ENGINEERING
TOMORROW

Application guide

Industrial Refrigeration systems in Potentially Explosive Atmospheres

(Hazardous area) ATEX 2014/34/EU Directive
[ATmosphères EXplosives]

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Contents

Introduction

Industrial refrigeration components are typically used in ammonia refrigeration systems, but some components are used in related applications, where locations are classified as hazardous areas.

Danfoss has over several years supplied components to this business area, particularly in Europe. However, due to new, more restrictive regulations, refrigeration components and refrigeration systems must fulfil requirements for potentially explosive atmospheres, as specified in the ATEX directive. PRS systems (Process Refrigeration Systems) are typically classified as hazardous areas, where the ATEX requirements also must be fulfilled.

The ATEX 2014/34/EU directive is one of the "new" European directives. The ATEX directive specifies the requirements for equipment intended for use in potentially explosive atmospheres.

The ATEX directive is mandatory in all EU and EFTA member states.

Disclaimer

This application guide has been developed based on present European directives and standards in order to describe relevant solutions for industrial applications.

Danfoss do not take any responsibility of specific application solutions. It is the designer of the system that has the responsibility to ensure compliance with all relevant requirements..

Application area for ATEX and Harmonised Standards

The ATEX as well as the harmonised technical standards state requirements for:

- Design of equipment / manufacture of equipment / testing of equipment
- Compliance with the ATEX directive ensures free movement of goods / equipment between all EU-member states and it also ensures that the equipment can be put into service, if there are no particular requirements for the country of destination.
  Important! - The zone classification for the country of destination of a final refrigeration system has to be approved by local authorities. If local authorities require higher classification than the actual equipment is approved for, the system must not be used
- Installation and start up

The ATEX directive does not state requirements for:

- **Operation** – When the equipment is operating at the end-users facility, national laws become effective

Gas Zones

Gas Zones				
Gas Zones	**Definition**	**ATEX Category**	**EPL**	**Required Protection**
Zone 0	Explosive atmosphere present continuously or for long periods, frequently	1G	Ga	Two Faults
Zone 1	Explosive atmosphere is likely to occur under normal conditions, occasionally	2G	Gb	One Fault
Zone 2	Explosive atmosphere is unlikely to occur under normal conditions, short periods	3G	Gc	Normal Operation

Fig. 1 Gas zones

Scope of ATEX

Included in the ATEX Directive: -

- Mining and non-mining equipment
- Explosive atmospheres caused by gas and dust
- Electrical and non-electrical equipment
- Equipment (machines, devices, built-in instruments or mobile devices)
- Security systems (equipment which can stop / limit explosions)
- Components (parts without any independent function)
- Security control and regulation devices intended for use outside explosive areas, but which secure the equipment in the hazardous areas

Not included in the ATEX Directive: -

- Medical equipment for hospital environments
- Equipment and protection systems for use in connection with explosive or unstable chemicals
- Household appliances and equipment intended for use in non-commercial surroundings
- Personal Protection Equipment directive
- Tankers and mobile offshore units.
- Means of transport except vehicles

Equipment for mining industries and explosive atmospheres caused by dust are not covered in this application guide.

Non-mining equipment for potential explosive atmospheres; classified as:

Equipment Group II.
– Category 1
– Category 2
– Category 3

The requirements in the categories depend on the type of equipment.

- Simple mechanical components like valves, filters, check valves, etc. do normally not contain any potential ignition source, and are therefore not covered by the ATEX-directive. Manufacturers of this kind of equipment, must nevertheless carry out and keep a risk assessment report, to prove that the equipment does not have an ignition source and are safe for the purpose
- Mechanical components with potential ignition sources e .g . components containing nonconductive materials, are covered by the ATEX-directive. These products must fulfil all requirements in the ATEX directive and must be marked with the required Ex marking
- Electrically operated components are covered by the ATEX-directive and have to fulfil all requirements in the ATEX directive and have to be marked with the required Ex marking

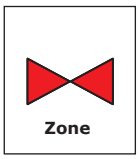
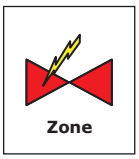
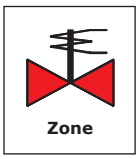
	Non electrical valve without potential ignition source  • Stop valves • Filters • Check valves • Etc.	Non electrical valve with potential ignition source  Not relevant for common industrial refrigeration components	Electrical operated valve  • Electronic comp. • Coils • Etc.
Category 1 (Zone 0)	**Not covered by the scope of ATEX Directive 2014/34/EU**	**CE-Type approval III + IV or V**	**CE-Type approval III + IV or V**
Category 2 (Zone 1)		**Documentation at Notified Body (VIII partly)**	**CE-Type approval III + IV or VII**
Category 3 (Zone 2)		**Internal quality control (VIII)**	**Internal quality control (VIII)**
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Fig. 2 - ATEX-requirements

NOTE:
The letters I, II,… .VIII in figure 2, specify the relevant ATEX 2014/34/EU directive "modules" that need to be complied with.

Explosion triangle for gas

The explosion triangle (fig. 3) shows the principle of explosion. All three elements must be present before an explosion can take place.

Removing one of the elements eliminates all risk of explosion.

In refrigeration, the consideration regarding the risk of explosion is limited to the outside of the system itself. Within the refrigeration system, there is 100% concentrated refrigerant with no oxygen present, consequently there is no risk of explosion.

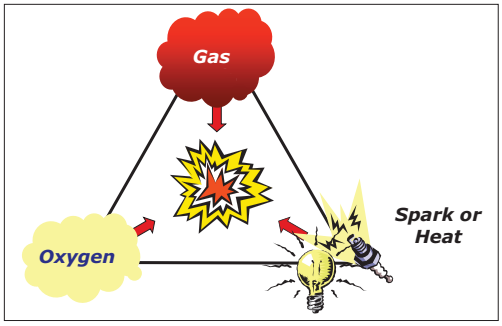

Fig. 3 - The explosion triangle

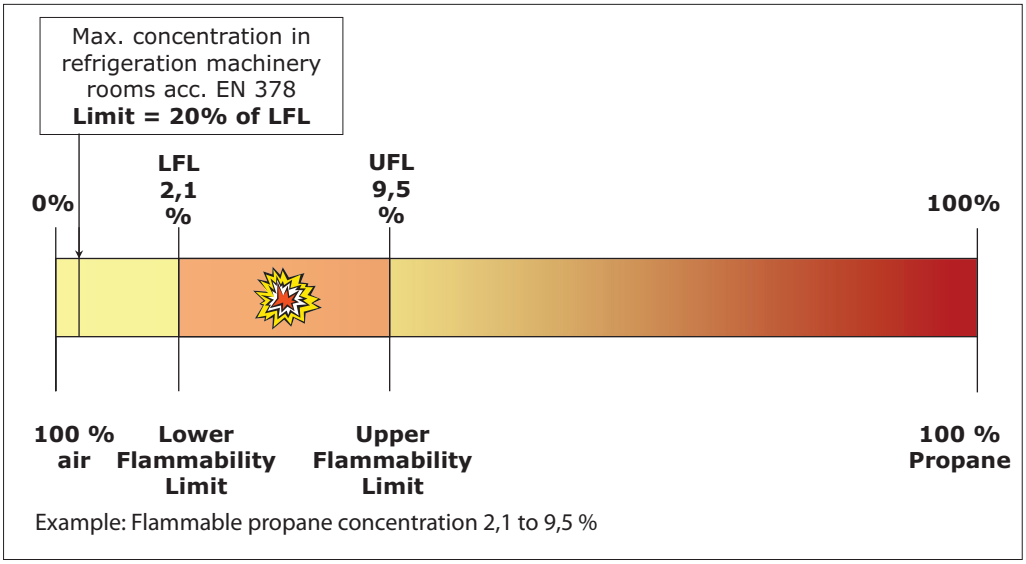

Fig. 4 Flammable concentration

Non-electrical equipment

The risk analysis of non-electrical refrigeration equipment (valves and similar components) must focus on ignition sources.

The requirements risk assessment for this kind of equipment must be conducted acc. EN/ISO 80079-36.

Examples:

- Non-conductive materials (e .g . plastic) are *not acceptable*. Non-conductive material can create "static electricity".
- Magnesium content
- Hot surfaces
- All possible sources of ignition must be analyzed and avoided

Simple components like stop valves, filters etc. without the above-mentioned ignition sources, are normally not covered within the scope of the ATEX directive.

Electrical equipment

The requirements for electrical equipment in hazardous areas are not new. The requirements specified in the ATEX directive are almost identical with the previous legislation and are much more demanding than the requirements for non-electrical equipment.

Several different methods can be used to protect electrical equipment. Detailed below are two commonly used methods of electrical protection.

Intrinsic safety protection method

Intrinsic safety is an explosion protection technique ensuring there is insufficient energy to cause the ignition of a surrounding explosive atmosphere by an electrical spark or the heating of components or circuitry.

Due to power consumption restrictions, this method is only suitable for equipment with low power consumption and is commonly used for measuring devices.

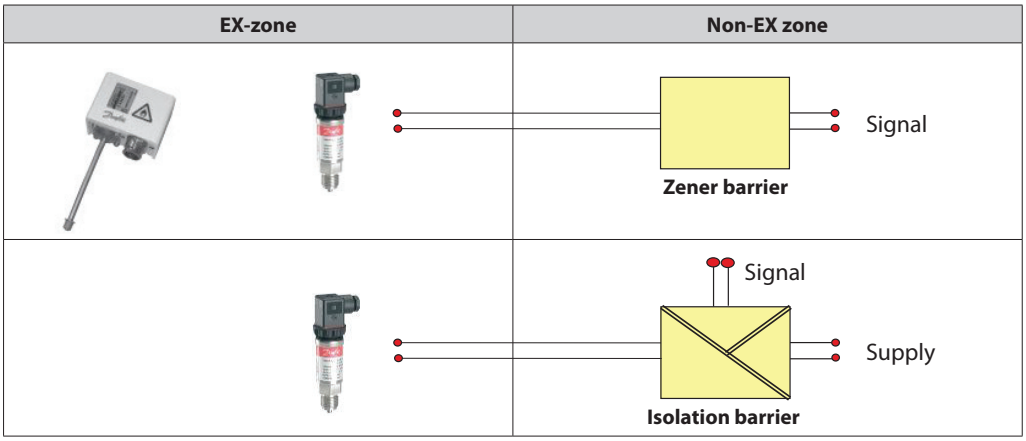

Fig. 5 - Intrinsic safety protection method

Encapsulation

Encapsulation is an explosion protection technique where the electrical components are fully encapsulated. This method is often used for components with" higher" power consumption e .g . solenoid coils. However, power consumption is also a limiting factor with this method due to the risk of "high" surface temperature of the component.

Note:
Solenoid valves with these coils can have relatively low MOPD .

Marking

Components covered within the scope of the ATEX directive have to be CE-marked, and marked with the specific Ex - sign . The marking depends on the actual type of equipment.

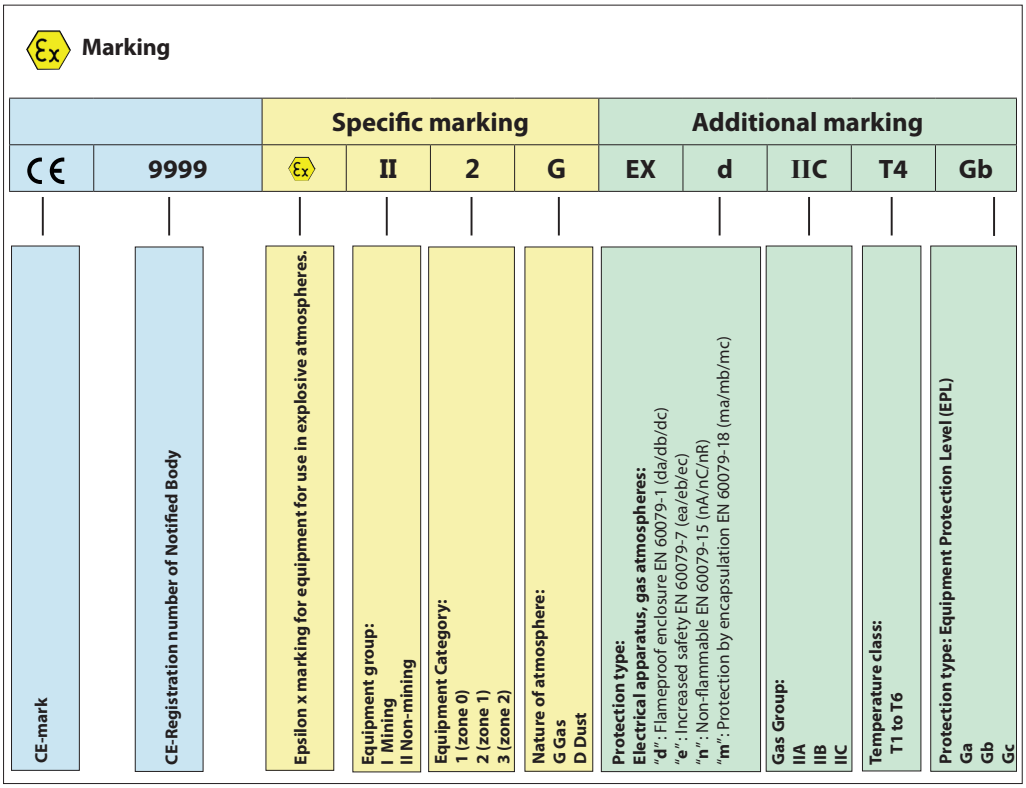

Fig. 6 - Ex -marking

Documentation

The required documentation depends on whether the component has an ignition source or not.

All components covered within the scope of the ATEX directive must be supplied with a CE declaration of conformity.

Non-electrical equipment without any ignition source, is not covered within the scope of the ATEX directive but must be supplied with the manufacturer's declaration.

The manufacturer's declaration must declare that the equipment is suitable for the purpose, and that it does not have any ignition sources. The manufacturer also has the obligation to document a safety risk assessment for the equipment.

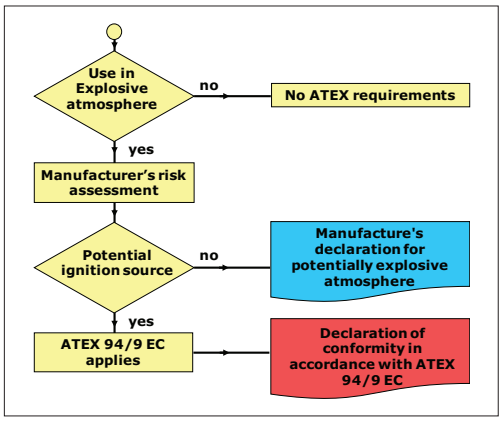

Fig. 7 - Documentation

Other requirements

The ATEX directive does not differentiate between different refrigerant types and for manufacturers of refrigerant valves, this is an important issue.

Refrigeration valves are normally designed for use with specific refrigerant types or groups of refrigerants. In PRS systems flammable refrigerants like propylene are often used.

When propylene is compared to e .g . ammonia it has many different material compatibility issues.

It is therefore very important that material compatibility is also evaluated.

The suitability of O-rings with the different refrigerant types depends on the compatibility judgement, and the actual type of sealing.

An O-ring with a judgement "fair", is normally suitable for all internal sealings, but not necessarily for external sealings. It is important to make sure that specific products are approved for the actual refrigerant.

Refrigerant (flammable)	Neoprene / CR (cloroprene) Used for standard refrigeration valves	Fluorcarbon FPM (Viton) NOTE [1])
Propane	fair	satisfactory
Butane	satisfactory	satisfactory
Iso-butane	fair	satisfactory
Propylene	unsatisfactory	satisfactory
Ethane	fair	satisfactory

[1]) *There are no FPM O-rings available for low temperature (below -40 °C)*

Fig. 8 - Material compatibility (sealing material / O-rings)

General zone classification

Components for use in hazardous areas are classified from Category 1 to Category 3 . Hazardous areas are classified in Zones; Zone 0 is the most restrictive and Zones 1 and 2 are less restrictive.

The zone classification of final equipment is very important. It is also important to acknowledge that local authorities must approve the specified zone classification of the final equipment. There is no standard available, where an exact definition of zones is made.

Valves and similar equipment in refrigeration systems located in hazardous areas classified for zone 2, 1 or 0, must fulfil the requirements in ATEX directive (Directive 2014/34/EU).

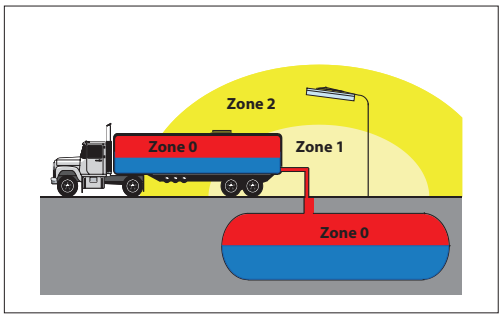

Fig. 9 - Zone-classification principle

Guideline – zone classification of refrigeration systems

- Locations for "standard "refrigeration systems with CFC, HCFC, HFC, Ammonia are "normally" not classified as hazardous areas. Requirements for ammonia are specifically mentioned in EN 378-2 (for information also see EN 378-2)
- Refrigeration systems located in hazardous areas (e .g . in petro chemical plants) have to fulfil requirements for "Potentially explosive atmospheres" irrespective of the refrigerant
- Industrial refrigeration systems with HC refrigerants (e .g . Propane, Butane, Propylene, etc.) are "normally" classified as hazardous areas
- Certain local authorities interpret the requirements so that equipment located in a machinery room for a HC refrigeration system is classified as Zone 2 if only one compressor is employed. If two compressors are present, and one of these is under service (e .g . changing oil), then it becomes Zone 1
- "Potentially explosive atmospheres" do not occur inside a refrigeration system because no oxygen is present. (Refrigeration systems designed and maintained according to EN 378 fulfil this requirement)
- "Potentially explosive atmospheres" can occur outside a refrigeration system (in the location of a refrigeration system)
- Refrigeration systems in "Potentially explosive atmospheres" can contain flammable or non- flammable refrigerants
- For refrigerant systems with flammable refrigerants, special consideration should be given to:
  - The tightness of the system
  - The correct equipment is being used e .g . sealing materials must be compatible with the refrigerant
  - The system is maintained correctly

Zone classification for refrigeration systems: Refrigeration systems are classified in relevant zones according to the risk for the location for a actual refrigerant system.

An actual refrigeration system can be classified in different zones, for different part of the system.

Equipment group and zones

Equipment located in zone specified areas must fulfil the following requirements:

- Category 3 - approved equipment can be installed in hazardous areas zone 2 and outside zone categorized areas
- Category 2 - approved equipment can be installed in hazardous areas zone 1, zone 2 and outside zone categorized areas
- Category 1 - approved equipment can be installed in hazardous areas zone 2, zone 1, zone 0 and outside zone categorized areas

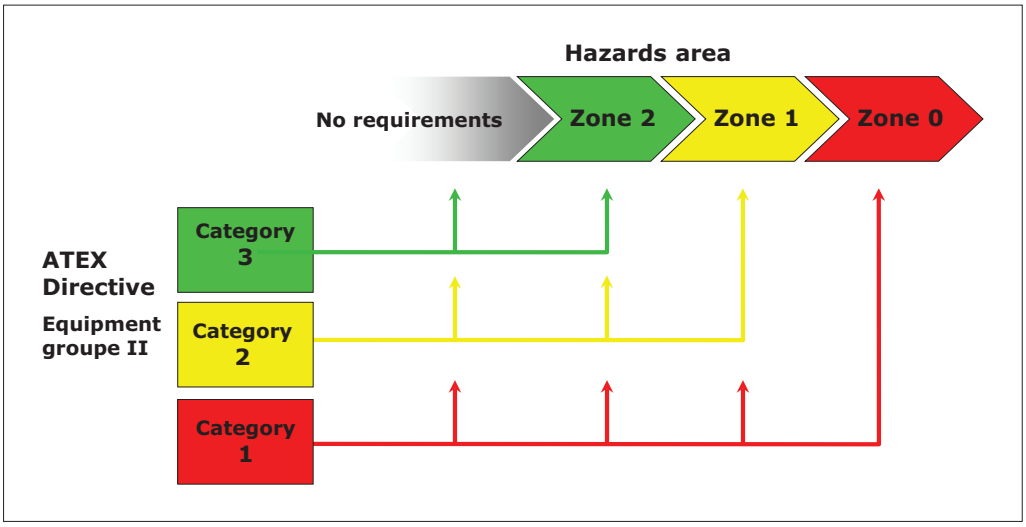

Fig. 10 - Category relations

Products approved acc ATEX directive

Solenoid coil type BO	CE 0539 Ex II 2G Ex mb IIC T4 Gb	Zone 1
Solenoid coil type BZ	CE 0539 Ex II 2G Ex mb IIC T4 Gb	Zone 1
Pressure transducer type AKS 32,32R,33 & EMP2	CE Ex II 3G Ex nA IIA T3 Gc	Zone 2
Pressure transducer type MBS 4201 & 4251	CE 0539 Ex II 1G Ex iA IIC T6..T4 Ga	Zone 0
Gas detector Type GD HeawyDuty	CE 0158 Ex II 2G Ex db IIC T4 Gb	Zone 1
Pressure & Temperature switches RTxxxE	CE 0539 Ex II 2G Ex ia IIC T6..T1 Gb	Zone 1

Fig. 11 Danfoss products approved according to ATEX directive

ANNEX I

Equipment Groups and Temperature Classes - EXPLOSION PROOF SOLENOIDS

CLASSIFICATION OF GASES INTO EXPLOSION GROUPS

Group I : Electrical equipment intended for use in the underground parts of mines, and to those parts of surface installations of such mines, likely to become endangered by firedamp and/or combustible dust.

Group II : Electrical equipment intended for use in other places likely to become endangered by explosive atmospheres (surface industries).

For the types of protection **"d"** and **"i"**, group **II** is subdivided into **IIA**, **IIB**, **IIC**. Electrical apparatus certified for **IIB** may be used in applications requiring apparatus to be certified for group **IIA**. Electrical apparatus certified for **IIC** may be used in applications requiring apparatus to be certified for groups **IIA** and **IIB**.
For example the **"d"** and **"i"** types of protection are respectively subdivided according to the Maximum Experimental Safe Gap (MESG) and to the Minimum Igniting Current (MIC).
Electrical apparatus certified for **IIB** may be certified for use with a gas belonging to group **IIC**. In this case, the identification is supplemented with the chemical symbol or the name of the gas (example: Ex d IIB + H2 according to EN 60079-0 and EN 60079.1). The table below indicates the groups to which some gas mixtures belong:

Groups		Gas	Ignition temperature[a] (°C)	Temperature class					
				T1	T2	T3	T4	T5	T6
I		methane (firedamp)							
II	A	acetone	540	•					
		acetic acide	485	•					
		ammonia	630	•					
		ethane	515	•					
		methylene chloride	556	•					
		methane (CH_4)	537	•					
		carbon monoxyde	605	•					
		propane	470	•					
		n-butane n-butyl	365		•				
			370		•				
		n-hexane	240			•			
		acetaldehyde ethyl ether	140				•		
			160				•		
		ethyl nitrite	90						•
	B	ethylene	425		•				
		ethyl oxyde	429 - 440		•				
		hydrogen sulfide	270			•			
	C	acetylene (C_2H_2)	305		•				
		carbon disulphide (CS_2)	102						•
		hydrogen (H_2)	560	•					

[a] Temperature of a hot surface able to ignite a gas mixture.
The ignition temperature of the gas mixture must be higher than the maximum surface temperature. In practice, a 10 to 20% safety margin is observed between the ignition temperature and the rated nameplate temperature.
The ignition temperature of a cloud of dust is generally between 300 °C and 700 °C. At 150 °C to 350 °C, the ignition temperature of a layer of dust is far below that of a dust cloud. A burning dust layer can initiate a dust explosion if brought in contact with a combustible dust cloud, so these values must be taken into account to limit the risk.

TEMPERATURE CLASS

The temperature classification is based on the maximum surface temperature of equipment. That is the highest temperature any part of or the entire surface of an electrical device can reach under the most unfavourable operating conditions capable of igniting a surrounding explosive atmosphere.

Group I : Temperature ≤ 150 °C or ≤ 450 °C according to coal dust accumulation on equipment

Group II : Equipment must be classified and marked:

- preferably with the temperature class (T classification)
- defined by the surface temperature or,
- limited to the specified flammable gases or dusts for which it is approved, if necessary (and marked accordingly).

Temperature class	Maximum surface temperature (°C)	Ignition temperature [1] (°C)
T1	450	>450
T2	300	>300
T3	200	>200
T4	135	>135
T5	100	>100
T6	85	>85

ANNEX II
Classification of Danfoss Industrial Refrigeration products

Group	Product groups - ATEX requirements		"Non-flammable" refrigerants (Ammonia, CFC,HCFC, HFC,CO_2)				Flammable refrigerants (Propane, Butane, Iso-butane, Ethane) (NOT PROPYLENE)				Flammable refrigerants (PROPYLENE)			
	Hazardous area		Outside Category / Zone	Zone 2	Zone 1	Zone 0	Outside Category / Zone	Zone 2	Zone 1	Zone 0	Outside Category / Zone	Zone 2	Zone 1	Zone 0
	ATEX Equipment group / Component type			Category 3	Category 2	Category 1		Category 3	Category 2	Category 1		Category 3	Category 2	Category 1
A	*Component which can be used to all refrigerants and - cannot be mounted with any electrically pilots / equipment and - have no ignition sources*													
	Stop Valves	SVA-S/L ,SVA-SS, SVA-DH/DL	X	X	X	-	X	X	X	-	X	X	X	-
	Filters FIA	FIA, FIA-SS	X	X	X	-	X	X	X	-	X	X	X	-
	Check Valves	NRVS	X	X	X	-	X	X	X	-	X	X	X	-
	Check Valves	NRVA	X	X	X	-	X	X	X	-	X	X	X	-
B	*Component which can be used to Ammonia, CO_2, CFC, HCFC, HFC refrigerants and specific HC-refrigerants and - cannot be mounted with any electrically pilots / equipment and - have no ignition sources*													
	Regulating Valves - REG	REG, REG-SS	X	X	X	-	X	X	X	-	-	-	-	-
	Stop Check Valves SCA	SCA, SCA-SS	X	X	X	-	X	X	X	-	-	-	-	-
	Check Valves	CHV, CHV-SS	X	X	X	-	X	X	X	-	-	-	-	-
	Overflow Valves	OFV, OFV-SS	X	X	X	-	-	-	-	-	-	-	-	-
	Float Valves	HFI	X	X	X	-	-	-	-	-	-	-	-	-
	Float Valves	SV	X	X	X	-	-	-	-	-	-	-	-	-
	Pilots for ICS Valves	CVP-L, CVP-M, CVP-H	X	X	X	-	-	-	-	-	-	-	-	-
	Pilots for ICS Valves	CVC-L, CVC-M	X	X	X	-	-	-	-	-	-	-	-	-
	Safety Valves	SFA	X	X	X	-	-	-	-	-	-	-	-	-
	Safety Valves	SFV	X	X	X	-	-	-	-	-	-	-	-	-
	Safety Valves	BSV	X	X	X	-	-	-	-	-	-	-	-	-
	Change Over Valves for Safety Valves	DSV	X	X	X	-	-	-	-	-	-	-	-	-
	Safety Valves	POV	X	X	X	-	-	-	-	-	-	-	-	-
C	*Component which can be used to Ammonia, CO_2, CFC, HCFC, HFC refrigerants and - can be mounted with electrically pilots / equipment and - have no ignition sources*													
								Note: Only EX approved coils, if any coils are used						
	Main Valves (control valves)	ICS 1 ICS 3	X	X	X	-	-	-	-	-	-	-	-	-
	Main Valves (control valves)	PMC	X	X	X	-	-	-	-	-	-	-	-	-
	Modulating liquid level regulators	PMFH	X	X	X	-	-	-	-	-	-	-	-	-
	Pilots for ICS Valves	EVM	X	X	X	-	-	-	-	-	-	-	-	-
	Electrically operated expansion valve	AKVA	X	X	X	-	-	-	-	-	-	-	-	-
	Solenoid Valves	EVRS	X	X	X	-	-	-	-	-	-	-	-	-
	Solenoid Valves	EVRA	X	X	X	-	-	-	-	-	-	-	-	-
D	*Component with special sealing material for HC-refrigerants* (Propane, Butane, Iso-butane and Propylene) *and - can be mounted with electrically pilots / equipment and - have no ignition sources*													
								Note: Only EX approved coils, if any coils are used						
	Main Valves (control valves)	ICS 3E	-	-	-	-	X	X	X	-	X	X	X	-
	Modulating liquid level regulators	PMFHE	-	-	-	-	X	X	X	-	X	X	X	-
	Modulating liquid level regulators	SV3E	-	-	-	-	X	X	X	-	X	X	X	-
	Pilots for ICS Valves	CVPE-L, CVPE-M	-	-	-	-	X	X	X	-	X	X	X	-
	Pilots for ICS Valves	CVCE-L	-	-	-	-	X	X	X	-	X	X	X	-
	Pilots for ICS Valves	EVME	-	-	-	-	X	X	X	-	X	X	X	-
	Safety Valves	SFVE	-	-	-	-	X	X	X	-	X	X	X	-
	Safety Valves	BSVE	-	-	-	-	X	X	X	-	X	X	X	-
E	*Component **not** to be used in hazardous areas Components in this group has an ignition source*													
	Motor Valves	ICM	-	-	-	-	-	-	-	-	-	-	-	-
	Level controls (switch)	AKS 38, LLS 4000	-	-	-	-	-	-	-	-	-	-	-	-
	Electronic regulators	all	-	-	-	-	-	-	-	-	-	-	-	-
	"Standard" coils	all	-	-	-	-	-	-	-	-	-	-	-	-
	Pilots	CVE	-	-	-	-	-	-	-	-	-	-	-	-
F	*Electrically component to be used in hazardous areas*													
	Solenoid coil type BO	CE 0539 Ex II 2G Ex mb IIC T4 Gb	X	X	X	-	X	X	X	-	X	X	X	-
	Solenoid coil type BZ	CE 0539 Ex II 2G Ex mb IIC T4 Gb	X	X	X	-	X	X	X	-	X	X	X	-
	Pressure transducer type AKS 32,32R,33 & EMP2	CE Ex II 3G Ex nA IIA T3 Gc	X	X	-	-	X	X	-	-	X	X	-	-
	Pressure transducer type MBS 4201 & 4251	CE 0539 Ex II 1G Ex iA IIC T6..T4 Ga	X	X	X	X	X	X	X	X	X	X	X	X
	Gas detector Type GD Heavy Duty	CE 0158 Ex II 2G Ex db IIC T4 Gb	X	X	X	-	X	X	X	-	X	X	X	-
	Pressure & Temperature switches RTxxxE	CE 0539 Ex II 2G Ex ia IIC T6..T1 Gb	X	X	X	-	X	X	X	-	X	X	X	-

ANNEX III
Example of:
Declaration of conformity in accordance with ATEX 94/9 EC

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Fax: +45 7449 0949

EU DECLARATION OF CONFORMITY

Danfoss A/S

Industrial Automation

declares under our sole responsibility that the
Product category: Pressure Transmitter
Type designation(s): MBS 4201, MBS 4251, MBS 4701 and MBS 4751

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.

EMC Directive 2014/30/EU

- EN61000-6-2:2005 Generic standards – Immunity standard for industrial environments
- EN61000-6-3:2007/A1:2011 Generic standards – Emission standard for residential, commercial and light industrial environments.

RoHS Directive 2011/65/EU and 2015/863/EU

- EN 50581:2012 Technical documentation for the assessment of electrical and electronics products with respect to the restriction of hazardous substances

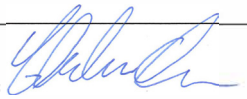
ATEX Directive 2014/34/EU

Equipment and protective systems intended for use in potentially explosive atmospheres

- EN 60079-0 : 2012 +A11 : 2013 — Equipment- general requirements
- EN 60079-11: 2012 — Equipment - protection by intrinsic safety "i"
- EN 60079-26: 2015 — Equipment - protection level (EPL) Ga

MBS 4201 / MBS 4251	MBS 4701 / MBS 4751
CE 0539 Ex II 1G	CE 0539 Ex II 1G
Ex iA IIC T6...T4 Ga	Ex iA IIC T4 Ga

EC-type Examination: DEMKO 01 ATEX 127938X
UL-DEMKO Notified Body no: 0539

Date: 2019.08.21 Place of issue:	Issued by	Date: 2019.08.21 Place of issue:	Approved by
6430 Nordborg Denmark	**Signature:**  **Name:** John Hansen **Title:** Product Manager	6430 Nordborg Denmark	**Signature:**  **Name:** Christian Dall Larsen **Title:** Senior Director, Product Mgmt.

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Example of: Manufacturer's declaration for potentially explosive atmospheres

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MANUFACTURER'S DECLARATION

Danfoss A/S

Industrial Refrigeration

declares under our sole responsibility that the product(s) 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.

Group C - Non- flammable refrigerants

Component which can be used to Ammonia, CO2, CFC, HCFC, HFC refrigerants
and - can be mounted with electrically pilots / equipment
and - have no ignition sources

Main Valves (control valves)	ICS 1, ICS 3, ICLX
Main Valves (control valves)	PMC
Modulating liquid level regulators	PMFL, PMFH
Pilots for ICS Valves	EVM
Electrically operated expansion valve	AKVA
Solenoid Valves	EVRS, EVRST
Solenoid Valves	EVRA,EVRAT

For the above listed valves a hazard analysis to the directive ATEX 2014/34/EU has been carried out with the following result:

- This non-electrical equipment holds no potential ignition source in normal rated conditions incl. malfunctions
- The listed valves are **not covered by the scope of ATEX Directive 2014/34/EU**.
- The listed valves can be used in the categories :
  - II 3G, gas groups IIA and IIB (applicable in Zone 2)
  - II 2G, gas groups IIA and IIB (applicable in Zone 1)

Note 1:
Valves used for the above condition shall be installed and maintained according to the requirements in EN 378.
Note 2:
Electronic / Mechanical actuators / pilots used to operate the above-mentioned equipment, has to undergo a separate conformity assessment.
Note 3:
End user shall avoid electrostatic discharge or make any impact to cause sparks in the application, service or maintenance.
Reference to standards and directives:
EN ISO 80079-36:2016
EN 378:2016

Date	Issued by	Date	Approved by
2019.11.06	Signature Name: Claus Juhl Title: Design and Approval Expert	2019.11.06	Signature Name: Jesper Kirkegaard Title: Director Engineering
2019.11.06	Signature Name: Cai Liang Title: ATEX Authorized person		

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ANNEX IV
Valves for HC-refrigerants

ICS pilot control		Code no.
ICS3E	20 D-5	027H1060
ICS3E	20 D-10	027H1061
ICS3E	20 D-15	027H1062
ICS3E	20 D-20	027H1063
ICS3E	20 D-25	027H1064
ICS3E	25 D-5	027H2175
ICS3E	25 D-10	027H2176
ICS3E	25 D-15	027H2177
ICS3E	25 D-20	027H2178
ICS3E	25 D-25	027H2179
ICS3E	32 D	027H3029
ICS3E	40 D	027H4038
ICS3E	50 D	027H5037
ICS3E	65 D	027H6038

PMFHE High pressure float valve		Code no.
PMFHE	80-4	027F4040
PMFHE	80-5	027F4041
PMFHE	80-6	027F4042
PMFHE	80-7	027F4043
PMFHE	200	027F4045
PMFHE	300	027F4046
PMFHE	500	027F4047

PMFLE Low pressure float valve		Code no.
PMFLE	80-1	027F4048
PMFLE	80-3	027F4050
PMFLE	80-4	027F4051
PMFLE	80-5	027F4052
PMFLE	80-6	027F4053
PMFLE	80-7	027F4054
PMFLE	125	027F4055
PMFLE	200	027F4056

SV3E Pilot float valve		Code no.
SV3E		027B0081

CVPE Pressure control pilot		Code no.
CVPE-M	4 to 28 bar	027B1021
CVPE-L	-0,66 to 7 bar	027B1020

CVCE Pressure control pilot		Code no.
CVCE	-0,66 to 7 bar	27B1040

EVME Solenoid pilot		Code no.
EVME		032F8029

ANNEX V
ICS3E valves

- Are servo operated valves which belong to the ICV (Industrial Control Valve) family
- Are special valves which can be used with Hydro Carbon refrigerants
- Have three pilot pressure connections

Technical data
Refrigerants:
Applicable to HC refrigerants (e.g. Propane, Butane, Propylene, …..).

Temperature range: -40 °C to 120 °C (-40 °F to 248 °F).

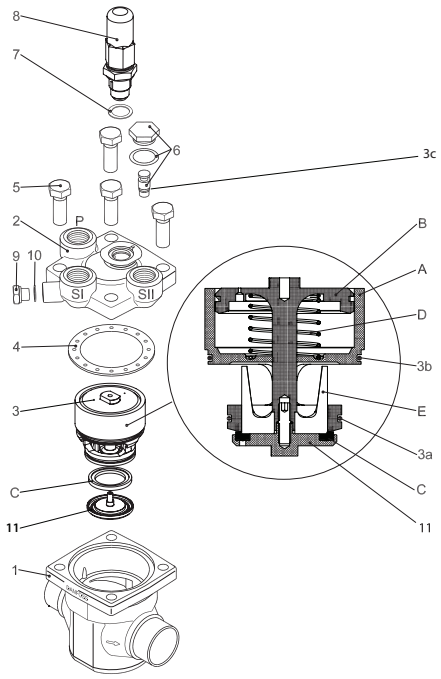
Max. working pressure: 52 bar (754 psig).

O-ring material:
Fluorocarbon (Viton) compound for low temperature application.

Marking:
The valve is marked with the name "ICS3E".

All dimensions and performance data are identical to the standard ICS (Literature no.: AI241186442033).

Material specification



No.	Part	Material	EN	ASTM	JIS
1	Body	Low temperature steel	G20Mn5QT, EN 10213-3	LCC A352	SCPL1 G5151
2	Top cover	Low temperature steel	G20Mn5QT, EN 10213-3 P285QH+QT 10222-4	LCC A352 LF2, A350	SCPL1 G5151
3	Function module (assembled)				
3a	**O-ring**	**Fluorocarbon (Viton)**			
3b	**O-ring**	**Fluorocarbon (Viton)**			
3c	**o-ring**	**Fluorocarbon (Viton)**			
A	Cylinder	Steel			
B	Piston	Steel			
C	Valve plate	PTFE			
D	Spring	Steel			
E	Cone	Steel			
4	Gasket	Fibre, non-asbestos			
5	Bolts	Stainless steel	A2-70, EN 1515-1	Grade B8 A320	A2-70, B 1054
6	Plug	Steel			
7	Gasket	Aluminium			
8	Manual operating spindle	Steel			
9	Plug	Steel			
10	Gasket	Aluminium			
11	Washer plate	Steel			

PMFHE and PMFLE valves

- Are modulating servo-controlled main expansion valves, controlled by pilot float valve type SV3E
- Are special valves which can be used with Hydro Carbon refrigerants
- Have one pilot pressure connection

Technical data

Refrigerants:
Applicable to HC refrigerants (e.g. Propane, Butane, Propylene, …..).

Temperature range: -40 °C to 120 °C (-40 °F to 248 °F).

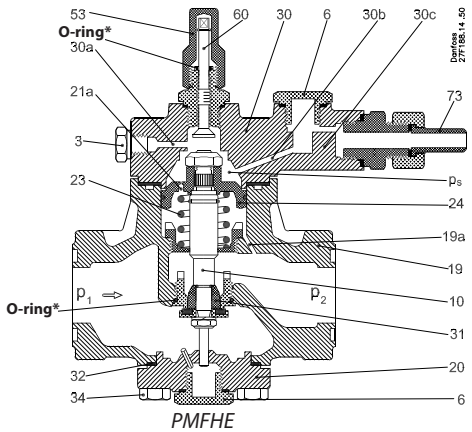
Max. working pressure: 28 bar (406 psig).

O-ring material:
Fluorocarbon (Viton) compound for low temperature application.

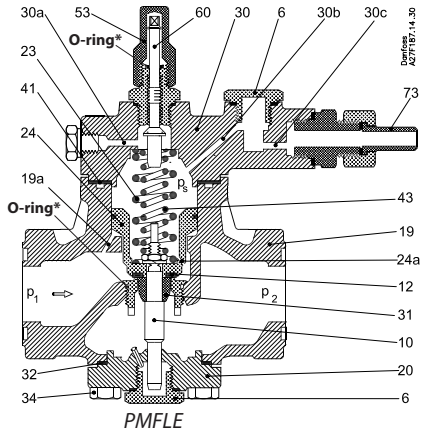
Marking:
The valve is marked with the name "PMFHE" or "PMFLE".

All dimensions and performance data are identical to the standard PMFH or PMFL(Literature no.: DKRCI.PD.GE0.E2.02)

Material specification



PMFHE



PMFLE

No.	Part	Material	DIN/EN	ISO	ASTM
2	Gasket between body and flange	Non-metal Non-asbestos			
3	Bolts for flange	Stainless steel	A2-70	A2-70	Type 308
4	Flange PM 5 - 65	Steel	RSt. 37-2, 10025	Fe360 B, 630	Grade C, A 283
6	Plug	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
10	Valve spindle	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
12	Valve seat	Teflon [PTFE]			
19	Valve body	Low temperature cast iron (spherical)	EN-GJS-400-18-LT EN-1693		
20	Bottom cover	Low temperature cast iron (spherical)	EN-GJS-400-18-LT EN-1693		
23	Spring	Steel			
24	Servo piston	Cast iron	GG-25	Grade 250	Class 40B
30	Cover	Low temperature cast iron (spherical)	EN-GJS-400-18-LT EN-1693		
31	Trottle cone	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
32	Gasket between body and bottom cover	Non-metal Non-asbestos			
34	Bolts for top and bottom cover	Stainless steel	A2-70	A2-70	Type 308
41	Gasket	Non-metal Non-asbestos			
43	Spring	Steel			
53	Spindle cap	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
60	Setting / manual operating spindle	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
73	Pilot connection	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
*	**O-ring**	**Fluorocarbon (Viton)**			

SV3E valves

- Can be used separately as a modulating liquid level regulator in refrigerating, freezing and air conditioning systems for ammonia or fluorinated refrigerants. However, in most cases, the SV3E is used as a float pilot valve for the main expansion valve type PMFHE
- Are special valves which can be used with Hydro Carbon refrigerants

Technical data
Refrigerants:
Applicable to HC refrigerants (e.g. Propane, Butane, Propylene, …..).

Temperature range: -40 °C to 120 °C (-40 °F to 248 °F).

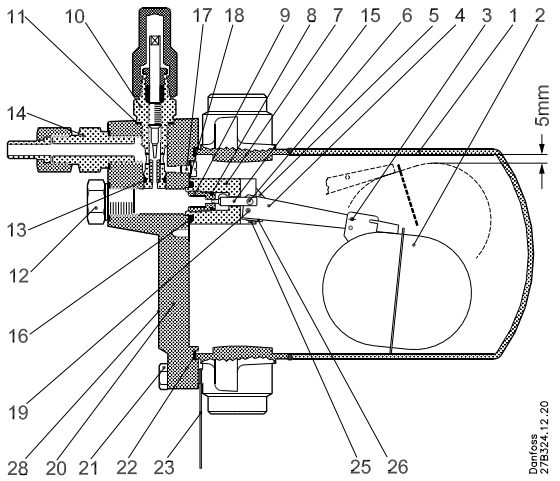
Max. working pressure: 28 bar (406 psig).

O-ring material:
Fluorocarbon (Viton) compound for low temperature application.

Marking:
The valve is marked with the name "SV3E".

All dimensions and performance data are identical to the standard SV (Literature no.: AI175286419654).

Material specification



No.	Part	Material	DIN / EN
1	Float housing	Stainless steel Low temperature, steel	X5CrNi18-10, DIN 17440 P285QH, EN 10222-4
2	Float	Stainless steel	
3	Split pin	Steel	
4	Float arm	Stainless steel	
5	Link	Steel	
6	Pin	High density polymer	
7	Valve housing	Steel	
8	**O-ring**	**Fluorocarbon (Viton)**	
9	Float orifice	High density polymer	
10	Manual regulation unit. Throttle valve	Steel	
11	Gasket	Non asbestos	
12	Plug	Steel	
13	**O-ring**	**Fluorocarbon (Viton)**	
14	Pilot connection (spare part)	Steel	
15	Orifice needle	Plastic	
16	**O-ring**	**Fluorocarbon (Viton)**	
17	Screw	Steel	
18	Gasket	Non asbestos	
19	Pin	Steel	
20	Cover	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563
21	Screw	Stainless steel	A2-70
22	Gasket	Non asbestos	
23	Label	Cardboard	
25	Screw	Steel	
26	Spring washer	Steel	
28	Sign	Aluminium	

CVPE valves

- Are constant pressure pilot valves for high pressure applications
- Are special valves which can be used with Hydro Carbon refrigerants

Technical data
Refrigerants:
Selected HC, Propane R290, Propylene R1270, Ethane R170, Butane R600, Iso-Butane R600a.

Temperature range: -40 °C to 120 °C (-40 °F to 248 °F).

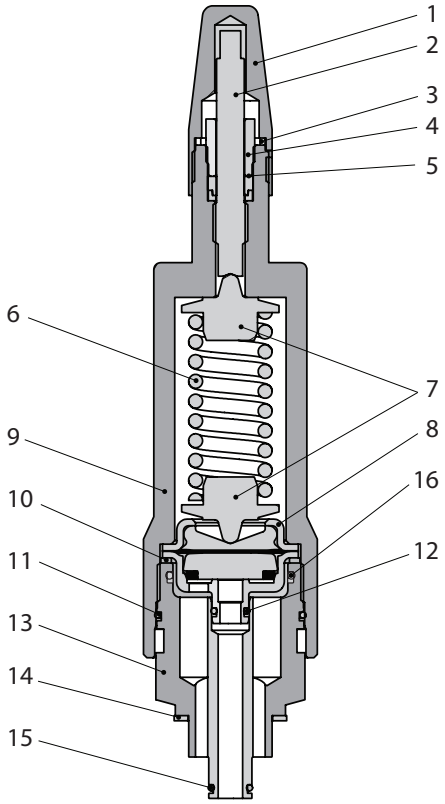
Max. working pressure: 52 bar (754 psig) .

O-ring material:
Fluorocarbon (Viton) compound for low temperature application.

Marking:
The valve is marked with the name "CVPE".

All dimensions and performance data are identical to the standard CVP (Literature no.: AI248786497190).

Material specification



No.	Part	Material
1	Protective cap	Steel
2	Setting spindle	Stainless steel
3	Cap seal	Nylon
4	Packing gland	Steel
5	Seal	Teflon
6	Spring	Steel
7	Spring plate	Steel
8	Diaphragm assembly	Stainless steel
9	Valve bonnet	Steel
10	Cover seal	Alu
11	Back up O-ring	CR
12	**O-ring**	**Fluorocarbon (Viton)**
13	Base part	Steel
14	Seal	Fiber gasket
15	**O-ring**	**Fluorocarbon (Viton)**
16	**O-ring**	**Fluorocarbon (Viton)**

CVCE valves

- Are pressure-operated pilot valves with an external signal connection that can be used to obtain an indication of the system reference pressure
- Are special valves which can be used with Hydro Carbon refrigerants

Technical data
Refrigerants:
Selected HC, Propane R290, Propylene R1270, Ethane R170, Butane R600, Iso-Butane R600a.

Temperature range: -40 °C to 120 °C (-40 °F to 248 °F).

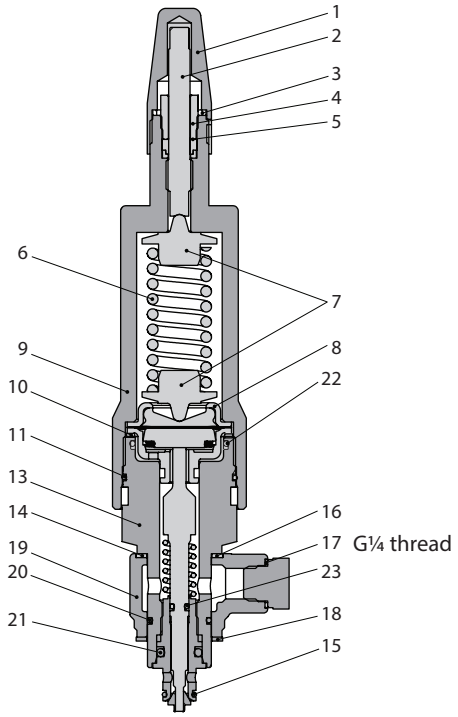
Max. working pressure: 52 bar (754 psig).

O-ring material:
Fluorocarbon (Viton) compound for low temperature application.

Marking:
The valve is marked with the name "CVCE".

All dimensions and performance data are identical to the standard CVC (Literature no.: AI248786497190).

Material specification



No.	Part	Material
1	Protective cap	Steel
2	Setting spindle	Stainless steel
3	Cap seal	Nylon
4	Packing gland	Steel
5	Seal	Teflon
6	Spring	Steel
7	Spring plate	Steel
8	Diaphragm assembly	Stainless steel
9	Valve bonnet	Steel
10	Cover seal	Alu
11	Back up O-ring	CR
13	Base part	Steel
14	Seal	Fiber gasket
15	**O-ring**	**Fluorocarbon (Viton)**
16	Seal	Fiber gasket
17	Plug for external pressure G¼	Steel
18	Seal	Fiber gasket
19	Banjo	Steel
20	**O-ring**	**Fluorocarbon (Viton)**
21	**O-ring**	**Fluorocarbon (Viton)**
22	**O-ring**	**Fluorocarbon (Viton)**
23	**O-ring**	**Fluorocarbon (Viton)**

EVME valves

- Are pilot solenoid valves suitable for liquid, suction and hot gas lines applications
- Are special valves which can be used with Hydro Carbon refrigerants

Technical data
Refrigerants:
Selected HC, Propane R290, Propylene R1270, Ethane R170, Butane R600, Iso-Butane R600a.

Temperature range: -40 °C to 120 °C (-40 °F to 248 °F).

Max. working pressure: 52 bar (754 psig).

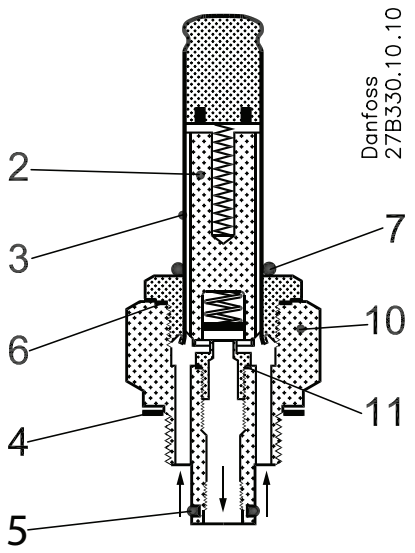
O-ring material:
Fluorocarbon (Viton) compound for low temperature application.

Marking:
The valve is marked with the name "EVME".

All dimensions and performance data are identical to the standard EVM (Literature no.: AI248786497190).

Note: Solenoid coils must be EX approved.

Material specification



No.	Part	Material
2	Armature	Stainless steel
3	Armature tube	Stainless steel
4	Seal	Non-asbestos
5	**O-ring**	**Fluorocarbon (Viton)**
6	Seal	Aluminium
7	Spacing ring	CR
10	Valve body	Steel
11	Valve seat	Teflon (PTFE)