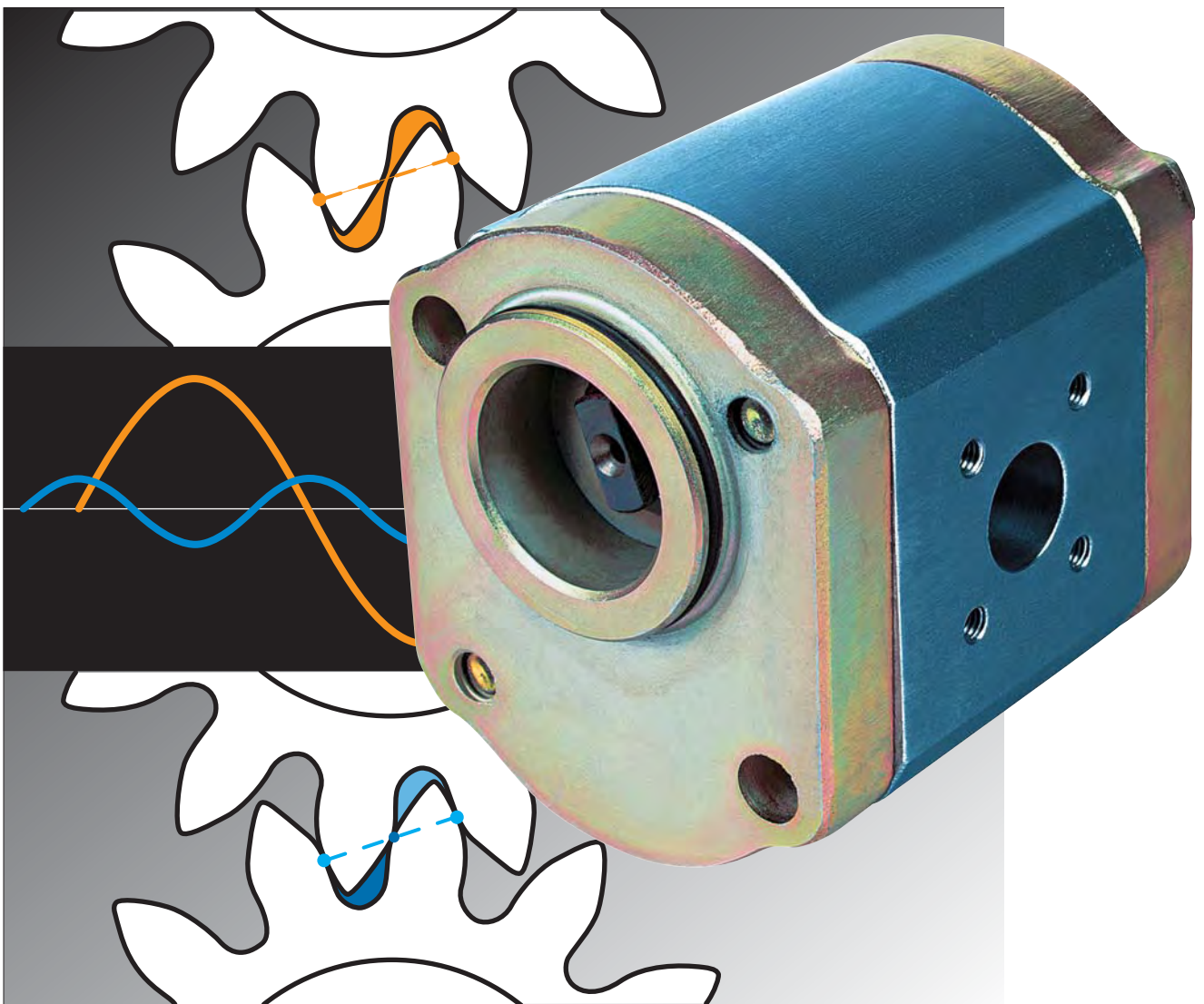


**NEW!**

**Haldex**

**CALMA PUMP SERIES  
SETTING A NEW STANDARD FOR NOISE**





## THE POWER OF CALMA

### Low noise across a wide speed range

HalDEX Hydraulics Systems 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.

HalDEX Hydraulics 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 HalDEX 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.

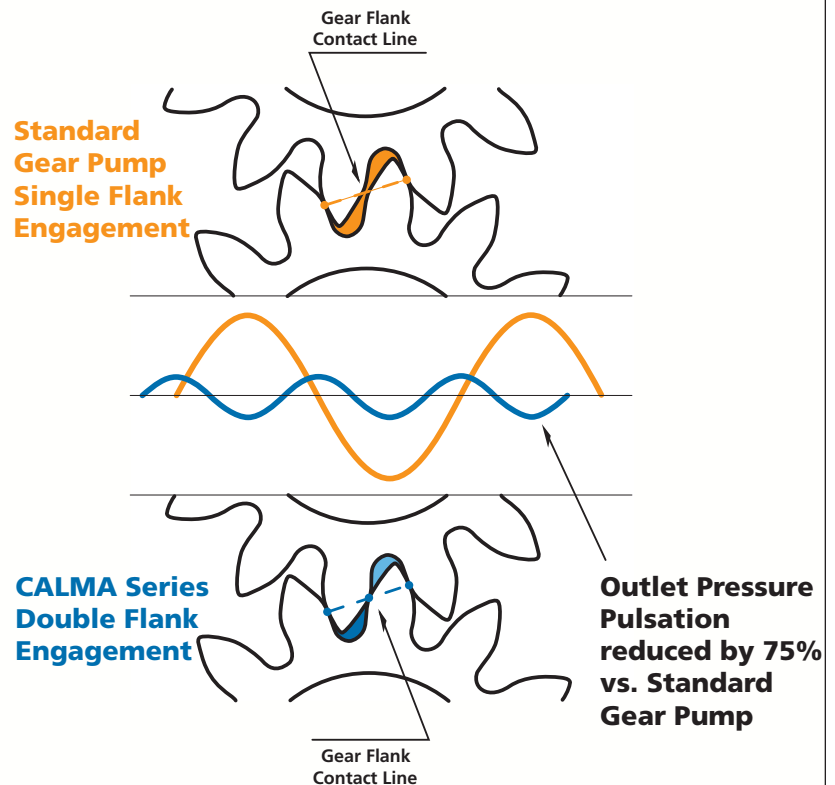
Calma is especially well suited to applications on electric counterbalanced lift trucks, warehouse lift trucks, electric aerial work platforms and other mobile equipment where low noise, low speed and high efficiency are required.

## 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



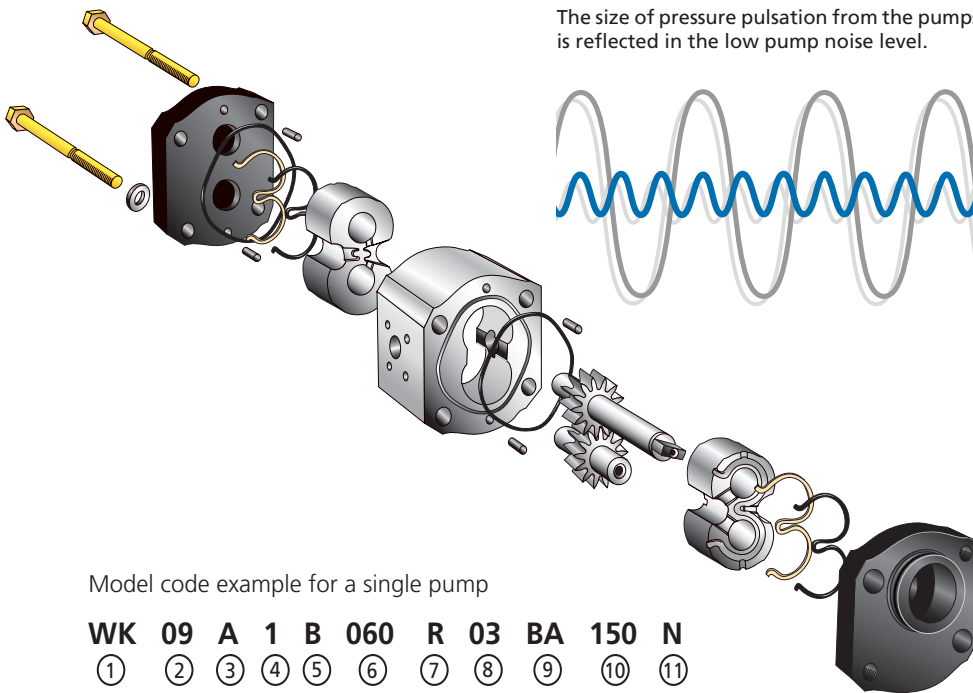
## Calma Series vs. Traditional Gear Pump



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
- ② = Range
- ③ = Design A - Std. Calma Design L - L (WSR)\*
- ④ = # of sections
- ⑤ = Seal material
- ⑥ = Displacement per section
- ⑦ = Rotation
- ⑧ = Mounting flange
- ⑨ = Drive shaft
- 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 mm<sup>2</sup>/s. The recommended operating viscosity range is from 40 to 16 mm<sup>2</sup>/s.

The **permissible cold start viscosity** is 2000 mm<sup>2</sup>/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 Haldex for indirect drive requirements. Pumps with outboard side load bearing are available.

### Mounting position

As required.

### Symbols

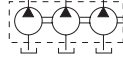
Single pump



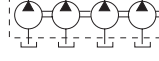
Double pump



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 <sub>2</sub> ) 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 P<sub>2</sub>: 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 mm<sup>2</sup>/s

## Design Code "L"

### Calma WK9L (WSR Design)

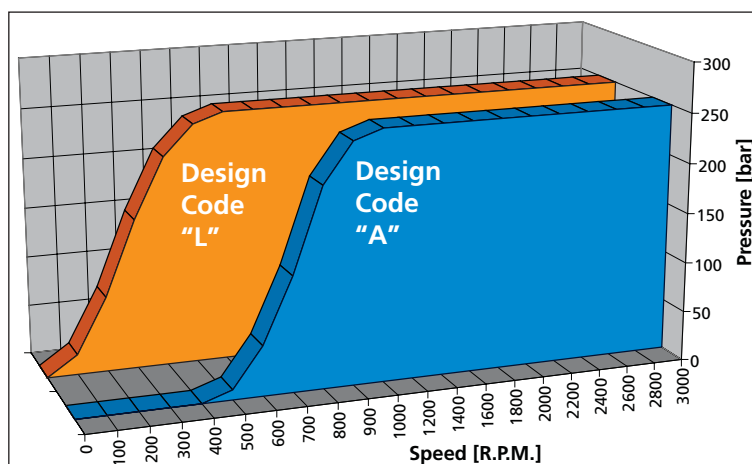
Wide operating speed range (WSR) offers low noise operation within the common operating speed range as well as additional low speed capability. This design incorporates additional side plates.

Size Code	Displacement cc/rev	Operating Pressure (P <sub>2</sub> ) 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 P<sub>2</sub>: 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 mm<sup>2</sup>/s

- Wide Operating Speed feature (Design Code "L") offers reduced minimum speed.  
 Valid at P<sub>2</sub> 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.

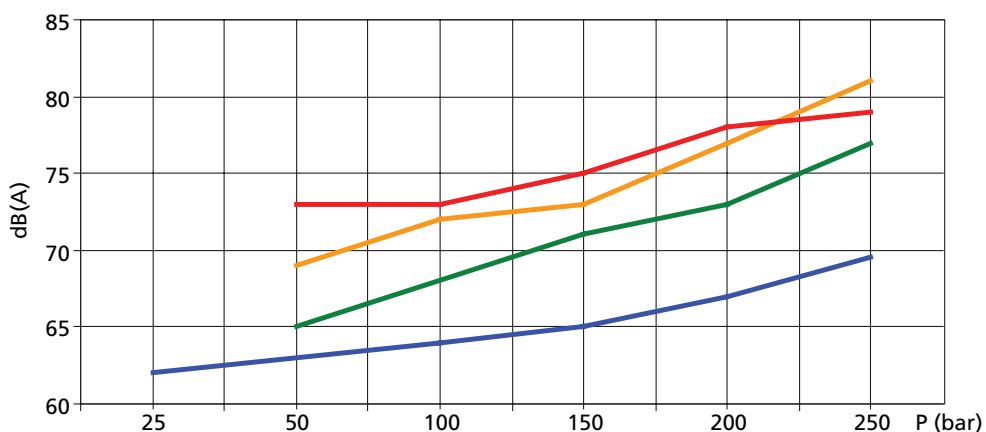
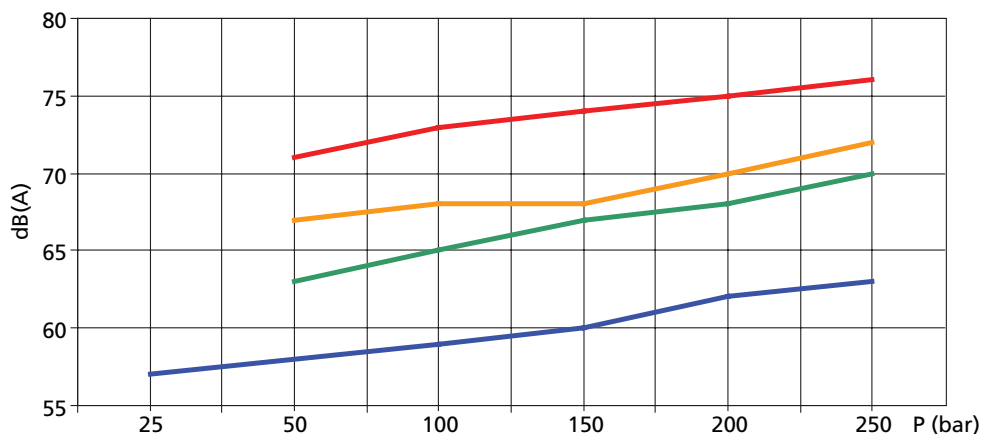
## Permissible Pressure vs. Speed Capability



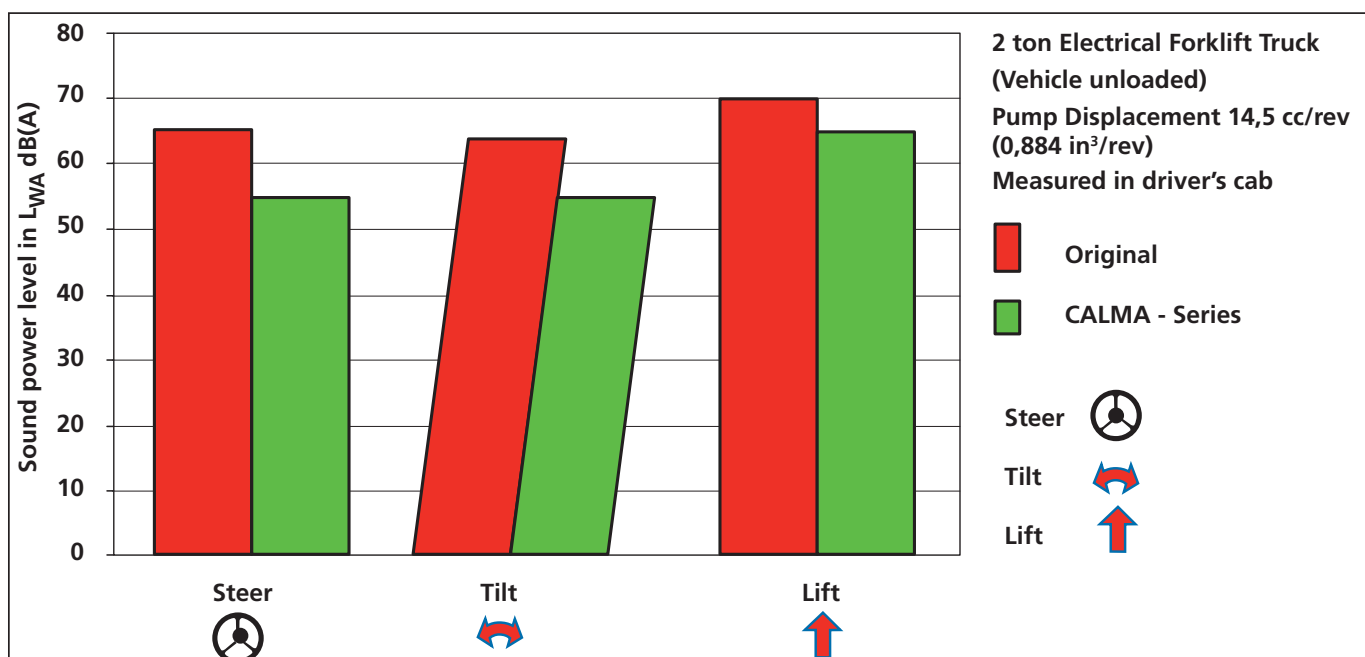
Haldex offers two different versions of Calma pumps:

- **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 $L_{WA}$

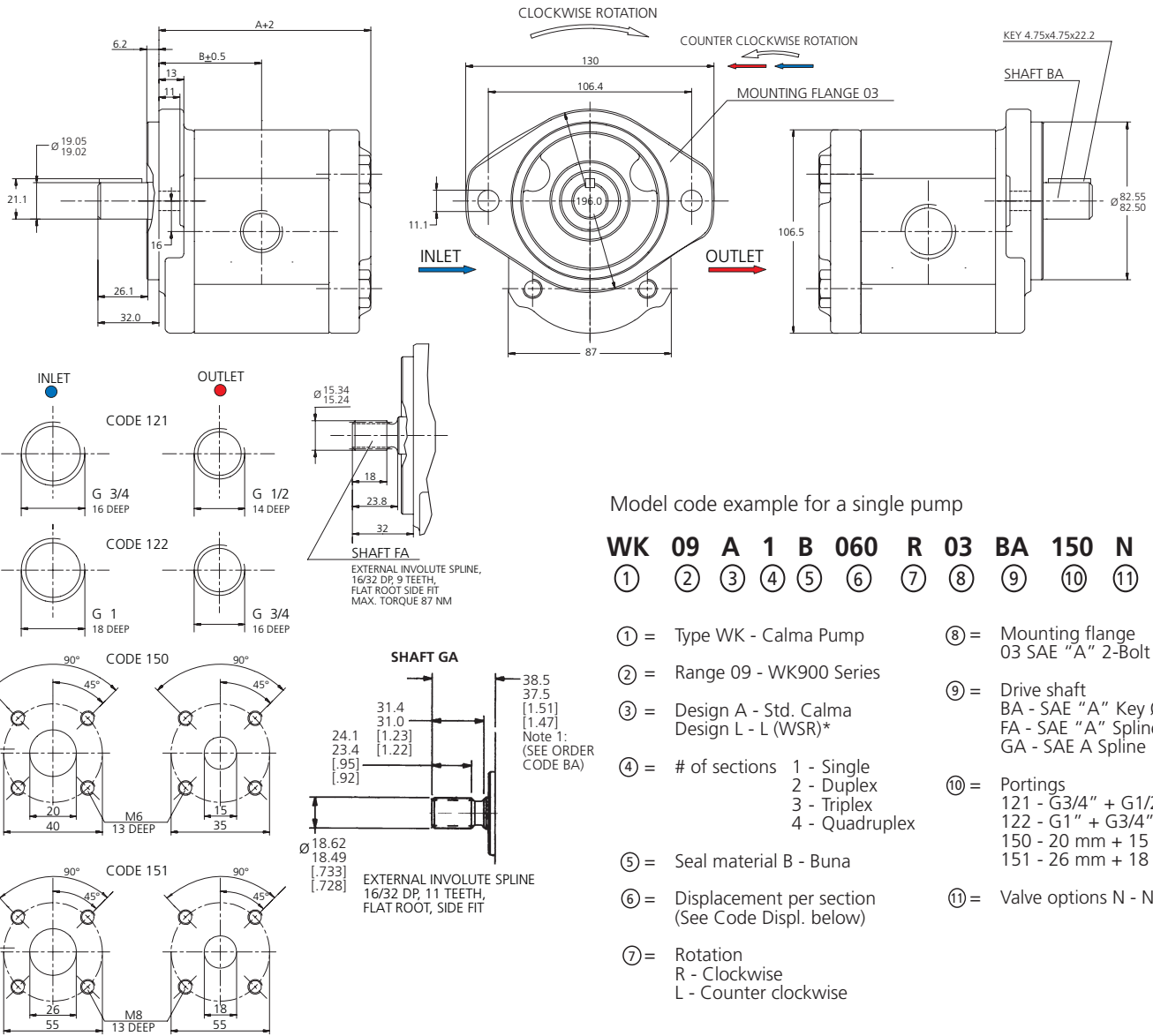


## Sound Comparison





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



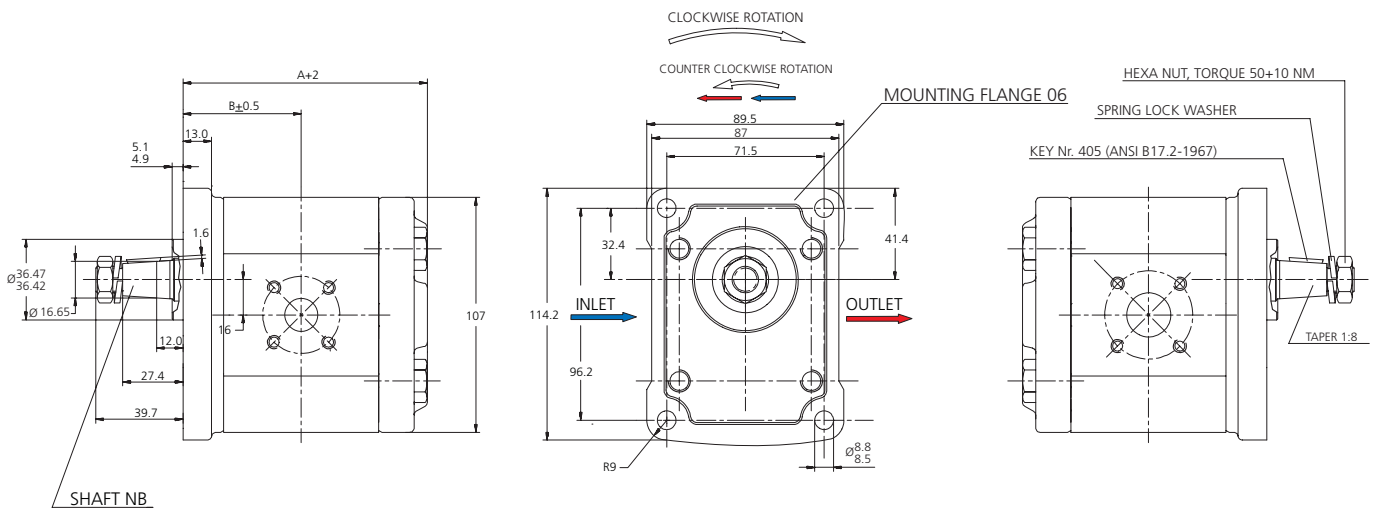
Size	Operating pressure (p <sub>2</sub> ) (bar)		Maximum speed (rpm)		Dimensions**		Weight (approx.) [kg]
	Shaft 'BA'	Shaft 'FA'	Port. '121'/'150'	Port. '122'/'151'	A [mm]	B [mm]	
060 - 6,2cc	250	250	4000	-	91,6	44,0	3,8
080 - 8,3cc	250	250	4000	-	94,6	45,5	3,9
110 - 11,3cc	250	250	3600	-	99,0	47,7	4,1
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.

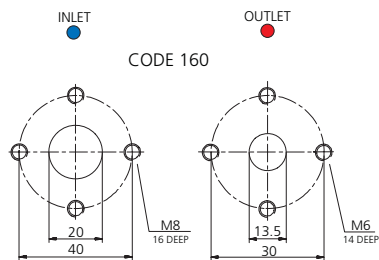


## FLANGE CODE 06 (Ø 36.5 MM PILOT)



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

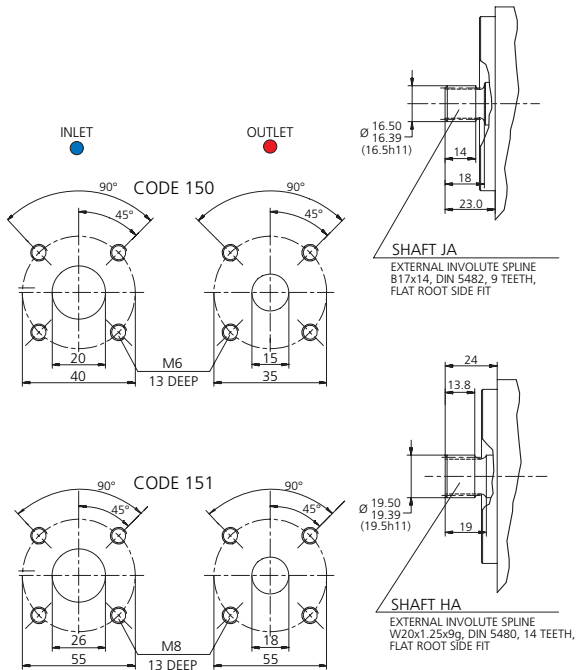
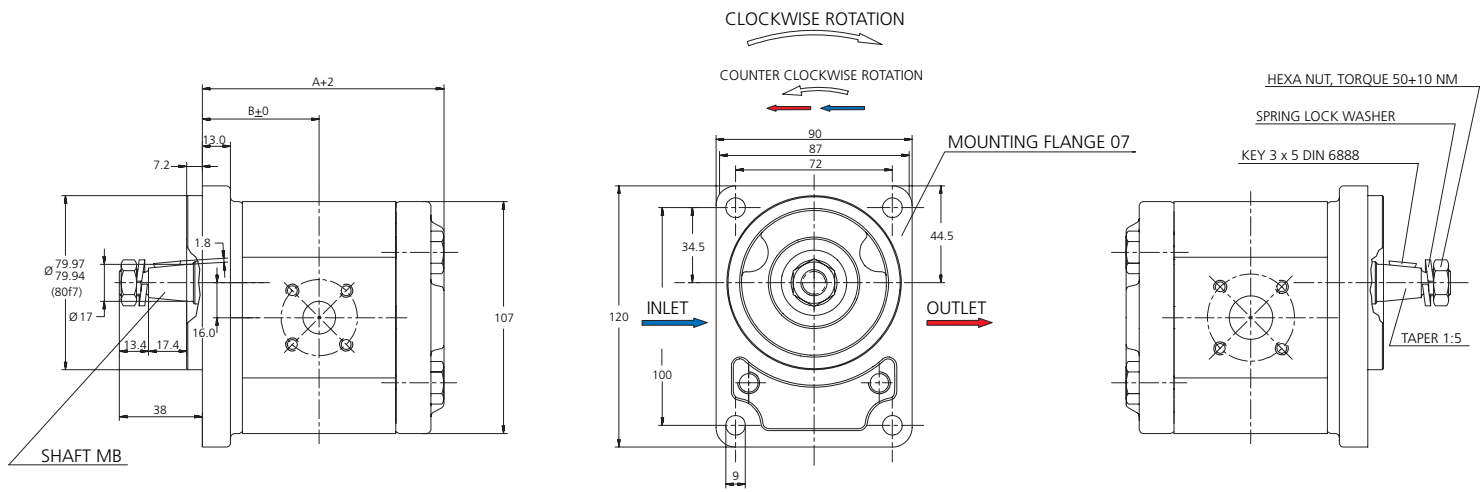
Size	Operating pressure (p <sub>2</sub> ) (bar)	Maximum speed (rpm) Port code '160'	Dimensions**		Weight (approx.) [kg]
			A [mm]	B [mm]	
060 - 6,2cc	250	4000	91,6	44,0	3,8
080 - 8,3cc	250	4000	94,6	45,5	3,9
110 - 11,3cc	250	3600	99,0	47,7	4,1
140 - 14,5cc	250	3300	103,5	50,0	4,2
160 - 16,5cc	250	3000	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

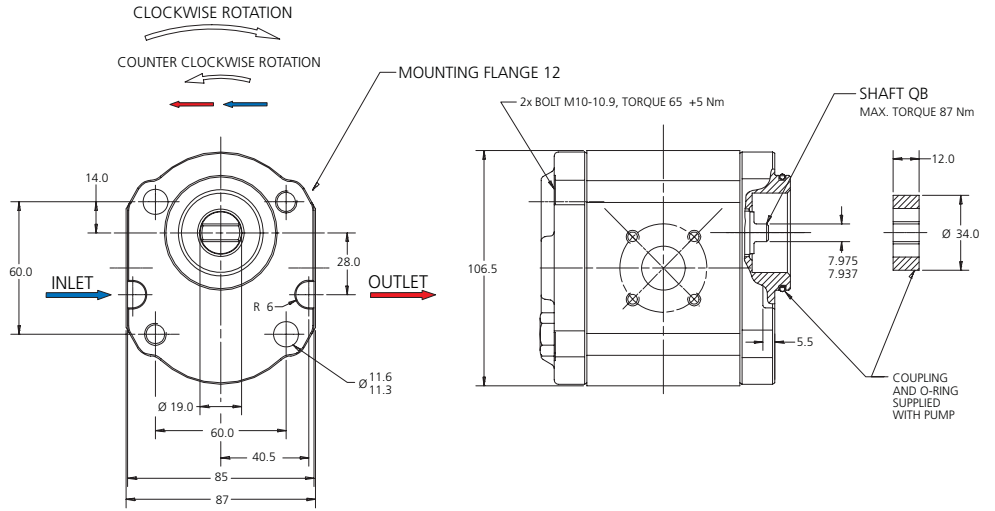
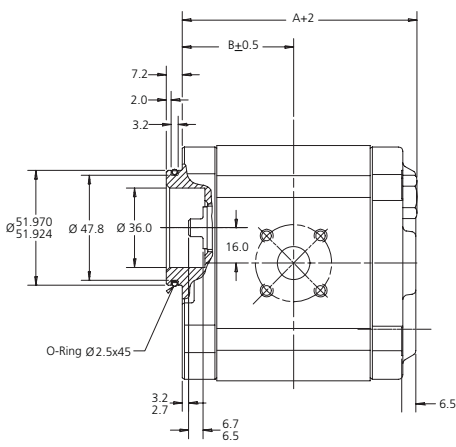
Size	Operating pressure (p <sub>2</sub> ) (bar)	Maximum speed (rpm)		Dimensions**		Weight (approx.) [kg]
		Port. c. '150'	Port. c. '151'	A [mm]	B [mm]	
060 - 6,2cc	250	4000	-	91,6	44,0	3,8
080 - 8,3cc	250	4000	-	94,6	45,5	3,9
110 - 11,3cc	250	3600	-	99,0	47,7	4,1
140 - 14,5cc	250	3300	-	103,5	50,0	4,2
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.

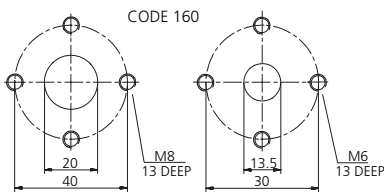
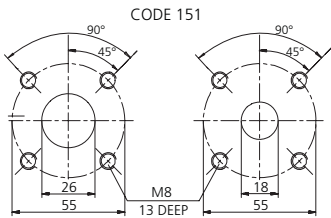
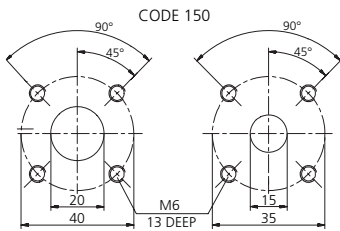
\*\* Displacements greater than 15 cc adds 4,8 mm to A-dimension and 2,4 mm to B-dimension in L design.



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

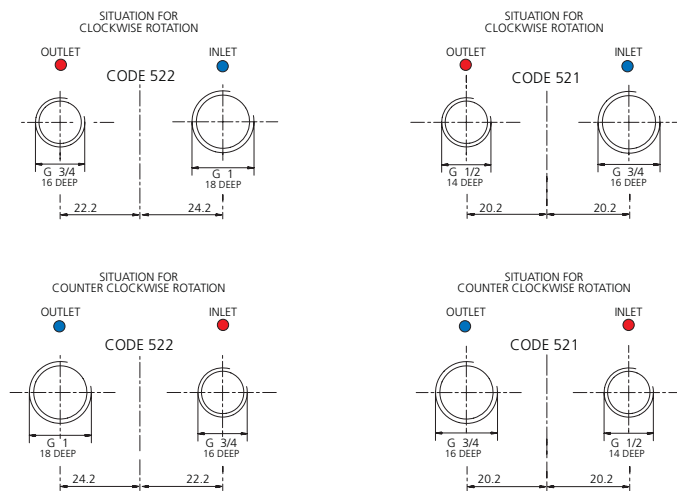
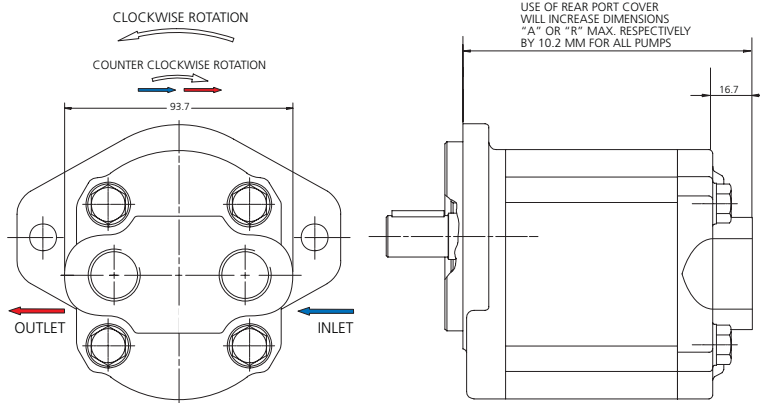
\* Design Code "L" (WSR) Wide operating speed range with low speed capability n=400 rpm at max. operating pressure.

\*\* 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.

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

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

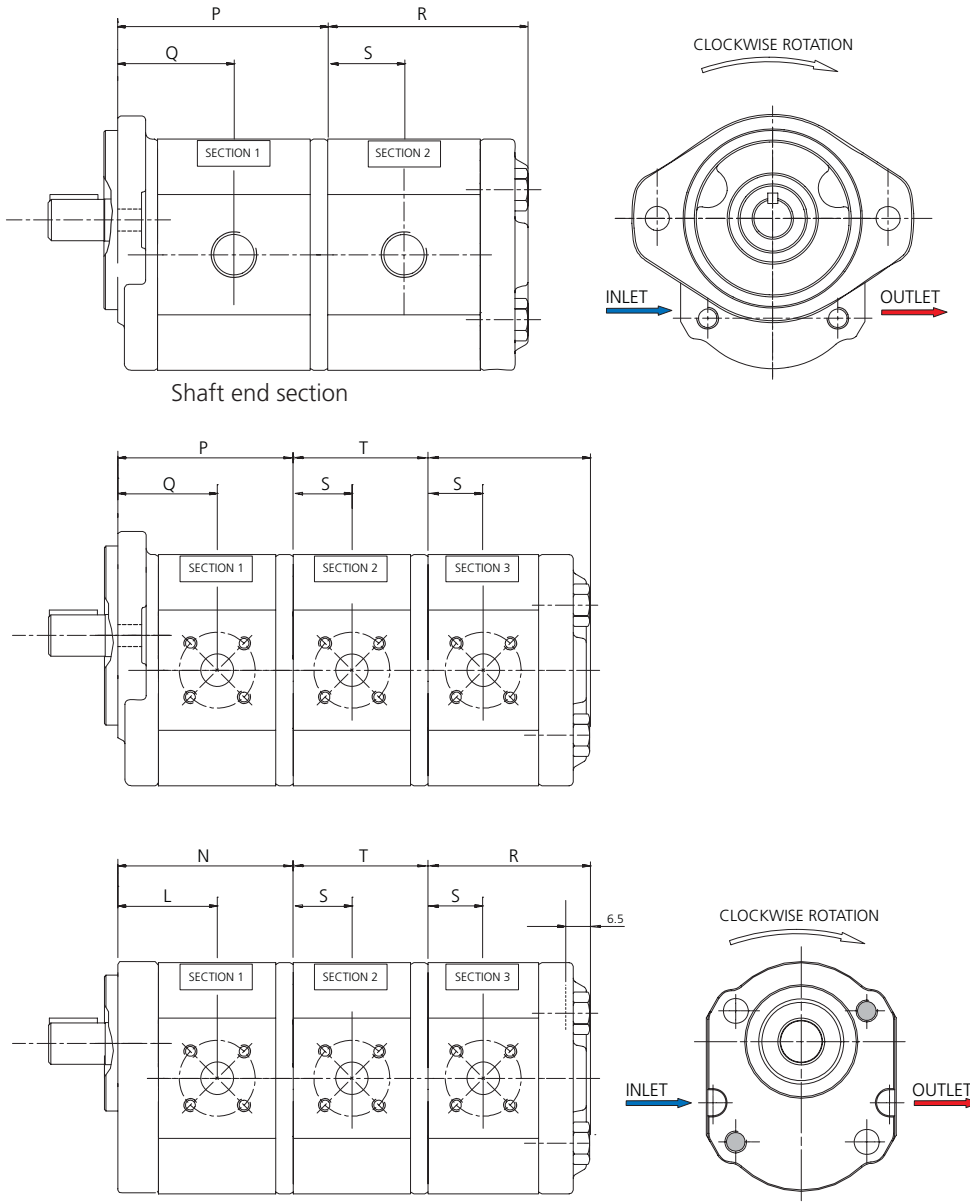
Note: P = actual pressure in bar, V = applicable displacement from Table pages 6-9.

### REDUCED INLET MULTIPLE PUMPS

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

Haldex multiple pumps are also available with reduced number of inlets. Please contact Haldex for details. Please contact Haldex 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 Shaft end section	Weight kg	R mm Rear section	S mm Rear section	Weight kg	T mm 2nd & 3rd section	Weight kg	N mm A1-section	L mm A1-section	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".

# Haldex

## 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 230 bar

### W300 Hydraulic pumps

0,8 – 5,7 cc 230 bar

### W600 Hydraulic pumps

3 – 12 cc 276 bar

### WM600 Hydraulic motors

3 – 12 cc 276 bar

### W900 Hydraulic pumps

5 – 31 cc/section 276 bar

### WM900 Hydraulic motors

5 - 31 cc/section 276 bar

### CALMA WK900

The quiet pumps  
6 - 23 cc/section 250 bar

### FERRA Heavy duty pumps

16 - 41 cc/section 276 bar

### WP900X Hydraulic pumps

16 - 31 cc/section 276 bar

### W1500 Hydraulic pumps

19 - 50 cc/section 276 bar

### WM1500 Hydraulic motors

19 - 50 cc/section 276 bar

### GPA Internal Gear pumps

1,7 – 63 cc/section 100 bar

### GC Hydraulic pumps

1,06 – 11,65 cc/section 276 bar

### II-Stage Hydraulic pumps

4,2 – 22,8 cc/section 276 bar

### Rotary Flow Dividers

3,8 – 13,3 cc/section 300 bar

### F20/F30 (LS) Hydraulic pumps

23 – 161 cc/section 276 bar

### Transmission pumps

[www.haldex.com/hbus](http://www.haldex.com/hbus)



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# Haldex

Haldex ([www.haldex.com](http://www.haldex.com)), headquartered in Stockholm, Sweden, is a provider of

proprietary and innovative solutions to the global vehicle industry, with focus on products in vehicles that enhance safety, environment and vehicle dynamics. Haldex is listed on the Stockholm Stock Exchange and had net sales of nearly 8,5 billion SEK in 2008. The number of employees amounts to about 5,000.