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# Introduction

- Axial piston pumps with swash plate design for reliable operation and long life.
- Rotating and pressure loaded parts are pressure balanced.
- Wide range of available integrated charge and pilot pressure pump combinations for single and combination units.
- Special design for closed loop application.
- Oversize shaft and shaft bearings.
- Standard available transmission circuits with integrated valves and filters to build complete closed loop system. For charge flow and flushing.
- Through drive enable multiple pump installation from a single shaft. Multiple pump combinations are also available.
- Pressure up to 420 bar. Rated speed up to 1800 rpm. Higher speeds possible.
- Large charge flow rates for low system temperature.
- Fast response times.

## AVAILABLE DISPLACEMENT SIZES

130 ccm
180 ccm
250 ccm
360 ccm
500 ccm
750 ccm

### Displacement controls:

**ES** - Electric motor displacement control

**HG** - Handwheel displacement control (Special feature)

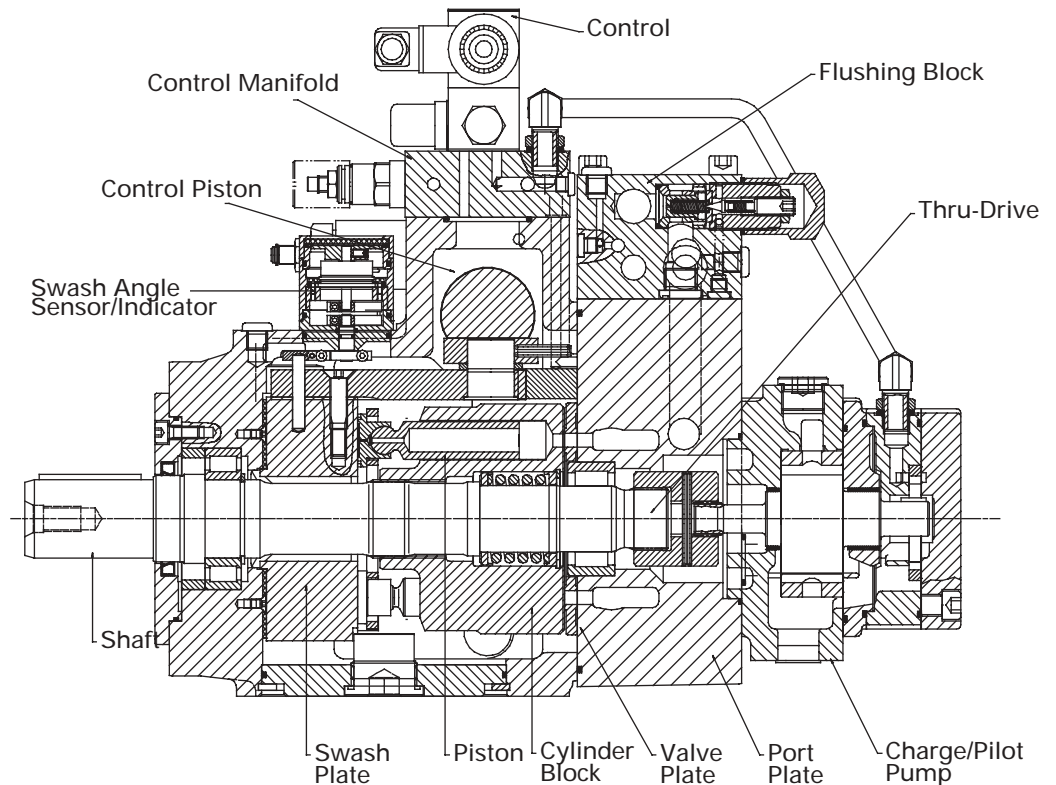
**FE** - Screw adjustment control (Special feature)

**SP, SM** - Displacement proportional to electric signal

**DP** - Displacement proportional to pressure signal

Extra functions available for SP, SM & DP:  
Pressure Limitation and/or power control overriding function.

### Typical Section of Transmission Pump



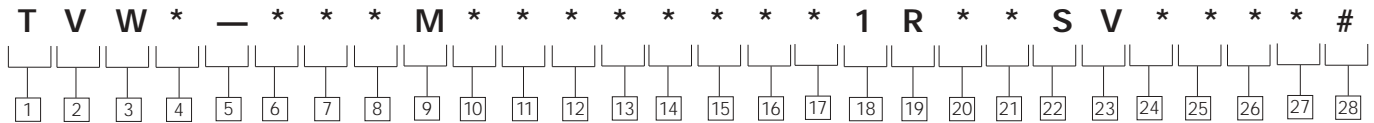
Dimensional information listed in this catalog is subject to change without notice.



# Model Code

## Transmission Pumps

### "W" Series - Basic Pump



#### 1 Pump

T – Transmission Pump

#### 2 Displacement

V – Variable displacement

#### 3 Pump Series

W – "W" Series  
(was 30 design)

#### 4 Configuration

S – Single Unit  
F – Front Unit  
M – Middle Unit  
R – Rear Unit

#### 5 Separator

– – Separator

#### 6 7 8 Displacement Size

130 – 130 cm<sup>3</sup>/r [7.9 in<sup>3</sup>/rev]  
180 – 180 cm<sup>3</sup>/r [11.0 in<sup>3</sup>/rev]  
250 – 250 cm<sup>3</sup>/r [15.3 in<sup>3</sup>/rev]  
360 – 360 cm<sup>3</sup>/r [22.0 in<sup>3</sup>/rev]  
500 – 500 cm<sup>3</sup>/r [30.5 in<sup>3</sup>/rev]  
750 – 750 cm<sup>3</sup>/r [45.8 in<sup>3</sup>/rev]

#### 9 Basic standard

M – Metric

#### 10 11 Mounting flange

05 – ISO 3019/2 - 160B4HW  
(130 and 180 cm<sup>3</sup>/r)  
07 – ISO 3019/2 - 200B4HW  
(250 and 360 cm<sup>3</sup>/r)  
08 – ISO 3019/2 - 250B4HW  
(500 and 750 cm<sup>3</sup>/r)

#### 12 Rotation Direction

R – Right hand [CW]  
L – Left hand [CCW]

#### 13 Adjustment stop

0 – No adjustment stop  
4 – Fixed mechanical  
Adjustment stop side A  
5 – Fixed mechanical  
Adjustment stop side B  
6 – Fixed mechanical  
Adjustment stop side A  
and B

#### 14 15 16 17 Thru-Drive

##### Options

0000 – None  
000A – SAE A  
000B – SAE B  
000C – SAE C  
000D – ISO 3019/2 -  
125A2HW  
000E – ISO 3019/2 -  
160A2HW  
000F – ISO 3019/2 -  
125B4HW  
000G – ISO 3019/2 -  
160B4HW  
000H – ISO 3019/2 -  
200B4HW  
000J – ISO 3019/2 -  
250B4HW  
000P – Pilot pump (8 cm<sup>3</sup>/r)  
000T – Charge pump  
(~25% of unit  
displacement size)  
00TP – Charge pump (~25%  
of unit displacement  
size) and Pilot pump  
(8 cm<sup>3</sup>/r)  
00PP – Double pilot pump  
(8 cm<sup>3</sup>/r + 8 cm<sup>3</sup>/r)

#### 18 Main Ports

1 – SAE Port - Metric bolts

#### 19 Main Port Orientation

R – Radial (side ports)

#### 20 21 Main Drive Shaft End

01 – ISO straight key  
02 – ISO spline

#### 22 Drive Shaft Seal Configuration

S – Single shaft seal

#### 23 Seal Material

V – Viton\*  
\* Viton is a trademark of E.I. Dupont  
(other materials available, contact your  
Eaton Representative)

#### 24 Yoke Position Indicator

0 – No position indicator  
V – Visual position indicator  
P – Position sensor  
L – Position limit switch  
M – Position sensor and  
visual indicator

#### 25 Housing surface finish

A – Blue painted

#### 26 Transmission Circuit

0 – No transmission circuit  
1 – Block filter, optical dirt  
indicator  
2 – Block, filter, electrical dirt  
indicator  
3 – Block without filter

#### 27 Zero Position Valve

0 – No Zero Position Valve

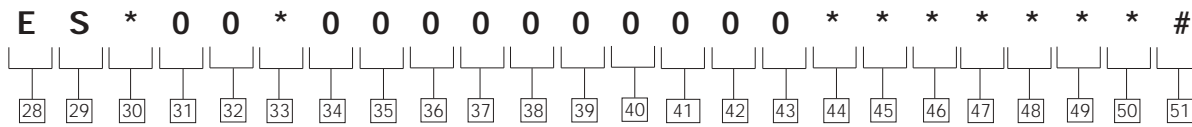
#### 28 Add Control Model Code

Code (characters 28...50) on  
the following pages

# Model Code

## Transmission Pumps

"W" Series - ES Control



**28 29 Control type**

**ES** – Electric motor displacement control

**30 Displacement**

**Adjustment Options**

- M** – Electric Motor - Fast response
- N** – Electric Motor - Medium response
- P** – Electric Motor - Slow response

**31 32 Electronic Controls**

**00** – Not required

**33 Yoke Displacement Zone**

- A** – Single side of center "A"
- C** – Over center

**34 Extra Functions**

**0** – Not available

**35 Pressure Control Options**

**0** – Not available

**36 37 38 39 40 41 Power**

**Control Options**

**000000** – Not required

**42 Pilot Oil Filter**

**0** – Not required

**43 Fail Safe Valve**

**0** – Not required

**44 Position Monitoring**

- A** – 4 limit switches
- B** – 8 limit switches
- P** – 4 limit switches + sensor
- T** – 8 limit switches + sensor

**45 Electric Motor Type**

- 2** – Motor with brake (IP54)
- 3** – Motor without brake (Explosion proof)

**46 Control Voltage of Zero Position Valve and Directional Control Valve**

- 0** – Not applicable
- B** – 110 AC 50 Hz/120 AC 60 Hz
- D** – 220 AC 50 Hz/240 AC 60 Hz
- G** – 12 VDC
- H** – 24 VDC

**47 48 49 50 Customer Adjustment Specification**

**0000** – None

**????** – Yes (final number will be assigned by Eaton. Specify on table below)

**51 Special Features** - Add special feature description (characters 51...55) on page 11 if required.

**Response Time (sec) for Zero to Max. Displacement**

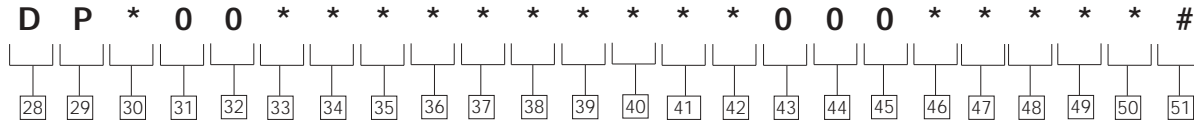
SIZE	130		180		250		360		500		750	
Frequency	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
Fast	10	8	10	8	8	7	11	9	10	8	14	12
Medium	20	17	20	17	20	17	27	23	24	20	35	29
Slow	50	42	50	42	40	33	55	46	48	40	70	58

CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STANDARD SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Revolution Adjustments below set at ...	rpm	1500	–	
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve	bar	20	–	
Flushing (Low) Pressure Relief Valve	bar	10	–	
Mechanical Adjustment Stop Side A	L/min	Q <sub>max</sub>		
Mechanical Adjustment Stop Side B	L/min	Q <sub>min</sub>		
Displacement Adjusted to ...	L/min	-50% Q <sub>max</sub> Side A		
Position Monitoring Switch 1	L/min	0 from A		
Position Monitoring Switch 2	L/min	95% Q <sub>max</sub> Side A		> 95% not possible
Position Monitoring Switch 3	L/min	0 from B		
Position Monitoring Switch 4	L/min	95% Q <sub>max</sub> Side B		> 95% not possible
Position Monitoring Switch 5	L/min	–		
Position Monitoring Switch 6	L/min	–		
Position Monitoring Switch 7	L/min	–		
Position Monitoring Switch 8	L/min	–		

# Model Code

## Transmission Pumps

"W" Series - DP Control



### 28 29 Control type

**DP** – Pressure signal displacement control

### 30 Displacement Adjustment Options

- G** – Mounting interface Cetop 3 only
- H** – Remote port G 1/4
- J** – Proportional relief inc. electronics
- K** – Proportional relief inc. electr. & dir. control

### 31 32 Electronic Controls

**00** – Not required

### 33 Yoke Displacement Zone

- A** – Single side of center "A"
- C** – Over center

### 34 Extra Functions

- 0** – Not required for this control type
- 1** – Pressure limiter overriding function side A
- 2** – Pressure limiter overriding function side B
- 3** – Pressure limiter overriding function side A and B
- 4** – Pressure limiter and power control overriding function side A

**5** – Pressure limiter and power control overriding function side B

**6** – Pressure limiter and power control overriding function side A and B

**7** – Pressure limiter function side A and B power control function side A

**8** – Pressure limiter function side A and B power control function side B

### 35 Pressure Control Options

- 0** – Not required for this control type
- F** – Remote port, only side A
- G** – Remote port, only side B
- H** – Remote port, only side A and B
- A** – Electro Proportional Relief Valve Side A
- B** – Electro Proportional Relief Valve Side B
- K** – Electro Proportional Relief Valve Side A and B

### 36 37 38 39 40 41 Power Control Options

- 000000** – Not required for this control type
- ???000** – ??? kW at 1500 RPM Side A
- 000???** – ??? kW at 1500 RPM Side B

### 42 Pilot Oil Filter

- 0** – Not applicable
- V** – Filter with visual indicator
- E** – Filter with electrical indicator

### 43 Fail Safe Valve

**0** – Not applicable

### 44 Position Monitoring

**0** – No position monitoring

### 45 Electric Motor Type

**0** – No electric motor

### 46 Control Voltage of Zero Position Valve and Directional Control Valve

- 0** – Not applicable
- B** – 110 AC 50 Hz/120 AC 60 Hz
- D** – 220 AC 50 Hz/240 AC 60 Hz
- G** – 12 VDC
- H** – 24 VDC

### 47 48 49 50 Customer Adjustment Specification

- 0000** – None
- ????** – Yes (final number will be assigned by Eaton. Specify on table below)

### 51 Special Features - Add special feature description (characters 51...55) on page 11 if required

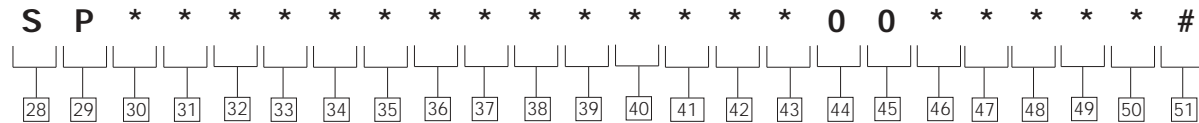
CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STANDARD SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Revolution Adjustments below set at ...	rpm	1500	–	–
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve	bar	20	–	
Flushing (Low) Pressure Relief Valve	bar	10	–	
Pilot Pressure Size 130, 180, 250, 360	bar	60	–	
Pilot Pressure Size 500 & 750	bar	80	–	
Mechanical Adjustment Stop Side A	L/min	Q <sub>max</sub>		
Mechanical Adjustment Stop Side B	L/min	Q <sub>min</sub>		
Max. Stop by Control Side A	L/min	95% Q <sub>max</sub>		
Max. Stop by Control Side B	L/min	95% Q <sub>max</sub>		
Pressure Override Side A	bar	90		
Pressure Override Side B	bar	90		



# Model Code

## Transmission Pumps

"W" Series - SP Control



**28 29 Control type**  
**SP** – Proportional valve displacement control

**30 Displacement Adjustment Options**  
**C** – With Cetop 3 valve KDG4V S  
**F** – With Cetop 5 Proportional valve

**31 32 Electronic Controls**  
**03** – ER 9.3 - 10 (Cetop 3)  
**04** – ER 9.4 - 10 (Cetop 5)

**33 Yoke Displacement Zone**  
**A** – Single side of center "A"  
**C** – Over center

**34 Extra Functions**  
**0** – Not required for this control type  
**1** – Pressure limiter overriding function side A  
**2** – Pressure limiter overriding function side B  
**3** – Pressure limiter overriding function side A and B  
**4** – Pressure limiter and power control overriding function side A

**5** – Pressure limiter and power control overriding function side B  
**6** – Pressure limiter and power control overriding function side A and B  
**7** – Pressure limiter function side A and B power control function side A  
**8** – Pressure limiter function side A and B power control function side B

**35 Pressure Control Options**  
**0** – Not required for this control type  
**F** – Remote port, only side A  
**G** – Remote port, only side B  
**H** – Remote port, only side A and B  
**A** – Electro Proportional Relief Valve Side A  
**B** – Electro Proportional Relief Valve Side B  
**K** – Electro Proportional Relief Valve Side A and B

**36 37 38 39 40 41 Power Control Options**  
**000000** – Not required for this control type  
**????000** – ??? kW at 1500 RPM Side A  
**000???** – ??? kW at 1500 RPM Side B

**42 Pilot Oil Filter**  
**0** – Not applicable  
**V** – Filter with visual indicator  
**E** – Filter with electrical indicator

**43 Fail Safe Valve**  
**0** – Not applicable  
**1** – With solenoid valve

**44 Position Monitoring**  
**0** – No position monitoring

**45 Electric Motor Type**  
**0** – No electric motor

**46 Control Voltage of Fail Safe Valve**  
**0** – Not applicable  
**B** – 110 AC 50 Hz/120 AC 60 Hz  
**D** – 220 AC 50 Hz/240 AC 60 Hz  
**G** – 12 VDC  
**H** – 24 VDC

**47 48 49 50 Customer Adjustment Specification**  
**0000** – None  
**????** – Yes (final number will be assigned by Eaton. Specify on table below)

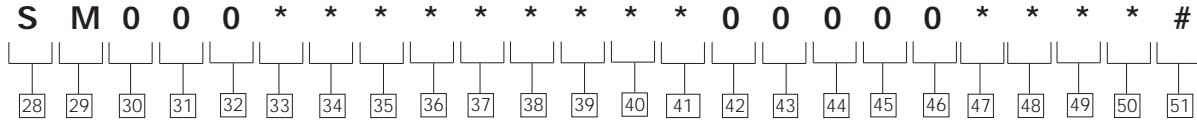
**51 Special Features**  
 Add special feature description (characters 51...55) on page 11 if required

CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STANDARD SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Revolution Adjustments below set at ...	rpm	1500	–	–
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve	bar	20	–	
Flushing (Low) Pressure Relief Valve	bar	10	–	
Pilot Pressure Size 130, 180, 250, 360	bar	60	–	
Pilot Pressure Size 500 & 750	bar	80	–	
Mechanical Adjustment Stop Side A	L/min	Q <sub>max</sub>		
Mechanical Adjustment Stop Side B	L/min	Q <sub>min</sub>		
Max. Stop by Control Side A	L/min	95% Q <sub>max</sub>		
Max. Stop by Control Side B	L/min	95% Q <sub>max</sub>		
Ramp Time 0 _ A	sec	0	El. Card Adjustment Done by Customer	Refer to El. card manual
Ramp Time A _ 0	sec	0	El. Card Adjustment Done by Customer	Refer to El. card manual
Pressure Override Side A	bar	90		
Pressure Override Side B	bar	90		

# Model Code

## Transmission Pumps

"W" Series - SM Control



**28 29 Pump**  
**SM** – El. servo displacement control - mechanical feedback

**30 Displacement Adjustment Option**  
**0** – Not required for this control type

**31 32 Electronic Controls**  
**00** – Not required for this control type

**33 Yoke Displacement Zone**  
**A** – Single side of center "A"  
**C** – Over center

**34 Extra Functions**  
**0** – Not required for this control type  
**1** – Pressure limiter overriding function side A  
**2** – Pressure limiter overriding function side B  
**3** – Pressure limiter overriding function side A and B  
**4** – Pressure limiter and power control overriding function side A  
**5** – Pressure limiter and power control overriding function side B  
**6** – Pressure limiter and power control overriding function side A and B  
**7** – Pressure limiter function side A and B power control function side A  
**8** – Pressure limiter function side A and B power control function side B

**35 Pressure Control Options**  
**0** – Not required for this control type  
**F** – Remote port, only side A  
**G** – Remote port, only side B  
**H** – Remote port, only side A and B  
**A** – Electro Prop. Relief Valve Side A  
**B** – Electro Prop. Relief Valve Side B  
**K** – Electro Prop. Relief Valve Side A and B

**36 37 38 39 40 41 Power Control Option**  
**000000** – Not required for this control type  
**???000** – ??? kW at 1500 RPM Side A  
**000???** – ??? kW at 1500 RPM Side B

**42 Pilot Oil Filter**  
**0** – Filter has to be installed by customer

**43 Fail Safe Valve**  
**0** – Not required for this control type

**44 Position Monitoring**  
**0** – Not required for this control type

**45 Electric Motor Type**  
**0** – Not required for this control type

**46 Control Voltage of Zero Position Valve**  
**0** – Not required for this control type

**47 48 49 50 Customer Adjustment Specification**  
**0000** – None  
**????** – Yes (final number will be assigned by Eaton. Specify on table below)

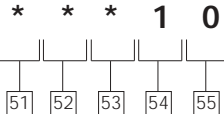
**51 Special Features**  
 Add special feature description (characters 51...55) on page 11 if required

CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STANDARD SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Adjustment below set at ...	RPM	1500	-	
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve	bar	20	-	
Flushing (low) Pressure Relief Valve	bar	10	-	
Pilot Pressure Size 130, 180, 250, 360	bar	60	-	
Pilot Pressure Size 500 and 750	bar	80	-	
Max. Mechanical Stop Side A	l/min	Qmax		
Max. Mechanical Stop Side B	l/min	Qmax		
Pressure Override Side A	bar	90		
Pressure Override Side B	bar	90		

# Model Code

Transmission Pumps

"W" Series -  
Special Features



51 52 53 **Special Features**

000 - None  
\*\*\* - Defined by Eaton

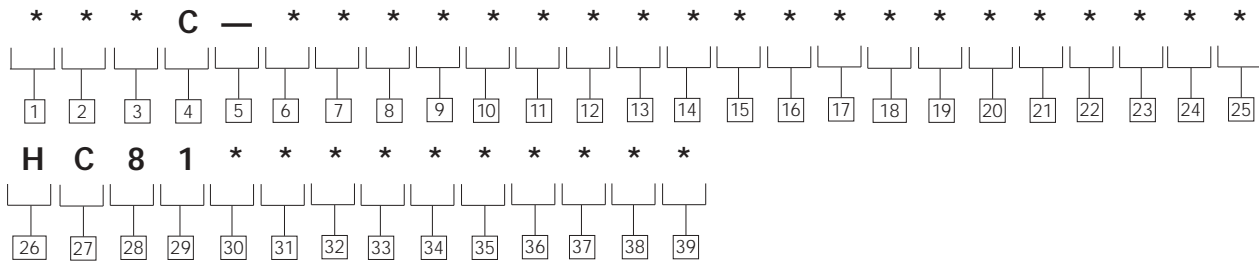
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54 55 **Design Number**

10 - Design Number

# Model Code

## Combination Units



### 1 Combination Unit

**P** – Pump  
**T** – Transmission Pump  
**M** – Motor

### 2 Displacement

**F** – Filled  
**V** – Variable

### 3 Pump Series

**W** – “W” Series  
 (was 30 design)  
**X** – “X” Series  
 (was 20 design)

### 4 Combination Unit

**C**

### 5 Separator

### 6 7 8 First

#### Displacement cm<sup>3</sup>/r

**066** – 66 cm<sup>3</sup>/r [4.0 in<sup>3</sup>/rev]  
**090** – 90 cm<sup>3</sup>/r [5.5 in<sup>3</sup>/rev]  
**130** – 130 cm<sup>3</sup>/r [7.9 in<sup>3</sup>/rev]  
**180** – 180 cm<sup>3</sup>/r [11.0 in<sup>3</sup>/rev]  
**250** – 250 cm<sup>3</sup>/r [15.3 in<sup>3</sup>/rev]  
**360** – 360 cm<sup>3</sup>/r [22.0 in<sup>3</sup>/rev]  
**500** – 500 cm<sup>3</sup>/r [30.5 in<sup>3</sup>/rev]  
**750** – 750 cm<sup>3</sup>/r [45.8 in<sup>3</sup>/rev]

### 9 10 First Control Type

**00** – No Control (for Fixed Displacement Only)  
**DF** – Pressure Compensator  
**LR** – Power Control  
**ES** – Electric Motor Control  
**HG** – Handwheel  
 Displacement Control  
**FE** – Screw Adjustment  
 Displacement Control  
**SM** – Servo Adjustment  
 Displacement Control -  
 Mech Feedback  
**DP** – Pressure Signal  
 Displacement Control  
**SP** – Proportional Valve  
 Displacement Control

### 11 12 13 Second

#### Displacement cm<sup>3</sup>/r

**066** – 66 cm<sup>3</sup>/r [4.0 in<sup>3</sup>/rev]  
**090** – 90 cm<sup>3</sup>/r [5.5 in<sup>3</sup>/rev]  
**130** – 130 cm<sup>3</sup>/r [7.9 in<sup>3</sup>/rev]  
**180** – 180 cm<sup>3</sup>/r [11.0 in<sup>3</sup>/rev]  
**250** – 250 cm<sup>3</sup>/r [15.3 in<sup>3</sup>/rev]  
**360** – 360 cm<sup>3</sup>/r [22.0 in<sup>3</sup>/rev]  
**500** – 500 cm<sup>3</sup>/r [30.5 in<sup>3</sup>/rev]  
**750** – 750 cm<sup>3</sup>/r [45.8 in<sup>3</sup>/rev]

### 14 15 Second Control Type

**00** – No Control (for Fixed Displacement Only)  
**DF** – Pressure Compensator  
**LR** – Power Control  
**ES** – Electric Motor Control  
**HG** – Handwheel  
 Displacement Control  
**FE** – Screw Adjustment  
 Displacement Control  
**SM** – Servo Adjustment  
 Displacement Control -  
 Mech Feedback  
**DP** – Pressure Signal  
 Displacement Control  
**SP** – Proportional Valve  
 Displacement Control

### 16 17 18 Third

#### Displacement cm<sup>3</sup>/r

**000** – Not Required  
**066** – 66 cm<sup>3</sup>/r [4.0 in<sup>3</sup>/rev]  
**090** – 90 cm<sup>3</sup>/r [5.5 in<sup>3</sup>/rev]  
**130** – 130 cm<sup>3</sup>/r [7.9 in<sup>3</sup>/rev]  
**180** – 180 cm<sup>3</sup>/r [11.0 in<sup>3</sup>/rev]  
**250** – 250 cm<sup>3</sup>/r [15.3 in<sup>3</sup>/rev]  
**360** – 360 cm<sup>3</sup>/r [22.0 in<sup>3</sup>/rev]  
**500** – 500 cm<sup>3</sup>/r [30.5 in<sup>3</sup>/rev]  
**750** – 750 cm<sup>3</sup>/r [45.8 in<sup>3</sup>/rev]

### 19 20 Third Control Type

**00** – No Control (for Fixed Displacement Only)  
**DF** – Pressure Compensator  
**LR** – Power Control  
**ES** – Electric Motor Control  
**HG** – Handwheel  
 Displacement Control  
**FE** – Screw Adjustment  
 Displacement Control  
**SM** – Servo Adjustment  
 Displacement Control -  
 Mech Feedback  
**DP** – Pressure Signal  
 Displacement Control  
**SP** – Proportional Valve  
 Displacement Control

### 21 22 23 Fourth Displacement cm<sup>3</sup>/r

**000** – Not Required  
**066** – 66 cm<sup>3</sup>/r [4.0 in<sup>3</sup>/rev]  
**090** – 90 cm<sup>3</sup>/r [5.5 in<sup>3</sup>/rev]  
**130** – 130 cm<sup>3</sup>/r [7.9 in<sup>3</sup>/rev]  
**180** – 180 cm<sup>3</sup>/r [11.0 in<sup>3</sup>/rev]  
**250** – 250 cm<sup>3</sup>/r [15.3 in<sup>3</sup>/rev]  
**360** – 360 cm<sup>3</sup>/r [22.0 in<sup>3</sup>/rev]  
**500** – 500 cm<sup>3</sup>/r [30.5 in<sup>3</sup>/rev]  
**750** – 750 cm<sup>3</sup>/r [45.8 in<sup>3</sup>/rev]

- For a combination of two or more units fill out this Combination Model Code.
- Start with the biggest size unit for the first displacement.
- For each unit included in this combination, a separate model code must be chosen. Use the form on page 5.
- Character 26 to 39 will be P/N of the combination. This number will be defined by Eaton and provided in the order acknowledgement.

### 24 25 Fourth Control Type

**00** – No Control (for Fixed Displacement Only)  
**DF** – Pressure Compensator  
**LR** – Power Control  
**ES** – Electric Motor Control  
**HG** – Handwheel  
 Displacement Control  
**FE** – Screw Adjustment  
 Displacement Control  
**SM** – Servo Adjustment  
 Displacement Control -  
 Mech Feedback  
**DP** – Pressure Signal  
 Displacement Control  
**SP** – Proportional Valve  
 Displacement Control

### 26 27 28 29 Assembly Numbers

**HC81** – Defined By Eaton

### 30 31 32 33 34 35 36 37 38 39 Assembly Numbers

Defined By Eaton

- Charge and Pilot Pump through drive option must be specified on the rear unit of the combination (as a special feature).
- Front and middle units shall have the through drive option of the following unit in the combination.

# Model Code

Examples for  
Combination Units

## Example 1: Combination of two closed loop pumps

Model Code Front Unit	TVWF-500M08R0000H1R02SVMA20SPC03C00000000E100H000000010
Model Code Rear Unit	TVWR-250M07R000PP1R02SVMA20SPC03C00000000E100H000000010
Model Code Combination Unit	TVWC-500SP250SP0000000000HC81*****

## Example 2: Combination of one closed loop - and two open loop pumps (For open loop model code refer to the according catalog)

Mode Code Front Unit	TVWF-500M08R0000H1R02SVMA20SPC03C00000000E100H000000010
Model Code Middle Unit	PVWM-250M07R00E1R02SV0ADF000A0000000000000000010
Model Code Rear Unit	PFXR-130M02R00P1A02SV0A00000A0000000000000000010
Model Code Combination Unit	TVWC-500SP250DF1300000000HC81*****

# Pump Specifications - US

MODEL			TVW 130	TVW 180	TVW 250	TVW 360	TVW 500	TVW 750
Design	Swash plate - Axial piston pump							
Type of mounting	Flange or foot-mounted. Combination units foot mounted only							
Pipe connection SAE/Flange	B A	psi	1-1/4"-6000	1-1/4"-6000	1-1/2"-6000	1-1/2"-6000	2"-6000	2"-6000
Direction of rotation	Clockwise when viewing shaft end of pump Counterclockwise available on request							
Speed range	n <sub>min</sub> n <sub>max</sub>	rpm	150 1800					1500 <sup>1)</sup>
Installation position	Optional, see mounting information							
Ambient temperature range	min max	°F	-4 122					
Weight	m	lb	353	364	518	529	926	1014
Mass of inertia	J	lb ft <sup>2</sup>	1.07	1.07	3.46	3.61	11.9	13.1

## HYDRAULIC CHARACTERISTICS

Nominal pressure (100% duty cycle)	p <sub>N</sub>	psi	5075						
Input pressure	p <sub>1min</sub> p <sub>1max</sub>	psi	58 abs Pressure can be applied to the pump inlet but the sum of p <sub>1</sub> and p <sub>2</sub> must not exceed the maximum value of 6090 psi						
Max. pressure to DIN 24312	p <sub>2max</sub>	psi	6090						
Hydraulic fluid	Hydraulic oil to DIN 51524 part 2. Refer to section Application Data-Fluid Recommendations								
Hydraulic fluid temperature range	min max	°F	-13 194						
Viscosity range for continuous operation	min max	cSt cSt	10 150						
Max. permissible start viscosity	max	cSt	1000 <sup>2)</sup>						
Filtering	ISO 4406		18/15/13						
Maximum geometric displacement	V <sub>g</sub>	in <sup>3</sup>	7.9	11	15.2	22	30.5	45.7	
Max. geom. pump flow	n= 1500 rpm n= 1800 rpm	Q <sub>g</sub>	USgpm	51.5 62	71 85.5	99 119	142 171	198 238	297 297 <sup>1)</sup>
Case pressure	p <sub>v max</sub>	psi	max. 7.2 psi over p <sub>1</sub> . p <sub>max</sub> = 58 psi abs.						

## HYDRAULIC CHARACTERISTIC OF CHARGE AND PILOT PUMP

Displacement charge pump	V <sub>g Sp</sub>	in <sup>3</sup>	2.44	2.44	3.91	4.88	7.63	12.2
Charge pressure	p <sub>N Sp</sub>	psi	145/290	145/290	145/290	145/290	174/290	232/348
Input pressure charge & pilot pump	p <sub>min Sp/St</sub>	psi	11.6 absolute					
Displacement pilot pump	V <sub>g St</sub>	in <sup>3</sup>	0.5					
Pilot pressure	p <sub>St</sub>	psi	870	870	870	870	1160	1160

## DRIVE

Max. driving torque - single unit (p <sub>2</sub> max., h= 100%)	M <sub>1 Single</sub>	lb.ft.	642	888	1232	1774	2463	3688
Max. power consumption - single unit (p <sub>2</sub> max., h= 100%; n= 1800 rpm)	P <sub>1 Single</sub>	hp	220	304	422	608	845	1055 <sup>1)</sup>
Max. driving torque - comb. unit	M <sub>1 Comb.</sub>	lb.ft.	2x642	2x888	2x1232	2x1774	3688	3688

1) TVW - 750 at 1800 rpm reduced to 38.1 in<sup>3</sup>

2) When pressure below 1450 psi and flow below 25% of max. flow

# Pump Specifications - Metric

MODEL			TVW 130	TVW 180	TVW 250	TVW 360	TVW 500	TVW 750
Design			Swash plate - Axial piston pump					
Type of mounting			Flange or foot-mounted. Combination units foot mounted only					
Pipe connection SAE/Flange	B A	psi	1-1/4"-6000	1-1/4"-6000	1-1/2"-6000	1-1/2"-6000	2"-6000	2"-6000
Direction of rotation			Clockwise when viewing shaft end of pump Counterclockwise available on request					
Speed range	n <sub>min</sub> n <sub>max</sub>	min <sup>-1</sup>	150 1800					1500 <sup>1)</sup>
Installation position			Optional, see mounting information					
Ambient temperature range	min max	°C	-20 50					
Weight	m	kg	160	165	235	240	420	460
Mass of inertia	J	kg m <sup>2</sup>	0,045	0,045	0,146	0,152	0,5	0,55

## HYDRAULIC CHARACTERISTICS

Nominal pressure (100% duty cycle)	p <sub>N</sub>	bar	350					
Input pressure	p <sub>1min</sub> p <sub>1max</sub>	bar bar	4 Pressure can be applied to the pump inlet but the sum of p <sub>1</sub> and p <sub>2</sub> must not exceed the maximum value of 420 bar					
Max. pressure to DIN 24312	p <sub>2max</sub>	psi	420					
Hydraulic fluid			Hydraulic oil to DIN 51524 part 2. Refer to section Application Data-Fluid Recommendations					
Hydraulic fluid temperature range	min max	°C	-25 90					
Viscosity range for continuous operation	min max	cSt cSt	10 150					
Max. permissible start viscosity	max	cSt	1000 <sup>2)</sup>					
Filtering	ISO 4406		18/15/13					
Maximum geometric displacement	V <sub>g</sub>	cm <sup>3</sup>	130	180	250	360	500	750
Max. geom. pump flow	n= 1500 min <sup>-1</sup> n= 1800 min <sup>-1</sup>	Q <sub>g</sub> l/min	195 234	270 324	375 450	540 648	750 900	1125 1125 <sup>1)</sup>
Case pressure	p <sub>v max</sub>	bar	max. 0,5 bar over p <sub>1</sub> . p <sub>max</sub> = 4 bar abs.					

## HYDRAULIC CHARACTERISTIC OF CHARGE AND PILOT PUMP

Displacement charge pump	V <sub>g Sp</sub>	cm <sup>3</sup>	40	40	64	80	125	200
Charge pressure	p <sub>N Sp</sub>	bar	10/20	10/20	10/20	10/20	12/20	16/24
Input pressure charge & pilot pump	p <sub>min Sp/St</sub>	bar	0,8 absolute					
Displacement pilot pump	V <sub>g St</sub>	cm <sup>3</sup>	8					
Pilot pressure	p <sub>St</sub>	bar	60	60	60	60	80	80

## DRIVE

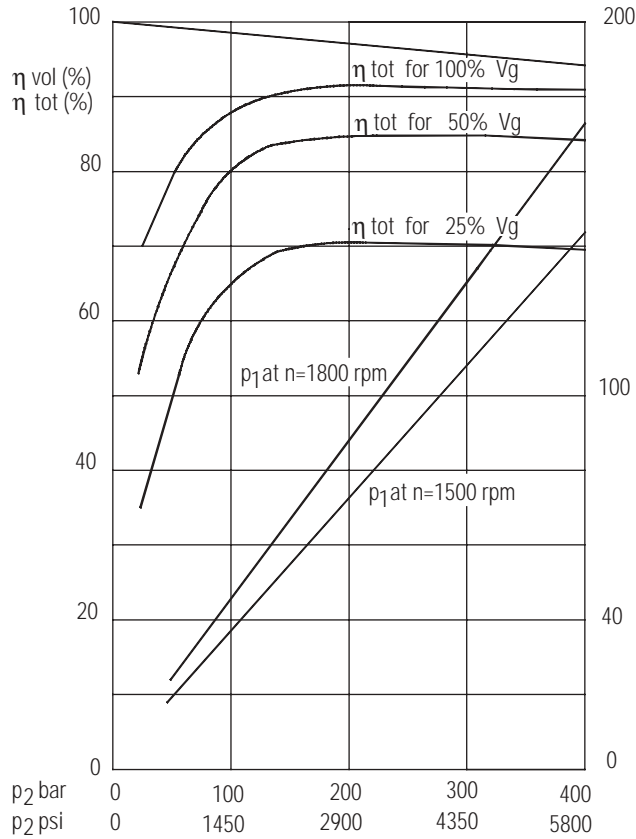
Max. driving torque - single unit (p <sub>2</sub> max., h= 100%)	M <sub>1 Single</sub>	Nm	870	1204	1670	2405	3340	5000
Max. power consumption - single unit (p <sub>2</sub> max., h= 100%; n= 1800 min <sup>-1</sup> )	P <sub>1 Single</sub>	KW	164	227	315	454	630	787 <sup>1)</sup>
Max. driving torque - comb. unit	M <sub>1 Comb.</sub>	Nm	2x870	2x1204	2x1670	2x2405	5000	5000

1) TVW - 750 at 1800 min<sup>-1</sup> reduced to 625cm<sup>3</sup>

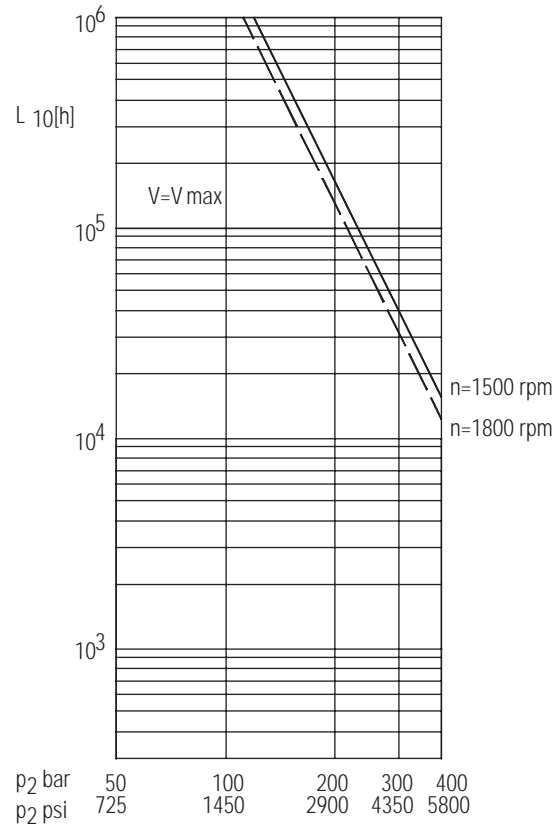
2) When pressure below 100 bar and flow below 25% of max. flow

# Performance Curves - 130 Series

**Power efficiency performance curve**



**Roller bearing life**



**Combination units**

For combination pumps the characteristic values are as for the individual units.

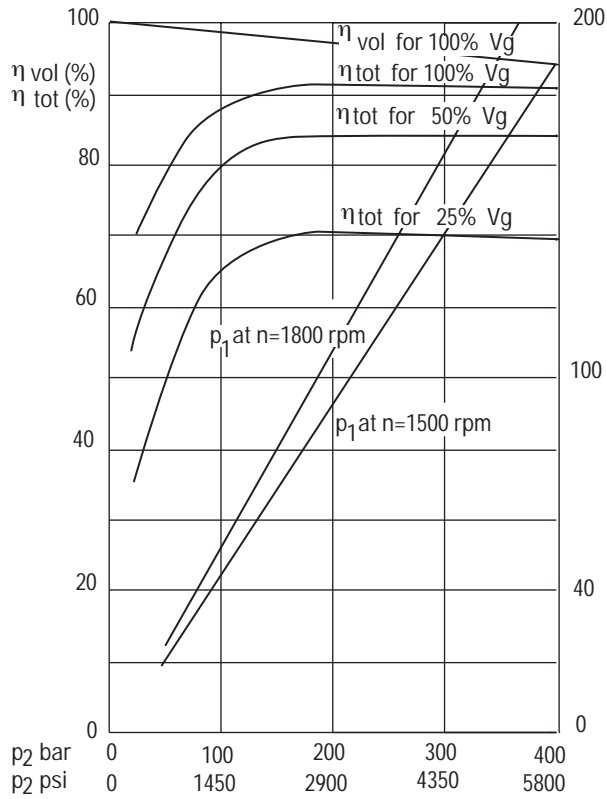
**For reduced swash-angle:**

$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

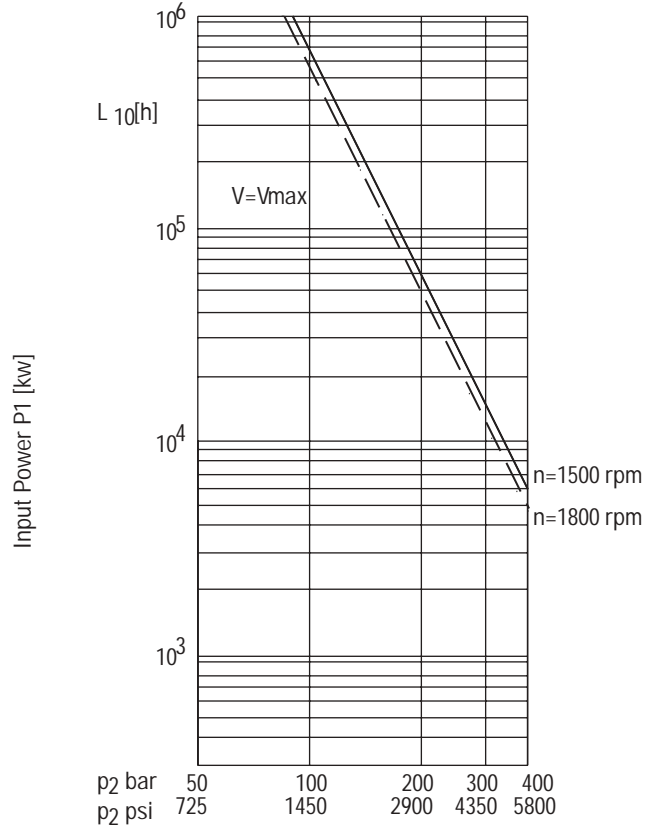


# Performance Curves - 180 Series

**Power efficiency performance curve**



**Roller bearing life**



**Combination units**

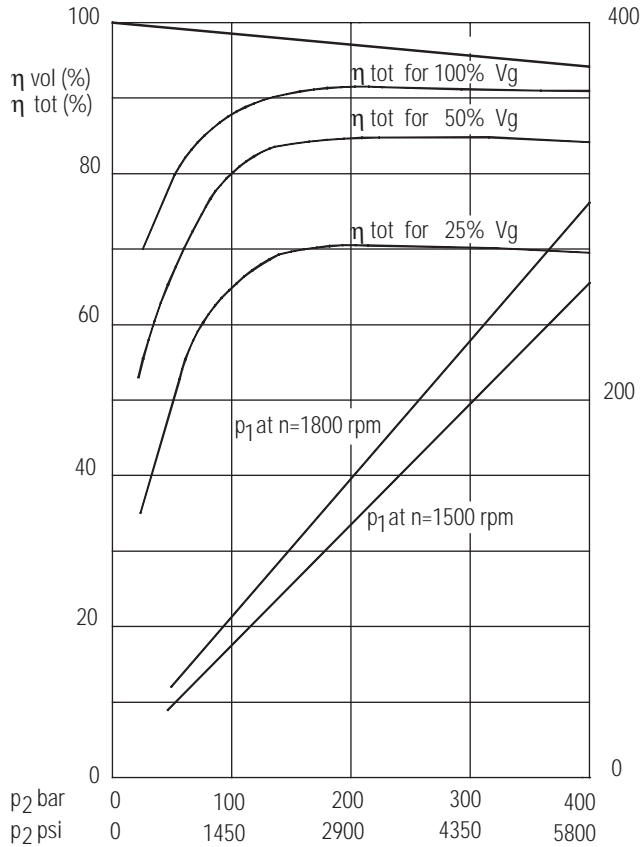
For combination pumps the characteristic values are as for the individual units.

**For reduced swash-angle:**

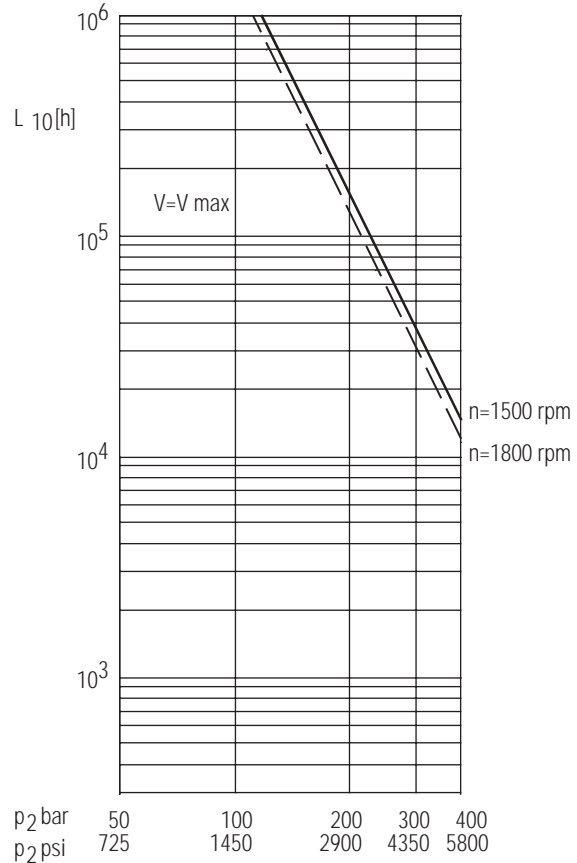
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

# Performance Curves - 250 Series

**Power efficiency performance curve**



**Roller bearing life**



**Combination units**

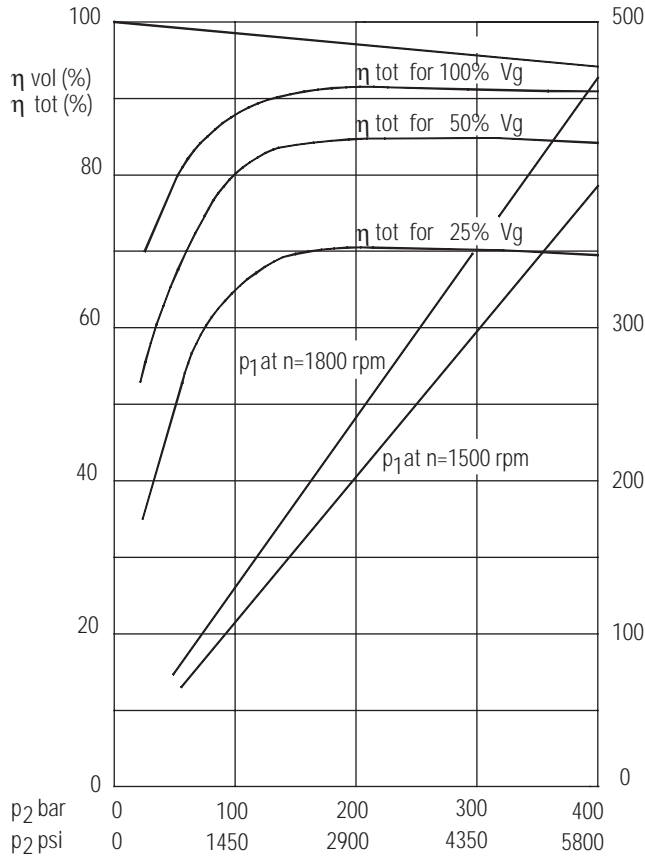
For combination pumps the characteristic values are as for the individual units.

**For reduced swash-angle:**

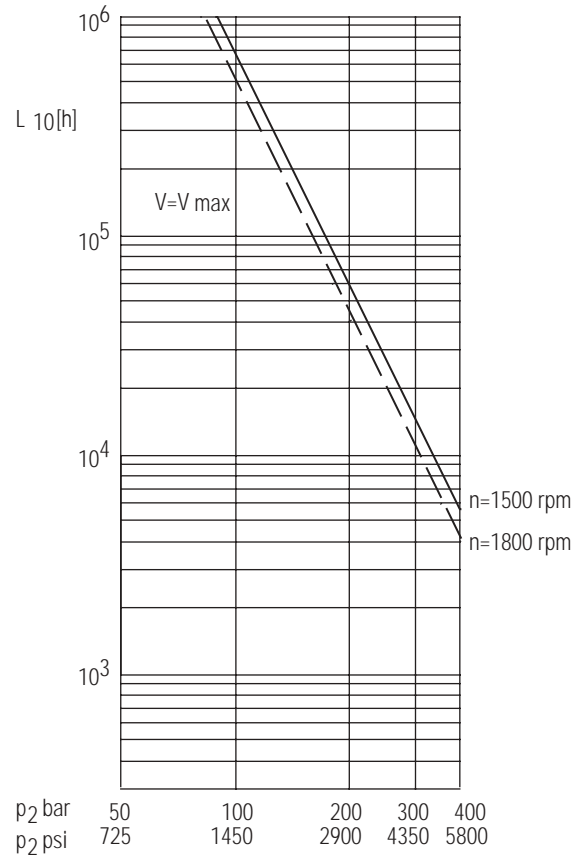
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

# Performance Curves - 360 Series

**Power efficiency  
performance curve**



**Roller bearing life**



**Combination units**

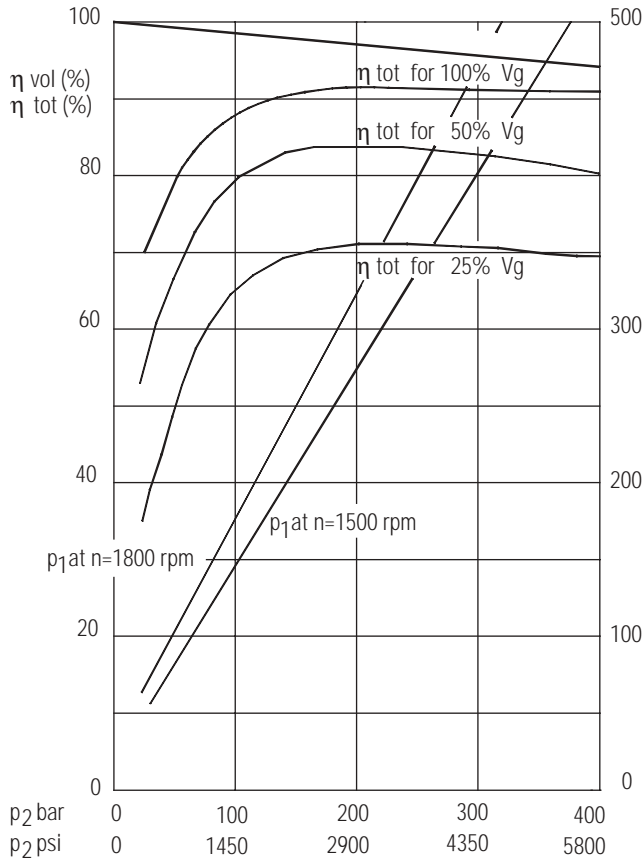
For combination pumps the characteristic values are as for the individual units.

**For reduced swash-angle:**

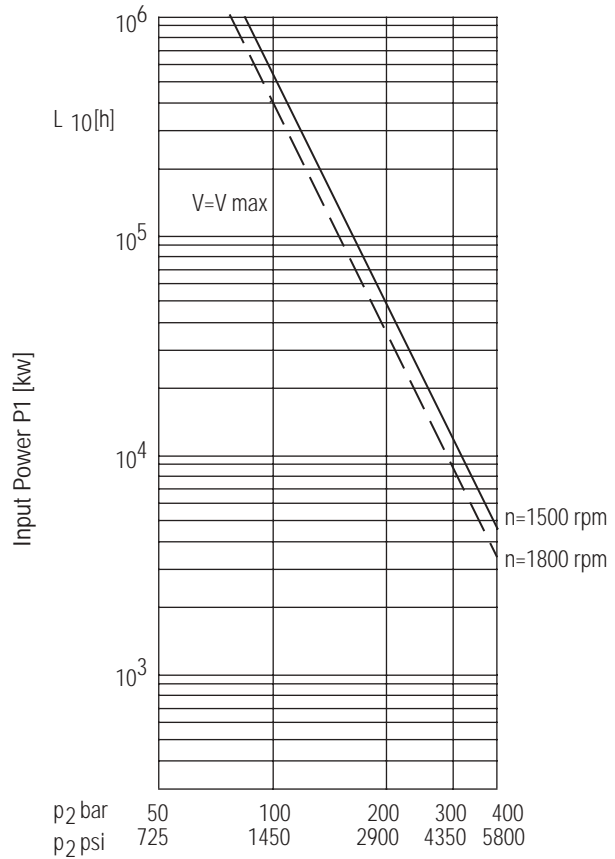
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

# Performance Curves - 500 Series

**Power efficiency performance curve**



**Roller bearing life**



**Combination units**

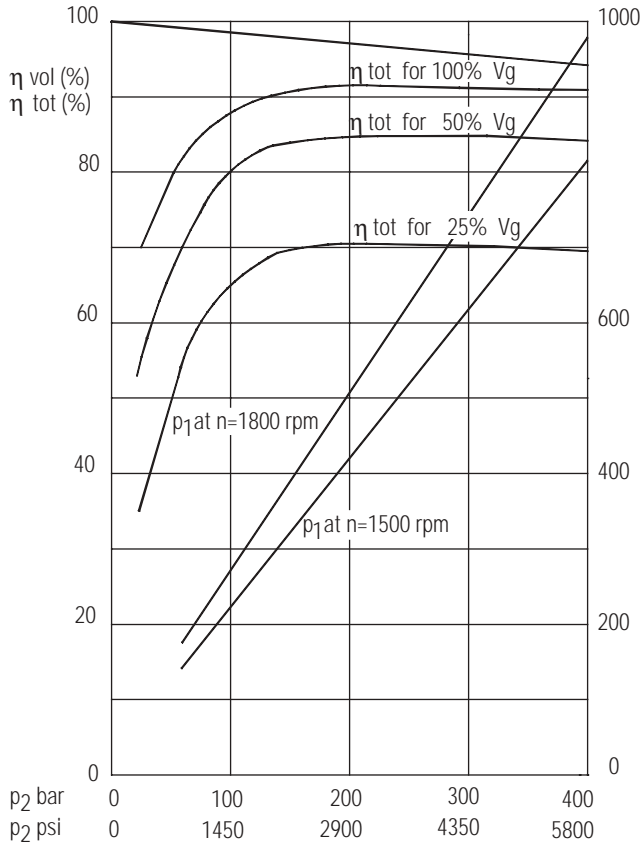
For combination pumps the characteristic values are as for the individual units. Only the torque  $M_1$  is limited to 5000 Nm.

**For reduced swash-angle:**

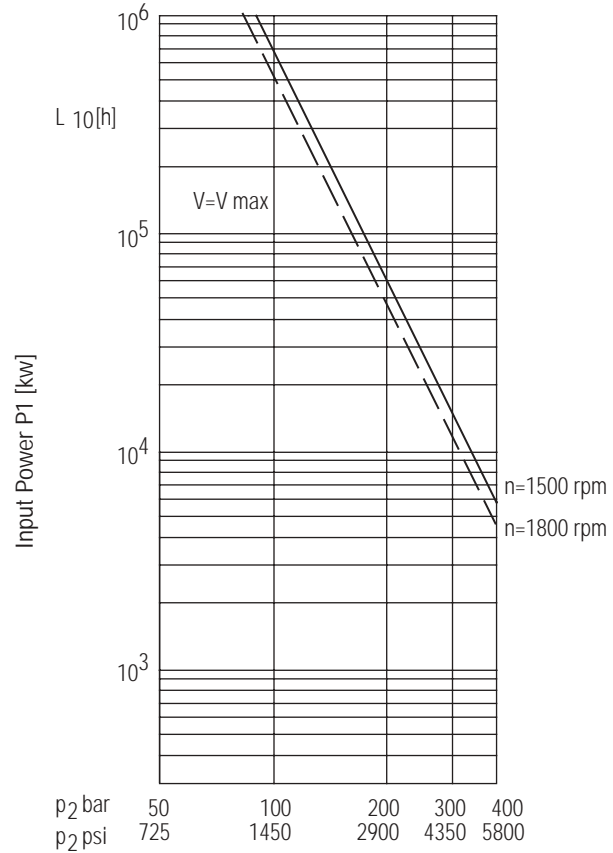
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

# Performance Curves - 750 Series

**Power efficiency  
performance curve**



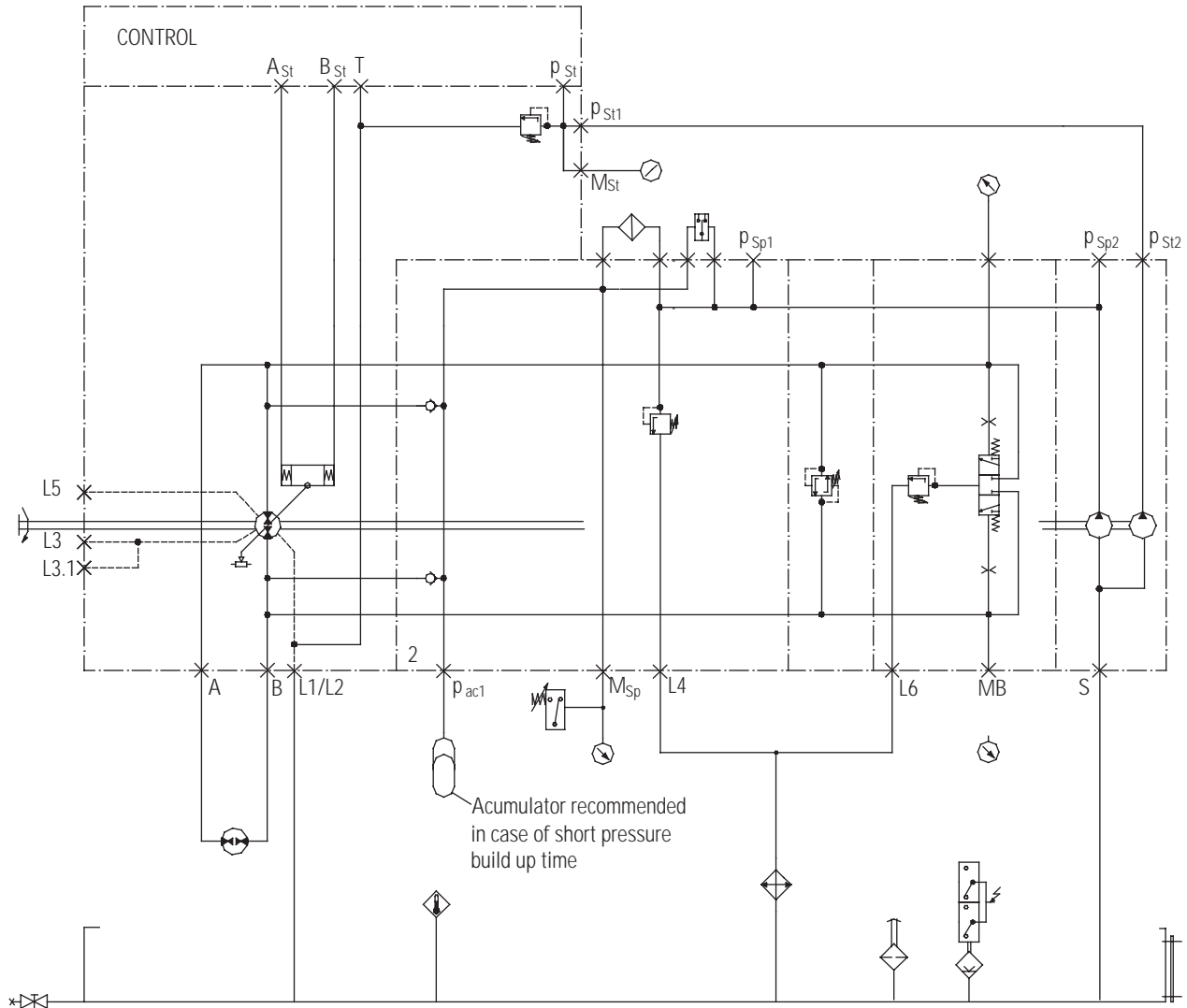
**Roller bearing life**



**For reduced swash-angle:**

$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

# Hydraulic Transmission Circuit

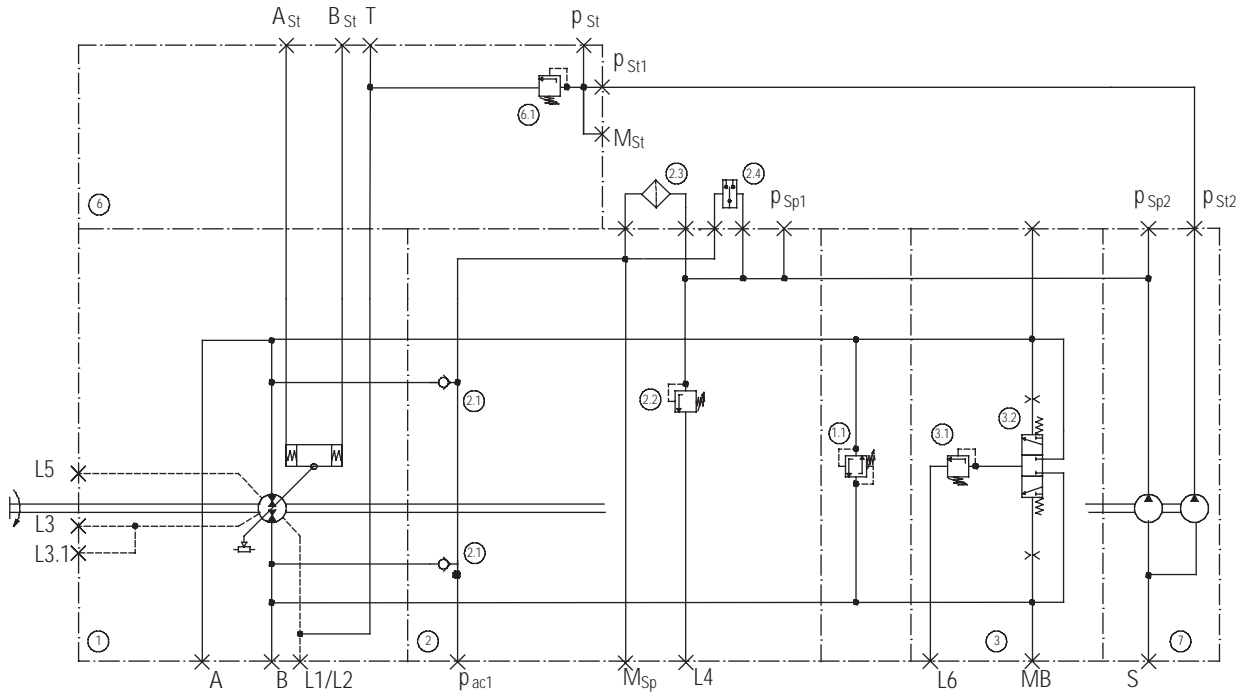


A, B	System port	L4	Return line charge flow	M <sub>Sp</sub>	Gauge port charge pressure	p <sub>St2</sub>	Pilot pump outlet port
A <sub>St</sub> , B <sub>St</sub>	Control	L5	Oil filling plug	M <sub>St</sub>	Gauge port pilot pressure	S	Suction port for charge and pilot pump
L1, L2	Drain port	L6	Return line charge flow	p <sub>ac1</sub>	Accumulator port	T	Tank port
L3	Ventilation port for vertical mounting	MA, MB	Gauge port system pressure	p <sub>Sp1</sub> , p <sub>Sp2</sub>	Port for external charge flow		
L3.1	Air bleeding port for vertical mounting			p <sub>St1</sub>	Port for pilot flow		
				p <sub>St</sub>	Port for pilot flow to control		

# Hydraulic Transmission Circuit

with Charge Flow Filter

Size 130 ..... 500.  
(Not available for 750)

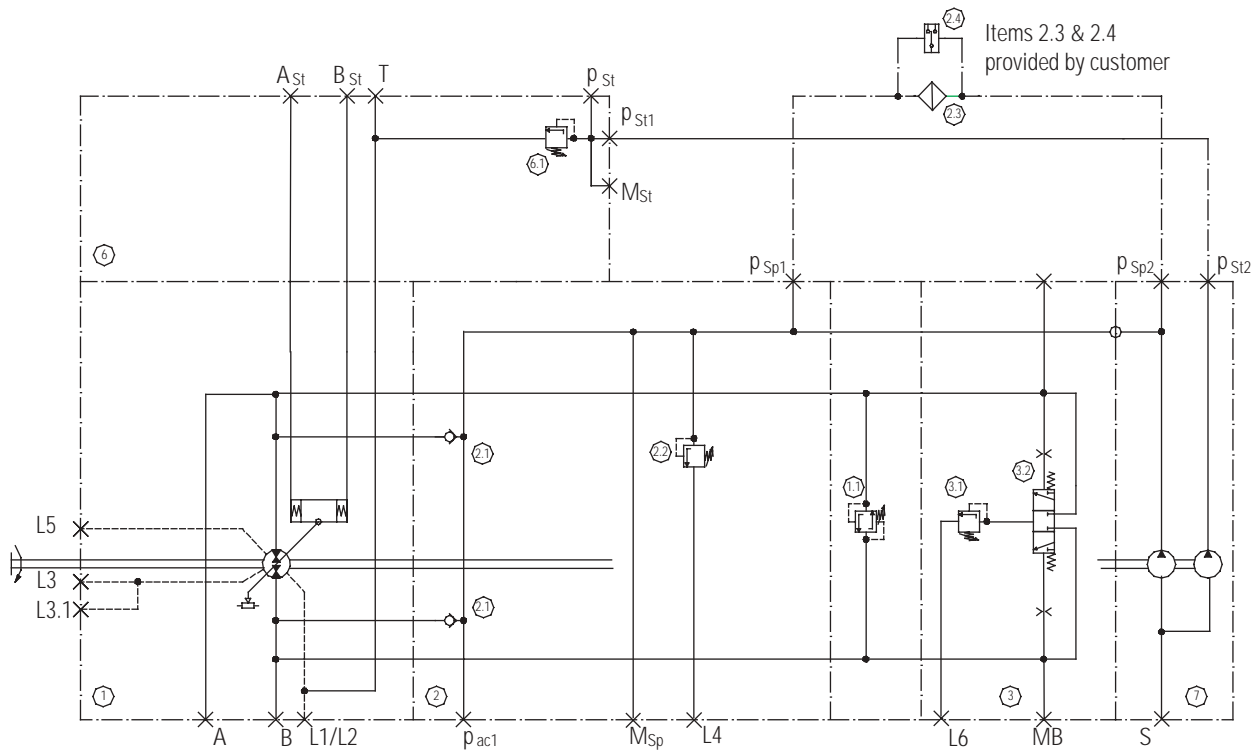


A, B	System port	MA, MB	Gauge port system pressure	S	Suction port for charge and pilot pump	2.4	Clogging indicator for charge flow filter
A <sub>St</sub> , B <sub>St</sub>	Control	M <sub>Sp</sub>	Gauge port charge pressure	T	Tank port	3	Flushing block
L1, L2	Drain port	M <sub>St</sub>	Gauge port pilot pressure	1	Basic pump	3.1	Low pressure relief valve
L3	Ventilation port for vertical mounting	p <sub>ac1</sub>	Accumulator port	1.1	High pressure relief valve	3.2	Flushing flow shuttle valve
L3.1	Air bleeding port for vertical mounting	p <sub>Sp1</sub> , p <sub>Sp2</sub>	Port for external charge flow	2	Charge block	6	Manifold
L4	Return line charge flow	p <sub>St1</sub>	Port for pilot flow	2.1	Charge check valve	6.1	Pilot pressure relief valve
L5	Oil filling plug	p <sub>St</sub>	Port for pilot flow to control	2.2	Charge pressure relief valve	7	Charge/pilot pump
L6	Return line charge flow	p <sub>St2</sub>	Pilot pump outlet port	2.3	Charge flow filter		

# Hydraulic Transmission Circuit

without Charge Flow Filter

Size 130 ..... 750

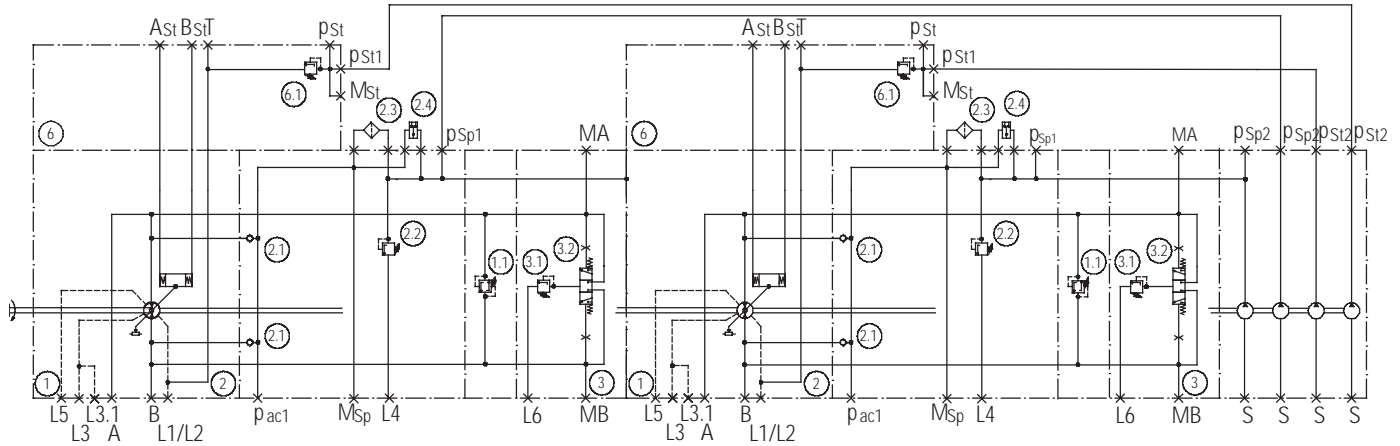


A, B	System port	MA, MB	Gauge port system pressure	S	Suction port for charge and pilot pump	3	Flushing block
A <sub>St</sub> , B <sub>St</sub>	Control	M <sub>Sp</sub>	Gauge port charge pressure	T	Tank port	3.1	Low pressure relief valve
L1, L2	Drain port	M <sub>St</sub>	Gauge port pilot pressure	1	Basic pump	3.2	Flushing flow shuttle valve
L3	Ventilation port for vertical mounting	p <sub>ac1</sub>	Accumulator port	1.1	High pressure relief valve	6	Control Manifold
L3.1	Air bleeding port for vertical mounting	p <sub>Sp1</sub>	Port for external charge flow	2	Charge block	7	Charge/pilot pump (option)
L4	Return line charge flow	p <sub>St1</sub>	Port for pilot flow	2.1	Charge check valve		
L5	Oil filling plug	p <sub>St2</sub>	Pilot pump outlet	2.2	Charge pressure relief valve		
L6	Return line charge flow						



# Hydraulic Transmission Circuit

Combination of Two Pumps



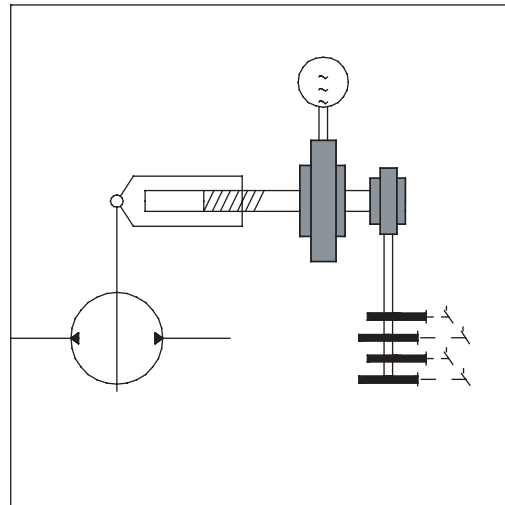
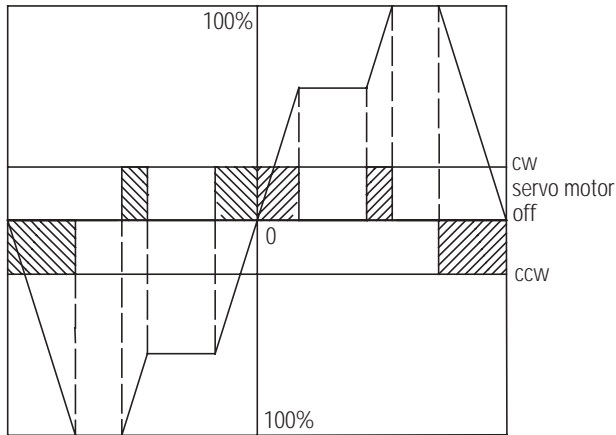
A, B	System port	MA, MB	Gauge port system pressure	p <sub>St2</sub>	Pilot pump outlet port	2.2	Charge pressure relief valve
A <sub>St</sub> , B <sub>St</sub>	Control	M <sub>Sp</sub>	Gauge port charge pressure	S	Suction port for charge and pilot pump	3	Flushing block
L1, L2	Drain port	M <sub>St</sub>	Gauge port pilot pressure	T	Tank port	3.1	Low pressure relief valve
L3	Ventilation port for vertical mounting	p <sub>ac1</sub>	Accumulator port	1	Basic pump	3.2	Flushing flow shuttle valve
L3.1	Air bleeding port for vertical mounting	p <sub>Sp1</sub>	Port for external charge flow	1.1	High pressure relief valve	6	Control manifold
L4	Return line charge flow	p <sub>Sp2</sub>	Charge pump outlet pump	2	Charge block	2	Charge check valve
L5	Oil filling plug	p <sub>St1</sub>	Port for pilot flow	2.1	Charge check valve	2.1	
L6	Return line charge flow						

# Controls – Electric Motor Displacement Control ES

The unit is used for stepless flow adjustment. It has a three phase electric servo motor, worm gearing and a switch box with 4 and 8 limit switches for 4 or 8 positions. A potentiometer is also available.

The response times from zero to maximum depends on the chosen ratio and the speed of the servo motor (this means that during operation the response times are not variable).

No pressure/power limiter possible.  
Explosion protection version are also available.



THEORETICAL RESPONSE TIME (SEC) FOR MAX. DISPLACEMENT

Size	130	180	250	360	500	750						
Freq. Hz	50	60	50	60	50	60						
Fast	10	8	10	8	8	7	11	9	10	8	14	12
Medium	20	17	20	17	20	17	27	23	24	20	35	29
Slow	50	42	50	42	40	33	55	46	48	40	70	58

Response time from 0 to +Q<sub>max</sub> or 0 to -Q<sub>max</sub>

# Controls – Controls for Position/ Displacement DP, SP, SM

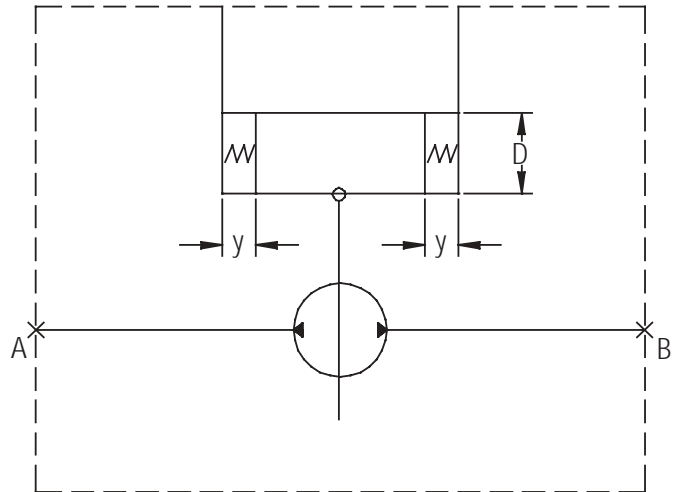
The electro or pressure proportional hydraulic displacement control will operate a hydrostatic drive in all four quadrants and work without throttle losses within either electrically or hydraulically adjustable limits. This done by controlling delivery flow respect; ie. swash angle.

The displacement of the axial piston unit is proportional to the swash plate angle and can be adjusted by a spring centered servo piston.

The servo piston is controlled by the required input signal with a mechanical, hydraulic or electrical control device.

Economical and energy saving drives can be produced with the "building block" principle for open loop and closed circuits as well.

Note: setting the pressure compensator or a control or a constant power, lower than the adjusted pilot oil pressure  $p_{s \min} = 60/80 \text{ bar (870/1160 psi)}$ , is not possible.



## Pressure Limitation:

Each of the servo controls DP, SM and SP can be combined with a hydromechanical pressure limitation control. This destrokes the swash plate when the system pressure reaches a control setting. The response time for de-stroking the the pump is much faster than that of the servo control alone.

The pressure limitation control can also operate the unit in the motor mode of operation. This means when the hydraulic motor delivers energy to the system e.g. from energy stored

in a flywheel, the pump goes over-center thus acting as a motor delivering mechanical energy to the drive, as in a mooring control function.

For each of the system sides, A and B, a separate pressure control is required. This control consist of a main stage valve conducting the system pressure to the pump actuator piston a pressure relief valve where the pressure is set. The minimum setting of this valve cannot be lower than the pilot pressure.

## Power Limitation (Torque Control):

An additional power limitation valve can be used in conjunction with the pressure limitation control. This senses the position of the pump actuator piston which is proportional to the swash plate angle. In accordance with the swash plate angle the pressure adjustment is set to a determined level to follow a hyperbolic relationship between flow and pressure.

High Flow - Low Pressure

Low Flow - High Pressure

The power level, a function of the product of flow and pressure, is hence adjustable.

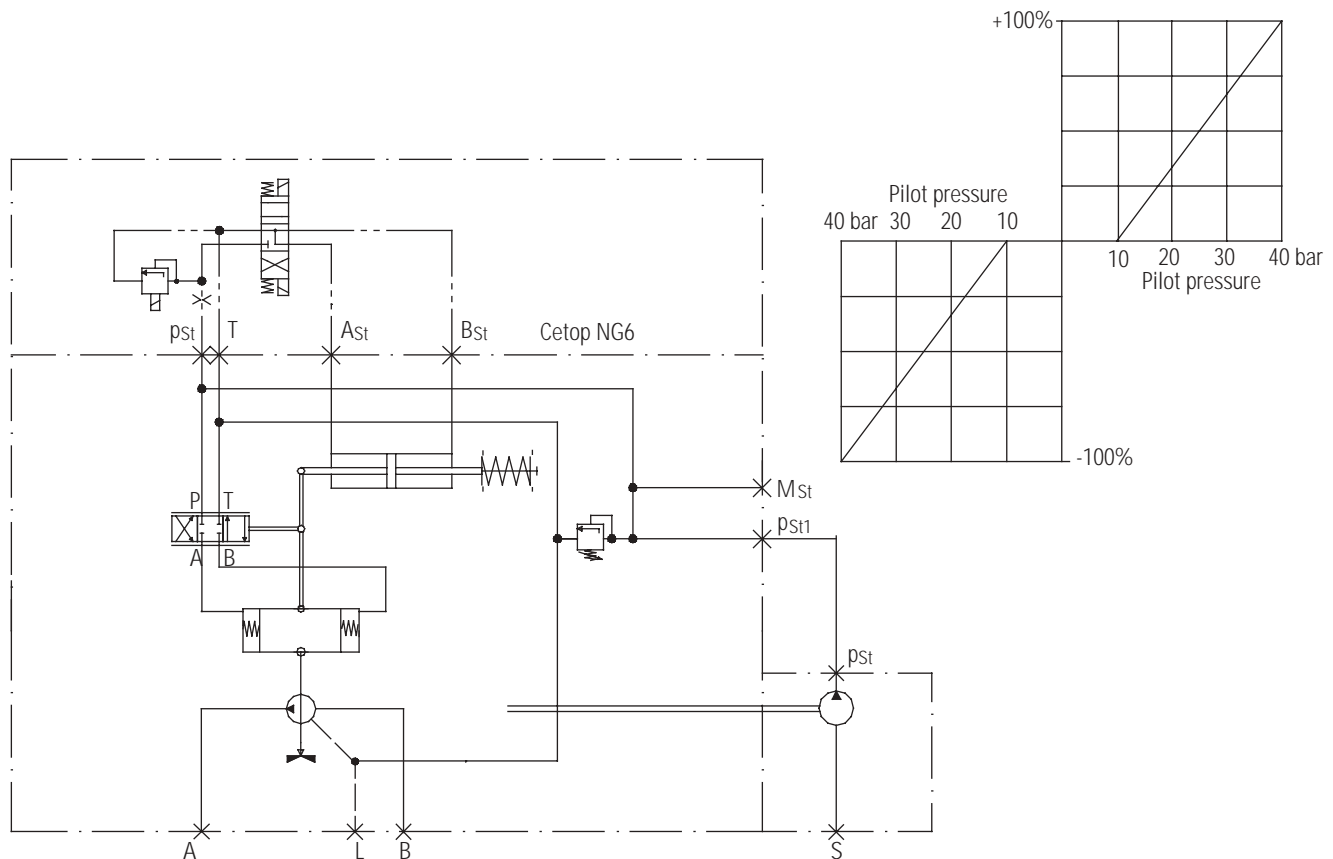
# Controls – Pressure Signal Displacement Control DP

The output flow of the pump is proportional to the pilot pressure. Each of the two pilot ports is responsible for an output flow direction.

A separate pilot oil circuit is necessary with  $p_{min} 60/80 \text{ bar}$ ,  $Q_{St} = 12 \text{ l/min}$  (3.17 USgpm). From this the control pressure is reduced to the desired set value by means of a suitable circuit.

For exchange with:  
Pressure limiting valve (mechanical or proportional) from P to T line and throttle in P line 0,8 Dia. (0.03)

The pressure proportional adjustment can also be supplied with a pressure and/or power limitation.



## Pressure proportional adjustment DP

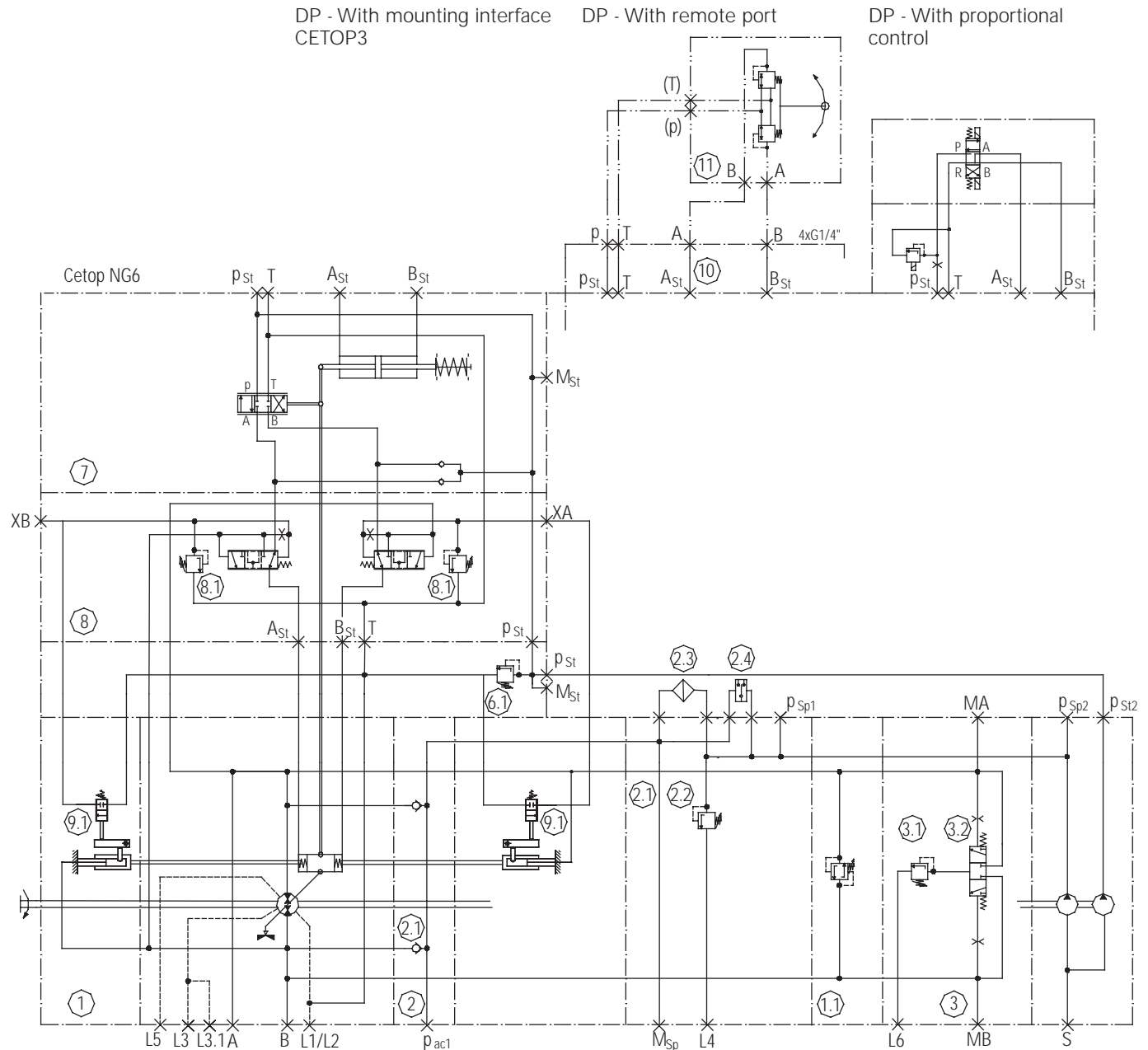
The output flow of the pump is proportional to the pilot pressure. Each of the two pilot ports is responsible for an output flow direction.

SIZE	RESPONSE TIME (S) 12 L/MIN	RESPONSE TIME* (S)	
		PRESSURE CONTROL DESTROKING	PILOT PRESSURE P <sub>ST</sub> BAR
130/180	0.8	0.07	60
250/360	1.0	0.08	60
500/750	2.2	0.110	80

\*Measured with a 2m pressure line of diameter 50 mm

# Controls – Example for TVW - DP Control

with Pressure - & Power  
Limiter



A, B	System port	MA, MB	Gauge port system pressure	S	Suction port for charge and pilot pump	2.3	Filter
A <sub>St</sub> , B <sub>St</sub>	Control	M <sub>Sp</sub>	Gauge port charge pressure	T	Tank port	2.4	Clogging indicator
L1, L2	Drain port	M <sub>St</sub>	Gauge port pilot pressure	XA, XB	Pilot port pressure control	3	Flushing block
L3	Ventilation port for vertical mounting	p <sub>ac1</sub>	Accumulator port	1	Basic pump	3.1	Low pressure relief valve
L3.1	Air bleeding port for vertical mounting	p <sub>Sp1</sub>	Port for external charge flow	1.1	High pressure relief valve	3.2	Flushing flow shuttle valve
L4	Return line charge flow	p <sub>St1</sub>	Port for pilot flow	2	Charge block	6	Control manifold
L5	Oil filling plug	p <sub>St1.1</sub>	Port for pilot flow	2.1	Charge check valve	6.1	Pilot pressure relief valve
L6	Return line charge flow	p <sub>St2</sub>	Pilot pump outlet port	2.2	Charge pressure relief valve	7	DP-Control
						8.1	Pressure limiter 100 to 350 bar

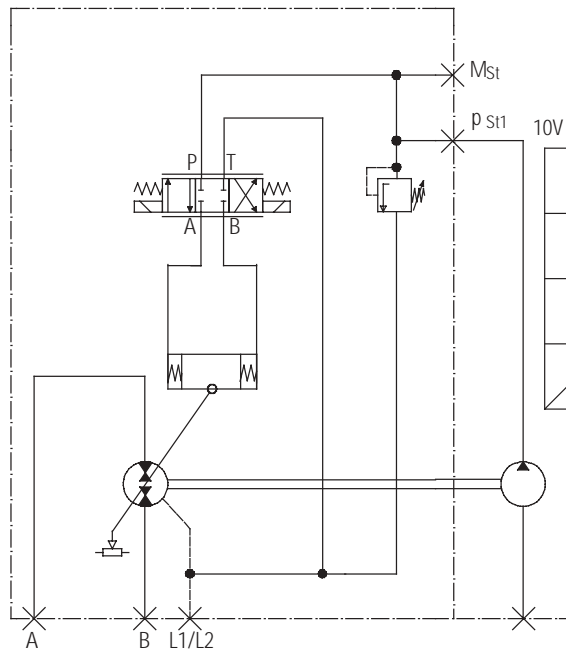
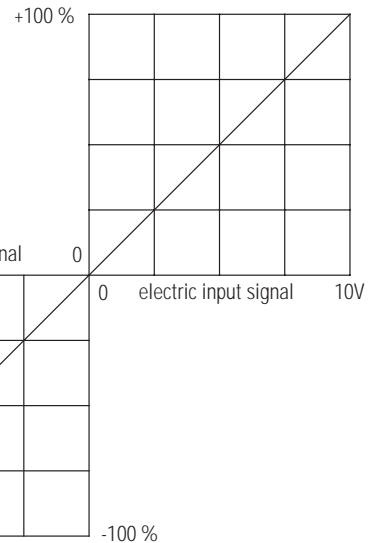
# Controls – Proportional Valve Displacement Control SP

The electro hydraulic displacement control will operate a hydrostatic drive in all four quadrants and work without throttle losses within electrically adjustable limits.

This is done by controlling delivery flow with swash plate angle feedback. All control valves are recorded as an electrical signal and lead back to the control card. The proportional valve or

servo valve and servo piston transform the output signal of the control card to the desired setting.

This results in a very precise and dynamic control



## Electrohydraulic servo adjustment SP

The electro hydraulic displacement control will operate a hydrostatic drive in all four quadrants and work without throttle losses within electrically adjustable limits. This is done by controlling delivery flow swash plate angle feedback

## PROPORTIONAL VALVE

	NOMINAL FLOW		CONTROL PRESSURE PST	CONTROL ELECTRONICS	RESPONSE TIME	UNIT SIZE	SERVO PISTON		VOLUME
	L/MIN (USGPM)	AT ΔP BAR (PSI)	BAR (PSI)		0 < > VMAX [MS]	CM <sup>3</sup> (IN <sup>3</sup> )	DIAMETER MM (IN)	STROKE MM (IN)	CM <sup>3</sup> (IN <sup>3</sup> )
Medium response (CETOP 3)	12 (3.17)	10 (150)	60 (870) to 80 (1160)	ER 9.0 - 10	250 to 800	130 (7.9)	60 (2.36)	21 (.83)	59 (3.60)
						180 (11)	60 (2.36)	21 (.83)	59 (3.60)
						250 (15.2)	75 (2.95)	18 (.71)	79 (4.82)
						360 (22)	75 (2.95)	25 (.98)	110 (6.71)
						500 (30.5)	75 (2.95)	22 (.87)	97 (5.92)
						750 (45.7)	75 (2.95)	30 (1.18)	132 (8.06)
High response (CETOP 5)	40 (11) to 80 (21)	70 (1000)	80 (1160) to 100 (1450)	ER 9.4 - 10	40 to 150	130 (7.9)	60 (2.36)	21 (.83)	59 (3.60)
						180 (11)	60 (2.36)	21 (.83)	59 (3.60)
						250 (15.2)	75 (2.95)	18 (.71)	79 (4.82)
						360 (22)	75 (2.95)	25 (.98)	110 (6.71)
						500 (30.5)	75 (2.95)	22 (.87)	97 (5.92)
						750 (45.7)	75 (2.95)	30 (1.18)	132 (8.06)

# Controls – Control Cards

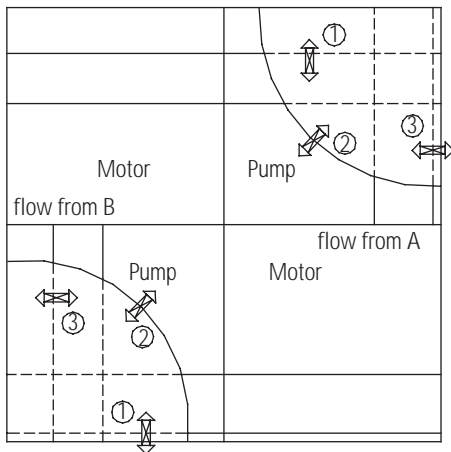
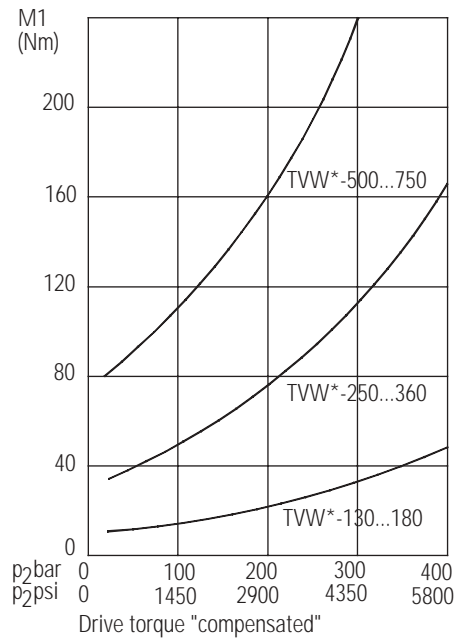
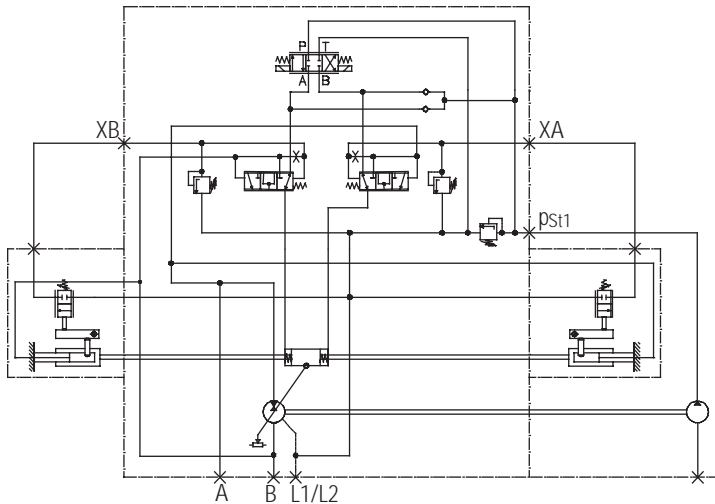
SP - Control with Pressure  
and Power Limitation

## Control Cards

The ER 9.3 - 10 and ER 9.4 - 10 Digital control cards are available and optimized for use with the SP - Control. Software is available for parameter setting and storing (Database function).

Contact Eaton to request the free of charge manual- and software CD.

SP - Control with pressure  
and power limitation



- ① Pressure limiter setting
- ② Power limiter setting
- ③ SP Displacement control

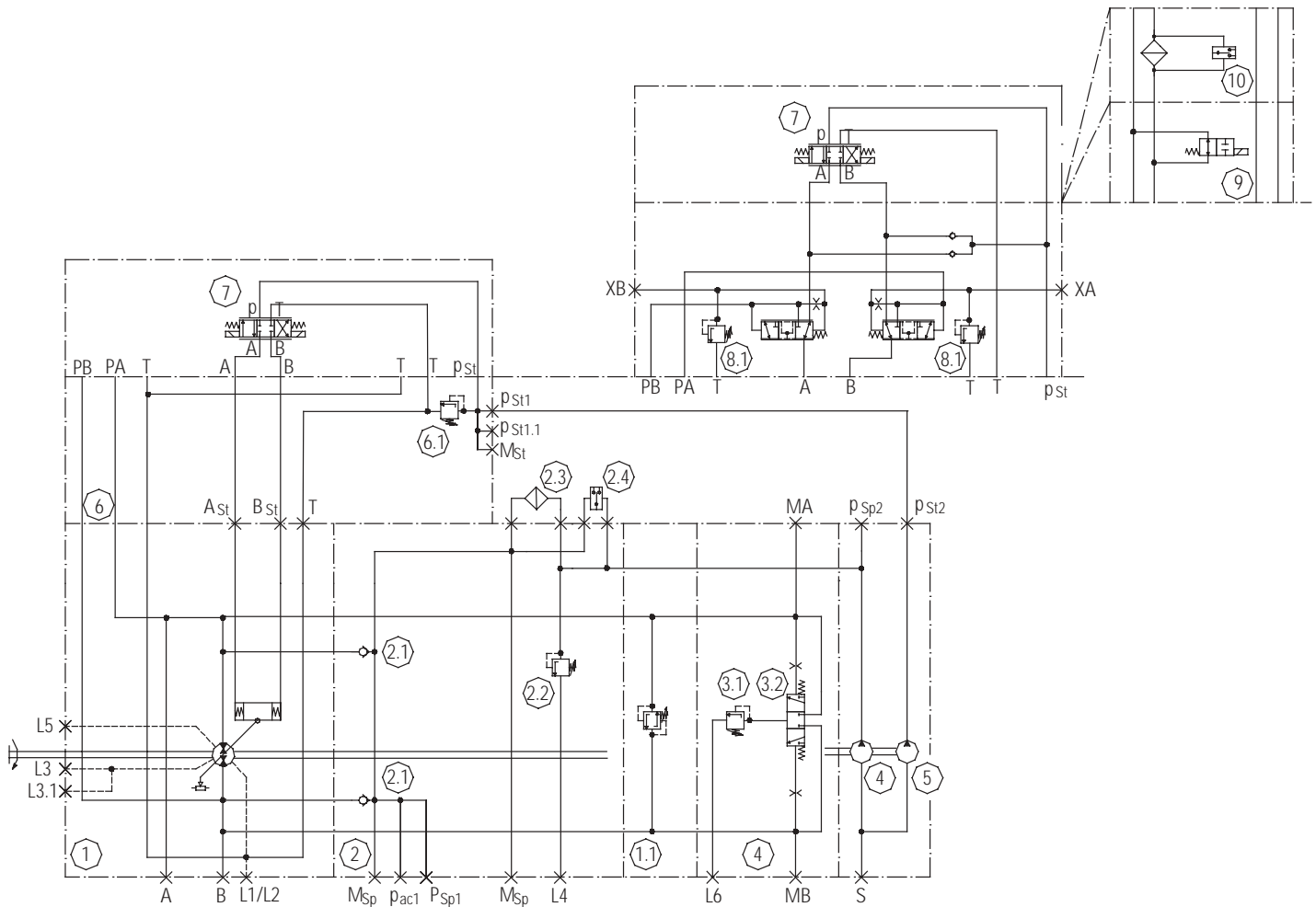
The patented circuit provides extremely short response times for the pressure compensator regardless of the servo control used: The response time is independent from the particular flow characteristic!

FRAME SIZE	RESPONSE TIME WHEN COMPENSATING FROM +/- V <sub>MAX</sub> — 0
130/180	80 ms
250/360	90 ms
500/750	110 ... 130 ms

# Controls – SP Control with and without Pressure Limitation Example for TVWS

... SPC03C0 ...

... SPC03C3 ...

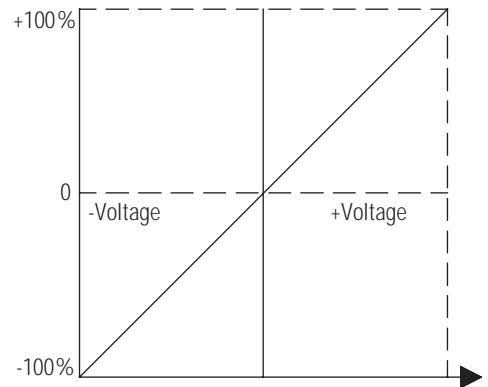
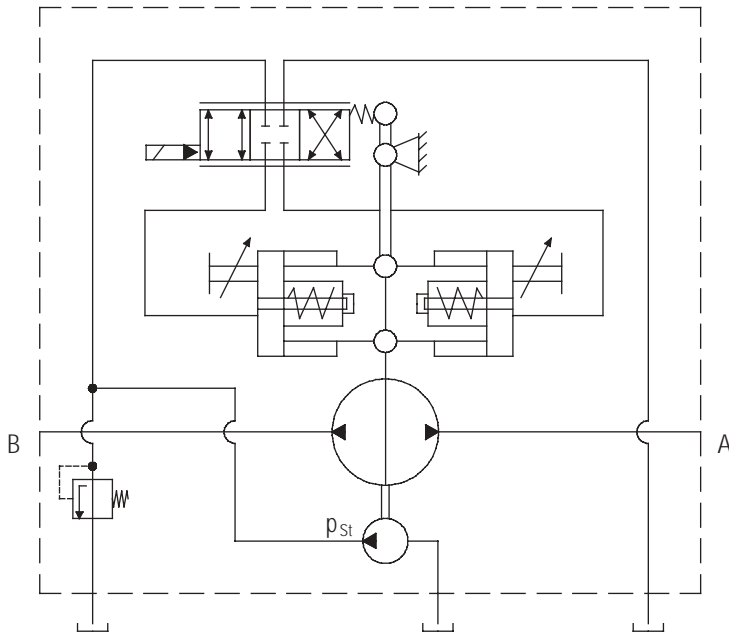


A, B	System port	M <sub>Sp</sub>	Gauge port charge pressure	S	Suction port for charge and pilot pump	3.1	Low pressure relief valve
A <sub>St</sub> , B <sub>St</sub>	Pilot oil port pump side A, B	M <sub>St</sub>	Gauge port pilot pressure	T	Tank port	3.2	Flushing flow shuttle valve
L1, L2	Drain port	p <sub>ac1</sub>	Accumulator port	XA, XB	Pilot port pressure control	4	Charge pump
L3	Ventilation port for vertical mounting	p <sub>Sp1</sub>	External port charge flow	1	Basic pump	5	Pilot pump
L3.1	Air bleeding port	p <sub>Sp2</sub>	Additional charge pump outlet port	1.1	High pressure relief valve	6	Connection plate for SP-Control
L4	Drain port (charge oil)	p <sub>St1</sub>	Port for pilot pressure	2	Charge block	6.1	Pilot pressure relief valve
L5	Oil filling plug	p <sub>St1.1</sub>	Port for pilot pressure	2.1	Charge check valve	7	Proportional valve
L6	Drain port (flushing oil)	p <sub>St2</sub>	Piston pump outlet port	2.2	Charge pressure relief valve	8.1	Pressure limiter 100 to 350 bar
L7	Port for return line of control circuit			3	Flushing block	9	Fail safe valve intermeditate plate
MA, MB	Gauge port system pressure					10	Pilot oil filter



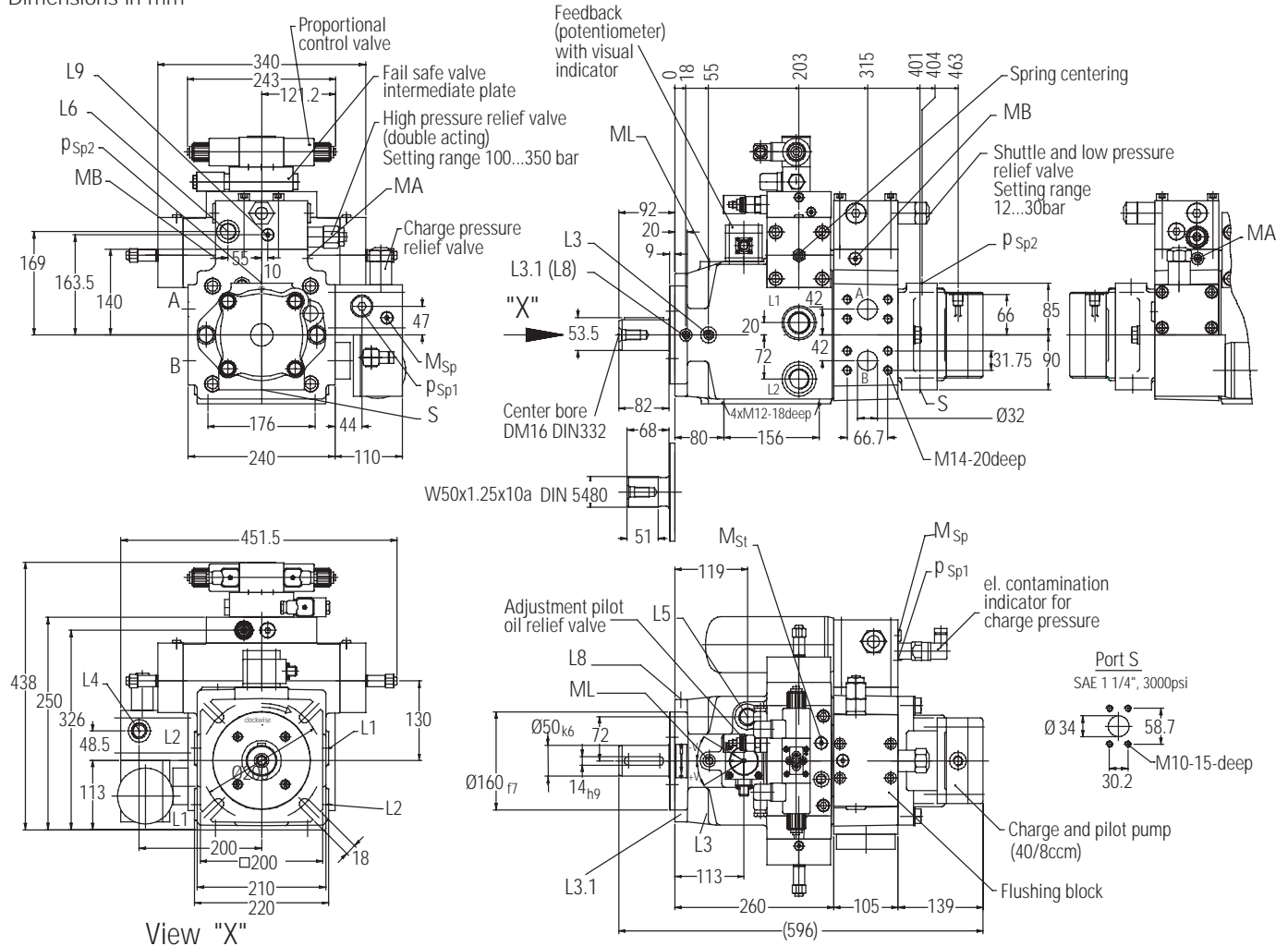
# Controls – Servo Adjustment Displacement Control with Mechanical Feedback SM

- Servo control with integrated mechanical feedback of swash plate position. Mainly used in hazardous environments.
- No electronic control card necessary
- Input signal  $\pm 50$  mA (linear coil connection) ;  $\pm 100$  mA (parallel coil connection)
- Hysteresis, repeatability: 8% of end value
- Available in explosion proof class Eex i II version for hazardous duty.
- Pressure/power limitation available



# Pump Dimensions - TVWS 130/180

Dimensions in mm



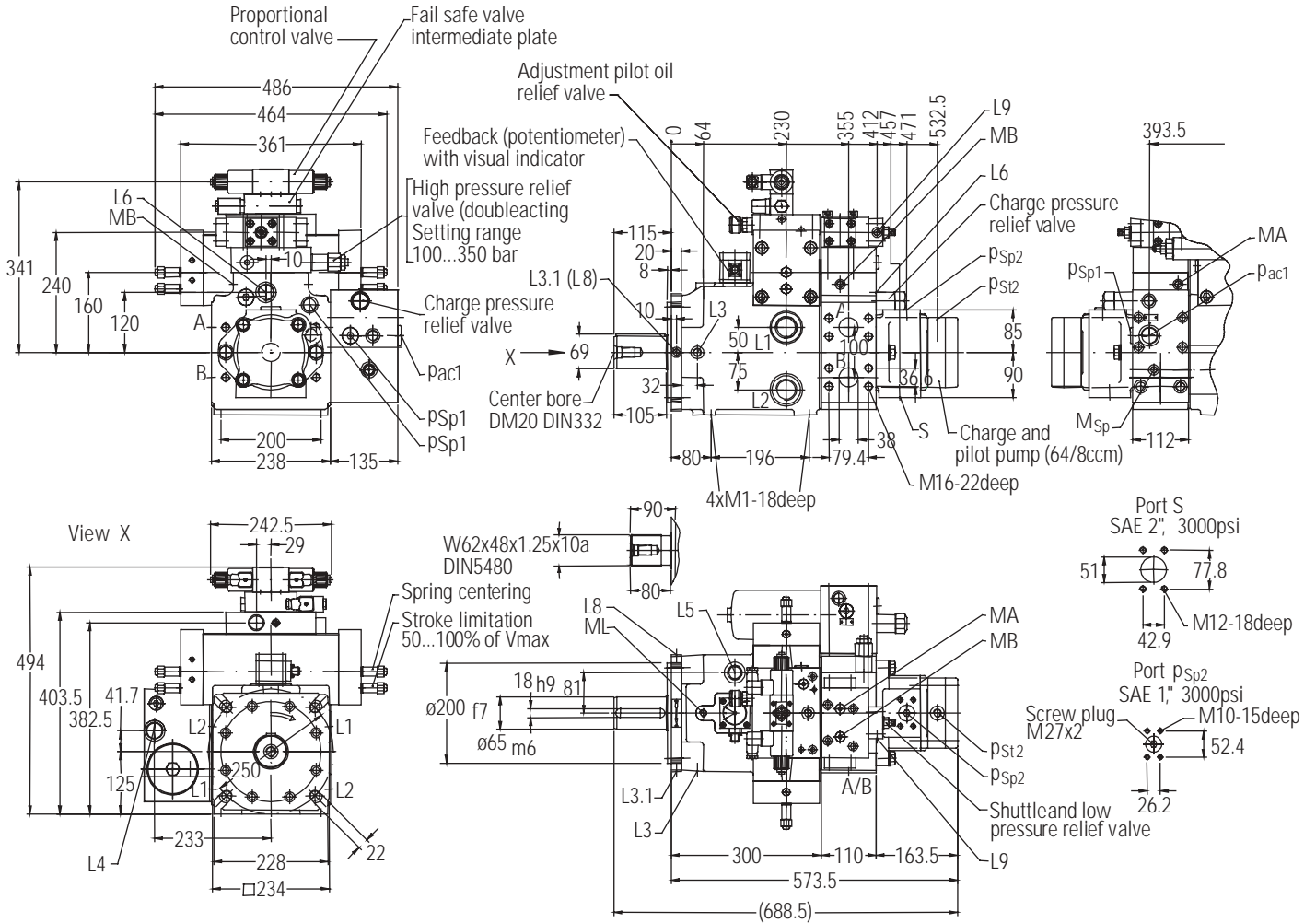
DIRECTION OF ROTATION	RANGE OF SWASH ANGLE	INPUT	OUTPUT
Right Hand Rotation	To + $V_{max}$	B	A
	To - $V_{max}$	A	B

For left hand rotation a special setup of charge and pilot pump is required!

A	System pressure port SAE 1 1/4", 6000 psi	L4	Drain port G 3/4" (charge oil)	(MB)	Gauge port system pressure G 1/4"	$p_{Sp2}$	Additional charge pump outlet port G 3/4" (closed)
(L1)	Drain port 1 1/16" - 12 UNF-2B (according to mounting position use upper port)	L5	Oil filling plug 1 1/16" - 12 UNF-2B	(ML)	Gauge port of case pressure G 1/4"	S	Suction port of charge and pilot pump SAE 1 1/4", 3000 psi (common port)
		L6	Drain port G 3/4" (flushing oil)	(M <sub>Sp</sub> )	Gauge port of charge pressure G 1/4"		
		(L8)	Air bleeding port G 1/4"	(M <sub>St</sub> )	Gauge port of pilot pressure G 1/4"		
L2	Drain port G 1" (according to mounting position use upper port)	(L9)	Drain port for low pressure relief valve G 1/4"	$p_{Sp1}$	External port of charge pressure G 3/4"	(...)	Normally plugged
(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"				

# Pump Dimensions - TVWS 250

Dimensions in mm



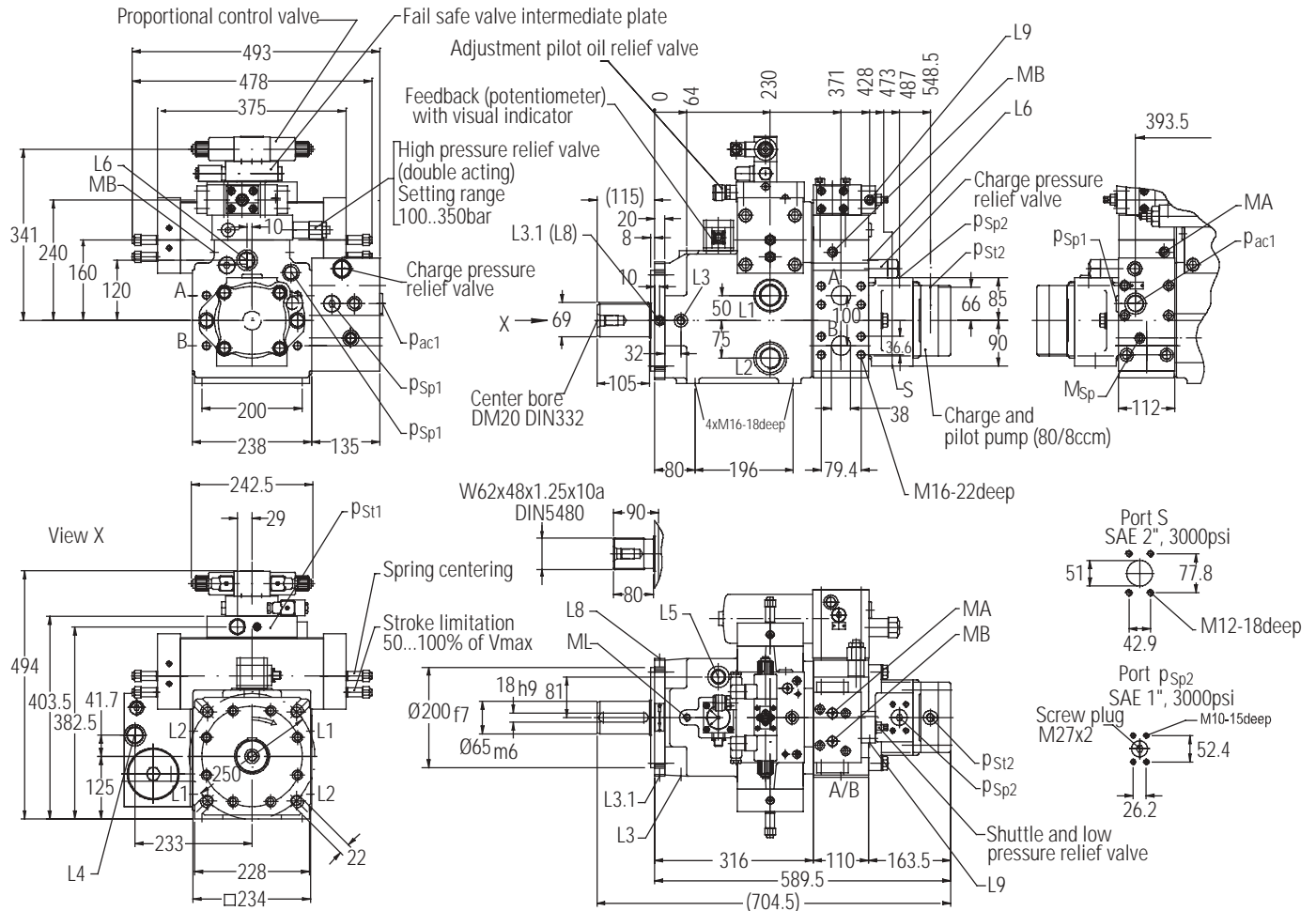
DIRECTION OF ROTATION	RANGE OF SWASH ANGLE	INPUT	OUTPUT
Right Hand Rotation	To + V <sub>max</sub>	B	A
	To - V <sub>max</sub>	A	B

For left hand rotation a special setup of charge and pilot pump is required!

A	System pressure port SAE 1 1/2", 6000 psi	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(L9)	Drain port for low pressure relief valve G 1/4"	(p <sub>Sp1</sub> )	External port of charge pressure G 3/4"
B	System pressure port SAE 1 1/2", 6000 psi	(L3.1)	Port G 1/8"	(MA)	Gauge port system pressure G 1/4"	(p <sub>Sp2</sub> )	Additional charge pump outlet port M27x2
(L1)	Drain port 1 5/8" - 12 UNF-2B (according to mounting position use upper port)	L4	Drain port G 1" (charge oil)	(MB)	Gauge port system pressure G 1/4"	p <sub>St2</sub>	Pilot pump outlet port G 3/8"
		(L5)	Oil filling plug 1 1/16" - 12 UNF-2B	(ML)	Gauge port of case pressure G 1/4"	S	Suction port of charge and pilot pump SAE 2", 3000 psi (common port)
L2	Drain port G 1 1/4" (according to mounting position use upper port)	(L8)	Air bleeding port G 1/4"	(M <sub>Sp</sub> )	Gauge port of charge pressure G 1/4"		
				(p <sub>ac1</sub> )	Accumulator port G 1"		
				(...)			Normally plugged

# Pump Dimensions - TVWS 360

Dimensions in mm



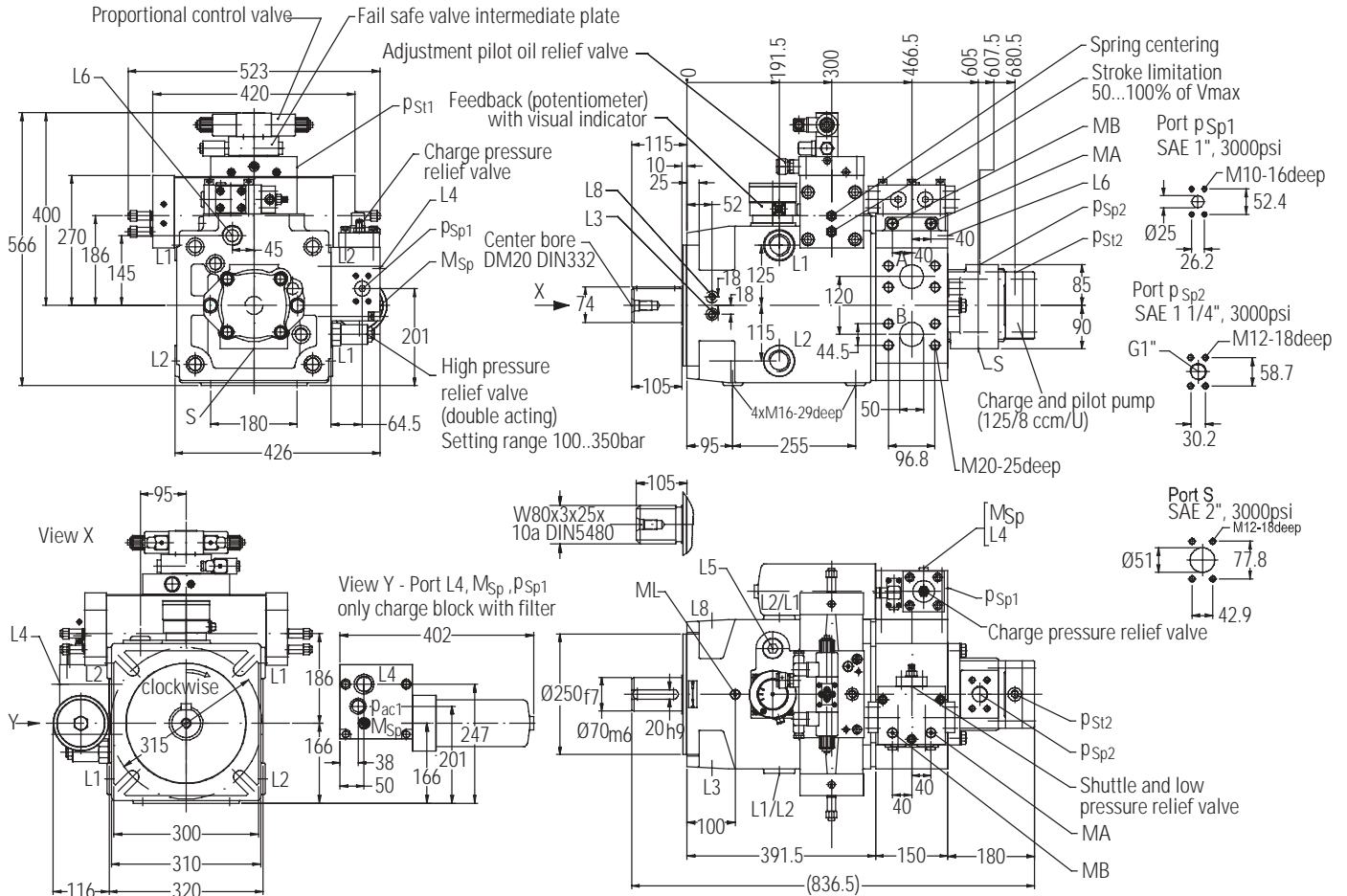
DIRECTION OF ROTATION	RANGE OF SWASH ANGLE	INPUT	OUTPUT
Right Hand Rotation	To + V <sub>max</sub>	B	A
	To - V <sub>max</sub>	A	B

For left hand rotation a special setup of charge and pilot pump is required!

A	System pressure port SAE 1 1/2", 6000 psi	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(p <sub>Sp2</sub> )	Additional charge pump outlet port M27x2
B	System pressure port SAE 1 1/2", 6000 psi	(L3.1)	Port G 1/8"	(MB)	Gauge port system pressure G 1/4"	p <sub>St2</sub>	Pilot pump outlet port G 3/8"
(L1)	Drain port 1 5/8" - 12 UNF-2B (according to mounting position use upper port)	L4	Drain port G 1" (charge oil)	(ML)	Gauge port of case pressure G 1/4"	S	Suction port of charge and pilot pump SAE 2", 3000 psi (common port)
(L2)	Drain port G 1/4" (according to mounting position use upper port)	(L5)	Oil filling plug 1 1/16" - 12 UNF-2B	(M <sub>Sp</sub> )	Gauge port of charge pressure G 1/4"	(...)	Normally plugged
		L6	Drain port G 1" (flushing oil)	(p <sub>ac1</sub> )	Accumulator port G 1"		
		(L8)	Air bleeding port G 1/4"	(p <sub>Sp1</sub> )	External port of charge pressure G 3/4"		
		(L9)	Drain port for low pressure relief valve G 1/4"				

# Pump Dimensions - TVWS 500

Dimensions in mm



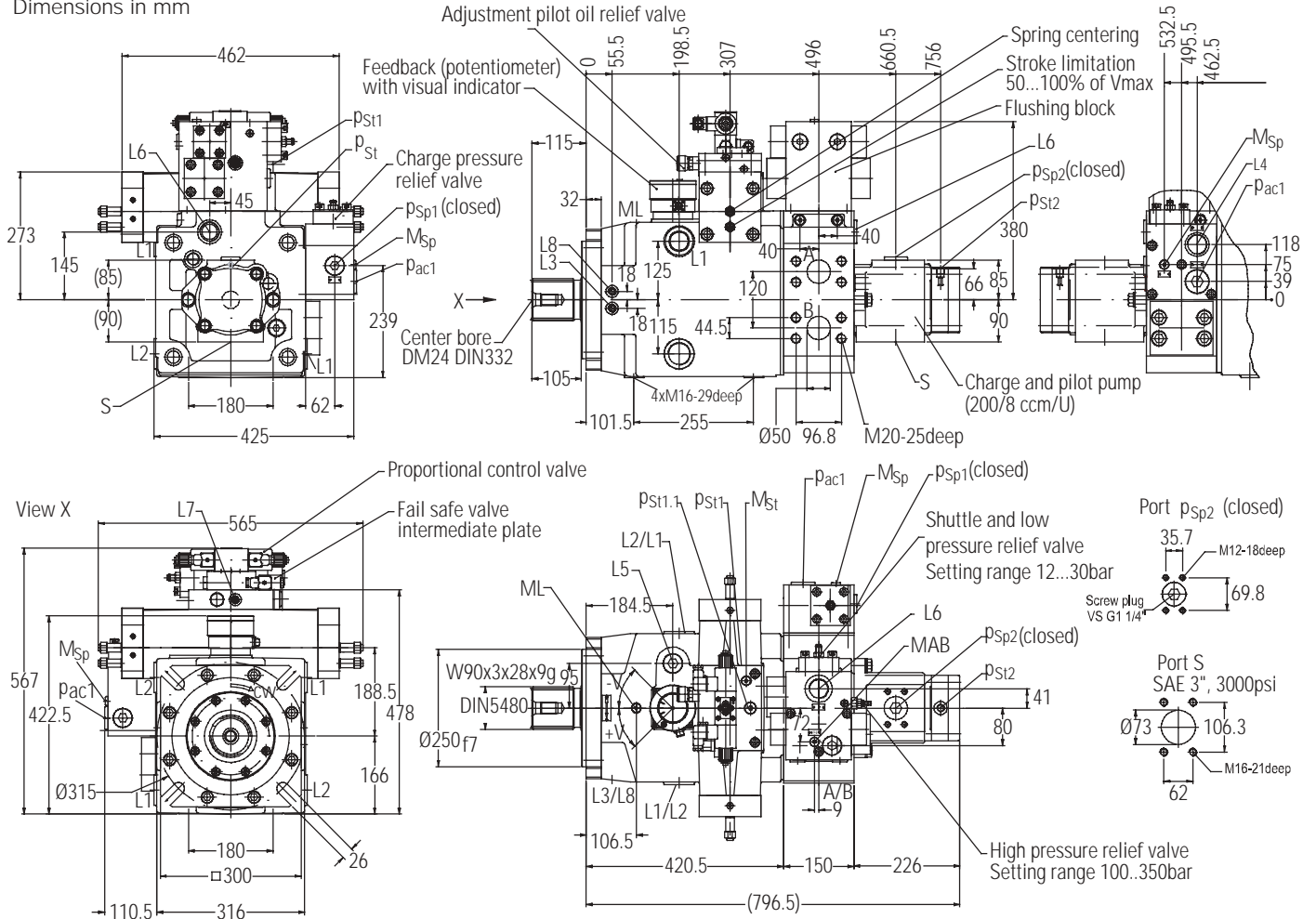
DIRECTION OF ROTATION	RANGE OF SWASH ANGLE	INPUT	OUTPUT
Right Hand Rotation	To + V <sub>max</sub>	B	A
	To - V <sub>max</sub>	A	B

For left hand rotation a special setup of charge and pilot pump is required!

A	System pressure port SAE 2", 6000 psi	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(p <sub>Sp2</sub> )	Additional charge pump outlet port M27x2
B	System pressure port SAE 2", 6000 psi	(L3.1)	Port G 1/8"	(MB)	Gauge port system pressure G 1/4"	p <sub>St1</sub>	Port of pilot pressure G 1/2"
(L1)	Drain port 1 5/8" - 12 UNF-2B (according to mounting position use upper port)	(L5)	Oil filling plug 1 1/16" - 12 UNF-2B	(ML)	Gauge port of case pressure G 1/4"	p <sub>St2</sub>	Pilot pump outlet port G 3/8"
L2	Drain port G 1/2" (according to mounting position use upper port)	(L6)	Drain port G 1" (flushing oil)	(M <sub>Sp</sub> )	Gauge port of charge pressure G 1/4"	S	Suction port of charge and pilot pump SAE 2", 3000 psi (common port)
		(L8)	Air bleeding port G 1/4"	(M <sub>St</sub> )	Gauge port of pilot pressure G 1/4"		
		(L9)	Drain port for low pressure relief valve G 1/4"	(p <sub>ac1</sub> )	Accumulator port G 1"		
				(p <sub>Sp1</sub> )	External port of charge pressure G 3/4"	(...)	Normally plugged

# Pump Dimensions - TVWS 750

Dimensions in mm



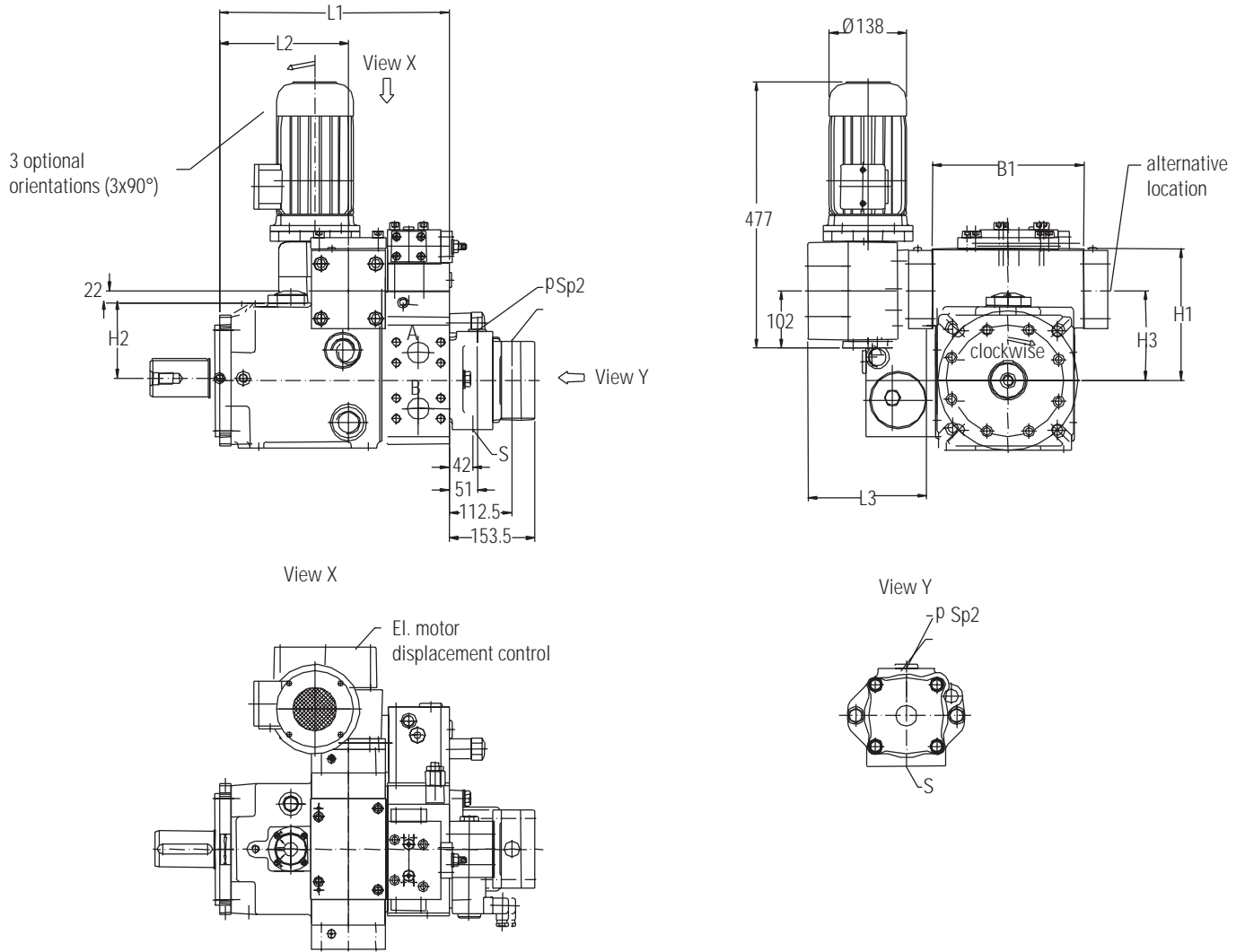
DIRECTION OF ROTATION	RANGE OF SWASH ANGLE	INPUT	OUTPUT
Right Hand Rotation	To + V <sub>max</sub>	B	A
	To - V <sub>max</sub>	A	B

For left hand rotation a special setup of charge and pilot pump is required!

A	System pressure port SAE 2", 6000 psi	L6	Drain port G 1 1/4" (flushing oil)	(p <sub>ac1</sub> )	Accumulator port G 1 1/4"	p <sub>Si2</sub>	Pilot pump outlet port G 3/8" ***
B	System pressure port SAE 2", 6000 psi	L7	Port G 3/8" for return line of control circuit	(p <sub>ac2</sub> )	Accumulator port G1 1/4" (optional)	S	Suction port of charge and pilot pump SAE 3", 3000 psi (common port)
(L1)	Drain port 1 5/8" - 12 UNF-2B*	(L8)	Air bleeding port G 1/4"	(p <sub>sp1</sub> )	External port of charge pressure G 1" (Port of charge pressure internal)	(...)	Normally plugged
L2	Drain port G 1 1/2" *	(MAB)	Gauge port system pressure G 1/4"	(p <sub>sp2</sub> )	Additional charge pump outlet port G 1/4"	*	According to mounting position use upper port
(L3)	Ventilation port for vertical mounting G 3/8" **	(ML)	Gauge port of case pressure G 1/4"				
L4	Drain port G 1 1/4" (charge oil)	(M <sub>Sp</sub> )	Gauge port of charge pressure G 1/4"	p <sub>Si1</sub>	Port of pilot pressure G 1/2" ***	**)	Shaft upwards
(L5)	Oil filling plug 1 1/16" - 12 UNF-2B	(M <sub>Si</sub> )	Gauge port of pilot pressure G 1/4"	(p <sub>Si1.1</sub> )	Port of pilot pressure G 3/8" ***	***)	Piping by HYDROKRAFT (alternatively p <sub>Si1</sub> or p <sub>Si1.1</sub> )

# Control Dimensions - TVWS 130/180/250/360/ 500/750 ES Control

Dimensions in mm



	L1	L2	L3	B1	H1	H2	H3
130*	365	203	216,5	256	192	120	130
180*	365	203	216,5	256	192	120	130
250	410	230	222	271	236	135	160
360	426	230	222	285	236	135	160
500	541,5	300	222	330	267,5	172	186
750	571	307	222	372	270	172	188,5

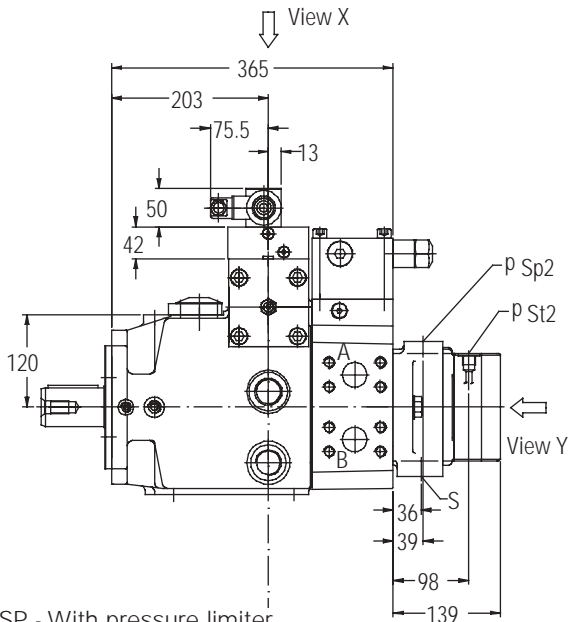
\* Only alternative location possible.

DISPLACEMENT (CCM)	
Pump Size	Charge Pump
130	40
180	40
250	63
360	87
500	125
750	200

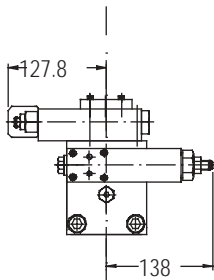
# Control Dimensions - TVWS 130/180 SP Control

Dimensions in mm

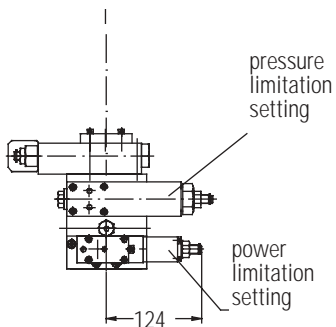
SP - With Prop. Valve  
CETOP 3



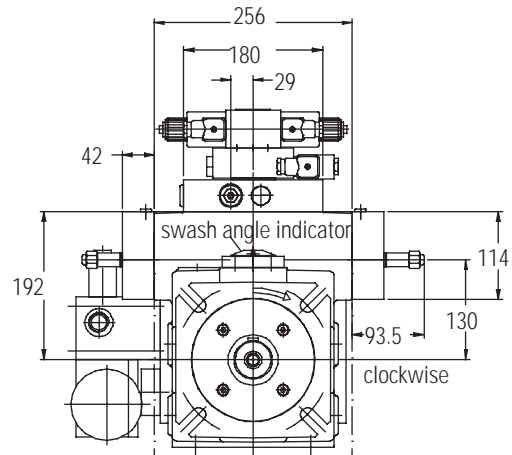
SP - With pressure limiter  
overriding function



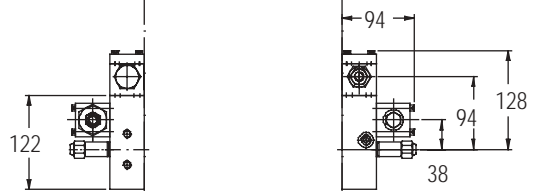
SP - With pressure limiter  
and power control overriding  
function



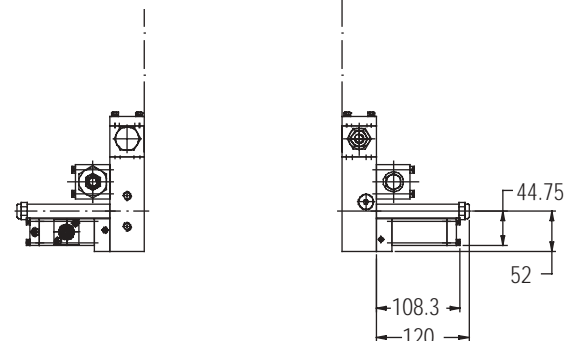
SP - With Prop. Valve  
CETOP 3 + Fail safe valve



SP - With pressure limiter  
overriding function



SP - With pressure limiter  
and power control overriding  
function

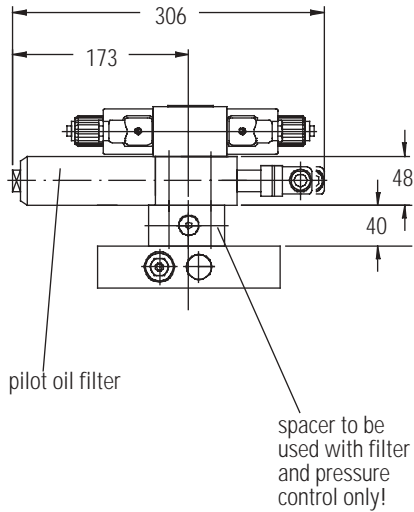




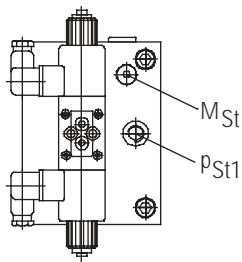
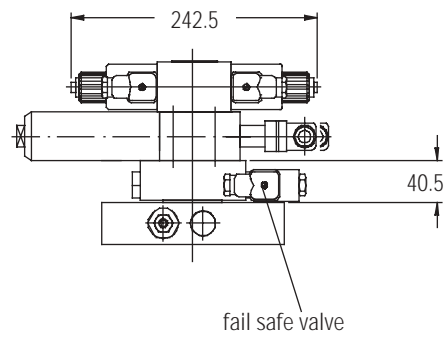
# Control Dimensions - TVWS 130/180 SP Control

Dimensions in mm

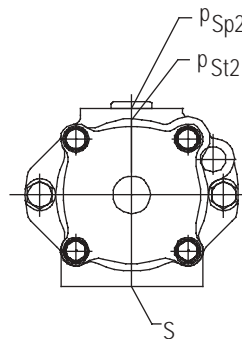
SP - With Prop. Valve CETOP  
3 + filter with el. indicator



SP - With Prop. Valve CETOP  
3 + filter with visual indicator  
+ fail safe valve



View Y

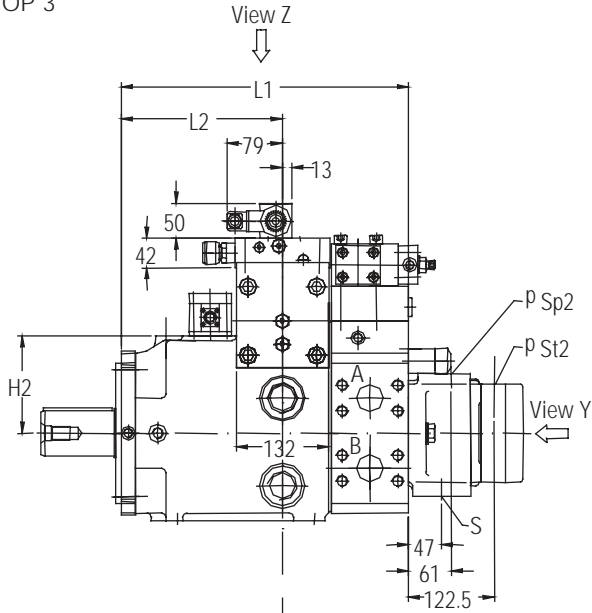


charge & pilot  
pump 40/8ccm

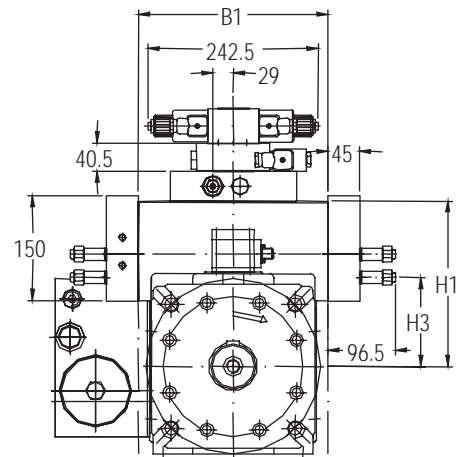
# Control Dimensions - TVWS 250/360/500/750 SP Control

Dimensions in mm

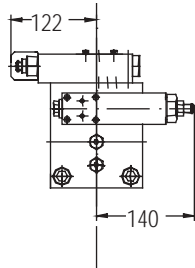
SP - With Prop. Valve  
CETOP 3



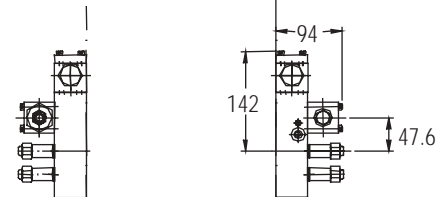
SP - With Prop. Valve  
CETOP 3 + Fail safe valve



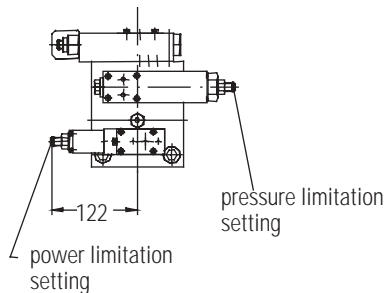
SP - With pressure limiter  
overriding function



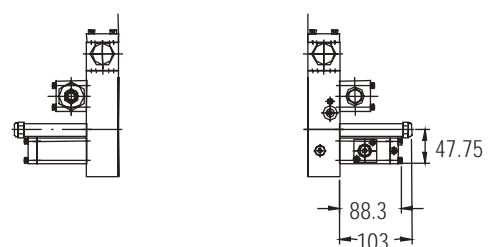
SP - With pressure limiter  
overriding function



SP - With pressure limiter and  
power control overriding  
function



SP - With pressure limiter and  
power control overriding  
function

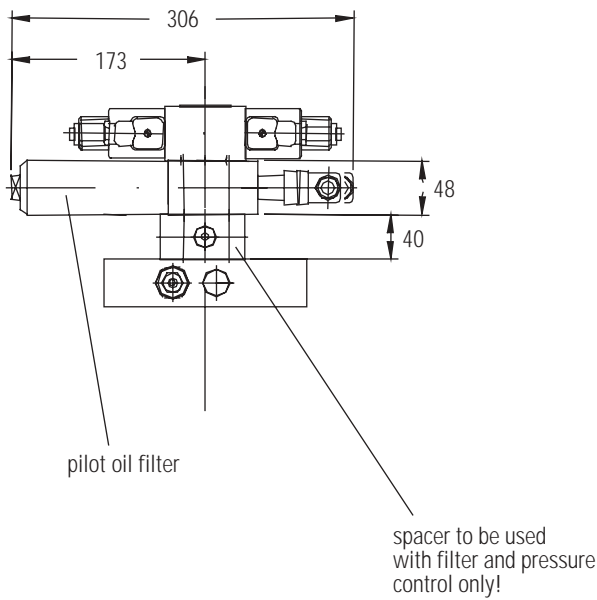


	L1	L2	B1	H1	H2	H3
250	410	230	271	236	135	160
360	426	230	285	236	135	160
500	541,5	300	330	267,5	172	186
750	571	307	372	270	172	188,5

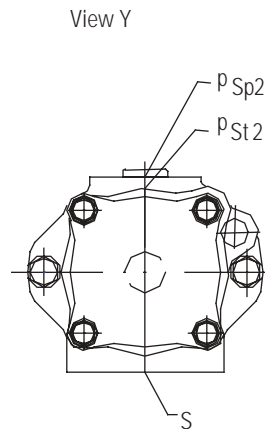
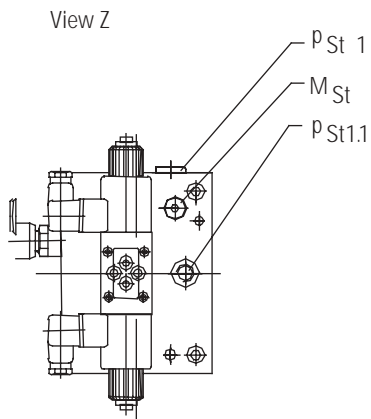
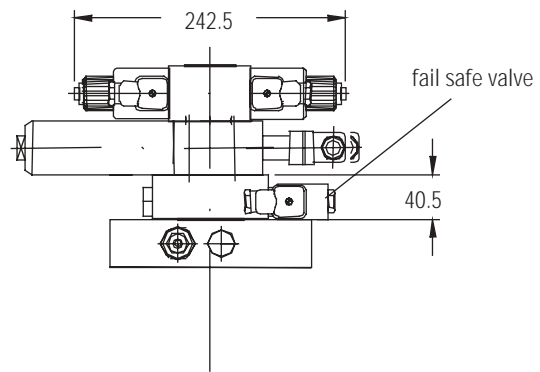
# Control Dimensions - TVWS 250/360/500/750 SP Control

Dimensions in mm

SP - With Prop. Valve CETOP  
3 + filter with el. indicator



SP - With Prop. Valve CETOP  
3 + filter with visual indicator  
+ fail safe valve



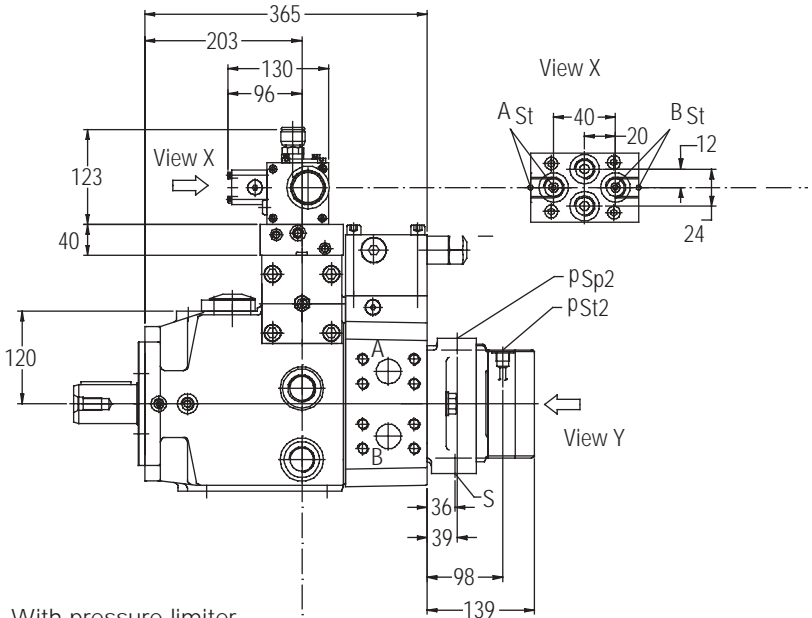
DISPLACEMENT FOR CHARGE PILOT PUMPS (CCM)

Pump Size	Charge Pump	Pilot Pump
250	64	8
360	80	8
500	125	8
750	200	8

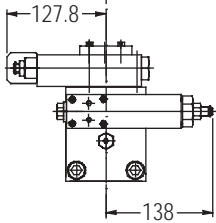
# Control Dimensions - TVWS 130/180 DP Control

Dimensions in mm

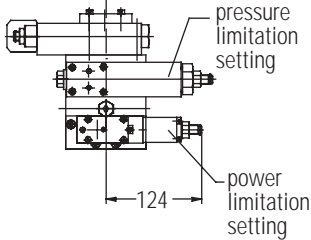
DP - With remote control



DP - With pressure limiter  
overriding function



DP - With pressure limiter  
and power control overriding  
function

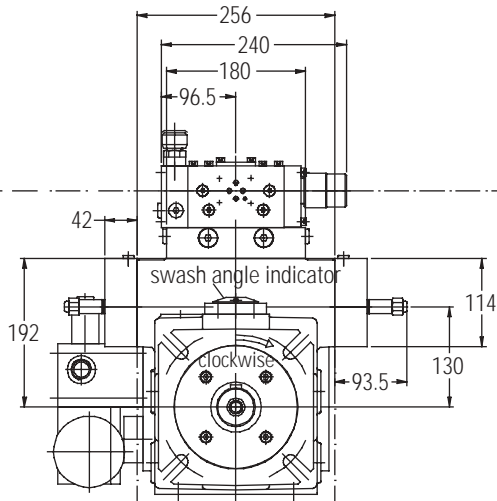


# Control Dimensions - TVWS 130/180 DP Control

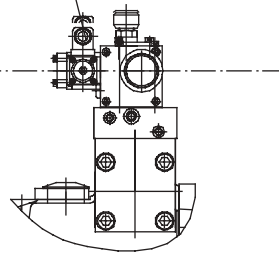
Dimensions in mm

DP - With mounting interface  
CETOP 3

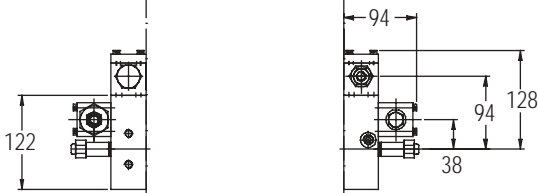
DP - With prop. relief



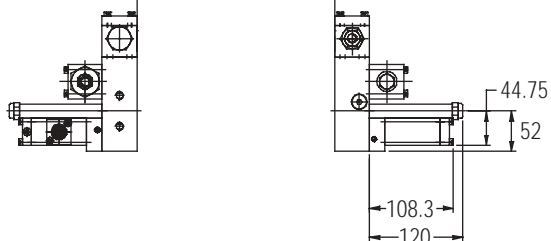
Prop. pressure  
valve NG6



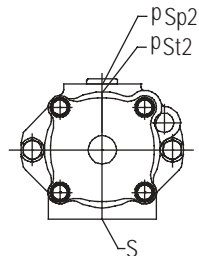
DP - With pressure limiter  
overriding function



DP - With pressure limiter  
and power control overriding  
function



View Y

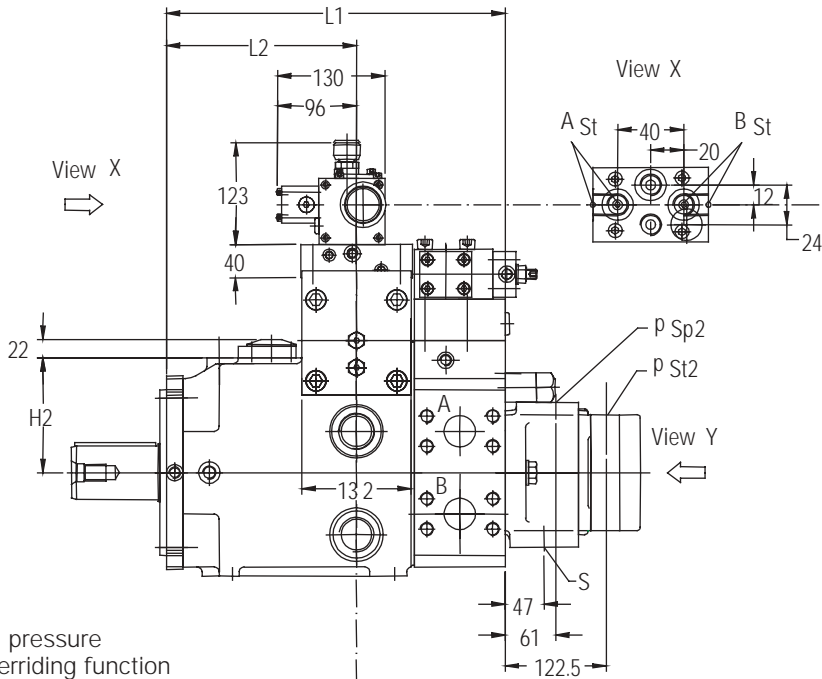


charge & pilot pump 40/8ccm

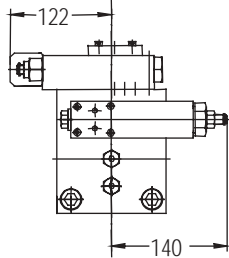
# Control Dimensions - TVWS 250/360/500/750 DP Control

Dimensions in mm

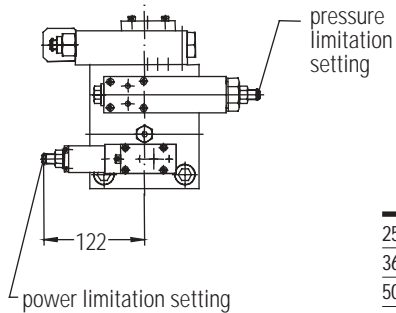
DP - With remote port



DP - With pressure  
limiter overriding function



DP - With pressure  
limiter and power  
control overriding function

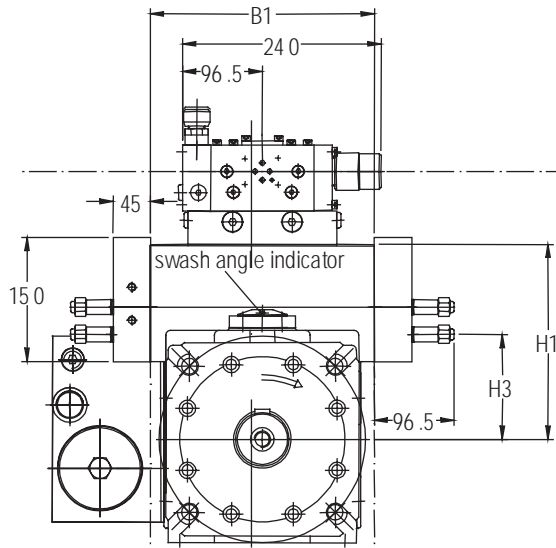


	L1	L2	B1	H1	H2	H3
250	410	230	271	236	135	160
360	426	230	285	236	135	160
500	541,5	300	330	267,5	172	186
750	571	307	372	270	172	188,5

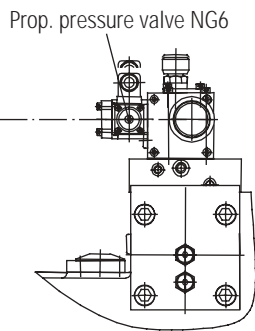
# Control Dimensions - TVWS 250/360/500/750 DP Control

Dimensions in mm

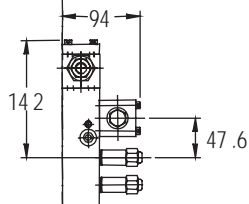
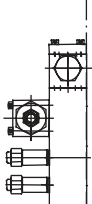
DP - With mounting interface  
CETOP 3



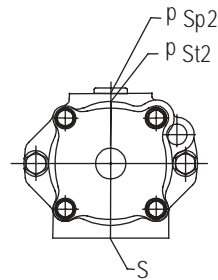
DP - With prop. relief



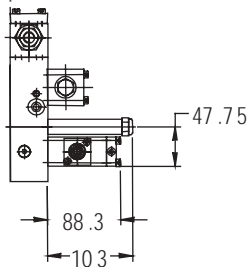
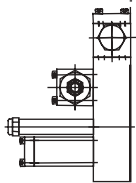
DP - With pressure  
limiter overriding function



View Y



DP - With pressure  
limiter and power  
control overriding function

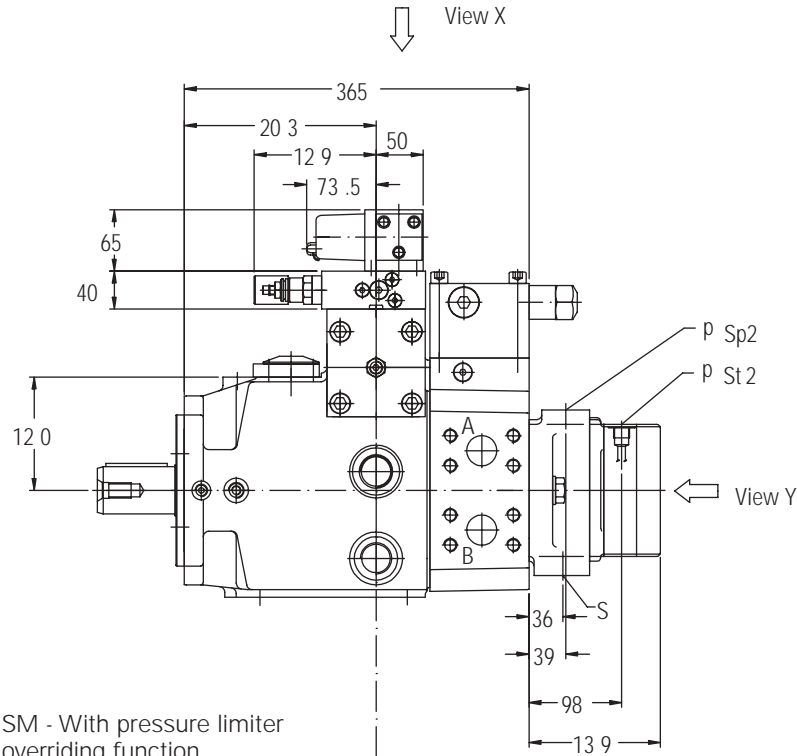


DISPLACEMENT FOR CHARGE PILOT PUMPS (CCM)

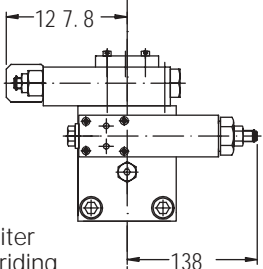
Pump Size	Charge Pump	Pilot Pump
250	64	8
360	80	8
500	125	8
750	200	8

# Control Dimensions - TVWS 130/180 SM Control

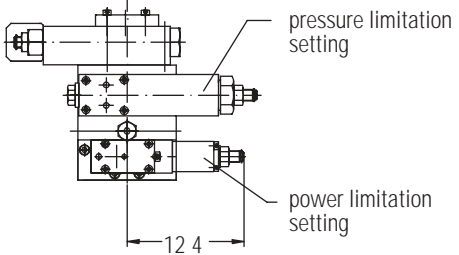
Dimensions in mm



SM - With pressure limiter  
overriding function



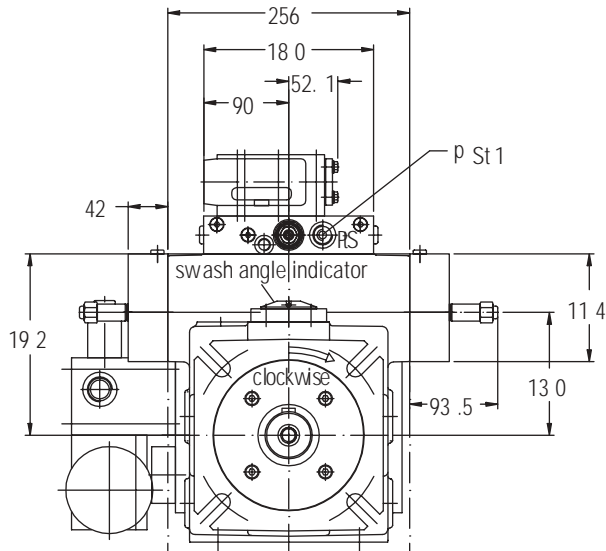
SM - With pressure limiter  
and power control overriding  
function



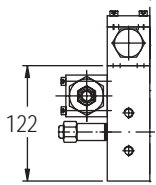


# Control Dimensions - TVWS 130/180 SM Control

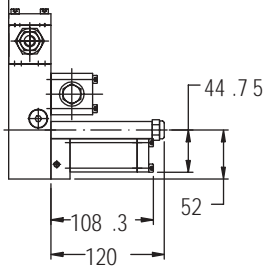
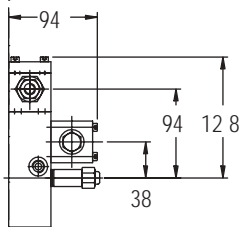
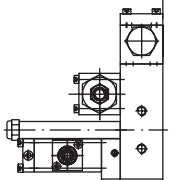
Dimensions in mm



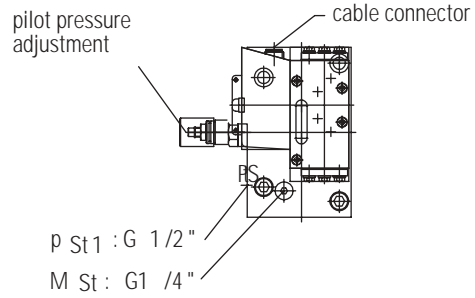
SM - With pressure limiter  
overriding function



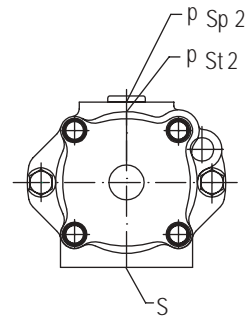
SM - With pressure limiter  
and power control overriding  
function



View X



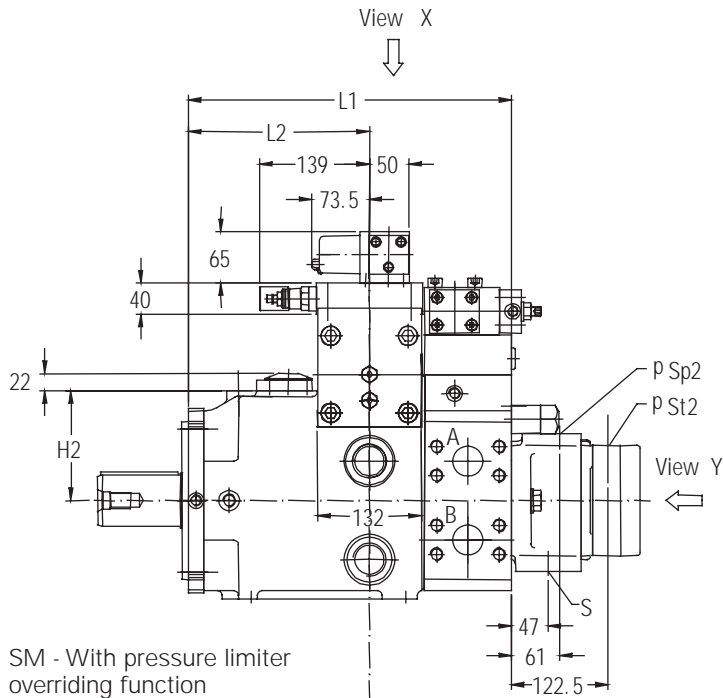
View Y



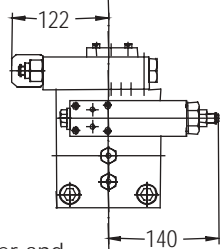
charge & pilot pump 4 0 / 8 ccm

# Control Dimensions - TVWS 250/360/500/750 SM Control

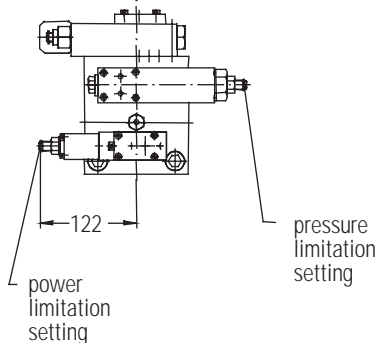
Dimensions in mm



SM - With pressure limiter  
overriding function



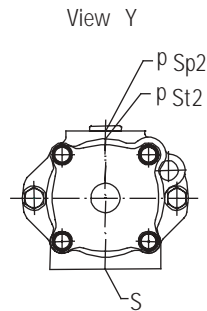
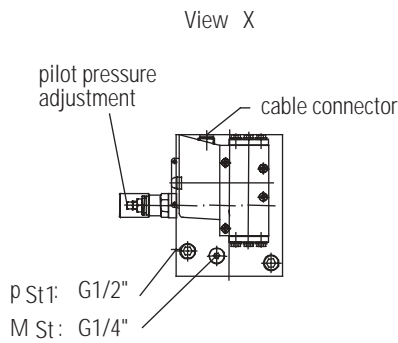
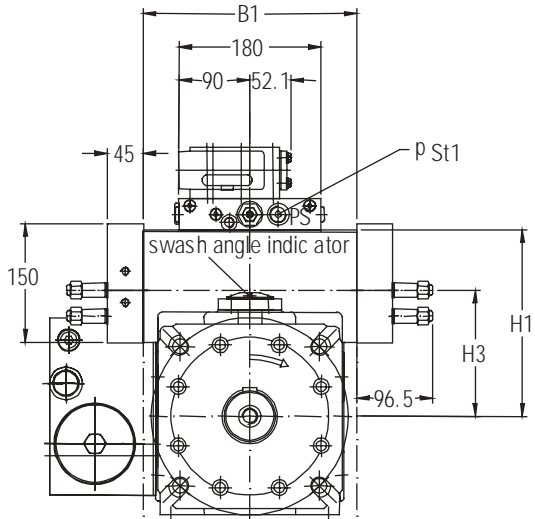
SM - With pressure limiter and  
power control overriding  
function



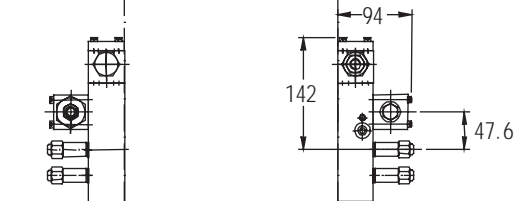
	L1	L2	B1	H1	H2	H3
250	410	230	271	236	135	160
360	426	230	285	236	135	160
500	541,5	300	330	267,5	172	186
750	571	307	372	270	172	188,5

# Control Dimensions - TVWS 250/360/500/750 SM Control

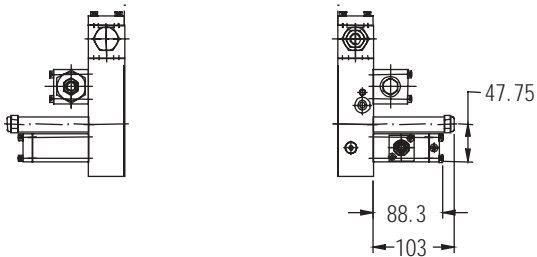
Dimensions in mm



SM - With pressure limiter  
overriding function



SM - With pressure limiter  
and power control overriding function



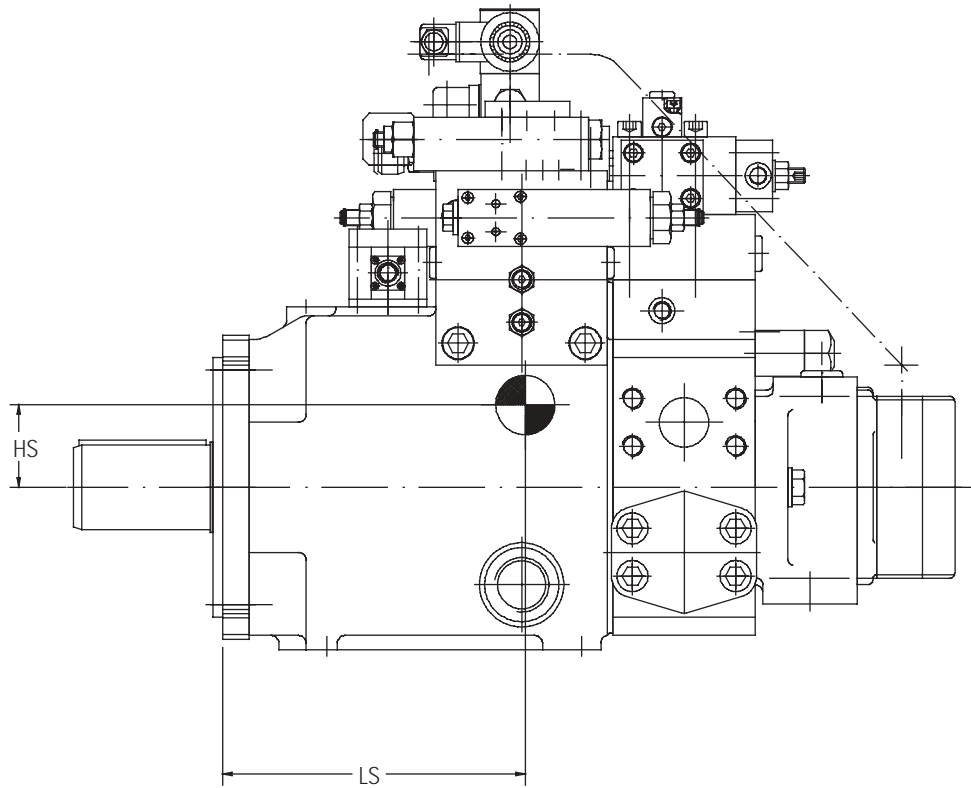
DISPLACEMENT FOR CHARGE PILOT PUMPS (CCM)

Pump Size	Charge Pump	Pilot Pump
250	64	8
360	80	8
500	125	8
750	200	8

# Control Dimensions - TVWS Position of Center of Gravity

130/180/250/360/500/750  
SP - DR

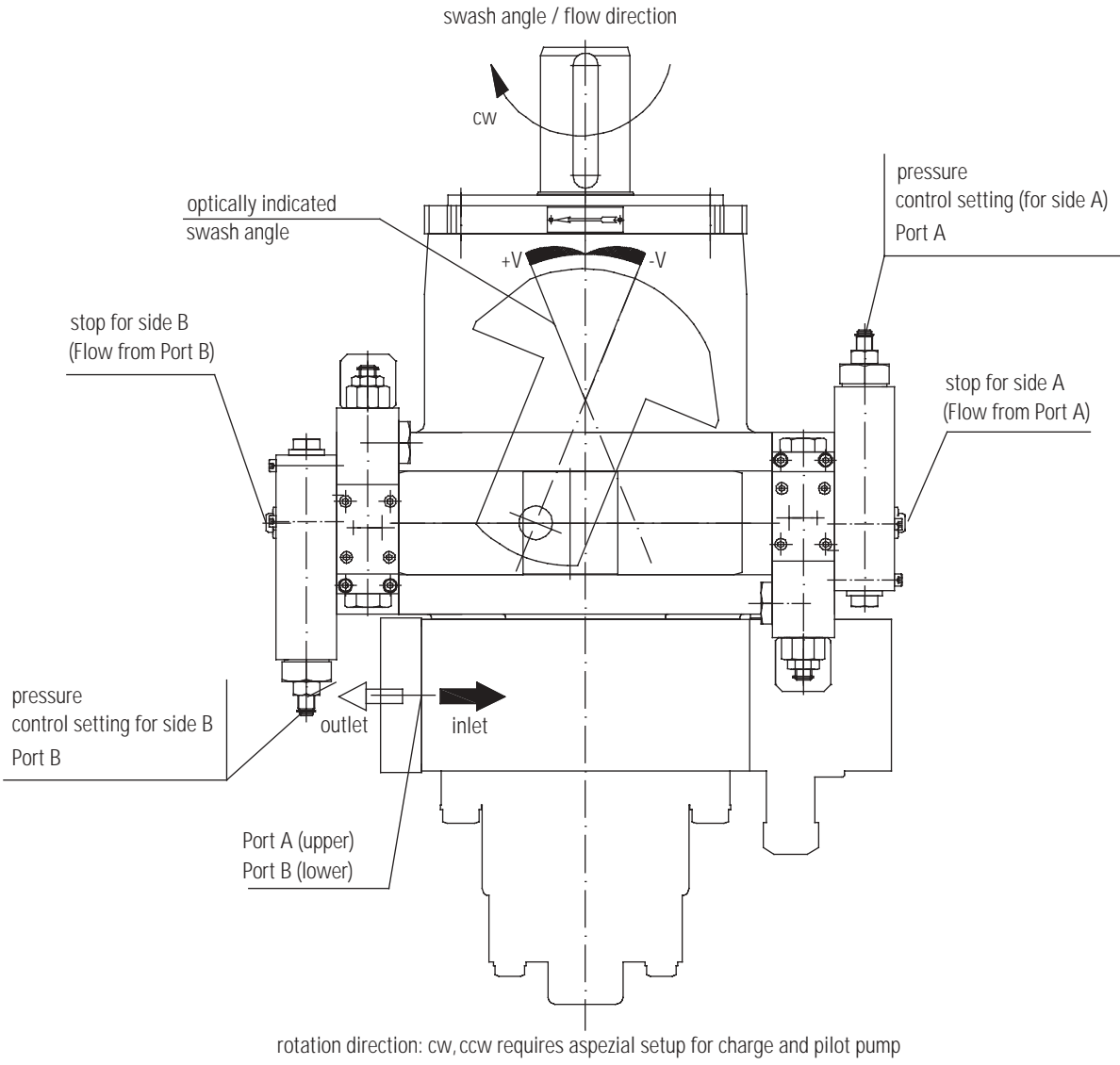
Dimensions in mm



TVW SIZE	WEIGHT KG	LS MM	HS MM
130	160	205	55
180	165	205	55
250	235	233	63
360	240	250	63
500	420	306	55
750	460	318	65

# TVW - Swash Angle/ Flow Direction

Dimensions in mm

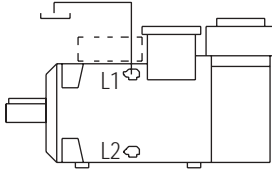
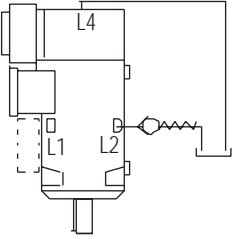


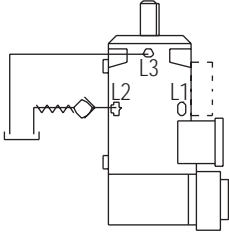
	ACTUATOR PISTON STOP A (+V)	STOP B (-V)
Inlet port	B	A
Outlet port	A	B

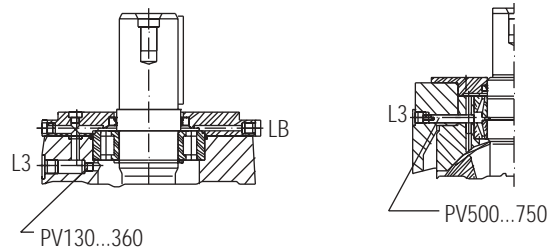
# Application Data

## Installation position

Installation position is optional however note bearing lubrication with respect to mounting

INSTALLATION POSITION	DRAIN PIPING	INSTALLATION POSITION	DRAIN PIPING
<p>Shaft horizontal</p> <p>Pump can be rotated freely about the lateral axis</p> <p>Use the highest case drain connection L<sub>1</sub> or L<sub>2</sub></p>		<p>Shaft pointed downwards</p> <p>Use ventilation line L<sub>4</sub></p> <p>Prime main case drain connection L<sub>2</sub> (L<sub>1</sub>) with 0,2 bar (2.9 psi)</p>	

INSTALLATION POSITION	DRAIN PIPING	INSTALLATION POSITION	DRAIN PIPING
<p>Shaft pointed upwards</p> <p>Use ventilation line L<sub>3</sub></p> <p>Pre load drain port case drain connection L<sub>2</sub> (L<sub>1</sub>) with 0.2 bar (2.9 psi)</p>		<p>Vertically mounted</p> <p>Internal connection to be closed with pin no. HC46082101401</p> <p>Internal connection close with plug G 1/8"</p> <p>Horizontally mounted</p> <p>Internal connection open L<sub>3</sub> plugged</p>	



# Application Data

## Fluid Recommendations

### Case Flushing Requirements

A check valve must not be used in the drain pipe. The drain pipe must interminate below the oil level in the reservoir.

For all other conditions with low pressure < 20 bar (<300 psi) and low flow (<10% of Qmax) case flushing is required.

For operation with special fluids HFB and HFC, case flushing is recommended.

### Flushing Flow

Flushing flow via the pump case should be >1% of maximum pump flow. Maximum flushing flow depends on case pressure.

### Notes:

- All listed ratings are based on the use of a good quality fluid.
- Alternative fluids have a reduced tolerance for contamination over petroleum base fluids. Good filtration is therefore critical.
- The pumps will provide exceptional life when used with a good quality clean fluid at the pump ratings specified for that fluid.

### Fluids

Pumps in the catalogue are primarily designed to operate with conventional petroleum based hydraulic oil. Alternative fluids and restrictions:

- Fluid maintenance is critical to the durability of all hydraulic components, and particularly so with hydraulic pumps. This becomes even more of a factor when alternative fluids are used. All types of alternative fluids require extensive maintenance in order to maintain proper levels of water content, acidity, viscosity and contamination.

### Fluid Cleanliness

These pumps are rated for anti-wear petroleum fluids with a contamination level of 18/15/13 per ISO 4406. Operation in fluids with levels more contamination than this is not recommended and may reduce the life of the pump components. Fluids other than petroleum, severe service cycles, or temperature extremes

are cause for adjustment of these codes. Please contact your Eaton representative for special duty cycle recommendations.

Eaton pumps, as well as any variable displacement piston pumps, will operate with apparent satisfaction in fluids up to the rating specified here.

Experience has shown, however, that pump and hydraulic system life is not optimised with high fluid contamination levels (high ISO cleanliness codes).

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials, and additives for protection against wear of inclusion of air.

Essential information on the correct methods for treating hydraulic fluid is included in Eaton publication 561- "Vickers Guide to Systemic Contamination Control"-available from your local Eaton distributor.

In this publication, filtration and cleanliness levels for extending the life of axial piston pumps and other system components are listed. Included is an excellent discussion of the selection of products needed to control fluid condition.

### Ordering Procedure

When ordering please specify full model designation of items required; see "Model Codes" section of this catalogue..

Note the following:

- Designation of variable displacement pumps must include the supplementary designation of the required control

## FLUIDS

TYPE	CLASSIFICATION	MAX. PRESSURE BAR	MAX. SPEED RPM	RECOMMENDED SEAL MATERIAL	MAX OPERATING TEMPERATURE °C	BEARING LIFE
Oil in Water Emulsion	HFAE	Not Rated				0
Water in oil Emulsion	HFB	250	1800	Fluorocarbon	49	50%
Water Glycol	HFC	250	1800	Fluorocarbon	49	25%
Phosphate Ester	HFDR	350/420	1800	Fluorocarbon	66	100%
Polyol Ester	HFDU	350/420	1800	Fluorocarbon	66	100%

\*Refer to the general specifications for the displacement speed limitation

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