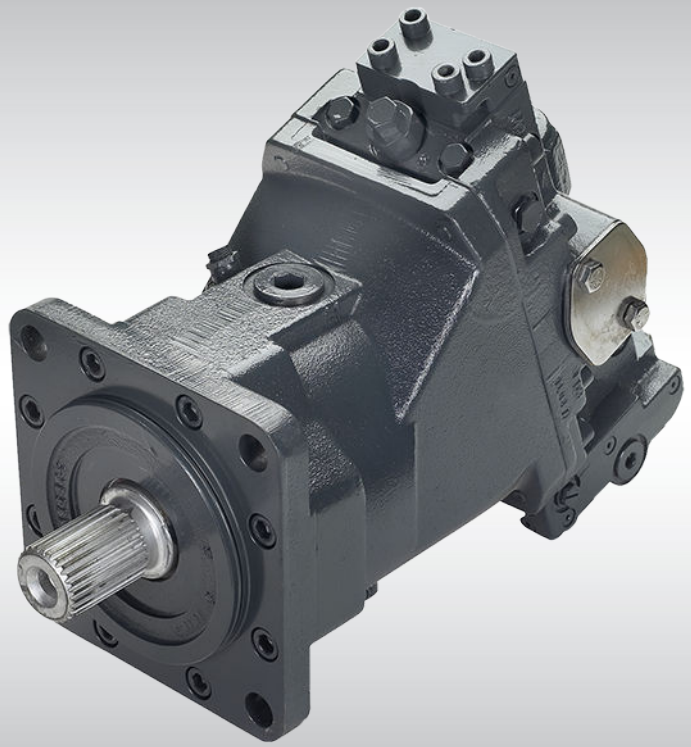
MAKING MODERN LIVING POSSIBLE

Technical Information

# Bent Axis Variable Displacement Motors

# Series 51 and 51-1



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## Revision History

*Table of Revisions*

| Date | Changed | Rev |
|---|---|---|
| Jan 2014 | Converted to Danfoss layout - DITA CMS | BA |
| Jun 2005 | First version | AA |

## Contents

## Contents

## Contents

## General description

Series 51 and 51-1 variable displacement motors are bent axis design units, incorporating spherical pistons.

These motors are designed primarily to be combined with other products in closed circuit systems to transfer and control hydraulic power. Series 51 and 51-1 motors have a large maximum / minimum displacement ratio (5:1) and high output speed capabilities. SAE, cartridge, and DIN flange configurations are available.

A complete family of controls and regulators is available to fulfill the requirements of a wide range of applications.

Motors normally start at maximum displacement. This provides maximum starting torque for high acceleration.

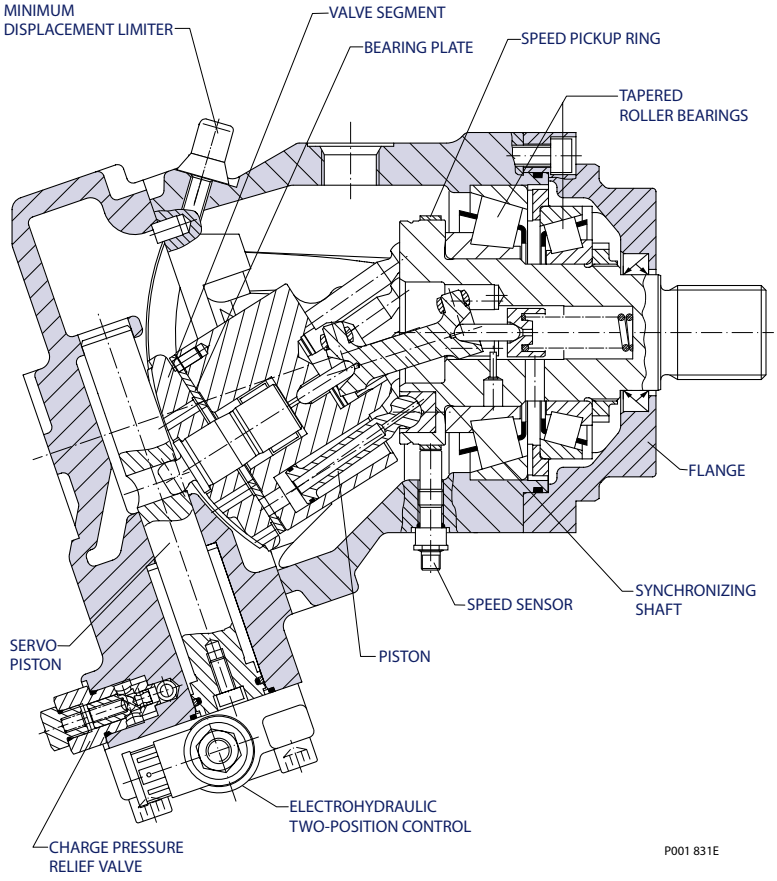
The controls may utilize internally supplied servo pressure. They may be overridden by a pressure compensator which functions when the motor is operating in motor and pump modes. A defeat option is available to disable the pressure compensator override when the motor is running in pump mode.

The pressure compensator option features a low pressure rise (short ramp) to ensure optimal power utilization throughout the entire displacement range of the motor. The pressure compensator is also available as a stand-alone regulator.

- The series 51 and 51-1 motors – Advanced technology today
- The most technically advanced hydraulic units in the industry
- SAE, cartridge, and DIN flange motors
- Cartridge motors designed for direct installation in compact planetary drives
- Large displacement ratio (5:1)
- Complete family of control systems
- Proven reliability and performance
- Optimum product configurations
- Compact, lightweight

## Sectional view

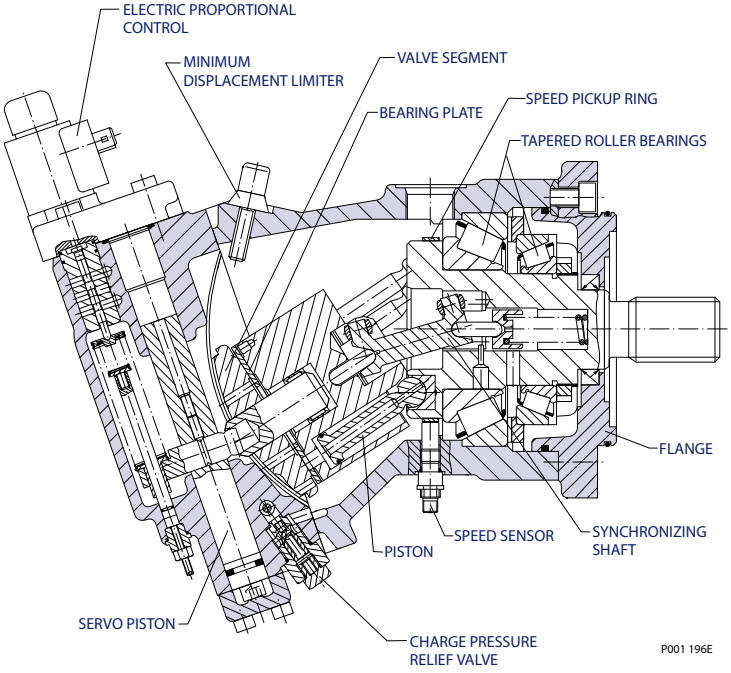
### Series 51-1, two-position control




*Name plate*

## Sectional view

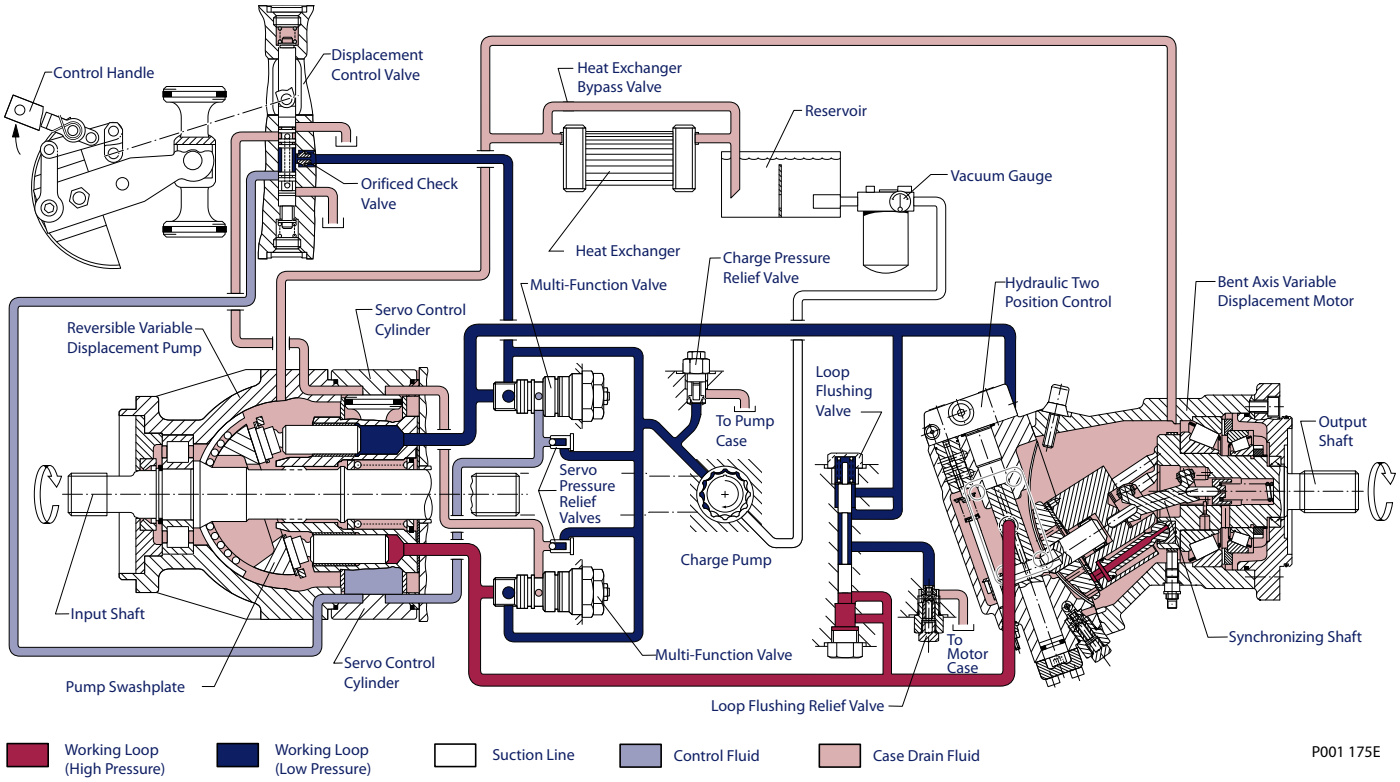
### Series 51, proportional control



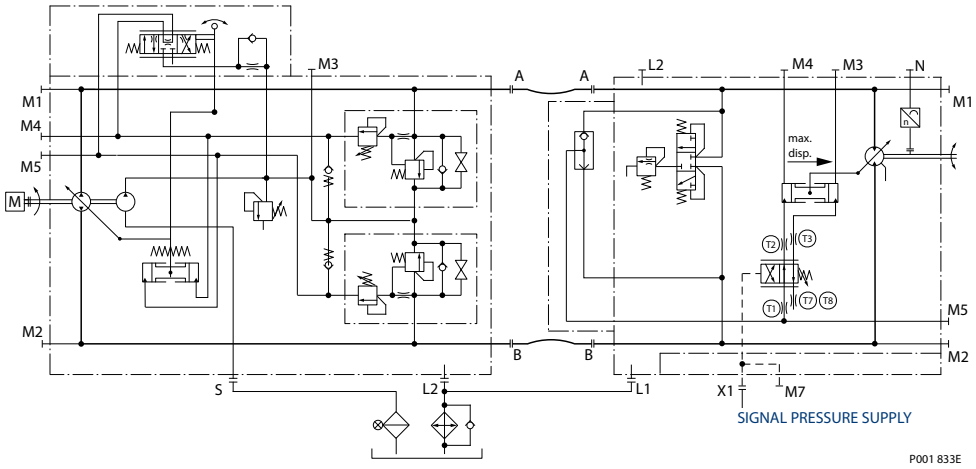

*Name plate*

## System circuit description

### Pictorial diagram




### System circuit diagram




Above schematics show the function of a hydrostatic transmission using a Series 90 Axial Piston Variable Displacement Pump with manual displacement control (MA) and a Series 51 Bent Axis Variable Displacement Motor with hydraulic two-position control (HZ).

## Technical specifications

### General specifications

Most specifications for bent axis variable displacement motors are listed on these pages. For definitions of the various specifications, see the related pages in this publication. Not all hardware options are available for all configurations; consult the series 51 and 51-1 model code supplement or price book for more information.

| General Specifications | |
|---|---|
| Motor type | Axial piston motor with variable displacement bent axis design. |
| Direction of rotation | Clockwise and counter-clockwise (bi-directional). |
| Installation position | Discretionary, the housing must always be filled with hydraulic fluid. |
| Other system requirements | Independet braking system, circuit overpressure protection, suitable reservoir. |

### Specific data

| Specific Data | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Frame size | | | | |
| | | Dimension | 060 | 080 | 110 | 160 | 250 |
| Displacement maximum | $Vg_{max}$ | $cm^3$ [$in^3$] | 60.0 [3.66] | 80.7 [4.92] | 109.9 [6.71] | 160.9 [9.82] | 250.0 [15.26] |
| Displacement minimum | $Vg_{min}$ | $cm^3$ [$in^3$] | 12.0 [0.73] | 16.1 [0.98] | 22.0 [1.34] | 32.2 [1.96] | 50.0 [3.05] |
| Rated flow | Q | l/min [US gal/min] | 216 [57] | 250 [66] | 308 [81] | 402 [106] | 550 [145] |
| Maximum flow | $Q_{max}$ | l/min [US gal/min] | 264 [70] | 323 [85] | 396 [105] | 515 [136] | 675 [178] |
| Maximum corner power | P corner max. | kW [hp] | 336 [450] | 403 [540] | 492 [660] | 644 [864] | 850 [1140] |
| Weight (approx.) | m | kg [lb] | 28 [62] | 32 [71] | 44 [97] | 56 [123] | 86 [190] |
| Mass moment of inertia of the internal rotating parts | J | $kgm^2$ [$lb \cdot ft^2$] | 0.0046 [0.1092] | 0.0071 [0.1685] | 0.0128 [0.3037] | 0.0234 [0.5553] | 0.0480 [1.1580] |
| Type of mounting | Four (4) bolt flange, SAE or DIN-flange configuration.<br>Two (2) bolt flange cartridge motor configuration. | | | | | | |
| Pipe connections | Main pressure ports: SAE-flange.<br>Remaining ports: SAE straigt thread O-ring boss. | | | | | | |
| Controls | N1, HZ, E1, E2, E7, F1, F2, T1, T2, TA, TH, EP, EQ, L1, L2, L7, D7, D8, HS | | | | | | |
| Displacement limiter | All Series 51 motors incorporate mechanical minimum and maximum displacement limiters. | | | | | | |
| Shaft configuration | Splined ANSI or DIN shaft. | | | | | | |

*Case pressure*

| | **bar [psi]** |
|---|---|
| Rated pressure | 3 [44.0] |
| Maximum pressure (cold start) | 5 [73.0] |
| Minimum pressure (at rated speed) | 1 [14.5] |

*System pressure range, input*

| | **bar [psi]** |
|---|---|
| Maximum delta pressure | 480 [7000] |
| Minimum low pressure | 10 [145] |
| Maximum pressure | 510 [7400] |

| Speed Limits | | | | | | |
|---|---|---|---|---|---|---|
| | | $min^{-1}$ (rpm) | | | | |
| Frame size | | 060 | 080 | 110 | 160 | 250 |
| Rated speed | at max. disp.<br>at min. disp. | 3600<br>5600 | 3100<br>5000 | 2800<br>4500 | 2500<br>4000 | 2200<br>3400 |
| Maximum speed[1)] | at max. disp.<br>at min. disp. | 4400<br>7000 | 4000<br>6250 | 3600<br>5600 | 3200<br>5000 | 2700<br>4250 |

[1)] Contact your Sauer-Danfoss representative for max. speed at displacements between max. and min. displacement.

## Technical specifications

| Theoretical Torque | | | | | | |
|---|---|---|---|---|---|---|
| Frame size | | 060 | 080 | 110 | 160 | 250 |
| At maximum displacement | Nm/bar [lbf•in/1000 psi] | 0.95 [583] | 1.28 [784] | 1.75 [1067] | 2.56 [1563] | 3.98 [2428] |
| At minimum displacement | Nm/bar [lbf•in/1000 psi] | 0.19 [117] | 0.26 [156] | 0.35 [214] | 0.51 [313] | 0.80 [486] |

### Fluid specifications

*Temperature range* [1)]

| | °C [°F] | |
|---|---|---|
| Minimum | -40 [-40] | intermittent, cold start |
| Rated | 104 [220] | |
| Maximum | 115 [240] | intermittent |
| [1)] At the hottest point, normally the case drain port. | | |

*Viscosity*

| | mm²/s [SUS] | |
|---|---|---|
| Minimum | 7 [49] | intermittent |
| Recommanded operating range | 12-80 [70-370] | |
| Maximum | 1600 [7500] | intermittent cold start |

*Cleanliness level and βx-ratio*

| | |
|---|---|
| Required Fluid Cleanliness Level | ISO 4406 Class 22-18-13 |
| Recommended βx-Ratio for Suction Filtration | β35-45 = 75 (β10 ≥2) |
| Recommended βx-Ratio for Charge Pressure Filtration | β15-20 = 75 (β10 ≥10) |
| Recommended Inlet Screen Size for Charge Pressure Filtration | 100 µm-125 µm |

### Determination of nominal motor sizes

Vg • n Vg • n

| Metric system | | | Inch system | |
|---|---|---|---|---|
| Input flow: | $Q_e = \frac{Vg \cdot n}{1000 \cdot \eta_v}$ | l/min | $Q_e = \frac{Vg \cdot n}{231 \cdot \eta_v}$ | [US gal/min] |
| Output torque: | $M_e = \frac{Vg \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi}$ | Nm | $M_e = \frac{Vg \cdot \Delta p \cdot \eta_{mh}}{2 \cdot \pi}$ | [lbf-in] |
| Output power: | $P_e = \frac{M_e \cdot n}{9550} = \frac{Q_e \cdot \Delta p \cdot \eta_t}{600}$ | kW | $P_e = \frac{Vg \cdot n \cdot \Delta p \cdot \eta_t}{396\,000}$ | [hp] |
| Speed: | $n = \frac{Q_e \cdot 1000 \cdot \eta_v}{Vg}$ | $min^{-1}$ | $n = \frac{Q_e \cdot 231 \cdot \eta_v}{Vg}$ | $min^{-1}$ (rpm) |

Vg = Motor displacement per rev. $cm^3$ [$in^3$]

Δp = pHD - pND bar [psi]

ηv = Motor volumetric efficiency

## Technical specifications

ηmh = Motor mechanical-hydraulic (Torque) efficiency

ηt = Motor total (overall) efficiency

pHD = High pressure bar [psi]

pND = Low pressure bar [psi]

## General technical specifications

### Case pressure

Under normal operating conditions, case pressure must not exceed the rated pressure. Momentary case pressure exceeding this rating is acceptable under cold start conditions, but still must stay below the maximum pressure rating. The minimum pressure provides proper lubrication at high speeds. Operation with case pressure in excess of these limits may result in external leakage due to damage to seals, gaskets, and/or housings.

*Case pressure*

| | bar | [psi] |
|---|---|---|
| Rated pressure | 3 | [44.0] |
| Maximum pressure (cold start) | 5 | [73.0] |
| Minimum pressure (at rated speed) | 1 | [14.5] |

### Speed range

**Rated Speed** is the speed limit recommended at full power condition and is the highest value at which normal life can be expected.

**Maximum Speed** is the highest operating speed permitted and cannot be exceeded without reduction in the life of the product or risking immediate failure and loss of driveline power (which may create a safety hazard). In the range between rated and maximum speed please contact your Danfoss representative.

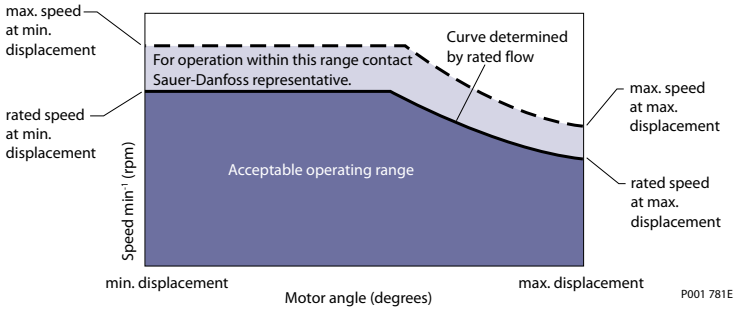
**Warning**

The loss of hydrostatic drive line power in any mode of operation (e.g., forward, reverse, or "neutral" mode) may cause the loss of hydrostatic braking capacity. A braking system, redundant to the hydrostatic transmission must, therefore, be provided which is adequate to stop and hold the system should the condition develop.

| Speed Limits | | | | | | |
|---|---|---|---|---|---|---|
| | | min$^{-1}$ (rpm) | | | | |
| Frame size | | 060 | 080 | 110 | 160 | 250 |
| Rated speed | at max. disp. | 3600 | 3100 | 2800 | 2500 | 2200 |
| | at min. disp. | 5600 | 5000 | 4500 | 4000 | 3400 |
| Maximum speed[1)] | at max. disp. | 4400 | 4000 | 3600 | 3200 | 2700 |
| | at min. disp. | 7000 | 6250 | 5600 | 5000 | 4250 |

[1)] Contact your Sauer-Danfoss representative for max. speed at displacements between max. and min. displacement.

*Speed limits*




### Pressure limits

System pressure is the dominant operating variable affecting hydraulic unit life. High pressure, which results from high load, reduces expected life in a manner similar to the affects of high load on other mechanical assemblies such as engines and gear boxes. There are load-to-life relationships for the rotating group and for the shaft anti-friction bearings.

## General technical specifications

Continuous pressure is the pressure at which the hydrostatic system could operate continuously and still achieve acceptable hydrostatic life. This pressure level varies depending on operating speed, and on the life requirements for a particular application. While most mobile applications require system pressure to vary widely during operation, a “weighted average” pressure can be derived from a machine duty cycle. (A duty cycle is a means of quantifying the pressure and speed demands of a particular system on a percent time basis). Once a duty cycle has been determined or estimated for a specific application, contact your Danfoss representative for system life ratings for the application.

**Maximum delta pressure** is the highest intermittent pressure allowed, and is the relief valve setting. It is determined by the maximum machine load demand. For most systems, the load should move at this pressure.

**Maximum pressure** is assumed to occur a small percentage of operating time, usually less than 2 % of the total. Both the continuous and maximum pressure limits must be satisfied to achieve the expected life.

**Minimum low pressure** must maintained under all operating conditions to avoid cavitation.

*System pressure range, input*

| | **bar** | **[psi]** |
|---|---|---|
| Maximum delta pressure | 480 | [7000] |
| Minimum low pressure | 10 | [145] |
| Maximum pressure | 510 | [7400] |

### Loop flushing

An integral non-adjustable loop flushing valve is incorporated into all these motors. Installations that require fluid to be removed from the low pressure side of the system circuit because of cooling requirements or contamination removal will benefit from loop flushing.

The integral loop flushing valve is equipped with an orificed charge pressure relief valve designed with a cracking pressure of 16 bar [232 psi]. Valves are available with several orifice sizes to meet the flushing flow requirements of all system operating conditions.

The total system charge pump flow should be of sufficient volume to accommodate:

- The number of motors in the system
- System efficiency under worst case conditions
- Pump control requirements
- External needs

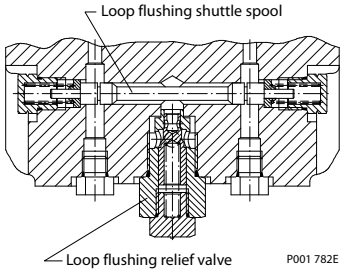
Although charge pump sizing requires the consideration of many system variables, the following table gives a recommendation of what charge pump displacement may be required to accommodate the flushing flow of each available charge relief valve orifice.

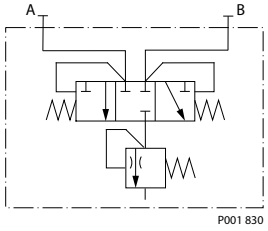
| **Recommanded Charge Pump Displacement** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Loop flushing valve | E4 | E6 | F0 | F3 | G0 | G3 | H0 |
| Charge pump size ($cm^3$) | 8 | 8 | 11 | 14 | 17 or 20 | 26 | 34, 47 or 65 |

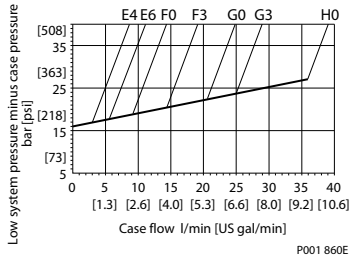
**Warning**

Warning: The loss of hydrostatic drive line power in any mode of operation (e.g., forward, reverse, or “neutral” mode) may cause the loss of hydrostatic braking capacity. A braking system, redundant to the hydrostatic transmission must, therefore, be provided which is adequate to stop and hold the system should the condition develop.

## General technical specifications




Equation:

$$Q_{Flush} = \frac{Q_{Charge} - Q_{Leak}}{2 \cdot k_{Mo}}$$

Where:

QFlush = flushing flow per motor

QCharge = charge flow at operating speed

kMo = number of motors feeded by one pump

QLeak. = sum of external leakages including

- motor leakage
- pump leakage + internal consumers:
  - 8 l/min [2.11 US gal/min] for displacement control pumps **or**
  - for non-feedback controlled pumps at 200 bar [2900 psi]
- external consumers
  - (e.g. brakes, cylinders, and other pumps)

### Minimum displacement limiter

All Series 51 and 51-1 motors incorporate mechanical displacement limiters. The minimum displacement of the motor is preset at the factory with a set screw in the motor housing. A tamper-proof cap is provided.

## General technical specifications

### Hydraulic fluids

Ratings and data are based on operating with hydraulic fluids containing oxidation, rust and foam inhibitors. These fluids must possess good thermal and hydrolytic stability to prevent wear, erosion and corrosion of the internal components.

Fire resistant fluids are also suitable at modified operating conditions. Please see

Danfoss literature Hydraulic Fluids and Lubricants Technical Information for more information.

It is not permissible to mix hydraulic fluids. For more information contact your

Danfoss representative.

Suitable Hydraulic fluids:

- Hydraulic fluids per DIN 51 524, part 2 (HLP)
- Hydraulic fluids per DIN 51 524, part 3 (HVLP)
- API CD, CE and CF engine fluids per SAE J183
- M2C33F or G automatic transmission fluids (ATF)
- Agricultural multi purpose oil (STOU)
- Premium turbine oils (for Premium turbine oils contact your Danfoss representative).

### Temperature and viscosity

Temperature and viscosity requirements must be concurrently satisfied. The data shown in the tables assume petroleum-based fluids, are used.

The high temperature limits apply at the hottest point in the transmission, which is normally the motor case drain. The system should generally be run at or below the **rated temperature**. The **maximum temperature** is based on material properties and should never be exceeded.

Cold oil will generally not affect the durability of the transmission components, but it may affect the ability to flow oil and transmit power; therefore temperatures should remain 16 °C [30 °F] above the pour point of the hydraulic fluid. The **minimum temperature** relates to the physical properties of component materials.

For maximum unit efficiency and bearing life the fluid viscosity should remain in the **recommended operating range**. The **minimum viscosity** should be encountered only during brief occasions of maximum ambient temperature and severe duty cycle operation. The **maximum viscosity** should be encountered only at cold start.

Heat exchangers should be sized to keep the fluid within these limits. Testing to verify that these temperature limits are not exceeded is recommended.

*Temperature range [1)]*

| | **°C** | **[°F]** | |
|---|---|---|---|
| Minimum | -40 | [-40] | intermittent, cold start |
| Rated | 104 | [220] | |
| Maximum | 115 | [240] | intermittent |
| 1) At the hottest point, normally the case drain port. | | | |

*Viscosity*

| | **$mm^2/s$** | **[SUS]** | |
|---|---|---|---|
| Minimum | 7 | [49] | intermittent |
| Recommanded operating range | 12-80 | [70-370] | |
| Maximum | 1600 | [7500] | intermittent cold start |

## General technical specifications

### Fluid and filtration

To prevent premature wear, it is imperative that only clean fluid enter the hydrostatic transmission circuit. A filter capable of controlling the fluid cleanliness to ISO 4406 Class 22/18/13 (SAE J1165) or better under normal operating conditions is recommended.

The filter may be located either on the inlet (suction filtration) or discharge (charge pressure filtration) side of the charge pump. The selected filtration system must maintain a cleanliness level of 22/18/13 per ISO 4406.

The selection of a filter depends on a number of factors including the contaminant ingression rate, the generation of contaminants in the system, the required fluid cleanliness, and the desired maintenance interval. Filters are selected to meet the above requirements using rating parameters of efficiency and capacity.

Filter efficiency may be measured with a Beta ratio1) (βX). For simple suction-filtered closed circuit transmissions and open circuit transmissions with return line filtration,

a filter with a β-ratio within the range of β35-45 = 75 (β10 ≥ 2) or better has been found to be satisfactory. For some open circuit systems, and closed circuits with cylinders being supplied from the same reservoir, a considerably higher filter efficiency is recommended. This also applies to systems with gears or clutches using a common reservoir. For these systems, a charge pressure or return filtration system with a filter β-ratio in the range of β15-20 = 75 (β10 ≥ 10) or better is typically required.

Since each system is unique, the filtration requirement for that system will be unique and must be determined by test in each case. It is essential that monitoring of prototypes and evaluation of components and performance throughout the test program be the final criteria for judging the adequacy of the filtration system.
Please see Danfoss literature Hydraulic Fluids and Lubricants Technical Information for more information.

1) Filter βx-ratio is a measure of filter efficiency defined by ISO 4572. It is defined as the ratio of the number of particles greater than a given diameter ("x" in µm) upstream of the filter to the number of these particles downstream of the filter.

*Cleanliness level and βx-ratio*

| | |
|---|---|
| Required Fluid Cleanliness Level | ISO 4406 Class 22-18-13 |
| Recommended βx-Ratio for Suction Filtration | β35-45 = 75 (β10 ≥2) |
| Recommended βx-Ratio for Charge Pressure Filtration | β15-20 = 75 (β10 ≥10) |
| Recommended Inlet Screen Size for Charge Pressure Filtration | 100 µm-125 µm |

### Independent braking system

**Warning**

The loss of hydrostatic drive line power in any mode of operation (e.g., forward, reverse, or "neutral" mode) may cause the loss of hydrostatic braking capacity. A braking system, redundant to the hydrostatic transmission must, therefore, be provided which is adequate to stop and hold the system should the condition develop.

### Reservoir

The function of the reservoir is to remove air and to provide make up fluid for volume changes associated with fluid expansion or contraction, possible cylinder flow, and minor leakage.

The reservoir should be designed to accommodate maximum volume changes during all system operating modes and to promote deaeration of the fluid as it passes through the tank.

A minimum reservoir volume equal to 1/2 to 1 1/2 times charge pump flow/min is suggested. This allows 30 seconds fluid dwell for removing entrained air at the maximum return flow. This is usually adequate to allow for a closed reservoir (no breather) in most applications. The reservoir outlet to the charge pump

## General technical specifications

inlet should be above the bottom of the reservoir to take advantage of gravity separation and prevent large foreign particles from entering the charge inlet line.

The reservoir inlet (fluid return) should be positioned so that the flow to the reservoir is discharged below the normal fluid level, and also directed into the interior of the reservoir for maximum dwell and efficient deaeration.

### Motor bearing life

The rated motor bearing life, Lh10 , shown in the table below, is based on a 90 % survival rate of shaft bearings, when operating at a speed of n = 1500 min-1 (rpm) with a charge pressure of 20 bar [290 psi] and without external shaft load.

Contact your Danfoss representative for bearing life values at other pressures and angles.

Lifetimes for speeds other than 1500 min-1 (rpm) can be calculated from:

$$L_2 = \frac{L1 \cdot 1500\ \text{min}^{-1}\ (\text{rpm})}{n_2}\ \text{h}$$

$L_1$ = Rated $L_{10}$ life at 1500 $\text{min}^{-1}$ (rpm)

$n_2$ = Operating speed $\text{min}^{-1}$ (rpm)

| $L_{h10}$ - Bearing Life (hours) | | | | | |
|---|---|---|---|---|---|
| Frame size | Effective delta pressure (Δp) | | Motor angle (°) | | |
| | bar | [psi] | 6 | 15 | 32 |
| 060 | 140 | [2030] | 19 800 | 18 530 | 16 370 |
| | 210 | [3050] | 6320 | 5960 | 5340 |
| | 280 | [4060] | 2740 | 2600 | 2350 |
| 080 | 140 | [2030] | 14 420 | 13 580 | 12 120 |
| | 210 | [3050] | 4610 | 4370 | 3960 |
| | 280 | [4060] | 2000 | 1910 | 1750 |
| 110 | 140 | [2030] | 15 800 | 14 890 | 13 330 |
| | 210 | [3050] | 5040 | 4790 | 4350 |
| | 280 | [4060] | 2180 | 2090 | 1920 |
| 160 | 140 | [2030] | 15 670 | 14 770 | 13 200 |
| | 210 | [3050] | 5005 | 4750 | 4300 |
| | 280 | [4060] | 2170 | 2070 | 1900 |
| 250 | 140 | [2030] | 11 760 | 11 130 | 10 020 |
| | 210 | [3050] | 3750 | 3580 | 3260 |
| | 280 | [4060] | 1630 | 1560 | 1440 |

### External shaft loads

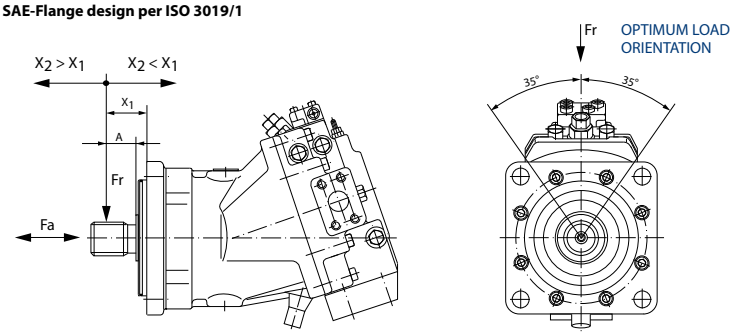
Series 51 and 51-1 motors are designed with bearings that can accept external radial and thrust loads.

The external radial shaft load limits are a function of the load position, the load orientation, and operating conditions of the unit.

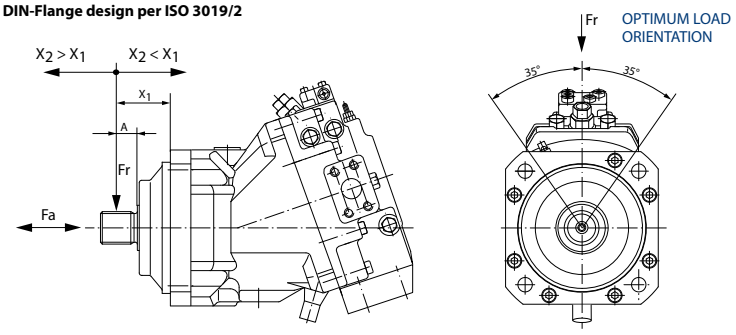
## General technical specifications

### External shaft load orientation

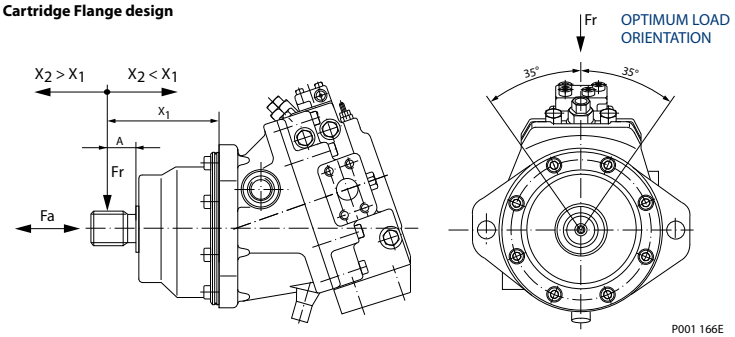
**SAE-Flange design per ISO 3019/1**




**DIN-Flange design per ISO 3019/2**




**Cartridge Flange design**




The table below provides the following information:

- The maximum allowable radial load (**Fr**) based on the distance (**x1**) from the mounting flange to the load.
- The maximum allowable axial load (**Fa**).
- The actual distance of (**Fr**) for a given application from the mounting flangeto the load is (**x2**).
- **A** is the basic distance.
- **Fa/Δp** ratio of allowable axial load, dependent upon system pressure.

The values in the table are maximum values, and are not allowed under continuous load conditions.

## General technical specifications

| Radial and Thrust Loads to the Output Shaft | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frame size | | | 060 | 080 | 110 | 160 | 250 |
| Maximum allowable radial load | **Fr** | N [lbf] | 10 000 [2248] | 12 000 [2698] | 14 000 [3147] | 18 000 [4047] | 26 000 [5845] |
| Distance from the SAE-mounting flange | $X_1$ | mm [in] | 33.6 [1.32] | 33.6 [1.32] | 62.7 [2.47] | 52.7 [2.07] | 45.3 [1.78] |
| Distance from the DIN-mounting flange | $X_1$ | mm [in] | 57.2 [2.25] | 57.6 [2.27] | 94.7 [3.73] | 84.7 [3.33] | — |
| Distance from the Cartridge design mounting flange | $X_1$ | mm [in] | 117.6 [4.63] | 136.1 [5.36] | 177.5 [7.00] | — | — |
| Basic distance | **A** | mm [in] | 25.2 [0.99] | 25.6 [1.01] | 54.7 [2.15] | 44.7 [1.76] | 37.3 [1.47] |
| Maximum allowable bending moment | **M** | Nm [lbf•in] | 252 [2230] | 307 [2717] | 766 [6780] | 805 [7125] | 970 [8585] |
| Maximum allowable axial load at zero rpm or running in the idle pressure | **Fa** | N [lbf] | 1100 [247] | 1400 [315] | 1800 [405] | 2500 [562] | 4500 [1012] |
| Maximum allowable axial load at pressure | **Fa/Δp** | N/bar [lbf/1000 psi] | 10.4 [161] | 12.6 [195] | 15.2 [236] | 19.2 [298] | 26.4 [409] |

— = not available

### Allowable external shaft load, when shaft load distance is different from standard

Use this formula to calculate maximum allowable radial load when max. shaft load distance (**X2**) is different from (**X1**):

(**X2**) is the actual distance of (**Fr**) from the mounting flange to the load for a given application. If **X2 < X1**, (**Fr**) could also be calculated by the first equation, but in addition the bearing life has to be checked.

Contact your Danfoss representative for load ratings of specific shafts or when the load orientation deviates more than 35° in either direction from the optimum.

Metric system:

$$X_2 > X_1 \qquad Fr = \frac{M \cdot 10^3}{A - X_1 + X_2} \qquad N$$

Inch system:

$$X_2 > X_1 \qquad Fr = \frac{M \cdot 12}{A - X_1 + X_2} \qquad lbf$$

Metric or inch system:

$$X_2 > X_1 \qquad Fr = Fr\ max\ N \qquad lbf$$

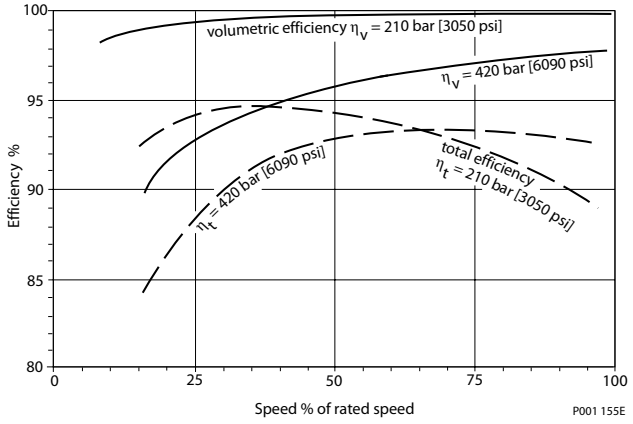
### Efficiency graphs and maps

This graph provides the volumetric and overall efficiencies for a typical Series 51 and 51-1 motor operating at maximum displacement, system pressures of 210 and 420 bar [3050 and 6090 psi], and a fluid viscosity of 8.2 $mm^2/s$ [53 SUS].

These efficiencies can be used for all frame sizes.

## General technical specifications

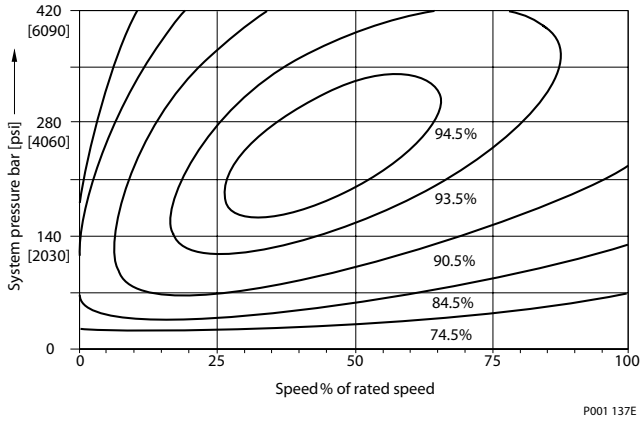
*Overall efficiency and volumetric efficiency at maximum displacement*




This graph shows typical overall efficiencies for Series 51 and 51-1 motors operating at maximum displacement and system pressures up to 420 bar [6090 psi], and a fluid viscosity of 8.2 mm²/s [53 SUS].

These efficiencies can be used for all frame sizes.

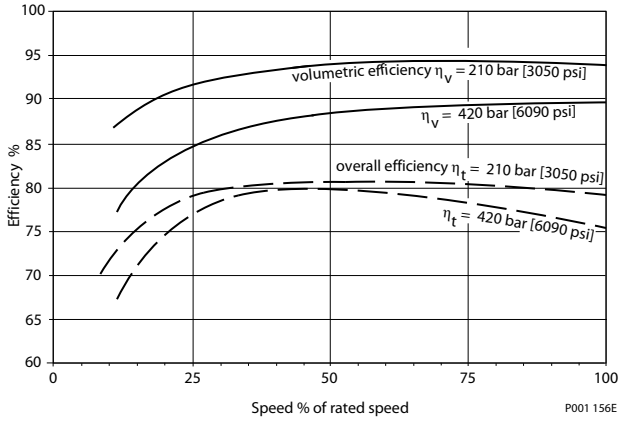
*Overall efficiency at maximum displacement*




This graph shows typical overall efficiencies for Series 51 and 51-1 motors operating at 30% of maximum displacement and system pressures up to 420 bar [6090 psi], and a fluidviscosity of 8.2 mm²/s (53 SUS).

These efficiencies can be used for all frame sizes.

*Overall efficiency and volumetric efficiency at 30% of maximum displacement*

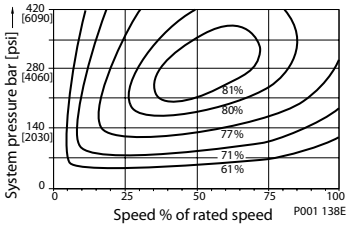


## General technical specifications

This graph shows typical overall efficiencies for Series 51 and 51-1 motors operating at 30% of maximum displacement and system pressures up to 420 bar [6090 psi], and a fluidviscosity of 8.2 $mm^2/s$ (53 SUS).

These efficiencies can be used for all frame sizes.

*Overall efficiency at 30% of maximum displacement*




### Speed sensor

An optional speed sensor for direct measurement of speed is available. This sensor may also be used to sense the direction of rotation.

A special magnetic speed pick-up ring is pressed onto the outside diameter of the shaft and a Hall effect sensor is located in the motor housing. The sensor accepts supply voltage and outputs a digital pulse signal in response to the speed of the ring. The output changes its high/low state as the north and south poles of the permanently magnetized speed ring pass by the face of the sensor. The digital signal is generated at frequencies suitable for microprocessor based controls.

The sensor is available with different connectors (see below).

The SAE and DIN flange motors use a flat end speed sensor. The cartridge flange motors use a conical end speed sensor.

Contact your Danfoss representative for more information.

| Data Magnetic Speed Pick-up Ring | | | | | |
|---|---|---|---|---|---|
| Frame Size | 060 | 080 | 110 | 160 | 250 |
| Pulse/Rev | 45 | 49 | 54 | 61 | 71 |

Connecting pin designation:

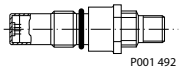
- Pin 1 or A : Supply voltage
- Pin 2 or D : Direction of rotation
- Pin 3 or B : Speed signal, digital
- Pin 4 or C : Gnd common

| Technical Data Speed Sensor | |
|---|---|
| Supply voltage[1)] | 4.5-8.5 $V_{DC}$ |
| Supply voltage regulated | 15 $V_{DC\ max.}$ |
| Required current | 12 mA at 5 $V_{DC}$ (no load) |
| Max. current | 20 mA at 5 $V_{DC}$ and 1 Hz |
| Max. frequency | 15 kHz |
| Voltage "high" | Supply voltage -0.5 $V_{min.}$ |
| Voltage "low" | 0.5 $V_{DC\ max.}$ |
| Temperatur range | -40 to 110 °C [-40 to 230 °F] |

[1)] It is not acceptable to energize the 4.5-8.5 $V_{DC}$ speed sensor with 12 $V_{DC}$ battery voltage; it must be energized by a regulated power supply. If it is desirable to energize the sensor with battery voltage, contact your Sauer-Danfoss representative for an optional speed sensor.

## General technical specifications

*Speed sensor with Turck Eurofast connector*



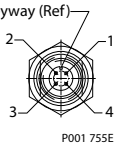
P001 492

**Turck Eurofast Connector**
**4 pin**
(Supplied connector)

IP Rating (DIN 40 050) IP 67

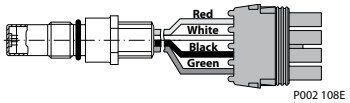
Mating connector
straight
No.: K14956
Id.-No.: 500724

right angle
No.: K14957
Id.-No.: 500725




P001 755E

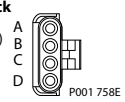
*Speed sensor with Packard Weather-Pack connector*




P002 108E

**Packard Weather-Pack**
**4 pin**
(Supplied Connector)

Mating Connector
No.: K03379
Id.-No.: 505341




P001 758E

## Typical control and regulator applications

### Typical control and regulator applications

The following table is provided to assist in selecting controls and regulators for various applications.

These recommendations are based on experience with a wide range of applications.

Contact your Danfoss representative for more information on control selection.

| Control and Regulators | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Machine | Function | N1 | HZ | TA | | E1/E2/E7 | F1/F2 | T1/T2 | | TH | EP/EQ | | L1/L2/L7 | D7/D8 | HS | |
| | | A | A | B | C | A | A | B | C | B | A | C | A | C | B | C |
| Wheel loader | Propel | | | m | m | m | m | m | m | m | | | m | m | | |
| Roller compactor | Propel | m | m | | | m | m | | | | | | | | | |
| Paver-Wheeled | Propel | m | | | | m | m | | | | | | | | | |
| Paver-Tracked | Propel | m | | | | m | m | | m | | m | | m | | | |
| Sweeper | Propel | | m | | | | | | | | | | | m | | m |
| Trencher | Propel | m | m | | | m | | | | | | | | | | m |
| Excavator-Wheeled | Propel | | | | | | | | | m | | | | m | | m |
| Fork lift truck | Propel | | | | | | | | | | | | m | m | | |
| Agricultural machines | Propel | | | | | | | | | | m | m | m | m | | |
| Forestry machines | Propel | | | | | | | m | m | m | | m | | m | m | m |
| Telescopic handler | Propel | | | m | m | | | | m | m | | | | m | | |
| Railroad machines | Propel | | | | | | | | m | | m | m | m | m | | |
| Snow groomer | Propel | m | m | | | m | | | | | m | | m | | | |
| Snow blower | Propel | | | | | m | | | | | | m | | m | | |
| Crane | Winch | | | | | m | | | | | | | | | | |

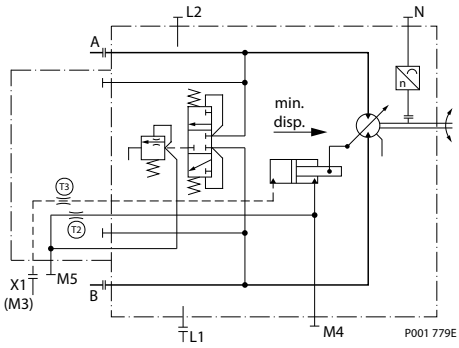
A = Control without pressure compensator override
B = Control with pressure compensator override
C = Control with pressure compensator override and defe

m = Suitable configuration

## Controls circuit diagram – nomenclature – description

### Hydraulic two-position control – option N1NN for 51-1 frame size 060, 080, 110

*Circuit Diagram–Motor with Hydraulic Two-Position Control N1NN*




Ports:

A, B = Main pressure lines

L1, L2 = Drain lines

M4 = Gauge port

servo pressure

M5 = Gauge port

servo supply pressure

internal

X1 (M3) = Control pressure port

T2, T3, T3 = Optional orifices

N = Speed sensor

#### *Hydraulic two-position control N1NN*

Displacement changes from maximum displacement to minimum displacement position, under load, as control pressure at port X1 (M3) is equal to low pressure or higher.

#### *Control pressure*

No pressure on port X1 (M3) = maximum displacement

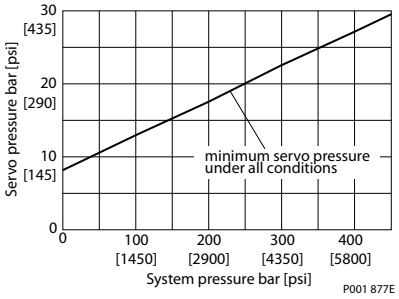
Control pressure on port X1 (M3) = minimum displacement.

Max. control pressure X1(M3) = 50 bar [725 psi]

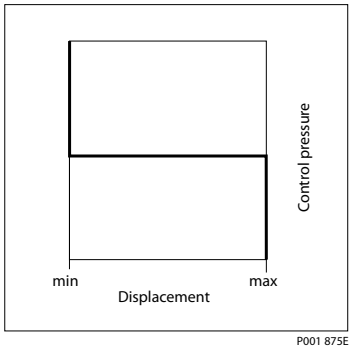
The graph shows the necessary external and internal (= low system pressure) control pressure X1, which is needed to stroke the motor depending on high system pressure.

## Controls circuit diagram – nomenclature – description

*Control N1NN necessary control pressure*



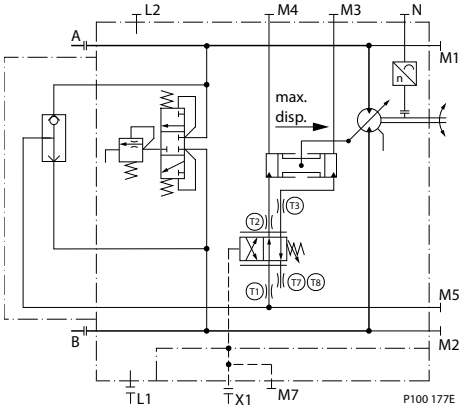

*Control operation N1NN*




Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

### Hydraulic two-position control – option HZB1 for 51 frame size 160, 250

*Circuit diagram–motor with hydraulic two-position Control HZB1*




Ports:

A, B = Main pressure lines

L1, L2 = Drain lines

M1, M2 = Gauge port for A and B

M3, M4 = Servo pressure port

M5 = Gauge port servo supply pressure internal

M7 = Gauge port control pressure

## Controls circuit diagram – nomenclature – description

X1 = Control pressure port

T1, T2, T3, = Optional orifices

T7, T8

N = Speed sensor

***Hydraulic two-position control HZB1***

Displacement can be changed hydraulically under load from minimum displacement to maximum displacement and vice versa by control pressure to port X1.

***Control pressure***

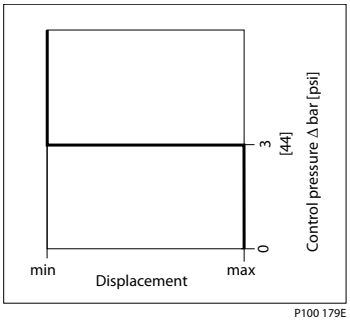
No pressure on port X1 = maximum displacement

Control pressure on port X1 = minimum displacement.

Max. control pressure X1 = 50 bar [725 psi]

The standard control start point setting = 3 bar [44 psi]

*Control operation HZB1*

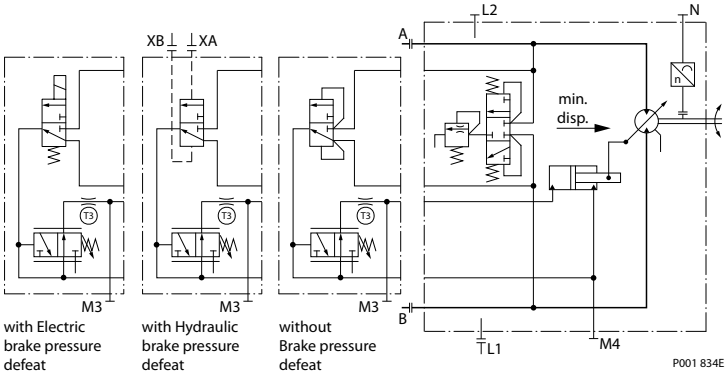



Proportional control, option HZB1 see page 60.

Not all control options are shown in this Technical Information contact your Danfoss representative for special control functions.

**Pressure compensator control – options TA** for 51-1 frame size 060, 080, 110**

*Circuit diagram–motor with pressure compensator control TA***




with Electric brake pressure defeat

with Hydraulic brake pressure defeat

without Brake pressure defeat

Ports:

A, B = Main pressure lines T3 = Orifice

## Controls circuit diagram – nomenclature – description

L1, L2 = Drain lines N = Speed sensor

M3, M4 = Gauge port servo pressure

XA, XB = Control pressure port brake pressure defeat

***Pressure compensator control TA*****

Displacement is regulated automatically between minimum displacement and maximum displacement in response to system pressure.

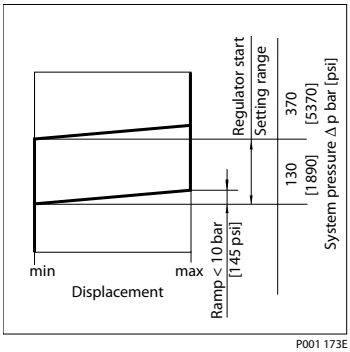
Regulator start = minimum displacement

Regulator end = maximum displacement

Regulator start pressure is adjustable from 130 to 370 bar [1890 to 5370 psi].

Pressure ramp from regulator start pressure (with motor at minimum displacement) until maximum displacement is reached is less than 10 bar [145 psi]. This ensures optimal power utilization throughout the entire displacement range of the motor.

*Control operation TA***




P001 173E

***Pressure Compensator Configuration: TACA with Hydraulic Brake Pressure Defeat***

A shuttle valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The shuttle valve must be controlled by a 2-line external signal, based on direction of motor rotation, based on the following table.

| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Control pressure on port | PCOR-Function |
| CW | A | XA | yes |
| CW | A | XB | no |
| CCW | B | XA | no |
| CCW | B | XB | yes |

Differential control pressure between port XA/XB
$\Delta p_{min}$ = 0.5 bar [7 psi]
$\Delta p_{max}$ = 50 bar [725 psi]

Pressure compensator override with brake pressure defeat is mainly used in systems with pumps having electric or hydraulic proportional controls or automotive controls.

## Controls circuit diagram – nomenclature – description

### *Pressure Compensator Configuration: TAD1, TAD2, TAD7 with Electric Brake Pressure Defeat*

A solenoid-switched valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The solenoid valve must be controlled by an external electric signal, based on direction of motor rotation, based on the following table.

| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Solenoid | PCOR-Function |
| CW | A | energized | yes |
| CW | A | non energized | no |
| CCW | B | energized | no |
| CCW | B | non energized | yes |

### *Solenoid Connectors*

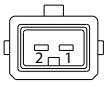
**Magnet-Steckanschluss für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117

P001 752D

**AMP Junior Timer Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388



P001 751E

| Solenoid Data | | | |
|---|---|---|---|
| Configuration | Voltage | Electric power | Connector |
| TAD1 | 12 $V_{DC}$ | 34 W | DIN 46350 |
| TAD7 | 12 $V_{DC}$ | 34 W | AMP Junior Timer two pin connector |
| TAD2 | 24 $V_{DC}$ | 34 W | DIN 46350 |

### *Pressure Compensator Configuration: TAC2 without Brake Pressure Defeat*

Pressure compensator functions when the motor is running in motor mode as well as in pump (deceleration) mode.

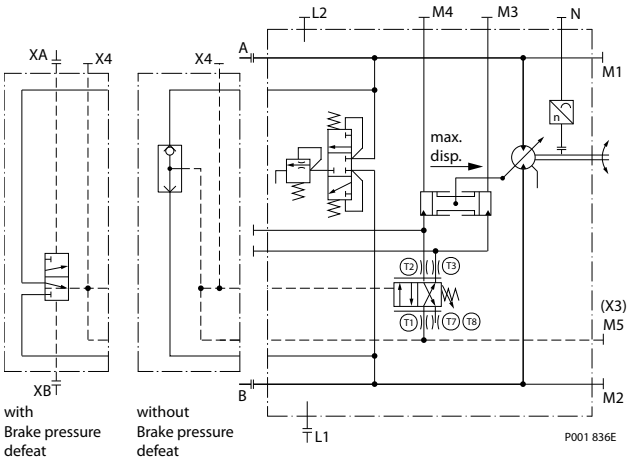
| Pressure Compensator Options | | |
|---|---|---|
| Configuration | High pressure at port | PCOR-Funktion |
| TAC2 | A and B | yes |

Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

## Controls circuit diagram – nomenclature – description

### Pressure Compensator Control – Options TA** for 51 Frame Size 160, 250

*Circuit Diagram–Motor with Pressure Compensator Control TA***




Ports:

A, B = Main pressure lines XA, XB = Control pressure ports,

L1, L2 = Drain lines brake pressure defeat

M1, M2 = Gauge port for A and B X4 = Gauge port pressure compensator

M3, M4 = Gauge port servo pressure T1, T2, T3, = Optional orifices

M5 (X3) = Gauge port servo supply T7, T8

N = Speed sensor

***Pressure Compensator Control TA****

Displacement is regulated automatically between minimum displacement and maximum displacement in response to system pressure.

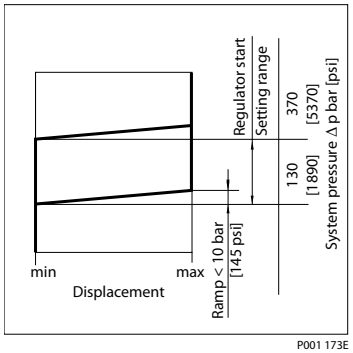
Regulator start = minimum displacement

Regulator end = maximum displacement

Regulator start pressure is adjustable from 130 to 370 bar [1890 to 5370 psi].

Pressure ramp from regulator start pressure (with motor at minimum displacement) until maximum displacement is reached is less than 10 bar [145 psi]. This ensures optimal power utilization throughout the entire displacement range of the motor.

*Control Operation TA***



## Controls circuit diagram – nomenclature – description

### *Pressure Compensator Configuration: TAC0 with Hydraulic Brake Pressure Defeat*

A shuttle valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The shuttle valve must be controlled by a 2-line external signal, based on direction of motor rotation, based on the following table.

| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Control pressure on port | PCOR-Function |
| CW | A | XA | no |
| CW | A | XB | yes |
| CCW | B | XA | yes |
| CCW | B | XB | no |

Differential control pressure between port XA/XB
$\Delta p_{min}$ = 0.5 bar [7 psi]
$\Delta p_{max}$ = 50 bar [725 psi]

Pressure compensator override with brake pressure defeat is mainly used in systems with pumps having electric or hydraulic proportional controls or automotive controls.

### *Pressure Compensator Configuration: TAC2 without Brake Pressure Defeat*

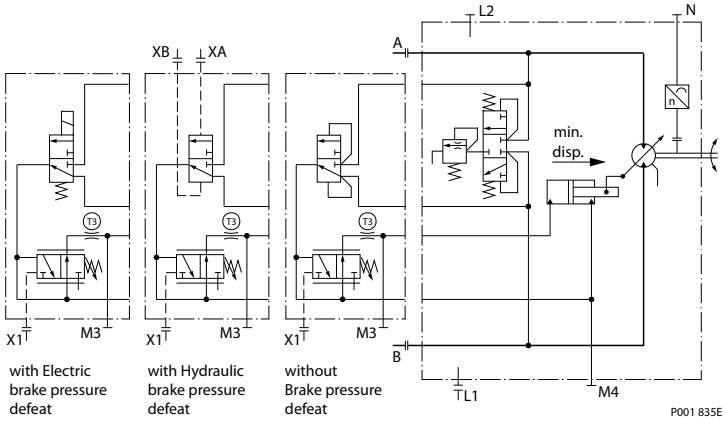
Pressure compensator functions when the motor is running in motor mode as well as in pump (deceleration) mode.

| Pressure Compensator Options | | |
|---|---|---|
| Configuration | High pressure at port | PCOR-Funktion |
| TAC2 | A and B | yes |

Not all control options are shown in this Technical Information Contact your Danfoss representative for special control functions.

### Hydraulic Two-Position Control – Options TH** for 51-1 Frame Size 060, 080, 110

*Circuit Diagram–Motor with Two-Position Control TH***




with Electric brake pressure defeat | with Hydraulic brake pressure defeat | without Brake pressure defeat

Ports:

A, B = Main pressure lines XA, XB = Control pressure ports

L1, L2 = Drain lines brake pressure defeat

M3, M4 = Gauge port servo pressure T3 = Orifice

X1 = Control pressure port, N = Speed sensor hydr. override to max. angle

## Controls circuit diagram – nomenclature – description

### *Hydraulic Two-Position Control TH***

Displacement can be changed hydraulically under load from minimum displacement to maximum displacement and vice versa.

Pressure on port X1 must be equal to the pressure of the motor case ± 0.2 bar, [3.0 psi] this keeps the motor at minimum displacement.

Pressure 10 bar, [145 psi] to 35 bar, [510 psi] above case pressure on port X1 strokes the motor to maximum displacement.

### *Pressure Compensator Override (PCOR)*

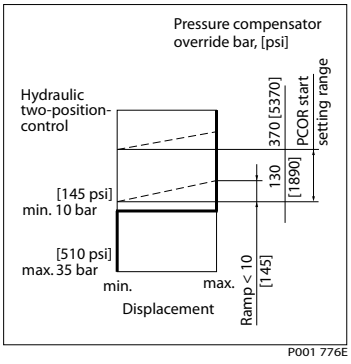
The control can be overridden by PCOR using high loop pressure.

When the PCOR activates, the motor displacement increases toward maximum.

Pressure ramp from PCOR start pressure (with motor at minimum displacement) until maximum displacement is reached is less than 10 bar [145 psi].
This ensures optimal power utilization throughout the entire displacement range of the motor.

PCOR start pressure is adjustable from 130 to 370 bar [1890 to 5370 psi].

*Control Operation TH***




### *Pressure Compensator Configuration: THCA with Hydraulic Brake Pressure Defeat*

A shuttle valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The shuttle valve must be controlled by a 2-line external signal, based on direction of motor rotation, based on the following table.

| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Control pressure on port | PCOR-Function |
| CW | A | XA | yes |
| CW | A | XB | no |
| CCW | B | XA | no |
| CCW | B | XB | yes |

Differential control pressure between port XA/XB
$\Delta p_{min}$ = 0.5 bar [7 psi]
$\Delta p_{max}$ = 50 bar [725 psi]

Pressure compensator override with brake pressure defeat is mainly used in systems with pumps having electric or hydraulic proportional controls or automotive controls.

## Controls circuit diagram – nomenclature – description

### *Pressure Compensator Configuration: THD1, THD2, THD7 with Electric Brake Pressure Defeat*

A solenoid-switched valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The solenoid valve must be controlled by an external electric signal, based on direction of motor rotation, based on the following table.

| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Solenoid | PCOR-Function |
| CW | A | energized | yes |
| CW | A | non energized | no |
| CCW | B | energized | no |
| CCW | B | non energized | yes |

### *Solenoid Connectors*

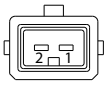
**Magnet-Steckanschluss für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117

P001 752D

**AMP Junior Timer Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388



P001 751E

| Solenoid Data | | | |
|---|---|---|---|
| Configuration | Voltage | Electric power | Connector |
| THD1 | 12 $V_{DC}$ | 34 W | DIN 46350 |
| THD7 | 12 $V_{DC}$ | 34 W | AMP Junior Timer two pin connector |
| THD2 | 24 $V_{DC}$ | 34 W | DIN 46350 |

### *Pressure Compensator Configuration: THC2 without Brake Pressure Defeat*

Pressure compensator functions when the motor is running in motor mode as well as in pump (deceleration) mode.

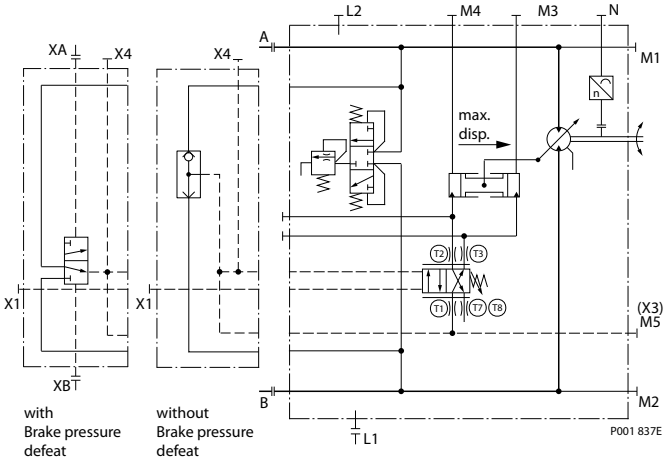
| Pressure Compensator Options | | |
|---|---|---|
| Configuration | High pressure at port | PCOR-Funktion |
| THC2 | A and B | yes |

Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

## Controls circuit diagram – nomenclature – description

### Hydraulic Two-Position Control – Options TH** for 51 Frame Size 160, 250

*Circuit Diagram–Motor with Two-Position Control TH***




Ports:

A, B = Main pressure lines X4 = Gauge port pressure compensator

L1, L2 = Drain lines XA, XB = Control pressure ports M1, M2 = Gauge port for A and B brake pressure defeat

M3, M4 = Gauge port servo pressure T1, T2, T3, = Optional orifices

M5 (X3) = Gauge port servo supply T7, T8

X1 = Hydr. two-position signal N = Speed sensor

#### *Hydraulic Two-Position Control TH***

Displacement can be changed hydraulically under load from minimum displacement to maximum displacement and vice versa.

Pressure on port X1 must be equal to the pressure of the motor case ± 0.2 bar, [3.0 psi] this keeps the motor at minimum displacement.

Pressure 10 bar, [145 psi] to 35 bar, [510 psi] above case pressure on port X1 strokes the motor to maximum displacement.

#### *Pressure Compensator Override (PCOR)*

The control can be overridden by PCOR using high loop pressure.

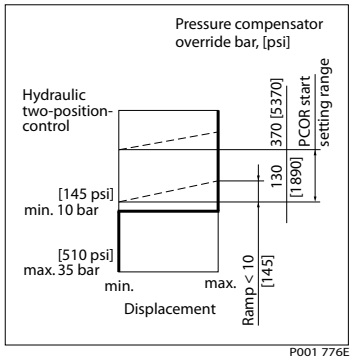
When the PCOR activates, the motor displacement increases to maximum.

Pressure ramp from PCOR start pressure (with motor at minimum displacement) until maximum displacement is reached is less than 10 bar [145 psi]. This ensures optimal power utilization throughout the entire displacement range of the motor.

PCOR start pressure is adjustable from 130 to 370 bar [1890 to 5370 psi].

## Controls circuit diagram – nomenclature – description

*Control Operation TH***




### *Pressure Compensator Configuration: THC0 with Hydraulic Brake Pressure Defeat*

A shuttle valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The shuttle valve must be controlled by a 2-line external signal, based on direction of motor rotation, based on the following table.

| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Control pressure on port | PCOR-Function |
| CW | A | XA | no |
| CW | A | XB | yes |
| CCW | B | XA | yes |
| CCW | B | XB | no |

Differential control pressure between port XA/XB
$\Delta p_{min}$ = 0.5 bar [7 psi]
$\Delta p_{max}$ = 50 bar [725 psi]

Pressure compensator override with brake pressure defeat is mainly used in systems with pumps having electric or hydraulic proportional controls or automotive controls.

### *Pressure Compensator Configuration: THC2 without Brake Pressure Defeat*

Pressure compensator functions when the motor is running in motor mode as well as in pump (deceleration) mode.

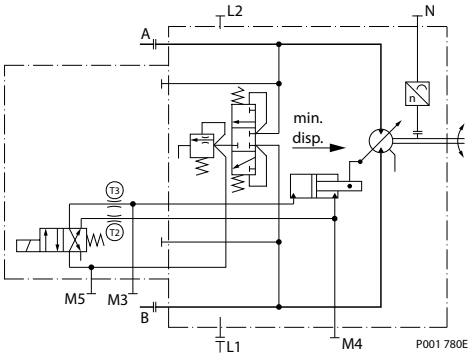
| Pressure Compensator Options | | |
|---|---|---|
| Configuration | High pressure at port | PCOR-Function |
| THC2 | A and B | yes |

Not all control options are shown in this Technical Information Contact your Danfoss representative for special control functions.

## Controls circuit diagram – nomenclature – description

### Electrohydraulic Two-Position Control – Options E1B1, E2B1, E7B1 for 51-1 Frame Size 060, 080, 110

*Circuit Diagram–Motor with Electrohydraulic Two-Position Control E1B1, E2B1, E7B1*




Ports:

A, B = Main pressure lines

L1, L2 = Drain lines

M3, M4 = Servo pressure port

M5 = Gauge port

servo supply pressure internal

T2, T3 = Optional orifices

N = Speed sensor

#### *Electrohydraulic Two-Position Control*

Displacement can be changed electrohydraulically under load from maximum displacement to minimum displacement and vice versa, by using a built-in solenoid valve.

#### *Options E1B1, E2B1, E7B1*

Solenoid off = max. displacement

Solenoid on = min. displacement

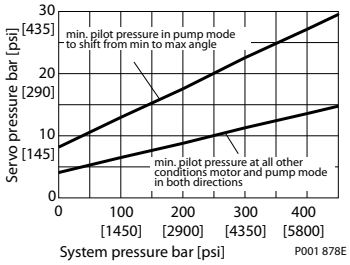
#### *Pilot Pressure for Solenoid*

internal = low pressure

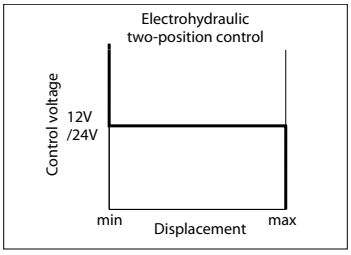
The graph shows the necessary servo pressure (= low pressure), which is needed to stroke the motor, depending on high system pressure and the pump or motor mode.

## Controls circuit diagram – nomenclature – description

*Control E1B1, E2B1, E7B1 necessary low system pressure*




*Control Operation E1B1, E2B1, E7B1*




### *Solenoid Connectors*

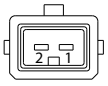
**Magnet-Steckanschluss für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117

P001 752D

**AMP Junior Timer Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388



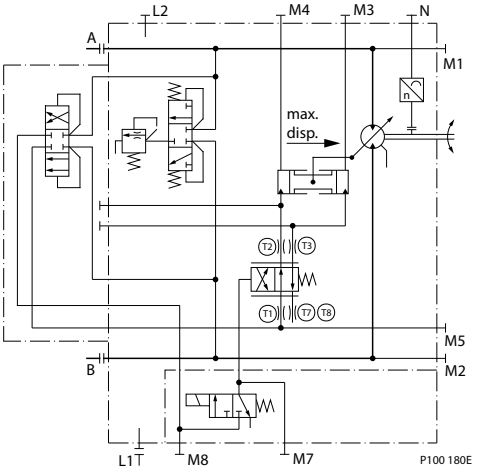
P001 751E

| Solenoid Data | | | |
|---|---|---|---|
| Configuration | Voltage | Electric power | Connector |
| E1B1 | 12 $V_{DC}$ | 14.7 W | DIN 46350 |
| E7B1 | 12 $V_{DC}$ | 14.7 W | AMP Junior Timer two pin connector |
| E2B1 | 24 $V_{DC}$ | 14.7 W | DIN 46350 |

Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

### Electrohydraulic Two-Position Control – Options E1A5, E2A5 for 51 Frame Size 160, 250

Circuit Diagram–Motor with Electrohydraulic Two-Position Control E1A5, E2A5,



## Controls circuit diagram – nomenclature – description

Ports:

A, B = Main pressure lines

L1, L2 = Drain lines

M1, M2 = Gauge port for A and B

M3, M4 = Gauge port

servo pressure

M5 = Gauge port servo supply pressure, internal

M7, M8 = Gauge port control pressure, internal

T1, T2, T3, = Optional orifices

T7, T8

N = Speed sensor

### *Electrohydraulic Two-Position Control*

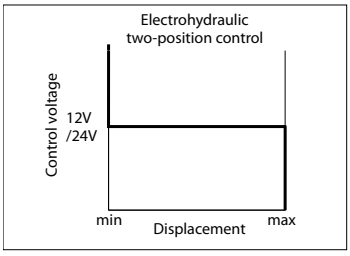
Displacement can be changed electrohydraulically under load from maximum displacement to minimum displacement and vice versa, by using a built-in solenoid valve.

### *Options E1A5, E2A5*

Solenoid off = max. displacement

Solenoid on = min. displacement

*Control Operation E1A5, E2A5*




P001 870E

### *Pilot Pressure for Solenoid*

internal = low pressure

### *Solenoid Connector*

**Magnet-Steckanschluss**
**für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117


P001 752D

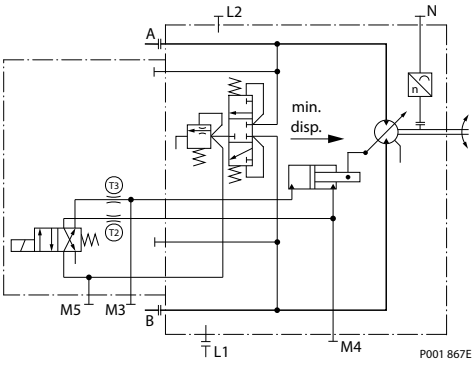
| Solenoid Data | | | |
|---|---|---|---|
| Configuration | Voltage | Electric power | Connector |
| E1A5 | 12 $V_{DC}$ | 14.7 W | DIN 46350 |
| E2A5 | 24 $V_{DC}$ | | |

## Controls circuit diagram – nomenclature – description

Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

### Electrohydraulic Two-Position Control – Options F1B1, F2B1 for 51-1 Frame Size 060, 080, 110

*Circuit Diagram–Motor with Electrohydraulic Two-Position Control F1B1, F2B1,*




Ports:

A, B = Main pressure lines

L1, L2 = Drain lines

M3, M4 = Servo pressure port

M5 = Gauge port servo supply pressure, internal

T2, T3 = Optional orifices

N = Speed sensor

#### *Electrohydraulic Two-Position Control*

Displacement can be changed electrohydraulically under load from maximum displacement to minimum displacement and vice versa, by using a built-in solenoid valve.

#### *Options F1B1, F2B1*

Solenoid off = min. displacement

Solenoid on = max. displacement

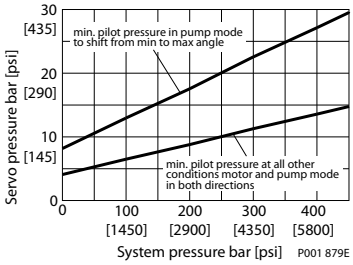
#### *Pilot Pressure for Solenoid*

internal = low pressure

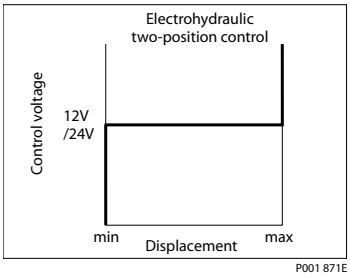
The graph shows the necessary servo pressure (= low system pressure), which is needed to stroke the motor, depending on high system pressure and the pump or motor mode.

## Controls circuit diagram – nomenclature – description

*Control F1B1, F2B1 necessary low system pressure*




*Control Operation F1B1, F2B1*




### *Solenoid Connector*

**Magnet-Steckanschluss**
**für DIN 46350**
(angebauter Stecker)

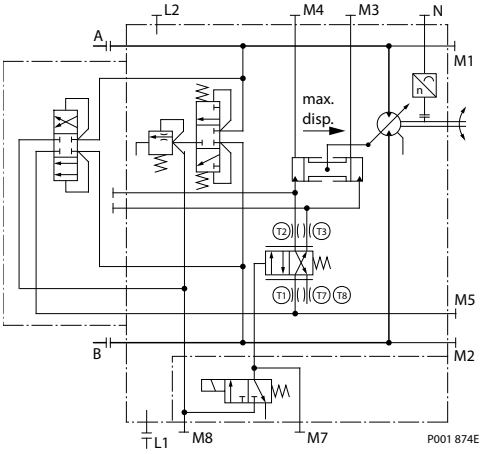
Gegenstecker
Nr.: K09129
Id.-Nr.: 514117


| Solenoid Data | | | |
|---|---|---|---|
| Configuration | Voltage | Electric power | Connector |
| F1B1 | 12 $V_{DC}$ | **14.7 W** | **DIN 46350** |
| F2B1 | 24 $V_{DC}$ | | |

Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

### Electrohydraulic Two-Position Control – Options F1A5, F2A5 for 51 Frame Size 160, 250

*Circuit Diagram–Motor with Electrohydraulic Two-Position Control F1A5, F2A5*



## Controls circuit diagram – nomenclature – description

Ports:

A, B = Main pressure lines

L1, L2 = Drain lines

M1, M2 = Gauge port for A and B

M3, M4 = Gauge port servo pressure

M5 = Gauge port servo supply pressure, internal

M7, M8 = Gauge port control pressure, internal

T1, T2, T3, = Optional orifices

T7, T8

N = Speed sensor

### *Electrohydraulic Two-Position Control*

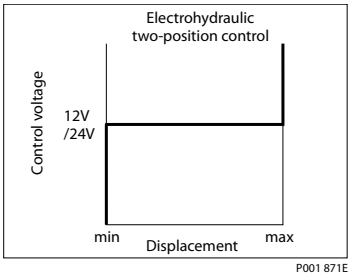
Displacement can be changed electrohydraulically under load from maximum displacement to minimum displacement and vice versa, by using a built-in solenoid valve.

### *Options F1A5, F2A5*

Solenoid off = min. displacement

Solenoid on = max. displacement

*Control Operation F1A5, F2A5*




P001 871E

### *Pilot Pressure for Solenoid*

internal = low pressure

### *Solenoid Connector*

**Magnet-Steckanschluss**
**für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117


P001 752D

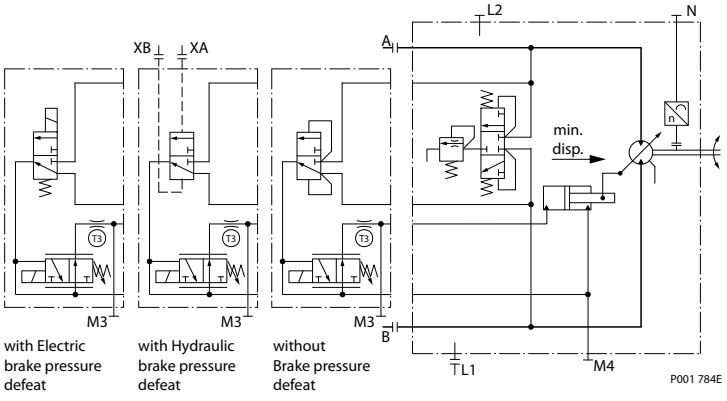
| Solenoid Data | | | |
|---|---|---|---|
| Configuration | Voltage | Electric power | Connector |
| F1A5 | 12 $V_{DC}$ | 14.7 W | DIN 46350 |
| F2A5 | 24 $V_{DC}$ | | |

Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

## Controls circuit diagram – nomenclature – description

### Electrohydraulic Two-Position Control – Options T1**, T2**, T7** for 51-1 Frame Size 060, 080, 110

*Circuit Diagram–Motor with Electrohydraulic Two-Position Control T1**, T2**, T7***




Ports:

A, B = Main pressure lines

L1, L2 = Drain lines

M3, M4 = Gauge port servo pressure

XA, XB = Control pressure ports, brake pressure defeat

T3 = Optional orifices

N = Speed sensor

***Electrohydraulic Two-Position Control T1**, T2**, T7****

Displacement can be changed electrohydraulically under load from minimum displacement to maximum displacement and vice versa, by using a solenoid. When the solenoid is energized the motor has maximum displacement and the pressure compensator does not function.

Solenoid not energized = minimum displacement

Solenoid energized = maximum displacement

***Pressure Compensator Override (PCOR)***

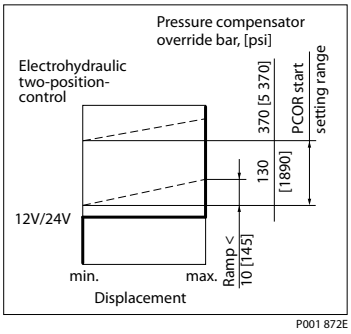
The control can be overridden by PCOR using high loop pressure.

When the PCOR activates, the motor displacement increases toward maximum. Pressure ramp from PCOR start pressure (with motor at minimum displacement) until maximum displacement is reached is less than 10 bar [145 psi].
This ensures optimal power utilization throughout the entire displacement range of the motor.

PCOR start pressure is adjustable from 130 to 370 bar [1890 to 5370 psi].

## Controls circuit diagram – nomenclature – description

*Control Operation T1**, T2**, T7***




### *Pressure Compensator Configuration: T*CA with Hydraulic Brake Pressure Defeat*

A shuttle valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The shuttle valve must be controlled by a 2-line external signal, based on direction of motor rotation, based on the following table.

| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Control pressure on port | PCOR-Function |
| CW | A | XA | yes |
| CW | A | XB | no |
| CCW | B | XA | no |
| CCW | B | XB | yes |

Differential control pressure between port XA/XB
$\Delta p_{min}$ = 0.5 bar [7 psi]
$\Delta p_{max}$ = 50 bar [725 psi]

Pressure compensator override with brake pressure defeat is mainly used in systems with pumps having electric or hydraulic proportional controls or automotive controls.

### *Pressure Compensator Configuration: T*D1, T*D2, T* D7 with Electric Brake Pressure Defeat*

A solenoid-switched valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The solenoid valve must be controlled by an external electric signal, based on direction of motor rotation, based on the following table.

| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Solenoid | PCOR-Function |
| CW | A | energized | yes |
| CW | A | non energized | no |
| CCW | B | energized | no |
| CCW | B | non energized | yes |

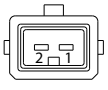
### *Solenoid Connectors*

**Magnet-Steckanschluss für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117


**AMP Junior Timer Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388



## Controls circuit diagram – nomenclature – description

| Solenoid Data | | | |
|---|---|---|---|
| Configuration | Voltage | Electric power | Connector |
| T1D1 | 12 $V_{DC}$ | 34 W | DIN 46350 |
| T7D7 | 12 $V_{DC}$ | 34 W | AMP Junior Timer two pin connector |
| T2D2 | 24 $V_{DC}$ | 34 W | DIN 46350 |

***Pressure Compensator Configuration: T*C2 without Brake Pressure Defeat***

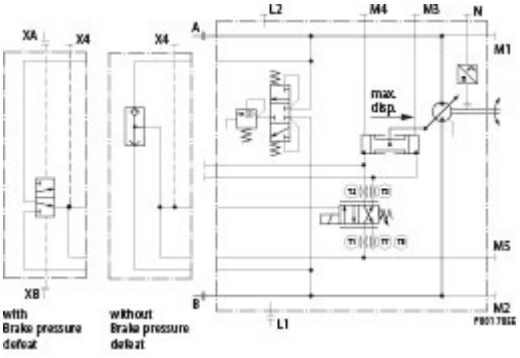
Pressure compensator functions when the motor is running in motor mode as well as in pump (deceleration) mode.

| Pressure Compensator Options | | |
|---|---|---|
| Configuration | High pressure at port | PCOR-Funktion |
| T*C2 | A and B | yes |

Not all control options are shown in this Technical Information. Contact your Danfoss representative for special control functions.

### Electrohydraulic Two-Position Control – Options T1**, T2** for 51 Frame Size 160, 250

*Circuit Diagram–Motor with Electrohydraulic Two-Position Control T1**, T2***




Ports:

A, B = Main pressure lines XA, XB = Control pressure ports,

L1, L2 = Drain lines brake pressure defeat

M1, M2 = Gauge port for A and B T1, T2, T3, = Optional orifices

M3, M4 = Gauge port servo pressure T7, T8

M5 = Gauge port servo supply N = Speed sensor pressure internal

## Controls circuit diagram – nomenclature – description

### *Electrohydraulic Two-Position Control T1**, T2***

Displacement can be changed electrohydraulically under load from minimum displacement to maximum displacement and vice versa, by using a solenoid. When the solenoid is energized the motor has maximum displacement and the pressure compensator is overridden.

Solenoid not energized = minimum displacement

Solenoid energized = maximum displacement

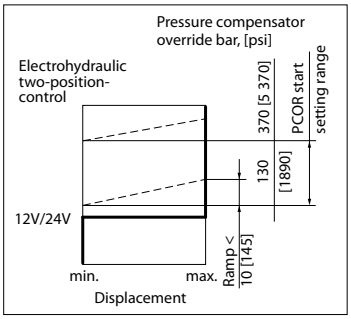
### *Pressure Compensator Override (PCOR)*

The control can be overridden by PCOR using high loop pressure.

When the PCOR activates, the motor displacement increases toward maximum. Pressure ramp from PCOR start pressure (with motor at minimum displacement) until maximum displacement is reached is less than 10 bar [145 psi]. This ensures optimal power utilization throughout the entire displacement range of the motor.

PCOR start pressure is adjustable from 130 to 370 bar [1890 to 5370 psi].

*Control Operation T1**, T2***




### *Pressure Compensator Configuration: T*C0 with Hydraulic Brake Pressure Defeat*

A shuttle valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The shuttle valve must be controlled by a 2-line external signal, based on direction of motor rotation, based on the following table.

| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Control pressure on port | PCOR-Function |
| CW | A | XA | no |
| CW | A | XB | yes |
| CCW | B | XA | yes |
| CCW | B | XB | no |

Differential control pressure between port XA/XB
$\Delta p_{min}$ = 0.5 bar [7 psi]
$\Delta p_{max}$ = 50 bar [725 psi]

Pressure compensator override with brake pressure defeat is mainly used in systems with pumps having electric or hydraulic proportional controls or automotive controls.

| Pressure Compensator Options | | |
|---|---|---|
| Configuration | High pressure at port | PCOR-Funktion |
| T*C2 | A and B | yes |

## Controls circuit diagram – nomenclature – description

### *Pressure Compensator Configuration: T*C2 without Brake Pressure Defeat*

Pressure compensator functions when the motor is running in motor mode as well as in pump (deceleration) mode.

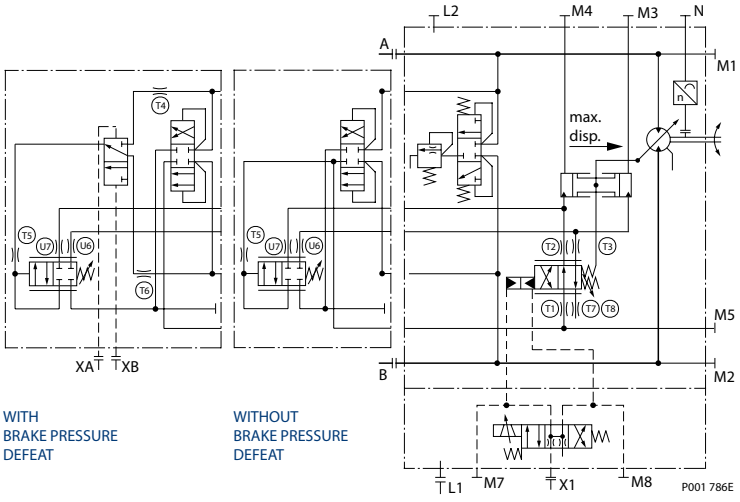
### *Solenoid Connector*


| Solenoid Data | | | |
|---|---|---|---|
| Configuration | Voltage | Electric power | Connector |
| T1C2 | 12 $V_{DC}$ | 34 W | DIN 46350 |
| T2C2 | 24 $V_{DC}$ | | |

Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

### Electrohydraulic Proportional Control – Options EP**, EQ** for 51 Frame Size 060, 080, 110, 160, 250

*Circuit Diagram–Motor with Electrohydraulic Proportional Control EP**, EQ***




Ports:

A, B = Main pressure lines

X1 = Port for control supply

L1, L2 = Drain lines pressure external

M1, M2 = Gauge port for A and B

XA, XB = Control pressure ports, brake pressure defeat

M3, M4 = Gauge port servo pressure

M5 = Gauge port servo supply pressure internal

T1, T2, T3,T4, T5, T6,T7, T8,U6, U7 = Optional orifices

M7, M8 = Gauge port control pressure internal

N = Speed sensor

## Controls circuit diagram – nomenclature – description

### *Electrohydraulic Proportional Control EP**, EQ***

Displacement can be changed under load in response to an electrical signal between maximum displacement and minimum displacement and vice versa.

Control start = maximum displacement

Control end = minimum displacement

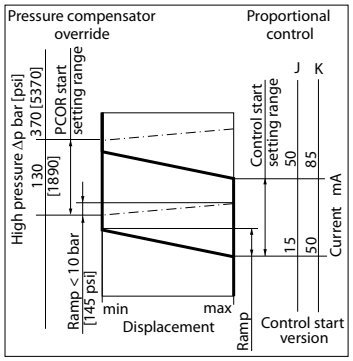
### *Control Supply Pressure (Port X1)*

pmin = 20 bar [290 psi]

pmax allowable = 70 bar [1015 psi]

| Design Options | | |
|---|---|---|
| Control supply | Connector | |
| | Packard | MS |

*Control Operation EP**, EQ***




| Control Setting Options | | | | |
|---|---|---|---|---|
| Type | Start current (adjustable) mA | Ramp (max. to min. displ.) (Full stroke current) mA | Standard setting Control start | Coil wiring |
| JY | 15 to 50 | 70 | 30 = 30 mA | Single coil |
| KY | 50 to 85 | | 70 = 70 mA | |
| JZ | 15 to 50 | 95 | 30 = 30 mA | |
| KZ | 50 to 85 | | 70 = 70 mA | |

Max. current = 250 mA

Coil resistance = 26 Ω

| Wiring (maximum to minimum displacement) | | |
|---|---|---|
| Coil wiring | Positiv voltage on pin | Ground on pin |
| Single coil | B | A |
| Single coil (alt.) | D | C |

### *Connectors*

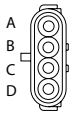
**MS Connector**
**MS3102C-14S-2P**
(Supplied Connector)

Mating Connector
No.: K08106
Id.-No.: 615062

P001 753E

**Packard Weather-Pack**
**4 pin**
(Supplied Connector)

Mating Connector
No.: K03384
Id.-No.: 712208



P001 759E

## Controls circuit diagram – nomenclature – description

### *Pressure Compensator Override (PCOR)*

The control can be overridden by PCOR using high loop pressure.

When the PCOR activates, the motor displacement increases to maximum. Pressure ramp from PCOR start pressure (with motor at minimum displacement) until maximum displacement is reached is less than 10 bar [145 psi] .
This ensures optimal power utilization throughout the entire displacement range of the motor.

PCOR start pressure is adjustable from 130 to 370 bar [1890 to 5370 psi].

| Configuration Options | | |
|---|---|---|
| Configuration | PCOR at port | Brake pressure defead |
| EPA1/EQA1 | A + B | with |
| EPA2/EQA2 | A + B | without |

### *Pressure Compensator Override Configuration: EPA1, EQA1 with Brake Pressure Defeat*

A shuttle valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The shuttle valve must be controlled by a 2-line external signal, based on direction of motor rotation, based on the following table.

Pressure compensator override with brake pressure defeat is mainly used in systems with pumps having electric or hydraulic proportional controls or automotive controls.

| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Control pressure on port | PCOR-Function |
| CW | A | XA | no |
| CW | A | XB | yes |
| CCW | B | XA | yes |
| CCW | B | XB | no |

Differential control pressure between port XA/XB
$\Delta p_{min}$ = 0.5 bar [7 psi]
$\Delta p_{max}$ = 50 bar [725 psi]

### *Pressure Compensator Override Configuration: EPA2, EQA2 without Brake Pressure Defeat*

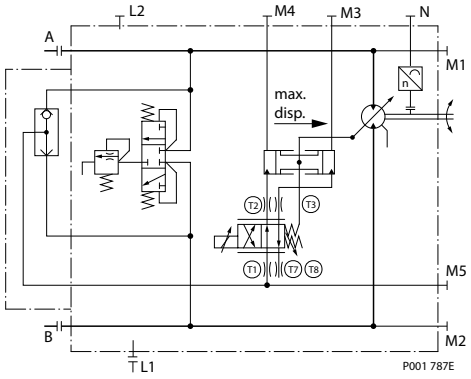
The pressure compensator override functions when the motor is running in motor mode as well as in pump (deceleration) mode.

Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

## Controls circuit diagram – nomenclature – description

### Electrohydraulic Proportional Control – Options L1B1, L2B1, L7B1 for 51 Frame Size 060, 080, 110, 160, 250

*Circuit Diagram–Motor with Electrohydraulic Proportional Control L1B1, L2B1, L7B1*




Ports:

A, B = Main pressure lines

L1, L2 = Drain lines

M1, M2 = Gauge port for A and B

M3, M4 = Gauge port servo pressure

M5 = Gauge port servo supply pressure

T1, T2, T3, T7, T8 = Optional orifices

N = Speed sensor

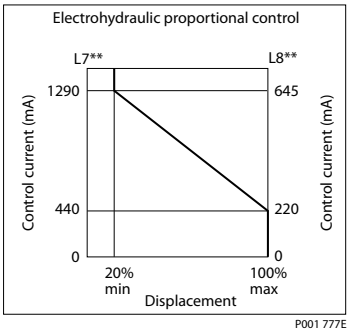
### *Electrohydraulic Proportional Control L1**, L2**, L7***

Displacement can be changed electrohydraulically under load in response to an electrical signal from minimum displacement to maximum displacement and vice versa. The displacement changes proportional to the electrical signal. The electrical signal must be a pulse-width modulated (PWM) signal, (f = 100...200 Hz).

Control start = maximum displacement

Control end = minimum displacement

*Control Operation L1**, L2**, L7***



## Controls circuit diagram – nomenclature – description

### *Solenoid Connectors*

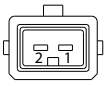
**Magnet-Steckanschluss für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117

P001 752D

**AMP Junior Timer Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388



P001 751E

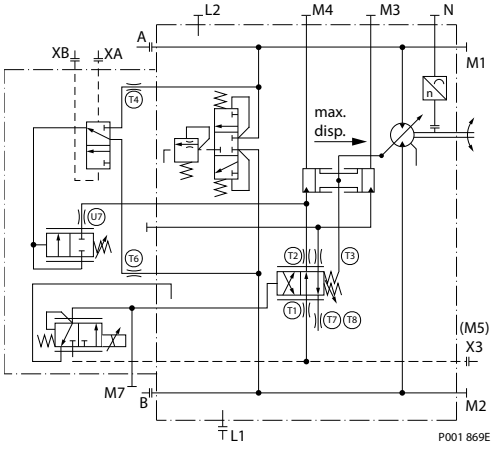
*Solenoid Data*

| Configuration | Voltage | Nominal resistance 20 °C | Control current | | | Connector |
|---|---|---|---|---|---|---|
| | | | Start | End | max. | |
| L1B1 | 12 VDC | 5.7 Ω | 440 mA | 1290 mA | 1500 mA | DIN 46350 |
| L7B1 | | | | | | AMP Junior Timer two pin connector |
| L2B1 | 24 VDC | 21.3 Ω | 220 mA | 645 mA | 750 mA | DIN 46350 |

Not all control options are shown in this Technical Information Contact your Danfoss representative for special control functions.

**Electrohydraulic**
**Proportional Control – Options D7M1, D8M1 for 51 Frame Size 060, 080, 110, 160, 250**

*Circuit Diagram–Motor with Electrohydraulic Proportional Control D7M1, D8M1 with Pressure Compensator (PCOR) and Hydraulic Brake Pressure Defeat*




Ports:

A, B = Main pressure lines

L1, L2 = Drain lines

M1, M2 = Gauge port for A and B

M3, M4 = Gauge port servo pressure

X3 (M5) = Servo pressure supply

M7 = Gauge port control pressure

XA, XB = Control pressure ports hydr. brake pressure defeat

T1, T2, T3, T4, T6, T7, T8, U7 = Optional orifices

N = Speed sensor

## Controls circuit diagram – nomenclature – description

### *Electrohydraulic Proportional Control D7M1, D8M1*

Displacement can be changed electrohydraulically under load in response to an electrical signal from minimum displacement to maximum displacement and vice versa. The displacement changes proportional to the electrical signal. The electrical signal must be a pulse-width modulated (PWM) signal, (f = 100...200 Hz).

Solenoid not energized = maximum

displacement

Solenoid energized = minimum

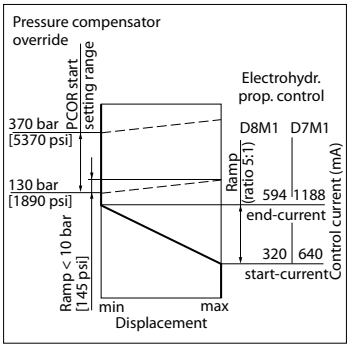
displacement

Servo pressure supply = external pressure at X3

min. pressure = 25 bar [360 psi]

max. pressure = 50 bar [725 psi]

*Control Operation D7M1, D8M1*




### *Pressure Compensator Override (PCOR)*

The control can be overridden by PCOR using high loop pressure.

When the PCOR activates, the motor displacement increases to maximum. Pressure ramp from PCOR start pressure (with motor at minimum displacement) until maximum displacement is reached is less than 10 bar [145 psi]. This ensures optimal power utilization throughout the entire displacement range of the motor.

PCOR start pressure is adjustable from 130 to 370 bar [1890 to 5370 psi].

### *Pressure Compensator Configuration: D7M1, D8M1 with Hydraulic Brake Pressure Defeat*

A shuttle valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The shuttle valve must be controlled by a 2-line external signal, based on direction of motor rotation, based on the following table.

Pressure compensator override with brake pressure defeat is mainly used in systems with pumps having electric or hydraulic proportional controls or automotive controls.

## Controls circuit diagram – nomenclature – description

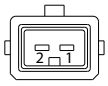
| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Control pressure on port | PCOR-Function |
| CW | A | XA | no |
| CW | A | XB | yes |
| CCW | B | XA | yes |
| CCW | B | XB | no |

Differential control pressure between port XA/XB
$\Delta p_{min}$ = 0.5 bar [7 psi]
$\Delta p_{max}$ = 50 bar [725 psi]

### *Solenoid Connector*

**AMP Junior Timer**
**Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388



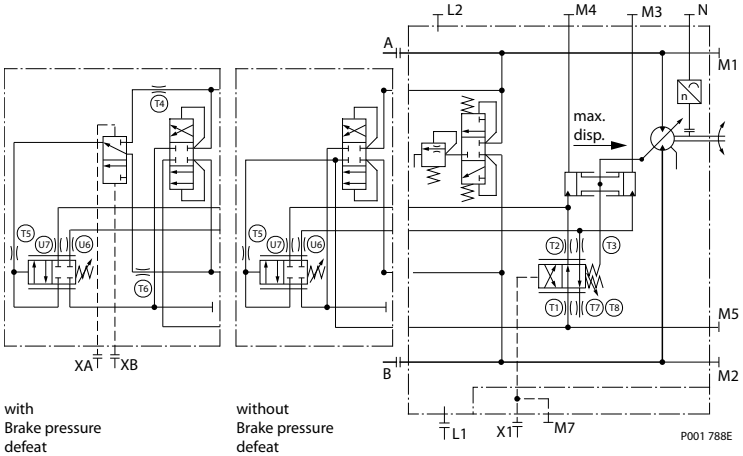
P001 751E

| Solenoid Data | | | | | | |
|---|---|---|---|---|---|---|
| Configuration | Voltage | nominal resistance 20 °C | Control current | | | Connector |
| | | | Start | End | max. | |
| D7M1 | 12 $V_{DC}$ | 5.7 Ω | 640 mA | 1188 mA | 1500 mA | AMP Junior Timer two pin connector |
| D8M1 | 24 $V_{DC}$ | 21.2 Ω | 320 mA | 594 mA | 750 mA | |

Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

### Hydraulic Proportional Control – Options HS** for 51 Frame Size 060, 080, 110, 160, 250

*Circuit Diagram–Motor with Hydraulic Proportional Control HS***



P001 788E

with
Brake pressure
defeat

without
Brake pressure
defeat

Ports:

A, B = Main pressure lines X1 = Control pressure port

L1, L2 = Drain lines XA, XB = Control pressure ports

M1, M2 = Gauge port or A and B brake pressure defeat

M3, M4 = Gauge port servo pressure T1, T2, T3,T4, = Optional orifices

M5 = Gauge port T5, T6, T7, T8,

servo supply pressure internal U6, U7

M7 = Gauge port control pressure N = Speed sensor

## Controls circuit diagram – nomenclature – description

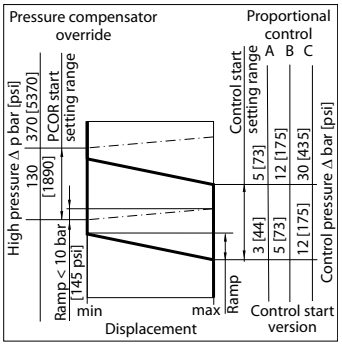
### *Hydraulic Proportional Control HS***

Displacement can be changed in response to a hydraulic signal under load between maximum displacement and minimum displacement and vice versa.

Control start = maximum displacement

Control end = minimum displacement

*Control Operation HS***

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### *Control Pressure (Port X1)*

External = Absolute pressure

### *Maximum allowable Control Pressure (Port X1)*

pmax allowable = Control start pressure

+ 50 bar [725 psi]

| Control Start | |
|---|---|
| Control start range (adjustable) | |
| bar | [psi] |
| 3 to 5 | [44 to 73] |
| 5 to 12 | [73 to 175] |
| 12 to 30 | [175 to 435] |

| Control Ramp | |
|---|---|
| Control ramp range from max. to min. displ. (control pressure rise) | |
| bar | [psi] |
| 7 | [102] |
| 14 | [206] |

### *Pressure Compensator Override (PCOR)*

The control can be overridden by PCOR using high loop pressure.

When the PCOR activates, the motor displacement increases to maximum. Pressure

ramp from PCOR start pressure (with motor at minimum displacement) until maximum displacement is reached is less than 10 bar [145 psi]. This ensures optimal power utilization throughout the entire displacement range of the motor.

PCOR start pressure is adjustable from 130 to 370 bar [1890 to 5370 psi].

## Controls circuit diagram – nomenclature – description

| Configuration Options | | |
|---|---|---|
| Configuration | PCOR at port | Brake pressure defead |
| HSA1 | A + B | with |
| HSA2 | A + B | without |

***Pressure Compensator Override Configuration: HSA1 with Brake Pressure Defeat***

A shuttle valve ahead of the pressure compensator prevents operation in the deceleration direction (when motor is running in pump mode). This is designed to prevent rapid or uncontrolled deceleration while the vehicle/machine is slowing down.

The shuttle valve must be controlled by a 2-line external signal, based on direction of motor rotation, based on the following table.

Pressure compensator override with brake pressure defeat is mainly used in systems with pumps having electric or hydraulic proportional controls or automotive controls.

| Pressure Compensator Operation | | | |
|---|---|---|---|
| Rotation | High pressure port | Control pressure on port | PCOR-Function |
| CW | A | XA | no |
| CW | A | XB | yes |
| CCW | B | XA | yes |
| CCW | B | XB | no |

Differential control pressure between port XA/XB
$\Delta p_{min}$ = 0.5 bar [7 psi]
$\Delta p_{max}$ = 50 bar [725 psi]

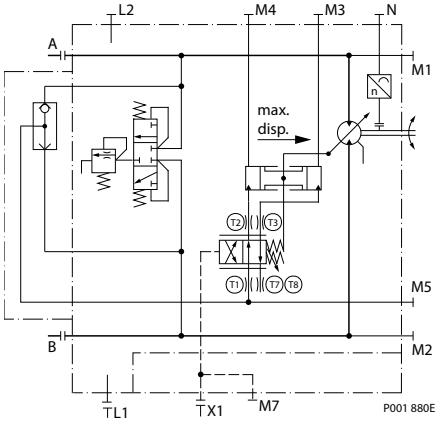
***Pressure Compensator Override Configuration: HSA2 without Brake Pressure Defeat***

The pressure compensator override functions when the motor is running in motor mode as well as in pump (deceleration) mode.

Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

**Hydraulic Proportional Control – Option HZB1 for 51 Frame Size 060, 080, 110, 160, 250**

*Circuit Diagram–Motor with Hydraulic Proportional Control HZB1*




Ports:

A, B = Main pressure lines

L1, L2 = Drain lines

M1, M2 = Gauge port for A and B

M3, M4 = Servo pressure port

## Controls circuit diagram – nomenclature – description

M5 = Gauge port

servo supply pressure internal

M7 = Gauge port control pressure

X1 = Control pressure port

T1, T2, T3, T7, T8 = Optional orifices

N = Speed sensor

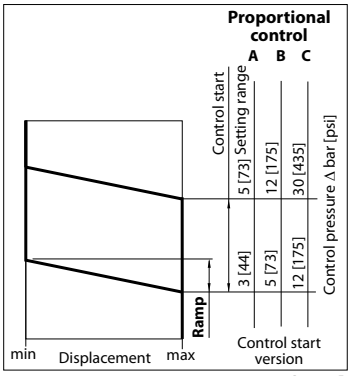
### *Hydraulic Proportional Control HZB1*

Displacement can be changed in response to a hydraulic signal under load between maximum displacement and minimum displacement and vice versa.

Control start = maximum displacement

Control end = minimum displacement

*Control Operation HZB1*




### *Control Pressure (Port X1)*

External = Absolute pressure

### *Maximum allowable Control Pressure (Port X1)*

pmax allowable = Control start pressure

+ 50 bar [725 psi]

| Control Start | |
|---|---|
| Control start range (adjustable) | |
| bar | [psi] |
| 3 to 5 | [44 to 73] |
| 5 to 12 | [73 to 175] |
| 12 to 30 | [175 to 435] |

| Control Ramp | |
|---|---|
| Control ramp range from max. to min. displ. (control pressure rise) | |
| bar | [psi] |
| 7 | [102] |
| 14 | [206] |

Two-position control, option HZB1 see page 29.

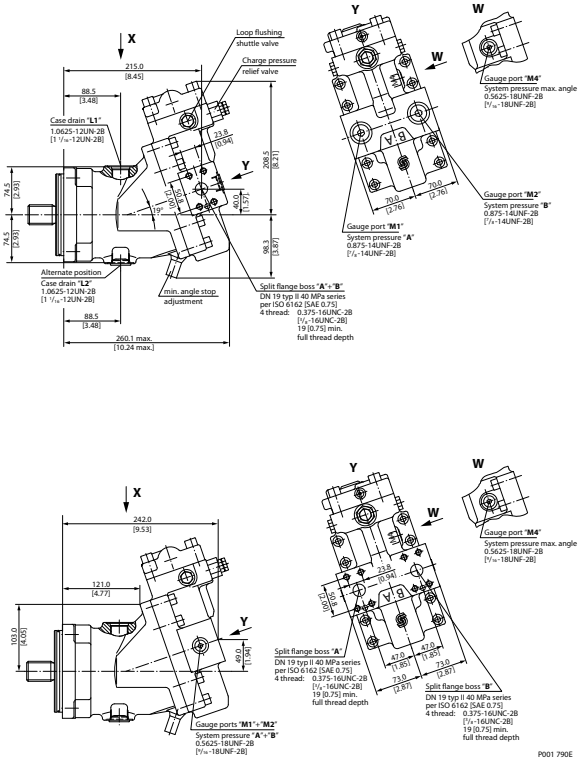
## Controls circuit diagram – nomenclature – description

Not all control options are shown in this Technical Information
Contact your Danfoss representative for special control functions.

## General Dimensions – Frame Size 060

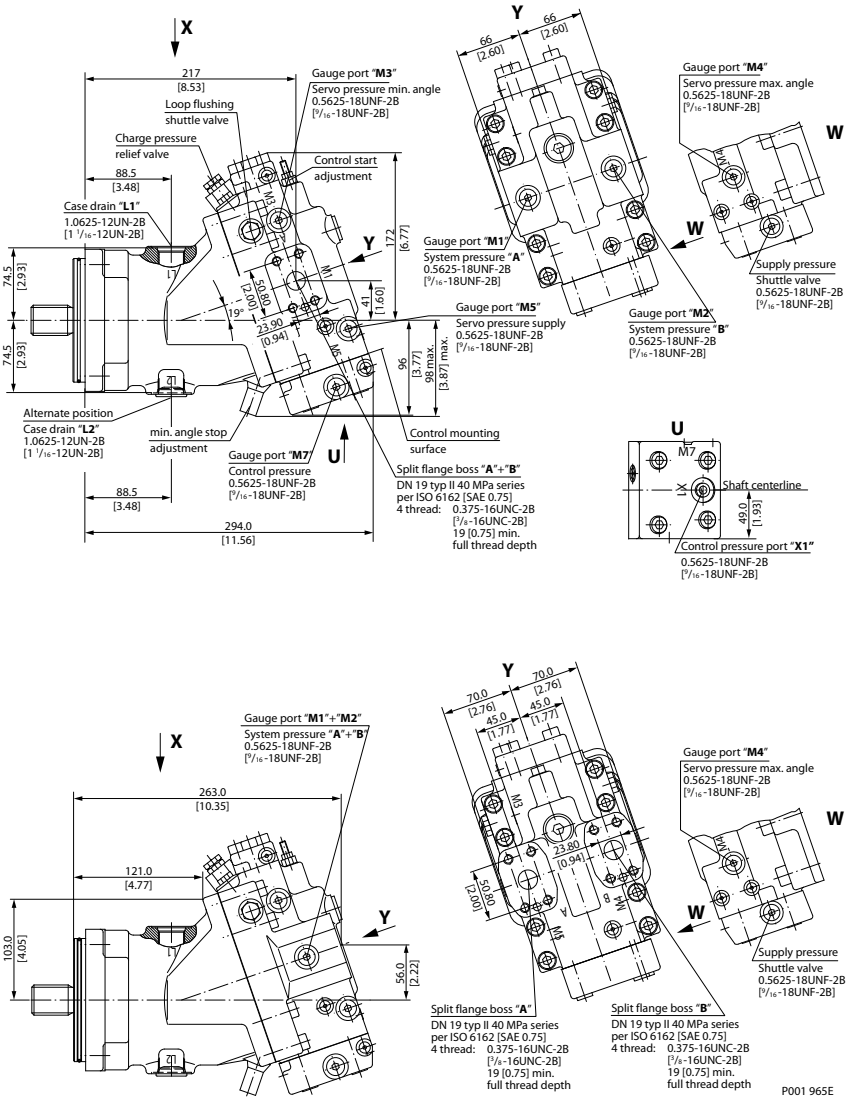
### SAE Flange Design per ISO 3019/1

*51V060-1 Two Position Control, N1NN*



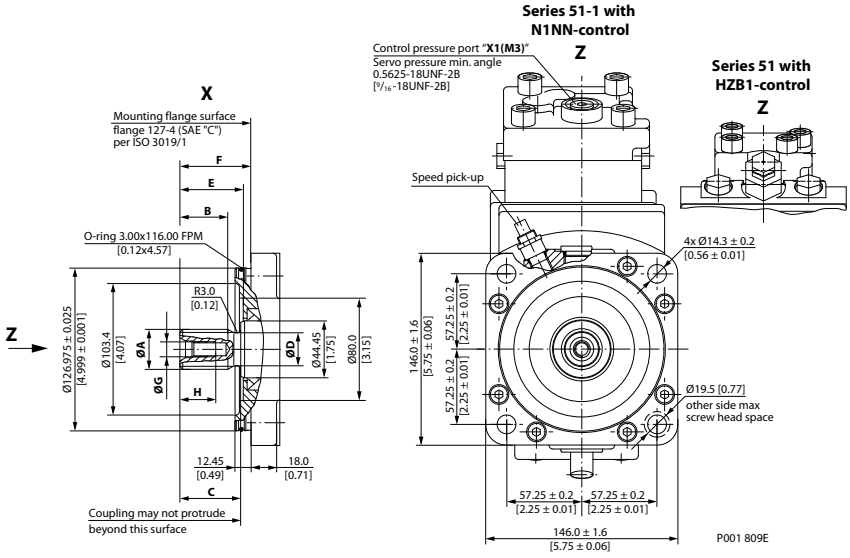
## General Dimensions – Frame Size 060

*51V060 Proportional and Two Position Control, HZB1*



## General Dimensions – Frame Size 060

*Shaft Options – 51V060-1 and 51V060*



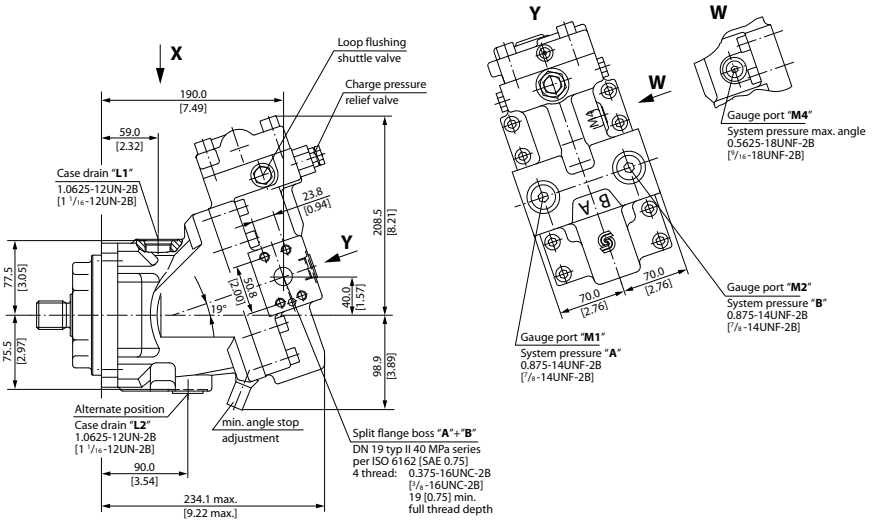

| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | S1 | | C6 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 14 | | 21 | |
| Pitch | 12/24 | | 16/32 | |
| Pressure angle | 30° | | | |
| Spline | ANSI B92.1-1970<br>class 5<br>flat root side fit | | | |
| Pitch dia | 29.633 | [1.167] | 33.337 | [1.312] |
| ∅ A | 31.15 | [1.23] | 34.43 | [1.36] |
| B | 37.50 | [1.48] | 37.50 | [1.48] |
| C | 47.50±0.5 | [1.87] | 47.50±0.5 | [1.87] |
| ∅ D | 25.80 | [1.02] | 30.00 | [1.18] |
| E | 50.30±1.2 | [1.98] | 50.30±1.2 | [1.98] |
| F | 55.50±0.7 | [2.19] | 55.50±0.7 | [2.19] |
| ∅ G | 0.4375-14UNC-2B [7/16-14UNC-2B]<br>allowed torque in thread max. 91 Nm [805 lbf•in] | | | |
| H | 28.00 | [1.10] | 28.00 | [1.10] |

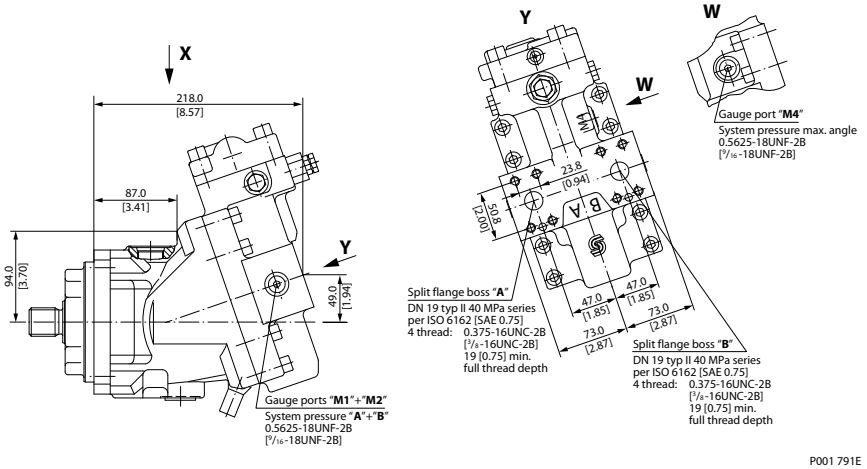
Flow into port A results in CW rotation of output shaft.
Flow into port B results in CCW rotation of output shaft.
Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 060

### DIN Flange Design per ISO 3019/2

*51D060-1 Two Position Control, N1NN*

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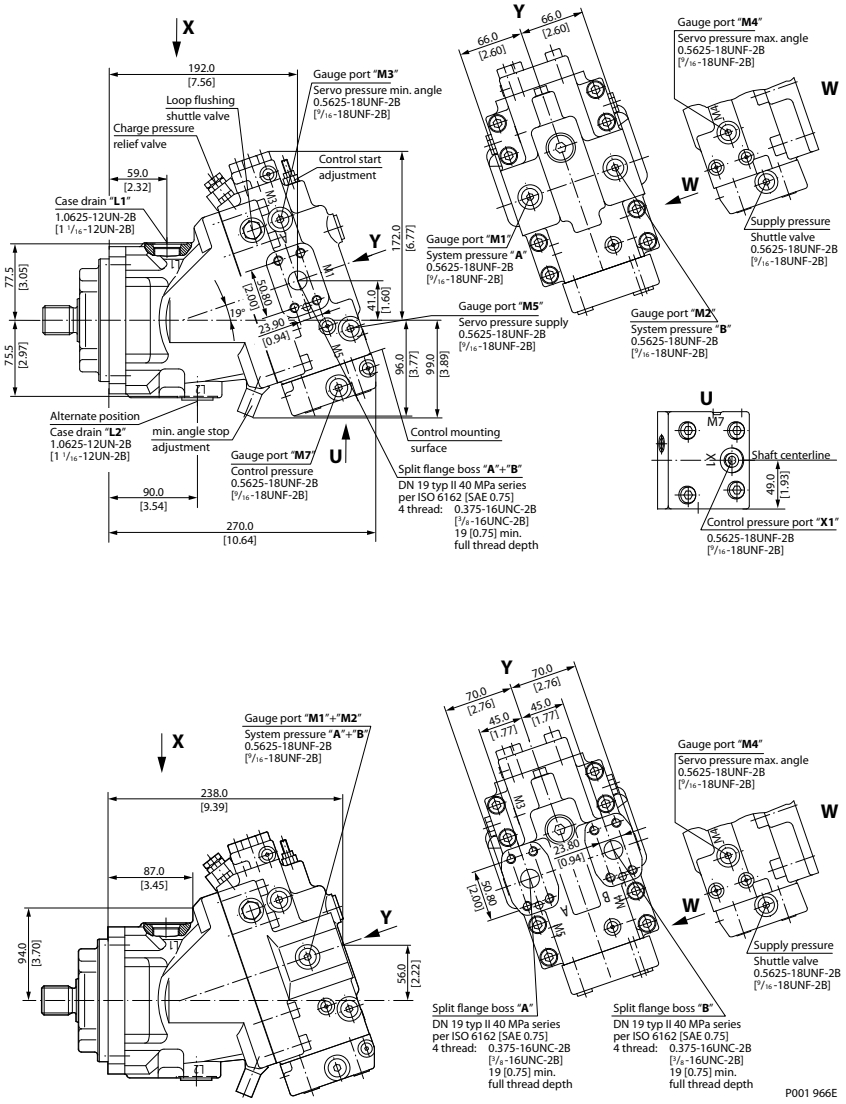
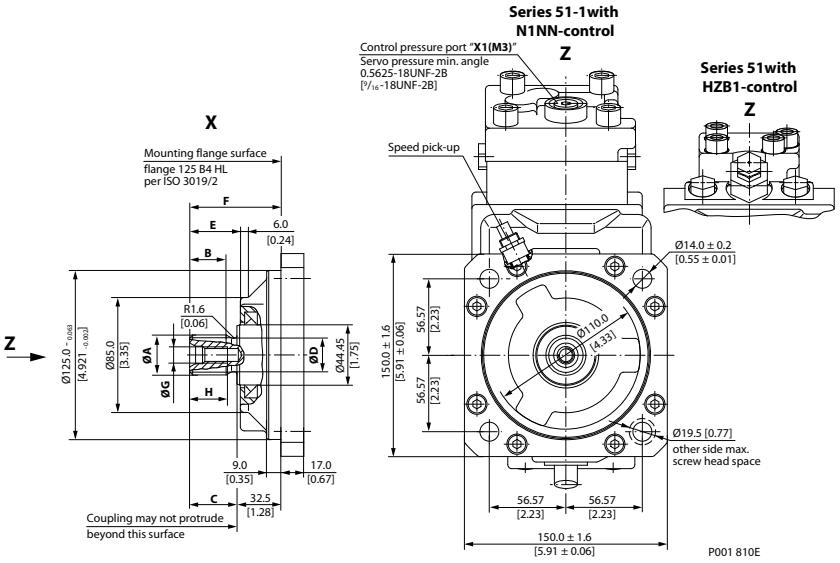
## General Dimensions – Frame Size 060

*51D060 Proportional and Two Position Control, HZB1*



## General Dimensions – Frame Size 060

*Shaft Options – 51D060-1 and 51D060*



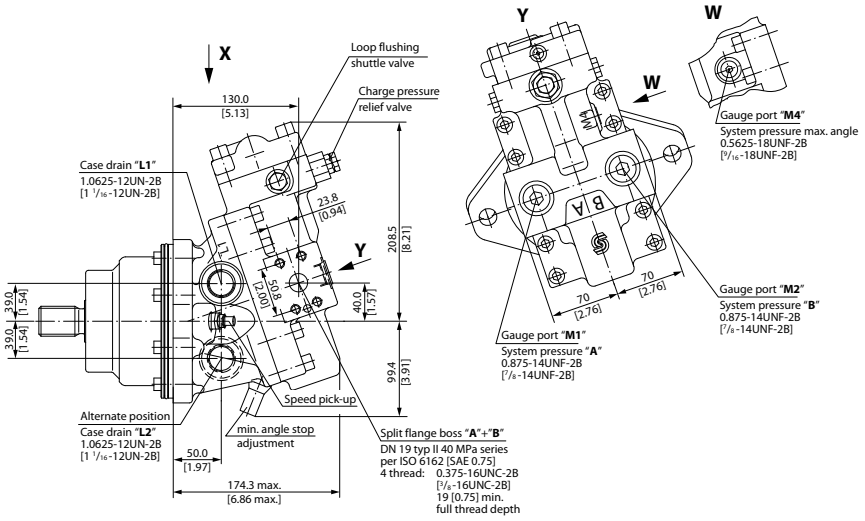

| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | D1 | | D2 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 14 | | 16 | |
| Spline | W30x2x30x14x9g<br>side fit<br>DIN 5480 | | W35x2x30x16x9g<br>side fit<br>DIN 5480 | |
| Pitch dia | 28.000 | [1.102] | 32.000 | [1.260] |
| ∅ A | 29.60 | [1.17] | 34.60 | [1.36] |
| B | 27.00 | [1.06] | 32.00 | [1.28] |
| C | 35.00±0.5 | [1.38] | 40.00±0.5 | [1.58] |
| ∅ D | 25.00 | [0.98] | 30.00 | [1.18] |
| E | 37.50±1.1 | [1.48] | 42.50±1.1 | [1.67] |
| F | 67.50±0.6 | [2.66] | 72.50±0.6 | [2.85] |
| ∅ G | M10x1.5<br>allowed torque in thread max. 67 Nm [593 lbf•in] | | | |
| H | 25.00 | [0.98] | 25.00 | [0.98] |

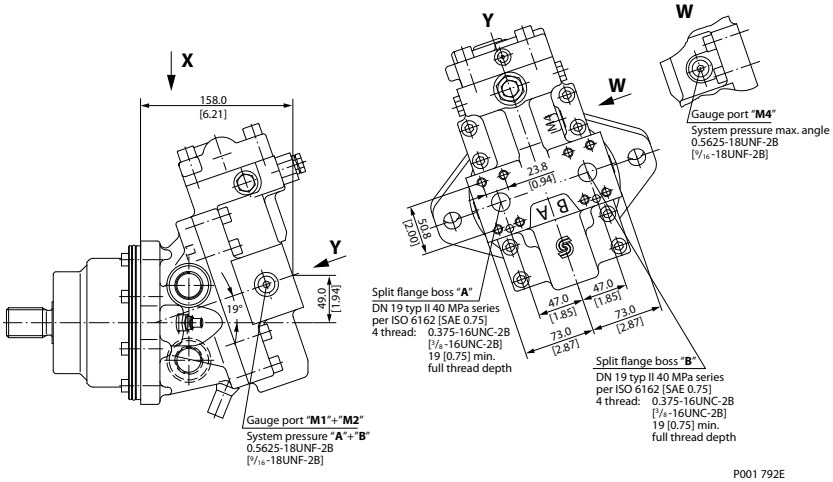
Flow into port A results in CW rotation of output shaft.
Flow into port B results in CCW rotation of output shaft.
Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 060

### Cartridge Flange

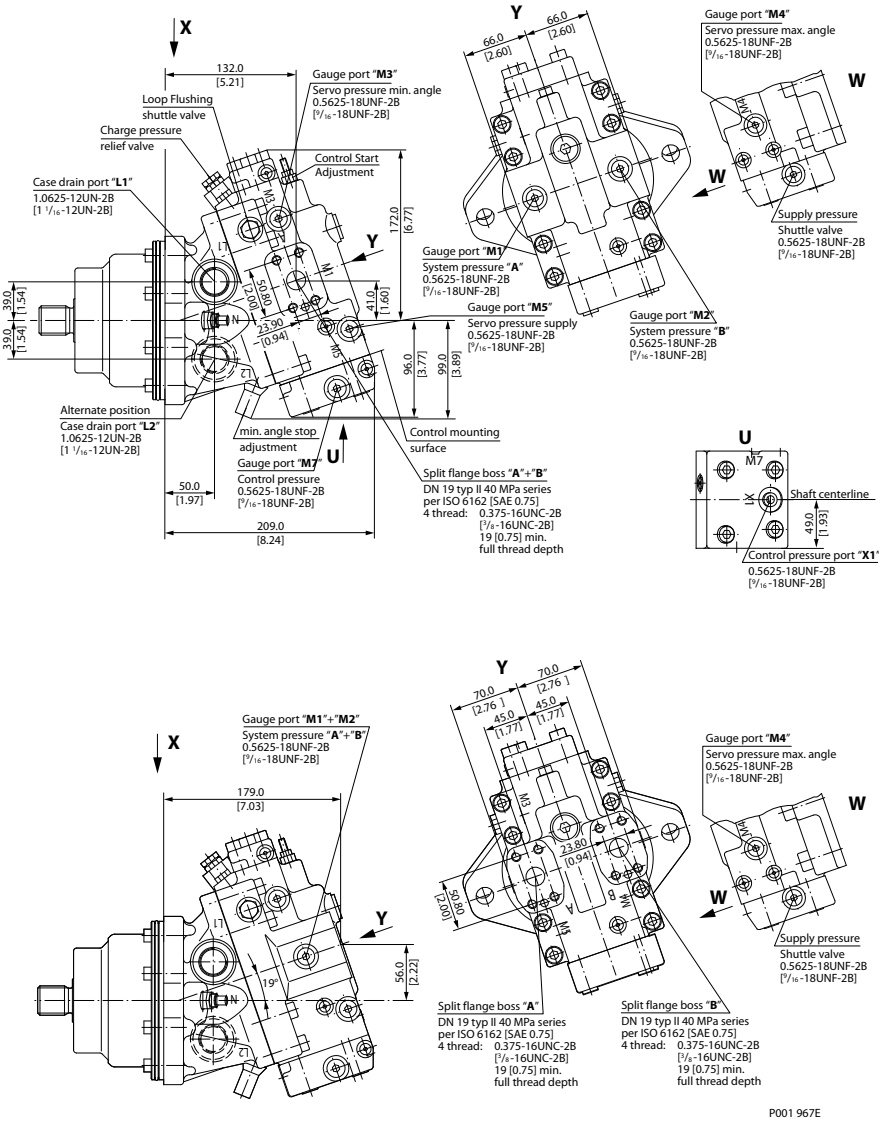
*51C060-1 Two Position Control, N1NN*



## General Dimensions – Frame Size 060

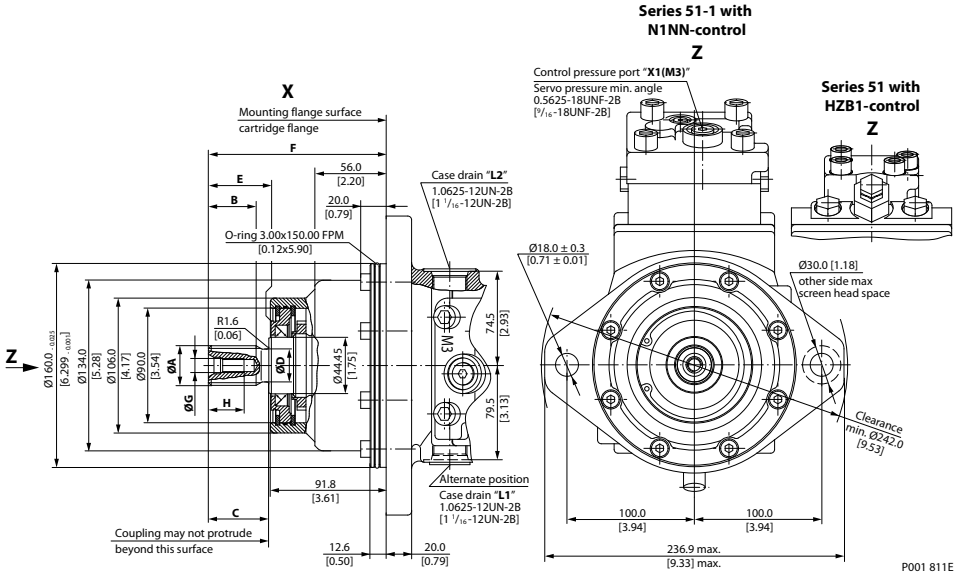
*51C060 Proportional and Two Position Control, HZB1*




P001 967E

## General Dimensions – Frame Size 060

*Shaft Options – 51C060-1 and 51C060*



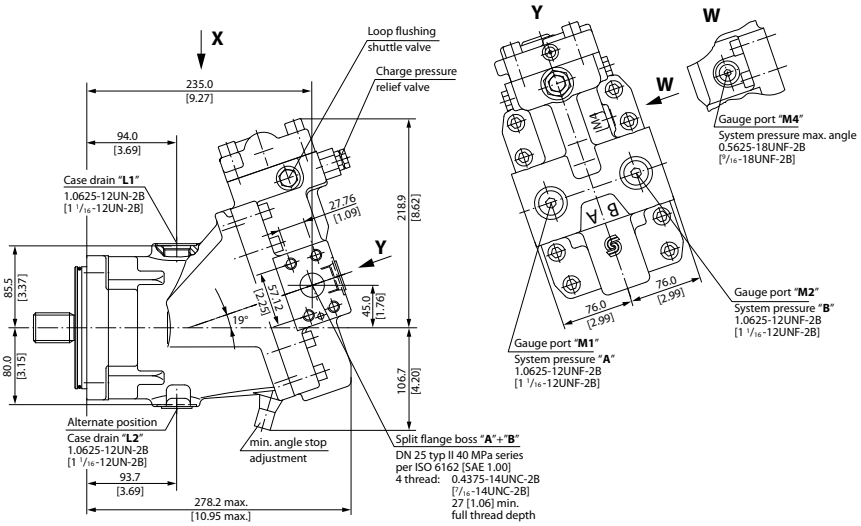

| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | D1 | | D2 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 14 | | 16 | |
| Spline | W30x2x30x14x9g<br>side fit<br>DIN 5480 | | W35x2x30x16x9g<br>side fit<br>DIN 5480 | |
| Pitch dia | 28.000 | [1.102] | 32.000 | [1.260] |
| ∅ A | 29.60 | [1.17] | 34.60 | [1.36] |
| B | 27.00 | [1.06] | 32.00 | [1.28] |
| C | 35.00±0.5 | [1.38] | 40.00±0.5 | [1.58] |
| ∅ D | 25.00 | [0.98] | 30.00 | [1.18] |
| E | 36.80±1.4 | [1.45] | 41.80±1.4 | [1.65] |
| F | 127.20±0.6 | [5.00] | 132.20±0.6 | [5.21] |
| ∅ G | M10x1.5<br>allowed torque in thread max. 67 Nm [593 lbf•in] | | | |
| H | 25.00 | [0.98] | 25.00 | [0.98] |

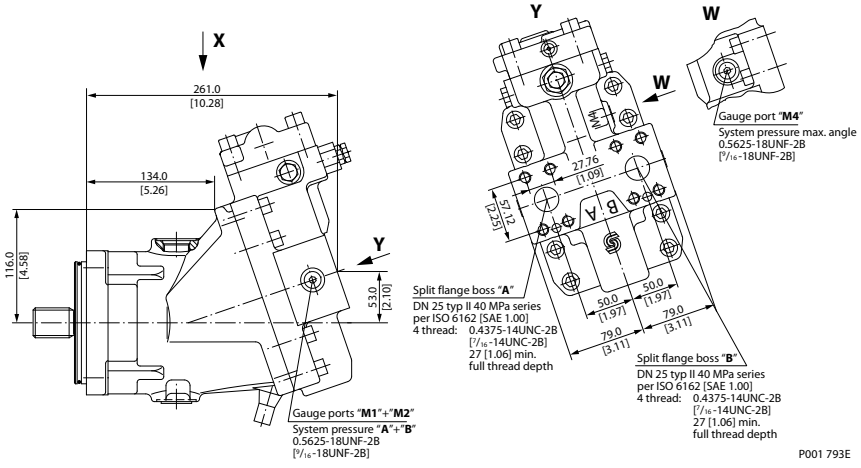
Flow into port A results in CW rotation of output shaft.
Flow into port B results in CCW rotation of output shaft.
Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 080

### SAE Flange Design per ISO 3019/1

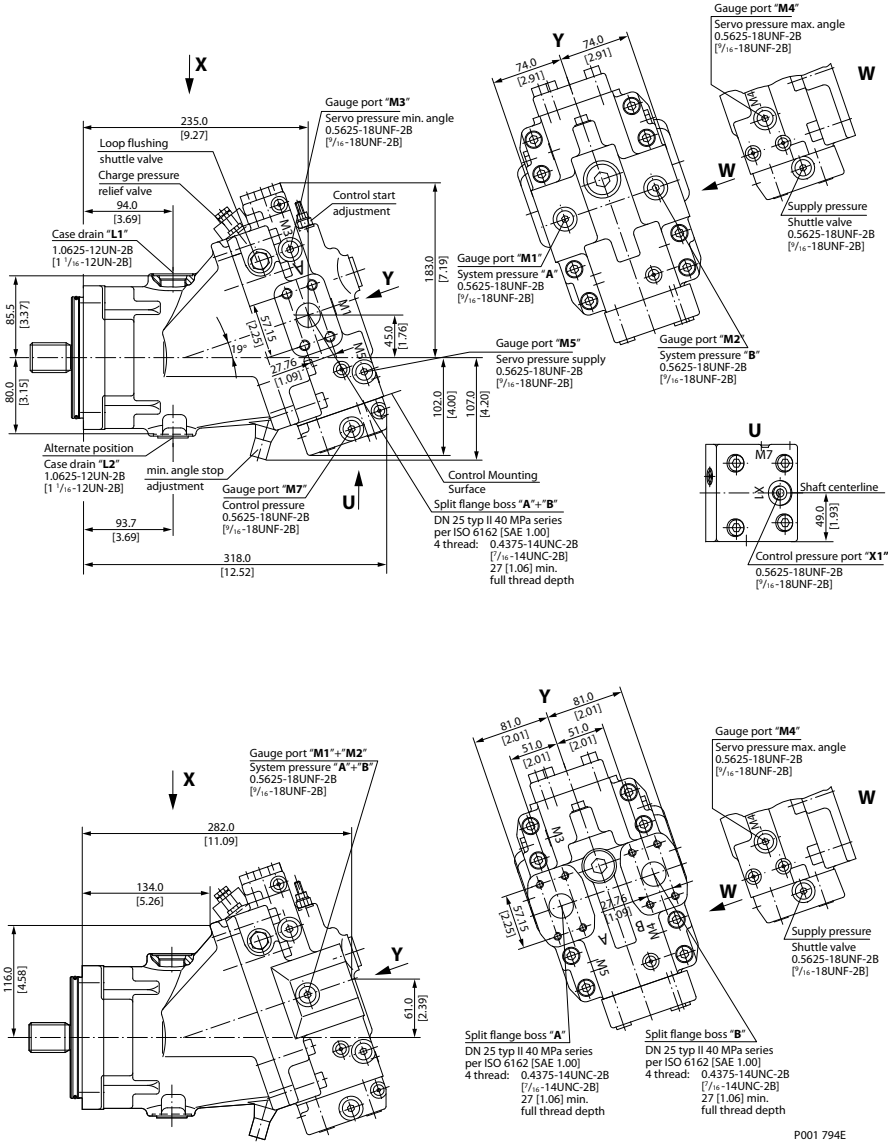
*51V080-1 Two Position Control, N1NN*



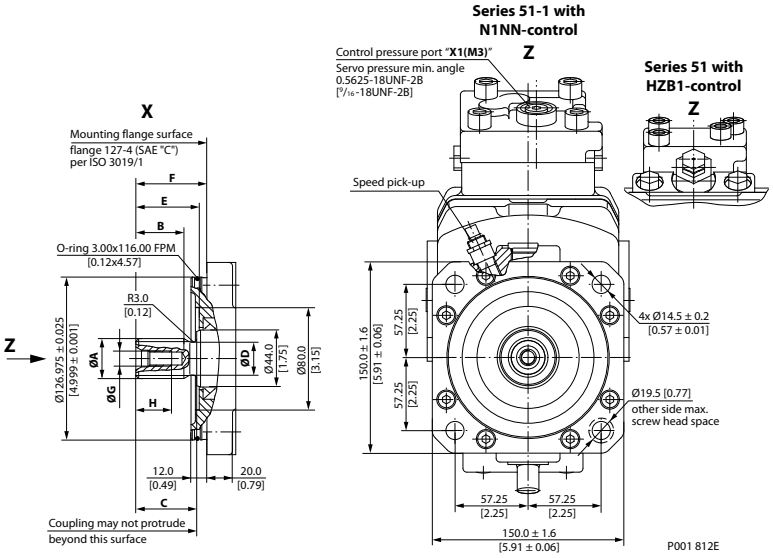
## General Dimensions – Frame Size 080

*51V080 Proportional and Two-Position Control, HZB1*



## General Dimensions – Frame Size 080

*Shaft Options – 51V080-1 and 51V080*



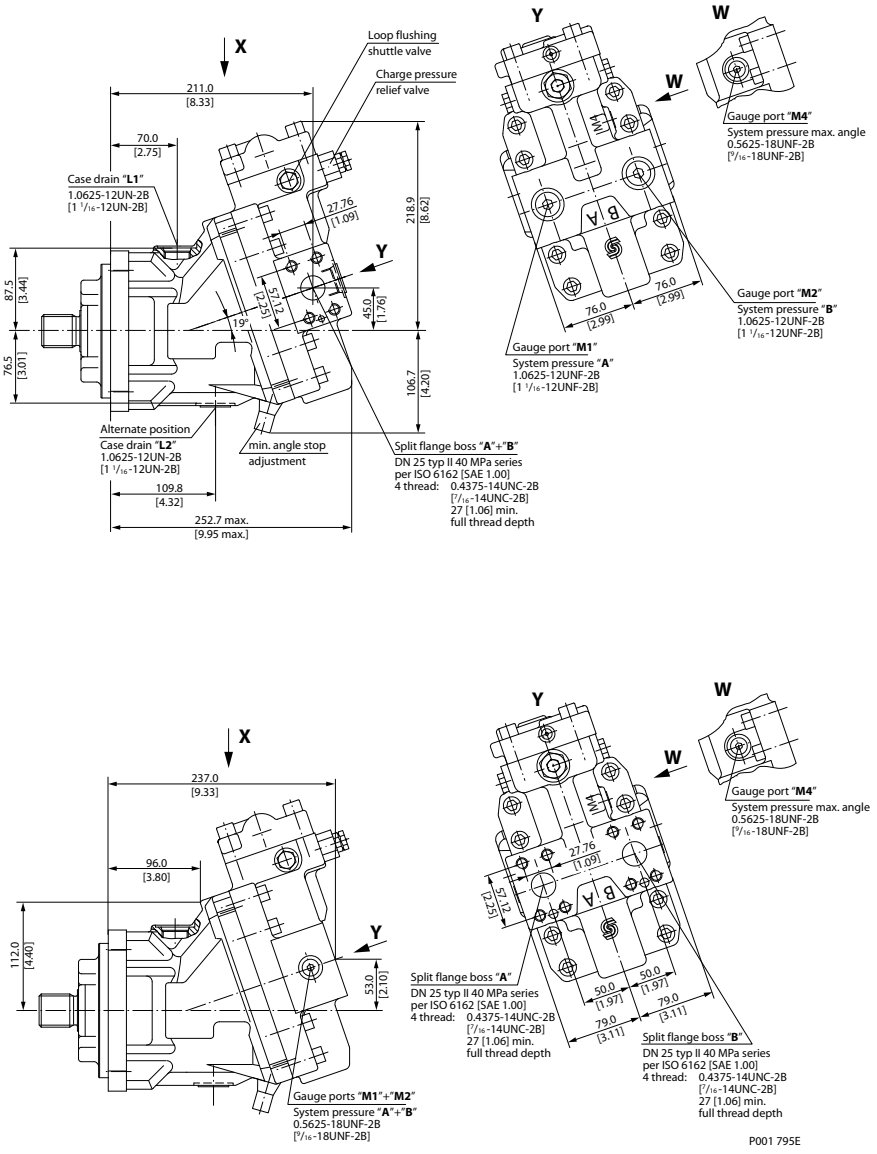

| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | S1 | | C7 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 14 | | 23 | |
| Pitch | 12/24 | | 16/32 | |
| Pressure angle | 30° | | | |
| Spline | ANSI B92.1-1970<br>class 5<br>flat root side fit | | | |
| Pitch dia | 29.633 | [1.167] | 36.513 | [1.438] |
| ∅ A | 31.15 | [1.23] | 37.61 | [1.48] |
| B | 37.50 | [1.48] | 37.50 | [1.48] |
| C | 47.50±0.5 | [1.87] | 47.50±0.5 | [1.87] |
| ∅ D | 25.80 | [1.02] | 32.00 | [1.26] |
| E | 49.50±1.1 | [1.95] | 49.50±1.1 | [1.95] |
| F | 55.50±0.7 | [2.19] | 55.50±0.7 | [2.19] |
| ∅ G | 0.4375-14UNC-2B [7/16-14UNC-2B]<br>allowed torque in thread max. 91 Nm [805 lbf•in] | | | |
| H | 28.00 | [1.10] | 28.00 | [1.10] |

Flow into port A results in CW rotation of output shaft.
Flow into port B results in CCW rotation of output shaft.
Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 080

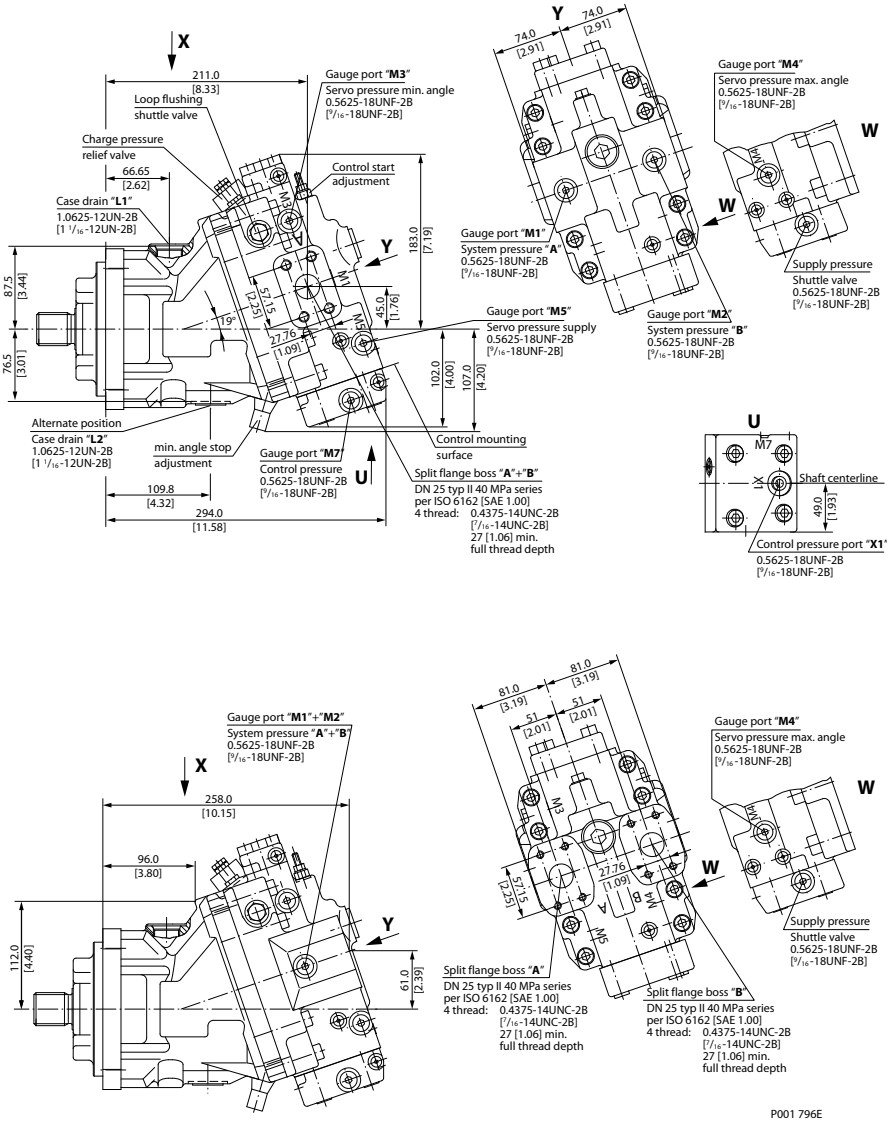
### DIN Flange Design per ISO 3019/2

*51D080-1 Two Position Control, N1NN*



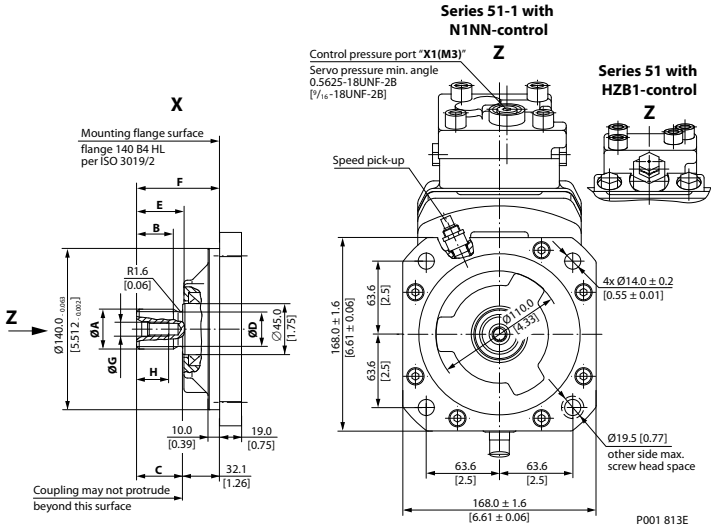
## General Dimensions – Frame Size 080

*51D080 Proportional and Two-Position Control, HZB1*



## General Dimensions – Frame Size 080

*Shaft Options – 51D080-1 and 51D080*



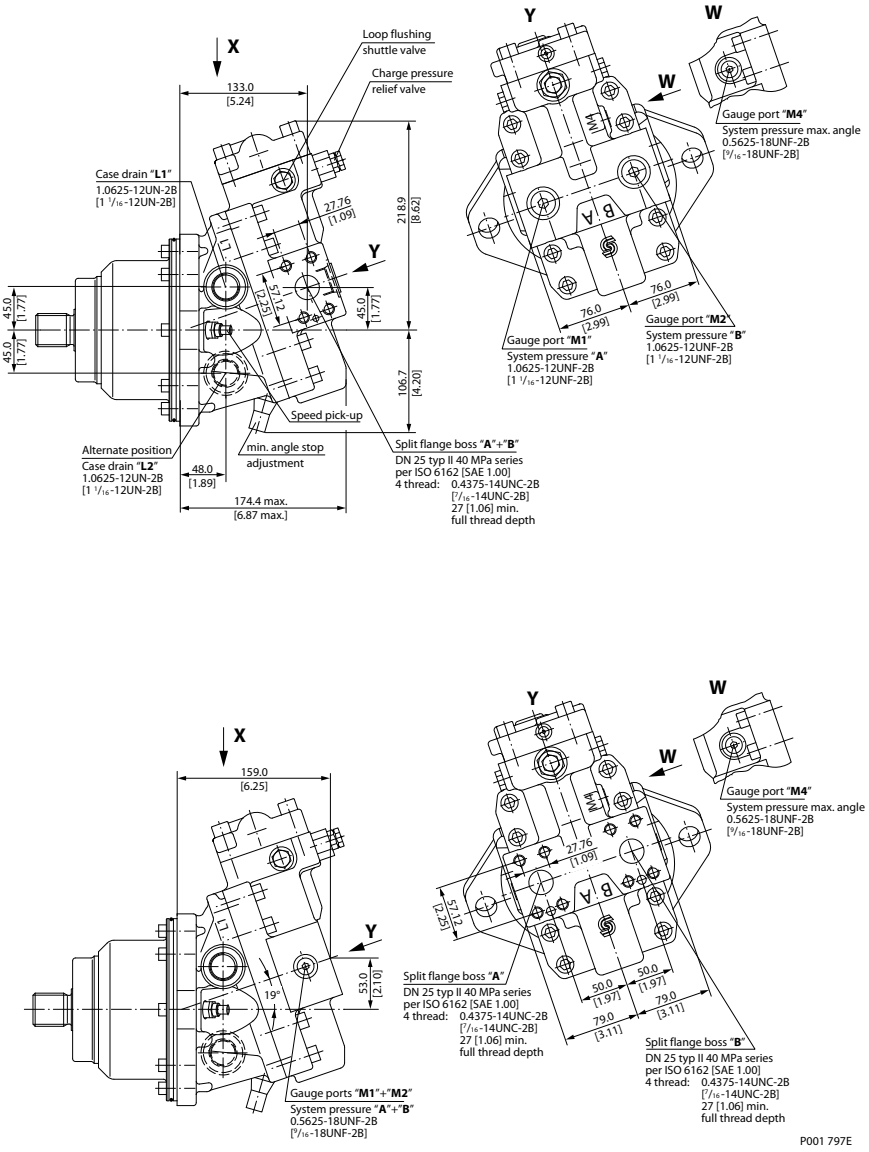

| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | D2 | | D3 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 16 | | 18 | |
| Spline | W35x2x30x16x9g<br>side fit<br>DIN 5480 | | W40x2x30x18x9g<br>side fit<br>DIN 5480 | |
| Pitch dia | 32.000 | [1.260] | 36.000 | [1.417] |
| ∅ A | 34.60 | [1.36] | 39.60 | [1.56] |
| B | 32.00 | [1.28] | 37.00 | [1.46] |
| C | 40.00±0.5 | [1.58] | 45.00±0.5 | [1.77] |
| ∅ D | 30.00 | [1.18] | 35.00 | [1.38] |
| E | 41.10±1.1 | [1.62] | 45.10±1.1 | [1.82] |
| F | 72.10±0.6 | [2.84] | 77.10±0.6 | [3.04] |
| ∅ G | M10x1.5<br>allowed torque in thread max. 67 Nm [593 lbf•in] | | | |
| H | 25.00 | [0.98] | 25.00 | [0.98] |

Flow into port A results in CW rotation of output shaft.
Flow into port B results in CCW rotation of output shaft.
Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 080

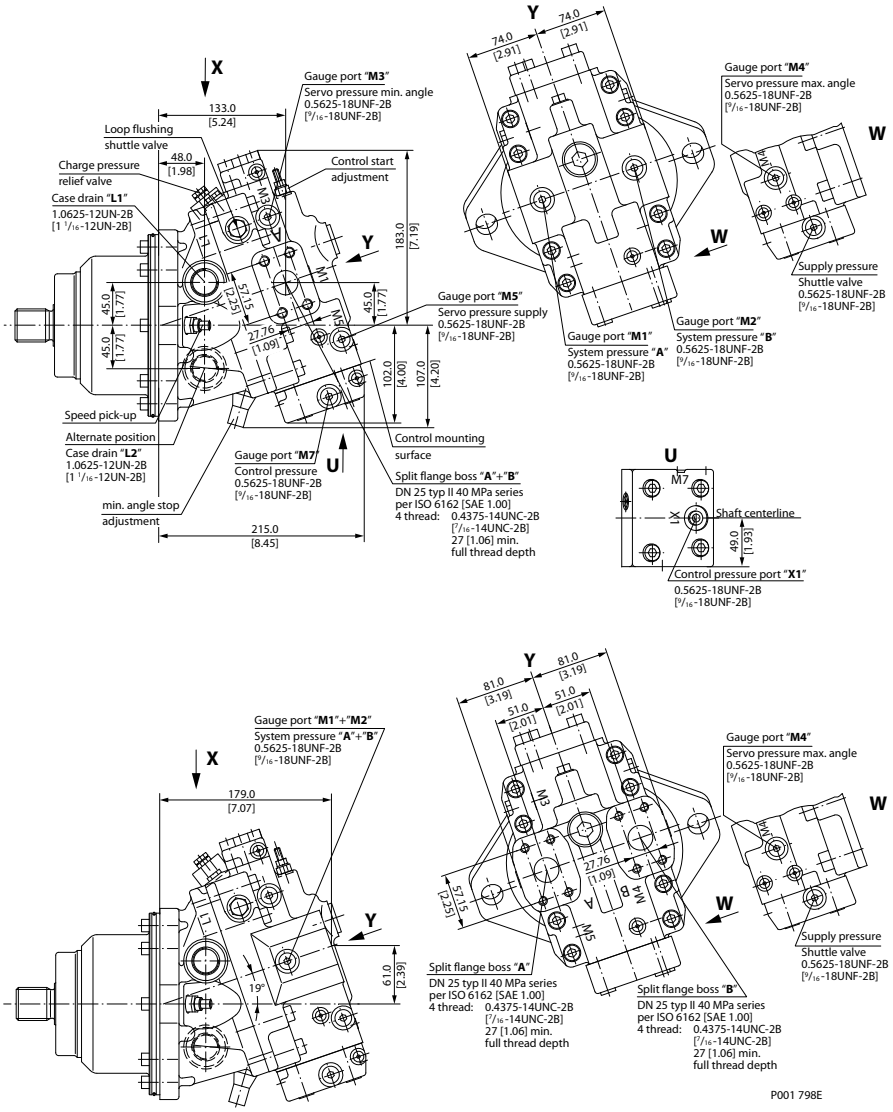
### Cartridge Flange

*51C080-1 Two Position Control, N1NN*



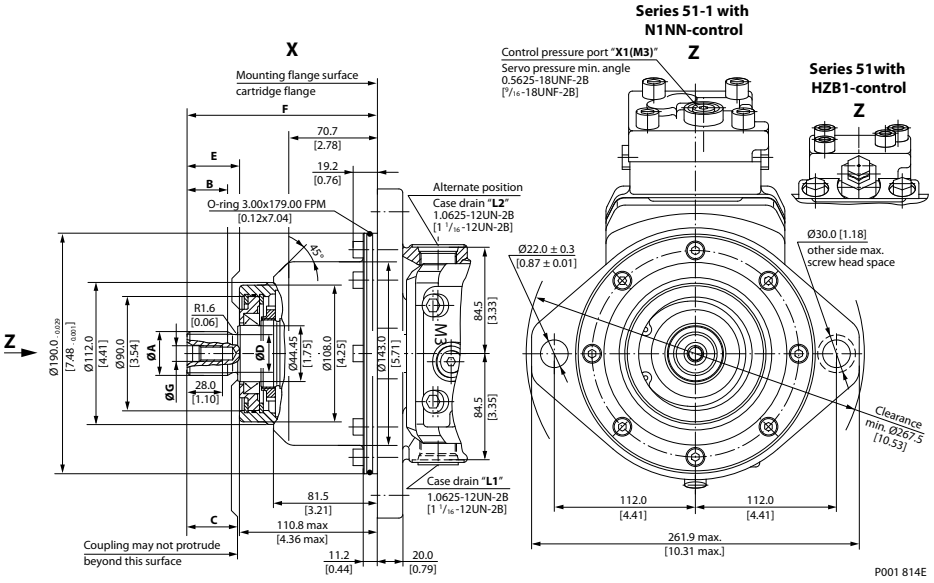
## General Dimensions – Frame Size 080

*51C080 Proportional and Two-Position Control, HZB1*



## General Dimensions – Frame Size 080

*Shaft Options – 51C080-1 and 51C080*



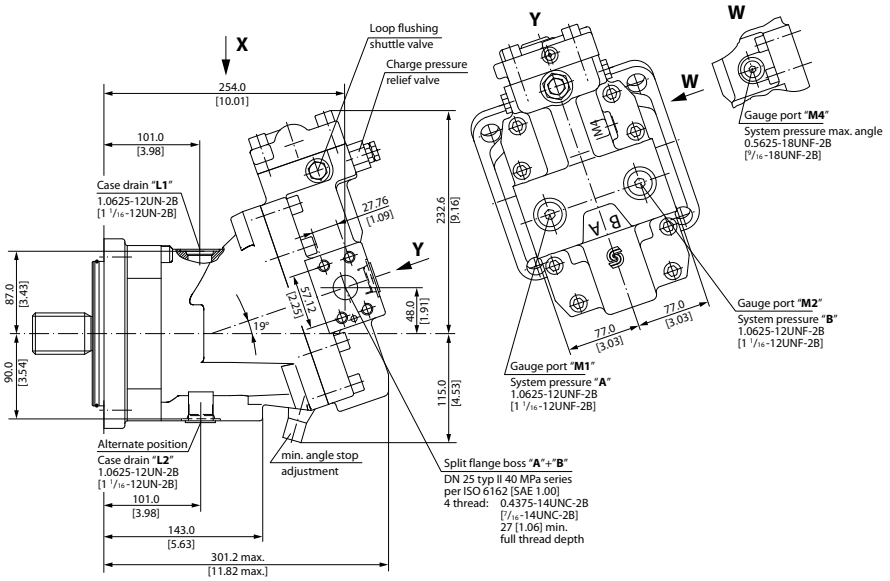

| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | D2 | | D3 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 16 | | 18 | |
| Spline | W35x2x30x16x9g<br>side fit<br>DIN 5480 | | W40x2x30x18x9g<br>side fit<br>DIN 5480 | |
| Pitch dia | 32.000 | [1.260] | 36.000 | [1.417] |
| ∅ A | 34.60 | [1.36] | 39.60 | [1.56] |
| B | 32.00 | [1.28] | 37.00 | [1.46] |
| C | 40.00±0.5 | [1.58] | 45.00±0.5 | [1.77] |
| ∅ D | 30.00 | [1.18] | 35.00 | [1.38] |
| E | 41.55±1.4 | [1.64] | 46.55±1.4 | [1.83] |
| F | 150.40±0.6 | [5.92] | 155.40±0.6 | [6.12] |
| ∅ G | M10x1.5<br>allowed torque in thread max. 67 Nm [593 lbf•in] | | | |
| H | 25.00 | [0.98] | 25.00 | [0.98] |

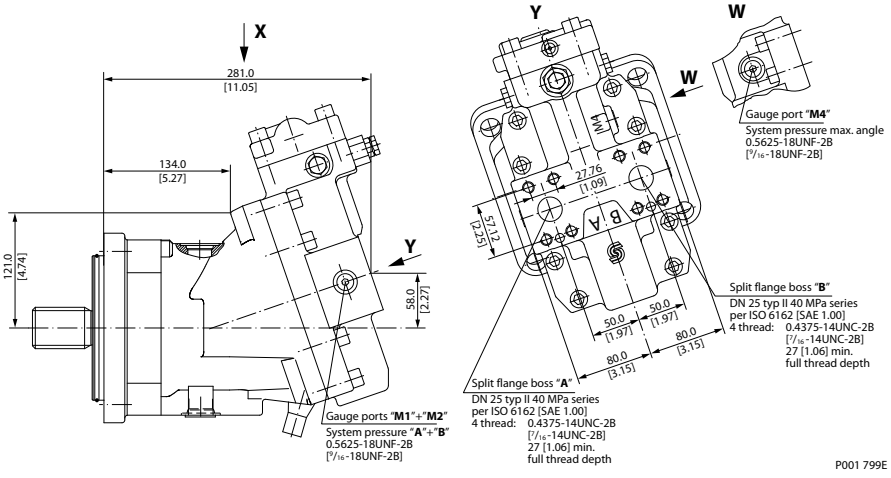
Flow into port A results in CW rotation of output shaft.
Flow into port B results in CCW rotation of output shaft.
Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 110

### SAE Flange Design per ISO 3019/1

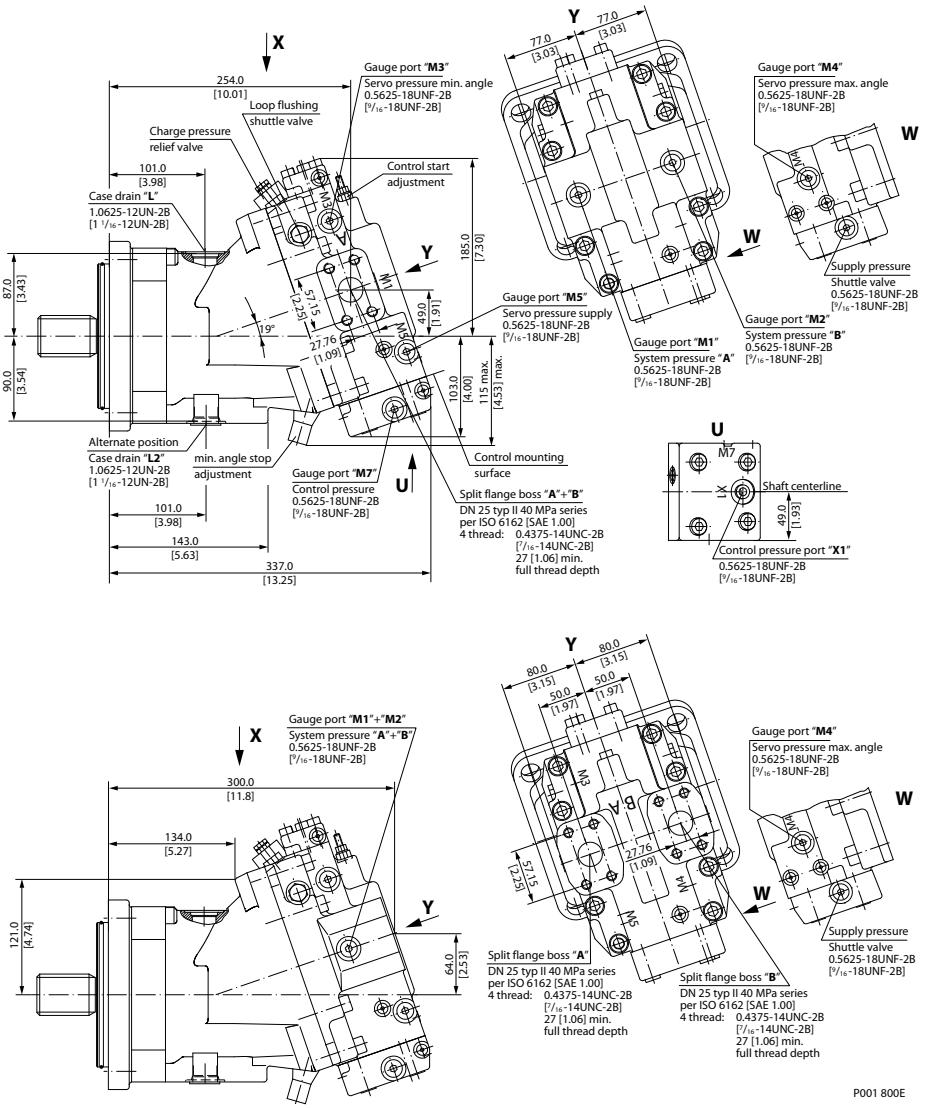
*51V110-1 Two Position Control, N1NN*



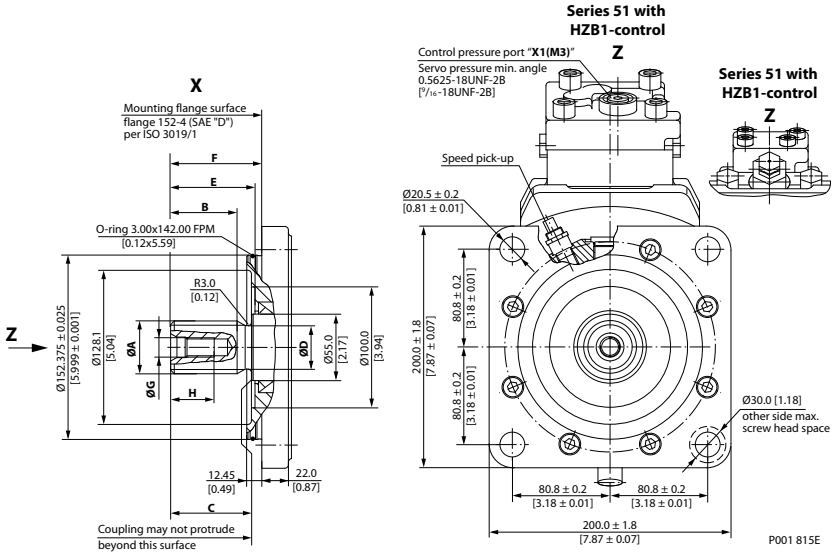
## General Dimensions – Frame Size 110

*51V110 Proportional and Two-Position Control, HZB1*



## General Dimensions – Frame Size 110

*Shaft Options – 51V110-1 and 51V110*




| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | F1 | | C8 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 13 | | 27 | |
| Pitch | 8/16 | | 16/32 | |
| Pressure angle | 30° | | | |
| Spline | ANSI B92.1-1970<br>class 5<br>flat root side fit | | | |
| Pitch dia | 41.275 | [1.625] | 42.862 | [1.688] |
| ∅ A | 43.64 | [1.72] | 43.96 | [1.73] |
| B | 55.00 | [2.17] | 55.00 | [2.17] |
| C | 67.00±0.5 | [2.64] | 67.00±0.5 | [2.64] |
| ∅ D | 36.00 | [1.42] | 39.60 | [1.56] |
| E | 69.80±1.1 | [2.75] | 69.80±1.1 | [2.75] |
| F | 75.40±0.7 | [2.97] | 75.40±0.7 | [2.97] |
| ∅ G | 0.625-11UNC-2B [5/8-11UNC-2B]<br>allowed torque in thread max. 200 Nm [1770 lbf•in] | | | |
| H | 36.00 | [1.42] | 36.00 | [1.42] |

Flow into port A results in CW rotation of output shaft.

Flow into port B results in CCW rotation of output shaft.

Shaft rotation is determined by viewing from shaft end.

Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.

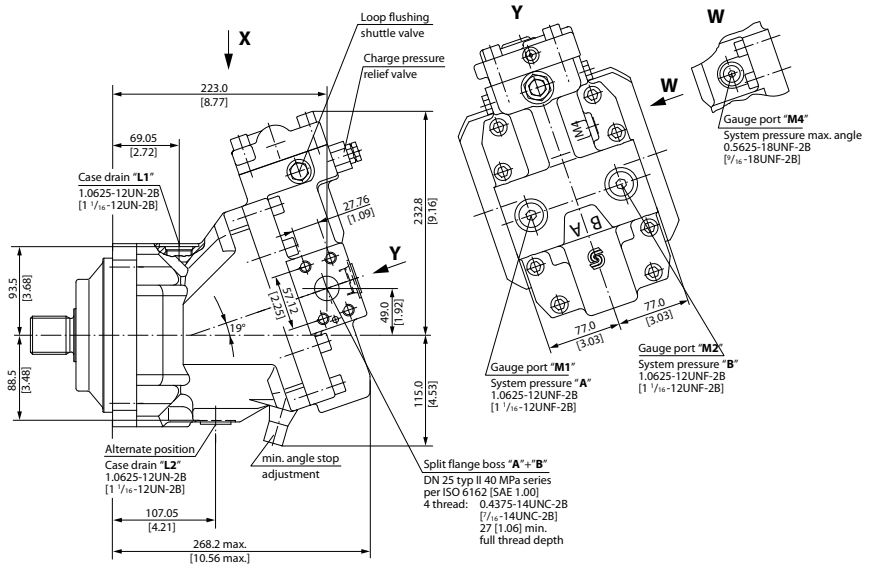
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).

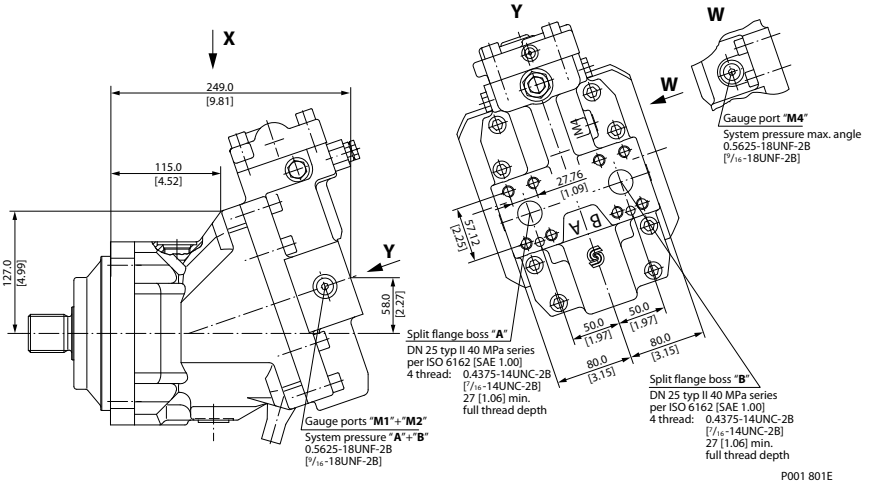
Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 110

### DIN Flange Design per ISO 3019/2

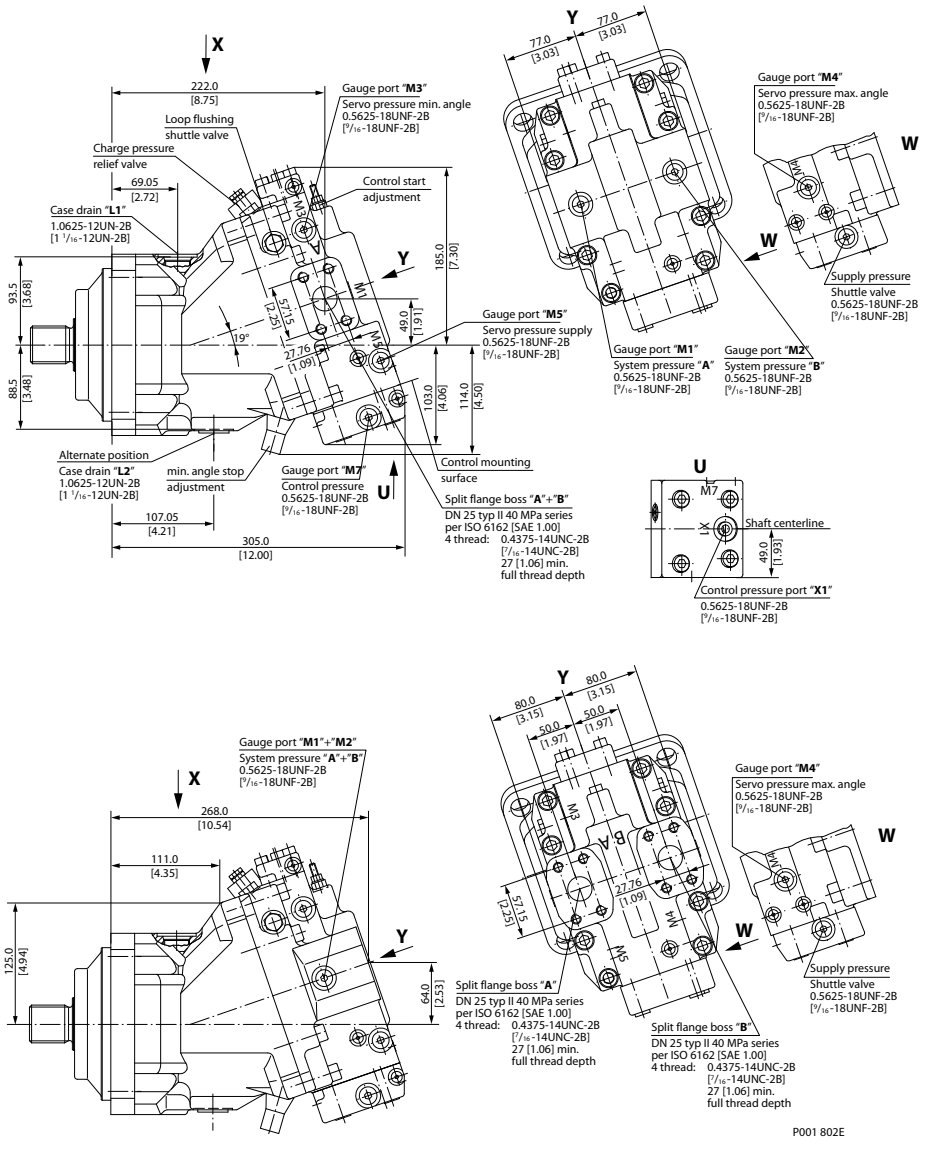
*51D110-1 Two Position Control, N1NN*



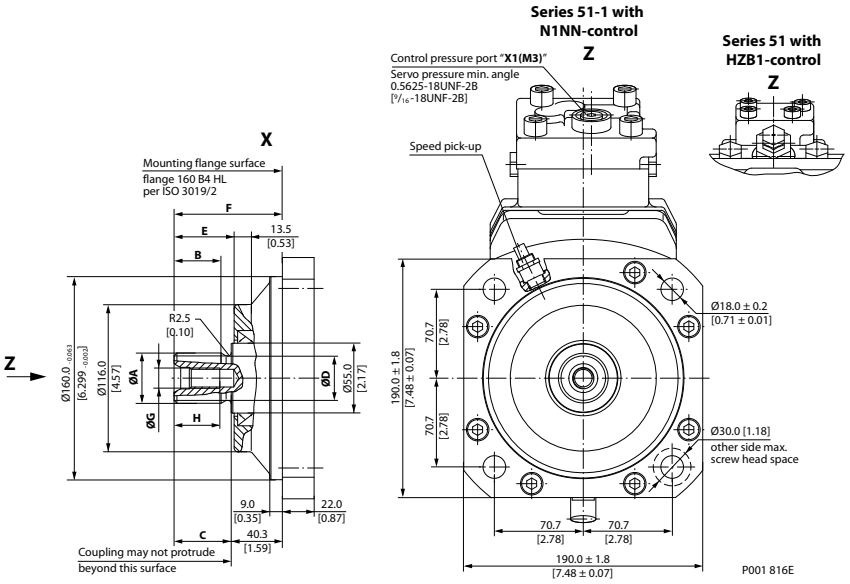
## General Dimensions – Frame Size 110

*51D110 Proportional and Two-Position Control, HZB1*



## General Dimensions – Frame Size 110

*Shaft Options – 51D110-1 and 51D110*



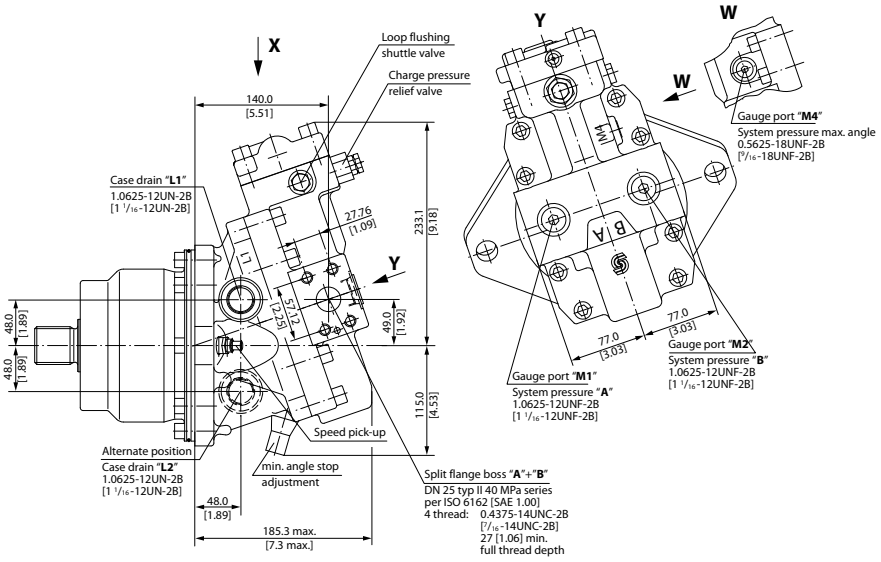

| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | D3 | | D4 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 18 | | 21 | |
| Spline | W40x2x30x18x9g<br>side fit<br>DIN 5480 | | W45x2x30x21x9g<br>side fit<br>DIN 5480 | |
| Pitch dia | 36.000 | [1.417] | 42.000 | [1.654] |
| ∅ A | 39.60 | [1.56] | 44.60 | [1.76] |
| B | 37.00 | [1.46] | 42.00 | [1.65] |
| C | 45.00±0.5 | [1.77] | 50.00±0.5 | [1.97] |
| ∅ D | 35.00 | [1.38] | 40.00 | [1.57] |
| E | 47.30±1.1 | [1.86] | 52.30±1.1 | [2.06] |
| F | 85.30±0.6 | [3.36] | 90.30±0.6 | [3.56] |
| ∅ G | M12x1.75<br>allowed torque in thread max. 115 Nm [1018 lbf•in] | | | |
| H | 30.00 | [1.18] | 30.00 | [1.18] |

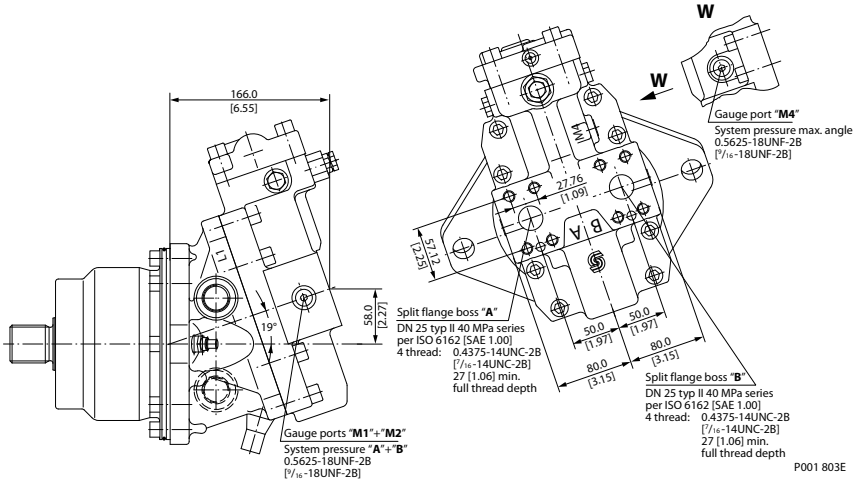
Flow into port A results in CW rotation of output shaft.
Flow into port B results in CCW rotation of output shaft.
Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 110

### Cartridge Flange

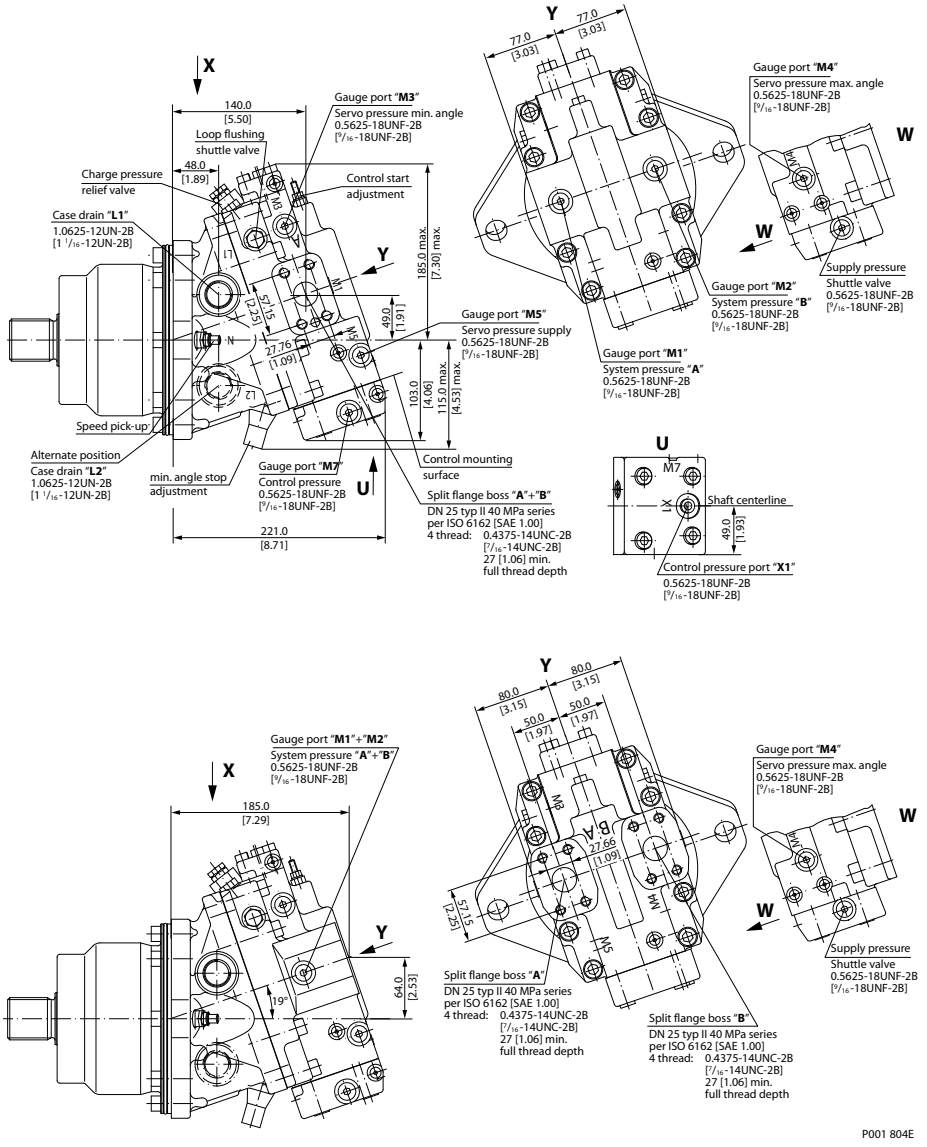
*51C110-1 Two Position Control, N1NN*



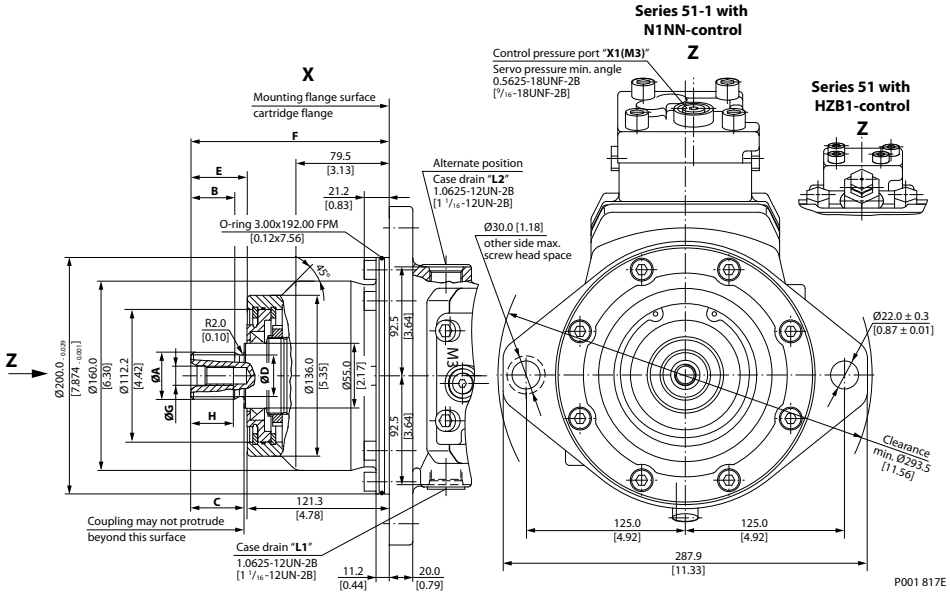
## General Dimensions – Frame Size 110

*51C110 Proportional and Two-Position Control, HZB1*



## General Dimensions – Frame Size 110

*Shaft Options – 51C110-1 and 51C110*



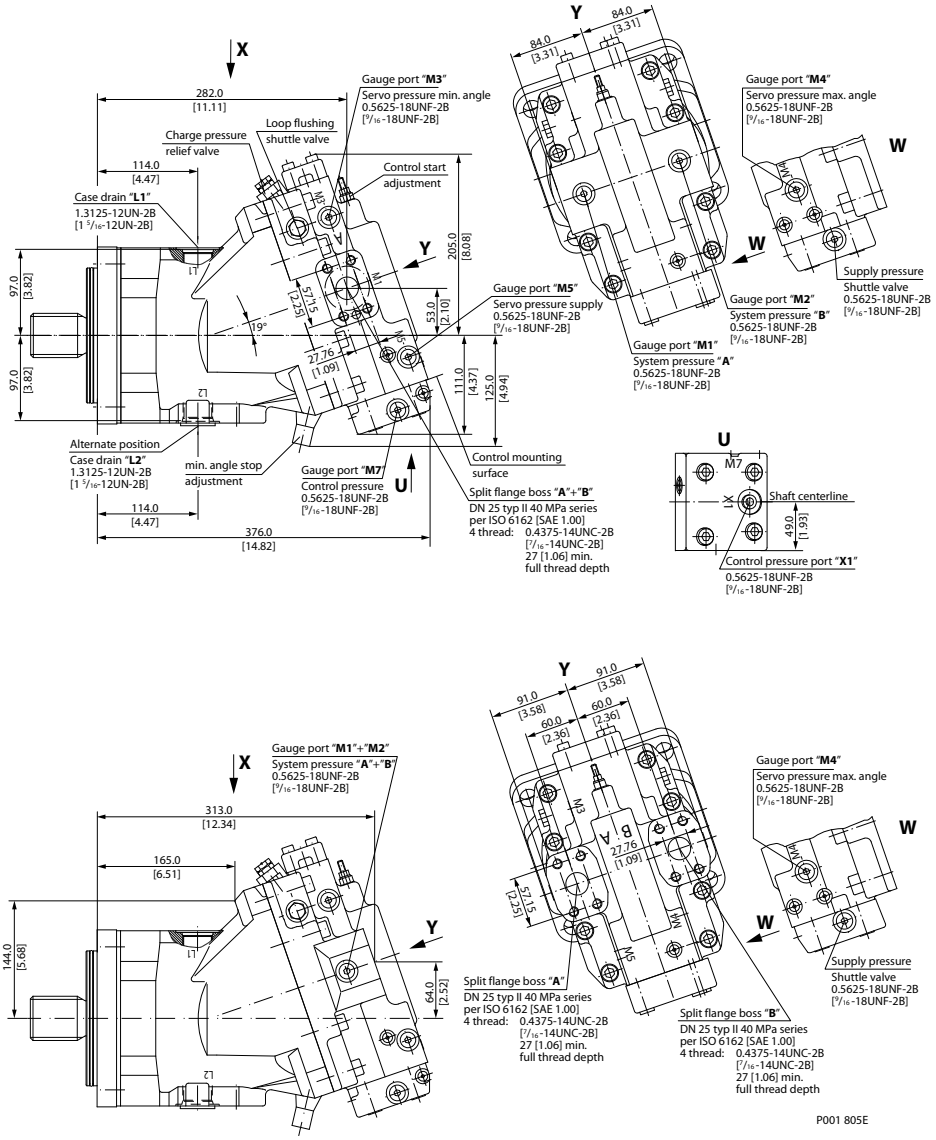

| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | D3 | | D4 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 18 | | 21 | |
| Spline | W40x2x30x18x9g<br>side fit<br>DIN 5480 | | W45x2x30x21x9g<br>side fit<br>DIN 5480 | |
| Pitch dia | 36.000 | [1.417] | 42.000 | [1.654] |
| ∅ A | 39.60 | [1.56] | 44.60 | [1.76] |
| B | 37.00 | [1.46] | 42.00 | [1.65] |
| C | 45.00±0.5 | [1.77] | 50.00±0.5 | [1.97] |
| ∅ D | 35.00 | [1.38] | 40.00 | [1.57] |
| E | 47.40±1.1 | [1.87] | 52.40±1.4 | [2.06] |
| F | 167.70±0.6 | [6.60] | 172.70±0.6 | [6.80] |
| ∅ G | M12x1.75<br>allowed torque in thread max. 115 Nm [1018 lbf•in] | | | |
| H | 30.00 | [1.18] | 30.00 | [1.18] |

Flow into port A results in CW rotation of output shaft.
Flow into port B results in CCW rotation of output shaft.
Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 160

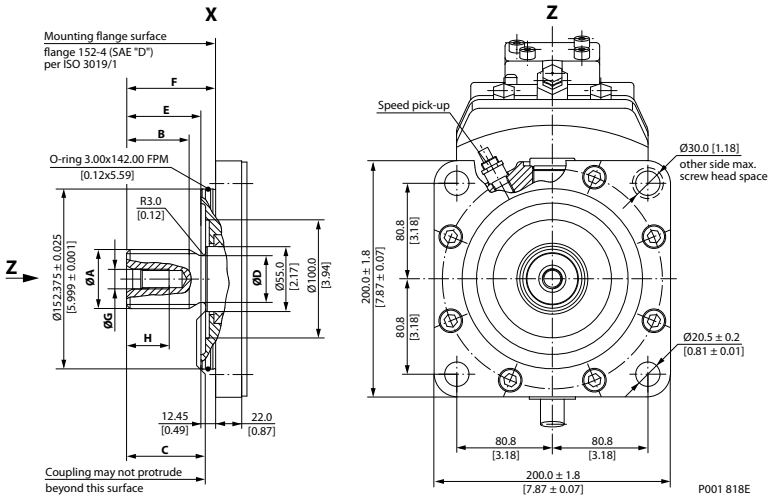
### SAE Flange Design per ISO 3019/1

*51V160 Proportional and Two-Position Control, HZB1*



## General Dimensions – Frame Size 160

*Shaft Options – 51V160*




| Shaft Spline Data | | | | | | |
|---|---|---|---|---|---|---|
| Shaft option | F1 | | F2 | | C8 | |
| Dimension | mm | [in] | mm | [in] | mm | [in] |
| Number of teeth | 13 | | 15 | | 27 | |
| Pitch | 8/16 | | 8/16 | | 16/32 | |
| Pressure angle | 30° | | | | | |
| Spline | ANSI B92.1-1970<br>class 5<br>flat root side fit | | | | | |
| Pitch dia | 41.275 | [1.625] | 47.625 | [1.875] | 42.862 | [1.688] |
| ∅ A | 43.64 | [1.72] | 49.99 | [1.97] | 43.96 | [1.73] |
| B | 55.00 | [2.17] | 53.00 | [2.09] | 55.00 | [2.17] |
| C | 67.00±0.5 | [2.64] | 67.00±0.5 | [2.64] | 67.00±0.5 | [2.64] |
| ∅ D | 36.00 | [1.42] | 42.20 | [1.66] | 39.60 | [1.56] |
| E | 70.00±1.1 | [2.76] | 70.00±1.1 | [2.76] | 70.00±1.1 | [2.76] |
| F | 75.40±0.7 | [2.97] | 75.40±0.7 | [2.97] | 75.40±0.7 | [2.97] |
| ∅ G | 0.625-11UNC-2B [5/8-11UNC-2B]<br>allowed torque in thread max. 200 Nm [1770 lbf•in] | | | | | |
| H | 36.00 | [1.42] | 36.00 | [1.42] | 36.00 | [1.42] |

Flow into port A results in CW rotation of output shaft.

Flow into port B results in CCW rotation of output shaft.

Shaft rotation is determined by viewing from shaft end.

Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.

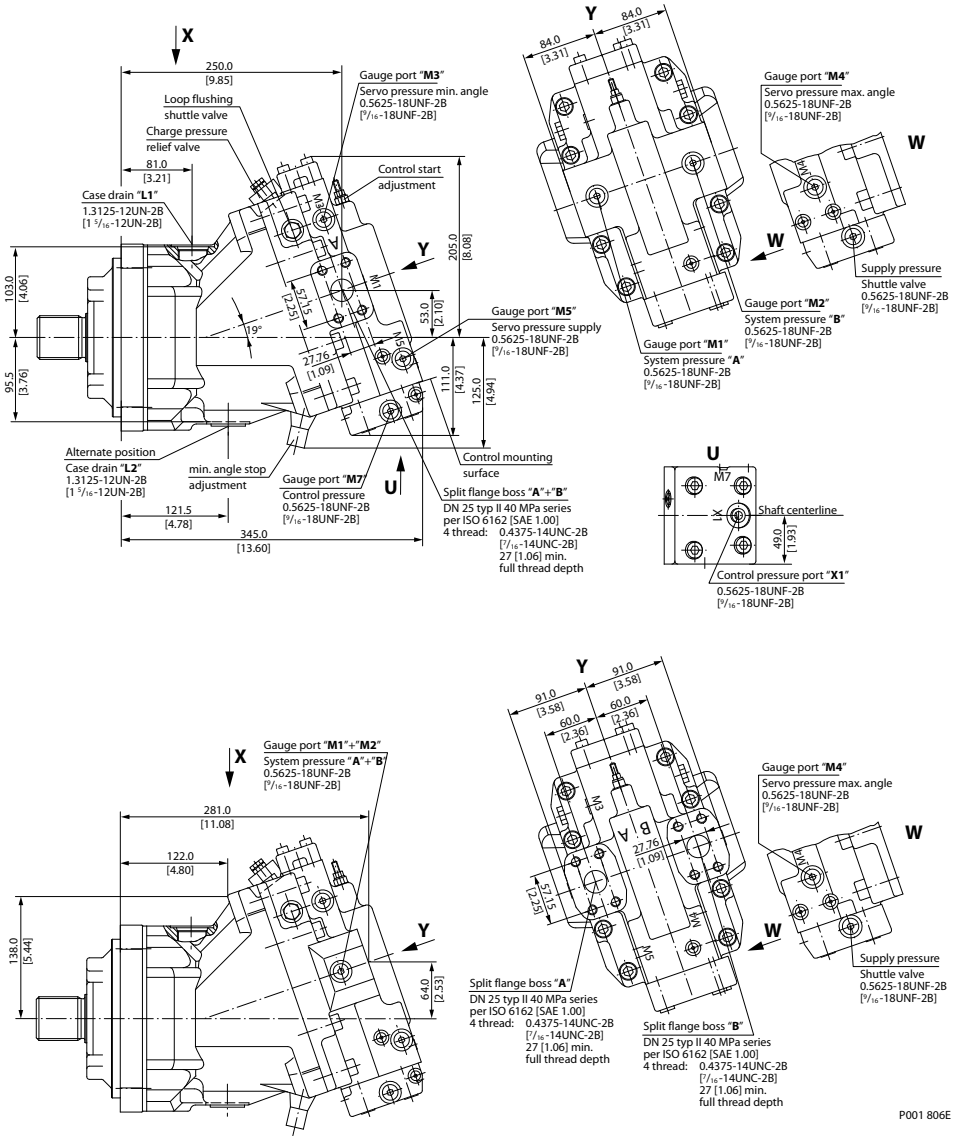
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).

Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 160

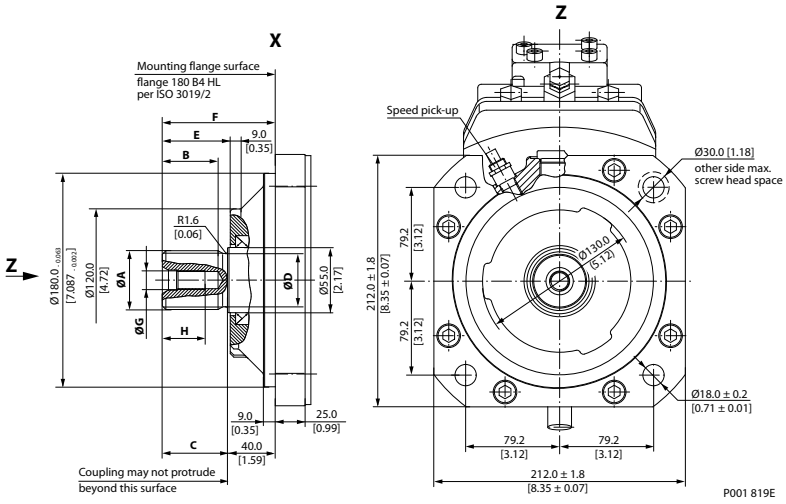
### DIN Flange Design per ISO 3019/2

*51D160 Proportional and Two-Position Control, HZB1*



## General Dimensions – Frame Size 160

*Shaft Options – 51D160*



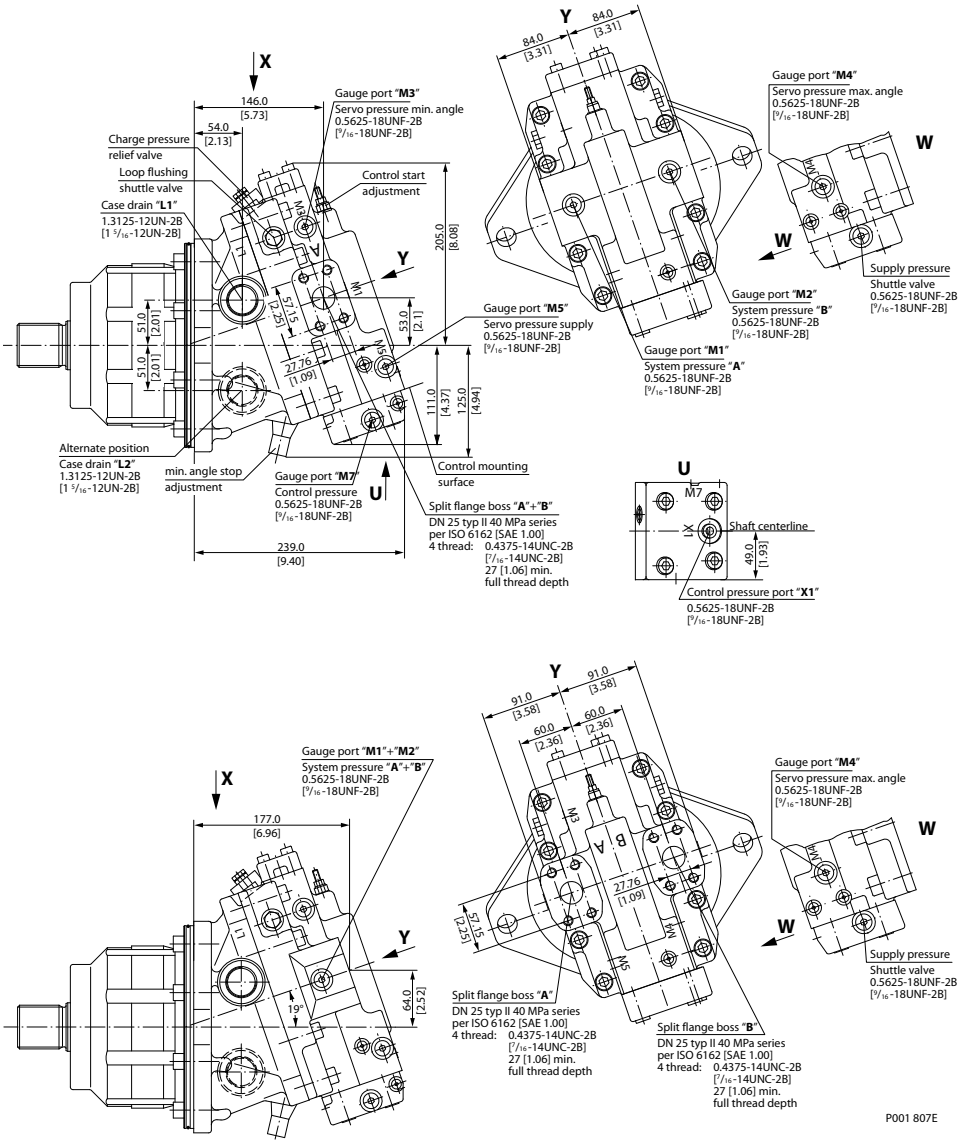

| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | D4 | | D5 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 21 | | 24 | |
| Spline | W45x2x30x21x9g side fit DIN 5480 | | W50x2x30x24x9g side fit DIN 5480 | |
| Pitch dia | 42.000 | [1.654] | 48.000 | [1.890] |
| ∅ A | 44.60 | [1.76] | 49.60 | [1.95] |
| B | 42.00 | [1.65] | 47.00 | [1.85] |
| C | 50.00±0.5 | [1.97] | 55.00±0.5 | [2.17] |
| ∅ D | 40.00 | [1.57] | 45.00 | [1.77] |
| E | 52.30±1.1 | [2.06] | 57.30±1.1 | [2.26] |
| F | 90.30±0.6 | [3.56] | 95.30±0.6 | [3.75] |
| ∅ G | M12x1.75 allowed torque in thread max. 115 Nm [1018 lbf·in] | | | |
| H | 30.00 | [1.18] | 30.00 | [1.18] |

Flow into port A results in CW rotation of output shaft.
Flow into port B results in CCW rotation of output shaft.
Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 160

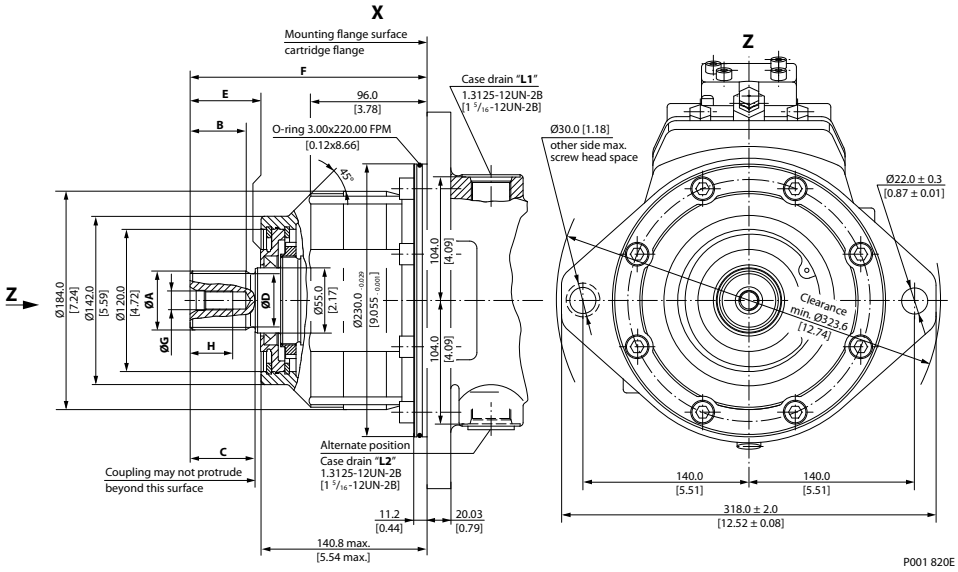
### Cartridge Flange

*51C160 Proportional and Two-Position Control, HZB1*



## General Dimensions – Frame Size 160

*Shaft Options – 51C160*



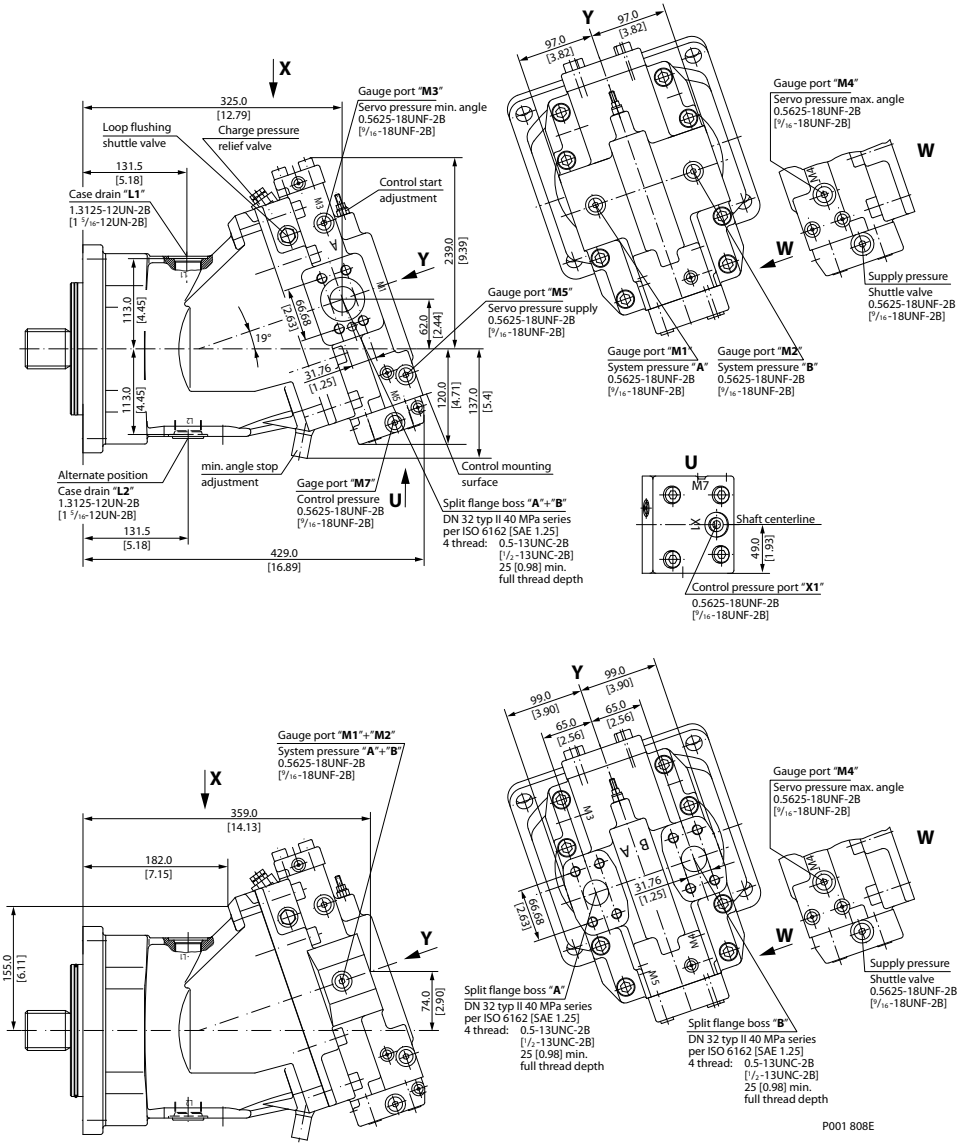

| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | D4 | | D5 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 21 | | 24 | |
| Spline | W45x2x30x21x9g<br>side fit<br>DIN 5480 | | W50x2x30x24x9g<br>side fit<br>DIN 5480 | |
| Pitch dia | 42.000 | [1.654] | 48.000 | [1.890] |
| ∅ A | 44.60 | [1.76] | 49.60 | [1.95] |
| B | 42.00 | [1.65] | 47.00 | [1.85] |
| C | 50.00±0.5 | [1.97] | 55.00±0.5 | [2.17] |
| ∅ D | 40.00 | [1.57] | 45.00 | [1.77] |
| E | 54.50±1.4 | [2.15] | 59.50±1.4 | [2.34] |
| F | 194.90±0.6 | [7.67] | 199.90±0.6 | [7.87] |
| ∅ G | M12x1.75<br>allowed torque in thread max. 115 Nm [1018 lbf•in] | | | |
| H | 30.00 | [1.18] | 30.00 | [1.18] |

Flow into port A results in CW rotation of output shaft.
Flow into port B results in CCW rotation of output shaft.
Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## General Dimensions – Frame Size 250

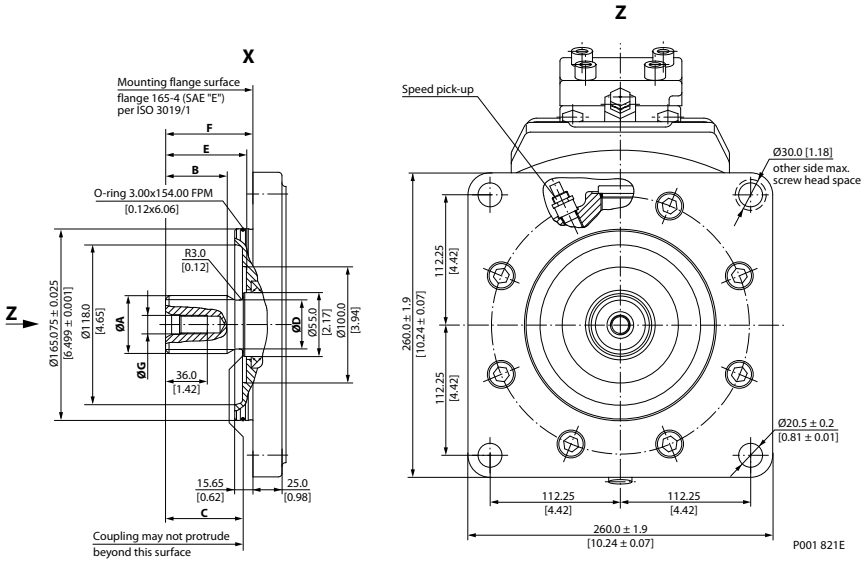
### SAE Flange Design per ISO 3019/1

*51V250 Proportional and Two-Position Control, HZB1*



## General Dimensions – Frame Size 250

*Shaft Options – 51V250*



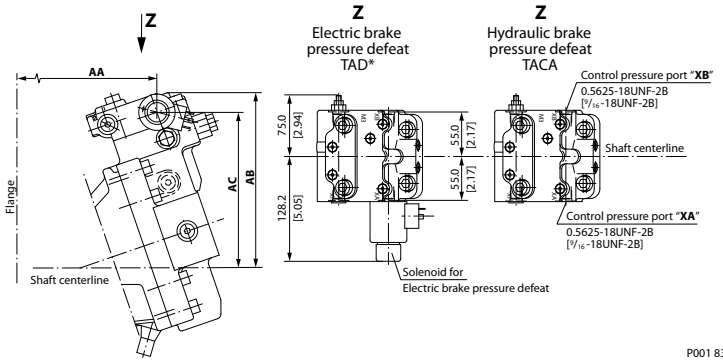

| Shaft Spline Data | | | | |
|---|---|---|---|---|
| Shaft option | F2 | | C8 | |
| Dimension | mm | [in] | mm | [in] |
| Number of teeth | 15 | | 27 | |
| Pitch | 8/16 | | 16/32 | |
| Pressure angle | 30° | | | |
| Spline | ANSI B92.1-1970<br>class 5<br>flat root side fit | | | |
| Pitch dia | 47.625 | [1.875] | 42.862 | [1.688] |
| ∅ A | 49.99 | [1.97] | 43.96 | [1.73] |
| B | 53.00 | [2.09] | 55.00 | [2.17] |
| C | 67.00±0.5 | [2.64] | 67.00±0.5 | [2.64] |
| ∅ D | 42.20 | [1.66] | 39.60 | [1.56] |
| E | 70.00±1.1 | [2.76] | 70.00±1.1 | [2.76] |
| F | 75.40±0.7 | [2.97] | 75.40±0.7 | [2.97] |
| ∅G | 0.625-11UNC-2B [5/8-11UNC-2B]<br>allowed torque in thread max. 200 Nm [1770 lbf·in] | | | |

Flow into port A results in CW rotation of output shaft.
Flow into port B results in CCW rotation of output shaft.
Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## Dimension – Controls

### Pressure Compensator Control – Options TA** for 51-1 Frame Size

*060, 080, 110*




| Control Option TA** for 51-1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame size | | 060 | | | 080 | | | 110 | | |
| Design | | V | D | C | V | D | C | V | D | C |
| AA | mm | 181.2 | 156.7 | 96.9 | 196.9 | 172.9 | 94.5 | 213.4 | 181.8 | 99.0 |
| | [in] | [7.13] | [6.17] | [3.82] | [7.75] | [6.81] | [3.72] | [8.40] | [7.16] | [3.90] |
| AB | mm | 199.3 | | | 209.7 | | | 223.5 | | 223.9 |
| | [in] | [7.85] | | | [8.26] | | | [8.80] | | [8.82] |
| AC | mm | 176.4 | | | 186.8 | | | 200.6 | | 201.0 |
| | [in] | [6.95] | | | [7.36] | | | [7.90] | | [7.91] |

V = SAE-flange, D = DIN-flange, C = Cartridge-flange

*Solenoid Connectors*

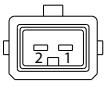
**Magnet-Steckanschluss für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117

P001 752D

**AMP Junior Timer Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388



P001 751E

Shaft rotation is determined by viewing from shaft end.

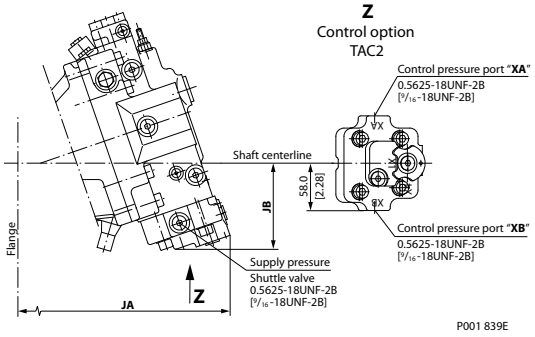
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.

Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).

Contact your Danfoss representative for specific installation drawings.

### Pressure Compensator Control – Options TA** for 51 Frame Size

*160, 250*



## Dimension – Controls

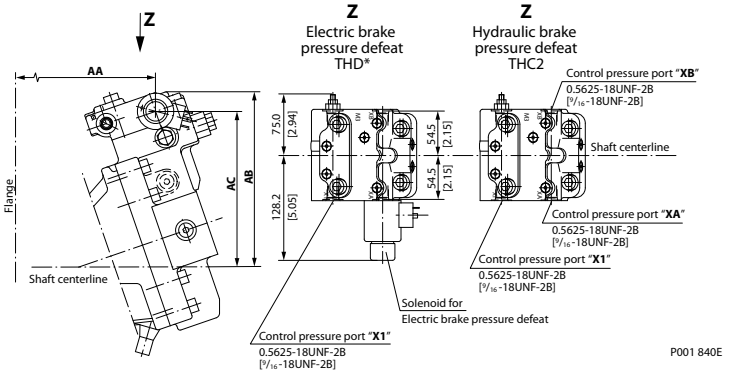
| Control Option TA** for 51 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frame size | | 160 | | | 250 | | |
| Design | | V | D | C | V | D | C |
| JA | mm [in] | 393 [15.48] | 361 [14.22] | 257 [10.11] | 445 [17.51] | — | |
| JB | mm [in] | 114 [4.48] | | | 122 [4.82] | — | |

V = SAE-flange, D = DIN-flange, C = Cartridge-flange
— = not available

Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

### Hydraulic Two-Position Control – Options TH** for 51-1 Frame Size

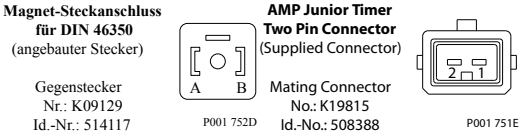
*060, 080, 110*




| Control Option TH** for 51-1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame size | | 060 | | | 080 | | | 110 | | |
| Design | | V | D | C | V | D | C | V | D | C |
| AA | mm [in] | 181.2 [7.13] | 156.7 [6.17] | 96.9 [3.82] | 196.9 [7.75] | 172.9 [6.81] | 94.5 [3.72] | 213.4 [8.40] | 181.8 [7.16] | 99.0 [3.90] |
| AB | mm [in] | 199.3 [7.85] | | | 209.7 [8.26] | | | 223.5 [8.80] | | 223.9 [8.82] |
| AC | mm [in] | 176.4 [6.95] | | | 186.8 [7.36] | | | 200.6 [7.90] | | 201.0 [7.91] |

V = SAE-flange, D = DIN-flange, C = Cratridge-flange

*Solenoid Connectors*

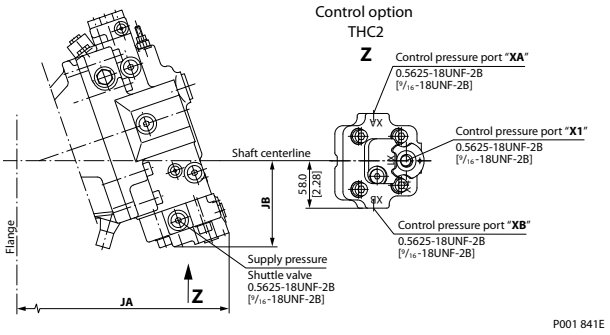



Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## Dimension – Controls

### Hydraulic Two-Position Control – Options TH** for 51 Frame Size

*160, 250*




| Control Option TH** for 51 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frame size | | 160 | | | 250 | | |
| Design | | V | D | C | V | D | C |
| JA | mm [in] | 393 [15.48] | 361 [14.22] | 257 [10.11] | 445 [17.51] | — | |
| JB | mm [in] | 114 [4.48] | | | 122 [4.82] | — | |

V = SAE-flange, D = DIN-flange, C = Cartridge-flange
— = not available

Shaft rotation is determined by viewing from shaft end.

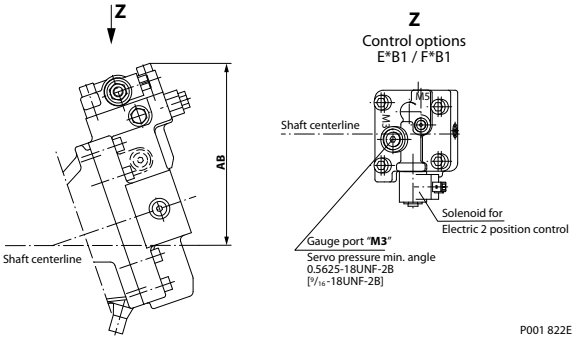
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.

Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).

Contact your Danfoss representative for specific installation drawings.

### Electrohydraulic Two-Position Control – Options E1B1, E2B1, E7B1, F1B1, F2B1 for 51-1 Frame Size

*060, 080, 110*




| Control Options E1B1, E2B1, E7B1, F1B1, F2B1 for 51-1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame size | | 060 | | | 080 | | | 110 | | |
| Design | | V | D | C | V | D | C | V | D | C |
| AB | mm [in] | 208.5 [8.21] | | | 218.9 [8.62] | | | 232.7 [9.16] | | |

V = SAE-flange, D = DIN-flange, C = Cratridge-flange

*Solenoid Connectors*

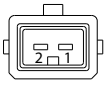
**Magnet-Steckanschluss für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117

P001 752D

**AMP Junior Timer Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388



P001 751E

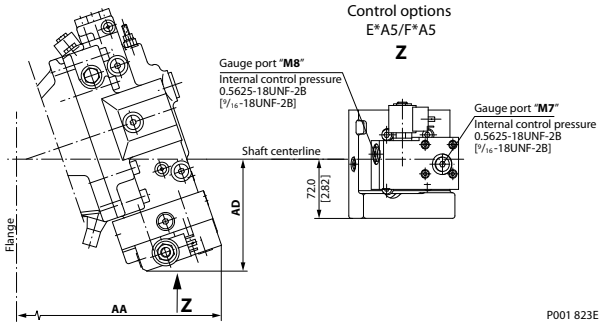
Shaft rotation is determined by viewing from shaft end.

## Dimension – Controls

Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

### Electrohydraulic Two-Position Control – Options E1A5, E2A5, F1A5, F2A5 for 51 Frame Size

*160, 250*




| Control Options E1A5, E2A5, F1A5, F2A5 for 51 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frame size | | 160 | | | 250 | | |
| Design | | V | D | C | V | D | C |
| AA | mm<br>[in] | 401<br>[15.79] | 369<br>[14.53] | 265<br>[10.42] | 453<br>[17.82] | — | |
| AD | mm<br>[in] | 145<br>[5.72] | | | 154<br>[6.06] | — | |

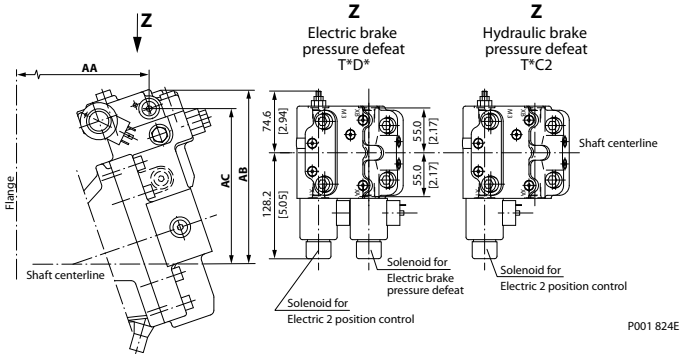
V = SAE-flange, D = DIN-flange, C = Cartridge-flange
— = not available

*Solenoid Connector*


Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

### Electrohydraulic Two-Position Control – Options T1**, T2**, T7** for 51-1 Frame Size

*060, 080, 110*



## Dimension – Controls

| Control Options T1**, T2**, T7** for 51-1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame size | | 060 | | | 080 | | | 110 | | |
| Design | | V | D | C | V | D | C | V | D | C |
| AA | mm [in] | 181.2 [7.13] | 156.7 [6.17] | 96.9 [3.82] | 196.9 [7.75] | 172.9 [6.81] | 94.5 [3.72] | 213.4 [8.40] | 181.8 [7.16] | 99.0 [3.90] |
| AB | mm [in] | 199.3 [7.85] | | | 209.7 [8.26] | | | 223.5 [8.80] | | 223.9 [8.82] |
| AC | mm [in] | 176.4 [6.95] | | | 186.8 [7.36] | | | 200.6 [7.90] | | 201.0 [7.91] |

V = SAE-flange, D = DIN-flange, C = Cratridge-flange

*Solenoid Connectors*

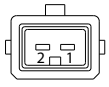
**Magnet-Steckanschluss für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117

P001 752D

**AMP Junior Timer Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388



P001 751E

Shaft rotation is determined by viewing from shaft end.

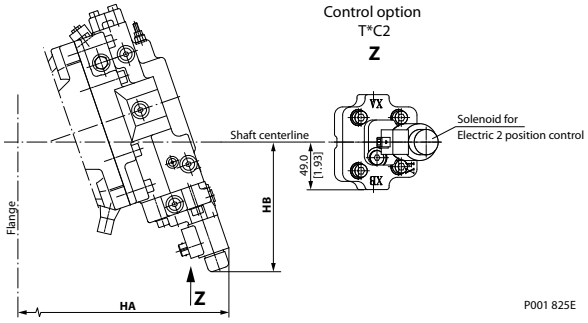
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.

Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).

Contact your Danfoss representative for specific installation drawings.

### Electrohydraulic Two-Position Control – Options T1C2, T2C2 for 51 Frame Size

*160, 250*



P001 825E

| Control Options T1C2, T2C2 for 51 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frame size | | 160 | | | 250 | | |
| Design | | V | D | C | V | D | C |
| HA | mm [in] | 409 [16.10] | 377 [14.84] | 272 [10.73] | 461 [18.13] | — | |
| HB | mm [in] | 178 [7.00] | | | 186 [7.33] | — | |

V = SAE-flange, D = DIN-flange, C = Cartridge-flange
— = not available

*Solenoid Connector*

**Magnet-Steckanschluss für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117

P001 752D

Shaft rotation is determined by viewing from shaft end.

Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.

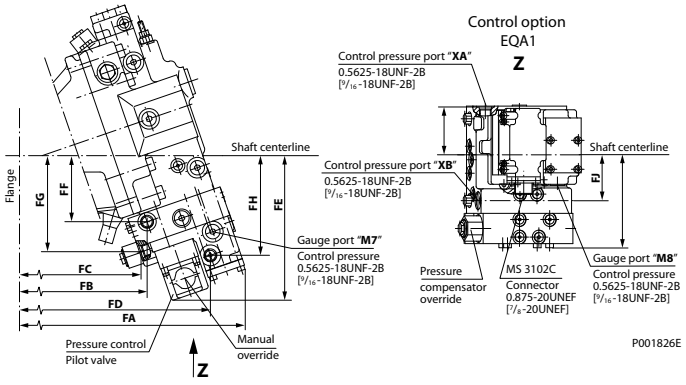
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).

Contact your Danfoss representative for specific installation drawings.

## Dimension – Controls

### Electrohydraulic Proportional Control – Options EPA1, EQA1 for 51 Frame Size

*060, 080, 110, 160, 250*




| Control Options EPA1, EQA1 for 51 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frame size | | 060 | | | 080 | | | 110 | | | 160 | | | 250 | | | |
| Design | | V | D | C | V | D | C | V | D | C | V | D | C | V | D | C | |
| FA | mm [in] | 327 [12.89] | 303 [11.93] | 243 [9.57] | 351 [13.81] | 327 [12.87] | 249 [9.78] | 369 [14.54] | 337 [13.28] | 255 [10.04] | 409 [16.11] | 377 [14.85] | 273 [10.73] | 461 [18.13] | — | | |
| FB | mm [in] | 210 [8.26] | 185 [7.29] | 125 [4.94] | 233 [9.18] | 209 [8.23] | 131 [5.15] | 252 [9.90] | 220 [8.65] | 137 [5.40] | 283 [11.14] | 251 [9.88] | 146 [5.76] | 334 [13.17] | — | | |
| FC | mm [in] | 203 [8.00] | 179 [7.04] | 119 [4.69] | 226 [8.88] | 202 [7.94] | 123 [4.85] | 244 [9.61] | 212 [8.35] | 130 [5.11] | 276 [10.85] | 244 [9.59] | 139 [5.48] | 327 [12.88] | — | | |
| FD | mm [in] | 286 [11.25] | 261 [10.29] | 202 [7.93] | 309 [12.17] | 285 [11.32] | 207 [8.14] | 328 [12.90] | 296 [11.64] | 213 [8.40] | 367 [14.47] | 335 [13.21] | 231 [9.09] | 419 [16.50] | — | | |
| FE | mm [in] | 168 [6.62] | | | 174 [6.85] | | | 176 [6.91] | | | 183 [7.22] | | | 192 [7.56] | — | | |
| FF | mm [in] | 74 [2.91] | | | 80 [3.15] | | | 81 [3.20] | | | 92 [3.63] | | | 101 [3.97] | — | | |
| FG | mm [in] | 110 [4.33] | | | 116 [4.58] | | | 118 [4.64] | | | 129 [5.06] | | | 137 [5.41] | — | | |
| FH | mm [in] | 114 [4.47] | | | 120 [4.74] | | | 122 [4.80] | | | 130 [5.11] | | | 138 [5.45] | — | | |
| FJ | mm [in] | 56 [2.20] | | | 56 [2.20] | | | 56 [2.20] | | | 57 [2.22] | | | 57 [2.22] | — | | |

V = SAE-flange, D = DIN-flange, C = Cartridge-flange
— = not available

*Connectors*

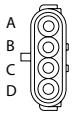
**MS Connector**
**MS3102C-14S-2P**
(Supplied Connector)

Mating Connector
No.: K08106
Id.-No.: 615062

P001 753E

**Packard Weather-Pack**
**4 pin**
(Supplied Connector)

Mating Connector
No.: K03384
Id.-No.: 712208



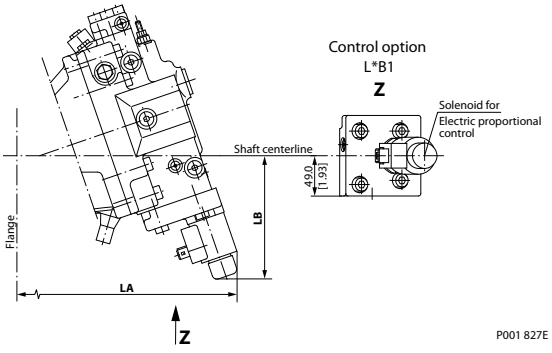
P001 759E

Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## Dimension – Controls

### Electrohydraulic Proportional Control – Options L1B1, L2B1, L7B1 for 51 Frame Size

*060, 080, 110, 160, 250*




| Control Options L1B1, L2B1, L7B1 for 51 | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frame size | | 060 | | | 080 | | | 110 | | | 160 | | | 250 | | |
| Design | | V | D | C | V | D | C | V | D | C | V | D | C | V | D | C |
| LA | mm | 321 | 296 | 236 | 344 | 320 | 242 | 363 | 331 | 248 | 402 | 370 | 266 | 454 | — | |
| | [in] | [12.63] | [11.66] | [9.31] | [13.55] | [12.60] | [9.52] | [14.28] | [13.02] | [9.77] | [15.84] | [14.58] | [10.47] | [17.87] | | |
| LB | mm | 144 | | | 150 | | | 151 | | | 159 | | | 168 | — | |
| | [in] | [5.66] | | | [5.90] | | | [5.96] | | | [6.27] | | | [6.61] | | |

V = SAE-flange, D = DIN-flange, C = Cartridge-flange
— = not available

*Solenoid Connectors*

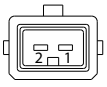
**Magnet-Steckanschluss für DIN 46350**
(angebauter Stecker)

Gegenstecker
Nr.: K09129
Id.-Nr.: 514117

P001 752D

**AMP Junior Timer Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388

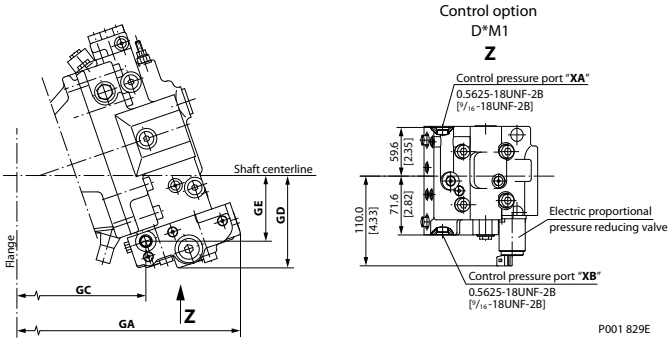


P001 751E

Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

### Electrohydraulic Proportional Control – Options D7M1, D8M1 for 51 Frame Size

*060, 080, 110*



## Dimension – Controls

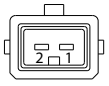
| Control Options D7M1, D8M1 for 51 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame size | | 060 | | | 080 | | | 110 | | |
| Design | | V | D | C | V | D | C | V | D | C |
| GA | mm [in] | 325 [12.81] | 301 [11.84] | 241 [9.49] | 349 [13.73] | 325 [12.78] | 246 [9.70] | 367 [14.64] | 335 [13.20] | 253 [9.95] |
| GC | mm [in] | 210 [8.26] | 185 [7.29] | 125 [4.94] | 233 [9.18] | 209 [8.23] | 131 [5.15] | 252 [9.91] | 220 [8.65] | 137 [5.40] |
| GD | mm [in] | 106 [4.19] | | | 112 [4.42] | | | 114 [4.48] | | |
| GE | mm [in] | 74 [2.91] | | | 80 [3.15] | | | 81 [3.20] | | |

V = SAE-flange, D = DIN-flange, C = Cratridge-flange

*Solenoid Connector*

**AMP Junior Timer**
**Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388




P001 751E

Shaft rotation is determined by viewing from shaft end.

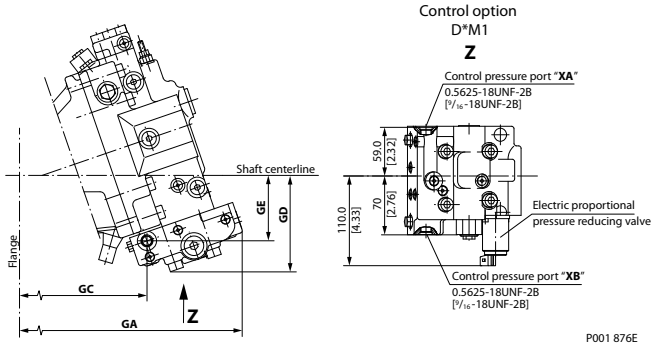
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.

Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).

Contact your Danfoss representative for specific installation drawings.

### Electrohydraulic Proportional Control – Options D7M1, D8M1 for 51 Frame Size

*160, 250*




P001 876E

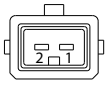
| Control Options D7M1, D8M1 for 51 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frame size | | 160 | | | 250 | | |
| Design | | V | D | C | V | D | C |
| GA | mm [in] | 407 [16.02] | 375 [14.76] | 270 [10.65] | 459 [18.05] | — | |
| GC | mm [in] | 283 [11.14] | 251 [9.88] | 146 [5.76] | 334 [13.17] | — | |
| GD | mm [in] | 133 [5.22] | | | 141 [5.55] | — | |
| GE | mm [in] | 92 [3.63] | | | 101 [3.97] | — | |

V = SAE-flange, D = DIN-flange, C = Cartridge-flange
— = not available

*Solenoid Connector*

**AMP Junior Timer**
**Two Pin Connector**
(Supplied Connector)

Mating Connector
No.: K19815
Id.-No.: 508388




P001 751E

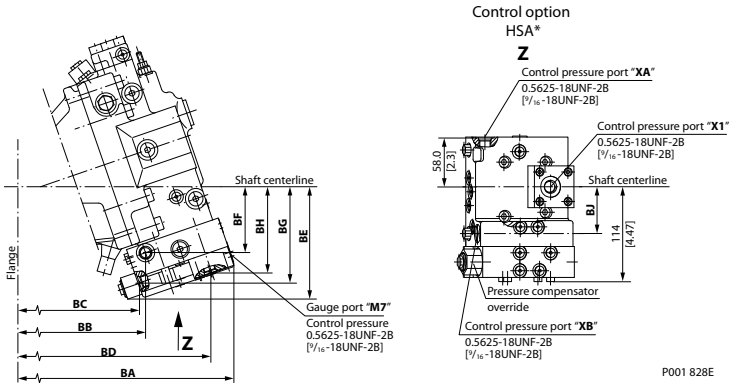
Shaft rotation is determined by viewing from shaft end.

## Dimension – Controls

Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

### Hydraulic Proportional Control – Options HSA* for 51 Frame Size

*060, 080, 110, 160, 250*




| Control Option HSA* for 51 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frame size | | 060 | | | 080 | | | 110 | | | 160 | | | 250 | | |
| Design | | V | D | C | V | D | C | V | D | C | V | D | C | V | D | C |
| BA | mm [in] | 316 [12.45] | 292 [11.49] | 232 [9.13] | 340 [13.37] | 316 [12.34] | 237 [9.34] | 358 [14.10] | 326 [12.84] | 244 [9.60] | 398 [15.66] | 366 [14.40] | 261 [10.29] | 449 [17.70] | — | |
| BB | mm [in] | 210 [8.26] | 185 [7.29] | 125 [4.94] | 233 [9.18] | 209 [8.23] | 131 [5.15] | 252 [9.90] | 220 [8.65] | 137 [5.40] | 283 [11.14] | 251 [9.88] | 146 [5.76] | 334 [13.17] | — | |
| BC | mm [in] | 203 [8.00] | 179 [7.04] | 119 [4.69] | 226 [8.88] | 202 [7.94] | 123 [4.85] | 244 [9.61] | 212 [8.35] | 130 [5.11] | 276 [10.85] | 244 [9.59] | 139 [5.48] | 327 [12.88] | — | |
| BD | mm [in] | 288 [11.35] | 264 [10.38] | 204 [8.03] | 312 [12.27] | 288 [11.32] | 209 [8.24] | 330 [12.99] | 298 [11.74] | 216 [8.49] | 370 [14.56] | 338 [13.30] | 233 [9.18] | 421 [16.59] | — | |
| BE | mm [in] | 130 [5.12] | | | 136 [5.35] | | | 137 [5.41] | | | 145 [5.72] | | | 154 [6.06] | — | |
| BF | mm [in] | 74 [2.91] | | | 80 [3.15] | | | 81 [3.20] | | | 92 [3.63] | | | 101 [3.97] | — | |
| BG | mm [in] | 110 [4.33] | | | 116 [4.58] | | | 118 [4.64] | | | 129 [5.06] | | | 137 [5.41] | — | |
| BH | mm [in] | 98 [3.87] | | | 104 [4.10] | | | 106 [4.16] | | | 114 [4.47] | | | 122 [4.81] | — | |
| BJ | mm [in] | 56 [2.20] | | | 56 [2.20] | | | 56 [2.20] | | | 57 [2.22] | | | 57 [2.22] | — | |

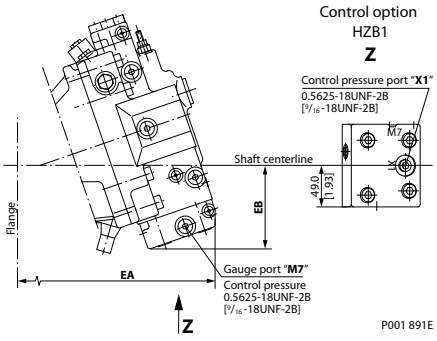
V = SAE-flange, D = DIN-flange, C = Cartridge-flange
— = not available

Shaft rotation is determined by viewing from shaft end.
Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.
Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).
Contact your Danfoss representative for specific installation drawings.

## Dimension – Controls

### Hydraulic Proportional Control – Option HZB1 for 51 Frame Size

*060, 080, 110, 160, 250*




| Control Option HZB1 for 51 | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frame size | | 060 | | | 080 | | | 110 | | | 160 | | | 250 | | |
| Design | | V | D | C | V | D | C | V | D | C | V | D | C | V | D | C |
| EA | mm | 294 | 270.0 | 209 | 318.0 | 294.0 | 215 | 337.0 | 305.0 | 221 | 376.0 | 345.0 | 239 | 429.0 | — | |
| | [in] | [11.56] | [10.64] | [8.24] | [12.52] | [11.58] | [8.45] | [13.25] | [12.00] | [8.71] | [14.82] | [13.60] | [9.40] | [16.89] | | |
| EB | mm | 96 | | | 102 | | | 103 | | | 111 | | | 120 | — | |
| | [in] | [3.77] | | | [4.00] | | | [4.06] | | | [4.37] | | | [4.71] | | |

V = SAE-flange, D = DIN-flange, C = Cartridge-flange
— = not available

Shaft rotation is determined by viewing from shaft end.

Ports with O-ring seal and inch threads shall be in accordance with ISO 11926/1.

Splite flange boss A and B per ISO 6162 is identical with high pressure series SAEJ518 code 62 (6000 psi).

Contact your Danfoss representative for specific installation drawings.

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