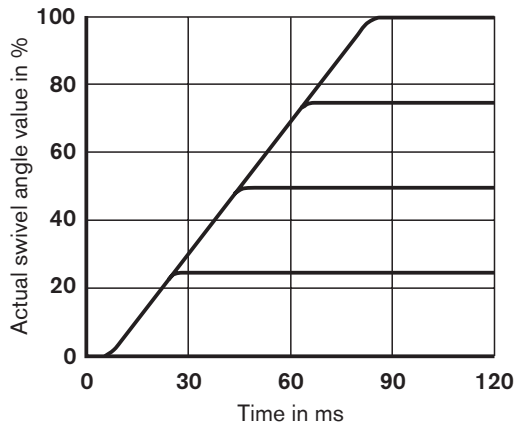


Sizes 18, 28, 45, 71  $p = 50$  bar (725 PSI)

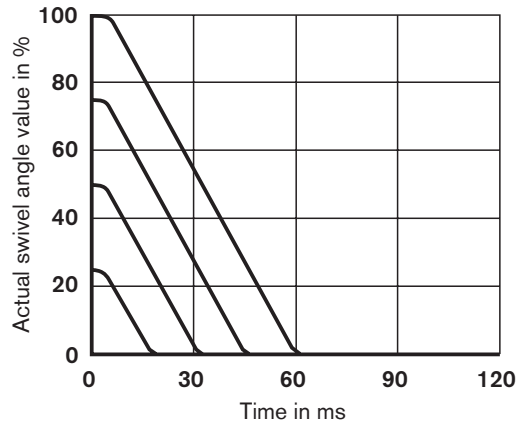
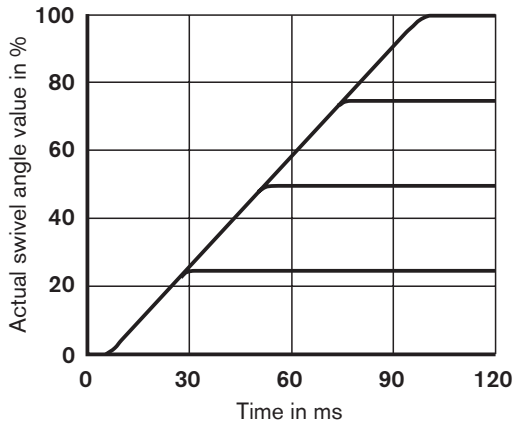


**Transient function with swivel angle command value step-change with 360° spool (version "A")**

Size 100  $p = 50 \text{ bar (725 PSI)}$



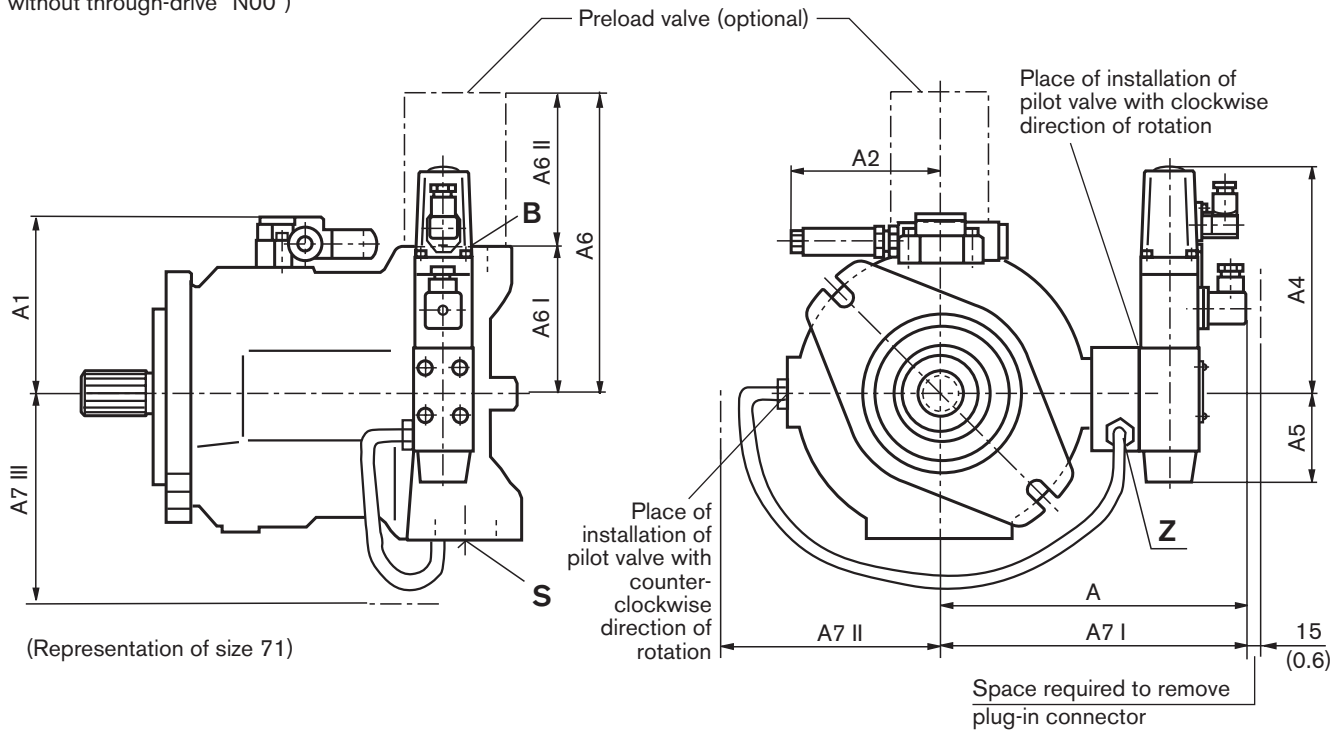
Size 140  $p = 50 \text{ bar (725 PSI)}$



**Unit dimensions of SYDFE1 – dimensions in mm (inches)**

**Sizes 18 to 140**

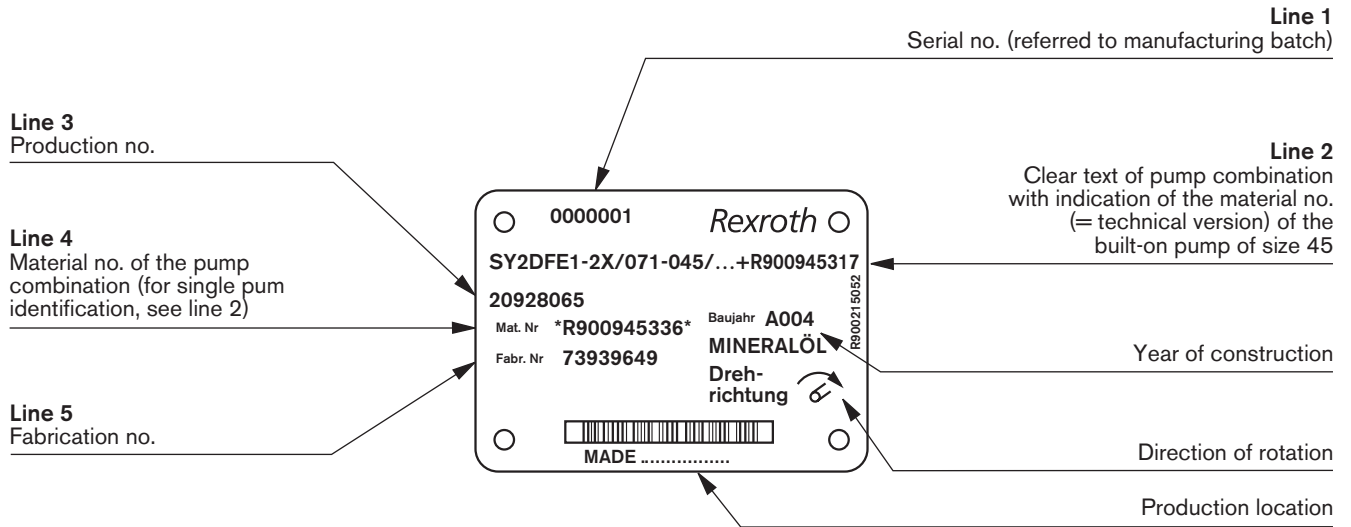
(shaft version "S";  
without through-drive "N00")



Size	A1	A2	A3	A4	A5	A6	A6 I	A6 II	Pilot oil port "Z"		
									A7 I	A7 II	A7III
18	98 (3.86)	107 (4.21)	161 (6.34)	158 (6.22)	63 (2.48)	178 (7.00)	63 (2.48)	115 (4.53)	196 (7.72)	125 (4.92)	100 (3.94)
28	106 (4.17)	107 (4.21)	171 (6.73)	158 (6.22)	63 (2.48)	195 (7.68)	80 (3.15)	115 (4.53)	206 (8.11)	135 (5.32)	115 (4.53)
45	112 (4.41)	107 (4.21)	181 (7.13)	158 (6.22)	63 (2.48)	205 (8.07)	90 (3.54)	115 (4.53)	216 (8.50)	145 (5.71)	125 (4.92)
71	124 (4.88)	107 (4.21)	195 (7.68)	158 (6.22)	63 (2.48)	254 (10.00)	104 (4.09)	150 (5.91)	230 (9.06)	159 (6.26)	150 (5.91)
100	129 (5.08)	107 (4.21)	200 (7.87)	158 (6.22)	63 (2.48)	247 (9.72)	100 (3.94)	147 (5.79)	235 (9.25)	164 (6.47)	150 (5.91)
140	140 (5.51)	107 (4.21)	213 (8.39)	143 (5.63)	78 (3.07)	257 (10.12)	110 (4.33)	147 (5.79)	248 (9.76)	182 (7.17)	150 (5.91)

## Example of nameplate for a pump combination SY2DFE1

The nameplate shown is that of the built on size-45 pump!



 For queries regarding the pump combination, state the material number (line 4) and the fabrication number (line 5).

## Plug-in connectors (included in the scope of supply)

- Plug-in connector for solenoid plug (material no. **R900008909**)
- Plug-in connector for valve position transducer (material no. **R900023126**)
- Plug-in connector for pump position transducer (material no. **R900013674**)

## Notes

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