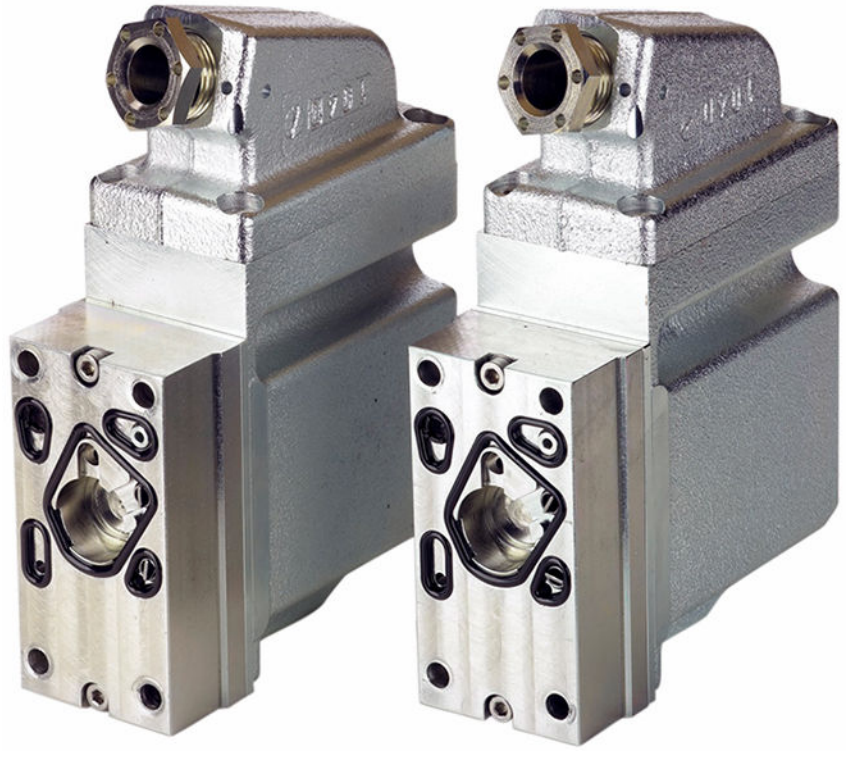
ENGINEERING
TOMORROW

Installation Guide

PVE-EX Ex eb mb version, Group II

Electro-hydraulic Actuator for PVG 32, PVG 100, PVG 120, and PVG 128/256



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Revision history

Table of revisions

Date	Changed	Rev
November 2020	Various technical changes, updated certificates	0404
June 2020	Updated Fault Monitoring section	0403
	Changed document number from 'AN00000349' to 'AN212686484914'	XX
June 2019	Major Update: Text, Drawings, Certificates.	0301
July 2017	Updated EU-Type and IECEx Certificates	0201
April 2017	First edition	0101

Contents

General information

Literature Reference

Literature reference for PVG and PVE products

Title	Type	Order number
PVG 32 Proportional Valve Group	Service Manual	AX152886481209
PVG 100 Proportional Valve Group	Service Manual	AX152886481171
PVG 32 Proportional Valve Group	Technical Information	BC152886483664
PVG 100 Proportional Valve Group	Technical Information	BC152886483475
PVG 120 Proportional Valve Group	Technical Information	BC152886483344
PVG 32 Metric ports	Technical Information	BC152886484163
PVG 128/256 Proportional Valve Group	Technical Information	BC220686485279
PVG Ex 32/128/256	Technical Information	

PVE-EX Introduction

The Danfoss PVE-EX is an actuator for PVG 32/128/256, PVG 100, and PVG 120.

The PVE-EX is an explosion proof PVE designed to be used in potentially explosive atmospheres like mining and oil and gas industries.

The PVE-EX has been certified by DNV GL Presafe.

Product Certification

The PVE-EX eb mb version is developed according to and in compliance with:

- EN ISO 4413:2010 Hydraulic fluid power - General rules and safety requirements for systems and their components
- EN 60079-0:2012 / IEC 60079-0:2011 Explosive atmospheres - Part 0: Equipment - General requirements
- IEC 60079-7: 2015 / EN 60079-7: 2015 Part 7: Equipment protection by increased safety "e"
- IEC 60079-18: 2014 / EN 60079-18: 2015 Part 18: Equipment protection by encapsulation "m"

Installation and Maintenance standards:

- EN/IEC 60079-14 Explosive atmospheres - Part 14: Electrical installations design, selection and erection
- EN/IEC 60079-17 Explosive atmospheres - Part 17: Electrical installations inspection and maintenance

The PVE-EX is in conformity with listed EU Directive (s) and EU harmonized standards:

- EMC Directive 2004/108/EC
- EN/IEC 61000-6-2:2005 Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
- EN 61000-6-4:2007/A1:2011, IEC 61000-6-4:2006 Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments

Protection

All PVE-EX actuators comply with protection class IP67 and IP69k according to EN60529. However, in particularly exposed applications, protection in the form of shielding is recommended.

General information

Specific conditions for safe use ("X"-mark)

Originally supplied "SD cable glands" may not provide sufficient clamping. User shall provide additional clamping of the cable to ensure that pulling and twisting is not transmitted to the terminations.

Fasteners used for enclosure must be made from stainless steel grade A4 or stronger (Yield stress 210 MPa)

Warnings

Before implementing actuators in any application, read all warnings. Warnings are listed next to the most relevant section and repeated in the chapter *PVE-EX warnings* on page 20.

Do not regard the warnings as a full list of potential risks. Depending on the application and use, other potential risks can occur.

Warning

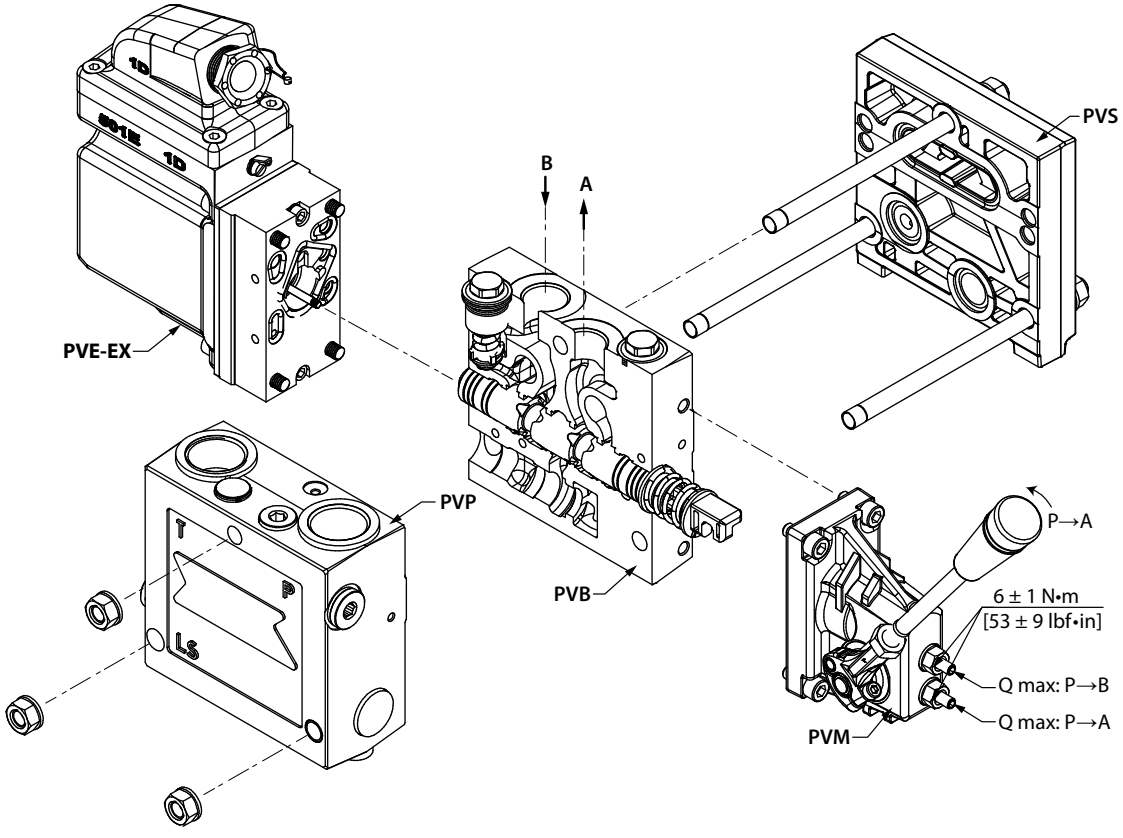
All brands and all types of directional control or proportional valves, which are used in many different operation conditions and applications, can fail and cause serious damage.

You must perform a risk assessment. The machine builder/system integrator alone is responsible for making the final selection of the products and assuring that all performance, safety and warning requirements of the application are met.

The process for choosing the control system and safety levels is governed by the Machinery Directive 2006/42/EC and EU harmonized standard EN 13849 (Safety related requirements for control systems).

Oil Flow Direction for Standard Assembled Groups

Oil Flow Direction for Standard Assembled Groups

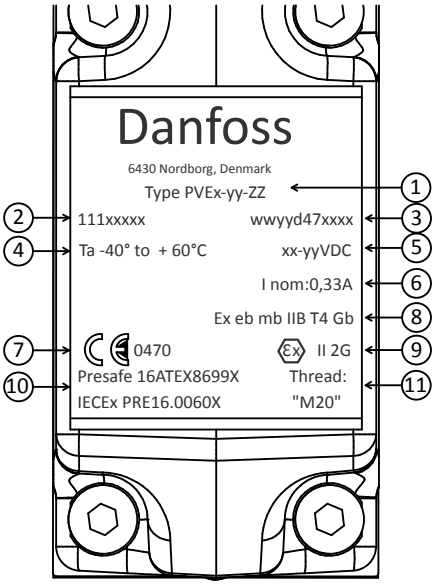


General information

Nameplate Description (eb mb version)

The PVE-EX actuator is mounted with a unique nameplate.

Nameplate for PVE-EX Ex eb mb version



Nameplate Legend:

1. PVE-EX type, see the table below.
2. Part number (111xxxxx)
3. Production date and serial number

   Example: 20 18 c xxxxx (Week: 20 Year: 2018 Day: Wednesday (A= Monday) xxxxx=serial number)
4. Ambient temperature range
5. Supply voltage
6. Nominal Current draw
7. Notified body *Example:* NEMKO/Presafe
8. IECEx Equipment Group and protection category X-marking
9. ATEX Equipment Group and protection category X-marking
10. Ex Certificate Number

    Specific conditions for safe use ("X"-mark)

    Originally supplied "SD cable glands" may not provide sufficient clamping. User shall provide additional clamping of the cable to ensure that pulling and twisting is not transmitted to the terminations.
11. Cable entry thread (M20 x 1.5) and temp. specification

    Determined temperature at entry point is +76° C, use appropriate cables and cable gland

PVE-EX Ex eb mb Group IIB part numbers

Type	Part No.
PVEO-EX-24V	**11123166**
PVEH-EX	**11156608**
PVES-EX	**11156609**
PVEH-U-EX	**11156610**
PVES-U-EX	**11156569**
PVES120-U-EX	**11156613**
PVEO120-EX-24V	**11156571**
PVES120-EX	**11156612**
PVEH120-EX	**11161001**
PVEO256-EX-24V	**11241525**
PVES256-U-EX	**11241590**
PVES256-EX	**11241519**

General information

Description of the EX code, eb mb versions

IEC marking of the EX code, eb mb versions

Description	IEC Marking
Explosion protection marking	**Ex**
Protection type	**eb mb**
Equipment Group	**IIb**
T-class	**T4**
Equipment Protection Level (EPL)	**Gb**

EU marking of the EX code, eb mb versions

Description	EU Marking
CE conformity marking	**CE**
Identification number of notified body involved in production control stage	**0470**
Explosion protection marking	
Equipment Group	**II**
Equipment Category	**2G**

EPL / Equipment Category

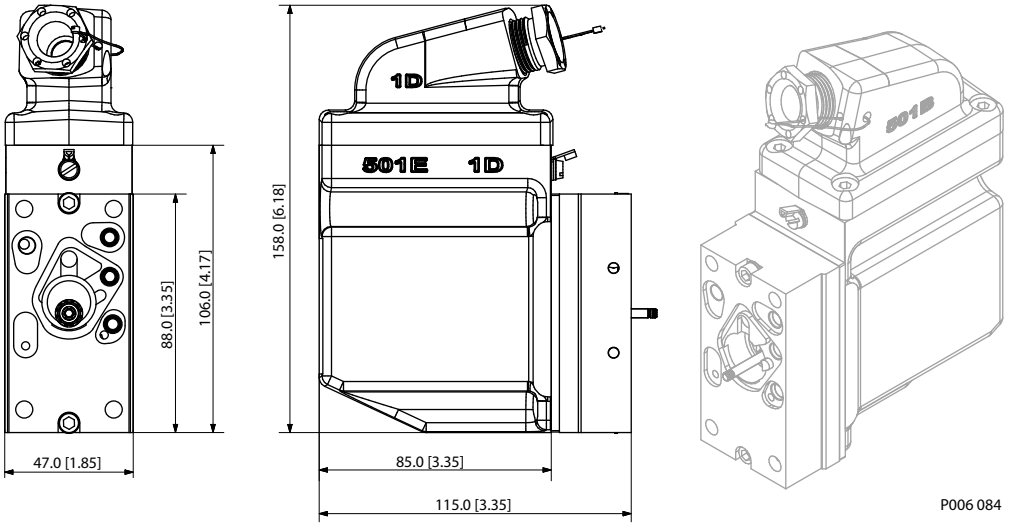
EPL/Equipment Category

Definition	Level of protection	Typical zone of application	IEC		EU	
			EPL	Group	Category	Group
Gas atmospheres	very high	0	Ga	II	1G	II
	high	1	Gb		2G	
	enhanced	2	Gc		3G	

Installation

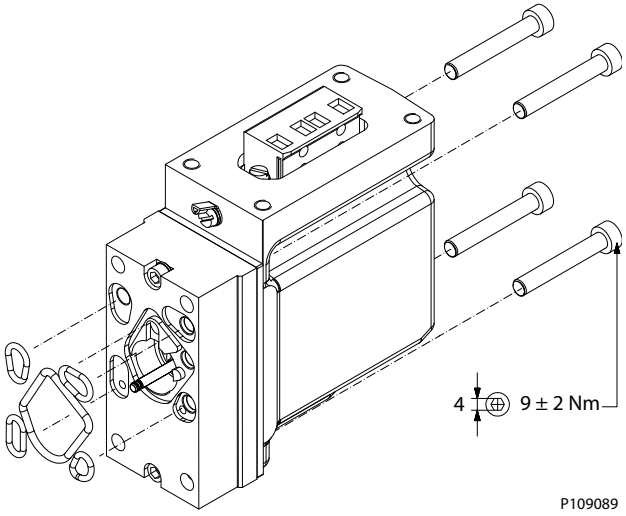
PVE-EX Dimensions

PVE-EX dimensions, mm [in]



Mounting of PVE-EX

1. Protect the LVDT pin. (PVEH-EX and PVES-EX actuators)
2. Ensure all O-rings are mounted and properly aligned in the grooves before mounting the PVE-EX to the PVG valve.
3. Only use the four screws (M6 x 40 mm) A2, Tensile strength min. 600 N/mm^2, 0,2% Proof stress min. 450 N/mm^2



Warning

The installation must be performed as intended in order to have a safe system and a proper functional application. In a case of damage to enclosure, plug or cable, the PVE-EX actuator must be replaced. Please refer to the information in this manual for assistance, or consult with a professional.

Installation

Mounting of Cable

The PVE-EX is equipped with a top part that holds the cable gland for cable installation.

1. Remove the insulation of an appropriate length to expose the wires.

   If wire shall be connected to the earth terminal, make sure to have insulation enough to crimp into the cable shoe and attach properly to the chassis.

   Cable material must be according to the specification.
2. Strip the wires so that a suitable length of cooper is exposed.
3. Insert wires and cable through the gland and grommet.
4. Insert wires into screw terminals and tighten the screws.
5. Pull the cable back to the position where the cable insulation is still going through the grommet.
6. Immerse the terminal compartment and mate the male and female connector.
7. Ensure that the O-ring is properly seated in its groove and that excess wires are not trapped between the two elements.
8. Tighten the screws (M6 x 12 mm) to the specified torque 6 ± 1 N•m.
9. Tighten the gland to the specified torque in which the cable is locked correctly, then fix the safety wire (not included).

Use screws made from stainless steel grade A4 or stronger (enclosed).

Cable Gland

The PVE-EX is required to be installed with a cable specified to the surrounding conditions and to the given diameter of the cable gland. There are two options available for cable glands:

- Supplied built-in cable gland (certified with the product)
- Pre-certified standard cable gland (M20 x 1.5 mm threaded entry and 20 x 1.5 mm O-ring).

Supplied Built-in Cable Gland

The PVE-EX has a built in cable gland for cable installation. The cable gland and grommet ensures that the internal components are not exposed to the outside. Furthermore, the cable gland arrangement has to retain any flame and pressure that can occur inside the PVE-EX.

1. Choose the grommets delivered with PVE-EX for different cable diameters. (see the table below)

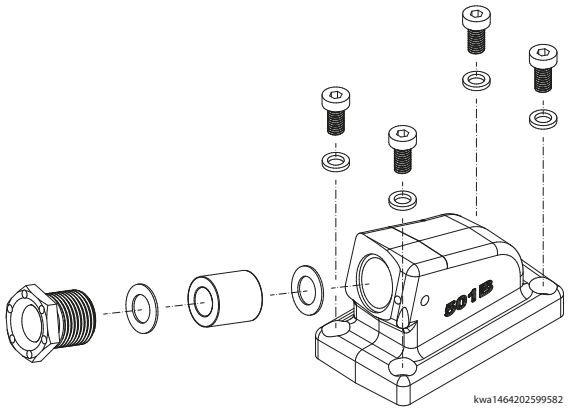
   The cable gland needs to meet the diameter of the cable and to the PVE-EX.

Grommet (inner dia)	**8.9 mm [0.356 in]**	**10.5 mm [0.42 in]**
Cable diameter span	7.9 to 8.9 mm [0.316 to 0.356 in]	9.9 to 10.5 mm [0.4 to 0.42 in]
Thread type, size	M20, 1.5 mm [0.06 in]	
Temperature span	-40 °C to +76 °C [-40 °F to +168.8 °F]	
Tightening torque	20 N•m	

2. Screw the cable gland at least 5 full threads.
3. Tighten the cable gland to the specified torque.

Installation

4. Install the safety wire (not included) between the cable gland and the top gland.



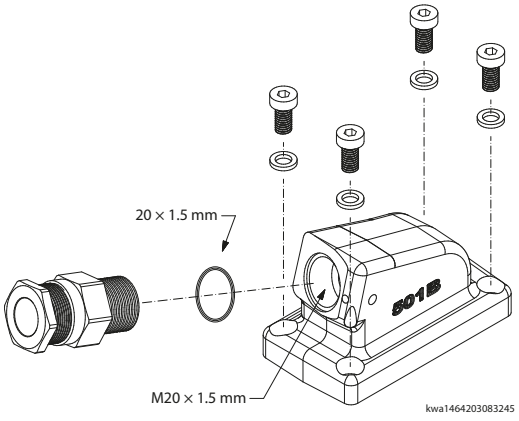
PVE-EX Pre-certified Cable Gland

For cable diameter specification, refer to the relevant instruction from the supplier of the pre-certified cable gland. In order to comply with the product certification the pre-certified cable gland must be marked with the following markings:

Marking	EU	IEC
Group II	II 2G	Ex d IIB Gb (-40° C ≤ ta ≤ +80° C) [-40° F to +176° F]

Warning

Pre-certified cable gland must have thread: M20 x 1.5 mm and must be sealed with O-ring Ø20 x 1.5 mm at the threaded entry.



Installation

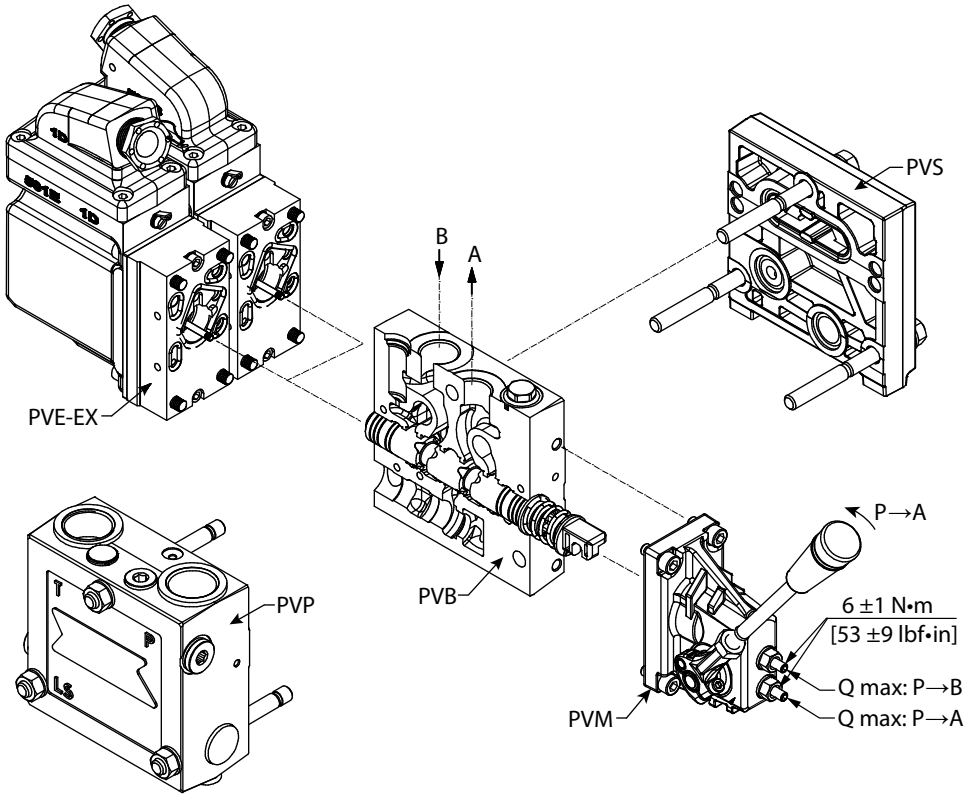
Mounting of PVG

For mounting information regarding PVG products, see Literature reference.

Mounting options and guidelines

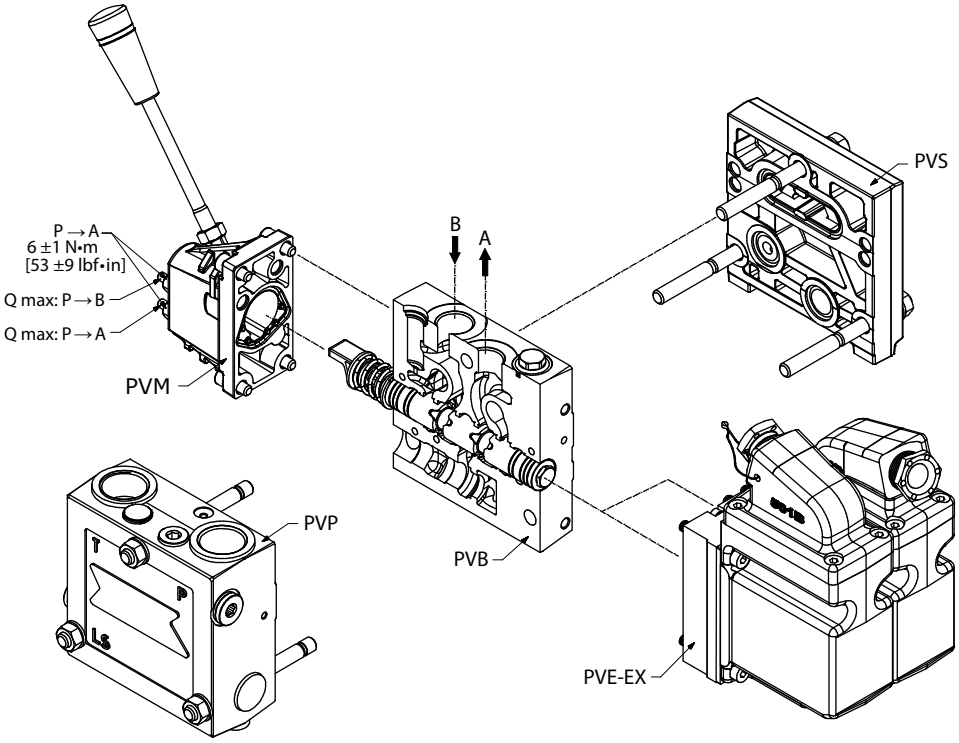
The PVE-EX can be installed as either standard or optional assembly.

Standard assembly



Installation

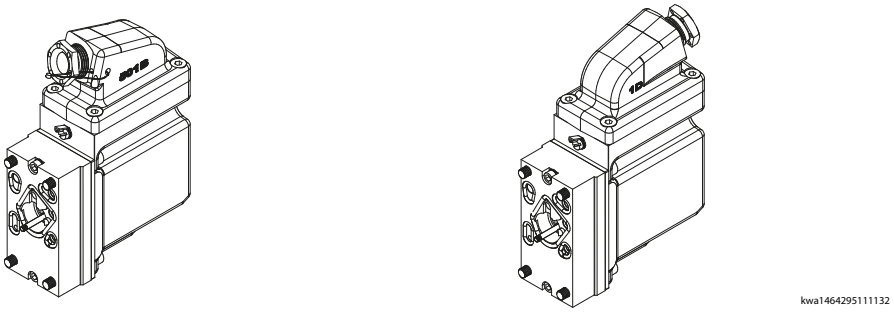
Optional assembly



Direction of cable exit

The design of the PVE-EX enables the customer to choose if the cable will exit towards or away from the PVG group.

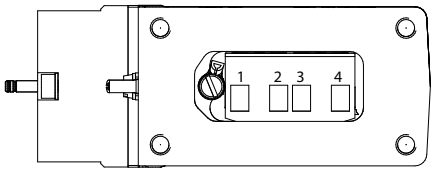
Cable exits towards PVG (left); Cable exits away from PVG (right)



Specifications

4-Pin layout

4-Pin connector, Group II



Minimum wire size	0.75 mm^2/AWG18
Maximum wire size	2.5 mm^2/AWG14

Versions	Pin 1	Pin 2	Pin 3	Pin 4
PVEO-EX-24V, PVEO120-EX-24V	U_{DC}-A	U_{DC}-B	GND	—
PVEH/-EX/-U-EX, PVES/-EX/-U-EX, PVES120/-EX/-U-EX, PVEH120-EX	U_s	V_{bat}	GND	Error

Radiometric Control Signal

Radiometric control signal for PVEH/PVES

PIN		Function	Versions
1	U_S	Demand signal	PVES-EX PVEH-EX PVES120-EX PVEH120-EX PVEH-DI-EX PVEH120-DI-EX PVEH-EX 128/256 PVEH256-Ex PVES256-Ex PVES256-DI-Ex PVEH256-DI-Ex
2	V_{bat2}	Supply voltage to solenoid valves (can be switched off separately)	
3	GND	Ground	
4	Error	Error pin (See *PVE-EX Fault Monitoring* on page 16)	

Control signal (U_S)

Neutral	Q: P → A	Q: P → B
$U_S = 0.5 \cdot U_{DC}$	$U_S = (0.5 \rightarrow 0.25) \cdot U_{DC}$	$U_S = (0.5 \rightarrow 0.75) \cdot U_{DC}$

Radiometric Fixed Control Signal (0-10 V)

Pin		Function	Versions
1	U_S	Demand signal	PVEH-U PVES-U-EX PVES120-U-EX PVEH-U EX 128/256 PVEH256-U-Ex PVES256-U-Ex
2*	V_{bat}	Supply Voltage	
3	GND	Ground	
4	Error	Error pin (See *PVE-EX Fault Monitoring* on page 16)	

* Pin 2 and 7 shall be connected together for PVE modules without the DI function

Control signal (U_S)

Neutral	Q: P → A	Q: P → B
$U_S = 5$ V	$U_S = 5$ V → 2.5 V	$U_S = 5$ V → 7.5 V

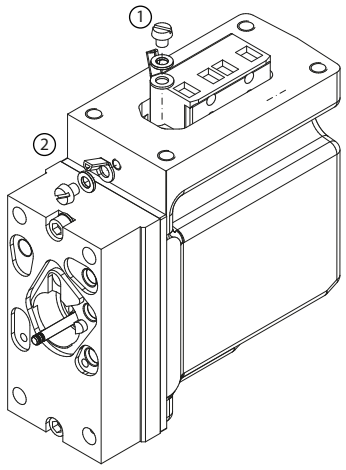
Specifications

Adjustment/calibration

The PVE-EX is pre-calibrated from the factory to be inside the dead band of the proportional valve. The position sensor built into the PVE-EX cannot be adjusted by user. Any biasing of the position has to be incorporated in the demand signal.

Earth Connection

Connector terminal



1. Internal earth terminals
2. External earth terminals

Internal earth connection

Internal earth terminal enables an earth wire to be connected to chassis.

1. Remove the insulation from the earth wire at a length that allows mounting the cable shoe to the threaded hole next to the connector.
2. Crimp or solder the earth wire to the cable shoe.
3. Attach the cable shoe to the chassis via the M4 screw, washer and spring washer.
4. Tighten the screws to the specified torque 2.5 ± 0.5 N•m. (M4 x 8 mm, Property class 70)

External earth connection

External earth terminal enables an earth wire to be connected to the PVE-EX.

1. Crimp or solder the earth wire to the cable shoe.
2. Attach the cable shoe to the chassis via the M4 screw, washer and spring washer.
3. Tighten the screws to the specified torque 2.5 ± 0.5 N•m. (M4 x 8 mm, Property class 70)

Fault monitoring

PVE-EX Fault Monitoring

Fault monitoring overview

PVE type		PVEH	PVEH-U	PVES	PVES-U	PVEO
Fault monitoring		Passive	Active	Passive	Active	No
Delay before error out		250 ms	500 ms	250 ms	500 ms	—
Fault monitoring memory (reset needed)		No	Yes	No	Yes	—
Error mode	No fault	Error output status – Low Fault output on PVE: < 2 V				—
	Input signal fault Transducer (LVDT) Close loop fault	Error output status – High Fault output on PVE: U_{DC}				—

Caution

The installation must be performed as intended in order to have a safe system.
Please refer to the information in this manual for an assistance, or consult with a professional.

Technical data

Fluid specification

The following data is from typical test results. Mineral based hydraulic oil with a viscosity of 21 mm^2/s [102 SUS] and a temperature of 50 °C [122 °F] was used for the hydraulic system testing.

Warning

The PVE is designed for use with pilot oil supply. Use without oil supply can damage the system. Intermission is no longer than 5 seconds and not more than once per minute.

Oil consumption

Supply voltage	Pilot oil flow function	PVEO/PVEH	PVES
Without	Neutral	0 l/min	0 l/min
With	Locked	0.1 l/min	0.1 l/min
	Actuating	0.7 l/min	0.8 l/min

Oil viscosity, Oil temperature and Pilot pressure

Parameter	Minimum	Maximum	Range
Oil viscosity	4 mm^2/s [39 SUS]	460 mm^2/s [2128 SUS]	12 - 75 mm^2/s [65 - 347 SUS]
Oil temperature	-30 ˚C [-22 ˚F]	90 ˚C [194 ˚F]	30 to 60 ˚C [86 to140 ˚F]
Pilot pressure (relative to T pressure)	10 bar [145 psi]	15 bar [217 psi]	Nominal 13.5 bar [196 psi]
Intermittent pressure peaks up to	–	50 bar [725 psi]	–

Filtering in the hydraulic system

Required operating cleanliness level (ISO 4406, 2017 version)	18/16/13

PVE-EX electrical data

Specification		PVEO	PVEH and PVES
Grade of enclosure EN 60529		IP 66 and IP 69k	
Ambient temperature	Minimum	-40 °C [-40 °F]	
	Maximum	60 °C [140 °F]	
Maximum (submitting) surface temperature, T4		135 °C [275 °F]	
Supply voltage	Rated	12 / 24 V_{DC}	11 – 30 V_{DC}
	Range PVEx-EX-12V	11 – 16 V_{DC}	N/A
	Range PVEx-EX-24V	22 – 30 V_{DC}	N/A
	Maximum ripple	5%	5%
Current consumption at rated voltage (12/24 V_{DC})	Typical	0.74 / 0.37 A	0.57 / 0.33 A
	Minimum	0.55 / 0.29 A	N/A
	Maximum	0.82 / 0.42 A	N/A
Power consumption at rated voltage		9 W	7 W
Input impedance in relation 0.5 x U_{DC}		N/A	12 kΩ
Fault monitoring	Maximum load	N/A	60 mA
	Reaction time at fault	N/A	500 ms

For more information about PVEO, PVES and PVEH versions please refer to Nameplate description.

Technical data

Reaction times

Reaction time for PVES/PVEH versions

Supply voltage	Function	Minimum	Rated	Maximum
Disconnected by means of neutral switch	From neutral position to max. spool travel	120 ms	150 ms	230 ms
	From max. spool travel to neutral position	65 ms	90 ms	175 ms
Constant voltage	From neutral position to max. spool travel	50 ms	120 ms	200 ms
	From max. spool travel to neutral position	65 ms	90 ms	100 ms

Reaction time for PVEO versions

Supply voltage	Function	Minimum	Rated	Maximum
Power on	From neutral position to max. spool travel	120 ms	180 ms	235 ms
Power off	From max. spool travel to neutral position			

Maintenance, service and troubleshooting

PVE-EX Installation, Start-up and Operation

The inspection intervals and definitions are to be seen in the standard EN/IEC 60079-17 and the corresponding Inspection schedules-table. Operators must under no circumstance try to repair or open a PVE-EX. A failing or damaged PVE-EX is to be replaced.

The PVE-EX module has a built- in thermal fuse. If the temperature rises above 102°C ±3°C, the thermal fuse will disconnect the power to the PVE-EX. It is not possible to change the thermal fuse. The PVE-EX actuator needs to be replaced.

Warning

The installation must be performed as intended in order to have a safe system and a proper functional application. In a case of damage to enclosure, plug or cable, the PVE-EX actuator must be replaced. Please refer to the information in this manual for assistance, or consult with a professional.

Warning

All national safety regulations must be fulfilled in connection with installation, start-up and operation of Danfoss PVE-EX electrical actuation's. Furthermore, the requirements of the Declaration of Conformity and national regulations for installations in potentially explosive atmospheres applies as well. Disregarding such regulations involves a risk of serious personal injury or extensive material damage.

Warning

Work in connection with the electrical actuations must be performed only by professionals and qualified persons.

Safety Guidelines

- If failure, damage or defect occurs, the PVE-EX has to be replaced.
- A failing PVE-EX must under no circumstance be repaired.
- No modifications, which could damage the explosion-safety and protection, are allowed to the PVE-EX, the cable gland, or on the cable.
- Demounting a PVE-EX must be done in an atmosphere with no potential for explosions.
- The machine and system approval has to be issued before using the PVE-EX in potentially explosive atmosphere.
- The manufacturer has the application responsibility and is solely responsible for the safety of the system.
- Deviations from recommended torque when mounting parts can harm performance and the PVE-EX.
- Do not adjust, bend or damage the position transducer (LVDT) as this will influence the safety and performance.
- If replacing the PVE-EX, the electrical and the hydraulic systems must be turned off and the oil pressure released.
- Hydraulic oil can cause both environmental damage and personal injuries.
- Actuator replacement can introduce contamination and errors to the system. It is important to keep the work area clean and components should be handled with care.

Warnings

PVE-EX warnings

Warning

All brands and all types of directional control or proportional valves, which are used in many different operation conditions and applications, can fail and cause serious damage.

You must perform a risk assessment. The machine builder/system integrator alone is responsible for making the final selection of the products and assuring that all performance, safety and warning requirements of the application are met.

The process for choosing the control system and safety levels is governed by the Machinery Directive 2006/42/EC and EU harmonized standard EN 13849 (Safety related requirements for control systems).

Warning

The installation must be performed as intended in order to have a safe system and a proper functional application. In a case of damage to enclosure, plug or cable, the PVE-EX actuator must be replaced. Please refer to the information in this manual for assistance, or consult with a professional.

Warning

- Not applying to the Operational Conditions can compromise safety.
- A PVG with PVE-EX can only perform according to specification if conditions in this Installation Guide are met.
- In particularly exposed applications, protection in the form of a shield is recommended.
- If the PVE-EX is in fault mode the quality of performance and validity of feedback is limited depending on the fault type.
- Error signals from more PVE-EX's must not be connected together. Inactive error pins are connected to ground and will disable any active signal. Error pins are signal pins and can only supply very limited power consumption.
- After replacement of actuators or cables wiring quality must be verified by a performance test.
- By actuation outside specified supply voltage range PVG will have reduced performance.
- The PVE-EX is not designed for use with supply voltage outside nominal.
- Obstacles for the Pilot oil can have direct influence on spool control.
- Reduced pilot oil pressure will limit spool control.
- Pilot oil pressure outside specification can damage the PVE-EX.
- The PVE-EX must be installed so that the flanged joints are not within 0.5 mm of a solid object that is not part of the PVG.

Certificates

EU Declaration of Conformity

ENGINEERING TOMORROW

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EU DECLARATION OF CONFORMITY

Danfoss A/S

Danfoss Power Solutions / BU SVS

declare under our sole responsibility that the following product(s) / component(s)

Product category:	Ex certified PVE Series 4 - PVE-Ex eb mb T4 Gb
Type designations:	PVEO32-EX-24V, PVEH32-EX, PVEH32-U-EX, PVES32-EX, PVES32-U-EX, PVEO120-EX-24V, PVEH120-EX, PVES120-EX, PVES120-U-EX, PVEO256-EX, PVES256-EX, PVES256-U-EX

Covered by this declaration is in conformity with the following directive(s), standard(s) or other normative document(s), provided that the product is used in accordance with our instructions.

CE 0470 Ex II 2G
Ex eb mb T4 Gb

Presafe 16ATEX8699X

QAN Notified body: 0470

Continued...

Date	Issued by	Date	Approved by
2019.11.12	**Lars Althof**	2019.11.12	
Director R&D Engineering		**Sr. Director Global Engineering SVS**	

Danfoss only vouches for the correctness of the English version of this declaration. In the event of the declaration being translated into any other language, the translator concerned shall be liable for the correctness of the translation

ID No. DOC00000433 Revision No. B Status D4G Approved Page 1 of 2

Certificates

ENGINEERING TOMORROW

ATEX Directive	**2014/34/EU**
EN60079-0:2012/A11:2013	Electrical apparatus for explosive gas atmospheres-part 0: General requirements
EN60079-7:2015	Explosive atmospheres – Part 7: Equipment protection by increased safety "e"
EN60079-18:2014	Electrical apparatus for explosive gas atmospheres – Part 18: Construction, test and marking of type protection encapsulation "m" electrical apparatus
EMC Directive	**2014/30/EU**
EN61000-6-4:2007/A1:2011	Electromagnetic compatibility - Emissions
EN61000-6-2:2005/AC:2005	Electromagnetic compatibility - Immunity

ID No. DOC00000433 Revision No. B Status D4G Approved Page 2 of 2

Certificates

EU-Type Examination Certificate

DNV·GL

EU-TYPE EXAMINATION CERTIFICATE

[2] EQUIPMENT OR PROTECTIVE SYSTEM INTENDED FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES DIRECTIVE 2014/34/EU

[3] EU-Type Examination Certificate Number: **Presafe 16 ATEX 8699 X** **Issue 3**

[4] Product: **Electrohydraulic actuator for proportional valve**

[5] Manufacturer: **Danfoss Power Solutions ApS**

[6] Address: **Nordborgvej 81**
DK-6430 Nordborg
Denmark

[7] This product and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

[8] DNV GL Presafe AS, notified body number 2460, in accordance with Article 17 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014, certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential reports listed in section 16.

[9] Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 60079-0:2012/A11:2013, EN 60079-7:2015/A1:2018 and EN 60079-18:2014/A1:2017.

[10] If the sign "X" is placed after the certificate number, it indicates that the product is subject to the Specific Conditions of Use specified in the schedule to this certificate.

[11] This EU - TYPE EXAMINATION CERTIFICATE relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.

[12] The marking of the product shall include the following:

Ex II 2 G Ex eb mb IIB T4 Gb, -40°C ≤ Tamb ≤ +60°C

Date of issue:
2020-02-28

NORSK AKKREDITERING
PROD 021

Asle Kaastad
For DNV GL Presafe AS
The Certificate has been digitally signed.
See www.dnvgl.com/digitalsignatures for info

This certificate may only be reproduced in its entirety and without any change, schedule included.
DNV GL Presafe AS, Veritasveien 3, 1363 Høvik, Norway, Tel +47 67 57 88 00, www.dnvgl.com

Page 1 of 3

Certificates

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[13] **Schedule**

[14] **EU-Type Examination Certificate No:** Presafe 16 ATEX 8699 X Issue 3

[15] **Description of Product**

Electrohydraulic actuator PVEX-yy-Ex is protected by combination of two types of protection, encapsulation and increased safety.

It consists of "housing", "housing top", "base plate", "valve block" with solenoid valves, "LVDT tube" fixed together by fasteners. All parts located in housing are encapsulated while "housing top" is making the increased safety enclosure compartment which includes the certified connection terminal.

"Valve Block", "Base plate", "Danfoss cable gland" are made from (carbon steel), Housing and Housing top made from cast iron with Zn plating (Cr3)12 µm. Enclosure is additionally protected against corrosion by coating of non-metallic layer.

Enclosure is provided with one threaded entry M20x1.5 located in "housing top. It can be either used for pre-certified cable gland or equipped with integrated "Danfoss cable gland" certified as part of the enclosure.

Type designation

Type Designation	Applicable Models
PVEx – yy - EX	PVEO-EX-24V PVEH-EX PVES-EX PVEH-U-EX PVES-U-EX PVEO-EX-12V PVES120-EX PVEH120-EX PVEH120-U-EX PVEO120-EX-12V PVEO120-EX-24V PVES120-U-EX PVEO256-EX-12V PVEO256-EX-24V PVES256-EX PVES256-U-EX PVEH256-EX PVEH256-U-EX

Electrical Data
Voltage:
-proportional types (PVEH … and PVES…) 11-30 V DC
-on/off types (PVEO…) 22-30 V DC.
Current: 0.33 A

Degrees of protection (IP Code)
IP66

Ambient temperature:
-40°C to +60°C

DNV GL Presafe AS, Veritasveien 3, 1363 Høvik, Norway, Tel +47 67 57 88 00, www.dnvgl.com

Certificates

DNV·GL

Routine tests
Dielectric strength test according to EN 60079-7:2014, Clause 7.1. (500V R.M.S.) (0-5%) at 48-62 Hz maintained 60s or 1.2 x test voltage maintained at least 100 ms.
Dielectric strength test according to EN 60079-18:2014 Cl. 8.2.4 with same conditions as above.
Visual inspections according to EN 60079-18:2014 Cl. 9.1

[16] **Project No:**
Report No.: D0001015-em

[17] **Specific Conditions of Use**

X – "Originally supplied "Danfoss cable gland" may not provide sufficient clamping. User shall provide additional clamping of the cable to ensure that pulling and twisting is not transmitted to the terminations".

[18] **Essential Health and Safety Requirements**

Essential Health and Safety Requirements (EHSRs) are covered by the standards listed at item 9

[19] **Drawings and documents**

Number	Title	Rev.	Date
DWG00000543	PVE32-without LVDT-Ex e mb	E	2019-08-16
DWG00000544	PVE120-without LVDT-Ex e mb	E	2019-08-16
DWG00000545	PVE120-with LVDT-Ex e mb	E	2019-08-16
DWG12069346	PVE32-LVDT-Ex e mb	F	2019-08-16
DWG00007179	PVE256-without LVDT-Ex eb mb	B	2019-09-05
DWG00007186	PVE256-with LVDT-Ex eb mb	B	2019-09-05
DOC00000592	PVE-Ex eb mb marking plate	C	2018-09-05

[20] **Certificate History**

Issue	Description	Issue date	Report no.
0	Original issue	2017-02-01	D0001015-em
1	Minor design and documentation change	2017-06-29	D0001015-em/01
2	Minor design and documentation change, update ac the harmonized standards.	2018-08-13	D0001015-em/02
3	Minor design and documentation change, new mode included.	2020-02-28	D0001015-em/03

END OF CERTIFICATE

DNV GL Presafe AS, Veritasveien 3, 1363 Høvik, Norway, Tel +47 67 57 88 00, www.dnvgl.com

IECEx Certificate of Conformity

Certificates

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification System for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	**IECEx PRE 14.0008X**	Page 1 of 5	Certificate history:
Status:	**Current**	Issue No: 3	Issue 2 (2016-12-21) Issue 1 (2015-08-21) Issue 0 (2014-12-15)
Date of Issue:	2020-04-02		
Applicant:	**DANFOSS POWER SOLUTIONS ApS** Nordborgvej 81 DK-6430 Nordborg **Denmark**		
Equipment:	**Electrohydraulic actuator for proportional valve**		
Optional accessory:			
Type of Protection:	**Ex-d**		
Marking:	Ex db I Mb, -40°C < Tamb < +60°C Ex db IIB T5 Gb, -40°C < Tamb < +60°C		

Approved for issue on behalf of the IECEx Certification Body: **Asle Kaastad**

Position: **Certification Manager**

Signature: (for printed version)

Date:

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting www.iecex.com or use of this QR Code.

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1363 Høvik
Norway

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Certificates

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification System for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	**IECEx PRE 16.0060X**	Page 1 of 4	Certificate history:
Status:	**Current**	Issue No: 3	Issue 2 (2018-08-13) Issue 1 (2017-06-30) Issue 0 (2017-02-01)
Date of Issue:	2020-02-28		
Applicant:	**Danfoss Power Solutions Aps** Nordborgvej 81 DK-6430 Nordborg **Denmark**		
Equipment:	**Electrohydraulic actuator for proportional valve**		
Optional accessory:			
Type of Protection:	**Ex e, m**		
Marking:	Ex eb mb IIB T4 Gb, Ta -40°C to +60°C		

Approved for issue on behalf of the IECEx Certification Body: **Asle Kaastad**

Position: **Certification Manager**

Signature: (for printed version) Asle Kaastad

Date: 2020-02-28

1. This certificate and schedule may only be reproduced in full.
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Certificate issued by:

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Norway

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Certificates

IECEx Certificate of Conformity

Certificate No.: **IECEx PRE 16.0060X** Page 2 of 4

Date of issue: 2020-02-28 Issue No: 3

Manufacturer: **Danfoss Power Solutions ApS**
Nordborgvej 81
DK-6430 Nordborg
Denmark

Additional manufacturing locations:

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements.This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended

STANDARDS :
The equipment and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards

IEC 60079-0:2011 Edition:6.0 — Explosive atmospheres - Part 0: General requirements

IEC 60079-18:2017 Edition:4.1 — Explosive atmospheres - Part 18: Protection by encapsulation "m"

IEC 60079-7:2017 Edition:5.1 — Explosive atmospheres - Part 7: Equipment protection by increased safety "e"

This Certificate **does not** indicate compliance with safety and performance requirements other than those expressly included in the Standards listed above.

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in:

Test Report:

NO/PRE/ExTR16.0075/03

Quality Assessment Report:

NO/NEM/QAR13.0010/04

Certificates

IECEx Certificate of Conformity

Certificate No.: **IECEx PRE 16.0060X** Page 3 of 4

Date of issue: 2020-02-28 Issue No: 3

EQUIPMENT:
Equipment and systems covered by this Certificate are as follows:

Electrohydraulic actuator PVEx-yy-EX is protected by combination of two types of protection, encapsulation and increased safety.

It consist of "housing", "housing top", "base plate", "valve block" with solenoid valves, "LVDT tube" fixed together by fasteners. All parts located in housing are encapsulated while "housing top" is making the increased safety enclosure compartment which includes the certified connection terminal.

"Valve Block", "Base plate", "Danfoss cable gland" are made from (carbon steel), Housing and Housing top made from cast iron with Zn plating (Cr3)12 µm. Enclosure is additionally protected against corrosion by coating of non-metallic layer.

Enclosure is provided with one thread entry M20x1.5 located in "housing top". It can be either used for pre-certified cable gland or equipped with integrated "Danfoss cable gland" certified as part of the enclosure.

Type identification: PVEx – yy – EX

Applicable models:
PVEO-EX-24V, PVEO-EX-12V, PVEH-EX, PVES-EX, PVEH-U-EX, PVES-U-EX, PVES120-U-EX, PVEO120-EX-24V, PVEO120-EX-12V, PVES120-EX, PVEH120-EX, PVEH120-U-EX, PVEO256-EX-12V, PVEO256-EX-24V, PVES256-EX, PVES256-U-EX, PVEH256-EX, PVEH256-U-EX, PVEO120- EX-12.

Electrical data:
Voltage:
-proportional types (PVEH … and PVES…) 11-30 V DC
-on/off types (PVEO…) 22-30 V DC.
Current: 0.33 A

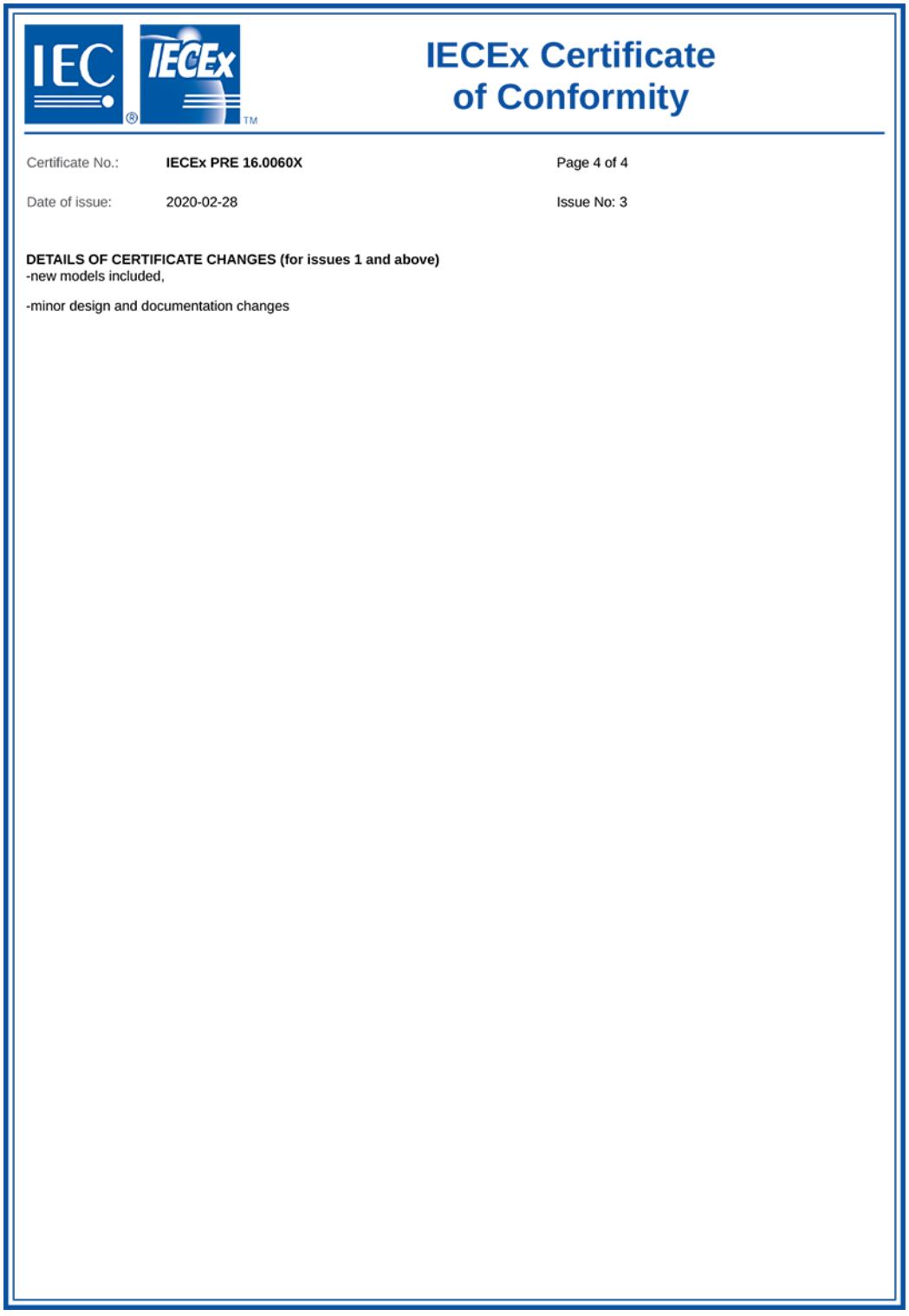
Ambient temperature range:
-40°C to +60°C

Degrees of protection (IP Code):
IP66

Routine tests:
-Visual inspections needs to be done by the manufacturer on each piece of equipment according to Clause 9.1 of IEC 60079-18:2014.
-Dielectric strength test according to Clause 7.1 of IEC 60079-7:2015 (500V R.M.S.) (0-5%) at 48-62 Hz maintained 60s or 1.2 x test voltage maintained at least 100 ms.
-Dielectric strength test according to IEC 60079-18:2014 Clause 8.2.4 with same conditions as specified above

SPECIFIC CONDITIONS OF USE: YES as shown below:
Originally supplied "Danfoss cable gland" may not provide sufficient clamping. User shall provide additional clamping of the cable to ensure that pulling and twisting is not transmitted to the terminations".

Certificates



IECEx Certificate of Conformity

Certificate No.: **IECEx PRE 16.0060X** Page 4 of 4

Date of issue: 2020-02-28 Issue No: 3

DETAILS OF CERTIFICATE CHANGES (for issues 1 and above)
-new models included,

-minor design and documentation changes

ENGINEERING
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- DCV directional control valves
- Electric converters
- Electric machines
- Electric motors
- Gear motors
- Gear pumps
- Hydraulic integrated circuits (HICs)
- Hydrostatic motors
- Hydrostatic pumps
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- PLUS+1® controllers
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- PLUS+1® software
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