# PISTON PUMP
## TPV Series 1 & Series 2
## Variable Displacement Pump



### Open Circuit

**Size 18...140**

**Series 1**
**Nominal Pressure 280 BAR**
**Peak pressure 350 BAR**

**Series 2**
**Nominal pressure 250 bar**
**Peak pressure 315 bar**

FEATURES:

Variable displacement axial piston pump of swashplate design
Flow is proportional to drive speed and displacement
SAE mounting flange and shaft
Flange connections to SAE
2 case drain ports
Good suction characteristics
Permissible continuous pressure 280 Bar
Low noise level
Long service life
Axial and radial loading of drive shaft possible
High power-weight ratio
Wide range of controls
Short response times
Through drive option for multi circuit system

# Model Code

# SAE mounting flange

| TPV | - | 1 | - | 071 | - | PF1 | - | S | 14 | - | R | - | TD | - | B | - | 62 | - | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Description | Series | Displacement in cc/rev | Control Device | Shaft Type | No of Spline Teeth | Shaft Rotation | End Cover | Mounting Flange | Service Line Connection | Through Drive spline coupling No of teeth |
|---|---|---|---|---|---|---|---|---|---|---|
| **T** (Tidal) | **1** 280 Bar Continious. 350 Bar peak | **018** (SAE A 2 Bolt Mount) | **P** Pressure Control | **S** Spline | **9** (5/8" Dia) **11** (3/4" Dia) | **Viewed** From Shaft End | | | | **61** End Ports Flanged |
| | | **028** (SAE B 2 Bolt Mount) | **PRG** Remote Pressure Control | **U** Spline | **13** (7/8" Dia) | **R** Right Hand Rotation | **N** No Through Drive | N/A | | **62** Side Ports Flanged |
| **P** (Pump) | | **045** (SAE B 2 Bolt Mount) | **PF** Pressure & Flow Control | **R** Spline | **13** (7/8" Dia) **15** (1" Dia) | **L** Left Hand Rotation | | | | **64** End Ports Threaded |
| **V** (Variable) | **2** 250 Bar Continious. 315 Bar peak | **063** (SAE B 2 Bolt Mount) | **PF1** Pressure & Flow Control (Orifice Plugged) | **K** Key | **15** (1" Dia) | | | **A** (3 1/4") | | **9** (5/8" Dia) **11** (3/4" Dia) **13** (7/8" Dia) |
| | | **071** (SAE C 2 Bolt Mount) | **PFLR** Pressure, Flow & Torque Control (HP Control) | | **14** (1 1/4" Dia) | | **TD** Through Drive | **B** (4") | All Side Ports No Code | **15** (1" Dia) **14** (1 1/4" Dia) |
| | | **100** (SAE C 2 Bolt Mount) | | | **14** (1 1/4" Dia) **17** (1 1/2" Dia) | | | **C** (5") | | **17** (1 1/2" Dia) |
| (Variable Displacement) | (Swashplate Design) | **140** (SAE D 4 Bolt Mount) | **FD** Fixed Displacement (No Control) | | **13** (1 3/4" Dia) | | | **D** (6") | | **13** (1 3/4" Dia) |

| Size | | 18 | 28 | 45 | 63 | 71 | 100 | 140 |
|---|---|---|---|---|---|---|---|---|
| Parrallel with keys | K | 3/4" | 7/8" | 1" | 1" | 1 1/4" | 1 1/2" | 1 3/4" |
| Spline shaft SAE (non through drive) | U | 9T (5/8") | | 13T (7/8") | | | 14T (1 1/4") | |
| Spline shaft SAE (non through drive) | S | 11T (3/4") | 13T (7/8") | 15T (1") | 14T (1 1/4") | 14T (1 1/4") | 17T (1 1/2") | 13T (1 3/4") |
| Spline shaft SAE (through drive) | S | | 13T (7/8") | 15T (1") | 14T (1 1/4") | 14T (1 1/4") | 17T (1 1/2") | 13T (1 3/4") |
| Spline shaft SAE (through drive)(High Torque) | R* | | 13T (7/8") | 15T (1") | | 14T (1 1/4") | 17T (1 1/2") | |

R* Non Standard

## End Cover (Series 1 unless noted)

| Size | | 18 | 28 | 45 | 63 | 71 | 100 | 140 |
|---|---|---|---|---|---|---|---|---|
| | N61 | | | | | * | | * |
| Without through drive | N62 | * | * | * Series 1 | * Series 2 | * | * | * |
| | N64 | | | * Series 2 | | | | |
| With through drive mounting | | Coupling Splines (through drive option only for series 1) | | | | | | |
| SAE A   Spline shaft   5/8" (15.875) | TD-A | - | 9 | 9 | - | 9 | 9 | 9 |
| SAE A-B   Spline shaft   3/4" (19.05) | TD-A | - | 11 | 11 | - | 11 | 11 | 11 |
| SAE B   Spline shaft   7/8" (22.22) | TD-B | - | | 13 | - | 13 | 13 | 13 |
| SAE B-B   Spline shaft   1" (25.4) | TD-B | - | | 15 | - | 15 | 15 | 15 |
| SAE C   Spline shaft   1 1/4" (31.8) | TD-C | - | | | - | 14 | 14 | 14 |
| SAE C-C   Spline shaft   1 1/2" (38.1) | TD-C | - | | | - | | 17 | 17 |
| SAE D   Spline shaft   1 3/4" (44.4) | TD-D | - | | | - | | | 13 |

## Technical Data

### ● Operating pressure range-inlet

Absolute pressure at port S

P$_{abs\,min}$ _____ 0.8 Bar
P$_{abs\,max}$ _____ 30 Bar

### ● Operating pressure range-outlet

Pressure at port B
Nominal pressurre P$_N$ _____ 280 Bar
Peak pressure P$_{max}$ _____ 350 Bar

(Pressure data to DIN 24312)
Applications with intermittent operating pressures
up to 315 Bar at 10% duty are permissible.
Limitation of pump output pressure spikes is possible
with relief valve blocks mounted directly on flange
connection.

### ● Case drain pressure

Maximum permissible pressure of leakage fluid (at port L,L$_1$);
Maximum 0.5 Bar higher than the inlet pressure at port S,
but no higher than 2 Bar Absolute

### ● Direction of through flow

S to P

Determination of inlet pressure P$_{abs}$ at
suction port S or reduction of displacement
for increasing speed.



### ● Table of values (theoretical values,without taking into accout $\eta_{mh}$ and $\eta_v$:values rounded off)

| Size | | | 18 | 28 | 45 | 63 | 71 | 100 | 140 |
|---|---|---|---|---|---|---|---|---|---|
| Displacement (V$_{g\,max}$) | | cc/rev | 18 | 28 | 45 | 63 | 71 | 100 | 140 |
| Max.speed[1] at V$_{g\,max}$ (n$_o$ max) | | rpm | 3000 | 3000 | 2600 | 2600 | 2200 | 2000 | 1800 |
| Max.permitted speed (limit speed) (n$_o$ max) with increased input pressure P$_{abs}$ bzw.V$_g$<V$_{g\,max}$ | | rpm | 3600 | 3600 | 3100 | 3140 | 2600 | 2400 | 2100 |
| Max.flow | at n$_{o\,max}$ (q$_{vo\,max}$) | L/min | 54 | 84 | 117 | 163 | 156 | 200 | 252 |
| | at n$_E$=1500 min$^{-1}$ | L/min | 27 | 42 | 68 | 95 | 107 | 150 | 210 |
| Max.power | at n$_{o\,max}$ (P$_o$ max) | kW | 25 | 39 | 55 | | 73 | 93 | 118 |
| (△P= ) | at n$_E$=1500 min$^{-1}$ | kW | 13 | 20 | 32 | | 50 | 70 | 98 |
| Max.torque (△P= ) | at V$_{g\,max}$ (T max) | Nm | 80 | 125 | 200 | | 316 | 445 | 623 |
| Torque (△P= ) | at V$_{g\,max}$ (T) | Nm | 29 | 45 | 72 | 100 | 113 | 159 | 223 |
| Moment of inertia about drive axis | | Kgm$^2$ | 0.0011 | 0.0017 | 0.0033 | 0.0056 | 0.0083 | 0.0167 | 0.0242 |
| Case volume ) | | L | 0.7 | 0.7 | 1.0 | 0.8 | 1.6 | 2.2 | 3.0 |
| Weight (without fluid) | | Kg | 15 | 15 | 12 | 22 | 33 | 45 | 60 |
| | | N | 1000 | 1000 | 1500 | 1760 | 2400 | 4000 | 4800 |
| Max.permissible radial force[2] | | N | 770 | 1200 | 1500 | 2000 | 1900 | 2300 | 2800 |

1) These values are valid for an absolute pressure of 1 Bar at the suction port S.By reducing
   the displacement or increasing the input pressure the speed can be increased as shown in
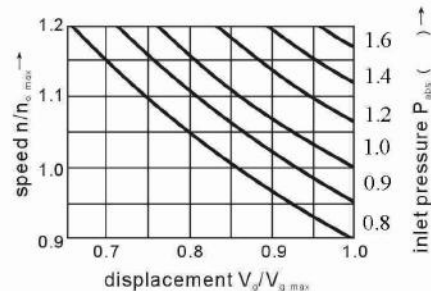   the diagram.
2) Please consult us for higher radial forces.



application of forces

### ● Determination of displacement

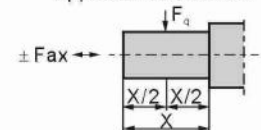Flow   $q_v = \dfrac{V_g \cdot n \cdot \eta_v}{1000}$   [L/min]

Torque   $T = \dfrac{1.59 \cdot V_g \cdot \triangle P}{100 \cdot \eta_{mh}} = \dfrac{V_g \cdot \triangle P}{20 \cdot \pi \cdot \eta_{mh}}$   [Nm]

Power   $P = \dfrac{T \cdot n}{9549} = \dfrac{2\pi \cdot T \cdot n}{60000} = \dfrac{q_v \cdot \triangle P}{600 \cdot \eta_t}$   [kW]

$V_g$ =displacement ( ) per revolution
$\triangle P$ = pressure differential ( )
$n$ = speed (rpm)
$\eta_v$ = volumetric efficiency
$\eta_{mh}$ = mechanical-hydraulic efficiency
$\eta_t$ = overall efficiency ( $\eta_t = \eta_v \cdot \eta_{mh}$ )

TPV......

# Fluid,Mechanical Displacement Limiter

## Hydraulic fluid

The TPV Variable Piston Pump is suitable for use with mineral oil.

## Operating viscosity range

In order to obtain optimum efficiency and service life,we recommend that the operating viscosity(at operating temperature) be selected from within the range

$\nu_{opt}$=operating viscosity 16...36 mm²/s

Referred to the reservoir temperature(open circuit).

## Viscosity limits

The limiting values for viscosity are as follows:

$\nu_{min}$=10 mm²/s
  short term at a max.permissible case temp. of 90℃.

$\nu_{max}$=1000 mm²/s
  short term on cold start

## Temperature range (see selection diagram)

$t_{min}$=-25℃
$t_{max}$=90℃

## Selection diagram
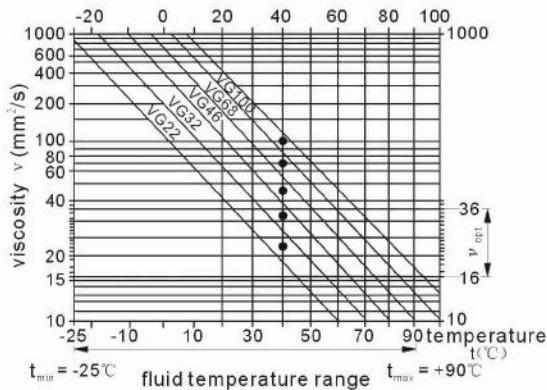


## Notes on the selection of the hydraulic fluid

In order to select the correct fluid,it is necessary to know the operating temperature in the tank (open loop) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range,the operating viscosity lies within the optimum range ( $\nu_{opt}$) (see shaded section of the selection diagram). We recommend that the higher viscosity range should be chosen in each case.

Example:At an ambient temperature of x℃ the operating temperature is 60℃.Within the operating viscosity range ( $\nu_{opt}$;shaded area), this corresponds to viscosity ranges VG46 or VG68;VG68 should be selected.

Important:The leakage oil (case drain oil) temperature is influenced by pressure and pump speed and is always higher than the tank temperature. However, at on point in the circuit may the temperature exceed 90℃.

If it is not possible to comply with the above conditions because of extreme operating parameters or high ambient temperatures please consult us.

## Filtration

The finer the filtration the better the cleanliness of the pressure fluid and the longer the life of the axial piston unit. To ensure the functioning of the axial piston unit a minimum cleanliness level of:

9 to NAS 1638
18/15 to ISO/DIS 4406 is necessary

if above mentioned grades cannot be maintained please consult supplier.

## Mechanical displacement limiter

Mechanical displacement limiter is possible on the nonthrough-drive model, N62 but not for N61 and N64

$V_{gmax}$: for sizes to 140
  setting range $V_{gmax}$ to 50% $V_{gmax}$ stepless

$V_{gmin}$: for sizes 100 and 140
  setting range $V_{gmin}$ to 50% $V_{gmin}$ stepless

Optional installation position. The pump housing must be filled with fluid during commissioning and remain full when operating. In order to attain the lowest noise level, all connections(suction, pressure,case drain ports) must be linked by flexble couplings to tank.
Avoid placing a check valve in the case drain line.
This may, however, be permissible in individual cases, after consultation with us.

### 1. Vertical installation (shaft end upwards)

The following installation conditions must be taken into account:

#### 1.1.Arrangement in the reservoir

Before installation fill pump housing,keeping it in a horizontal position.
a) If the minmum fluid level is equal to or above the pump mounting face close port "L"plugged, leave ports "L₁" and "S" open; L₁ piped and recommendation S piped (see Fig.1).
b) If the minmum fluid level is below the pump mounting face pipe port "L₁" and "S" according to Fig.2.
Close port "L" with respect taking into consideration conditions in 1.2.1.
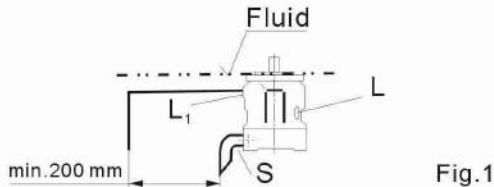


Fig.1

#### 1.2. Arrangement outside the reservoir

Before installation fill the pump housing, keeping it in a horizontal position.For mounting above resrvoir see Fig.2.

#### Limiting condition:

1.2.1. Minimum pump inlet pressure $P_{abs\,min}$ = under both static and dynamic conditions.
Note: Avoid mounting above reservoir wherever possible in order to achieve a low noise level.
The permissible suction height h comes from the overall pressure loss, but may not be bigger than $h_{max}$ = 800 mm (immerdion depth $h_{t\,min}$ = 200mm).
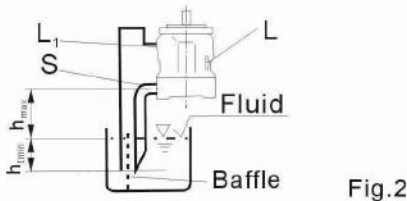


Fig.2

Overall pressure loss $\triangle P_{tot}$ = $\triangle P_1 + \triangle P_2 + \triangle P_3 \leqslant (1 - P_{abs\,min})$ = 0.2 Bar

$\triangle P_1$: Pressure loss in pipe due to accelerating column of fluid

$$\triangle P_1 = \frac{\rho \cdot l \cdot dv}{dt}$$ 10.5 (Bar)

$\triangle P_2$: Pressure loss due to static head

$\triangle P_2 = h \cdot \rho \cdot g$ 10.5 (Bar)

$\triangle P3$: Line losses (elbows etc.)

### 2. Horizontal installation

The pump must be installed,so that "L" or "L₁" is at the top.

#### 2.1.Arrangement in the reservoir

a) If the minimum fluid level is above the top of the pump, port "L₁" closed,"L" and "S" should remain open, L piped and recommendation S piped (see Fig.3)
b) If the minimum fluid level is equal to or below the top of the pump, pipe ports "L" and possibly "S" as Fig.4.; close port "L₁".
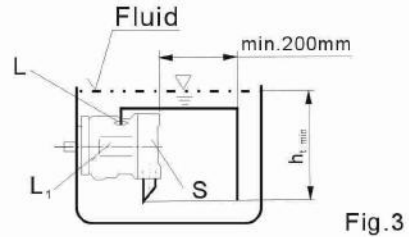The conditions acconrding to tiem 1.2.1.



Fig.3

#### 2.2. Installation outside the reservoir

Fill the pump housing before commissionsing.
Pipe ports "s" and the higher port "L" or "L₁".
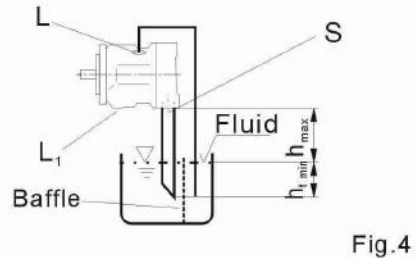a) When mounting above the reservoir, see fig.4. Conditions according to 1.2.1.



Fig.4

b) Mounting below the reservoir
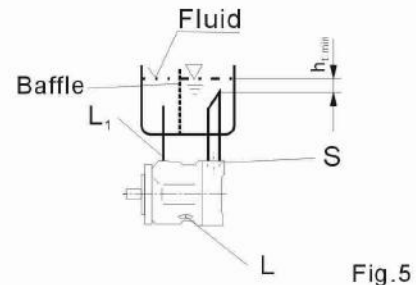Pipe ports "L₁" and "S" according to Fig.5, close port "L".



Fig.5

$\rho$ = density(kg/m³)
l = pipe lenght (m)
dv/dt = rate of change in fluid velocity(m/s²)
h = height( m)
$\rho$ = density( kg/m³)
g = gravity=9.81m/s²

# Installation Dimensions

## TPV-1-018-xx-xx-x-XX

**DFR/DFR1** Pressure /flow control with port plate 12; clockwise rotation



Port plate 12

Flange ISO 3019-1 82-2 (SAE A)

Valve mounting for counter clockwise rotation

View V

View W
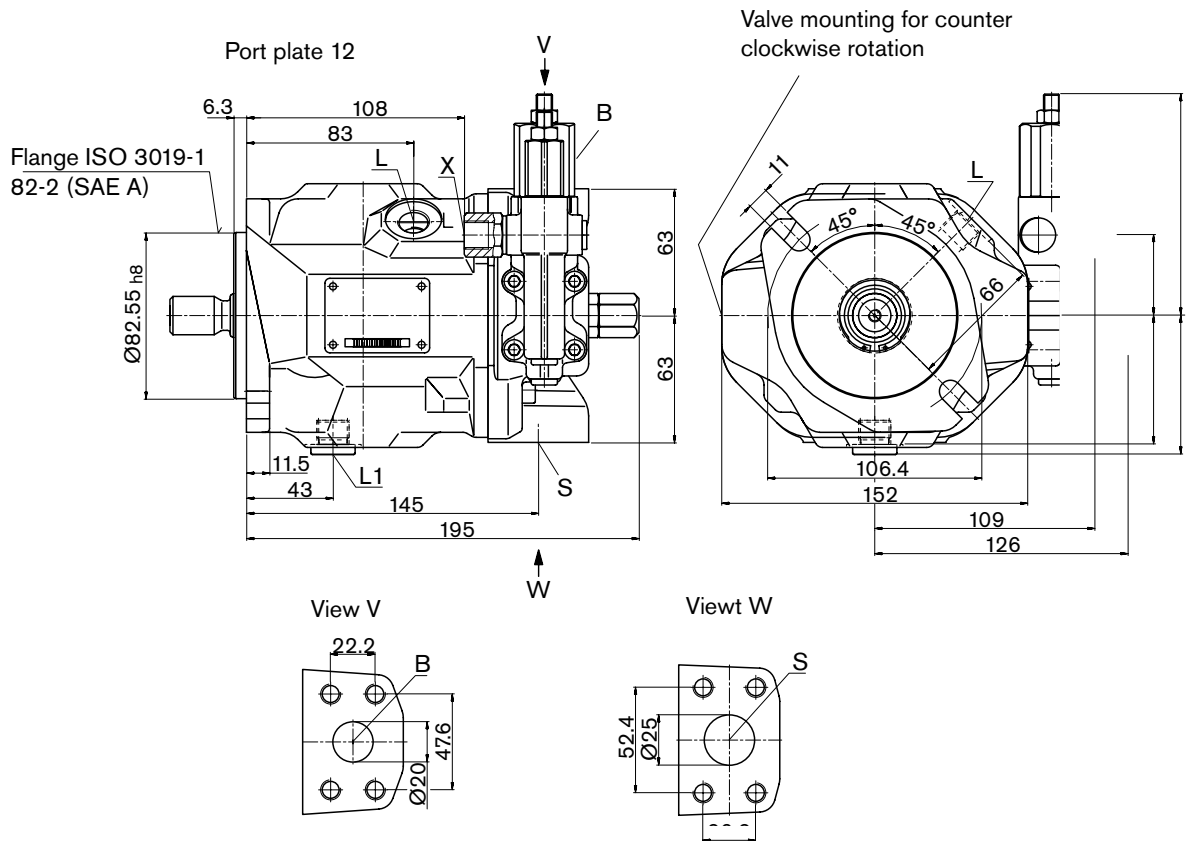
### Ports

| Designation | Port for | Standard | Size | Peak pressure [bar] [2] | State |
|---|---|---|---|---|---|
| B<br>Port plate 12 | Service line (standard pressure range)<br>Fixing thread | SAE J518<br>DIN 13 | 3/4 in<br>M10; 17 deep | 350 | O |
| S<br>Port plate 12 | Inlet (standard pressure range)<br>Fixing thread | SAE J518<br>DIN 13 | 1 in<br>M10; 17 deep | 5 | O |
| L | Case drain | DIN 3852 | M16x1,5 | 2 | O [4] |
| L | Case drain | DIN 3852 | M16x1,5 | 2 | plugged [4] |
| X | Pilot pressure | DIN 3852 | M14x1,5; 12 deep | 350 | O |
| X | Control press. for DG control | DIN 3852 | G 1/4 in | 120 | O |

[2] Application dependent pressure spikes can occur.. Please consider this when selecting measuring equipment or fittings

[4] Dependent on the installation position, port L or $L_1$ must be connected

O = Must be connected (plugged on delivery)

## Installation Dimensions

## TPV-1-018-xx-xx-x-XX

### DG
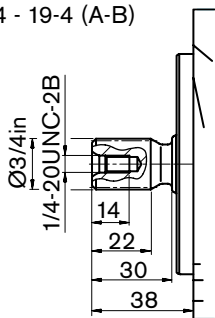Two point control, directly operated, port plate12

to mounting flange face

148

Valve mounting for counter
clockwise rotation

X

3

25 +0.4

G 1/4 in

12
89
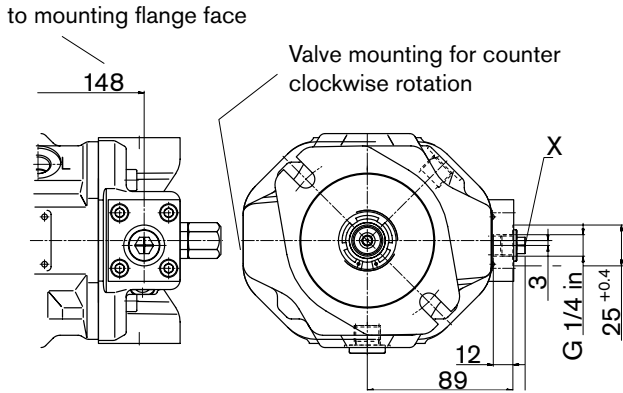
### DR
Pressure control, port plate 12

Valve mounting for counter
clockwise rotation

max. 110
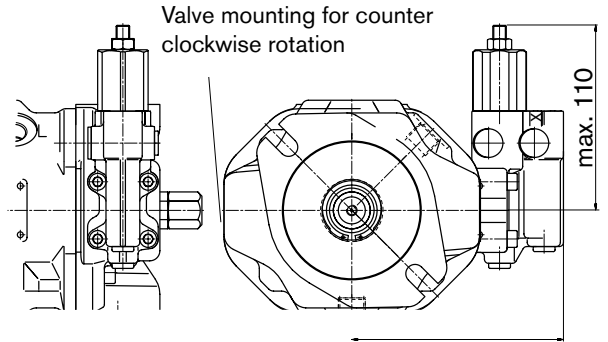
### DRG
Pressure control, remote, port plate 12

to mounting flange face

108

Valve mounting for counter
clockwise rotation

X

max. 110

40
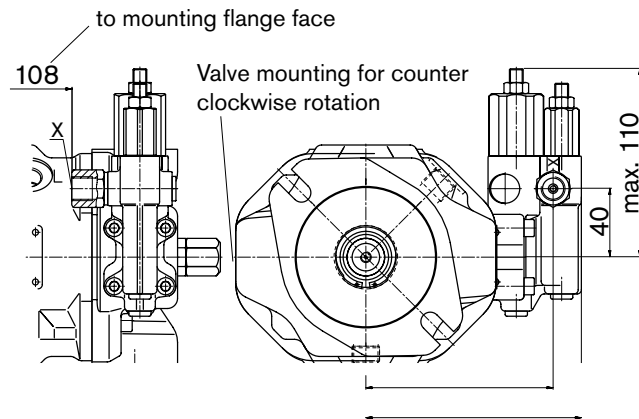
### Drive shafts

**S** splined shaft 3/4 in 11T 16/32 DP[1)]
SAE J744 - 19-4 (A-B)

Ø3/4in
1/4-20UNC-2B

14
22
30
38

**R** splined shaft 3/4 in 11T 16/32 DP[1)]
SAE J744 - 19-4 (A-B)

ø3/4 in
1/4-20UNC-2B

usable spline lenght

14
21
38
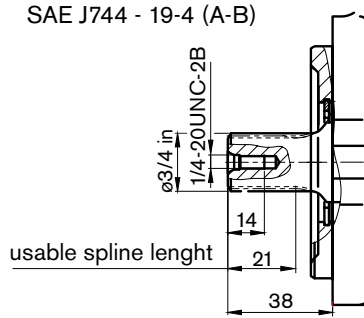
**U** splined shaft 5/8 in 9T 16/32 DP[1)]
SAE J744 - 16-4 (A)

centering [2)]
R 3.15 x 6.7 DIN 332

Ø5/8in

15.8
23.8
31.8
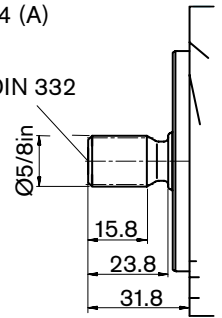
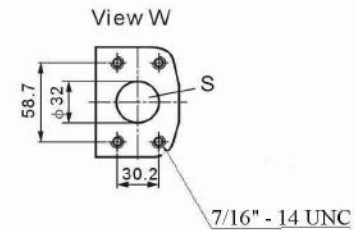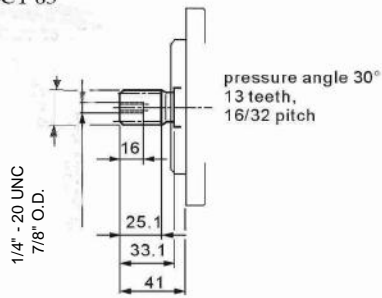[1)] ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5
[2)] Axial retention of coupling half eg. via clamp coupling or clamping bolt

## Installation Dimensions

TPV-1-028-xxx-xxx-x-N62 (without control valves)
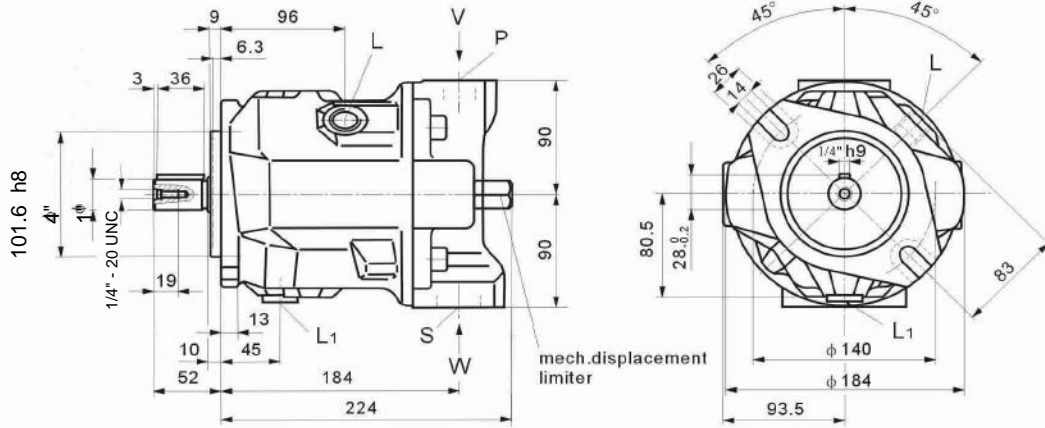Shaft K
SAE B

SAE B
2 hole
flange

101.6 h8
( φ 4" )

φ 7/8"

1/4" - 20 UNC

9
90
6.3
2
32
16
13
10
40
46
164
206
L
V
P
L₁
S
W
80
80

mech.displacement
limiter

45°
45°
26
14
φ 174
1/4"
75
24.5₋₀.₁
74
φ 140
φ 164
83.5
L
L₁
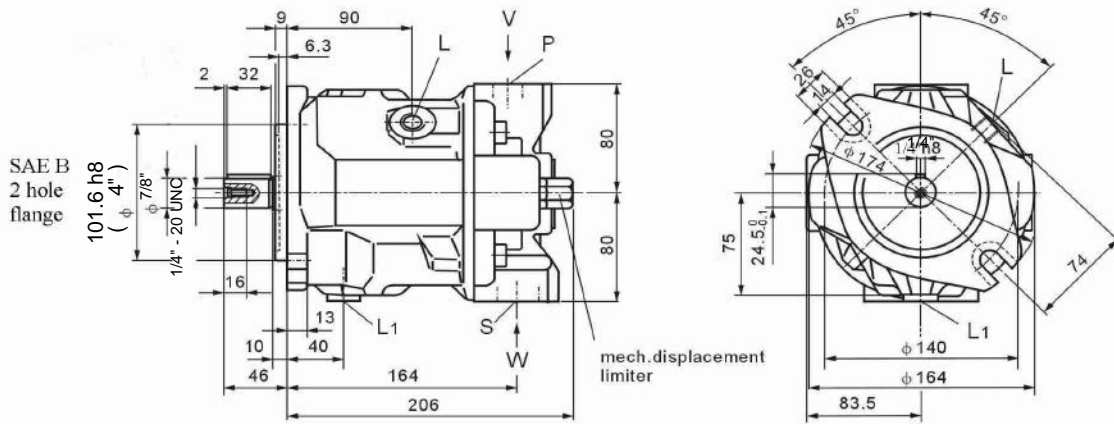
Shaft S13
Shaft 22.1; (SAE B)
SAE J744 OCT 83

pressure angle 30°
13 teeth,
16/32 pitch

1/4" - 20 UNC
7/8" O.D.

16
25.1
33.1
41

### View W

58.7
φ 32
30.2
S

7/16" - 14 UNC

### View V

47.6
φ 20
22.2
P

3/8" - 16 UNC
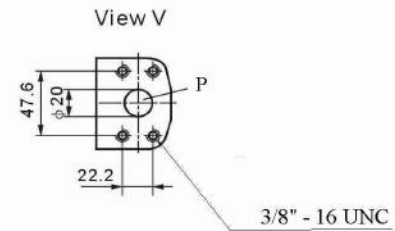
| | | | |
|---|---|---|---|
| P | Pressure port | SAE 3/4" | (Standard pressure range) |
| S | Suction port | SAE 11/4" | (Standard pressure range) |
| L/L₁ | Case drain ports | 3/4" - 16 UNO | (L₁ plugged at factory) |

TPV-1-045-xxx-xxx-x-N62 (without control valves)
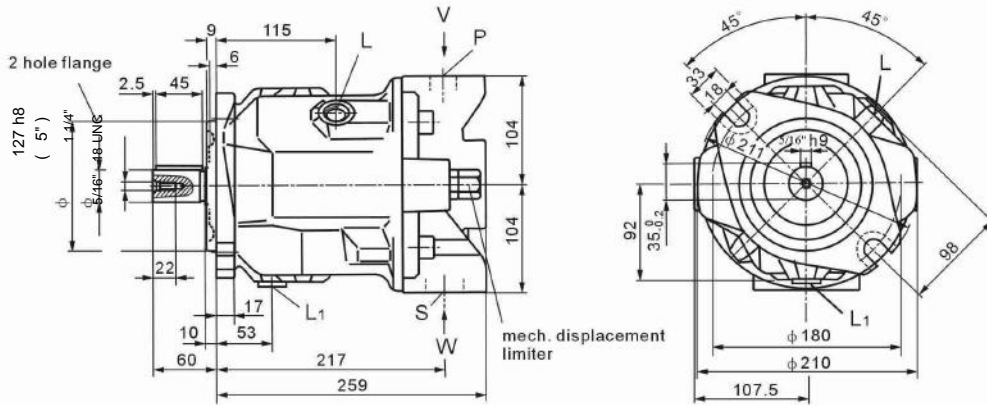Shaft K
SAE B-B



Shaft S13
Shaft 22.4; SAE B
SAE J744 OCT83

pressure angle 30°
13 teeth,
16/32 pitch

7/8" O.D.
1/4" - 20 UNC

16
25.1
33.1
41
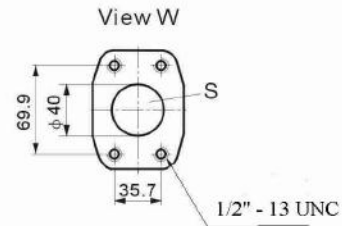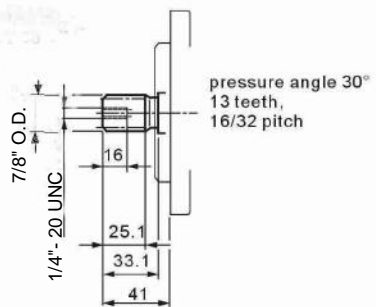
Shaft S15

Shaft 25-4;(SAE B-B)
SAE J744 OCT 83

pressure angle 30°
15 teeth,
16/32 pitch

φ 1"
1/4-20UNC-2B

16
30
38
45.9

View W

69.9
φ 40
S
35.7
1/2" - 13 UNC

View V

52.4
φ 25
P
26.2
3/8" UNC
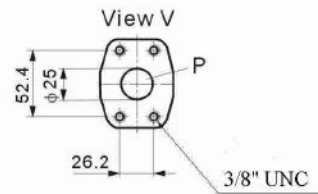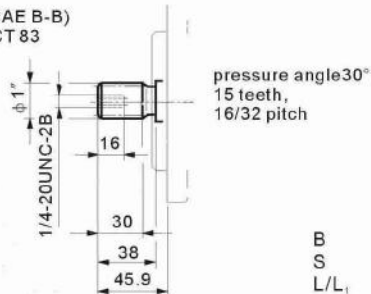
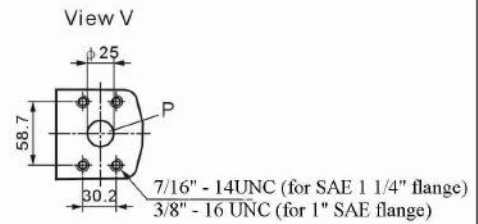| | | | |
|---|---|---|---|
| B | Pressure port | SAE 1″ | (Standard pressure range) |
| S | Suction port | SAE 11/2″ | (Standard pressure range) |
| L/L₁ | Case drain ports | 7/8" - 14 UNO | (L₁ plugged factory) |

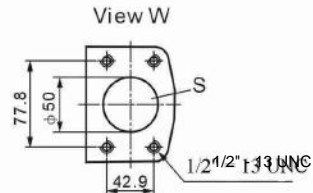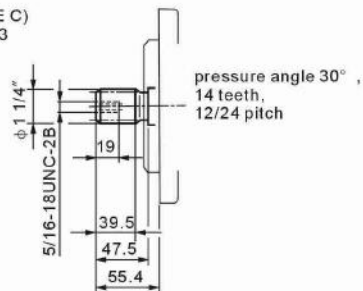## Installation Dimensions
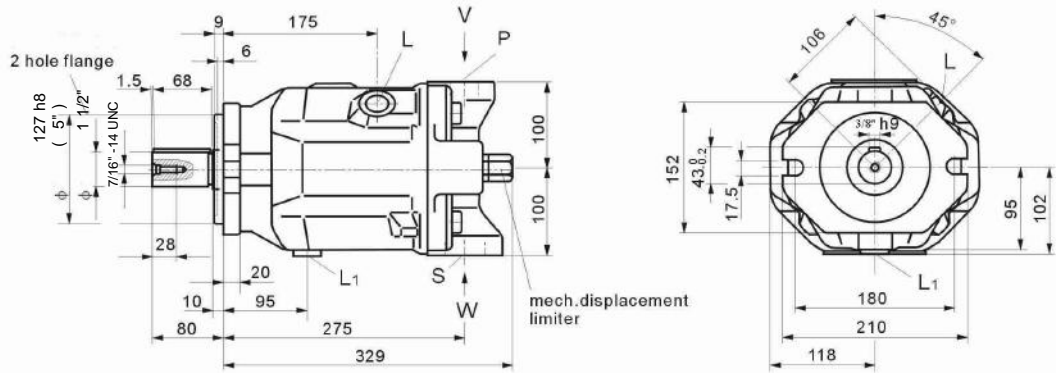
TPV-1-071-xxx-xxx-x-N62
Shaft K
SAE C



### Shaft S14

Shaft 32-4; (SAE C)
SAE J744 OCT 83



pressure angle 30°,
14 teeth,
12/24 pitch

View W



View V



7/16" - 14UNC (for SAE 1 1/4" flange)
3/8" - 16 UNC (for 1" SAE flange)

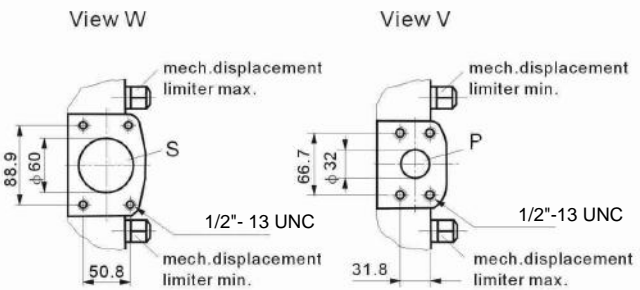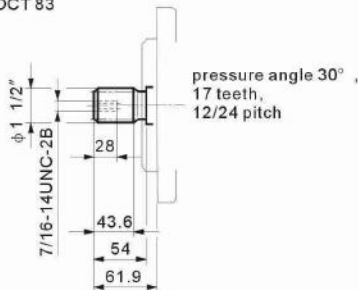| P | Pressure port | SAE 1″ | (Standard pressure range) |
| S | Suction port | SAE 2″ | (Standard pressure range) |
| L/L₁ | Case drain ports | 7/8 - 14 UNO | (L₁ plugged at factory) |

TPV-1-100-xxx-xxx-x-N62
Shaft K
SAE C-C



Shaft S17

Shaft 38-4;(SAE C-C)
SAE J744 OCT 83



pressure angle 30°,
17 teeth,
12/24 pitch

View W

mech.displacement
limiter max.

mech.displacement
limiter min.

1/2"- 13 UNC

View V

mech.displacement
limiter min.

P

1/2"-13 UNC

mech.displacement
limiter max.

| P | Pressure port | SAE 1 1/4" | (High pressure range) |
|---|---|---|---|
| S | Suction port | SAE 2 1/2" | (Standard pressure range) |
| L/L₁ | Case drain ports | 1 1/16" - 12 UNO | (L₁ plugged at factory) |

TPV-1-140-xxx-xxx-x-N62
Shaft K
SAE D
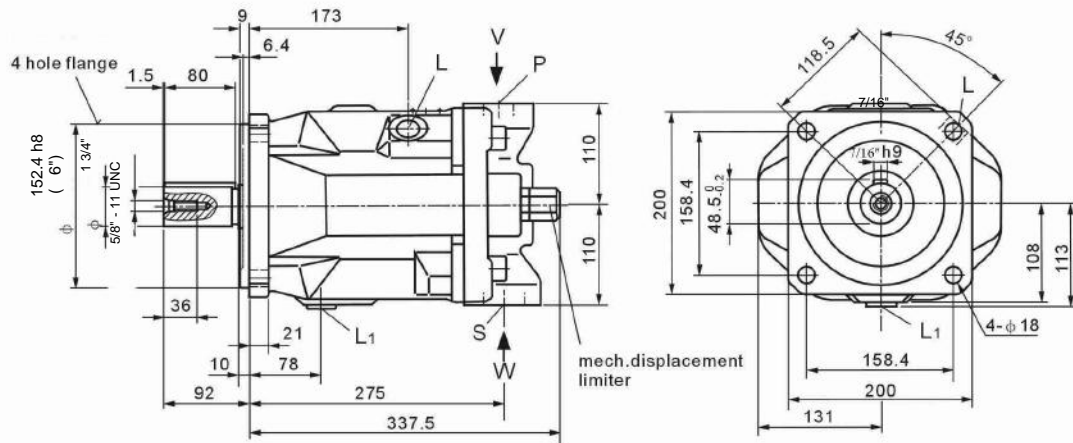


Shaft S13

Shaft 44-4; (SAE D)
SAE J744 OCT 83
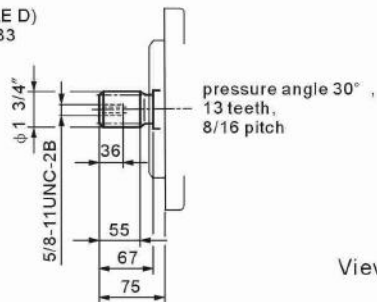
pressure angle 30°,
13 teeth,
8/16 pitch

View W

mech. displacement
limiter max.

mech.displacement
limiter min.

View V

mech.displacement
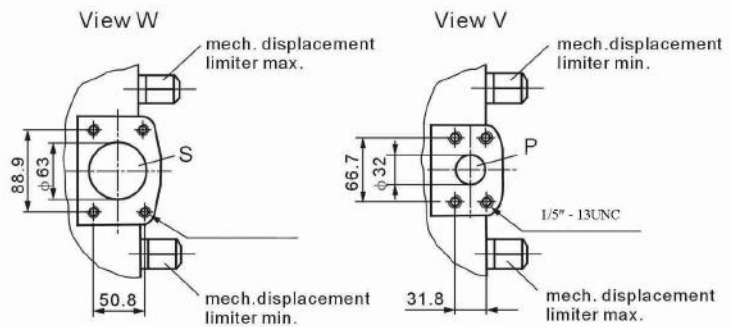limiter min.

mech. displacement
limiter max.

| P | Pressure port | SAE 1 1/4″ | (High pressure range) |
| S | Suction port | SAE 2 1/2″ | (Standard pressure range) |
| L/L₁ | Case drain port | 11/16 - 12 UNO | (L₁ plugged at factory) |

# P - Pressure Control

The pressure controller serves to maintain a constant pressure in a hydraulic system within the control range of the pump. The pump therefore supplies only the amount of hydraulic fluid required by the system. Pressure may be steplessly set at the control valves.

## ● Static operating curve
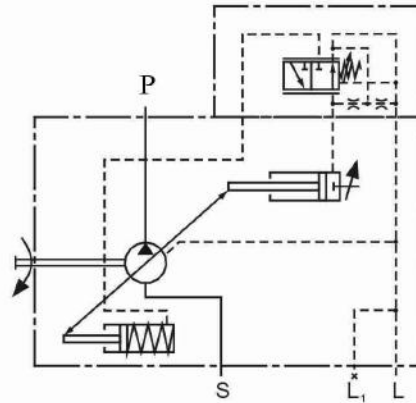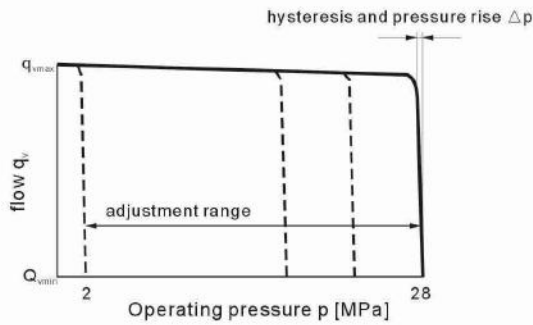
(at $n_1$=1500 rpm; $t_{oil}$=50℃)



## ● Dynamic Operating Curves

The operating curves are mean values measured under test conditions with the unit mounted inside the tank.

Conditions:    n = 1500 rpm
              $t_{oil}$ = 50℃
              Main relief set at 35 MPa

Load steps were obtained by suddenly opening and closing the pressure line with a pressure relief valve as load valve 1 m from the output flange of the pump.



## Ports

|   |   |
|---|---|
| P | Pressure port |
| S | Suction port |
| L, $L_1$ | Case drain ports ($L_1$ plugged) |
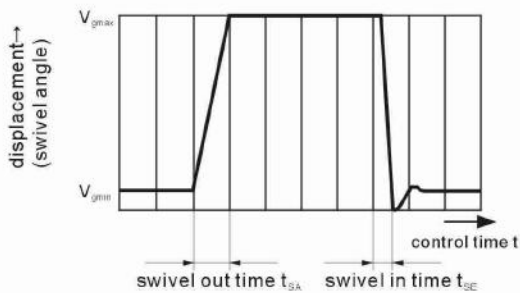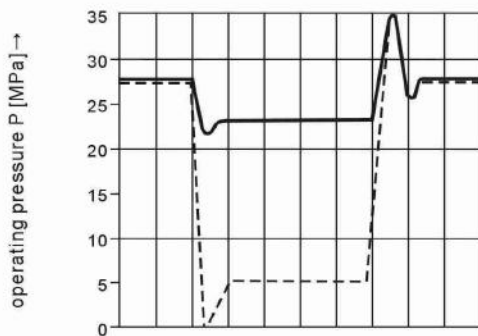
## ● Controller Data

Hysteresis and repetitive accuracy $\triangle P$ _____ max. 0.3 MPa

Max. pressure rise

| Size |     | 28  | 45  | 71  | 100 | 140 |
|------|-----|-----|-----|-----|-----|-----|
| $\triangle P$ | MPa | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 |

Pilot oil requirement _____ Max. approx 3 L/min

## ● Control Times

| Size | $t_{SA}$ (ms) again 5 MPa | $t_{SA}$ (ms) again 22 MPa | $t_{SA}$ (ms) again 28 MPa |
|------|------|------|------|
| 28   | 60   | 30   | 20   |
| 45   | 80   | 40   | 20   |
| 71   | 100  | 50   | 25   |
| 100  | 125  | 90   | 30   |
| 140  | 130  | 110  | 30   |

## TPV-1-xx-P-xxx-x-N62

Sizes 28...100



For pressure compensated control screw the standby adjustment all the way in and plug the port "X".

Control valve installed here for anti-clockwise rotation

adjustment screw for pressure cut off

Control valve installed here for clockwise rotation

P

S

A1

A2
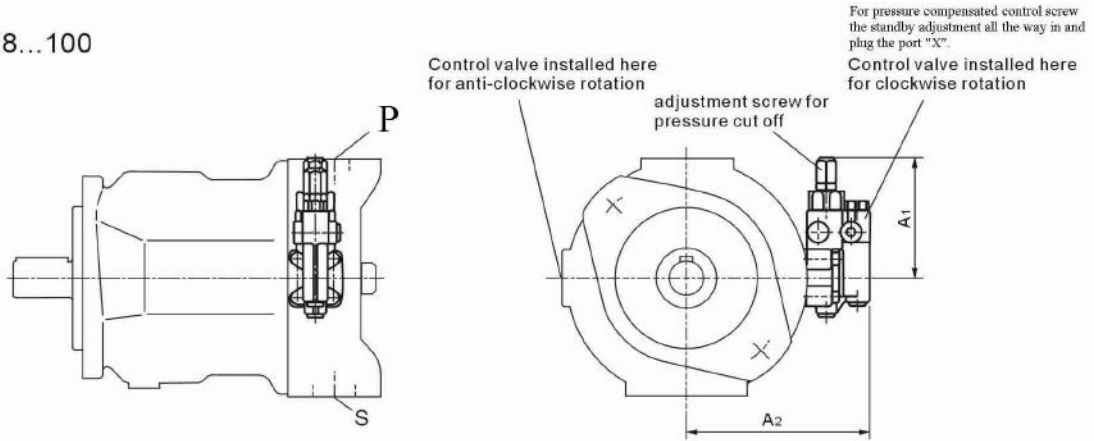
On sizes 28 to 100 the DFR valve used has the flow control spool blocked in the factory and is not tested.

Size 140



Control valve installed here for anti-clockwise rotation

Control valve installed here for clockwise rotation

adjustment screw for pressure cut off

P

S

A1

A2
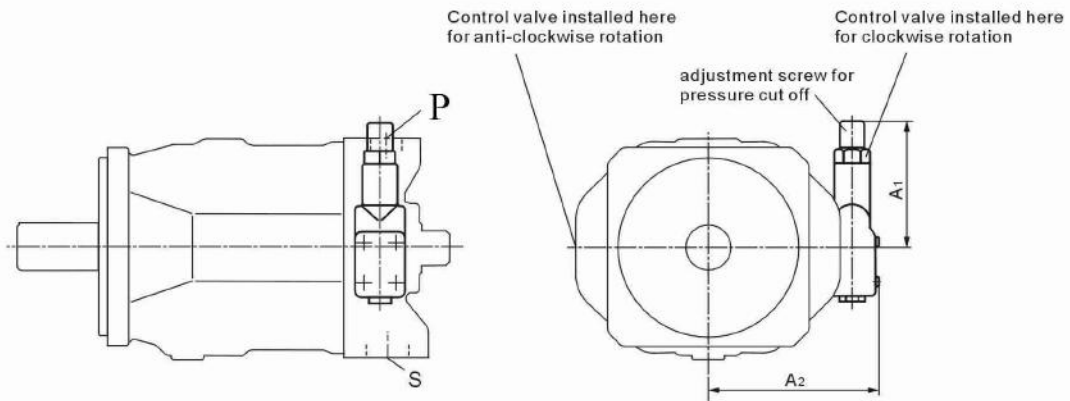
| Size | A₁ | A₂ |
|------|------|------|
| 28 | 109 | 136 |
| 45 | 106 | 146 |
| 71 | 106 | 160 |
| 100 | 106 | 165 |
| 140 | 127 | 169 |

A pressure relief valve can be connected to port X for remote control applications; this is not included in the items supplied with the PRG control.

The standard pressure differential setting at the control valve is 2 MPa. A pilot oil flow of approw. 1.5 L/min is then used. If an other setting (range 1-2.2 Mpa) is required please indicate in clear text.

## ● Static Operating Curve
(at $n_1$=1500 rpm; $t_{oil}$=50℃)
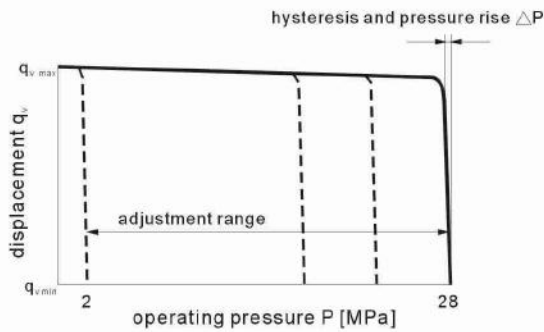


Sizes 8...100



## ● Controller Data

Hysteresis $\triangle P$ _____ max 3.0 Bar

Max. pressure rise

| Size | 8 | 28 | 45 | 71 | 100 | 140 |
|------|---|----|----|----|-----|-----|
| $\triangle P$ MPa | | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 |

Pilot oil requirement _____ approx. 4.5 L/min
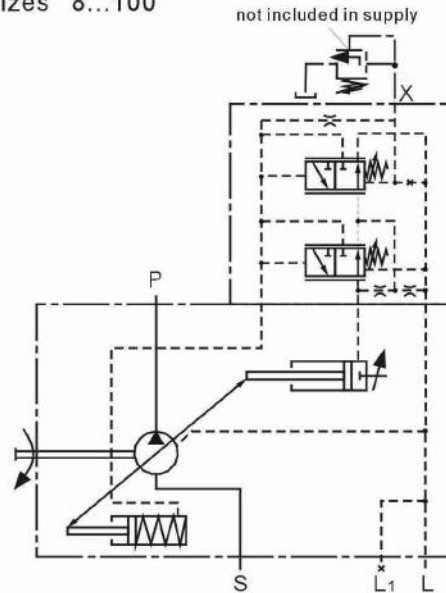
Size 140
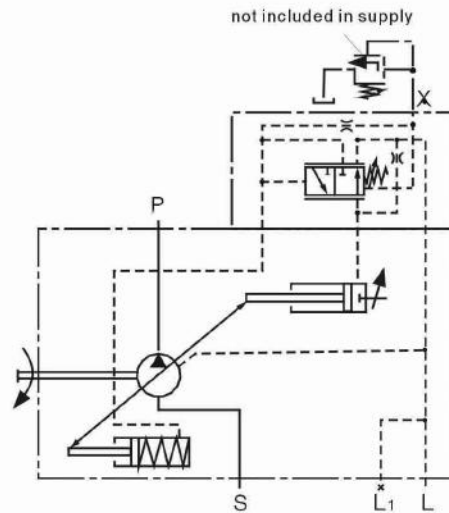


### Ports

| | |
|---|---|
| P | Pressure port |
| S | Suction port |
| L, $L_1$ | Case drain ports($L_1$ plugged) |
| X | Pilot pressure port |

## TPV-xxx-PRG-1-xxx-x-N62

### Sizes 28...100
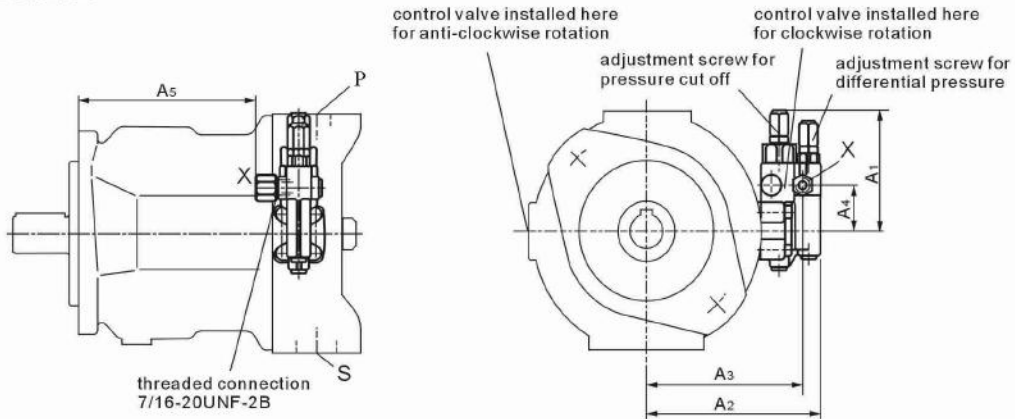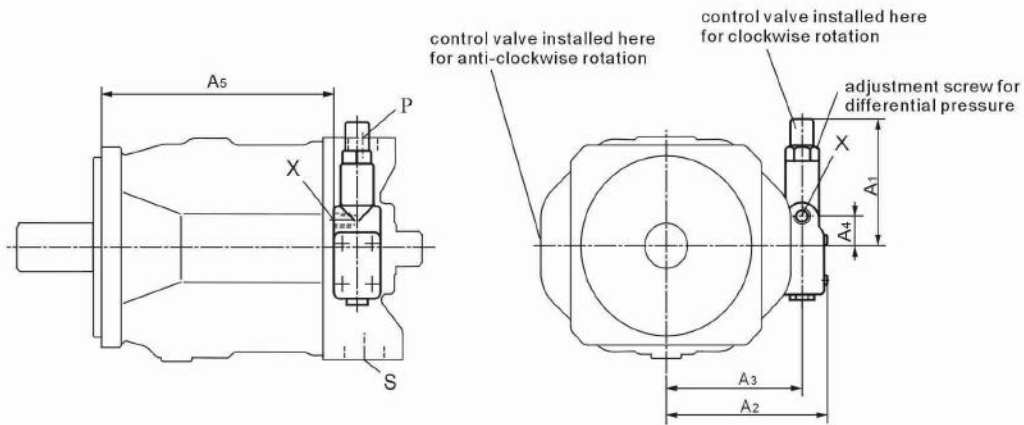


control valve installed here
for anti-clockwise rotation

control valve installed here
for clockwise rotation

adjustment screw for
pressure cut off

adjustment screw for
differential pressure

threaded connection
7/16-20UNF-2B

### Size 140



control valve installed here
for anti-clockwise rotation

control valve installed here
for clockwise rotation

adjustment screw for
differential pressure

| Size | A1 | A2 | A3 | A4 | A5 | Port X |
|------|-----|-----|-----|----|-----|--------|
| 28 | 109 | 136 | 119 | 40 | 119 | 7/16 - 20 unf-2B x 12 deep |
| 45 | 106 | 146 | 129 | 40 | 134 | |
| 71 | 106 | 160 | 143 | 40 | 162 | |
| 100 | 106 | 165 | 148 | 40 | 229 | |
| 140 | 127 | 169 | 143 | 27 | 244 | |

# PF/PF1 Pressure/Flow Control

In addition to the pressure control function, the pump flow may be varied by means of a differential pressure over an orifice or valvespool, installed in the service line. The pump flow is equal to the actual required flow by the actuator.
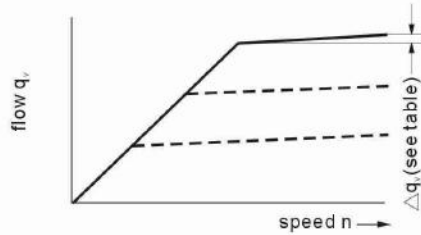
The PF1-valve has no connection between X and the tank. For function of pressure control see pages 13-15

## Static operating curve

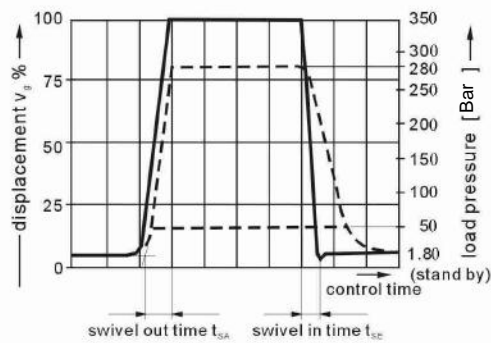(at $n_1$=1500 rpm; $t_{oil}$=50℃)
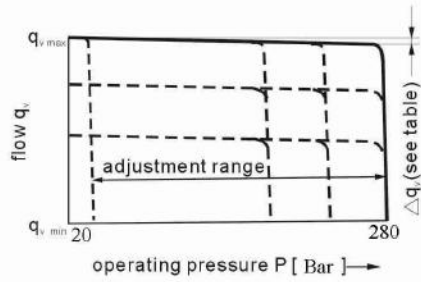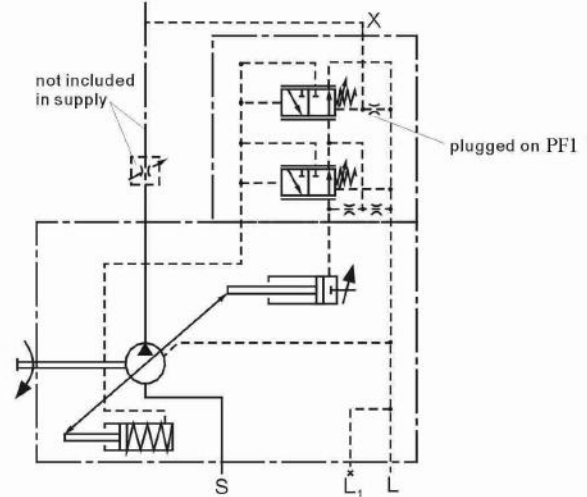


## Static operating curve at variable speed



## Dynamic flow control operating curve

The operating curves are average values measured under test conditions with the unit mounted inside the tank.



| Size | $t_{SA}$ (ms) stand by- 280 Bar | $t_{SE}$ (ms) 280 Bar-stand by | $t_{SE}$ (ms) 50 Bar-stand by |
|---|---|---|---|
| 28 | 40 | 20 | 40 |
| 45 | 50 | 25 | 50 |
| 71 | 60 | 30 | 60 |
| 100 | 120 | 60 | 120 |
| 140 | 130 | 60 | 130 |



## Ports

| | |
|---|---|
| P | Pressure port |
| S | Suction port |
| L, $L_1$ | Case drain ports($L_1$ plugged) |
| X | Pilot pressure port |

## Differential Pressure △P

Adjustable between 10 and 22 Bar (higher valves on request).
Standard setting: 14 Bar. If a different setting is required please indicate in clear text.
When port X is unloaded to tank a "zerostroke pressure" of P= 18 ±0.2 Bar (stand by) results (dependent on △P).

## Controller Data

Data pressure controller see page .
Max. Flow variation (hysteresis and increase) measured at drive speed n=1500 rpm

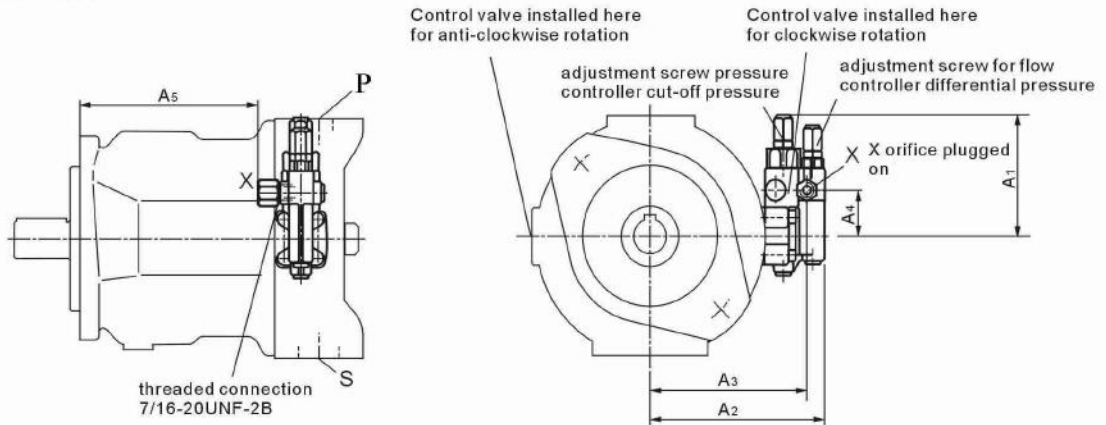| Size | | 28 | 45 | 71 | 100 | 140 |
|---|---|---|---|---|---|---|
| $\triangle q_{vmax}$ | L/min | 1.0 | 1.8 | 2.8 | 4.0 | 6.0 |

PF pilot oil consumption___max.approx. 3...4.5 L/min

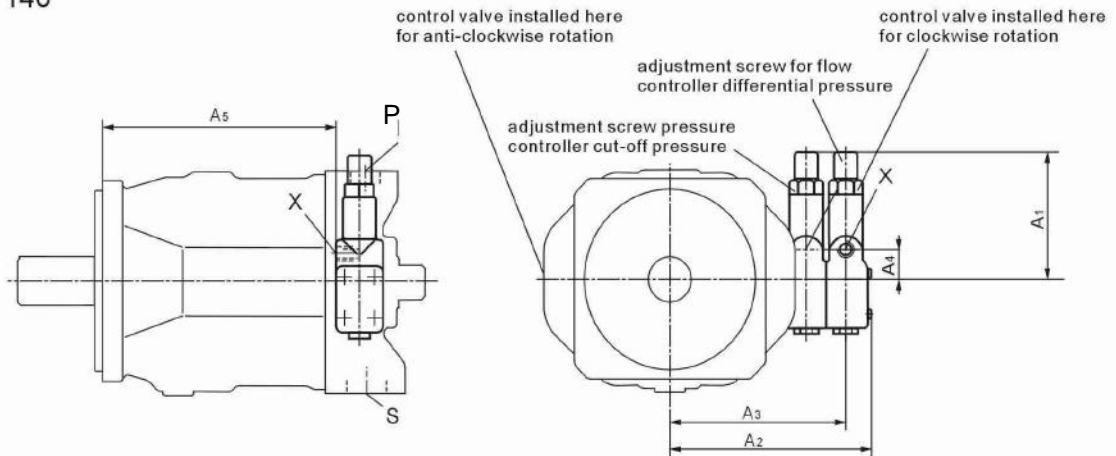PF1 pilot oil consumption___max.approx. 3 L/min

## TPV-1-xxx-PF-xxx-x-N62
## TPV-1-xxx-PF1-xxx-x-N62

### Sizes 18 - 100



Control valve installed here for anti-clockwise rotation

Control valve installed here for clockwise rotation

adjustment screw pressure controller cut-off pressure

adjustment screw for flow controller differential pressure

X orifice plugged on

threaded connection 7/16-20UNF-2B

### Size 140



control valve installed here for anti-clockwise rotation

control valve installed here for clockwise rotation

adjustment screw for flow controller differential pressure

adjustment screw pressure controller cut-off pressure

| Size | A1 | A2 | A3 | A4 | A5 | Port X |
|------|-----|-----|-----|----|-----|--------|
| 28 | 109 | 136 | 119 | 40 | 119 | 7/16 - 20UNF - 2Bx12 deep |
| 45 | 106 | 146 | 129 | 40 | 134 | |
| 71 | 106 | 160 | 143 | 40 | 162 | |
| 100 | 106 | 165 | 148 | 40 | 229 | |
| 140 | 127 | 209 | 183 | 27 | 244 | |

The TPV pump can be supplied with a through drive in accordance with the type code on Page 2. The through drive version is designated by the code numbers (TDA-TDD).

## Permissible moment of inertia



● Combination Pump

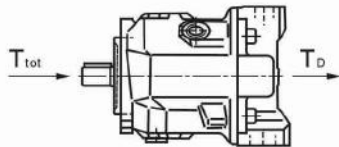By building on further pumps it is possible to obtain independent circuits:
   If the combination pump consists of 2    TPV     and if these are to be supplied assembled then the  two order codes should be linked by means of a "+"sign.
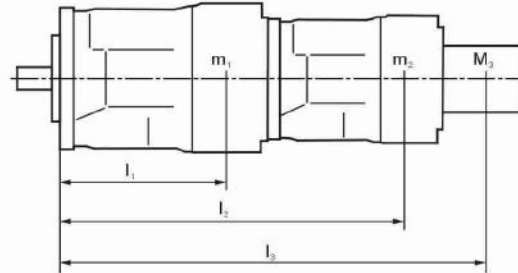Ordering example:

TPV071-PF-1-S14-R-TDB-13\+
TPV028-PF1-1-S13-R-N62

$m_1, m_2, m_3$ [kg]  Pump mass
$I_1, I_2, I_3$ [mm]  distance to center of gravity
$T_m = (m_1 \cdot I_1 + m_2 \cdot I_2 + m_3 \cdot I_3) \cdot \dfrac{1}{102}$ [Nm]

● Maximum permissible
   input and through drive torque



| Size | | 28 | 45 | 71 | 100 | 140 |
|---|---|---|---|---|---|---|
| Permissible moment of inertia | TmNm | 880 | 1370 | 2160 | 3000 | 4500 |
| Permissible moment of inertia at dynamic mass acceleration 10g ≐ 98.1 m/s² | TmNm | 88 | 137 | 216 | 300 | 450 |
| Mass | M1 Kg | 15 | 21 | 33 | 45 | 60 |
| To center of gravity | Il mm | 110 | 130 | 150 | 160 | 160 |

The split in torque between pump 1 and 2 is optional.
The max. permissible input torque $T_{tot}$ as well as the max. permissible through drive torque $T_D$ may not be exceeded.

| Size | | | 28 | 45 | 71 | 100 | 140 |
|---|---|---|---|---|---|---|---|
| Max. permissible input torque at pump 1 with shaft "P" | | | | | | | |
| | $T_{tot}$ | Nm | 137 | 200 | 439 | 857 | 1206 |
| Max. permissible through-drive torque | $T_D$ | Nm | 137 | 200 | 439 | 778 | 1206 |
| | $T_D$ Keyed shaft | Nm | 112 | 179 | 283 | 398 | 557 |

| Size | | | 28 | 45 | 71 | 100 | 140 |
|---|---|---|---|---|---|---|---|
| Max. permissible input torque at pump 1 with shaft "S" | | | | | | | |
| | $T_{tot}$ | Nm | 137 | 319 | 626 | 1104 | 1620 |
| Max. permissible through-drive torque | $T_D$ | Nm | 160 | 319 | 492 | 778 | 1266 |
| | $T_D$ Keyed shaft | Nm | 112 | 179 | 283 | 398 | 557 |

| Size | | | 28 | 45 | 71 | 100 | 140 |
|---|---|---|---|---|---|---|---|
| Max. Permissible input torque at pump 1 with shaft "R" | | | | | | | |
| | $T_{tot}$ | Nm | 225 | 400 | 644 | - | - |
| Max. permissible through-drive torque | $T_D$ | Nm | 176 | 365 | 548 | - | - |
| | $T_D$ Keyed shaft | Nm | 112 | 179 | 283 | - | - |

$T_{tot}$       = Max. permissible input torque at pump 1
$T_D$       = Max. permissible through-drive torque
                    at through-drive to splined shaft

$T_D$ keyed shaft = Max. permissible through-drive torque
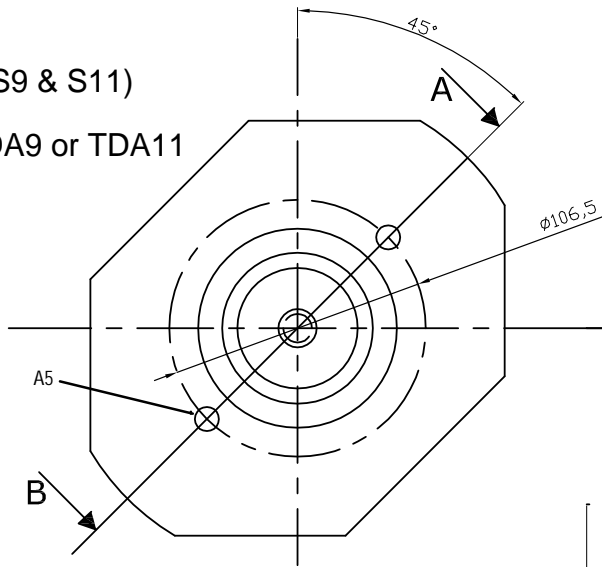                    at through-drive to keyed shaft
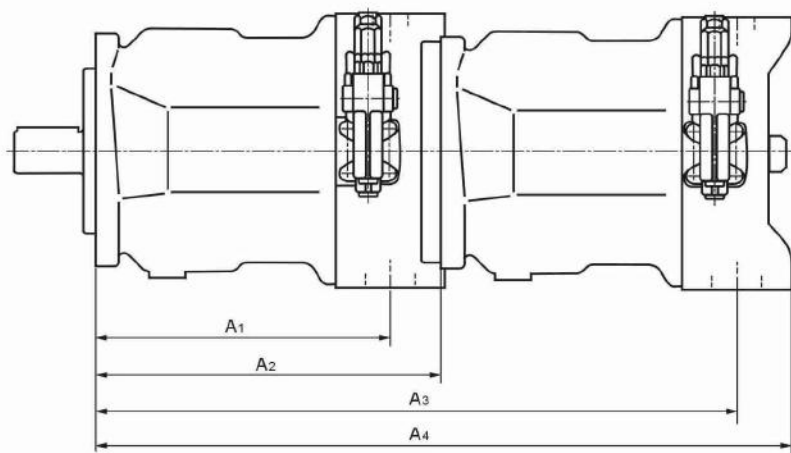
## TPV-1 + TPV-1



| | TPV028 | | | | TPV045 | | | | TPV071 | | | | TPV100 | | | | TPV140 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TPV018 | | | | | | | | | | | | | | | | | | | | |
| TPV028 | 164 | 204 | 368.5 | 410 | 184 | 229 | 394 | 423 | 217 | 267 | 431.5 | 473 | 275 | 338 | 502.5 | 544 | 275 | 350 | 514 | 556 |
| TPV045 | | | | | 184 | 229 | 413 | 453 | 217 | 267 | 451 | 491 | 275 | 338 | 522 | 562 | 275 | 350 | 534 | 574 |
| TPV071 | | | | | | | | | 217 | 267 | 484 | 524 | 275 | 338 | 555 | 595 | 275 | 350 | 567 | 609 |
| TPV100 | | | | | | | | | | | | | 275 | 337 | 613 | 664 | 275 | 350 | 625 | 679 |
| TPV140 | | | | | | | | | | | | | | | | | | | | |

# Installation Dimensions

## Through Drive TDA & TDB

**Flange SAE A**
**2 holes**
**(Splined shaft S9 & S11)**
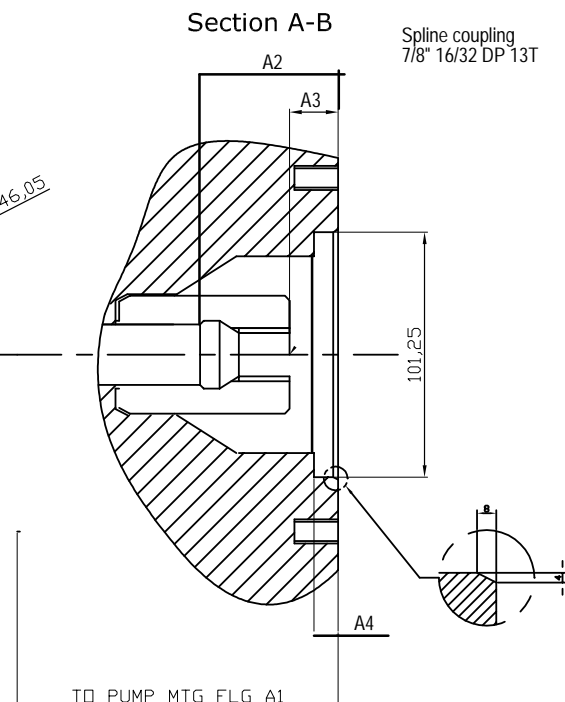
**Order Code TDA9 or TDA11**

Section A-B

Spline coupling
5/8" 16/32 DP 9T
3/4" 16/32 DP 11T

45°

A

B

Ø106,5

A5

A2

End of Shaft

A4

82,55dia

A4

TO PUMP MTG FLG A1
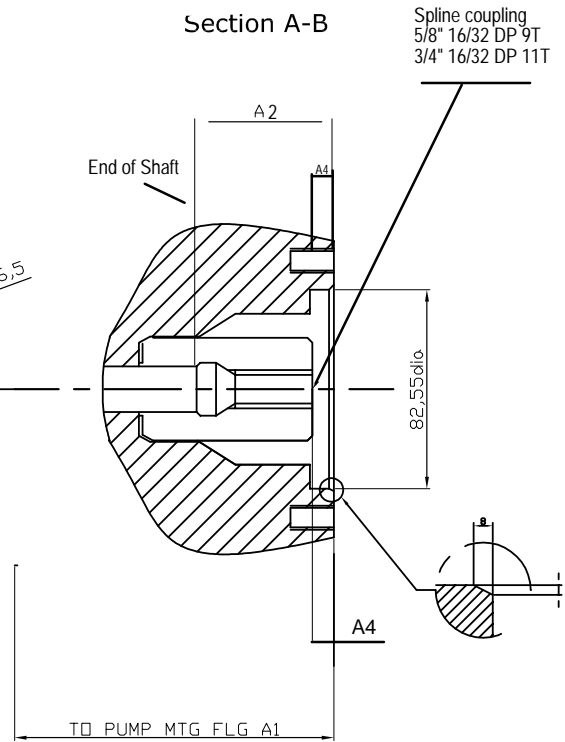
| Size of Main Pump | A1 | A2 | A3 | | A4 | A5 |
|---|---|---|---|---|---|---|
| | | | 9t | 11t | | |
| 28 | 204 | 47 | 8 | 18.8 | 10 | M10 x 16 deep |
| 45 | 229 | 53 | 8 | 18.8 | 10 | M10 x 16 deep |
| 71 | 267 | 61 | 8 | 21.3 | 10 | M10 x 20 deep |
| 100 | 338 | 65 | 8 | 19.0 | 10 | M10 x 20 deep |
| 140 | 350 | 77 | 8 | 18.9 | 10 | M10 x 17 deep |

**Flange SAE B**
**2 holes**
**(Splined shaft S13)**

**Order Code TDB13**

Section A-B

Spline coupling
7/8" 16/32 DP 13T

45°

A

B

Ø146,05

A5

A2

A3

A4

101,25

A4

TO PUMP MTG FLG A1
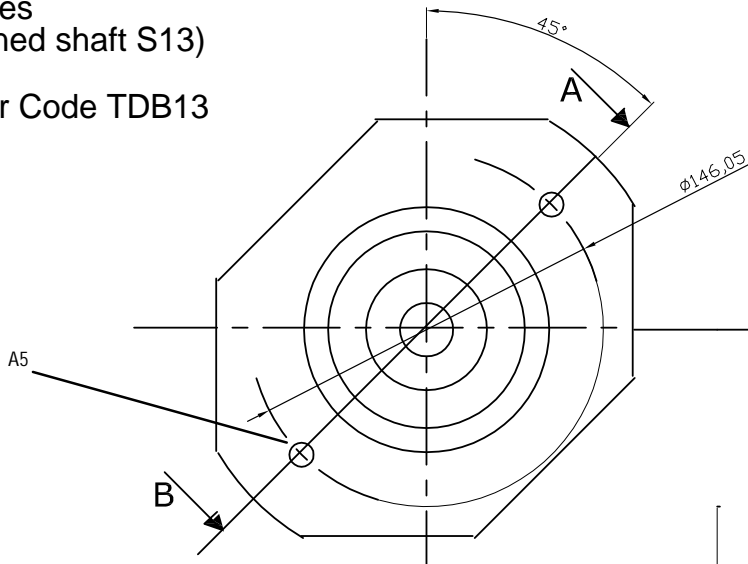
| Size of Main Pump | A1 | A2 | A3 | A4 | A5 |
|---|---|---|---|---|---|
| | | | 11t | | |
| 28 | 204 | 47 | 17.8 | 10 | M12 x 18 deep |
| 45 | 229 | 53 | 17.8 | 10 | M12 x 18 deep |
| 71 | 267 | 61 | 20.3 | 10 | M12 x 18 deep |
| 100 | 338 | 65 | 18.0 | 10 | M12 x 20 deep |
| 140 | 350 | 77 | 17.9 | 10 | M12 x 20 deep |

TPV......

# Installation Dimensions

## Through Drive TDB-B & TDC

Section A-B

Spline Coupling
1" 16/32 DP 15T

Flange SAE B-B
2 holes
(Splined shaft S15)

Order Code TDB15

A5

Threaded Holes

ø146,05

45°

A

B

A2

A3

101,25

A4

TO PUMP MTG FLG A1
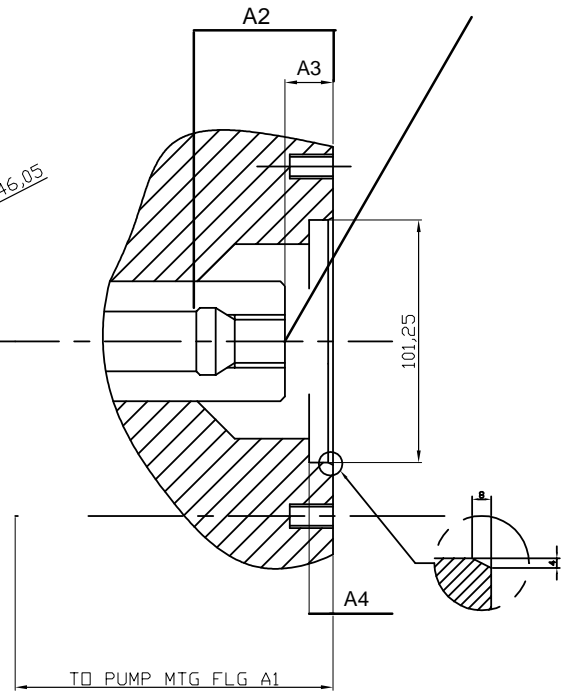
| Size of Main Pump | A1 | A2 | A3 | A4 | A5 |
|---|---|---|---|---|---|
| 28 | | | | | |
| 45 | 229 | 53 | 18.4 | 10 | M12 x 18 deep |
| 71 | 267 | 61 | 20.8 | 10 | M12 x 20 deep |
| 100 | 338 | 65 | 18.2 | 10 | M12 x 20 deep |
| 140 | 350 | 77 | 18.4 | 10 | M12 x 20 deep |

## Flange SAE C
4 holes
(Splined shaft S14)

Order Code TDC14

Section A-B

omitted on size 71

A5

ø181

45°

A

B

omitted on size 71
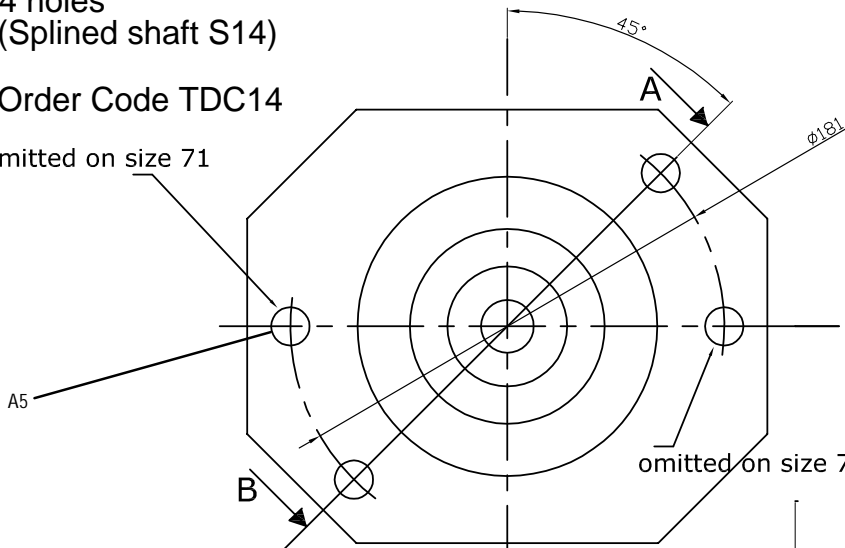
Spline Coupling
1 1/4" 16/32 DP 14T

A2

A3

127

13

A4

TO PUMP MTG FLG A1
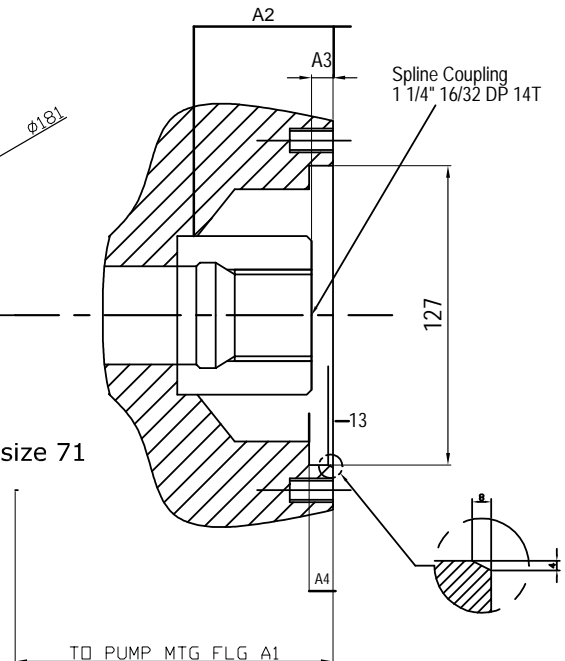
| Size of Main Pump | A1 | A2 | A3 | A4 | A5 |
|---|---|---|---|---|---|
| 28 | | | | | |
| 45 | | | | | |
| 71 | 267 | 61 | 22.0 | 13 | M16 x 18 deep |
| 100 | 338 | 65 | 19.5 | 13 | M16 x 24 deep |
| 140 | 350 | 77 | 19.4 | 13 | M16 x 24 deep |

# Installation Dimensions

## Through Drive TDC-C & TDD

### Flange SAE CC

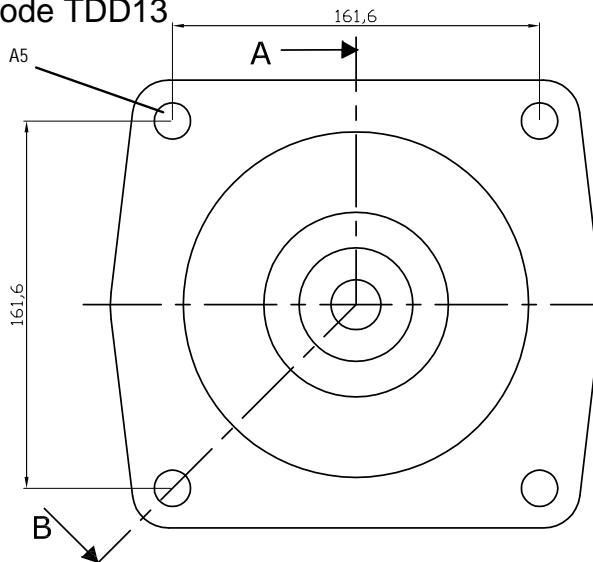### (Splined shaft S17)

### Order Code TDC17

Section A-B

45°

A

Ø181

A5

B

A2

A3

spline coupling
38-4(SAE C-C)
1½"16/32 DP 17T

127

A4

TO PUMP MTG FLG A1
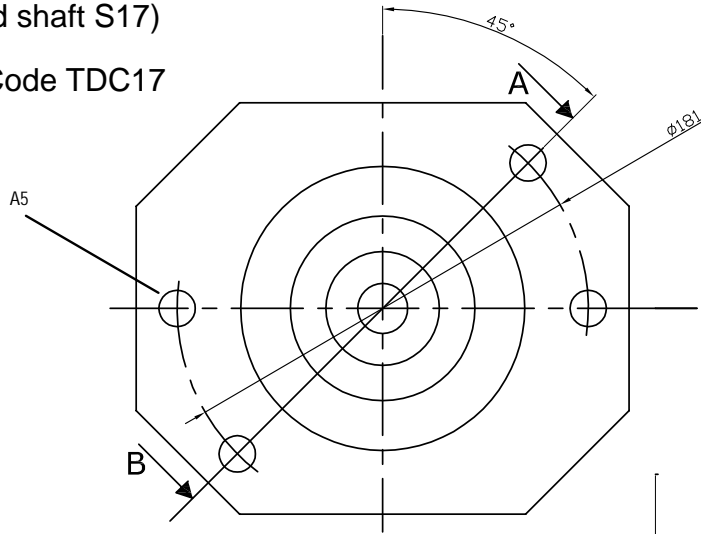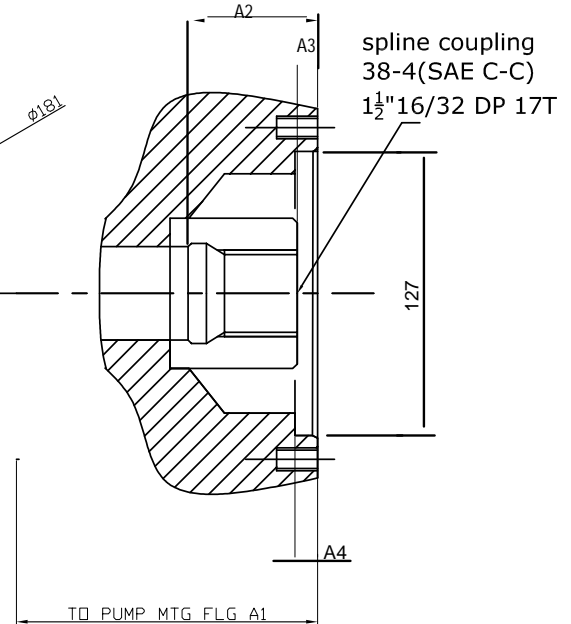
| Size of Main Pump | A1 | A2 | A3 | A4 | A5 |
|---|---|---|---|---|---|
| 28 45 71 100 | 338 | 65 | 8 | 13 | M16 x 24 deep |
| 140 | 350 | 77 | 8 | 13 | M16 x 24 deep |

### Flange SAE D
### 4 holes
### (Splined shaft S13)

### Order Code TDD13

Section A-B

161,6

A

A5

161,6

B

A2

A3

spline coupling
1 ¾" 8/16 DP 13T

152

350

A4

TO PUMP MTG FLG A1
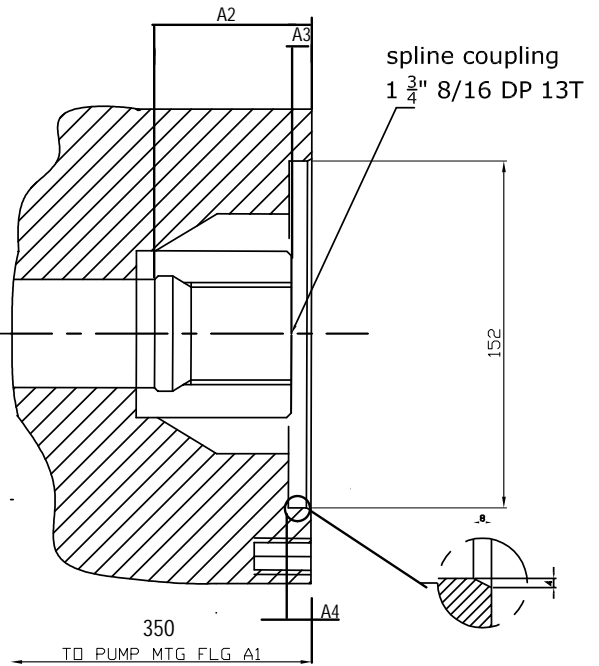
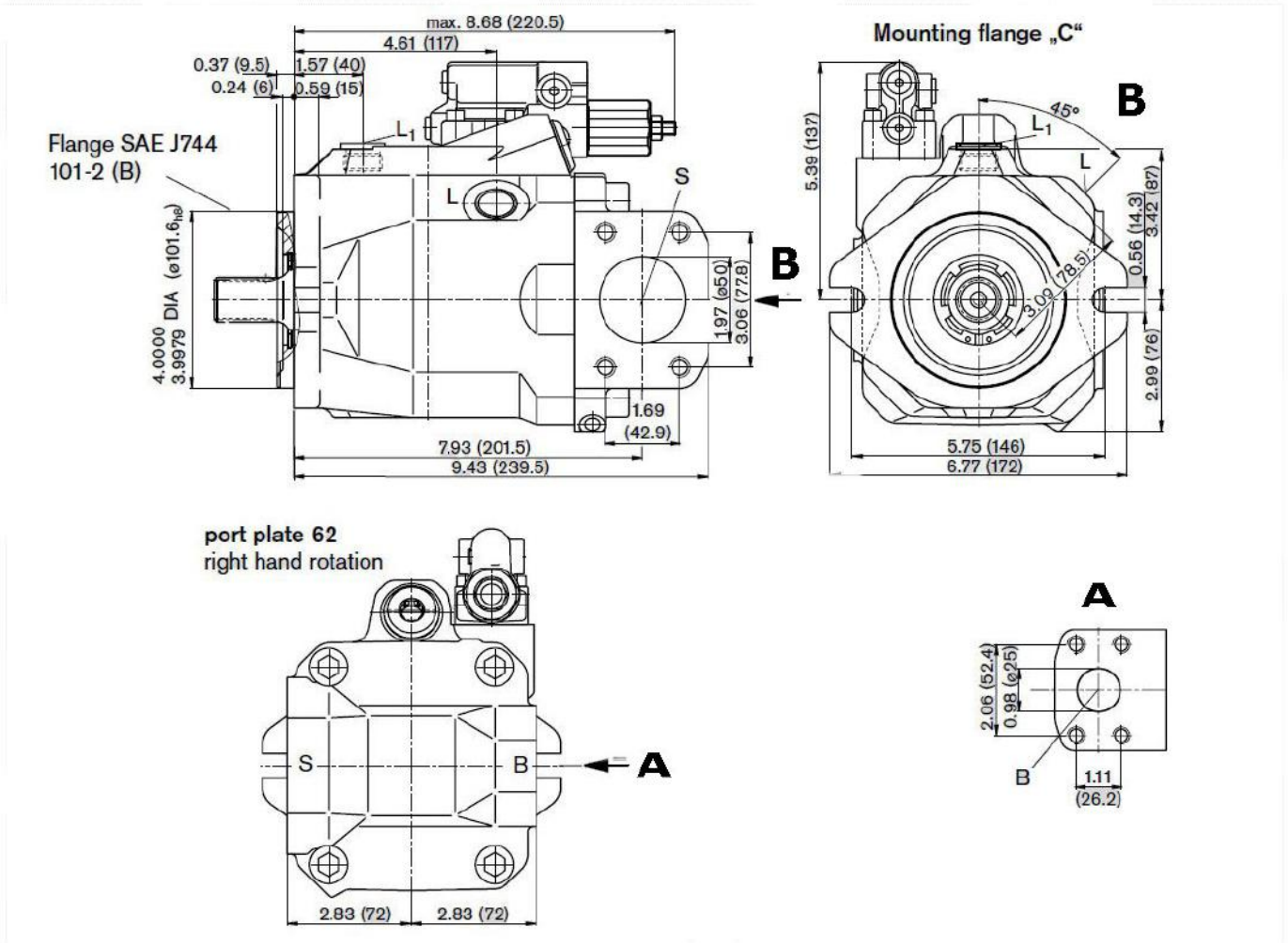| Size of Main Pump | A1 | A2 | A3 | A4 | A5 |
|---|---|---|---|---|---|
| 28 45 71 100 140 | 350 | 77 | 10.5 | 13 | M16 x 21 deep |

TPV......

# Installation Dimensions

TPV-02-045-xxx-Sxx-R-N64
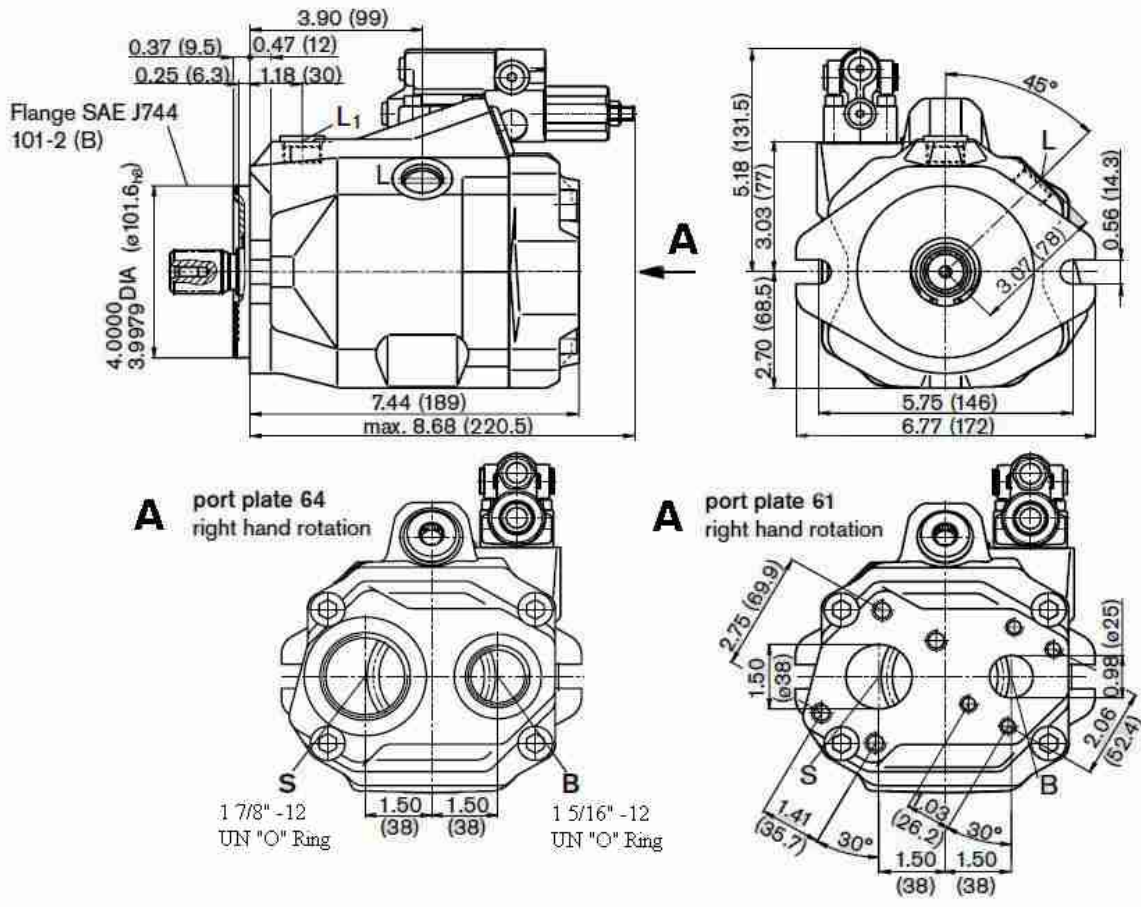
To locate the service ports for left hand rotation, turn port plate 180 degrees.

# Installation Dimensions

## TPV-2-060-xxx-Sxx-R-N62



### Flange SAE J744 101-2 (B)

max. 8.68 (220.5)
4.61 (117)
0.37 (9.5)   1.57 (40)
0.24 (6)   0.59 (15)
4.0000 DIA (ø101.6 H8)
3.9979
7.93 (201.5)
9.43 (239.5)
1.97 (ø50)
3.06 (77.8)
1.69 (42.9)

### Mounting flange „C"

5.39 (137)
45°
5.75 (146)
6.77 (172)
2.99 (76)
3.09 (78.5)
0.56 (14.3)
3.42 (87)

### port plate 62
### right hand rotation

2.83 (72)   2.83 (72)

2.06 (52.4)
0.98 (ø25)
1.11 (26.2)

To locate the service ports for left hand rotation, turn port plate 180 degrees.