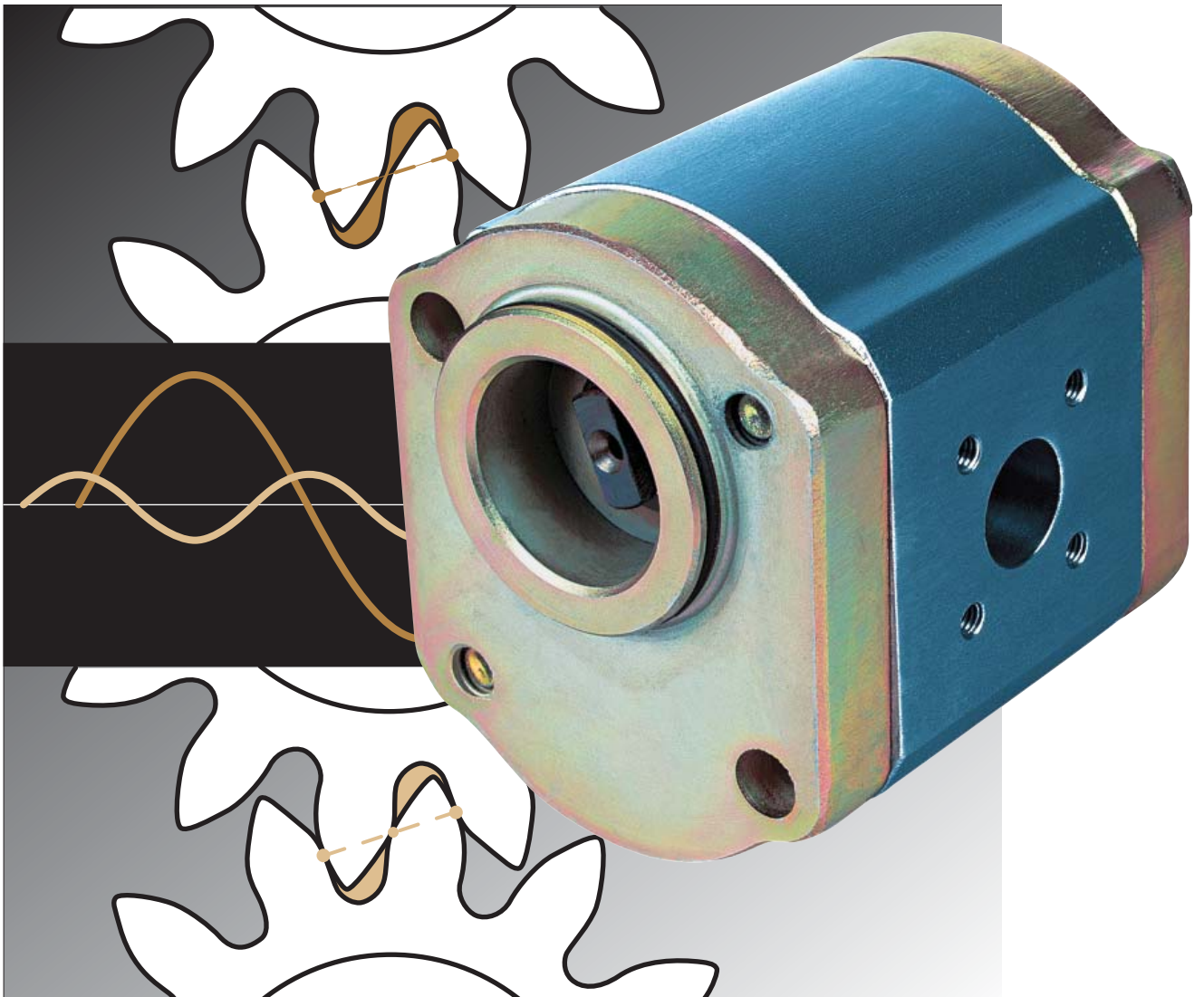


NEW!



CALMA PUMP SERIES
SETTING A NEW STANDARD FOR NOISE





THE POWER OF CALMA

Low noise across a wide speed range

Concentric is a specialist in hydraulic gear product technology. The company has a long standing tradition of developing gear products that meet the unique needs of specific markets and applications. In the electric vehicle markets low noise operation across a wide speed range is a key requirement. This capability enables operator comfort and improved control and positioning for various vehicle functions.

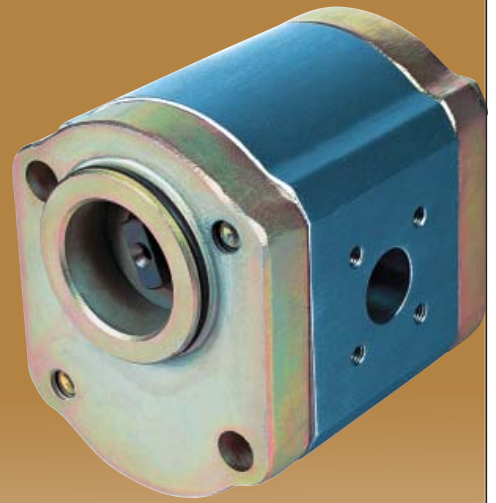
Concentric established itself as a leader in low noise gear products a decade ago when it introduced its WQ series (quiet) gear pump product line featuring dual flank engagement of the gear teeth to reduce the amplitude of the pressure pulsations introduced into the hydraulic system. The size of the pressure pulsation from the pump determines the pump noise levels.

Now Concentric is introducing the Calma Series which sets the new standard for low noise operation. Available in displacements from 6,2cc – 23,7cc the Calma pump's pressure pulsation is minimized to 25%. Calma's efficiency, wide speed range and low noise performance are the result of extensive research and development.

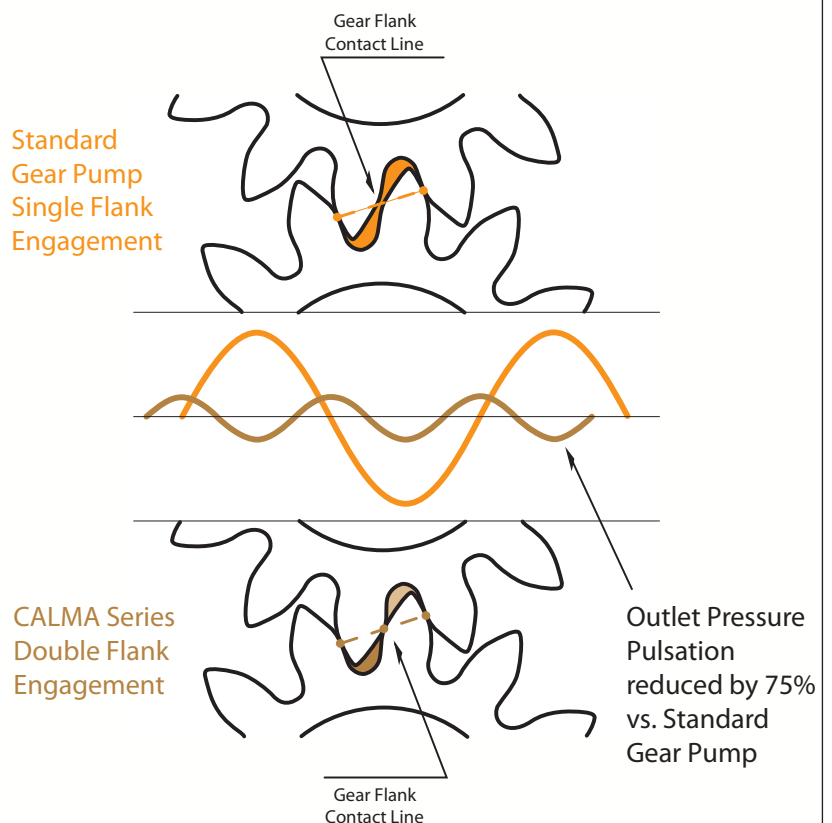
Calma is especially well suited to applications on electric counterbalanced lift trucks, warehouse lift trucks, electric aerial work platforms and other mobile equipment where low noise, low speed and high efficiency are required.

Calma Pump Features:

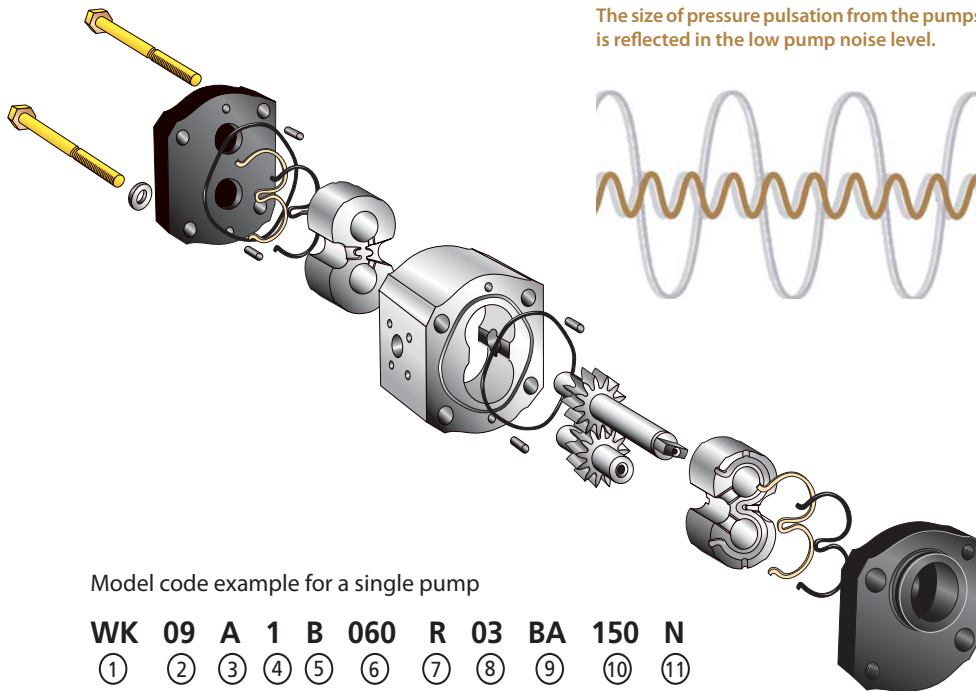
- 97% Typical Volumetric Efficiency
- Wide Speed Range
- Substantial Noise Reduction
- Pressure Pulsation Reduced by 75%
- A newly engineered tooth geometry
- An innovative approach to gear flank engagement
- Reduced trapped oil volume
- Compares favorably with more expensive internal gear pumps on efficiency and low noise operation



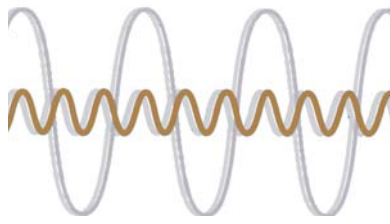
Calma Series vs. Traditional Gear Pump



Pictures on above are used with the kind permission of eg: Atlet, BT, Huddig, Scania, Toro and Volvo Construction Equipment. The right to modifications for technical improvements is reserved.



Pressure pulsation reduced by 75%.
The size of pressure pulsation from the pumps is reflected in the low pump noise level.



Model code example for a single pump

WK 09 A 1 B 060 R 03 BA 150 N
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

- | | |
|--|------------------------------|
| ① = Type | ⑥ = Displacement per section |
| ② = Range | ⑦ = Rotation |
| ③ = Design A - Std. Calma
Design L - L (WSR)* | ⑧ = Mounting flange |
| ④ = # of sections | ⑨ = Drive shaft |
| ⑤ = Seal material | ⑩ = Portings |
| | ⑪ = Valve options |

* L (WSR) Wide operating speed range with low speed capability $n=400$ rpm at max. operating pressure p_2 .

CALMA DESCRIPTION

The key performance features of Calma are its low noise operation over a wide speed range. Like its predecessor the WQ pump Calma is a three piece modular design. The pump body is manufactured from high strength aluminum alloy. The mounting flange and rear cover are of cast iron.

The Calma pumps come in single or multiple configuration of up to four sections.

For optimum strength, gears and shafts are precision machined in one piece. The 13-tooth gear geometry has been optimized for low noise level.

All shaft bearing surfaces are Teflon® coated and designed for long service life. They are continually cooled and lubricated by a controlled flow of fresh oil. This enables operation across a wide speed range at very high loads.

Multiple pumps in the Calma range are very compact. The drive shaft is capable of transmitting high torque even to the rear section. Each section has its own inlet and pressure ports. Single inlet features are optional for 2 and 3 section units.

A wide range of mounting flanges and port sizes are available to meet international standards.

General data

Displacement (V) 6,2 - 23,7 cc/rev
Wide Speed Range (WSR) (n) 400 - 4000 rpm

Pressure

Operating pressure (p_2) max. 250 bar
Operating temperatures (t) max. 105°C
Typical volumetric efficiency 97%
The maximum values for n , p_2 and t for a given pump specification may be applied simultaneously.

Options

- Mounting flanges - SAE, rectangular and through bolt.
- Shafts - Tang, spline, tapered or straight with key.
- Ports - Thread or flange.
- Rotation - CW or CCW.
- Integrated valves.
- Single inlet for multiple units.

PERFORMANCE DATA

Operating pressure range

Inlet port:
continuous, minimum -0,20 bar
intermittent, minimum -0,35 bar
maximum +2,00 bar

Outlet port (See tables on pages 6-9)

Speed range

Minimum speed for all pump sizes is $n=500$ rpm at maximum operating pressure. L (WSR) Wide operating speed range with low speed capability adds min. speed $n=400$ rpm at max. operating pressure.

Maximum speed for single pumps depends on the pump model in question and can be identified from tables on pages 6-9 for respective models.

Maximum speed for multiple pumps is the lowest one specified (See tables on pages 6-9) for any section of the configuration in question.

Noise performance data according to page 5.

Hydraulic Fluids

The use of HL- or HLP-hydraulic oil according to DIN 51 524 is recommended.

The **permissible viscosity** for all Calma pumps is from 750 to 10 mm²/s. The recommended operating viscosity range is from 40 to 16 mm²/s.

The **permissible cold start viscosity** is 2000 mm²/s. We recommend you contact Haldex before using fire resistant or bio-degradable fluids.

Viscosities (when operating at above temperature limits) have to remain within the range specified under "Hydraulic Fluids".

Temperature range

Ambient temperature min. -25° C
max. +80° C

Fluid temperature
continuous operation max. +90° C
intermittent operation max. +105° C

Please note

Fluid cleanliness

Fluid cleanliness according to ISO 4406/1999 [-18/14] or better is required in order to assure the pump's high level of efficiency in the long term.

Drive arrangement

Flexible couplings are preferred for direct drives. Please contact Concentric for indirect drive requirements. Pumps with outboard side load bearing are available.

Mounting position

As required.

Symbols

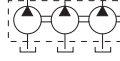
Single pump



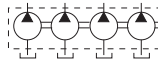
Double pump



Triple pump



Quadruple pump



Calma Design - Two Versions

Design Code "A"

Calma WK9A (Standard Design)

Standard design offers low noise operations within the common operating speed range.

Size Code	Displacement cc/rev	Operating Pressure (P ₂) bar	Max. Speed rpm	Min. Speed rpm
060	6,2	250	4000	500
080	8,3	250	4000	500
110	11,3	250	3600	500
140	14,5	250	3300	500
160	16,5	250	3000	500
190	19,6	250	3000	500
230	23,7	210	2800	500

- Operating pressure P₂: max. 20 sec. loaded following 10 sec. minimum unloaded. Pressure rating at min. speed is max. 100 bar (intermittent).
 - Operating pressure rating refers to flanged port configuration (210 bar for threaded ports).
 - Viscosity: minimum 10 mm²/s

Design Code "L"

Calma WK9L (WSR Design)

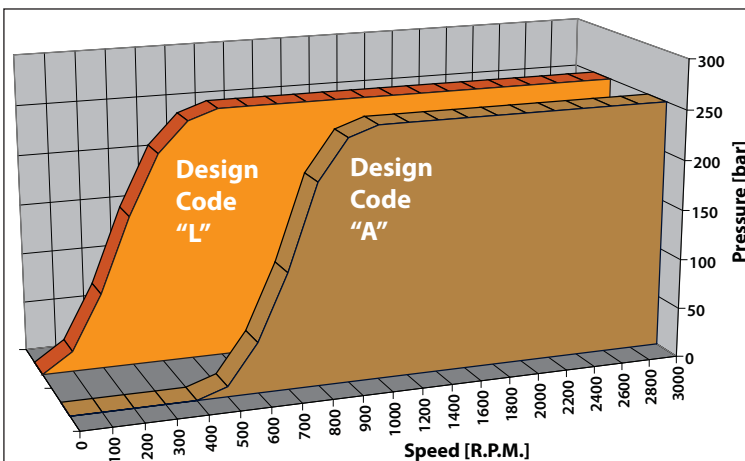
Wide operating speed range (WSR) offers low noise operation within the common operating speed range as well as additional low speed capability. This design incorporates additional side plates.

Size Code	Displacement cc/rev	Operating Pressure (P ₂) bar	Max. Speed rpm	Min. Speed rpm
060	6,2	250	4000	400
080	8,3	250	4000	400
110	11,3	250	3600	400
140	14,5	250	3300	400
160	16,5	250	3000	400
190	19,6	250	3000	400
230	23,7	210	2800	400

- Operating pressure P₂: max. 20 sec. loaded following 10 sec. minimum unloaded. Pressure rating at min. speed is max. 100 bar (intermittent).
 - Operating pressure rating refers to flanged port configuration (210 bar for threaded ports).
 - Viscosity: minimum 10 mm²/s

- Wide Operating Speed feature (Design Code "L") offers reduced minimum speed.
 Valid at P₂ operating pressure, max. 2,5 sec. load duration at 400 rpm.
 NOTE - Reduced operating pressure results in longer permissible load duration (> 2,5 sec.) and/or reduced speed < 400 rpm.

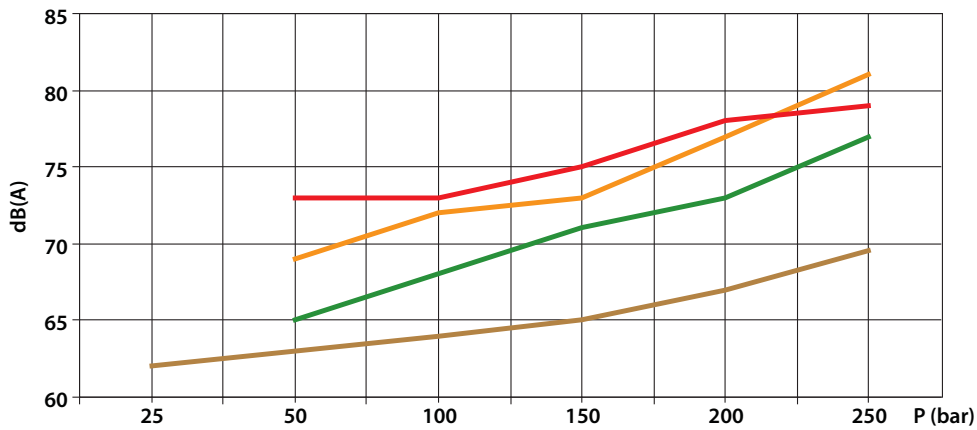
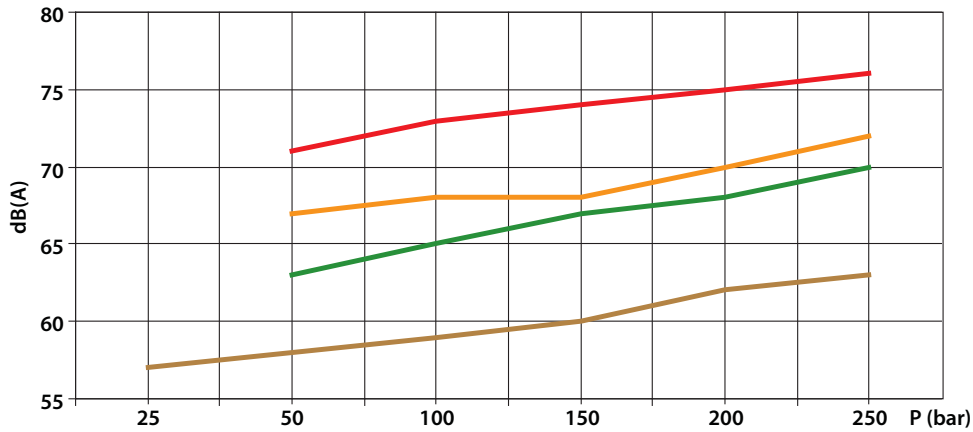
Permissible Pressure vs. Speed Capability



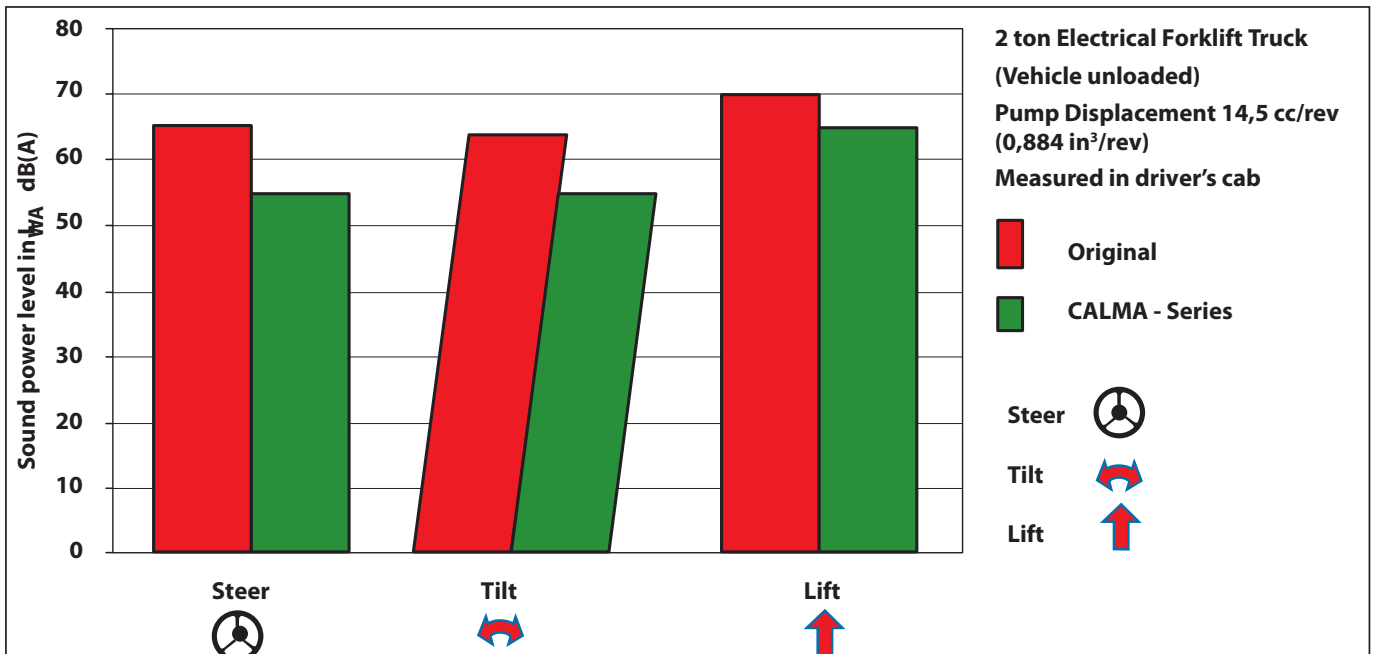
Concentric offers two different versions of Calma pumps:

- **Code Design "A"**
Calma WK9A. Standard design offers low noise operations within the common operating speed range.
- **Code Design "L"**
Calma WK9L. Wide operating speed range offers low noise operation within the common operating speed range as well as additional low speed performance and efficiency. The **L** option is ideally suited for applications like the steering idle mode on a electrical forklift truck. This design incorporates additional side plates.

CALMA Sound Power Level in L_{WA}

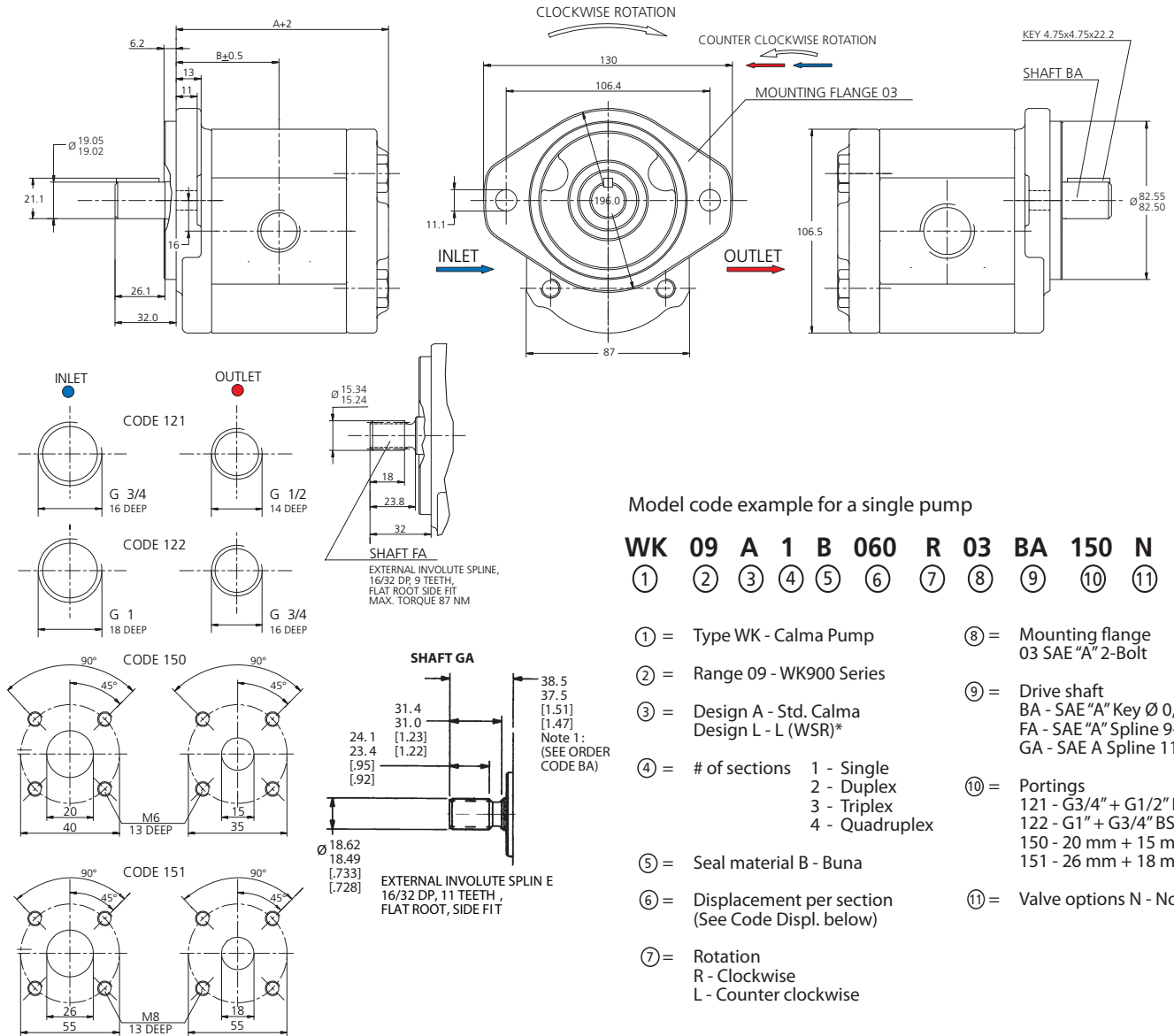


Sound Comparison





FLANGE CODE 03 (SAE "A" 2-BOLT)



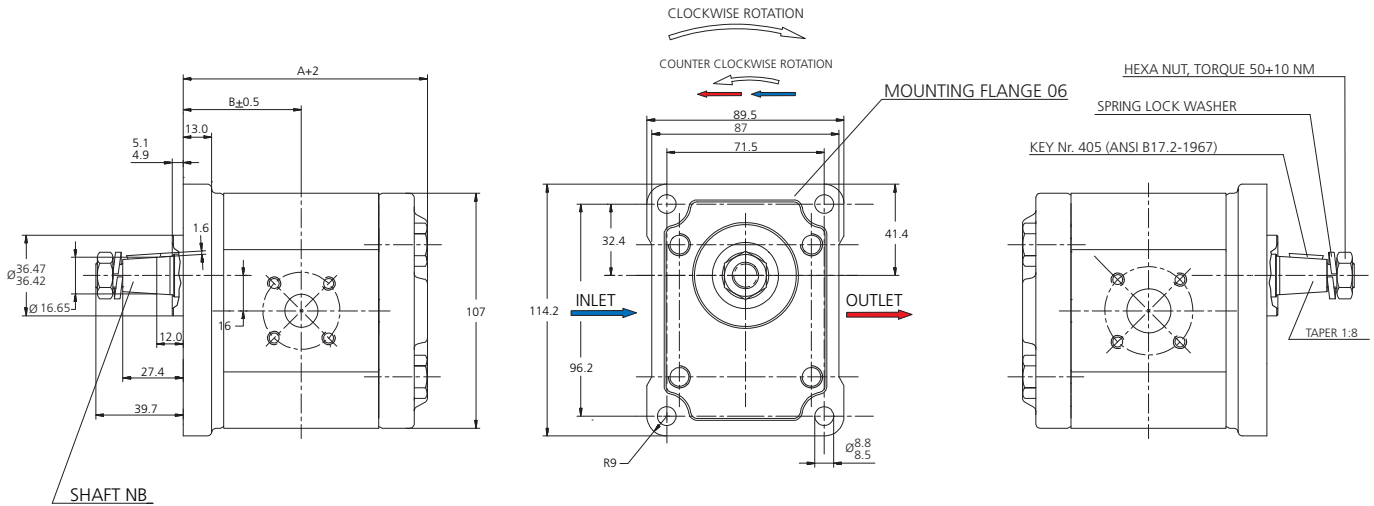
Size	Operating pressure (p ₂) (bar)		Maximum speed (rpm)		Dimensions** (mm)		Weight (approx.) (kg)
	Shaft 'BA'	Shaft 'FA'	Port. '121'/'150'	Port. '122'/'151'	A	B	
060 - 6,2cc	250	250	4000	-	91,6	44,0	3,8
080 - 8,3cc	250	250	4000	-	94,6	45,5	3,9
110 - 11,3cc	250	250	3600	-	99,0	47,7	4,1
140 - 14,5cc	250	250	3300	-	103,5	50,0	4,2
160 - 16,5cc	250	250	3000	-	106,4	51,4	4,3
190 - 19,6cc	250	250	3000	-	110,9	53,7	4,4
230 - 23,7cc	210	210	2800	3500	116,8	56,6	4,6

* Design Code "L" (WSR) Wide operating speed range with low speed capability n=400 rpm at max. operating pressure.

** Displacements greater than 15 cc adds 4,8 mm to A-dimension and 2,4 mm to B-dimension in L design.

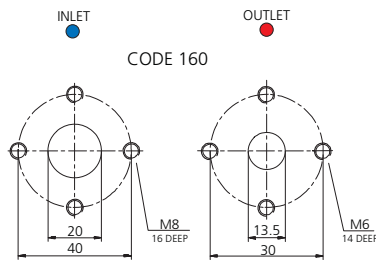


FLANGE CODE 06 (Ø 36.5 MM PILOT)



Model code example for a single pump

WK 09 A 1 B 060 R 06 NB 160 N
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪



- ① = Type WK - Calma Pump
- ② = Range 09 - WK900 Series
- ③ = Design A - Std. Calma
Design L - L (WSR)*
- ④ = # of sections 1 - Single
2 - Duplex
3 - Triplex
4 - Quadruplex
- ⑤ = Seal material B - Buna
- ⑥ = Displacement per section
(See Code Displ. below)
- ⑦ = Rotation
R - Clockwise
L - Counter clockwise
- ⑧ = Mounting flange
06 Ø 36,5 mm pilot
- ⑨ = Drive shaft
NB European Tapered shaft 1:8
- ⑩ = Portings
160 - 20 mm + 13,5 mm
- ⑪ = Valve options N - None

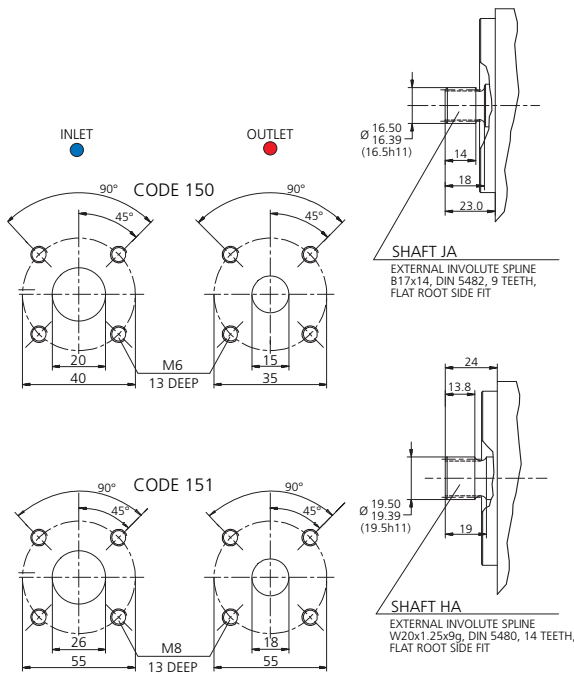
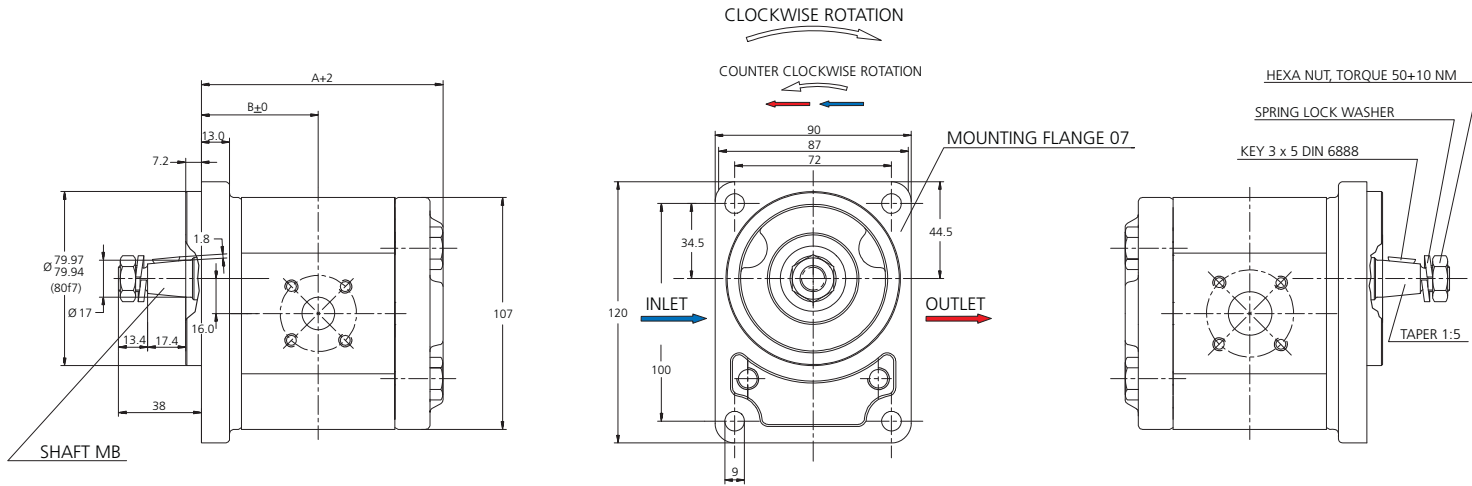
Size	Operating pressure (p ₂) (bar)		Maximum speed (rpm) Port code '160'	Dimensions**		Weight (approx.) [kg]
				A [mm]	B [mm]	
060 -	6,2cc	250	4000	91,6	44,0	3,8
080 -	8,3cc	250	4000	94,6	45,5	3,9
110 -	11,3cc	250	3600	99,0	47,7	4,1
140 -	14,5cc	250	3300	103,5	50,0	4,2
160 -	16,5cc	250	3000	106,4	51,4	4,3
190 -	19,6cc	250	3000	110,9	53,7	4,4
230 -	23,7cc	210	2800	116,8	56,6	4,6

* Design Code "L" (WSR) Wide operating speed range with low speed capability n=400 rpm at max. operating pressure.

** Displacements greater than 15 cc adds 4,8 mm to A-dimension and 2,4 mm to B-dimension in L design.



FLANGE CODE 07 (Ø 80 MM PILOT)



Model code example for a single pump

WK 09 A 1 B 060 R 07 MB 150 N
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

- ① = Type WK - Calma Pump
- ② = Range 09 - WK900 Series
- ③ = Design A - Std. Calma Design L - L (WSR)*
- ④ = # of sections 1 - Single
2 - Duplex
3 - Triplex
4 - Quadruplex
- ⑤ = Seal material B - Buna
- ⑥ = Displacement per section (See Code Displ. below)
- ⑦ = Rotation
R - Clockwise
L - Counter clockwise
- ⑧ = Mounting flange 07 Ø 80 mm pilot
- ⑨ = Drive shaft
MB European Tapered shaft 1:5
JA DIN 5482 Spline 9-t
HA DIN 5480 Spline 14-t
- ⑩ = Portings
150 - 20 mm + 15 mm
151 - 26 mm + 18 mm
- ⑪ = Valve options N - None

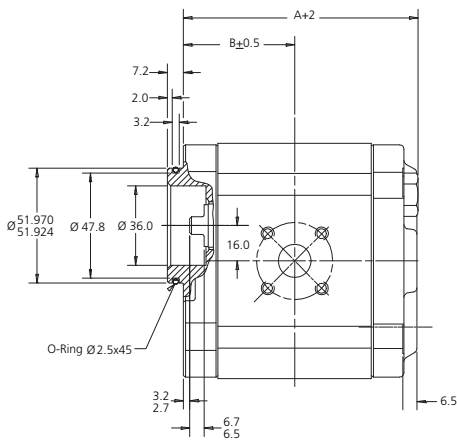
Size	Operating pressure (p ₂) (bar)	Maximum speed (rpm)		Dimensions**		Weight (approx.) [kg]
		Port. c. '150'	Port. c. '151'	A [mm]	B [mm]	
060 - 6,2cc	250	4000	-	91,6	44,0	3,8
080 - 8,3cc	250	4000	-	94,6	45,5	3,9
110 - 11,3cc	250	3600	-	99,0	47,7	4,1
140 - 14,5cc	250	3300	-	103,5	50,0	4,2
160 - 16,5cc	250	3000	-	106,4	51,4	4,3
190 - 19,6cc	250	3000	-	110,9	53,7	4,4
230 - 23,7cc	210	2800	3500	116,8	56,6	4,6

* Design Code "L" (WSR) Wide operating speed range with low speed capability n=400 rpm at max. operating pressure.

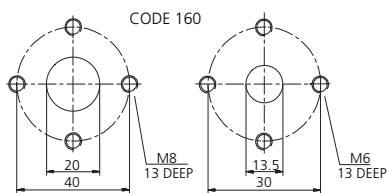
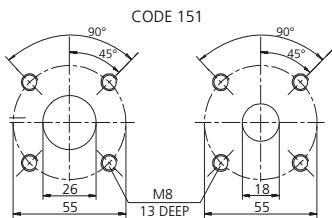
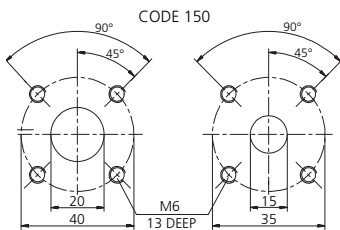
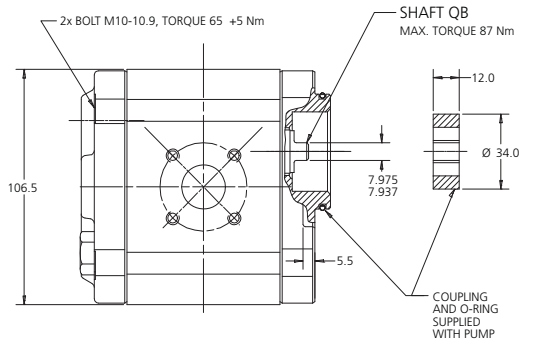
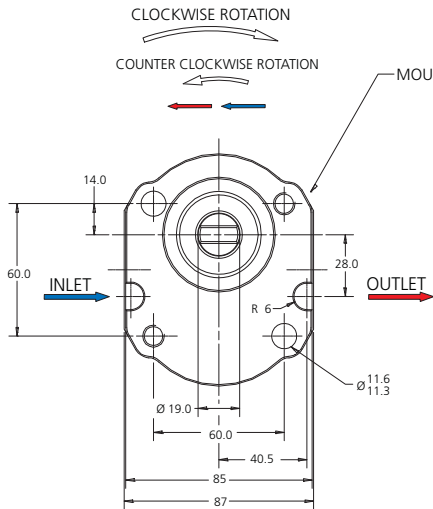
** Displacements greater than 15 cc adds 4,8 mm to A-dimension and 2,4 mm to B-dimension in L design.



FLANGE CODES 12 & 13***
(12 = THROUGH BOLT Ø 52 MM PILOT)
(13 = SAME AS ORDER CODE 12,
BUT OPPOSITE BOLT PATTERN)



INLET ●
 OUTLET ●



Model code example for a single pump

WK 09 A 1 B 060 R 12 QB 150 N
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

- ① = Type WK - Calma Pump
- ② = Range 09 - WK900 Series
- ③ = Design A - Std. Calma Design L - L (WSR)*
- ④ = # of sections
 1 - Single
 2 - Duplex
 3 - Triplex
 4 - Quadruplex
- ⑤ = Seal material B - Buna
- ⑥ = Displacement per section (See Code Displ. below)
- ⑦ = Rotation
 R - Clockwise
 L - Counter clockwise
- ⑧ = Mounting flange
 12 Through-bolt Ø 52 mm pilot
 13 Same as 12, but opposite mounting bolt pattern
- ⑨ = Drive shaft
 QB Wet Tang
- ⑩ = Portings
 150 - 20 mm + 15 mm
 151 - 26 mm + 18 mm
 160 - 20 mm + 13,5 mm
- ⑪ = Valve options N - None

Size	Operating pressure (p ₂) (bar)		Maximum speed (rpm)		Dimensions**		Weight (approx.) [kg]
		Shaft 'QB'	Port. '150'/'160'	Port. '151'	A [mm]	B [mm]	
060 -	6,2cc	250	4000	-	89,1	41,5	3,8
080 -	8,3cc	250	4000	-	92,1	43,0	3,9
110 -	11,3cc	250	3600	-	96,5	45,2	4,1
140 -	14,5cc	250	3300	-	101,0	47,5	4,2
160 -	16,5cc	250	3000	-	103,9	48,9	4,3
190 -	19,6cc	250	3000	-	108,4	51,2	4,4
230 -	23,7cc	210	2800	3500	114,3	54,1	4,6

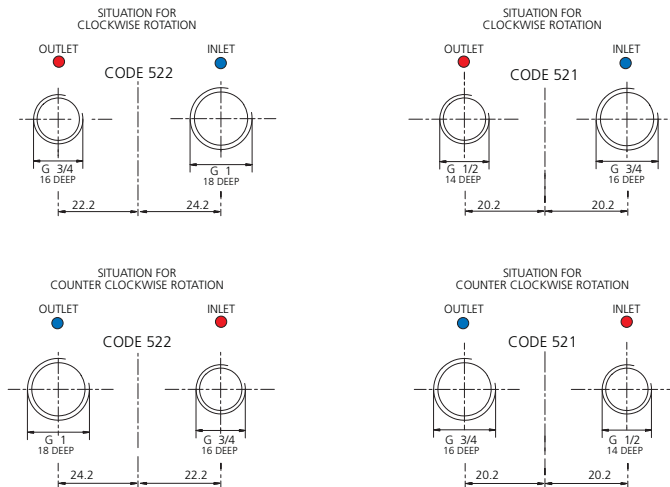
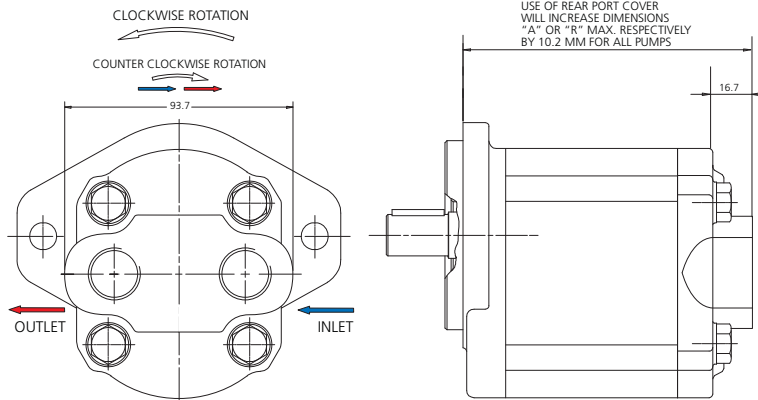
* Design Code "L" (WSR) Wide operating speed range with low speed capability n=400 rpm at max. operating pressure.

** Displacements greater than 15 cc adds 4,8 mm to A-dimension and 2,4 mm to B-dimension in L design.



REAR PORT

Rear port end cover can be combined with all flange and shaft options. All technical data from the preceding pages apply to this model.



Size	Operating pressure (p_2) (bar)	Maximum speed (rpm)		Weight (Approx.) [kg]
		Port. '521'	Port. '522'	
060 - 6,2cc	can be taken from Tables on pages 6-9	4000	-	4,1
080 - 8,3cc		4000	-	4,2
110 - 11,3cc		3600	-	4,4
140 - 14,5cc		3300	-	4,5
160 - 16,5cc		3000	-	4,6
190 - 19,6cc		3000	-	4,7
230 - 23,7cc		2800	3500	4,9



MULTIPLE PUMPS

The two following parameters are of the utmost importance when selecting multiple pumps and must never be exceeded:
 - Drive shaft load index "A" in chart at right.
 - Internal coupling load index "K" in Coupling Loading below at right.

In multiple pumps, shaft end section must have largest displacement. Each consecutive section must have displacement equal to or smaller than section preceding.

MULTIPLE SECTION SHAFT LOADING

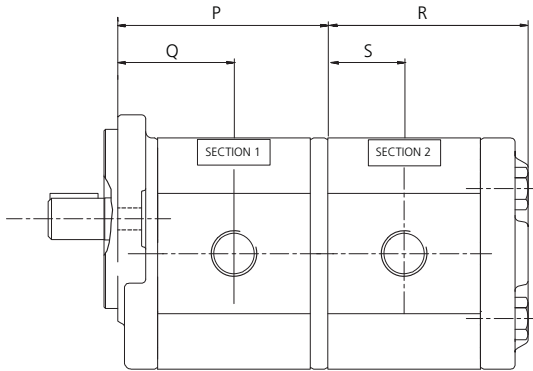
Max. drive shaft load index "A", see table below.

for double pump
 $A = (p1 \times V1) + (p2 \times V2)$

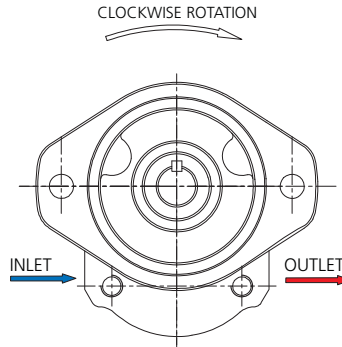
for triple pump
 $A = (p1 \times V1) + (p2 \times V2) + (p3 \times V3)$

for quadruple pump
 $A = (p1 \times V1) + (p2 \times V2) + (p3 \times V3) + (p4 \times V4)$

Note: P = actual pressure in bar, V = applicable displacement from Table pages 6-9.



Shaft end section



Drive Shaft	Load Index "A"	Drive Shaft	Load Index "A"
BA	10488	MB	10488
FA	5100	NB	10488
JA	6215	QB	5012

COUPLING LOADING

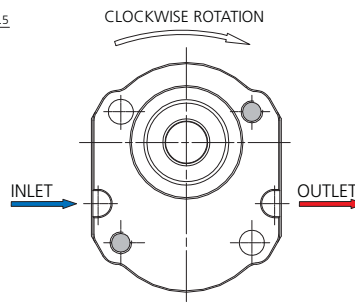
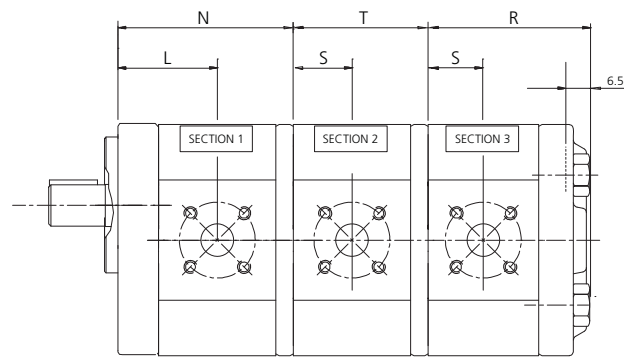
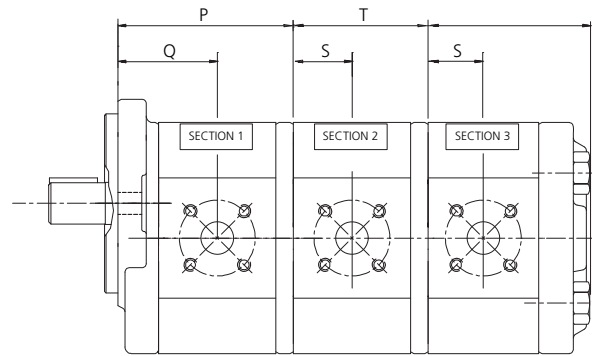
Max. load index "K" 5240:

for double pump
 $K = (p2 \times V2)$

for triple pump
 $K = (p2 \times V2) + (p3 \times V3)$

for quadruple pump
 $K = (p2 \times V2) + (p3 \times V3) + (p4 \times V4)$

Note: P = actual pressure in bar, V = applicable displacement from Table pages 6-9.



REDUCED INLET MULTIPLE PUMPS

Reduced inlets provide overall system savings by reducing the cost of redundant inlet hose and fittings. Contact Concentric regarding your reduced inlet multiple pump application.

Concentric multiple pumps are also available with reduced number of inlets. Please contact Concentric for details. Please contact Concentric for pump applications requiring independently sealed sections.

At left are shown the dimensions for the through bolt type pumps.

Size	P mm Shaft end section	Q mm	Weight kg	R mm Rear section	S mm	Weight kg	T mm 2nd & 3rd section	Weight kg	N mm A1-section	L mm	Weight kg
060 - 6,2cc	77,6	44,0	3,1	73,4	25,6	2,7	59,1	1,8	75,1	41,5	2,7
080 - 8,3cc	80,0	45,5	3,2	76,4	27,0	2,8	62,1	1,9	78,1	41,5	2,7
110 - 11,3cc	85,0	47,7	3,4	80,8	29,2	3,0	66,5	2,1	82,5	45,2	3,0
140 - 14,5cc	89,5	50,0	3,5	85,2	31,5	3,1	71,0	2,2	87,0	47,5	3,1
160 - 16,5cc	92,4	51,4	3,6	88,1	33,0	3,2	73,9	2,3	89,9	48,9	3,2
190 - 19,6cc	96,9	53,7	3,7	92,7	35,2	3,4	78,4	2,4	94,4	51,2	3,4
230 - 23,7cc	102,8	56,6	3,9	98,6	38,2	3,5	84,3	2,6	100,3	54,1	3,5

NOTE: Dimensions above are for Design Code "A".

PRODUCT RANGE

HE Powerpacks

12/24/48 VDC 0.3 – 4.5 kW and
0.75 – 3 kW AC modular power packs

HE Box Powerpacks

12/24/48 VDC modular powerpacks
in weatherproof boxes

Pressure Switches

5 - 350 bar, connecting/disconnecting

W100 Hydraulic pumps

0,5 - 2,0 cc 227 bar

W300 Hydraulic pumps

0,8 – 5,7 cc 230 bar

W600 Hydraulic pumps / motors

3 – 12 cc 276 bar

W900 Hydraulic pumps / motors

5 – 31 cc/section 276 bar

Calma The new quiet pumps

6,2 - 23,7 cc/section 250 bar

WQ900 The quiet pumps

5 - 23 cc/section 230 bar

WP900X Hydraulic pumps

16 - 31 cc/section 276 bar

W1500 Hydraulic pumps / motors

19 - 50 cc/section 276 bar

F12 FERRA Heavy duty pumps

16 - 41 cc/section 276 bar

F15 FERRA Heavy duty pumps

19 - 50 cc/section 276 bar

F20/F30 (LS) Hydraulic pumps / motors

23 – 161 cc/section 276 bar

GPA Internal Gear pumps

1,7 – 63 cc/section 100 bar

GC Hydraulic pumps / motors

1,06 – 11,65 cc/section 276 bar

D Hydraulic pumps

3,8 – 22,9 cc/section 207 bar

H Hydraulic pumps

9,8 – 39,4 cc/section 207 bar

II-Stage Hydraulic pumps

4,2 – 22,8 cc/section 276 bar

Rotary Flow Dividers

3,8 – 13,3 cc/section 300 bar

Transmission pumps

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