

Radial piston pumps type R and RG

with several pressure ports

Operating pressure p_{max} = 700 bar
 Delivery flow Q_{max} = 76,0 lpm (at 1450 rpm)
 Geometric displacement $V_{g max}$ = 53,5 cm³/rev.

Radial piston pumps type R and RG	D 6010
Radial piston pumps type R and RG with one main and one or two auxiliary pressure ports	D 6010 S
Hydraulic power packs type R and RG with several pressure ports	D 6010 DB

1. General

All pumps presented in D 6010 (with the exception of single-cylinder pumps) are available, depending on the pump design, with two or more individual pressure ports. This allows such pumps to cope with any overlap in consumer movement at various load conditions, as may occur in hydraulic systems due to sequence of functions involved, without requiring any significant design modifications and without such consumers affecting each other. Another application is the stepwise variation of the consumer speed via simple 2/2-way circulation valves by connecting or disconnecting individual pressure circuits to or from the joint pressure line. Additionally they can provide pressure fluid for control circuits with hydraulically controlled directional valves, which usually require a certain minimum pressure. For additional information regarding piloted directional spool valves type HSR, HSL, and HSF see D 7493 and D 7493 E.

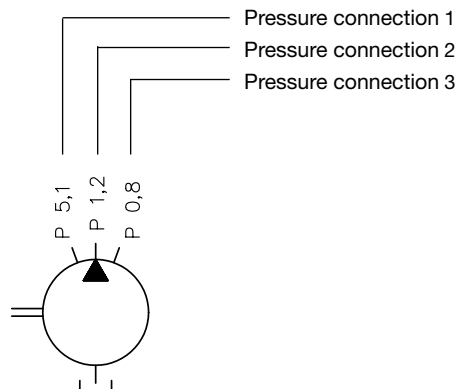
● Delivery flow subdivision

The delivery of individual pump cylinders may be either led out separately or joint, depending on the pump design involved (see D 6010). The various versions available are shown in sect. 2 ++, where also the specific type (order) coding is detailed.

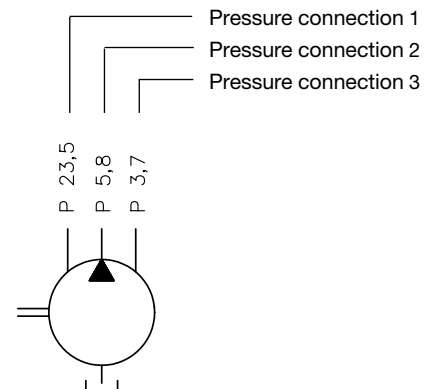
● Illustration of symbols

The pump symbols in the following are illustrated basically in two different ways to distinguish whether a port is fed by only one cylinder or by two or more cylinders. The delivery line leaves the pump symbol radially when only one cylinder is led out individually whereas it leaves in parallel whenever several cylinders or even complete radials are grouped. This different style of illustration enables also to judge the flow consistency (smoothness) for the respective pressure port. Complete radials show almost no pulsation, due to the equal distribution of an uneven number of cylinders, while individual or externally grouped cylinders retain their typical delivery characteristic (pulsation) more or less. For more details, see sect. 4.1 "Delivery characteristic". The port index No. count up clockwise in the following.

Typical example of a 1-radial pump with three pressure ports R 5,1 - 1,2 - 0,8. It is mandatory that the order coding specifies the grouped cylinders at port 1 and the individually led out cylinders subsequently i.e. port 2 and 3. For more details, see sect. 2.3.

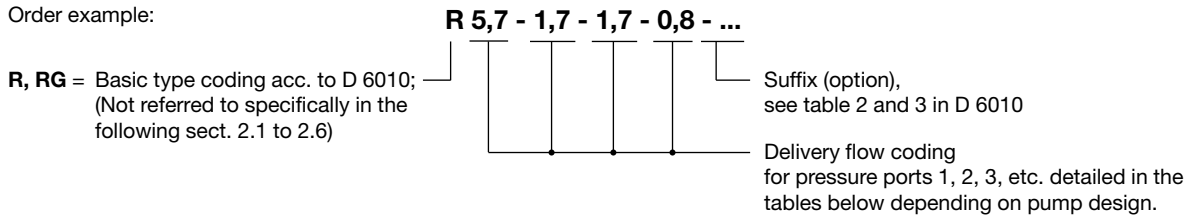


Typical example of a 4-radial pump with three pressure ports (comprising complete cylinder radials) R 23,5 - 5,8 - 3,7. It is mandatory that the order coding specifies the grouped cylinder radials at port 1 and the individually led out cylinder radials subsequently i.e. port 2 and 3. For more details, see sect. 2.5.



2. Available versions, main data

Order example:



It is mandatory that the order coding specifies the grouped cylinders (1-radial pumps) or complete radials (more-radial pumps) directly after the R (port 1), whereas the position (port index No.) of the other requested individual flows can be positioned as desired. Attention: 1-radial pumps (design 6011) with 7-cylinders are not available with 6 ports. Also not available are 2-radial pumps (design 6012) where from one of the two radials several individual cylinders should be grouped. Where necessary the cylinders of such a pump with 7 ports had to be grouped externally. See sect. 2.3 ++.

Delivery flow selection table

Design 7631, for more details see sect. 2.1

Piston-Ø (mm)		4	5	6	7	8	9
Operating pressure p_{\max} ¹⁾ (bar)		700	550	450	350	300	250
Delivery flow coding	1-cylinder	0,09	0,14	0,22	0,29	0,36	0,45
Delivery flow coding	3-cylinder ²⁾	0,27	0,42	0,64	0,81	1,1	1,35

Design 6010, 6011, 6012, 6014, and 6016, for more details see sect. 2.2 to 2.6

Joint pump cylinder per port		Connection index	Delivery flow coding (guideline figure Q in (lpm) at 1450 rpm)								
			Piston-Ø (mm)								
			6	7	8	10	12	13	14	15	16
			Operating pressure p_{\max} (bar) ¹⁾								
			700	600	550	450	350	300	250	200	160
Indiv. cylinder		a	0,3	0,41	0,5	0,8	1,2	1,45	1,7	1,9	2,2
Cylinder group consisting of	2-cylinder	b	0,6	0,83	1,0	1,6	2,4	2,8	3,3	3,8	4,4
	3-cylinder	c	0,9	1,25	1,5	2,5	3,6	4,3	5,1	5,6	6,5
	4-cylinder	d	1,15	1,65	2,15	3,35	4,8	5,7	6,7	7,7	8,7
	5-cylinder	e	1,4	2,08	2,6	4,2	6,0	7,0	8,3	9,5	10,9
	6-cylinder	f	1,8	2,45	3,2	5,0	7,2	8,6	9,9	11,5	13,1
Complete	5-cylinder radial	g	1,4	2,08	2,6	4,2	6,0	7,0	8,3	9,5	10,9
	7-cylinder radial	h	2,1	2,9	3,7	5,8	8,4	9,8	11,8	13,3	15,3
Number of joint radials per port (5- or 7-cylinder radials)	2 x 5-cylinder	i	2,7	4,15	5,3	8,2	12,0	14,2	16,8	19,3	21,7
	2 x 7-cylinder	k	4,0	5,85	7,4	11,6	17,0	20,0	23,5	26,5	30,4
	3 x 5-cylinder	l	4,6	6,2	8,25	13,0	18,8	22,5	25,2	28,5	32,6
	3 x 7-cylinder	m	5,95	8,75	11,2	17,3	25,5	29,9	35,3	39,8	45,6
	4 x 7-cylinder	n	8,0	11,65	15,0	23,0	34,0	40,0	47,0	53,0	60,8
5 x 7-cylinder	o	10,6	14,55	18,3	28,8	42,5	50,0	58,4	66,7	76,0	
Geometric displacement of one indiv. cylinder (connection index a)	(cm ³ /rev.)		0,21	0,29	0,38	0,59	0,84	1,0	1,15	1,32	1,53
Nom. delivery flow Q_N	(lpm)		The total geom. displacement $V_{g \text{ total}}$ of a cylinder group or radial (connection index b to o) can be calculated by multiplying the indiv. geom. displacement with the respective number of cylinders.								
			The delivery flow coding is a guideline but it can be calculated with the formula below: $Q_N = \frac{V_{g \text{ total}} \cdot n_N}{1000 \cdot \eta_{Vol}}$ Motor speed n_N in rpm Vol. efficiency $\eta_{Vol} \approx 0.98$								

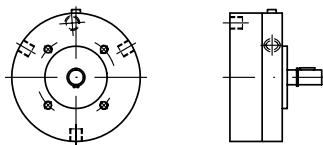
1) The operating pressure should be restricted for applications with continuous operation where the subsequent load cycles are all at the upper end of the pressure range (>75%) e.g. accumulator charging etc.

It is advisable for an economic service life of the bearings to restrict the operating pressure of the respective pump element diameter to about 75% of its original specification. Another pump with smaller but more pump elements should be selected, if this is not possible.

2) Only available as combination with 2 x 3 pump cylinders, e.g. R 0,81 - 0,27

2.1 1-radial pump, design 7631

2-, 3-, and 5-cylinder pump

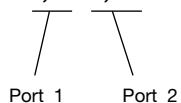


For design reasons each pump cylinder has its own pressure port. These ports must then be externally interconnected via pipes.

The only exception is a combination of 2 x 3 pump cylinders.

2 x 3 pump cylinders

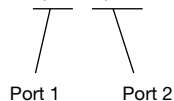
R 0,27 - 0,64



Type coding

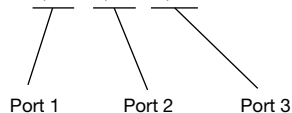
2-cylinder pump

R 0,14 - 0,36



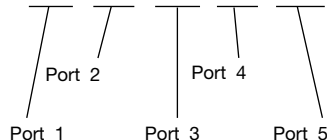
3-cylinder pump

R 0,09 - 0,29 - 0,29

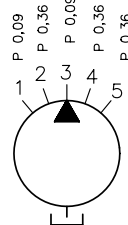
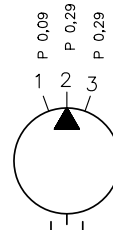
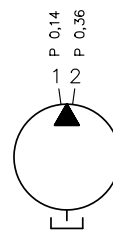


5-cylinder pump

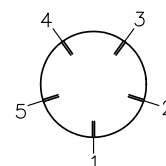
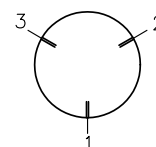
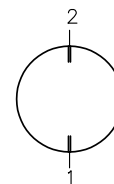
R 0,09 - 0,36 - 0,09 - 0,36 - 0,36



Symbols

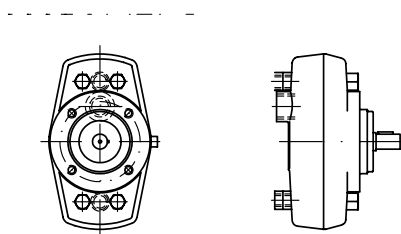


Cylinder arrangement

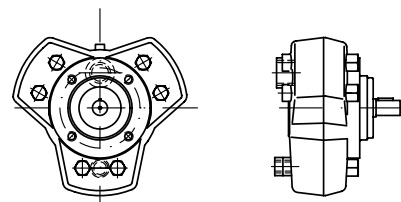


2.2 1-radial pump, design 6010

2-cylinder pump



3-cylinder pump



Option 1:

Delivery flow codings acc. to connection index a in table on page 2. The pump shows as many pressure ports as cylinders.

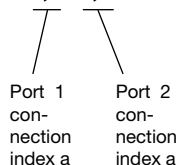
Option 2:

Two cylinders joint at port 1 (flow coding acc. to connection index b), the remaining cylinders joint at port 2 (flow coding acc. to connection index a).

Type coding

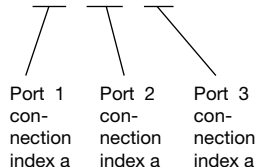
2-cylinder pump

R 0,8 - 1,7



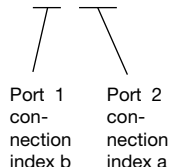
3-cylinder pump (option 1)

R 1,2 - 1,2 - 1,2

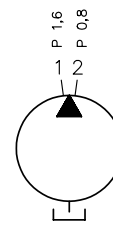
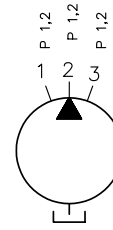
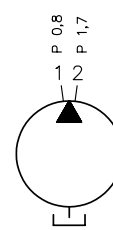


3-cylinder pump (option 2)

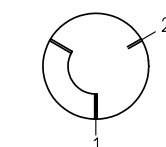
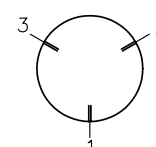
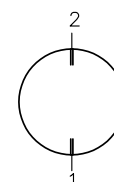
R 1,6 - 0,8



Symbols

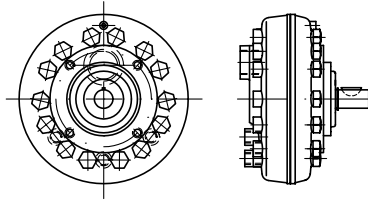


Cylinder arrangement



2.3 1-radial pump, design 6011

5- and 7-cylinder pump



Option 1 :

Delivery flow codings acc. to connection index a in table on page 2. The pump shows 5 or 7 pressure ports.

Option 2:

5-cylinder pump

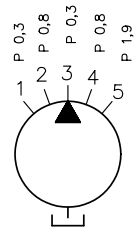
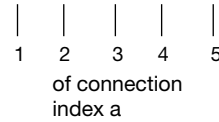
Two, three or four cylinders joint at pressure port 1 (flow coding acc. to connection index b, c or d) ; the remaining cylinders led out individually to pressure ports 2, 3 etc. (delivery flow index as specified in line a).

7-cylinder pump

Three, four, five or six cylinders joint at pressure port 1 (flow coding acc. to connection index c - f), the remaining cylinders led out individually to pressure ports 2, 3 etc. (delivery flow index as specified in line a).

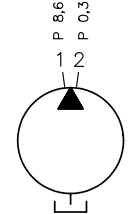
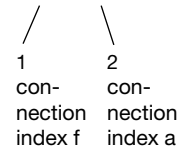
Order example (5-cylinder pump):

R 0,3 - 0,8 - 0,3 - 0,8 - 1,9



Order example (7-cylinder pump):

R 8,6 - 0,3



Cylinder combinations on versions available and appropriate symbols

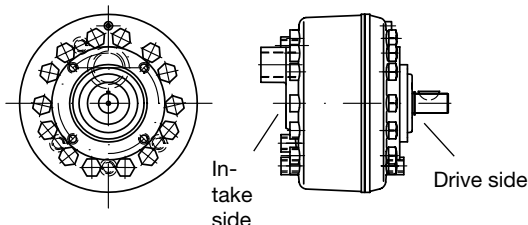
	Option 1	Option 2				
5-cylinder pump						
Order example	R 0,3-0,8-0,3-0,8-1,9	R 3,8-0,8-0,3-0,8	R 4,3-0,5-0,5	R 2,4-1,2-1,2	R 4,8-0,5	
Port 1 acc. to connection index a	a	b	c	b	d	
all other ports acc. to connection index	a	a	a	a	a	
7-cylinder pump						
Order example	R 1,2-1,2-1,2-1,2-1,2-0,5	R 5,1-0,8-0,5-0,8-0,5	R 7,7-1,2-1,2-0,5	R 4,3-1,45-1,45-1,45	R 7,0-0,8-0,8	R 8,6-0,3
Port 1 Connection index a	a	c	d	c	e	f
all other ports acc. to connection index	a	a	a	a	a	a

¹⁾ e.g. for providing two pressure circuits with equal flow. Dummy cylinders are not indicated in the coding. The respective delivery flow coding for this group represents only the active pump cylinders.

2.4 2-radial pump, design 6012

10- and 14-cylinder pump

Each cylinder radial comprises either 5 or 7-cylinders



Option 1 :

One pressure port per radial = two pressure ports in total. Pressure port 1 on the shaft side, port 2 on the suction side. Flow coding acc. to connection index g (5-cylinder radial) or acc. to line h (7-cylinder radial).

Option 2:

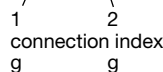
The cylinder radial on the shaft side is joined completely at port 1, the second radial is split up as with design 6011 (1-radial pump) among ports 2, 3... etc.. The flow codings from the two radials are separated by a slash.

Option 3 :

Both cylinder radials split-up among several pressure ports as with group 6011 (1-radial pumps, flow ratings from each radial separated by a slash). Attention: The usual intermediate flange acc. to D 6010 or D 6010 H or D 6010 Z can not be used. A suitable flange has to be customer furnished, for specifications see SK 6020 155.

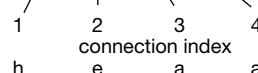
Order example (10-cylinder pump):

R 7,0 - 2,6



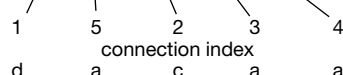
Order example (14-cylinder pump):

R 13,3 / 4,2 - 0,3 - 0,3



Order example (10-cylinder pump):

R 5,7 - 0,5 / 5,1 - 1,2 - 0,8



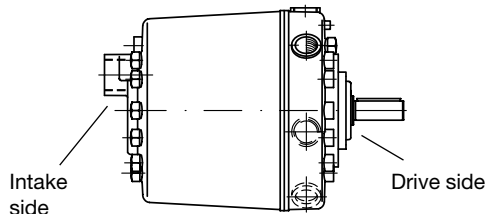
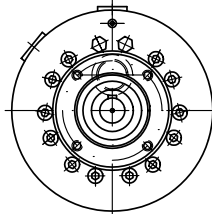
Cylinder combinations and respective symbols (only examples - there are many more versions) available

	Option 1		Option 2		Option 3		
	Drive side	Suction side	Drive side	Suction side	Drive side	Suction side	
10-cylinder pump 2 x 5-cylinder radials							These typical orders are examples of the many variations possible.
Order example	R 7,0-2,6		R 9,5 / 4,8-0,8		R 1,2-1,2-1,2-1,2-1,2 / 1,2-1,2-1,2-1,2-1,2		
Port 1 acc.to conn. index		g		g		a	
Port 2 acc.to conn. index		g		d		a	
all other ports acc. to connection index		--		a		a	
14-cylinder pump 2 x 7-cylinder radials							
Order example	R 8,4-8,4		R 13,3 / 7,7-0,5-0,5-0,5		R 7,7-0,5-0,5-0,5 / 7,7-0,5-0,5-0,5		
Port 1 acc.to conn. index		h		h		d	
Port 2 acc.to conn. index		h		d		d	
all other ports acc. to connection index		--		a		a	

2.5 4-radial pump, design 6014

20- and 28-cylinder pump

Each cylinder radial comprises either 5 or 7-cylinders

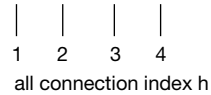


Option 1 :

One pressure port per radial = four pressure ports in total. Flow coding acc. to connection index g (5-cylinder radial) or acc. to line h (7-cylinder radial).

Order example (28-cylinder pump):

R 9,8 - 9,8 - 3,7 - 2,1

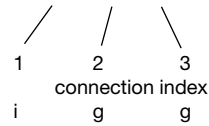


Option 2:

Two or three cylinder radials joint completely at port 1, the remaining on port 2 (3) acc. to connection index i + g + g, i + i or l + g (5-cylinder radials) or k + h + h, k + k or m + h (7-cylinder radials).

Order example (20-cylinder pump):

R 19,3 - 2,6 - 1,4

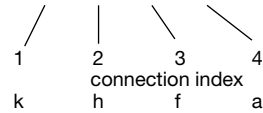


Option 3 :

One or two cylinders from the lowest radial (suction side) are led out at individual port(s) as supply for a control circuit for piloted valves. For more details, see D 6010S

Order example (28-cylinder pump):

R 4,0 - 2,1 - 1,8 - 0,3



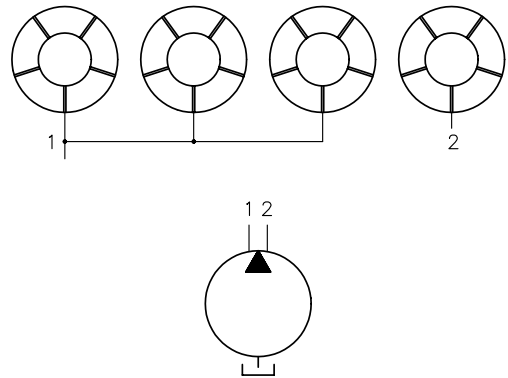
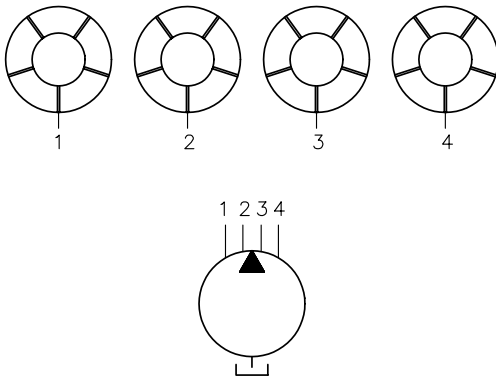
(indiv. cylinder for a control circuit)

Cylinder combinations and respective symbols (only exemplary - there are many more versions)

Option 1

Option 2

20-cylinder pump
4 x 5-cylinder radials

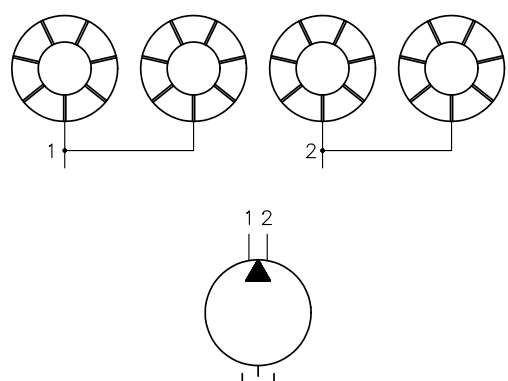
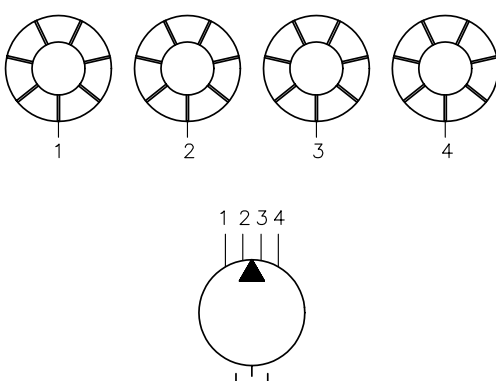


Order example

R 7,0-7,0-2,6-1,4
Connections 1 - 4 as specified in line g

R 18,8-5,3
Connection 1 as specif. in line l;
Connection 2 as specif. in line g

28-cylinder pump
4 x 7-cylinder radials



Order example

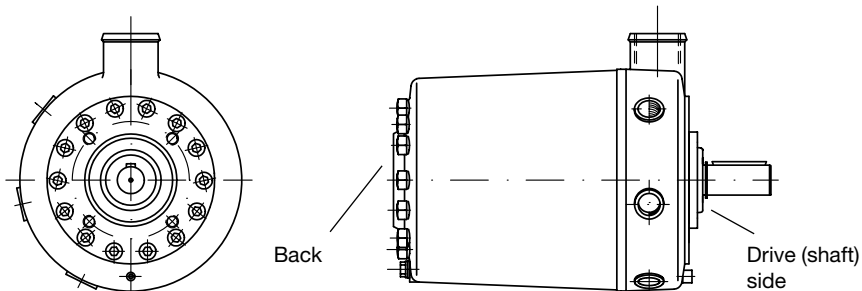
R 8,4-8,4-8,4-8,4
Connections 1 - 4 as specified in line h

R 17,0-17,0
Connections 1 - 2 as specified in line k

2.6 6-radial pump, design 6016

42-cylinder pump

Each cylinder radial comprises 7 cylinders

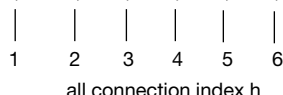


Option 1 :

One pressure port per radial = six pressure ports in total.
Flow coding acc. to connection index h (7-cylinder radial).

Order example:

R 11,8 - 11,8 - 5,8 - 5,8 - 2,1 - 2,1



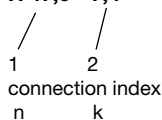
Option 2 :

Joint cylinder radials at (highest flow always at port 1):
Two ports, codings acc. to connection index m + m or n + k or o + h.

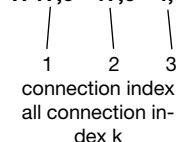
Three or five ports, codings acc. to connection index k + k + k, etc. or m + h + h + h, etc. or k + h + h + h + h

Order example:

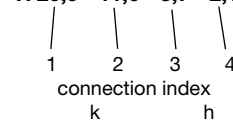
R 47,0 - 7,4



R 17,0 - 17,0 - 4,0



R 20,0 - 11,6 - 3,7 - 2,1



Option 3 :

One or two cylinders from the lowest radial (suction side) are led out at individual port(s) as supply for a control circuit for piloted valves. For more details, see D 6010S.

The order coding example is similar to 4-radial pumps (design 6014), see option 3 in sect. 2.5.

	Cylinder combinations and respective symbols (only exemplary - there are many more versions)	
	Option 1	Option 2
42-cylinder pump 6 x 7-cylinder radials		
Order example	R 11,8-11,8-5,3-5,3-2,1-2,1 Connections 1 - 6 as specified in line h	R 25,5-11,6-2,1 Connection 1 as specif. in line m Connection 1 as specif. in line k Connection 1 as specif. in line h

