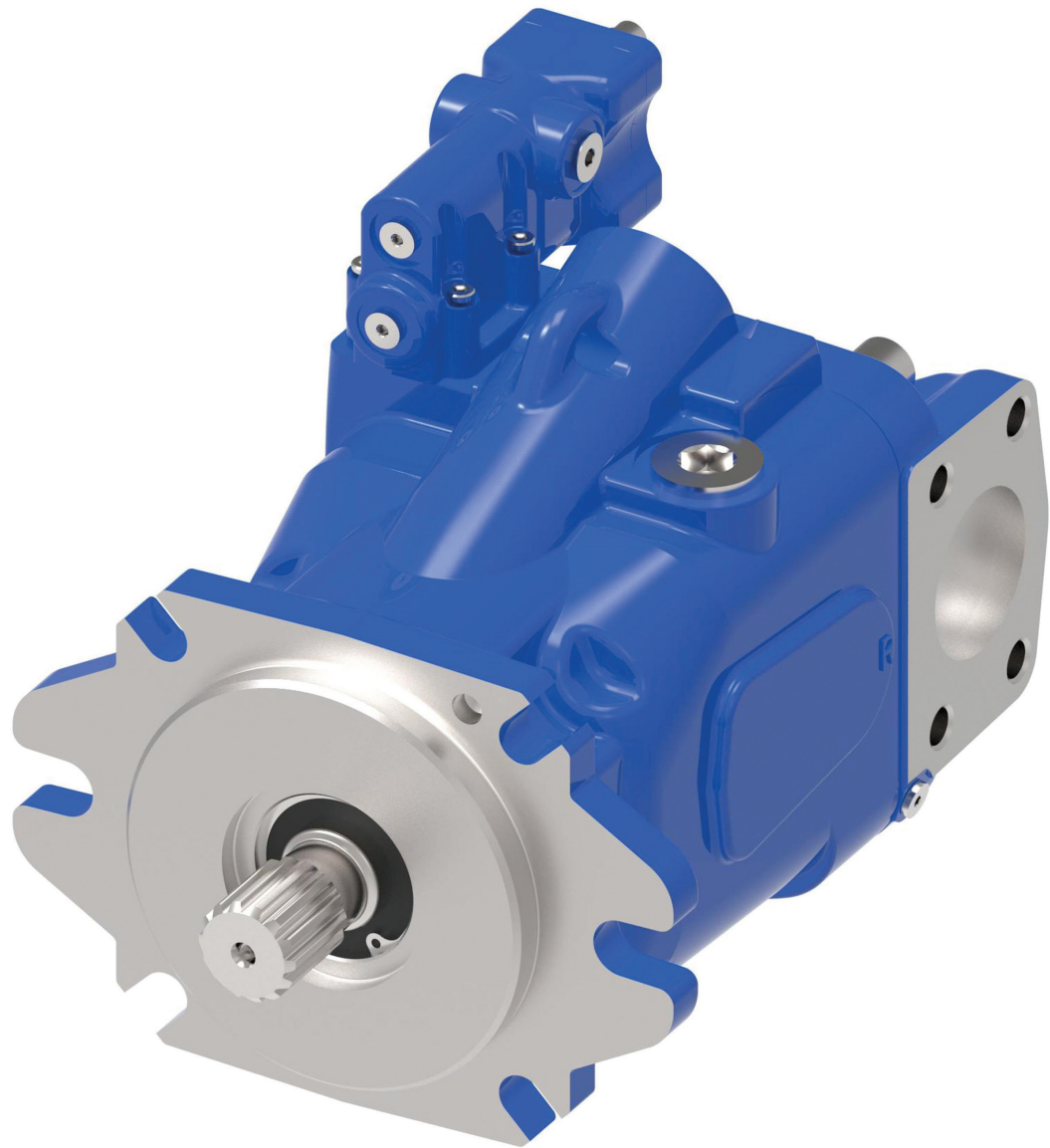


420 Mobile Piston Pump  
Design Code C

ADU041 280 bar (4060 psi)  
ADU049 280 bar (4060 psi)

ADU062 280 bar (4060 psi)  
ADU080 210 bar (3050 psi)



**EATON**

*Powering Business Worldwide*



|   |    |
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# Introduction

## 420 Series Mobile Piston Pump

The Eaton® X20 portfolio of open-circuit piston pumps is built to maximize machine performance and productivity. With sophisticated controls that enhance system efficiency and a compact design that delivers incredible power, the X20 portfolio empowers mobile machine operators to do more work in less time using less fuel.

**Sophisticated controls that improve performance while optimizing efficiency.**

**Excellent pressure responsiveness** – The X20 portfolio delivers the fastest response and recovery times in the open-circuit piston segment, helping customers get the job done faster.

**Low standby pressure** – The X20 portfolio can maintain low margin pressure (~150 psi) with exceptional stability, reducing heat generation and helping to eliminate wasted energy.

**Stable fan drive functionality** – Eaton’s fan drive control reaches desired speed more quickly and remains stable once there, reducing energy-wasting oscillation.

**Advanced electronic controls** – The cold start and fan drive controls are Pro-FX Ready, meaning they can be easily configured with pre-programmed development tools and controlled electronically for maximum flexibility and precision.

**Winning load sense combination** – X20 works in conjunction with Eaton’s CLS Load Sense Sectional Mobile Valve, providing OEMs one resource for their machine’s load sense needs.

**Compact design that enables greater flexibility and cost savings.**

**Simplified pump architecture** – The X20 pump has 25% fewer components than traditional pumps, reducing the number of leak points and simplifying maintenance.

**Compact package size** – The X20 portfolio’s small size satisfies Tier 4 requirements and provides more flexibility when designing the engine compartment.

**More horsepower** – The compact rotating group delivers a remarkable amount of horsepower, improving productivity without using more fuel.

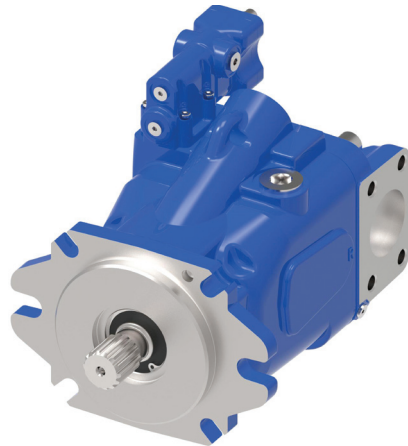
**One-piece housing** – Single-piece pump housing removes leak points and makes maintenance faster and easier versus more complicated multi-piece housings.

**Multiple options that make it easy to specify exactly what you need.**

**Variety of control options** – Including pressure control, load sense, cold start, torque control, remote pressure control, inverse proportional pressure control, proportional pressure control, electronic displacement control, and swash sensor feedback, giving you more ways to design more efficient, productive machines.

**Several displacement options** – With seven displacement options, there’s an X20 pump to fit virtually any mobile application need.

Eaton’s 420 Series is available with displacements of 41cc, 49cc, 62cc, and 80cc for operating speeds at 2,650 rpm. A strong, field-proven rotating group allows the pumps to handle pressures to 280 bar (4060 psi) continuous and 320 bar (4600 psi) intermittent.



The combination of high load capacity bearings and a stiff drive shaft help provide a pump B10 bearing life of up to 10,280 hours at rated mobile conditions, reducing operating costs and extending operating life.

**Variety of mounting options** – The X20 portfolio is available with both SAE and ISO mounting flange configurations, can be side- or rear-ported, and offers multiple drain ports to help overcome any installation challenges.

**Exceptional quality that provides remarkable reliability.**

**Unique control piston design** – Single-acting control piston with special coating helps minimize friction, increasing operating life.

**Bronze piston shoes** – Bronze piston shoes are robust against contamination should particles enter the fluid, enhancing system performance and component service life.

**High-load bearings** – Larger, more durable bearings resist wear and deliver industry-leading bearing life.

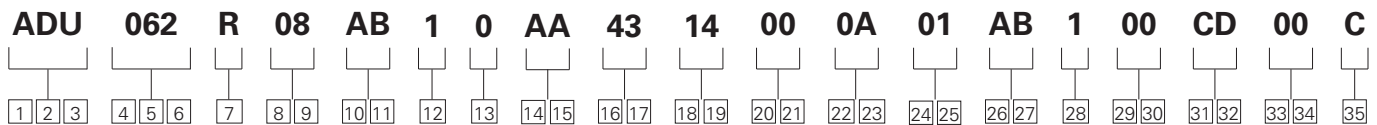
**3-year manufacturer’s warranty** – Eaton’s warranty terms provide peace of mind for three full years, helping you get through your warranty period with complete confidence.

**Global network of Eaton-certified experts for end-to-end support.**

**More partners in more regions** – Growing network of Eaton distributors around the world ensures there’s local service and support anywhere you need it.

**World-class system design and assembly** – Our expert distribution partners can help with everything from specifying to prototyping and assembly to commissioning, so you can focus on other areas of your business.

**Eaton-standardized practices and processes** – Eaton employs a unique system of tools and processes, known as the Eaton Business System, to ensure quality development and delivery of the 220 X20 product. These tools and process include such known methods as Design for Six Sigma, Lean Manufacturing and ISO certification.



**1 2 3** **Pump series**  
**ADU** – 420 Series open circuit piston pump

**4 5 6** **Pump displacement**  
**041** – 41.0 cm<sup>3</sup>/r [2.50 in<sup>3</sup>/r]  
**049** – 49.2 cm<sup>3</sup>/r [3.00 in<sup>3</sup>/r]  
**062** – 62.3 cm<sup>3</sup>/r [3.80 in<sup>3</sup>/r]  
**080** – 80.0 cm<sup>3</sup>/r [4.88 in<sup>3</sup>/r]

**7** **Input shaft rotation**  
**L** – Left hand  
**R** – Right hand

**8 9** **Front mount and shaft**  
**01** – 2 Bolt B, 22.2 mm (0.875in.) Dia. keyed shaft  
**02** – 2 Bolt B, 25.4 mm (1.00in.) Dia. keyed shaft  
**03** – 2 Bolt B, 22.22 mm (.875in.) Dia. tapered keyed shaft  
**05** – 2 Bolt B, 13 tooth 16/32 spline  
**08** – 2 Bolt B, 15 tooth 16/32 spline  
**32** – 2/4 Bolt C, 14 tooth 12/24 spline  
**33** – 2/4 Bolt C, 31.8 mm (1.25in) Dia. keyed shaft  
**34** – 2 Bolt B, 15 tooth 16/32 sled runner spline  
**35** – 2 Bolt B, 14 tooth 12/24 spline  
**38** – 2/4 Bolt C, 31.75 mm (1.25) Dia. tapered keyed shaft

**10 11** **Main ports size & location**  
**AA** – Rear ports suction - 2" (code 61);  
 Pressure - 1" (code 61)  
**AB** – Side ports suction - 2" (code 61);  
 Pressure - 1" (code 61)  
**AC** – Rear ports suction - 2" (code 61) with M12 threads;  
 Pressure - 1" (code 61) with M10 threads.  
**AD** – Side ports suction - 2" (code 61) with M12 threads;  
 Pressure - 1" (code 61) with M10 threads.  
**AE** – Rear ports suction - SAE o-ring port;  
 Pressure - UN-2B SAE o-ring port  
 (ADU041, ADU049 & ADU062 only)  
**AF** – Side ports suction - #24 SAE o-ring;  
 Pressure - #16 SAE o-ring  
 (ADU041 and ADU049 only)  
**AG** – Rear ports suction - M48 metric o-ring;  
 Pressure - M33 metric o-ring  
 (ADU041 & ADU049 Only)  
**AH** – Side ports suction - M48 metric o-ring;  
 Pressure - M33 metric o-ring  
 (ADU041 & ADU049 only)  
**AK** – Rear ports suction - 2" (code 61);  
 Pressure - #16 SAE o-ring (ADU062 only)

**12** **Case drain ports**  
**1** – #12 SAE o-ring - top  
**2** – #12 SAE o-ring - bottom  
**3** – M27 x 2 o-ring - top  
**4** – M27 o-ring - bottom  
**5** – #12 SAE o-ring - left side (swash sensor boss)

**13** **Diagnostic pressure ports not available on thru-drive units**  
**0** – No diagnostic pressure ports  
**1** – #6 SAE o-ring - plugged (rear ports only)  
**2** – M14 metric o-ring - plugged (rear ports only)  
**3** – #4 SAE o-ring - plugged (side ports only)  
**4** – M12 metric o-ring - plugged (side ports only)

**14 15** **Controller type**  
**AA** – Pressure flow compensator with #4 SAE o-ring  
 load sense port (left side)  
**AB** – Pressure flow compensator with M12 metric o-ring  
 load sense port (left side)  
**AC** – Pressure compensator only  
**AH** – Pressure flow compensator with torque control #4  
 SAE o-ring load sense port (left side)  
**AJ** – Pressure flow compensator with torque control  
 M12 metric o-ring load sense port (left side)  
**AK** – pressure compensator with torque control  
**AP** – Remote pressure control M12 metric o-ring port,  
 left side  
**AT** – Pressure and flow compensator with  
 electronic displacement control - EP type  
**AV** – EH Inverse proportional pressure control  
 (vertical mounting)  
**AW** – Remote pressure control with  
 .4375-20 SAE o-ring port, left side  
**AY** – Pressure and flow compensator with  
 electronic displacement control - EPD type

**16 17** **Pressure compensator setting\***  
**28** – 207-214 bar [3000-3100 lbf/in<sup>2</sup>]  
**35** – 241-248 bar [3500-3600 lbf/in<sup>2</sup>]  
**43** – 276-283 bar [4000-4100 lbf/in<sup>2</sup>]

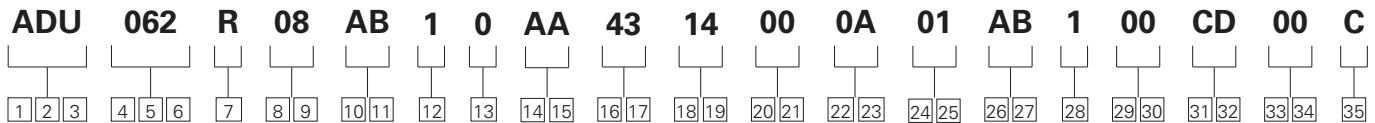
**18 19** **Flow compensator / remote pressure control setting\***  
**00** – No flow compensator setting  
**14** – 12-15 bar [180-220 lbf/in<sup>2</sup>]  
**24** – 23-26 bar [330-370 lbf/in<sup>2</sup>]

1 \* Additional settings available by request

2 # - Recommend RPC pressure settings 10-21 bar (140-350 psi)

# Model codes

## 420 Mobile Piston Pump



20 21

### Torque control setting

|           |                                   |
|-----------|-----------------------------------|
| <b>00</b> | No torque control                 |
| <b>AA</b> | 40 Nm [350 in-lbs] (41,49)        |
| <b>AB</b> | 51 Nm [450 in-lbs] (41,49)        |
| <b>AC</b> | 62 Nm [550 in-lbs] (41,49,62)     |
| <b>AD</b> | 73 Nm [650 in-lbs] (41,49,62,80)  |
| <b>AE</b> | 85 Nm [750 in-lbs] (41,49,62,80)  |
| <b>AF</b> | 96 Nm [850 in-lbs] (41,49,62,80)  |
| <b>AG</b> | 107 Nm [950 in-lbs] (41,49,62,80) |
| <b>AH</b> | 119 Nm [1050 in-lbs] (49,62,80)   |
| <b>AJ</b> | 130 Nm [1150 in-lbs] (49,62,80)   |
| <b>AK</b> | 141 Nm [1250 in-lbs] (49,62,80)   |
| <b>AL</b> | 153 Nm [1350 in-lbs] (62,80)      |
| <b>AM</b> | 164 Nm [1450 in-lbs] (62,80)      |
| <b>AN</b> | 175 Nm [1550 in-lbs] (62,80)      |
| <b>AP</b> | 186 Nm [1650 in-lbs] (62,80)      |
| <b>AR</b> | 198 Nm [1750 in-lbs] (62,80)      |
| <b>AT</b> | 209 Nm [1850 in-lbs] (62,80)      |
| <b>AU</b> | 220 Nm [1950 in-lbs] (80)         |

22 23

### Control special features

|           |  |
|-----------|--|
| <b>00</b> | Control special features   |
| <b>0A</b> | Bleed down orifice   |
| <b>0B</b> | 24V Cold start valve   |
| <b>0D</b> | 12V Cold start valve   |
| <b>0S</b> | 12V DC solenoid AMP Jr connector (used with EH inverse proportional pressure control)  |
| <b>0T</b> | 24V DC solenoid AMP Jr connector (used with EH inverse proportional pressure control)  |
| <b>0U</b> | 12V DC solenoid deutsch connector (used with EH inverse proportional pressure control) |
| <b>0V</b> | 24V DC Solenoid deutsch connector (used with EH inverse proportional pressure control) |

24 25

### Maximum displacement option\*

|           |  |
|-----------|--|
| <b>01</b> | Standard displacement (as given in code title) |
| <b>02</b> | External manual stroke adjustment set at max   |

26 27

### Auxiliary (rear) mount & output shaft

|           |                                |
|-----------|--------------------------------|
| <b>00</b> | No auxiliary mounting features |
| <b>AB</b> | SAE A 2 Bolt, 11T 16/32 Spline |
| <b>AC</b> | SAE B 2 Bolt, 13T 16/32 Spline |
| <b>AD</b> | SAE B 2 Bolt, 15T 16/32 Spline |
| <b>AE</b> | SAE A 2 Bolt, 9T 16/32 Spline  |

28

### Shaft seal

|           |  |
|-----------|--|
| <b>0</b>  | No shaft seal  |
| <b>1</b>  | Standard polyacrylate shaft seal                         |
| <b>2</b>  | Viton shaft seal   |
| <b>3†</b> | Double, two-way shaft seal, Viton with VHO filter        |
| <b>4</b>  | Nitrile shaft seal                                       |
| <b>5</b>  | Single viton shaft seal in 2/4 Bolt C mount pump housing |

29 30

### Pump special features

|           |   |
|-----------|---|
| <b>00</b> | No special features   |
| <b>AA</b> | Auxiliary mounting cover plate  |
| <b>AB</b> | Swash position sensor   |
| <b>AC</b> | Shaft speed sensor  |
| <b>AD</b> | Modified end cover, corner removed  |
| <b>AE</b> | Support Studs (1/2-13 UNC-2B x 117.8 (4.64) long in top two end cover/housing bolt locations) |
| <b>AG</b> | Swash position sensor and shaft speed sensor  |

31 32

### Paint

|           |             |
|-----------|-------------|
| <b>00</b> | No paint    |
| <b>CD</b> | Blue primer |
| <b>0B</b> | Black       |

33 34

### Identification/packaging

|           |   |
|-----------|---|
| <b>00</b> | Standard Eaton identification box packaging |
| <b>0J</b> | ATEX certification                          |

35

### Design level

|          |              |
|----------|--------------|
| <b>C</b> | Third design |
|----------|--------------|

1 \* Additional settings available by request, including fixed displacement stops.

2 † Not available on SAE B mount

### General performance specifications

|                                 |                           | Units                     | ADU041      | ADU049      | ADU062       | ADU080      |
|---------------------------------|---------------------------|---------------------------|-------------|-------------|--------------|-------------|
| <b>Displacement</b>             |                           | cc/r (in <sup>3</sup> /r) | 41.0 (2.50) | 49.2 (3.00) | 62.3 (3.80)  | 80.0 (4.88) |
| <b>Weight</b>                   | Single Seal <sup>1</sup>  | kg (lbm)                  | 22.9 (50.4) | 22.9 (50.4) | 23.8 (52.4)  | 24.2 (53.4) |
|                                 | Dual Seal <sup>1</sup>    |                           | 24.1 (53.1) | 24.1 (53.1) | 25.0 (55.1)  | 25.4 (56.1) |
| <b>Pressure</b>                 | Continuous                | bar (psi)                 | 280 (4060)  | 280 (4060)  | 280 (4060)   | 210 (3050)  |
|                                 | Intermittent <sup>2</sup> |                           | 320 (4600)  | 320 (4600)  | 320 (4600)   | 230 (3335)  |
|                                 | Peak <sup>3</sup>         |                           | 350 (5000)  | 350 (5000)  | 350 (5000)   | 250 (3625)  |
| <b>Speed<sup>4</sup></b>        | At 1 bar abs (0 psig)     | rpm                       | 2650        | 2650        | 2600         | 2500        |
|                                 | At .85 bar abs (5 in.Hg)  |                           | 2450        | 2450        | 2400         | 2200        |
|                                 | At 2 bar abs (15 psig)    |                           | 2950        | 2950        | 2800         | 2800        |
|                                 | Max (standby)             |                           | 3600        | 3600        | 3600         | 3600        |
|                                 | Min                       |                           | 600         | 600         | 600          | 600         |
| <b>Power</b>                    | Max (theoretical)         | kW (hp)                   | 50.7 (68.0) | 60.8 (81.5) | 75.6 (101.3) | 61.7 (82.7) |
|                                 | Standby                   |                           | .98 (1.3)   | .98 (1.3)   | 1.1 (1.5)    | 1.4 (1.9)   |
| <b>Torque</b>                   | Max (theoretical)         | Nm (lb-ft)                | 183 (135)   | 219 (162)   | 278 (205)    | 268 (198)   |
| <b>Bearing life<sup>5</sup></b> | At 140 bar (2030 psi)     | B10 Hours                 | 103,650     | 55,580      | 33,500       | 17,150      |
|                                 | At 210 bar (3045 psi)     |                           | 26,830      | 14,380      | 8,670        | 4,440       |
|                                 | At 280 bar (4060 psi)     |                           | 10,280      | 5,510       | 3,320        | N/A         |
| <b>Mass moment of inertia</b>   |                           | Nm-sec <sup>2</sup>       | .0033       | .0033       | .0046        | .0058       |
|                                 |                           | (lb-in-sec <sup>2</sup> ) | (.0288)     | (.0288)     | (.0403)      | (.0517)     |

1 Standard SAE B non-through drive.

2 Less than 10% of duty cycle.

3 Momentary system pressure spikes only.

4 Ratings based on Flange ports. Note: Tube ports are not available on the 62cc and 80cc displacements.

5 Bearing life ratings at rated speed - 1 bar abs (0 psig) inlet.

### Inlet pressure, case pressure, and operating temperature requirements

| Inlet pressure |                  |                | Case pressure      |                      |                | Operating temperature |                     |                      |
|----------------|------------------|----------------|--------------------|----------------------|----------------|-----------------------|---------------------|----------------------|
| Rated          | Minimum          | Maximum        | Maximum continuous | Maximum intermittent | Peak           | Rated                 | Minimum temperature | Maximum intermittent |
| bar abs (psig) | bar abs (in. Hg) | bar abs (psig) | bar abs (psig)     | bar abs (psig)       | bar abs (psig) | °C (°F)               | °C (°F)             | °C (°F)              |
| 1.0 (0)        | 0.85 (5)         | 4.4 (50)       | 1.3 (5)            | 3.1 (30)             | 6.2 (75)       | 93 (200)              | -37 (-35)           | 104 (220)            |

### Hydraulic fluids

| Fluid   | Recommended operating viscosity range cSt (SUS) | Maximum continuous cSt (SUS) | Maximum viscosity at startup cSt (SUS) | Minimum viscosity @ max. temperature of 93°C (200°F) cSt (SUS) | Minimum intermittent cSt (SUS) |
|---|---|------------------------------|--|--|--------------------------------|
| Use antiwear hydraulic oil, or automotive type crankcase oil (designations SC, SD, SE or SF) per SAE J183 FEB80 | 16 to 40 (80 to 188)                            | 430 (1192)                   | 2100 (9720)                            | 10 (59)  | 6 (46)                         |

For more information, see Eaton publication 579. For operation on other alternative or environmentally friendly fluids, please contact your Eaton representative.

# Control options

## Pressure & Flow (Load Sense) Compensator

The pump will provide flow & pressure matching of pump output to system load demand, maximizing efficiency and improving load metering characteristics of any directional control valve installed between the pump and the load. Load sensing ensures that the pump always provides only the amount of flow needed by the load. The pump operating pressure adjusts to the load pressure plus a pressure differential required for the load sense margin. When the system is not demanding flow, the load sense control will operate in low pressure zero flow, energy saving stand-by mode. The differential pressure is the difference between the pressure inlet and service port of a proportionally controlled directional valve, or a load sensing directional control valve. See the model code for differential pressure settings for load sensing. If the load pressure exceeds the system pressure setting, the pressure compensator reduces pump displacement. The load sensing line must be as short as possible and can also be used for remote pressure control or unloading of the pump pressure. For remote pressure control purposes, it is recommended that you contact your Eaton Representative for the correct configuration of the control.

### Warning:

1. When adjusting the pressure compensator, install a 0 to 350 bar (0 to 5000 psi) gage in the outlet gage port and limit the pressure setting to the continuous rated pressure for the pump displacement. It is possible to adjust the pressure compensator beyond the rated pressure of the pump. Doing so, may void the warranty of the pump.
2. EATON recommends use of relief valve in all systems.

### Pressure limit settings

The pressure compensator uses two springs to cover the full pressure range of the X20 pumps.

Spring 1 = < 140 bar (2050 psi)

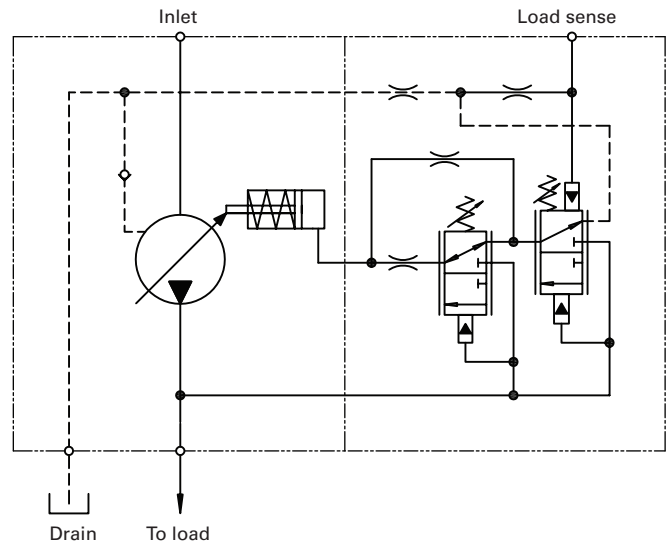
Spring 2 = 145 - 280 bar (2100 - 4060 psi)

### Flow compensator (load sense) settings

There are two springs used to cover the load sense adjustment range of this control. Available load sense range is

Spring 1 = < 20 bar (290 psi)

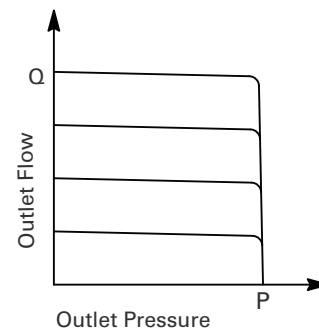
Spring 2 = 22- 42 bar (319- 609 psi).



### Dynamic response per SAE J745 (using swash plate position)

|        | Response (off stroke) | Recovery (on stroke) | Load sense recovery |
|--------|-----------------------|----------------------|---------------------|
|        | msec                  | msec                 | msec                |
| ADU041 | 20                    | 75                   | 90                  |
| ADU049 | 20                    | 75                   | 90                  |
| ADU062 | 25                    | 90                   | 115                 |
| ADU080 | 26                    | 75                   | 115                 |

### Typical operating curve





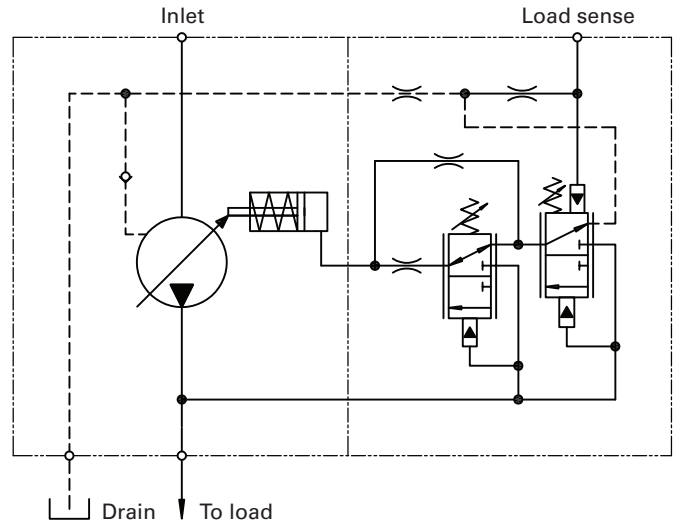
The pump will provide a continuously modulated flow to meet changing load demands at a pre-adjusted compensator pressure. At pressures below the compensator setting, the pump will operate at maximum displacement. See model code position 16,17 for compensator pressure ranges.

### Warning

1. When adjusting the pressure compensator, install a 0 to 350 bar (0 to 5000 psi) gage in the outlet gage port and limit the pressure setting to the continuous rated pressure for the pump displacement. It is possible to adjust the pressure compensator beyond the rated pressure of the pump. Doing so, may void the warranty of the pump.
2. EATON recommends use of relief valve in all systems.

### Pressure limit settings

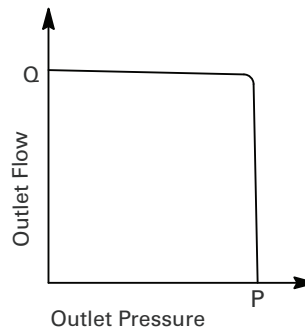
The pressure compensator uses two springs to cover the full pressure range of the X20 pumps. The high pressure spring covers the range from 140 bar (2050 psi) to 280 bar (4060 psi). The low pressure spring is adjustable from minimum pressure through 140 bar (2050 psi).



### Dynamic response per SAE J745 (using swash plate position)

|        | Response<br>(off stroke)<br>msec | Recovery<br>(on stroke)<br>msec |
|--------|----------------------------------|---------------------------------|
| ADU041 | 20                               | 75                              |
| ADU049 | 20                               | 75                              |
| ADU062 | 25                               | 90                              |
| ADU080 | 26                               | 75                              |

### Pressure cut-off characteristics of pressure compensator control at 49°C (120°F), static conditions.



# Control options

## Torque Control

The torque control limits the torque input to the pump preventing the engine from stalling while also optimizing the use of the engine power.

When combined with Pressure Compensator Control and/or Load Sense, it will allow the pump to remain inside the power envelope of the Pressure Flow curve. When the combination of pump flow and outlet pressure moves outside the envelope the pump displacement will automatically be reduced.

**This maximum setting is easily calculated using the following steps:**

- Select the 420 pump displacement you intend to use
- Identify the available engine horsepower (HP) and speed (rpm)
- Calculate the torque limit required by the system using the equations shown
- Select the MAX torque setting from the table shown

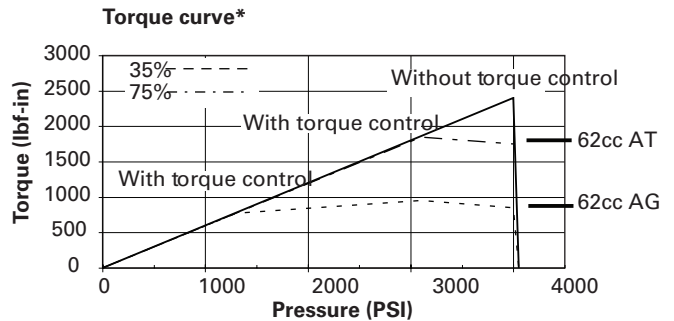
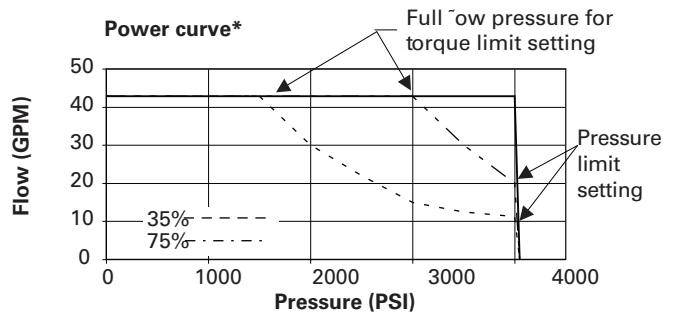
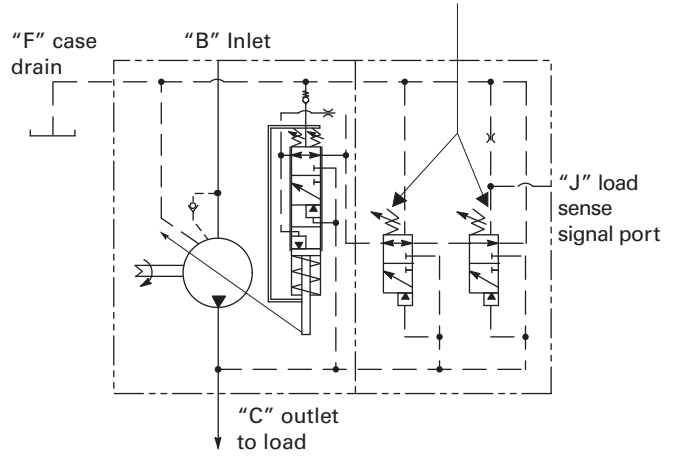
$$\text{Torque (in-lbs)} = \frac{\text{Horsepower (HP)} \times 63025}{\text{Engine RPM}}$$

$$\text{Torque (Nm)} = \frac{\text{Horsepower (KW)} \times 9550}{\text{Engine RPM}}$$

| Code | Torque setting       | 41cc | 49cc | 62cc | 80cc |
|------|----------------------|------|------|------|------|
| AA   | 40 Nm (350 in-lbs)   | √    | √    | —    | —    |
| AB   | 51 Nm (450 in-lbs)   | √    | √    | —    | —    |
| AC   | 62 Nm (550 in-lbs)   | √    | √    | √    | —    |
| AD   | 73 Nm (650 in-lbs)   | √    | √    | √    | √    |
| AE   | 85 Nm (750 in-lbs)   | √    | √    | √    | √    |
| AF   | 96 Nm (850 in-lbs)   | √    | √    | √    | √    |
| AG*  | 107 Nm (950 in-lbs)  | √    | √    | √    | √    |
| AH   | 119 Nm (1050 in-lbs) | —    | √    | √    | √    |
| AJ   | 130 Nm (1150 in-lbs) | —    | √    | √    | √    |
| AK   | 141 Nm (1250 in-lbs) | —    | √    | √    | √    |
| AL   | 153 Nm (1350 in-lbs) | —    | —    | √    | √    |
| AM   | 164 Nm (1450 in-lbs) | —    | —    | √    | √    |
| AN   | 175 Nm (1550 in-lbs) | —    | —    | √    | √    |
| AP   | 186 Nm (1650 in-lbs) | —    | —    | √    | √    |
| AR   | 198 Nm (1750 in-lbs) | —    | —    | √    | √    |
| AT*  | 209 Nm (1850 in-lbs) | —    | —    | √    | √    |
| AU   | 220 Nm (1950 in-lbs) | —    | —    | √    | √    |

\* reference 62cc

See page 5 & 6 for pressure compensator control and load sense

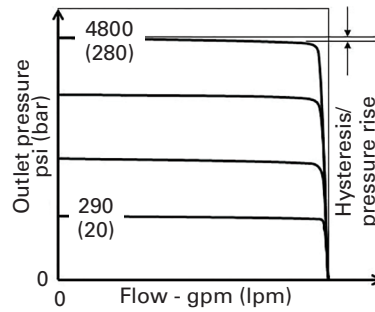


Remote relief valve is to be connected to pilot port "J" through necessary external piping. Standard differential pressure of 20 bar is set at RPC spool. The required outlet pressure (below 280 bar) can be set by adjusting remote relief valve setting. Once pressure reaches preset value, flow across remote relief valve starts, this results in RPC spool movement due to pressure imbalance. This will de-stroke the pump to maintain the set pressure.

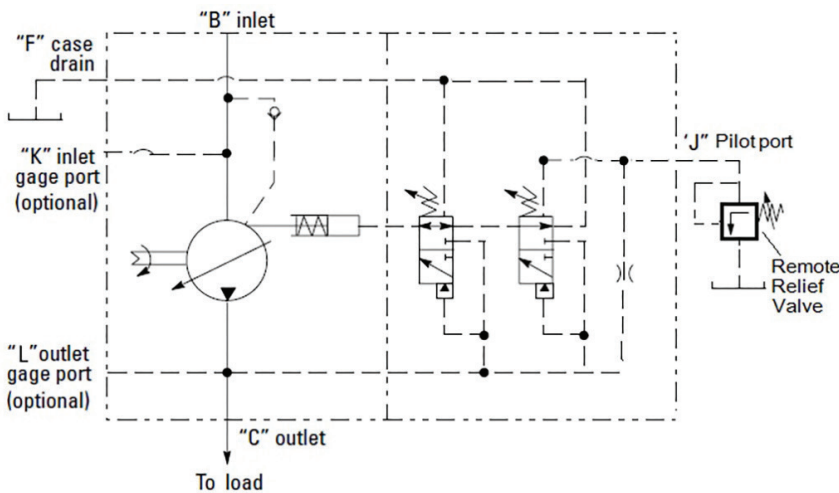
Secondary pressure compensator is provided to limit the max pressure setting as a fail safe measure. The delta pressure is factory set which can not be changed.

### Note-

- Flow compensator is not available with RPC.
- Flow compensator/ Remote pressure control setting should be selected within range of 10-24 bar (140-350 psi).
- Remote relief valve is not included in supply scope of the pump.
- If the remote line is connected directly to tank, the flow compensator setting selected in the model code will be the minimum pressure setting.



|   |                     |
|---|---------------------|
| Delta pressure setting at control valve - bar (psi)       | 14 - 24 (200 - 350) |
| Control fluid consumption - lpm (gpm)                     | 4.5 (1.2) max.      |
| Recommended flow rating of remote relief valve- lpm (gpm) | 3 - 5 (0.8 - 1.32)  |
| Recommended Eaton Relief Valve part number                | RV5-10-S-0-50       |



# Control options

## X20 Electronic Displacement Control (EDC)

Pump displacement can be controlled step-less, as per the current signal provided to the solenoid control valve. The integrated pump control makes use of an external current signal to vary the pump displacement. This control has an proportional characteristic i.e. with increasing current signal, the displacement increases proportionately.

This control is with manual override. Based failsafe condition there are two types:

**Min type (EP):** Return to min displacement in case of power loss.

**Max type (EPD):** Return to max displacement in case of power loss

**Warning:** The pressure setting may be adjusted beyond the rated pressure of the pump. When adjusting the pressure, install a 0-350 bar (0-5000 psi) gage in the outlet gage port and limit the pressure setting to the continuous rated pressure for the pump displacement.

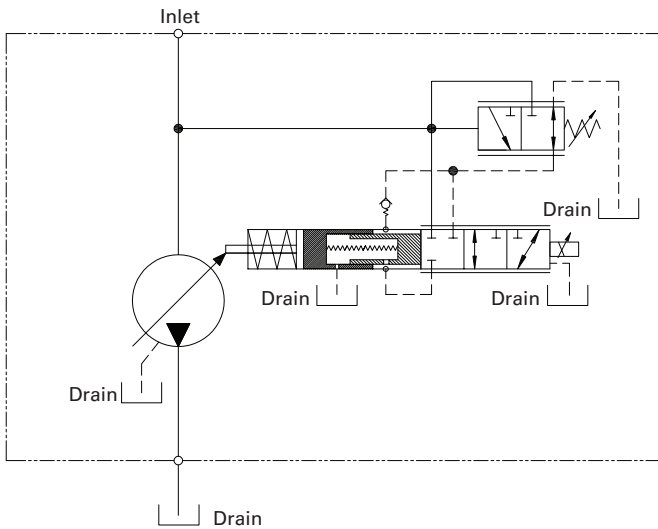
### Pressure limit settings

The EDC covers pressure range of the X20 pumps. The max pressure can be set from 140-280 bar (2050-4060 psi).

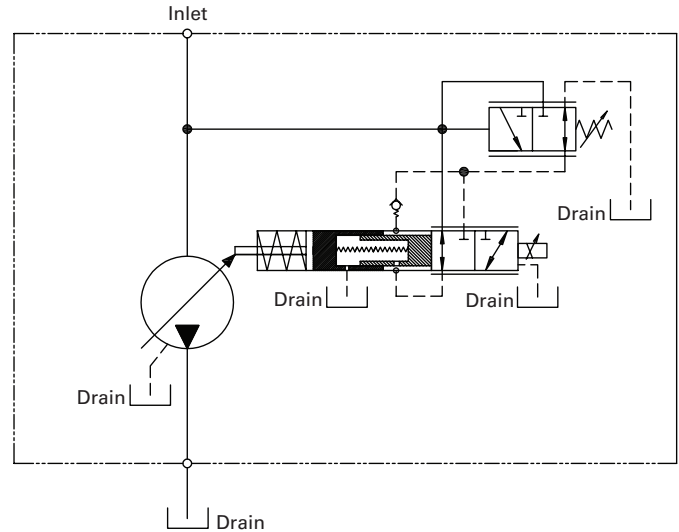
### Electrical data

|                       |                      |                     |
|-----------------------|----------------------|---------------------|
| Voltage               | 12 V DC              | 24 V DC             |
| Max Current           | 1500 mA              | 750 mA              |
| R20, Resistance(ohm)  | 5.19 +/- 0.52%       | 20.8 +/- 2.08%      |
| Type of Control       | Current              | Current             |
| Recommended           | 250 Hz               | 250 Hz              |
| PWM Frequency         |                      |                     |
| Dither Value          | 75 Hz                | 75 Hz               |
| Dither Amplitude      | 300 mA               | 300 mA              |
| Duty Cycle            | 100%                 | 100%                |
| Insulation material   | Class H, 180 deg C   | Class H, 180 deg C  |
| Protection Class      | IP69K                | IP69K               |
| Connector             | Deutsch              | Deutsch             |
| Operating Temperature | --40 deg C; 85 deg C | -40 deg C; 85 deg C |

X20 EDC EPD schematic with pressure compensator



X20 EDC EP schematic



## EH Inverse Proportional Pressure Control (IPPC)

The EH Inverse Proportional Pressure control allows for step less variation of the max pump output pressure, as per the current signal provided to the control valve solenoid.

The integrated pump control makes use of an external current signal to vary the pump output pressure.

This control has an inverse proportional characteristic i.e. with increasing current signal, the max output pressure is proportionately reduced.

### Warning:

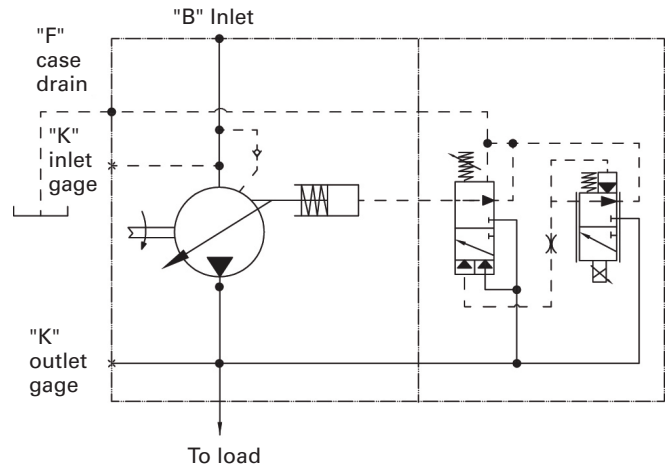
1. When adjusting the pressure compensator, install a 0 to 350 bar (0 to 5000 psi) gage in the outlet gage port and limit the pressure setting to the continuous rated pressure for the pump displacement. It is possible to adjust the pressure compensator beyond the rated pressure of the pump. Doing so, may void the warranty of the pump.
2. EATON recommends use of relief valve in all systems.

### Pressure limit settings

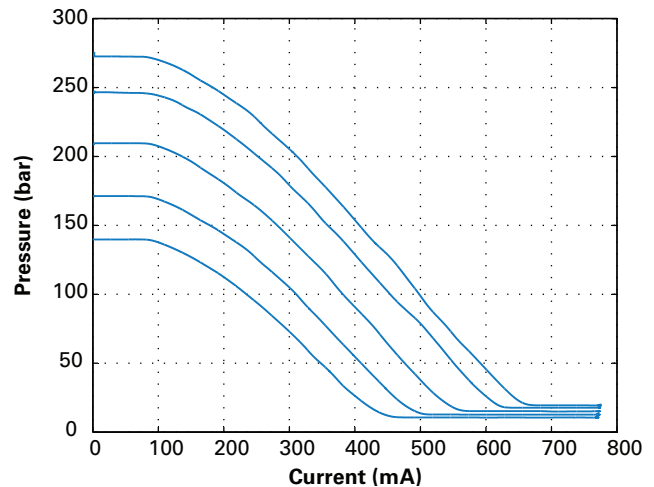
The EH IPPC pressure can be set in the range of 140 bar (2050 psi) to 280 bar (4060 psi).

### Electrical data

|                       |                      |                      |
|-----------------------|----------------------|----------------------|
| Voltage               | 12 V                 | 24 V                 |
| Max Current           | 1500 mA              | 750 mA               |
| R20, Resistance(ohm)  | 5.3 +/- 5%           | 21.2 +/- 5%          |
| Type of Control       | Current              | Current              |
| Recommended           | 100 Hz               | 100 Hz               |
| PWM Control           |                      |                      |
| Frequency             |                      |                      |
| Duty Cycle            | 100%                 | 100%                 |
| Insulation material   | Class H, 180 deg C   | Class H, 180 deg C   |
| Protection Class      | IP69K/IPX9K          | IP69K/IPX9K          |
| Connector             | AMP Junior Power     | AMP Junior Power     |
|                       | Timer/ Deutsch       | Timer/ Deutsch       |
|                       | Connector DT04-2P    | Connector DT04-2P    |
| Operating Temperature | -30 deg C; 105 deg C | -30 deg C; 105 deg C |



**Typ. Current vs pressure characteristics of IPPC at 1800 rpm at various max pressure settings at 49 Deg C (120deg F), static conditions.**

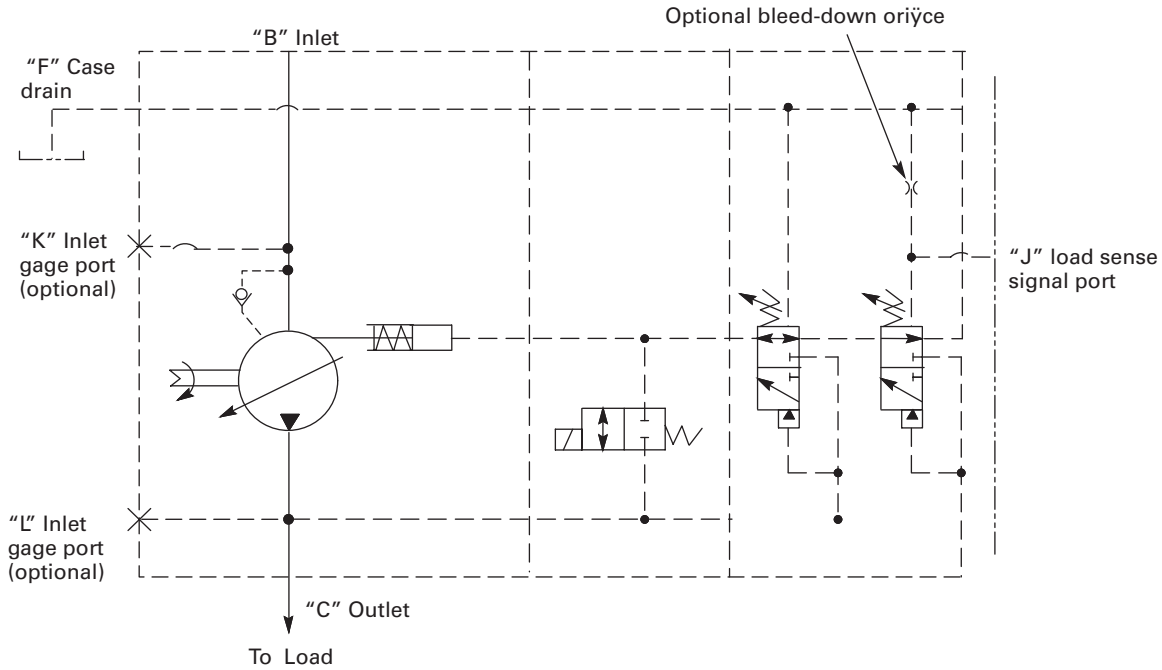


# Control options

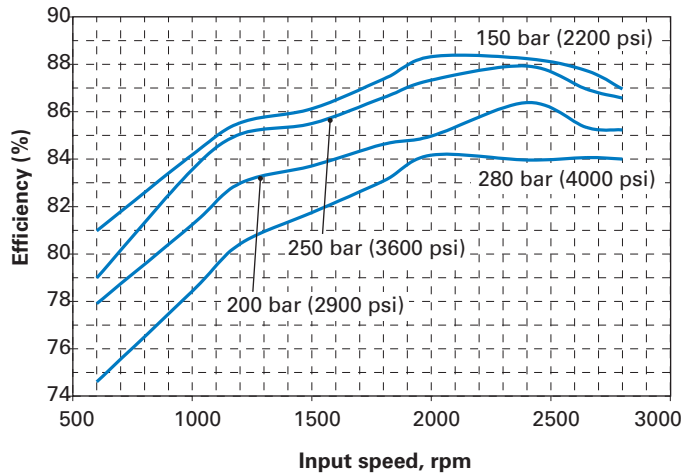
## Electronic De-stroke (Cold Start) Valve

The 620 Electronic Destroke Valve reduces pump start-up torque by directing outlet pressure to the control piston.

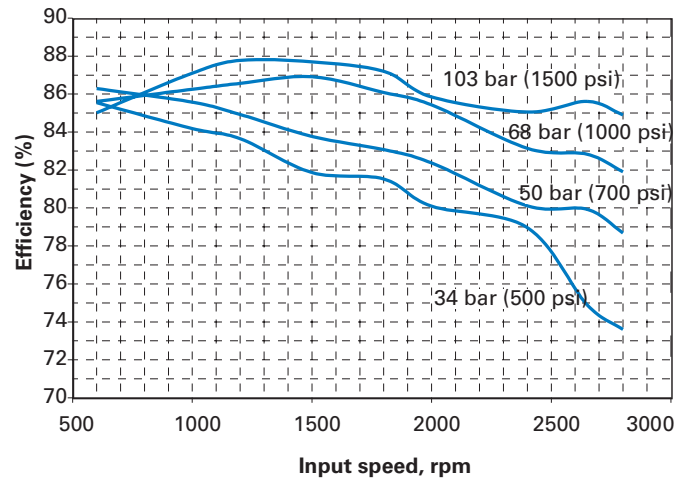
It is primarily used in cold weather applications and includes a 12 or 24 VDC directional control valve mounted between the pump housing and compensator. Refer model code position 22,23 - control special features for available connector options



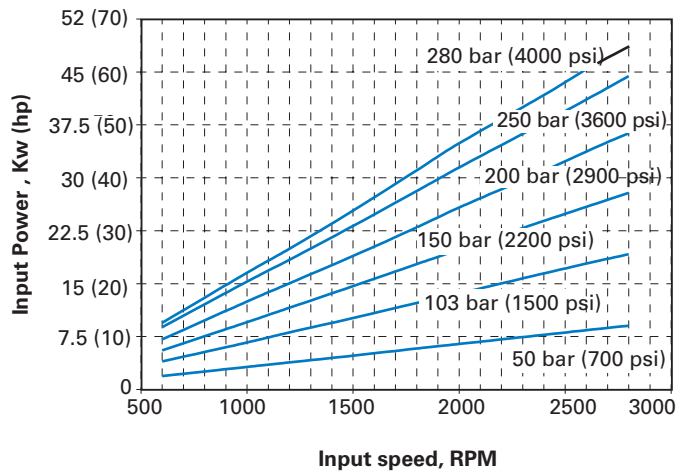
Overall efficiency versus speed @ 49° C (120° F), Full Flow, and 1.0 bar (0 psi) Inlet



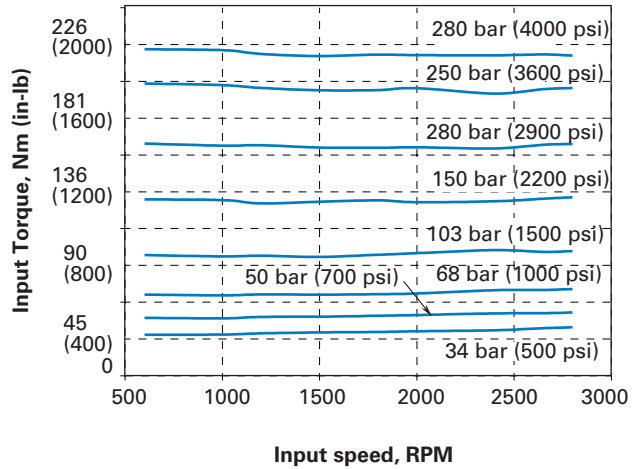
Overall efficiency versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) Inlet



Input power versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet



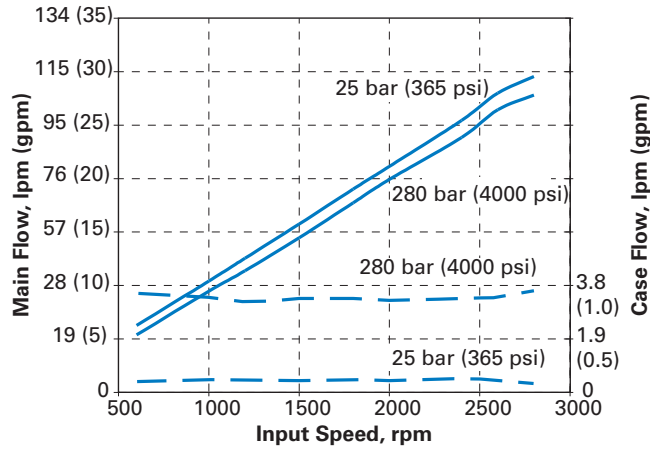
Input torque versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet



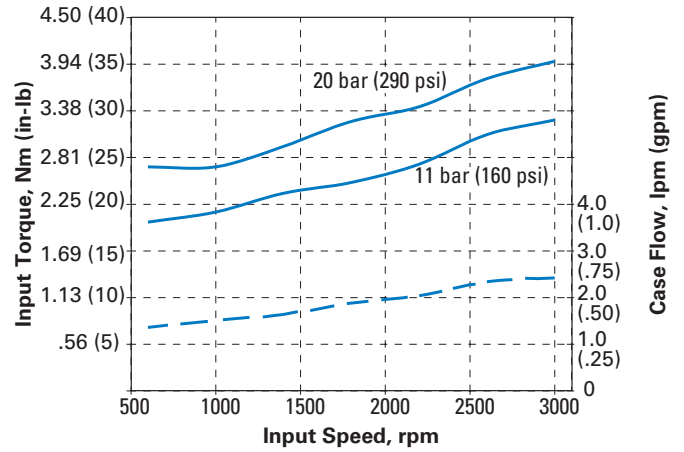
# Performance

ADU041

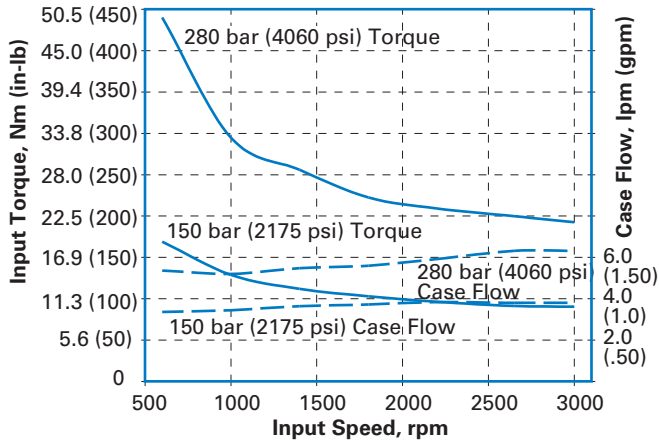
Delivery and case flow versus speed @ 49° C (120° F)



Input torque and case flow stand-by @ 49° C (120° F)

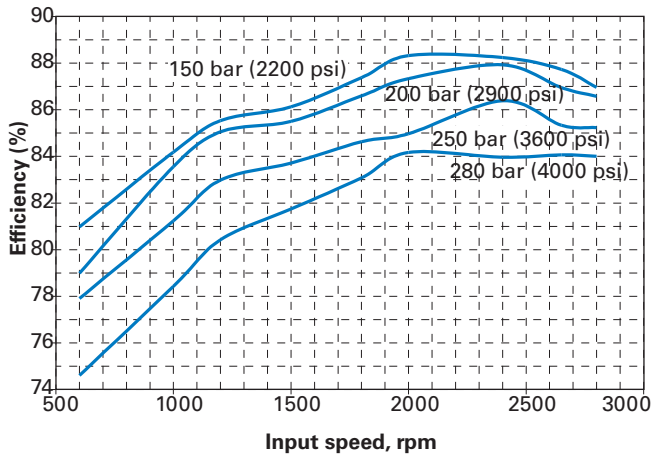


Input torque and case flow cut-off @ 49° C (120° F)

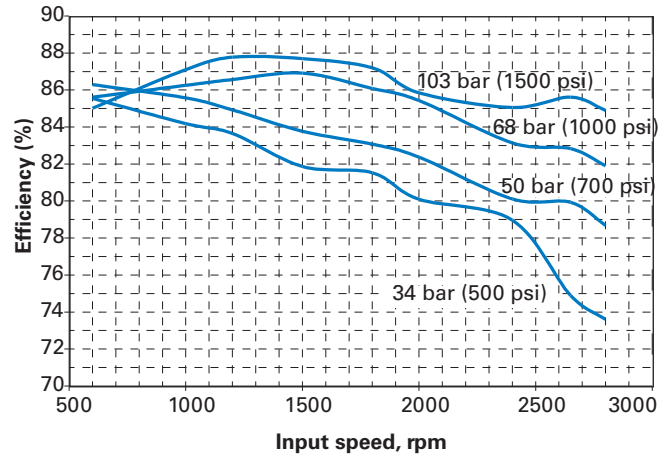




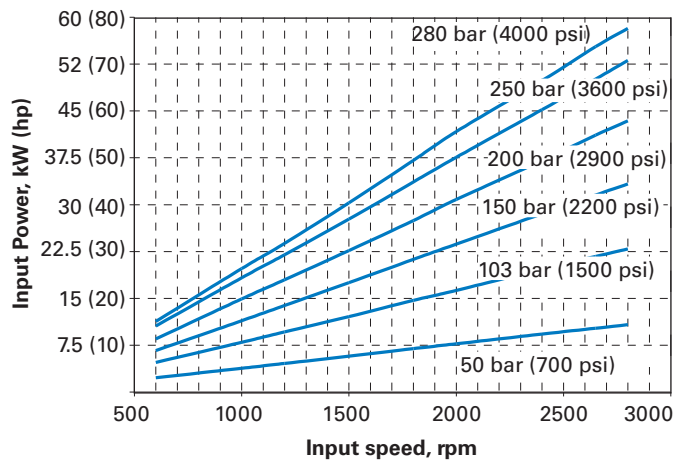
Overall efficiency versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet



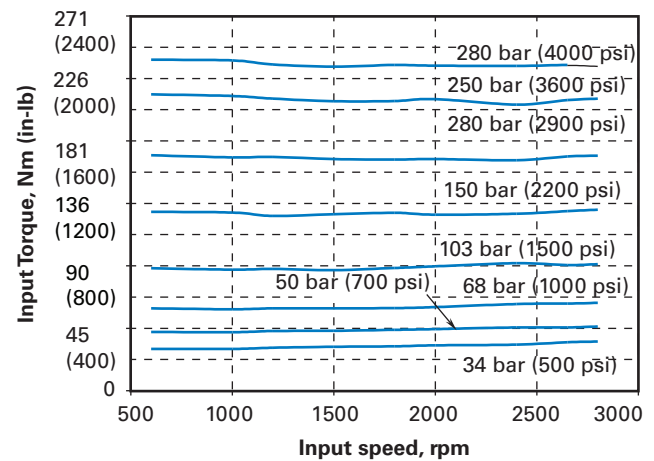
Overall efficiency versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet



Input power versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet



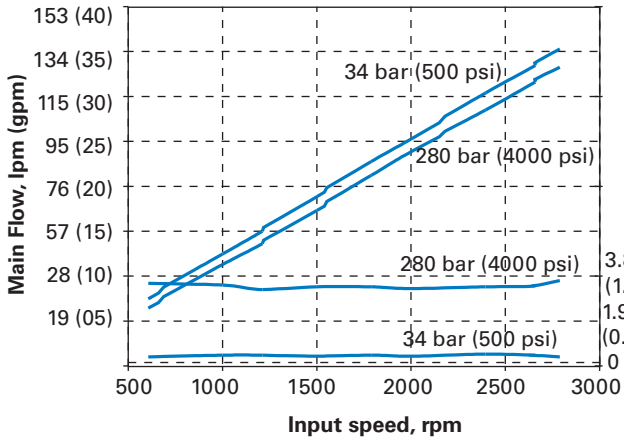
Input torque versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet



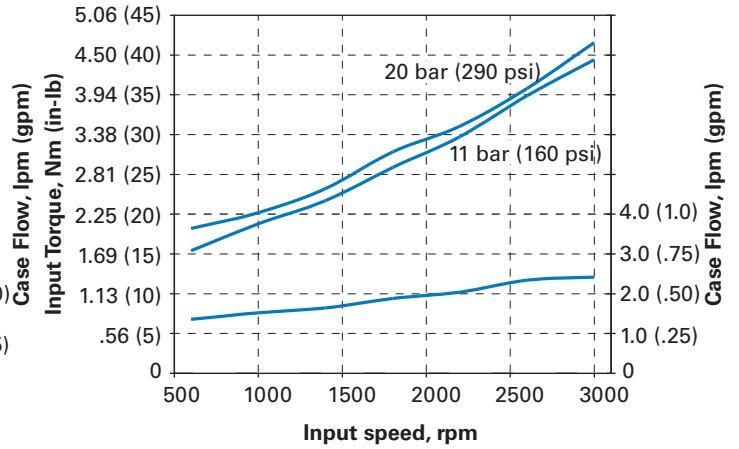
# Performance

ADU049

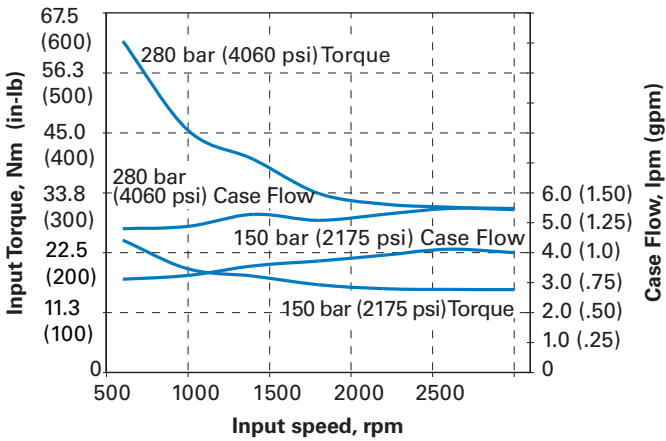
Delivery and case flow versus speed @ 49° C (120° F)



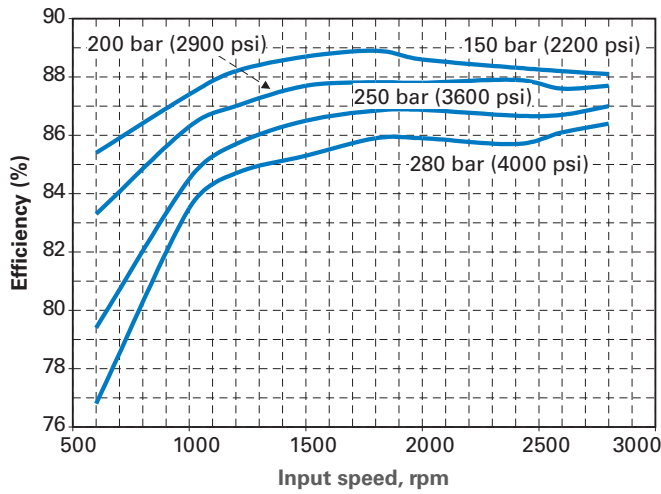
Input torque and case flow stand-by @ 49° C (120° F)



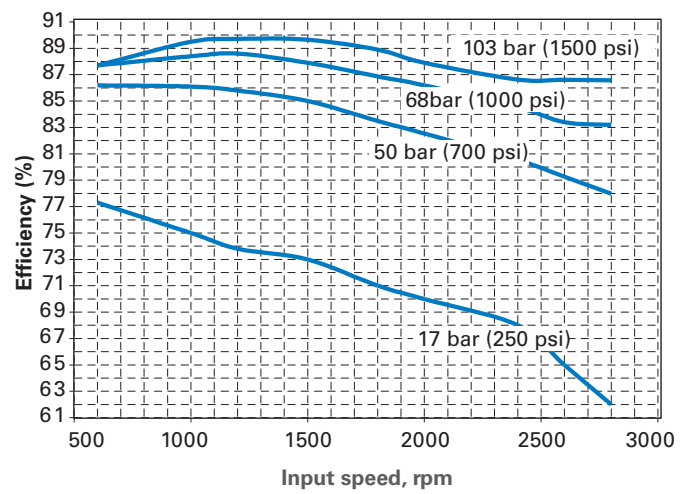
Input torque and case flow cut-off @ 49° C (120° F)



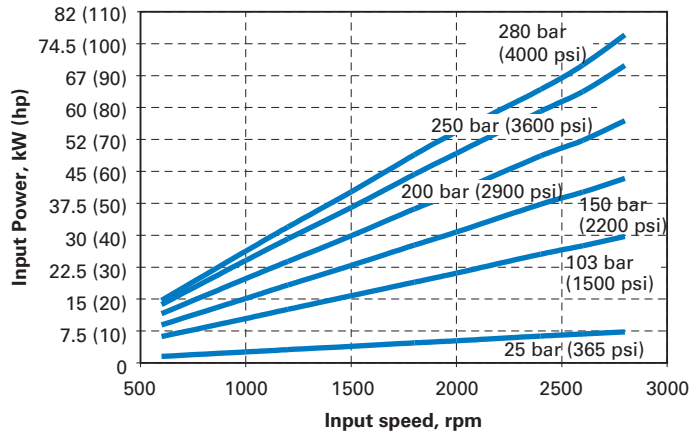
Overall efficiency versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet



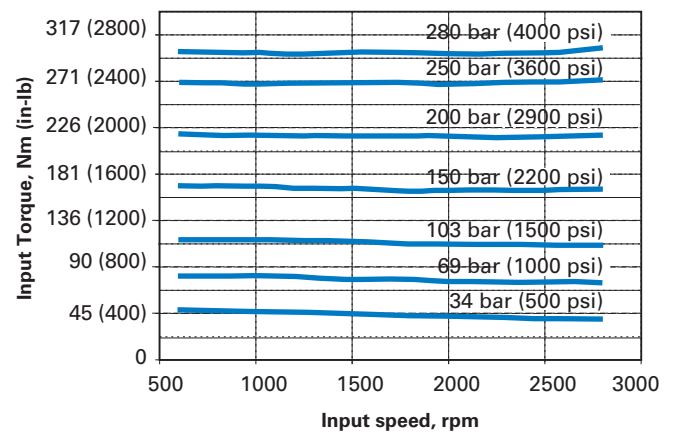
Overall efficiency versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet



Input power versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet



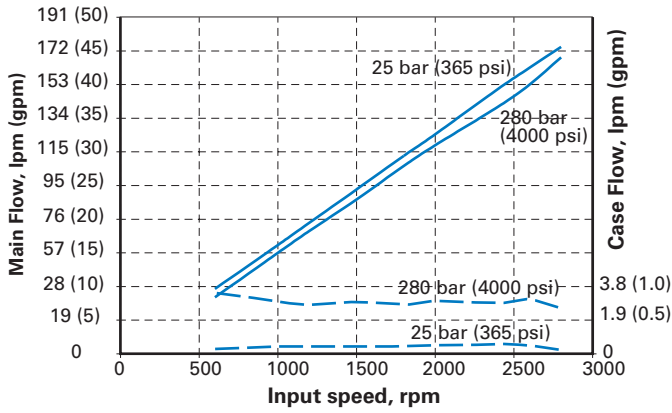
Input torque versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet



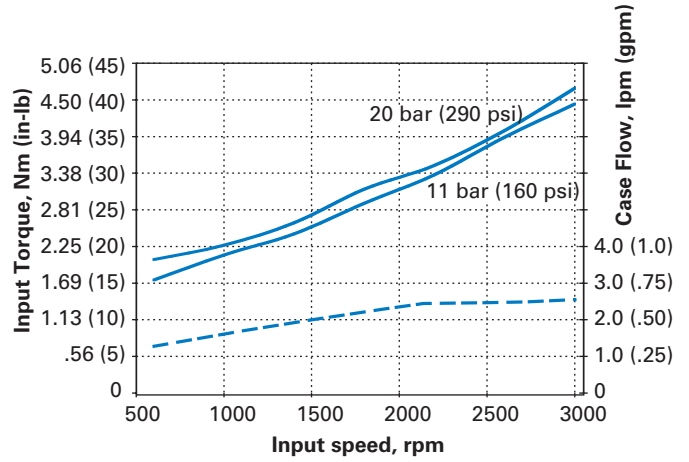
# Performance

ADU062

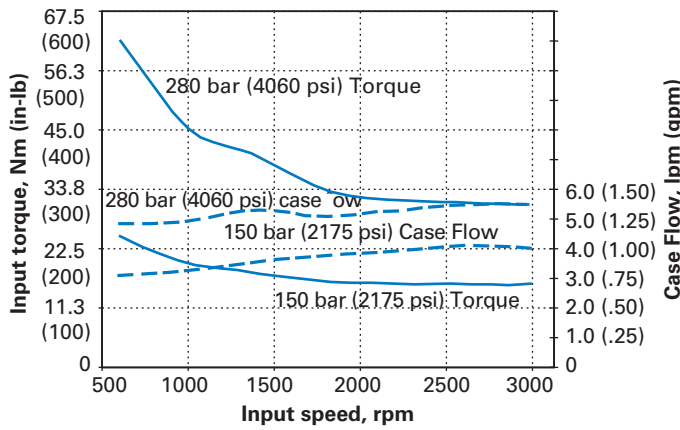
Delivery and case flow versus speed @ 49° C (120° F)



Input torque and case flow stand-by @ 49° C (120° F)



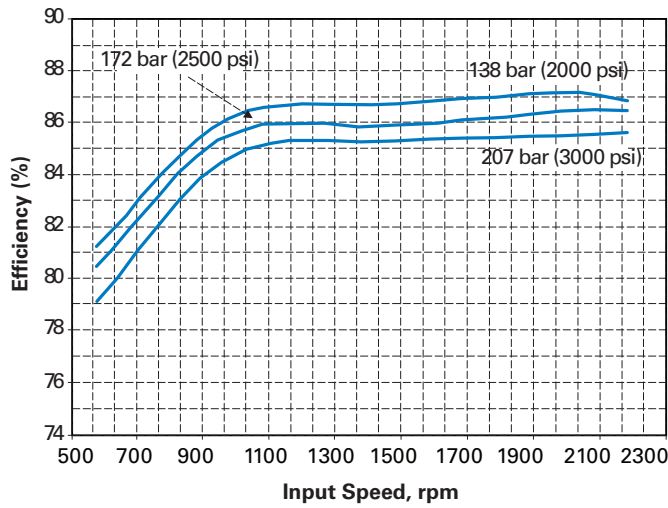
Input torque and case flow cut-off @ 49° C (120° F)



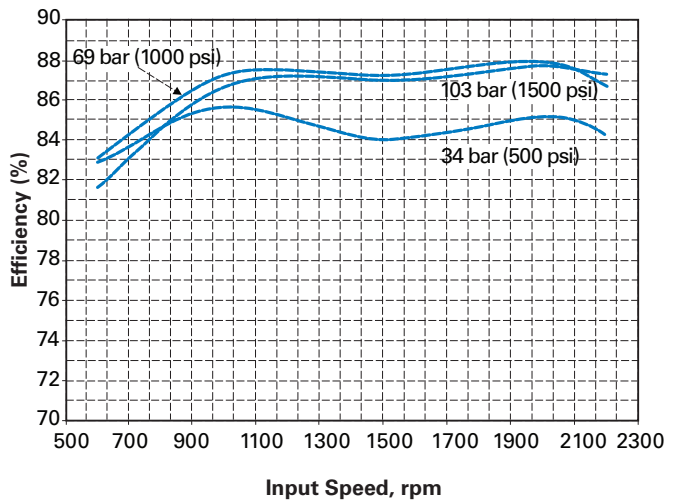
# Performance

ADU080

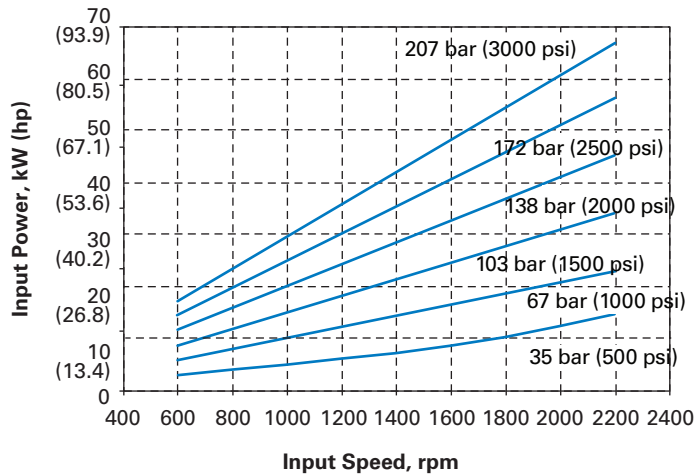
**Input power versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet**



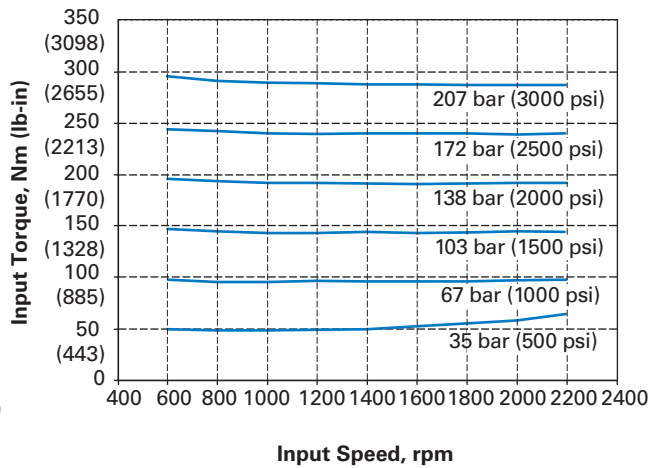
**Overall efficiency versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet**



**Input power versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet**



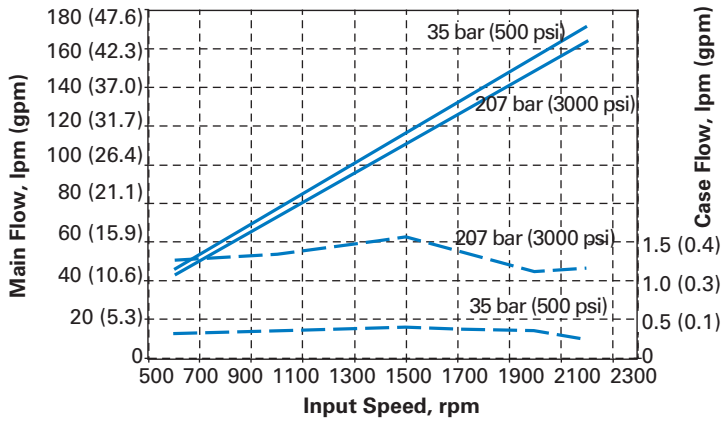
**Input torque versus speed @ 49° C (120° F), full flow, and 1.0 bar (0 psi) inlet**



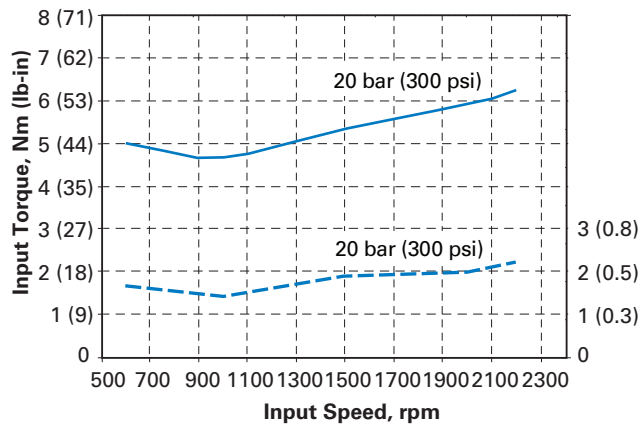
# Performance

ADU080

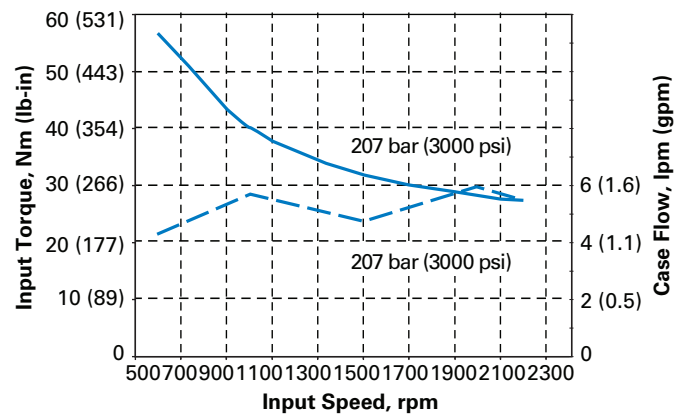
Delivery and case flow versus speed @ 49° C (120° F)



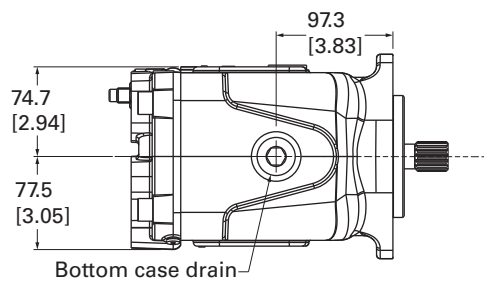
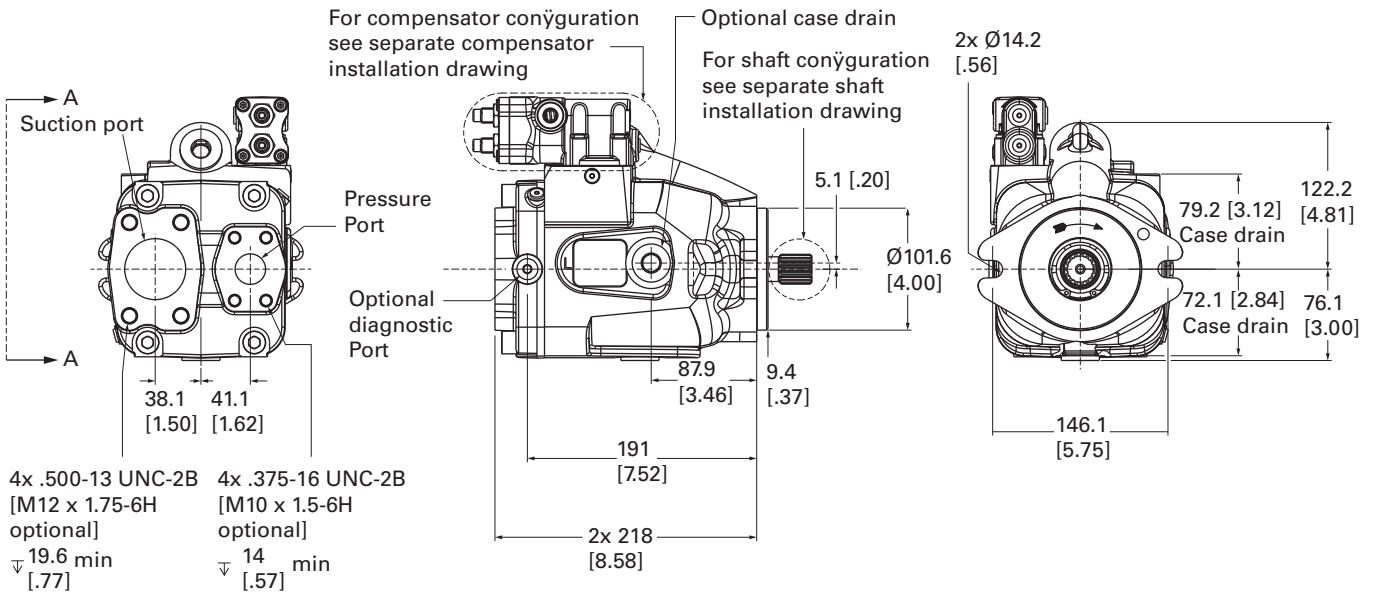
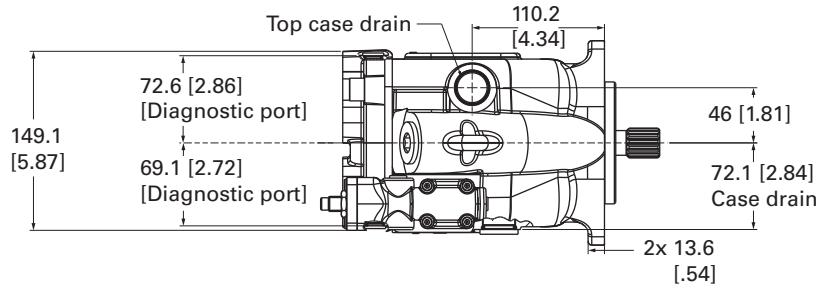
Input torque and case flow stand-by @ 49° C (120° F)



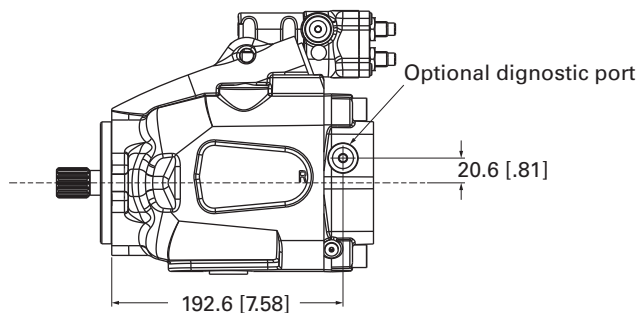
Input torque and case flow cut-off @ 49° C (120° F)



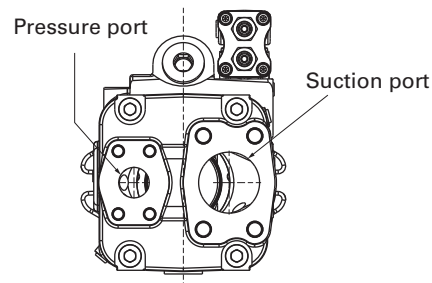
### RH Rotation



### View A-A



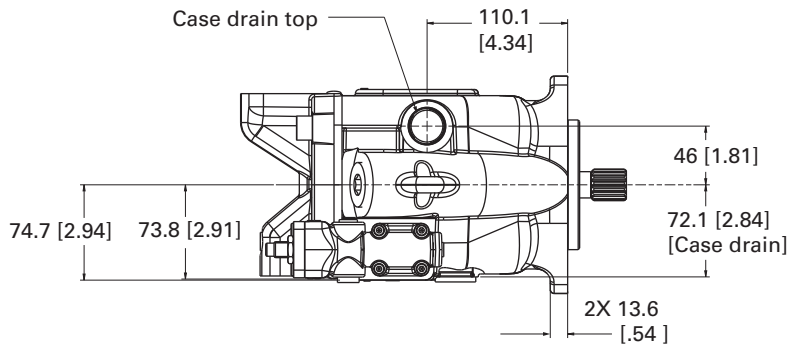
### LH Rotation



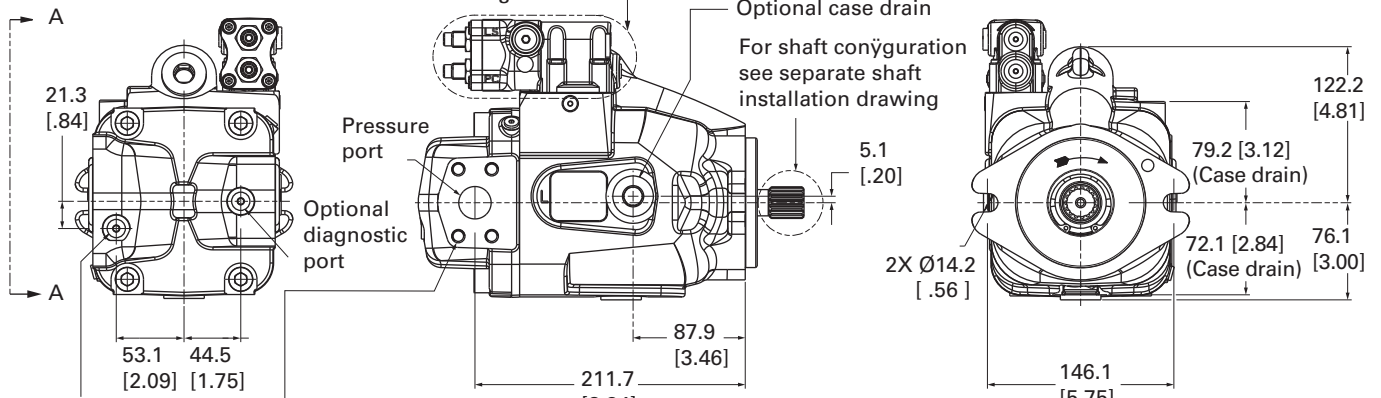
# Pump installation

B-Mount - side-ported

## RH Rotation



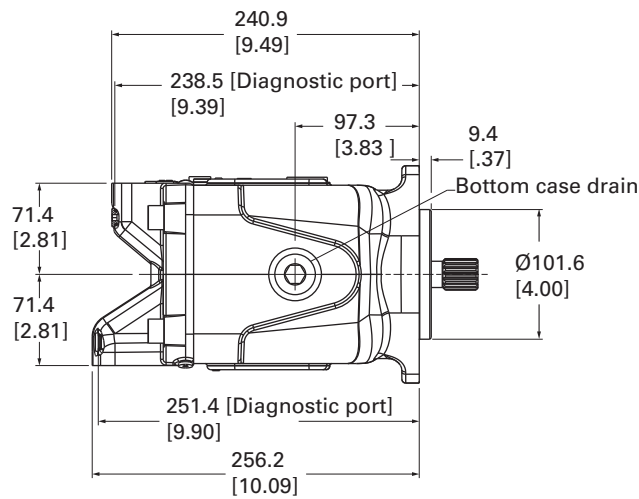
For compensator configuration see separate compensator installation drawing



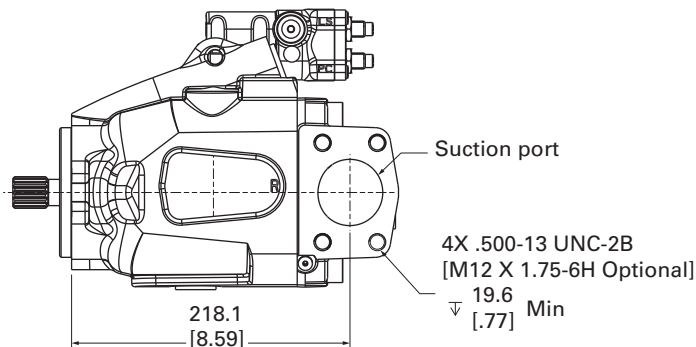
Optional suction port

4X .375-16 UNC-2B [M10 X 1.5-6H Optional]

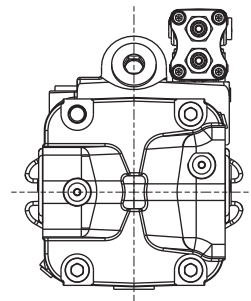
∇ 14 Min [.55]



## View A-A

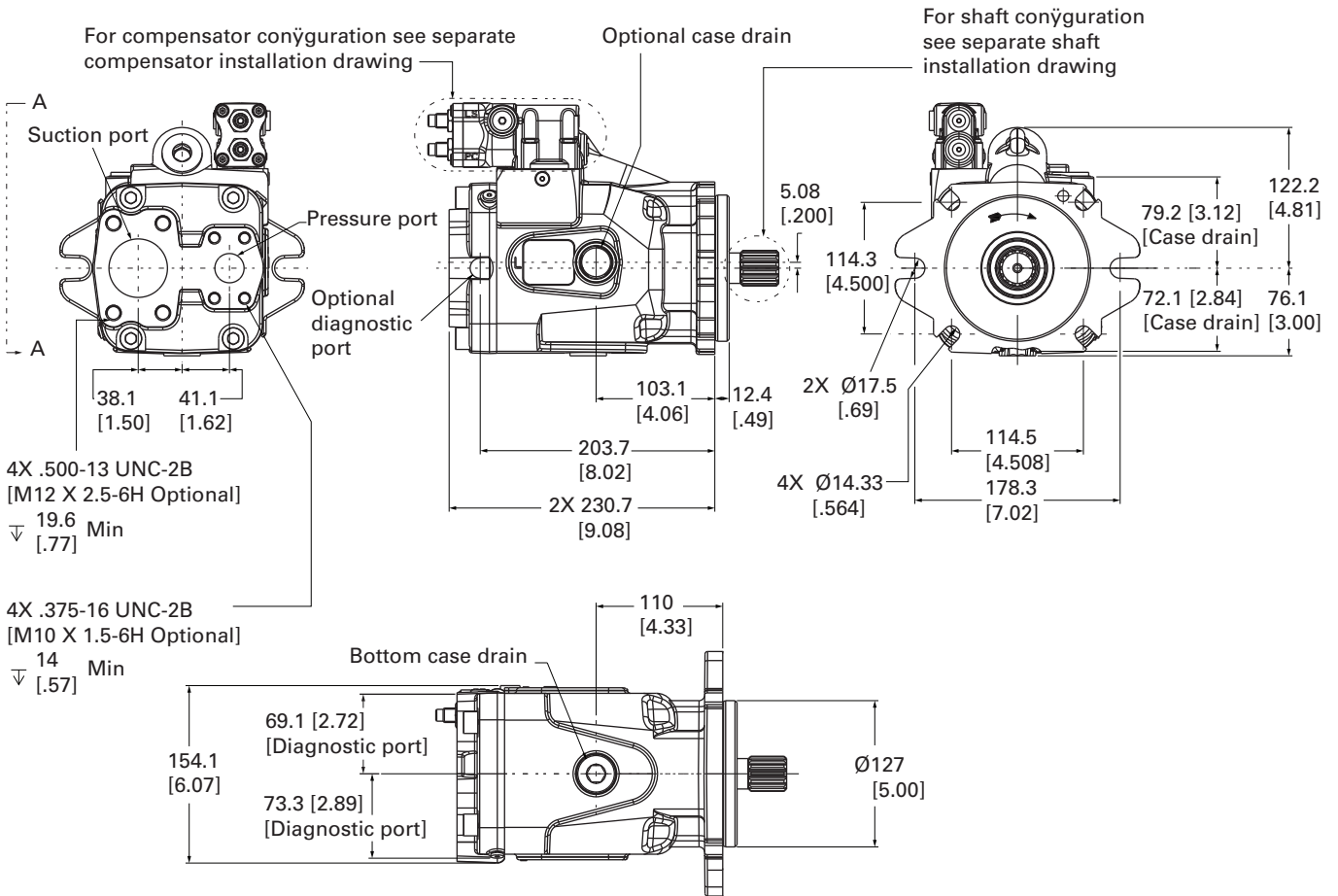
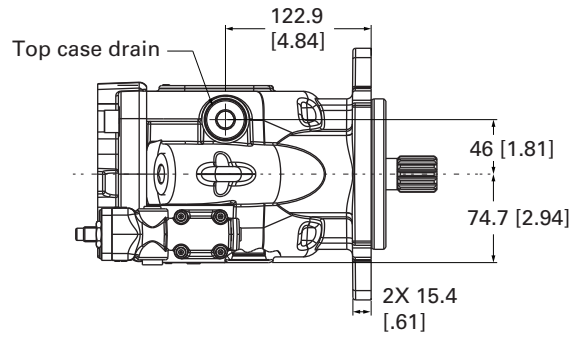


## LH Rotation

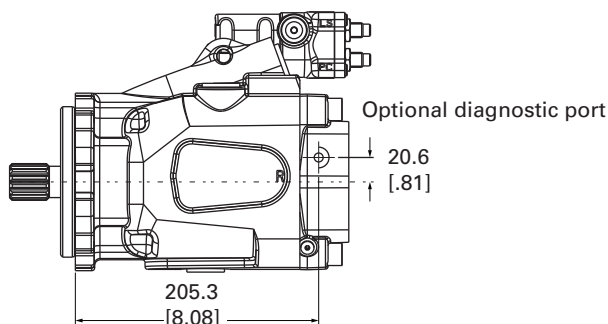




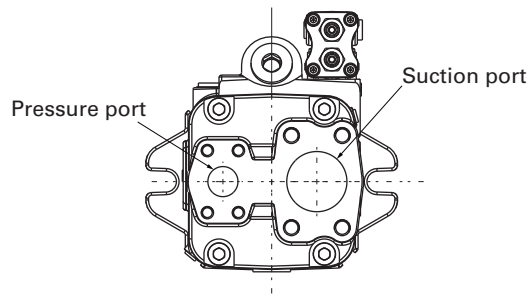
### RH Rotation



### View A-A



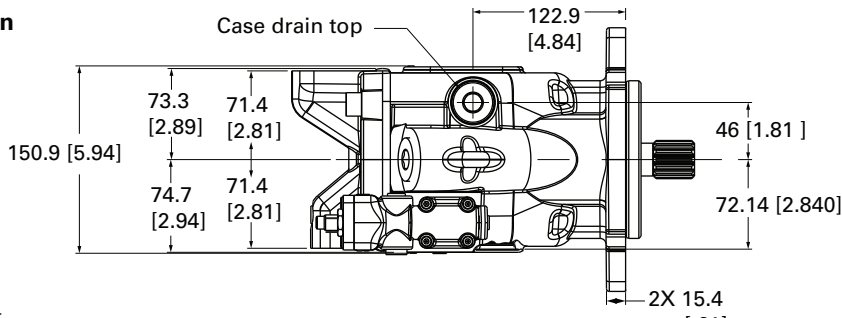
### LH Rotation



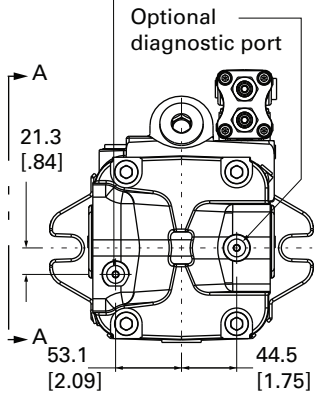
# Pump installation

C-Mount - side-ported

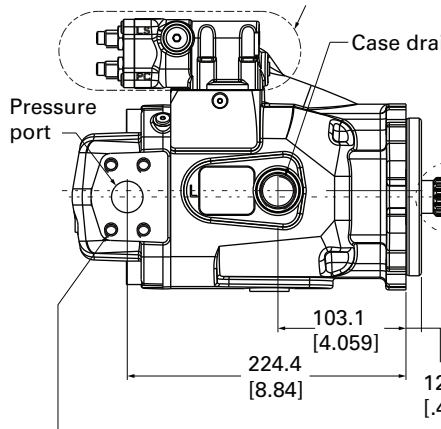
## RH Rotation



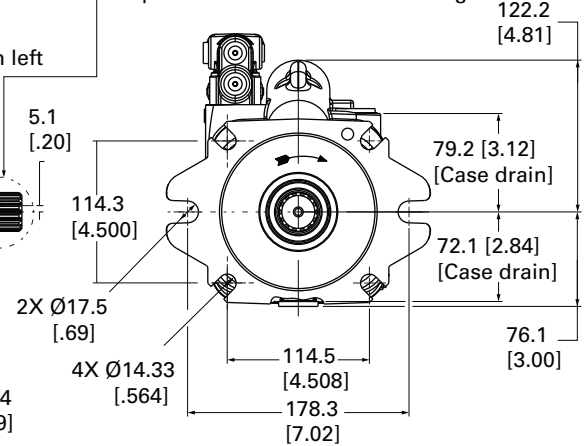
Optional suction port



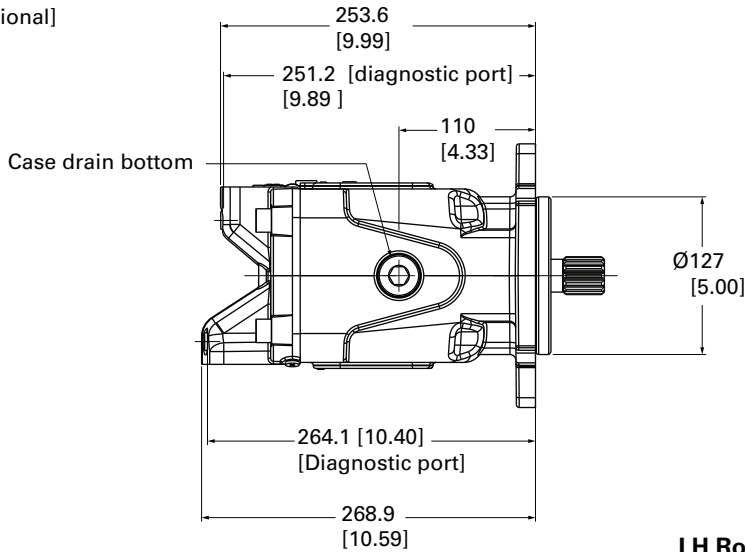
For compensator configuration see separate compensator installation drawing



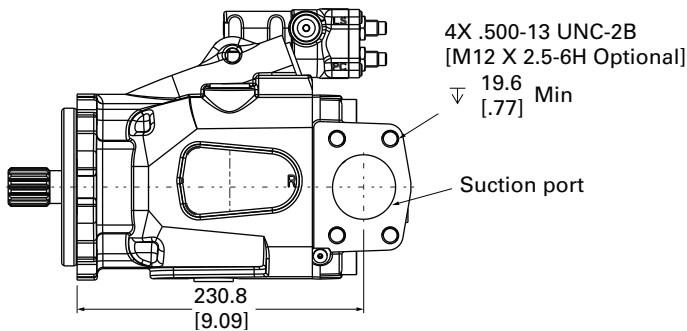
For shaft configuration see separate shaft installation drawing



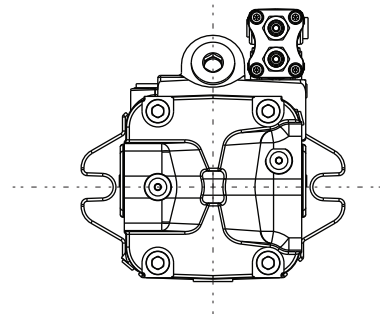
4X .375-16 UNC-2B  
[M10 X 1.5-6H Optional]  
14  
▽ [.57] Min



## View A-A

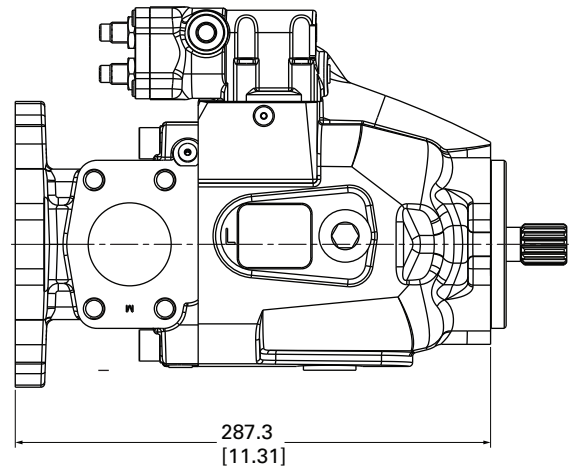
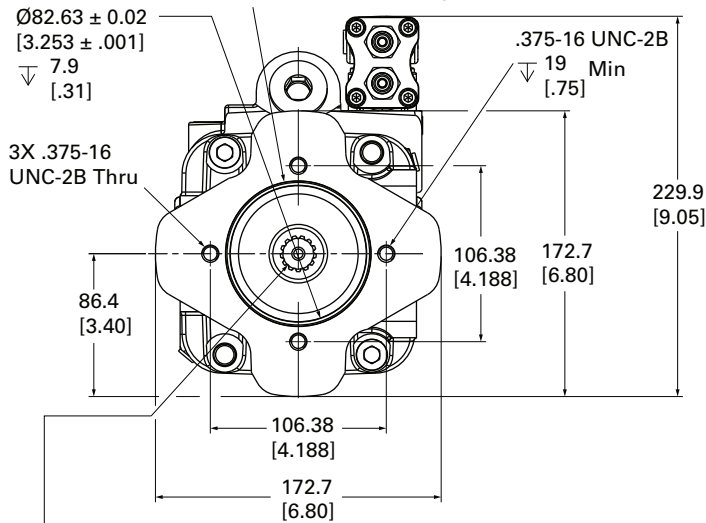


## LH Rotation



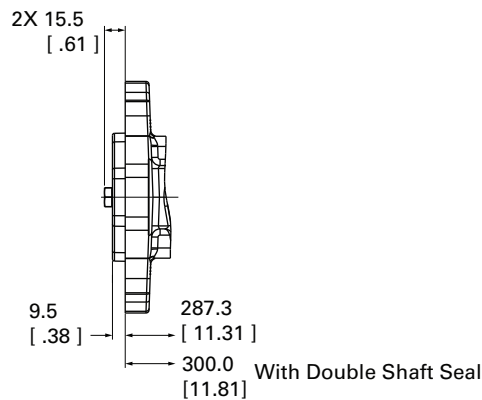
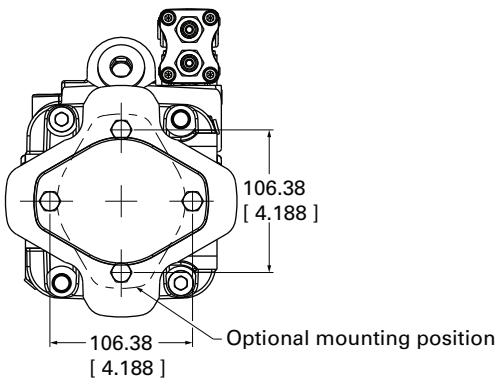
### Thru-drive SAE A

Groove to accept a cap as 568A size 042 (1/16 X 3 1/4 ID) o-ring



For output shaft configuration see separate output shaft installation drawing

### A Thru-drive cover plate installation



### Output shaft installation

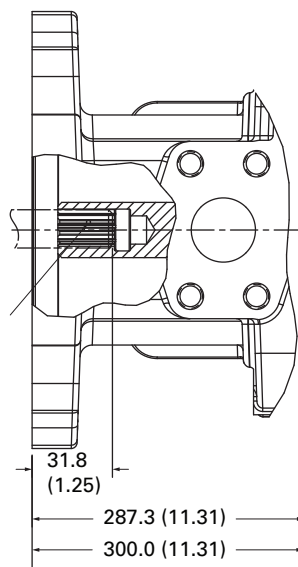
#### 9T spline

Maximum torque 75 Nm (660 in-lbf)

$\text{Ø} 16.54 (.651)$  9 tooth  $30^\circ$  at root side  $\text{y}t$  16/32 class 5 internal spline per ANSI B92.1

Accepts 9 tooth  $30^\circ$  at root side  $\text{y}t$  16/32 external splines per SAE J498b Class 1 or ANSI B92.1 class 5 with 31.8 (1.25) extension from mounting angle

Additional units driven by this spline must not require more than 74.6 N-m (55 Lbf-ft) of torque



With double shaft seal and C-mount

### Output shaft installation

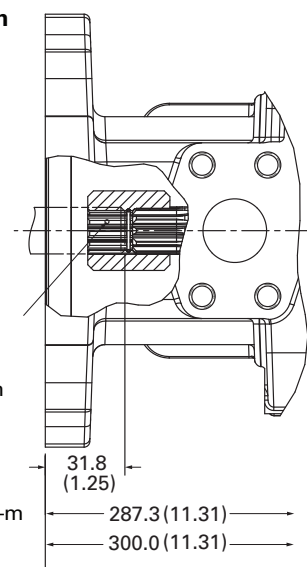
#### 11T spline

Maximum torque 119 Nm (1056 in-lbf)

$\text{Ø}19.33 (.761)$  11 tooth  $30^\circ$  Flat root side  $\text{y}t$  16/32 class 1 internal spine per SAE J498B

Accepts 11 tooth  $30^\circ$  at root side  $\text{y}t$  16/32 external splines per SAE J498B class 1 or ANSI B92.1 class 5 with 31.8 (1.25) extension from mounting angle

Additional units driven by this spline must not require more than 118.6 N-m (88 Lbf-ft) of torque



With double shaft seal and C-mount

# Pump installation

## Thru-Drive SAE B

### Thru-drive SAE B

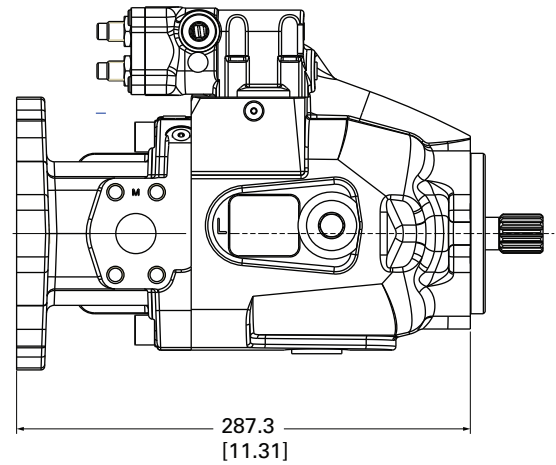
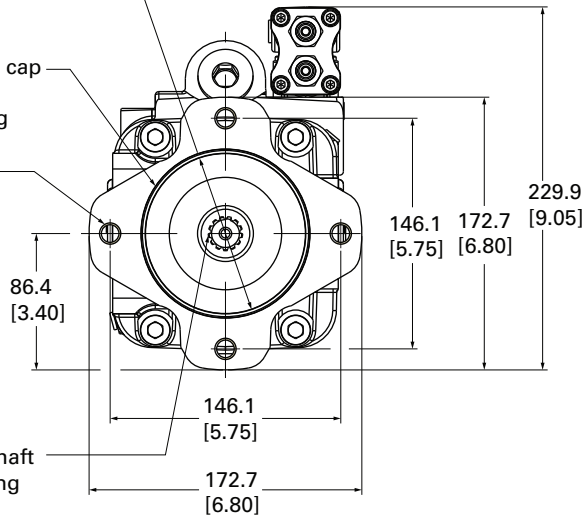
Ø101.68 ± 0.02  
[4.003 ± .001]  
▽ 10.4  
[.41]

Groove to accept a cap  
as 568A size 045  
(1/16 X 4 ID) O-Ring

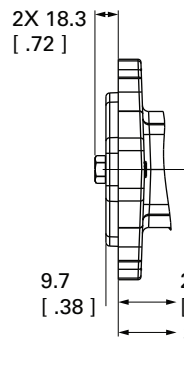
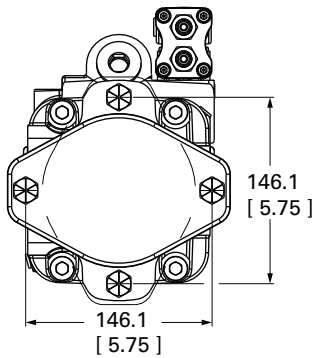
4X .500-13  
UNC-2B Thru

86.4  
[3.40]

For output shaft  
configuration see  
separate output shaft  
installation drawing



### SAE B thru-drive cover plate installation



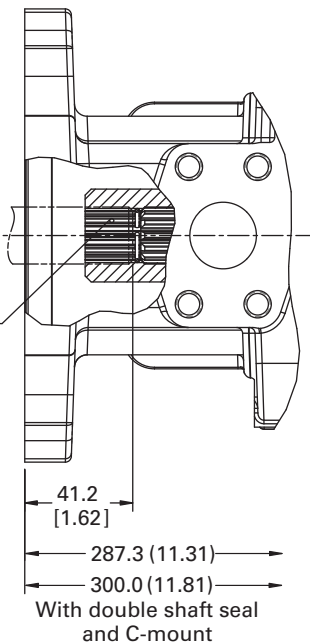
287.3 [11.31]  
300.0 [11.81] Double shaft seal c-mount

### Output shaft installation 13T spline

Maximum torque 209 Nm  
(1850 in-lbf)

Ø22.5 (.886) 13 tooth 30° at  
root side  $\sqrt{t}$  16/32 class 1  
internal spline per SAE J498B

Accepts 13 tooth 30° at root  
side  $\sqrt{t}$  16/32 external splines  
per SAE J498B class 1 or ANSI  
B92.1 class 5 with 41.2 (1.62)  
extension from mounting angle

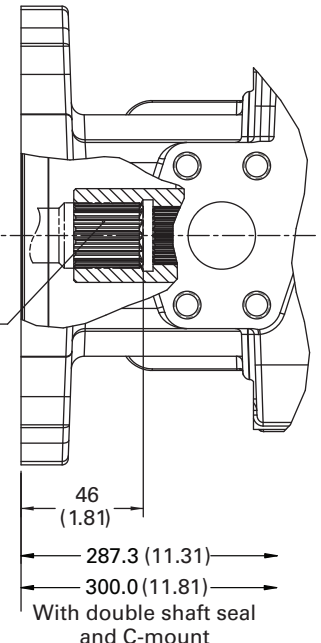


### Output shaft installation 15T spline

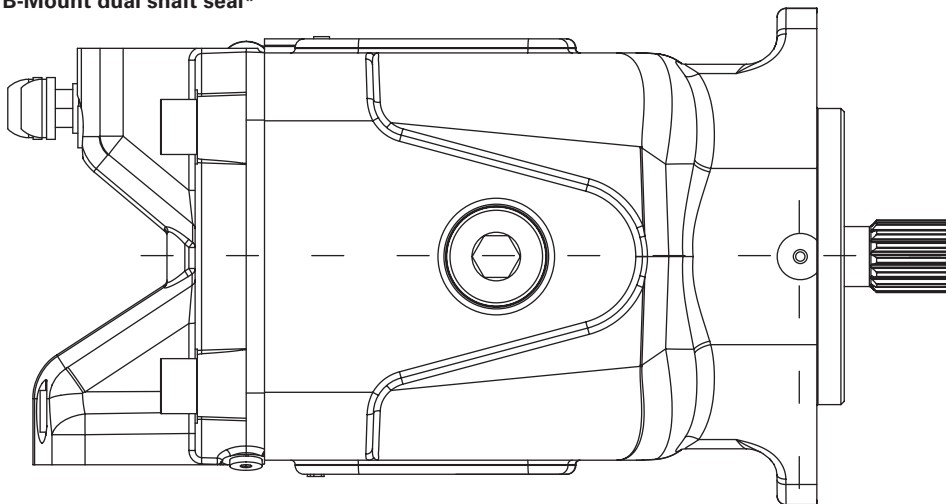
Maximum torque 337 Nm  
(2987 in-lbf)

Ø25.5 (1.006) 15 tooth 30° at  
root side  $\sqrt{t}$  16/32 internal  
spline per ASA B5.15-1960

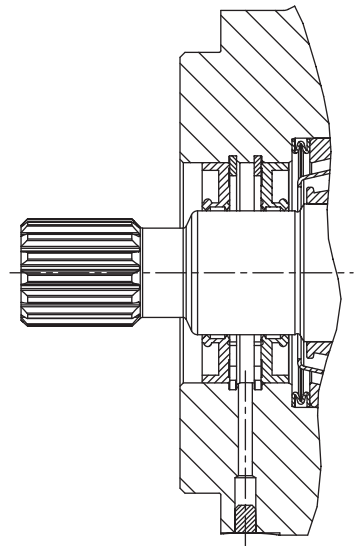
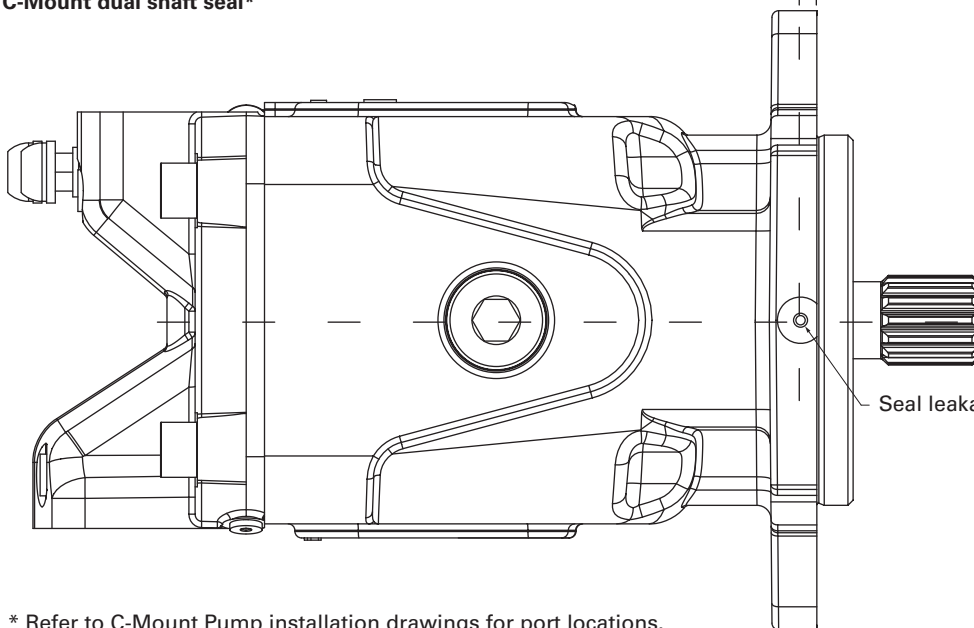
Accepts 15 tooth 30° at root  
side  $\sqrt{t}$  16/32 external splines  
per SAE J498B class 1 or ANSI  
B92.1 class 5 with 46 (1.81)  
extension from mounting angle



### B-Mount dual shaft seal\*



### C-Mount dual shaft seal\*

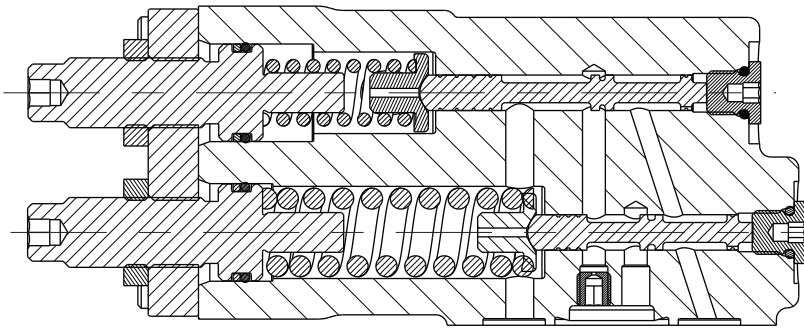
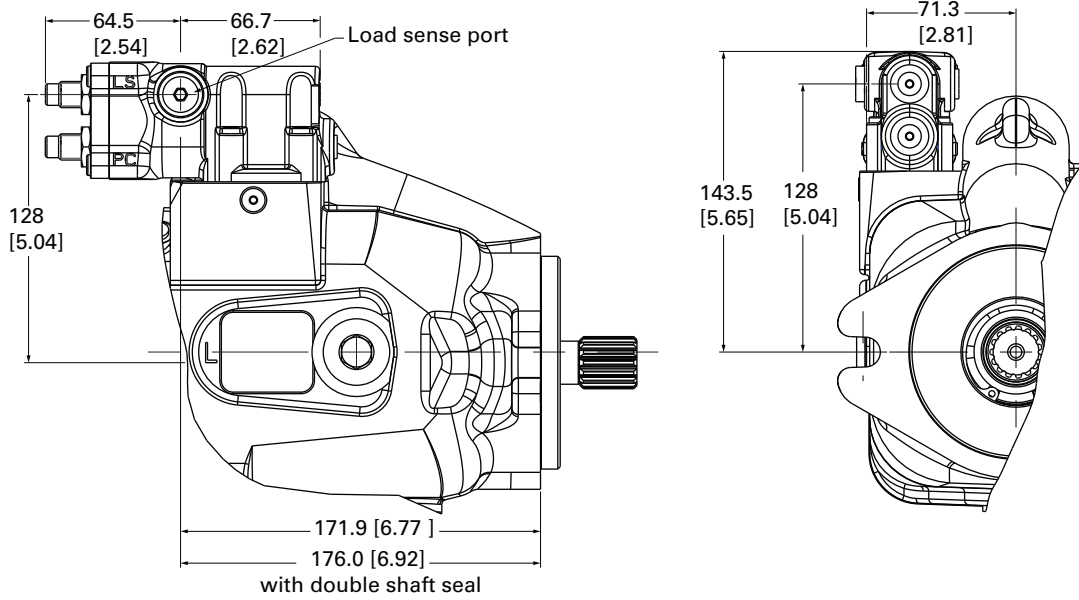


Cross section of dual shaft seal assembly

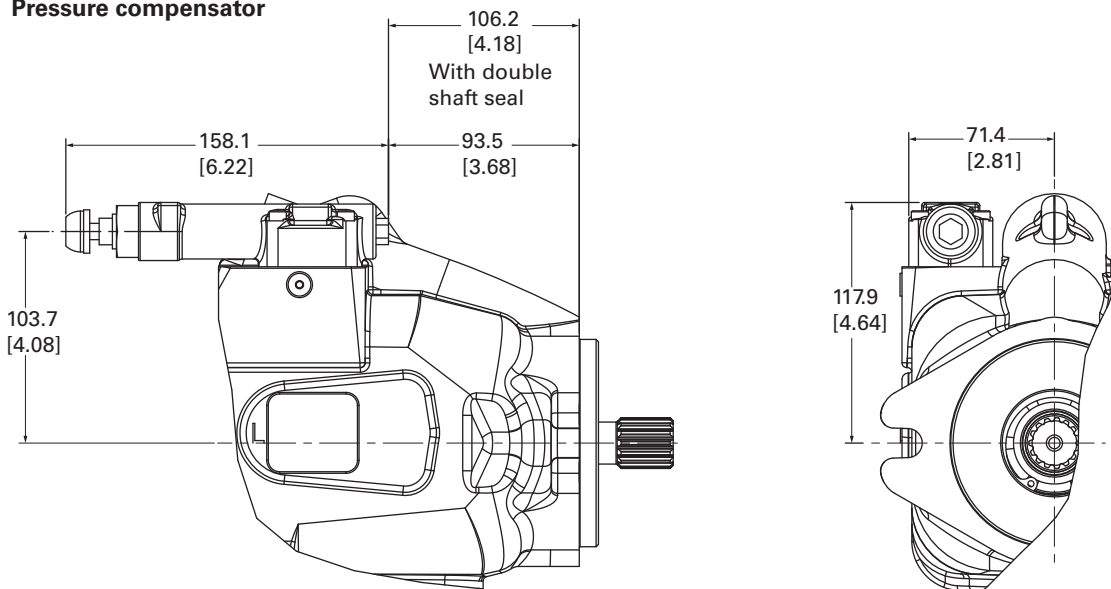
\* Refer to C-Mount Pump installation drawings for port locations.

# Control installation

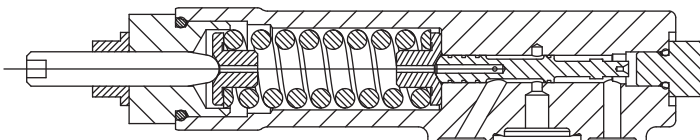
## Pressure & Flow (Load Sense) Compensator

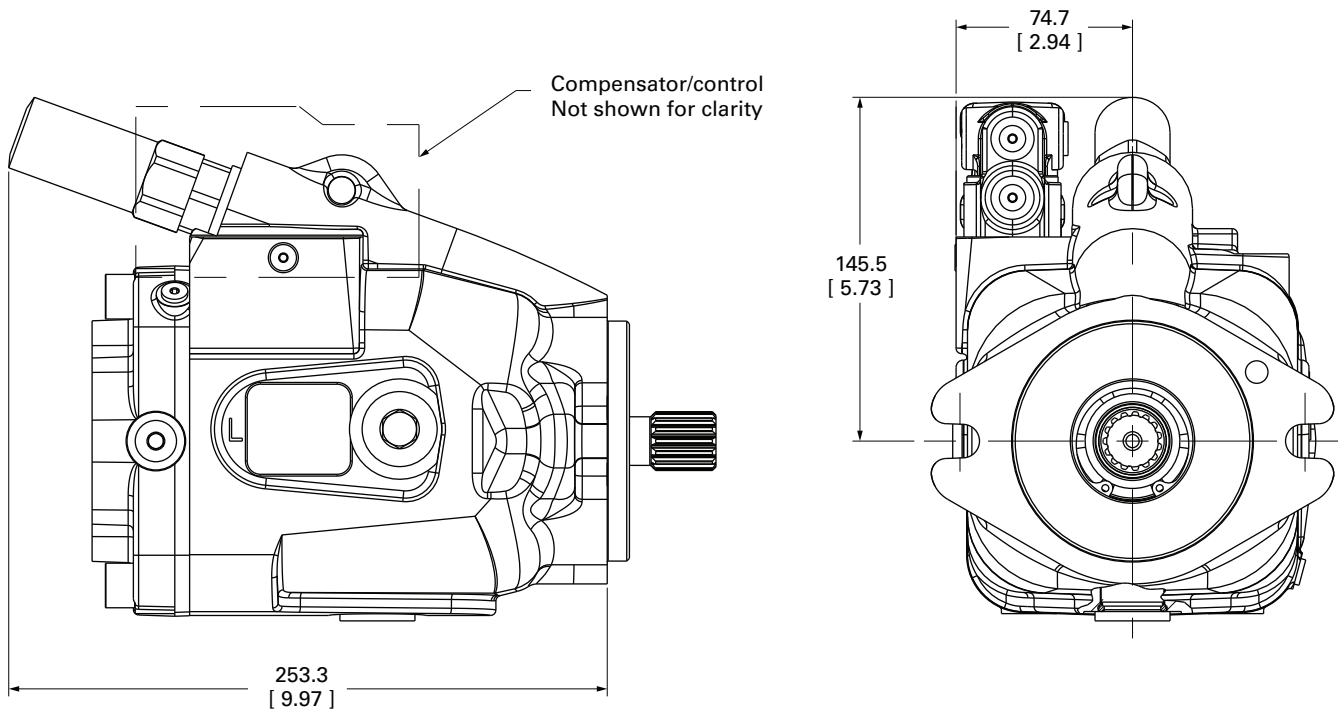


### Pressure compensator



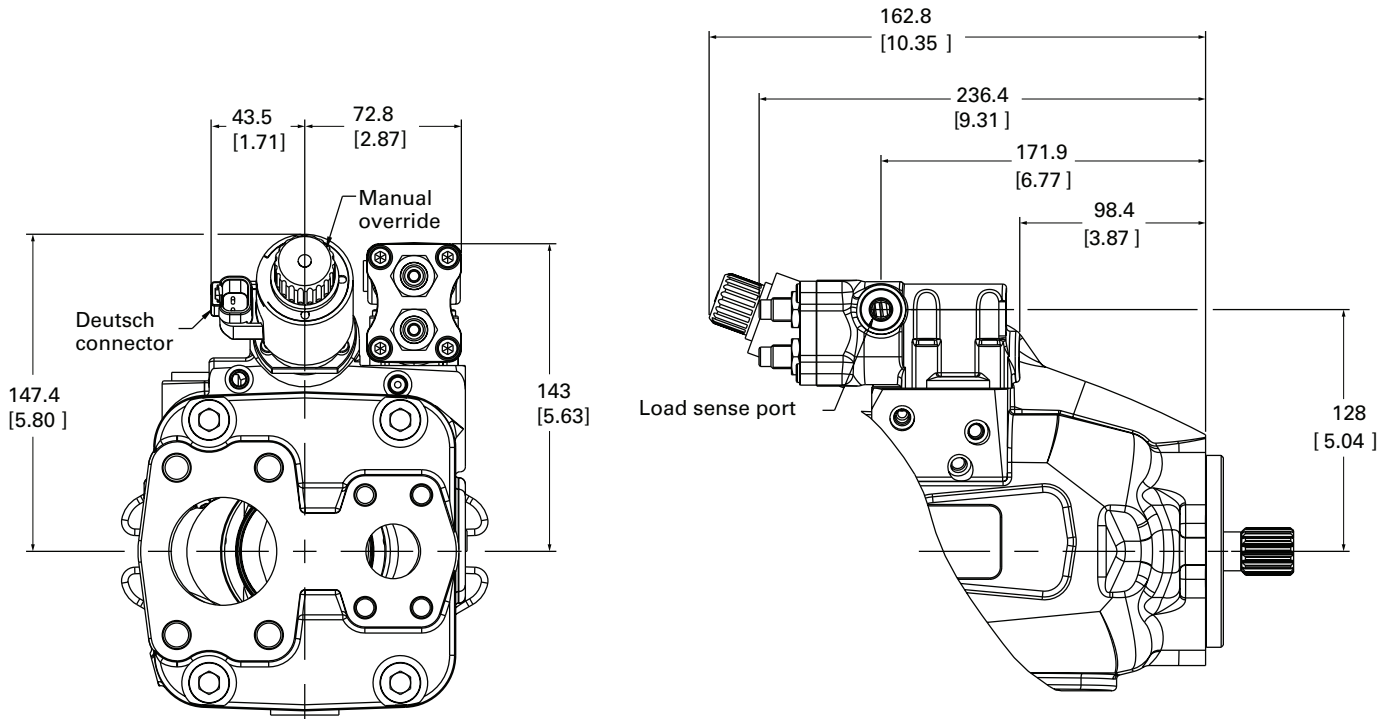
### Section A-A



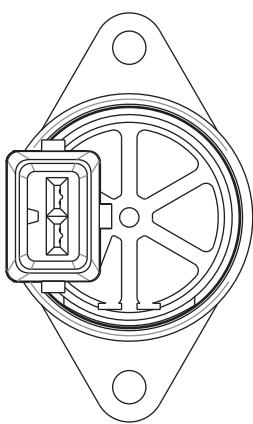
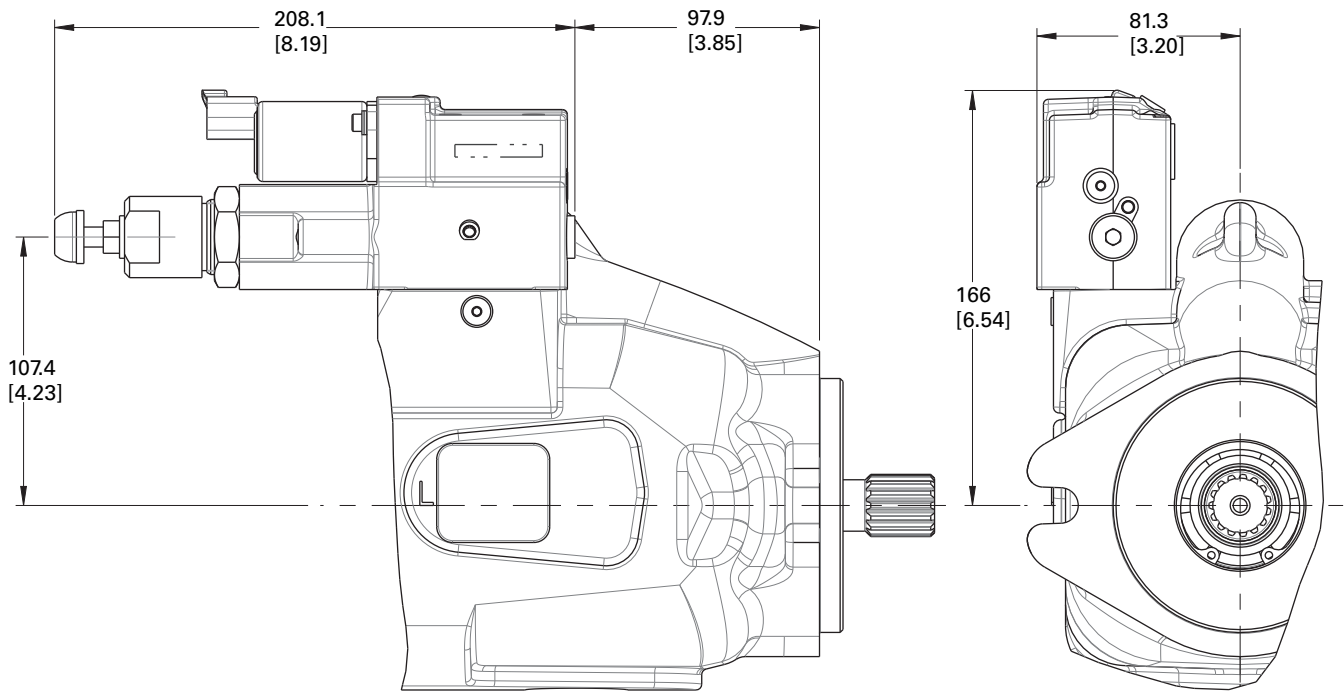


# Control installation

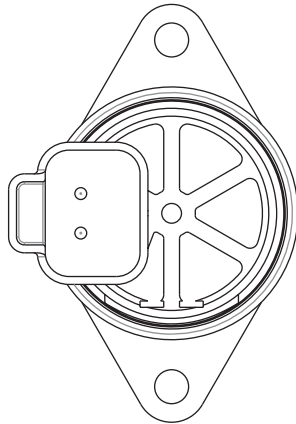
## Electronic Displacement Control (EDC)







AMP connector

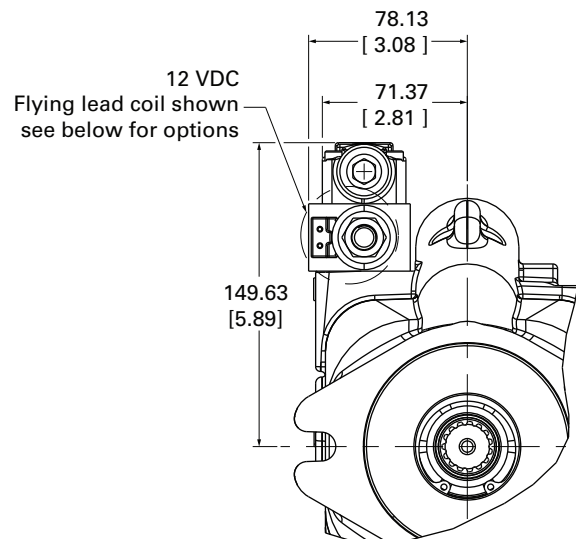
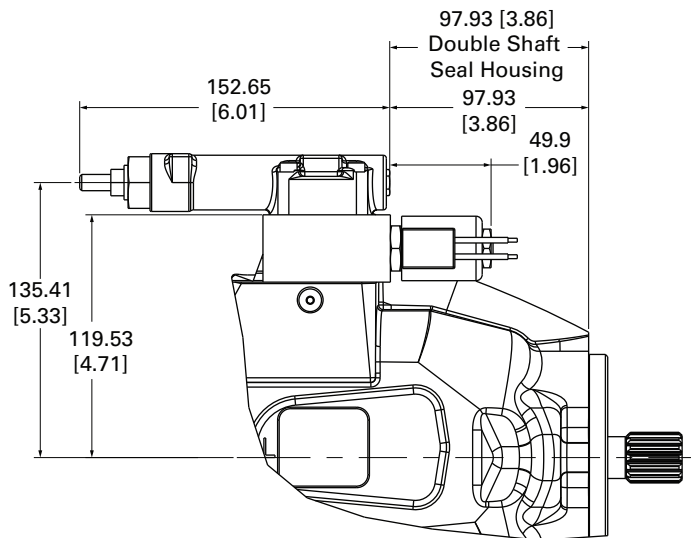
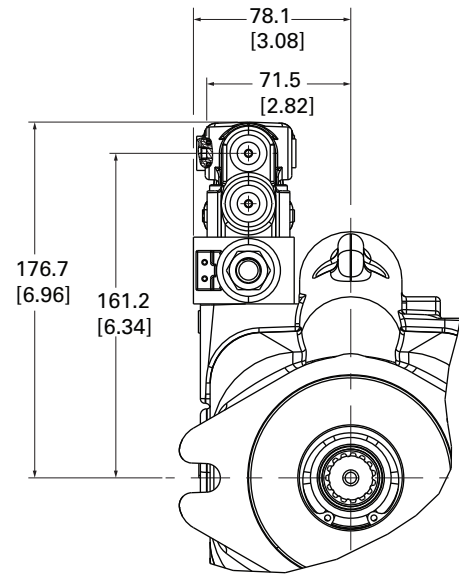
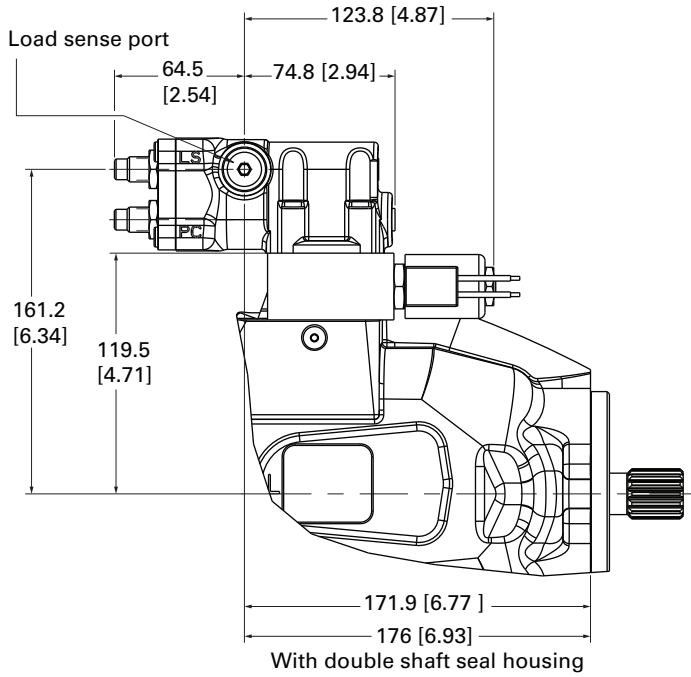


Deutsch connector

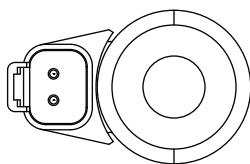
# Control installation

## Electronic De-stroke (Cold Start) Valve

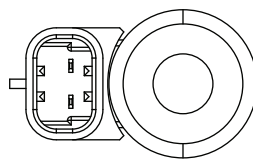
### Cold start valve



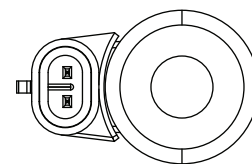
### Optional connectors



Deutsch option

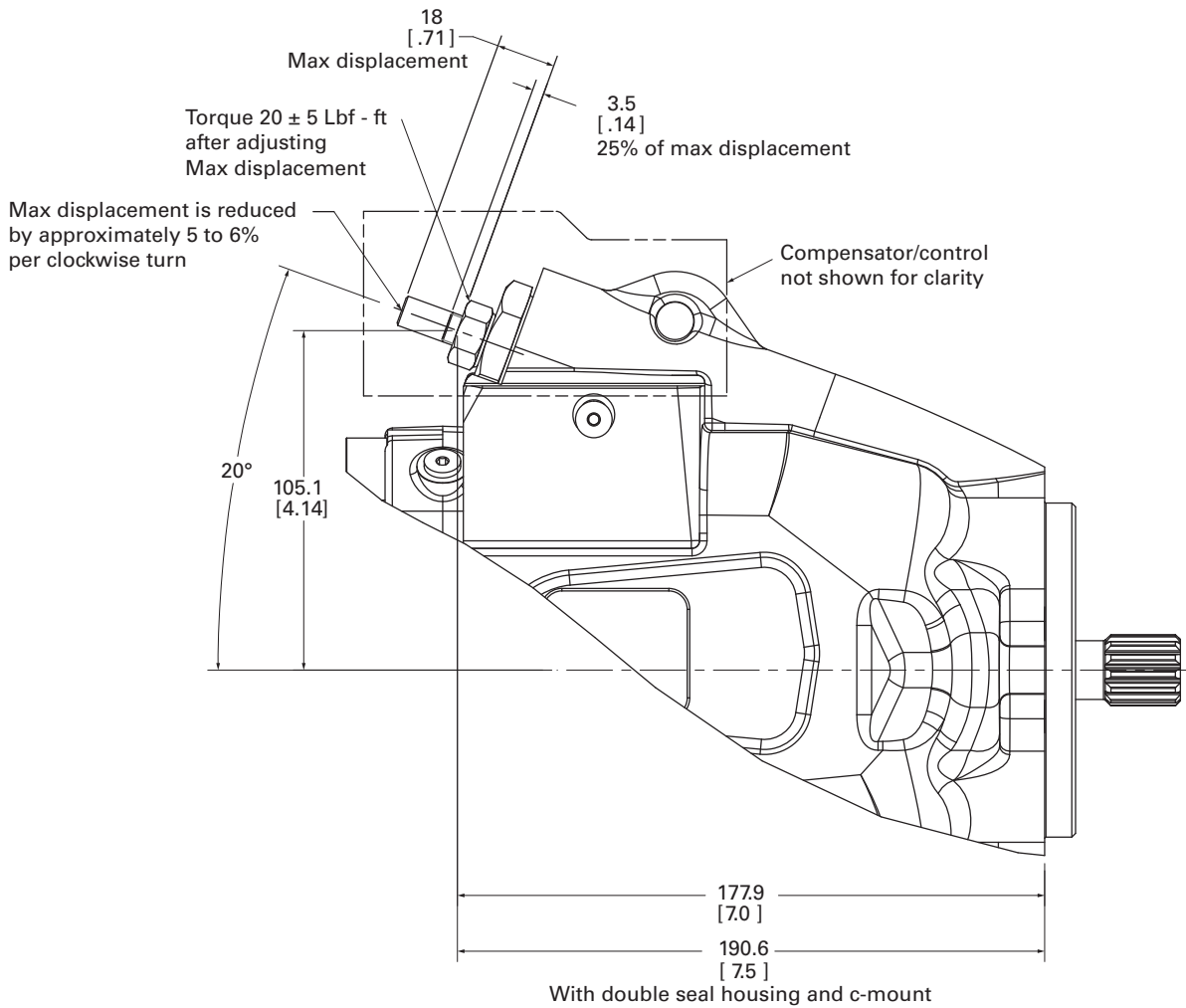


Metri-pack 280 option



Metri-pack 150 option

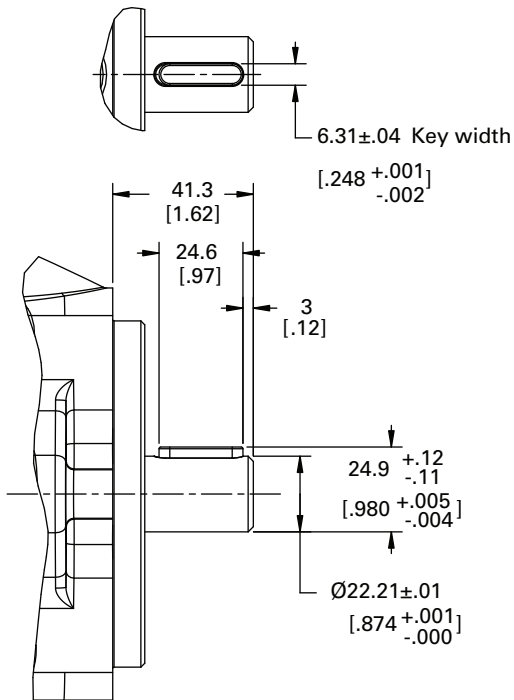
### Maximum stroke limiter



# Input shaft options

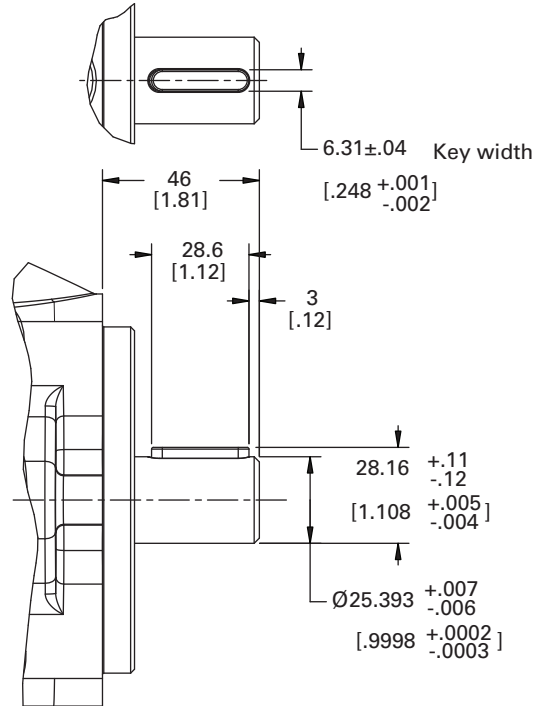
## 01 Code

Maximum torque 209 Nm (1850 in-lbf)



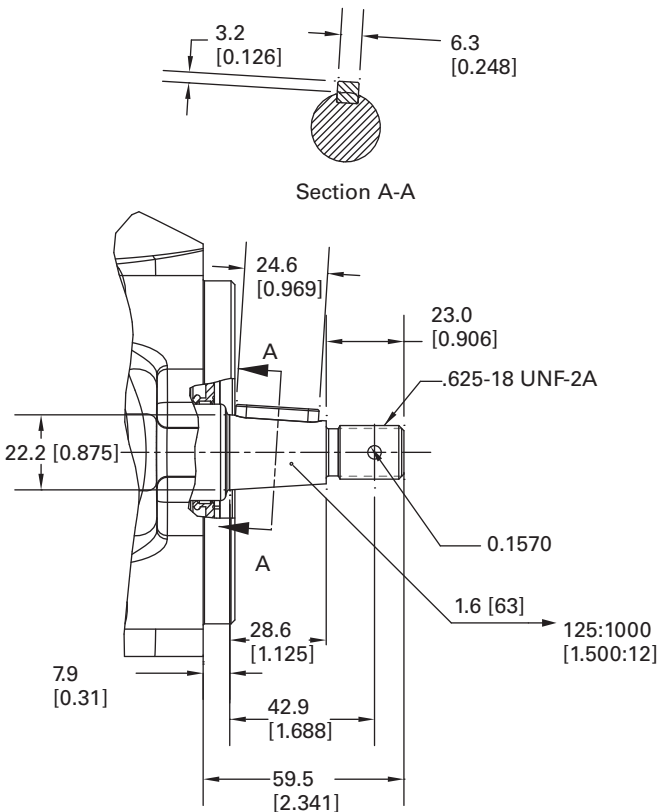
## 02 Code

Maximum torque 337 Nm (2987 in-lbf)



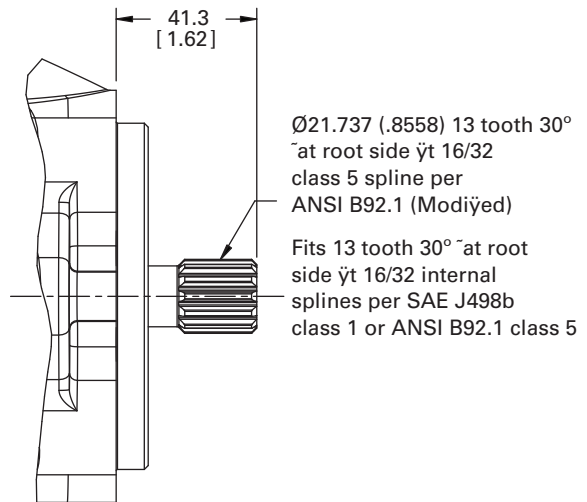
## 03 Code

Maximum torque 209 Nm (1850 in-lbf)



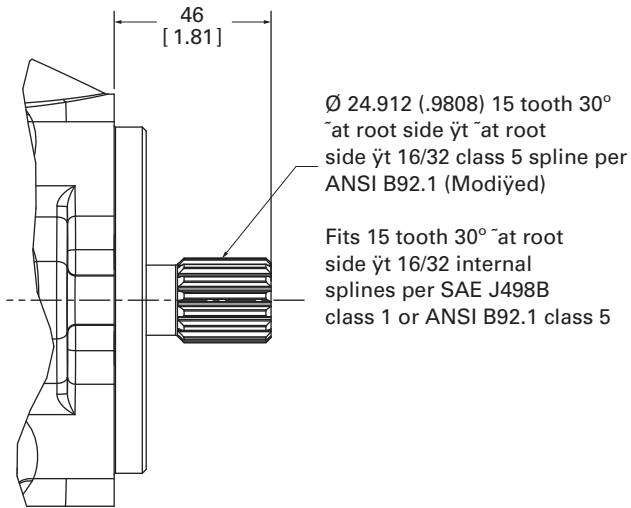
## 05 Code

Maximum torque 307 Nm (2717 in-lbf)



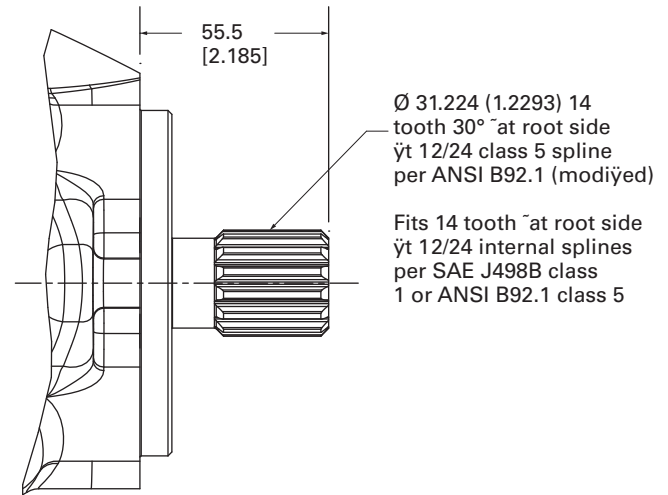
## 08 Code

Maximum torque 397 Nm (3514 in-lbf)



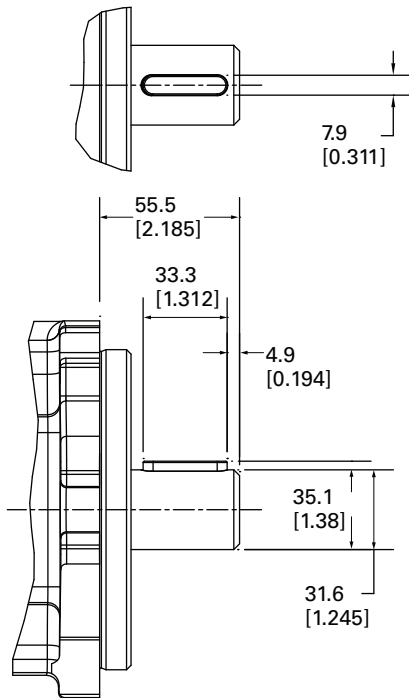
## 32 Code

Maximum torque 640 Nm (5660 in-lbf)



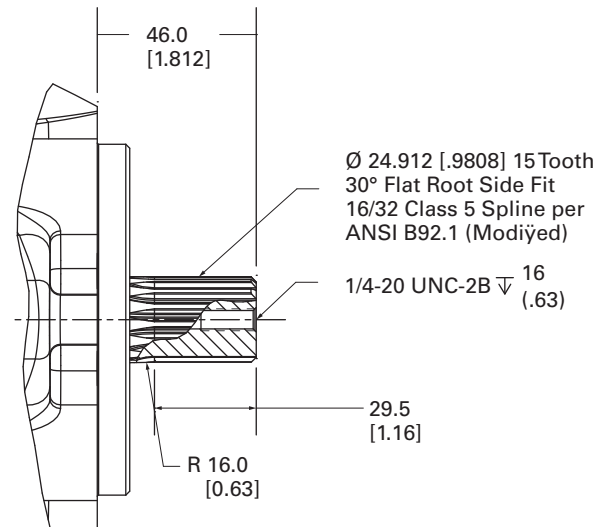
## 33 Code

Maximum torque 450 Nm (3980 in-lbf)



## 34 Code

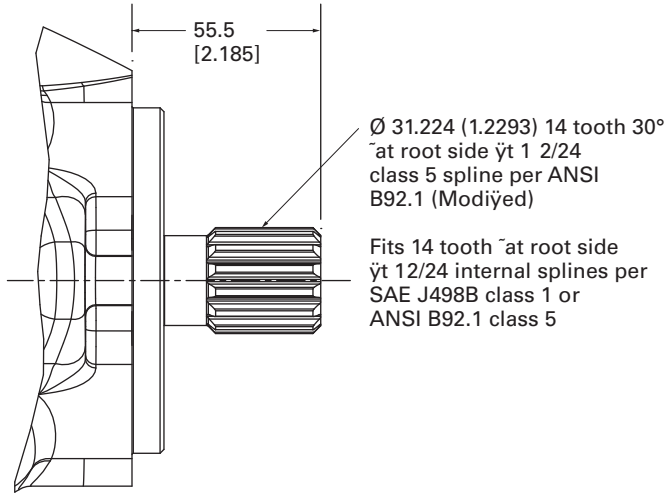
Maximum torque 397 Nm (3514 in-lbf)



# Input shaft options

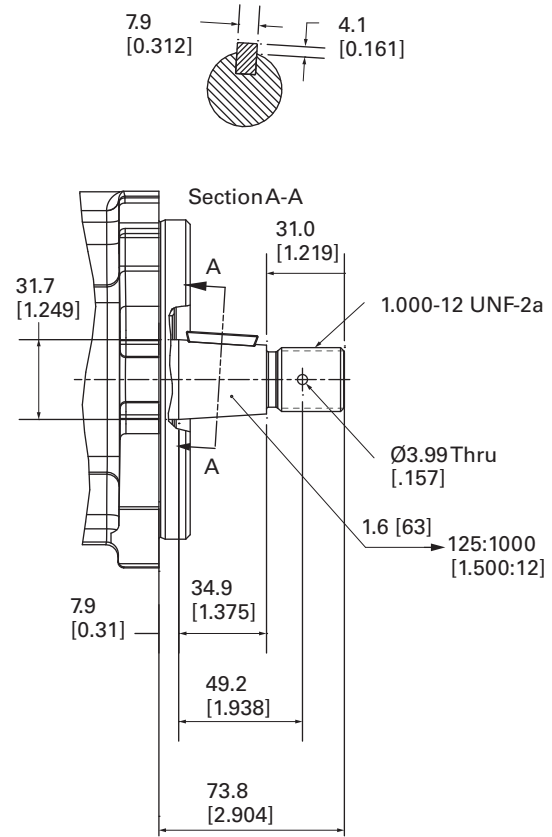
## 35 Code

Maximum torque 640 Nm (5660 in-lbf)

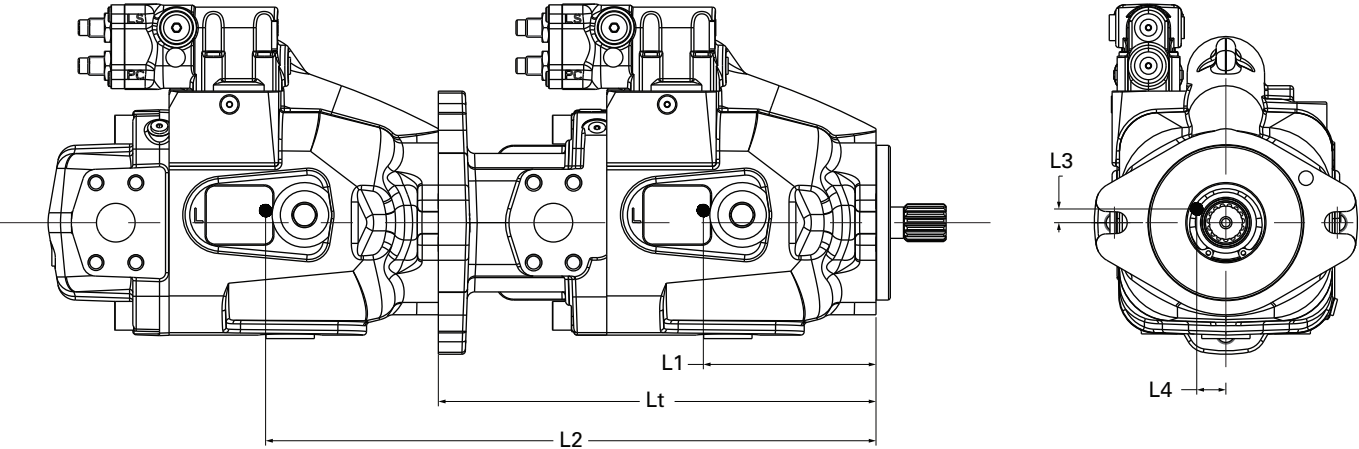


## 38 Code

Maximum torque 450 Nm (3980 in-lbf)



Center of gravity



|        | Rear Port    |            |            | Side Port    |            |            | Thru-Drive   |            |            | Length        | Dual Seal   |
|--------|--------------|------------|------------|--------------|------------|------------|--------------|------------|------------|---------------|-------------|
|        | Lcg          | L3         | L4         | Lcg          | L3         | L4         | Lcg          | L3         | L4         | Lt            | Lds         |
| ADU041 | 109.6 (4.31) | 9.6 (0.38) | 2.9 (0.11) | 114.7 (4.51) | 9.2 (0.36) | 2.4 (0.10) | 131.5 (5.18) | 8.2 (0.32) | 2.1 (0.08) | 287.3 (11.31) | 13.0 (0.50) |
| ADU049 | 109.6 (4.31) | 9.6 (0.38) | 2.9 (0.11) | 114.7 (4.51) | 9.2 (0.36) | 2.4 (0.10) | 131.5 (5.18) | 8.2 (0.32) | 2.1 (0.08) | 287.3 (11.31) | 13.0 (0.50) |
| ADU062 | 109.9 (4.32) | 9.4 (0.37) | 2.9 (0.11) | 114.9 (4.52) | 9.0 (0.35) | 2.4 (0.10) | 131.3 (5.17) | 8.0 (0.31) | 2.1 (0.08) | 287.3 (11.31) | 13.0 (0.50) |
| ADU080 | 109.9 (4.32) | 9.4 (0.37) | 2.9 (0.11) | 114.9 (4.52) | 9.0 (0.35) | 2.4 (0.10) | 131.3 (5.17) | 8.0 (0.31) | 2.1 (0.08) | 287.3 (11.31) | 13.0 (0.50) |

Examples: Calculation L<sub>1</sub> and L<sub>2</sub>

Tandem ADU062 Thru-drive with ADU041 rear ported

L<sub>1</sub> = Lcg                      131.3mm (5.17 inches)  
 L<sub>2</sub> = Lt + Lcg                287.3mm + 109.6mm  
                                       = 396.9mm (15.6 inches)

Tandem dual seal ADU049 Thru-drive with ADU049 side ported

L<sub>1</sub> = Lcg + Lds                131.5mm + 13mm = 144.5mm  
                                       (5.69 inches)  
 L<sub>2</sub> = Lt + Lds + Lcg        287.3mm + 13mm + 114.7mm  
                                       = 415mm (16.34 inches)

Tandem pump applications

Eaton recommends that tandem pump applications be provided with additional support to limit overhung loading of the mounting flange. The thru-drive alternate attachment points on the rear flange may be used with a customer designed support.

# Installation and start-up

**Warning:** Care should be taken that mechanical and hydraulic resonances are avoided in the application of the pump. Such resonances can seriously compromise the life and/or safe operation of the pump.

## Drive data

Mounting attitude should be horizontal using the appropriate case drain ports to ensure that the case remains full of fluid at all times. Consult your local Eaton Representative if a different arrangement is required.

In those cases where geometric tolerances of mounting are critical, or where specific tolerance ranges are required and not specified, consult Eaton Engineering for specific limits.

Direction of shaft rotation, viewed from the prime mover end, must be as indicated in the model designation on the pump—either right hand (clockwise) or left hand (counterclockwise).

Direct coaxial drive through a flexible coupling is recommended. If drives imposing radial shaft loads are considered, please consult your Eaton Representative.

## Start-up procedure

Make sure the reservoir and circuit are clean and free of dirt/debris prior to filling with hydraulic fluid.

Fill the reservoir with filtered oil and fill to a level sufficient enough to prevent vortexing at the suction connection to pump inlet. It is good practice to clean the system by flushing and filtering, using an external slave pump.

**Caution:** Before the pump is started, fill the case through the uppermost drain port with hydraulic fluid of the type to be used. The case drain line must be connected directly to the reservoir and must terminate below the oil level.

Once the pump is started, it should prime within a few seconds. If the pump does not prime, check to make sure that there are no restrictions between the reservoir and the inlet to the pump, and that the pump is being rotated in the proper direction, and that there are no air leaks in the inlet line and connections. Also check to make sure that trapped air can escape at the pump outlet.

After the pump is primed, tighten the loose outlet connections, then operate for five to ten minutes (unloaded) to remove all trapped air from the circuit.

If the reservoir has a sight gage, make sure the fluid is clear – not milky.

## Fluid cleanliness

The 420 Series pumps are rated in anti-wear petroleum fluids with a contamination level of 21/18/13 per ISO 4406. Operation in fluids with levels more contaminated than this is not recommended. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these codes. Please contact your Eaton Representative for specific duty cycle recommendation.

Eaton 420 Series pumps, as with 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 optimized 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 components, elevated viscosity and inclusion of air.

Essential information on the correct methods for treating hydraulic fluid is included in Eaton publication 561 – “Eaton 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.



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