

### 13.7 Pressure Equipment Directive (PED) 97/23/EC<sup>1</sup>

The Pressure Equipment Directive (PED) 97/23/EC applies to the design, manufacturing and conformity evaluation process of Pressure Equipment, as well as Pressure Equipment Assemblies. **The maximum allowable pressure must be greater than 0.5 bar.**

#### Pressure equipment means:

Vessels, piping, safety accessories (Article 1 – 2.1.3) and pressure accessories (Article 1 – 2.1.4).

Pneumatic actuators are considered as „actuating devices (Article 1 – 3.10) and are therefore not in the scope of the PED.

According to the directive, pressure equipment is defined as vessel, piping, safety and pressure accessories. The general term "Pressure Equipment" covers pressure vessels, steam boilers, heat exchangers, tubing (pipe) and safety and pressure accessories, as well as devices under pressure. Also included are all parts and products that are attached to pressurized parts (i.e., flanges, nozzles, lifting parts, fast-connectors, etc.)

According to Article 20, the PED is applicable since November 29, 1999, with a transitional period until May 29, 2002. Until then, manufacturers and the final users of pressure equipment can decide if the product shall meet the PED requirements or the national pressure vessel code requirements of the country where the product will be put into service (e.g. German Pressure Vessel Code).

Products covered include:

- Pressure Vessels
- Heat Exchangers
- Pressure Gas Cylinders
- Steam Boilers
- Pipeline Equipment
- Storage Tanks
- Pressure Relief Devices
- Valves, Regulators, etc.
- and more

When pressure equipment meets the requirements imposed in the Pressure Equipment Directive (97/23/EEC), the CE Mark shall be affixed to such equipment. The "way" to the CE Marking is outlined in Article 10 and Annex III of the directive. This is called the Conformity Assessment.

#### Relevant EU-Directives

- 87/404/EEC      Simple pressure vessels
- 89/336/EEC      Electromagnetic compatibility
- 89/392/EEC      Machine-Directive
- 73/23/EEC      Low Voltage Directive
- 97/23/EC      Pressure Equipment Directive
- 94/9/EC      ATEX 100

<sup>1</sup> [http://ec.europa.eu/enterprise/sectors/pressure-and-gas/documents/ped/guidelines/index\\_en.htm](http://ec.europa.eu/enterprise/sectors/pressure-and-gas/documents/ped/guidelines/index_en.htm)

## Essential Safety Requirements – Annex I

- General
  - Hazard analysis (related to pressure hazards)
- Design
  - Design for adequate strength
  - Provisions to ensure safe handling and operation
  - Means of examination
  - Means of draining and venting
  - Corrosion or other chemical attack
  - Wear
  - Assemblies
  - Provisions for filling and discharge
  - Protection against exceeding the allowable limits of pressure equipment
  - Safety accessories
  - External fire
- Manufacturing
  - Manufacturing procedures (Specially welding procedures and NDT)  
(NDT = Non-destructive testing)
  - Final assessment
  - Marking and labelling
  - Operating instructions
- Materials
  - Materials for pressurized parts
  - Characteristics of the materials
  - Material certificates

### 13.7.1. Glossary of Pressure Equipment Directive (PED)

Pressure	Pressure relative to atmospheric pressure, i.e. gauge pressure. As a consequence, vacuum is designated by a negative value.
Pressure accessories	Means devices with an operational function and having pressure-bearing housings.
Pressure equipment	Vessels, piping, safety accessories and pressure accessories. Where applicable, pressure equipment includes elements attached to pressurized parts, such as flanges, nozzles, couplings, supports, lifting lugs, valves, etc.

Maximum allowable pressure PS	<p>Maximum allowable pressure PS means the maximum pressure for which the equipment is designed, as specified by the manufacturer.</p> <p><b>It is defined at a location specified by the manufacturer.</b> This must be the location of connection of protective and/or limiting devices or the top of equipment or if not appropriate any point specified.</p>
Maximum/minimum allowable temperature TS	Maximum/minimum allowable temperature TS means the maximum/minimum temperatures for which the equipment is designed, as specified by the manufacturer.
Volume (V)	The internal volume of a chamber, including the volume of nozzles to the first connection or weld and excluding the volume of permanent internal parts.
Vessel	A housing designed and built to contain fluids under pressure including its direct attachments up to the coupling point connecting it to other equipment. A vessel may be composed of more than one chamber.
Piping	<p>Piping components intended for the transport of fluids, when connected together for integration into a pressure system.</p> <p>Piping includes in particular a pipe or system of pipes, tubing, fittings, expansion joints, hoses, or other pressure-bearing components such as valves.</p>
Nominal size (DN)	A numerical designation of size which is common to all components in a piping system other than components indicated by outside diameters or by thread size. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions. The nominal size is designated by DN followed by a number.
Assemblies	Several pieces of pressure equipment assembled by a manufacturer to constitute an integrated and functional whole.
Fluids	Fluids means gases, liquids and vapors in pure phase as well as mixtures thereof. A fluid may contain a suspension of solids.
European approval for materials	A technical document defining the characteristics of materials intended for repeated use in the manufacture of pressure equipment which are not covered by any harmonized standard.

Figure 13.7.1.-1: Glossary of Pressure Equipment Directive (PED)

### Technical requirements for Vessels

- Gases, liquefied gases, gases dissolved under pressure, vapors and also those liquids whose vapor pressure at the maximum allowable temperature is greater than 0.5 bar above normal atmospheric pressure, (1 013 mbar) within the following limits:
  - For fluids in Group 1 with a volume greater than 1 L (Liter) and a product of PS and V greater than 25 bar·L, or with a pressure PS greater than 200 bar (See Diagram 1 in this chapter).
  - For fluids in Group 2, with a volume greater than 1 L (Liter) and a product of PS and V is greater than 50 bar·L, or with a pressure PS greater than 1 000 bar, and all portable extinguishers and bottles for breathing apparatus (See PED Annex II, table 2).
- Liquids having a vapor pressure at the maximum allowable temperature of not more than 0.5 bar above normal atmospheric pressure (1 013 mbar) within the following limits:
  - For fluids in Group 1 with a volume greater than 1 L and a product of PS and V greater than 200 bar·L, or with a pressure PS greater than 500 bar (See PED Annex II, table 3),
  - For fluids in Group 2 with a pressure PS greater than 10 bar and a product of PS and V greater than 10 000 bar·L, or with a pressure PS greater than 1 000 bar (See Annex II, table 4).
- Fired or otherwise heated pressure equipment with the risk of overheating intended for generation of steam or super-heated water at temperatures higher than 110 °C having a volume greater than 2 L, and all pressure cookers (See PED Annex II, table 5).

### Technical requirements for Piping

- Gases, liquefied gases, gases dissolved under pressure, vapors and those liquids whose vapor pressure at the maximum allowable temperature is greater than 0,5 bar above normal atmospheric pressure (1 013 mbar) within the following limits:
  - For fluids in Group 1 with a DN greater than 25 (See Diagram 6 in this chapter),
  - For fluids in Group 2 with a DN greater than 32 and a product of PS and DN greater than 1 000 bar (See Diagram 7 in this chapter);
- Liquids having a vapor pressure at the maximum allowable temperature of not more than 0,5 bar above normal atmospheric pressure (1 013 mbar), within the following limits:
  - For fluids in Group 1 with a DN greater than 25 and a product of PS and DN greater than 2 000 bar (see Diagram 8 in this chapter), for fluids in Group 2 with a PS greater than 10 bar, a DN greater than 200 and a product of PS and DN greater than 5 000 bar (See Diagram 9 in this chapter).

## Classification of pressure equipment

Pressure equipment referred to in PED Article 3 shall be classified by category in accordance with PED Annex II, according to ascending level of hazard. For the purposes of such classification fluids shall be divided into two groups in accordance with 1. and 2.

Group 1 comprises dangerous fluids. A dangerous fluid is a substance or preparation covered by the definitions in PED Article 2 of Council Directive 67/548/EEC of 27 June 1967 on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.

### 1. **Group 1** comprises fluids defined as:

- Explosive,
- Extremely flammable,
- Highly flammable,
- Flammable (where the maximum allowable temperature is above flashpoint),
- Very toxic,
- Toxic,
- Oxidizing.

### 2. **Group 2** comprises all other fluids not referred to in 1.

## 13.7.2. Classification of Control Valves

- Maximum pressure or nominal pressure
- Nominal Diameter (for pressure accessories for pipes)  
The volume is not considered as the typical criteria for a control valve. Furthermore, a control valve is part of the piping system. Therefore control valves will be evaluated as piping accessories and classified according to the piping diagrams.  
(Annex II Sect. 3).
- Fluid Group (Gas/Steam or Liquid – hazardous or non-hazardous)

### Conformity assessment Diagrams 6 to 9 (Diagrams for Piping)

### 13.7.2.1 Conformity Assessment Diagrams

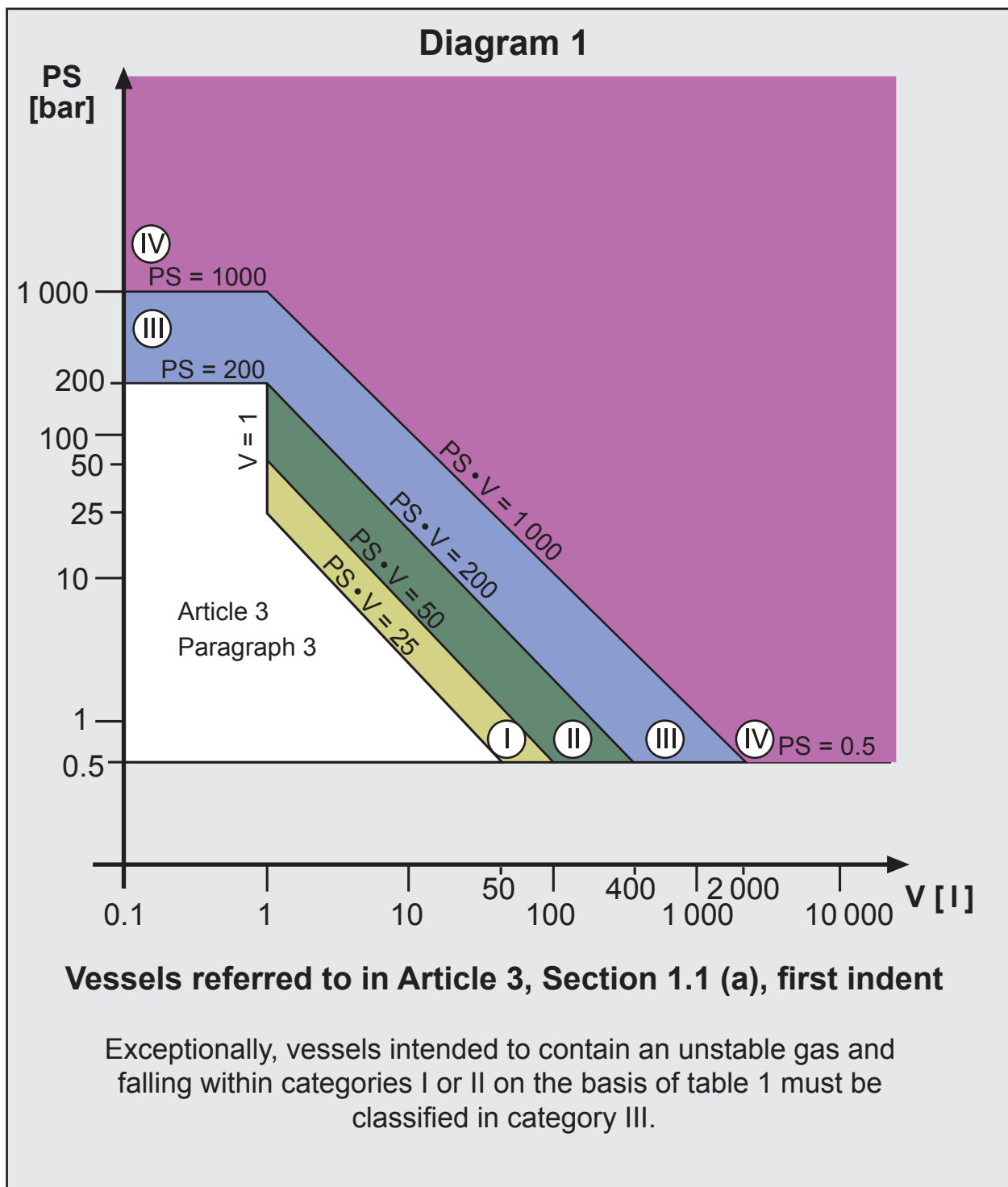


Figure 13.7.2.1.-1: Vessels referred to in Article 3, Section 1.1 (a), first indent

Vessel Diagram 1 - Gas Fluid Group 1 - BA 240					
DN	Volume Ltr.	PN10	PN16	PN25	PN40
25	0.15				
40	0.70				
50	00.9				
80	2.78				
100	4.61				
150	13.15				
200	40.00				
250	52.00				
Article 3 paragraph 3					
Category I		Category II		Category III	
				Category IV	

Figure 13.7.2.1.-2: Vessel Diagram 1 - Gas Fluid Group 1 - BA 240

Vessel Diagram 1 - Fluid Group 1 - BA 240											
DN	Volume Ltr.	PN 10	PN 16	PN 25	PN 40	PN 63	PN 100	PN 160	PN 250	PN 320	PN 400
15	0.18										
25	0.33										
40	0.90										
50	2.20										
80	5.00										
100	8.80										
150	23.50										
200	40.00										
250	52.00										
300	110.00										
400	150.00										
Article 3 paragraph 3											
Category I		Category II		Category III		Category IV					

Figure 13.7.2.1.-3: Vessel Diagram 1 - Fluid Group 1 - BA 240

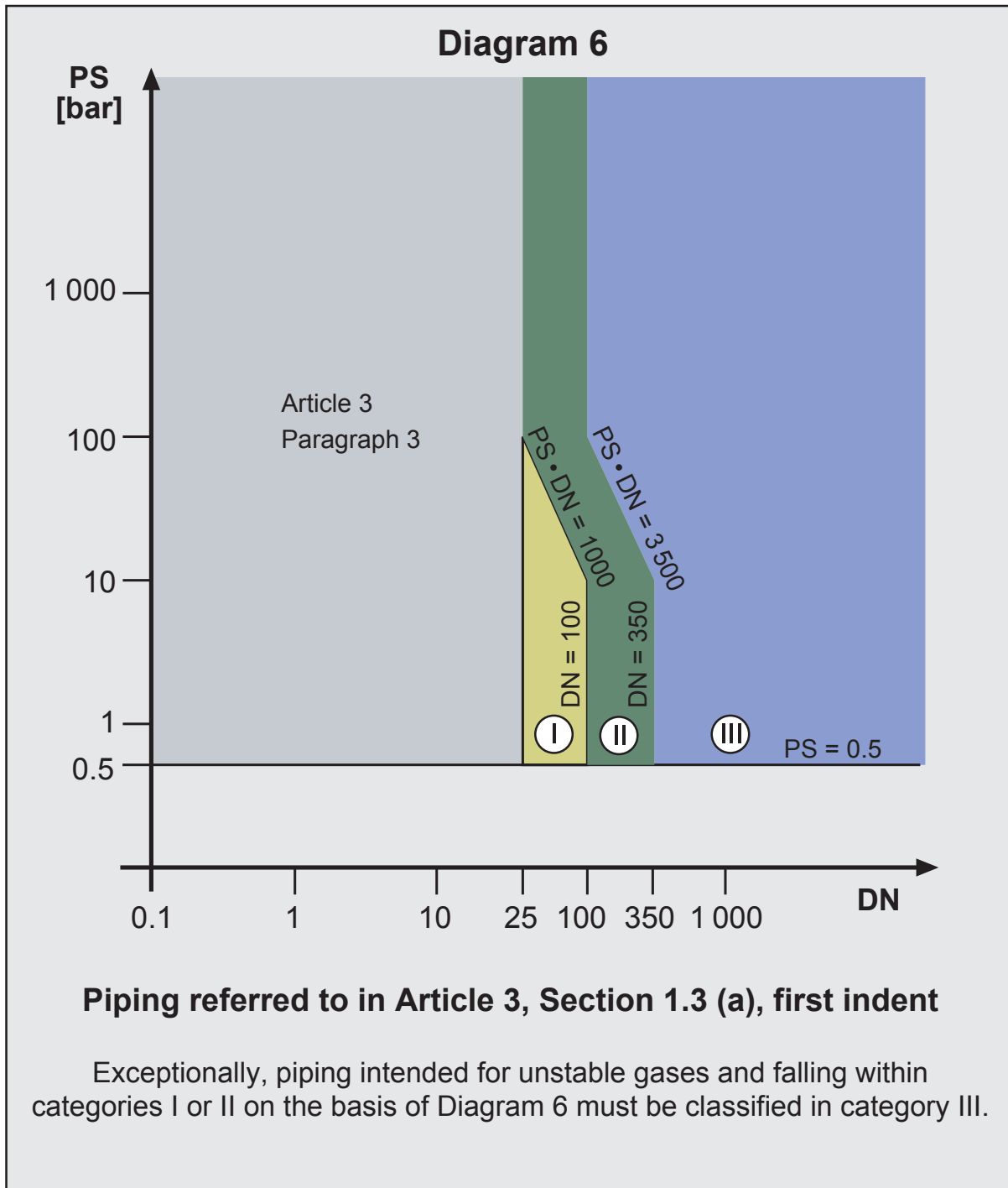


Figure 13.7.2.1.-4: Diagram 6: Piping referred to in Article 3, Section 1.3 (a), first indent



Piping Diagram 6 - Gas Fluid Group 1 - DIN										
DN	PN10	PN16	PN25	PN40	PN63	PN100	PN160	PN250	PN320	PN400
25										
32										
40										
50										
65										
80										
100										
125										
150										
200										
250										
300										
400										
Article 3 paragraph 3										
Category I				Category II				Category III		

Figure 13.7.2.1.-5: Piping Diagram 6 - Gas Fluid Group 1 - DIN

Piping Diagram 6 - Gas Fluid Group 1 - ANSI						
NPS	Class 150	Class 300	Class 600	Class 900	Class 1500	Class 2500
1						
1½						
2						
3						
4						
6						
8						
10						
12						
16						
Article 3 paragraph 3						
Category I				Category II		

Figure 13.7.2.1.-6: Piping Diagram 6 - Gas Fluid Group 1 - ANSI

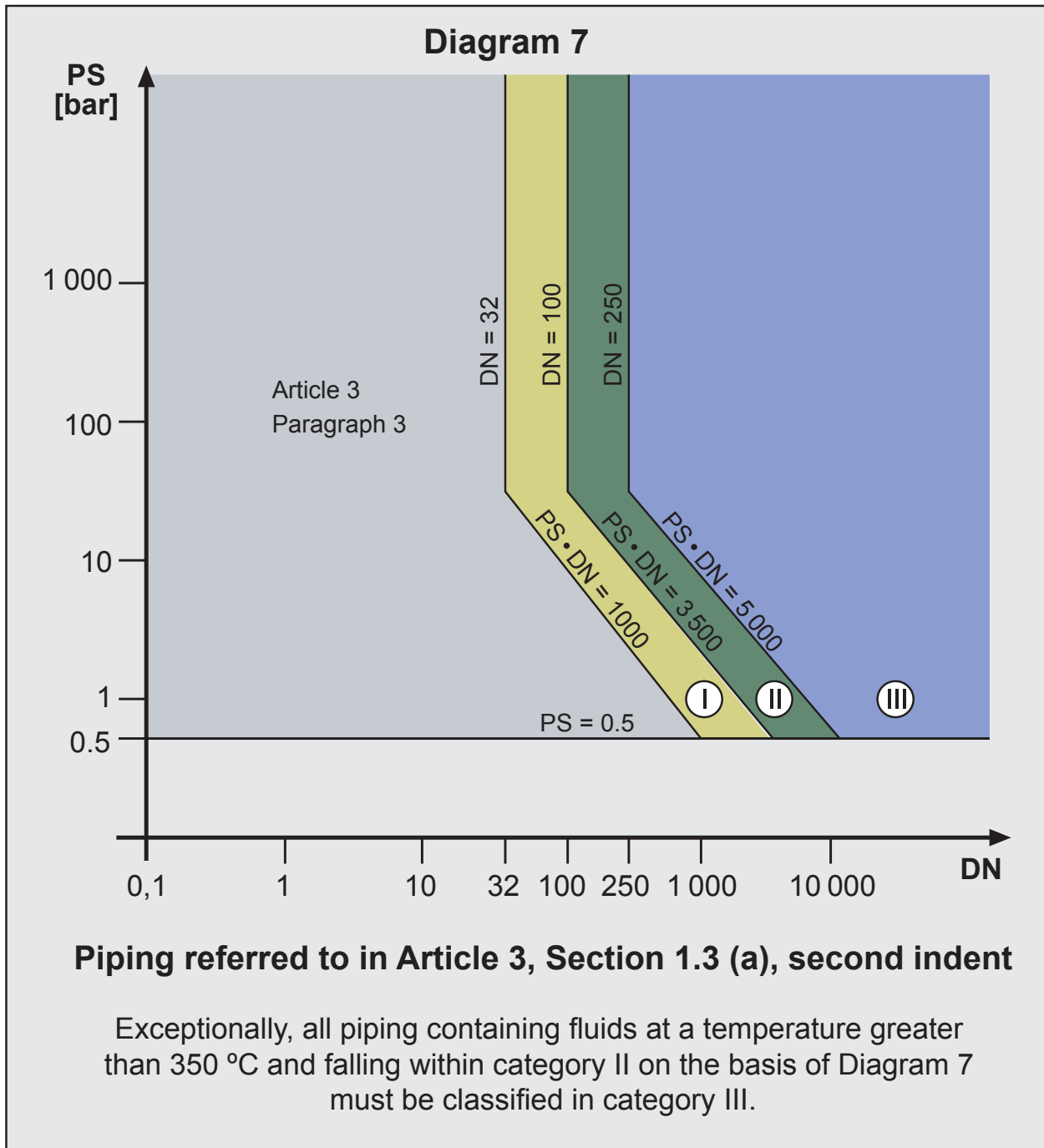


Figure 13.7.2.1.-7: Diagram 7: Piping referred to in Article 3, Section 1.3 (a), second indent

Piping Diagram 7 - Gas Fluid Group 2 - DIN										
DN	PN10	PN16	PN25	PN40	PN63	PN100	PN160	PN250	PN320	PN400
25										
32										
40										
50										
65										
80										
100										
125										
150										
200										
250										
300										
400										
Article 3 paragraph 3										
Category I					Category II			Category III		

Figure 13.7.2.1.-8: Piping Diagram 7 - Gas Fluid Group 2 - DIN

Piping Diagram 8 - Liquid Fluid Group 1 - DIN										
DN	PN10	PN16	PN25	PN40	PN63	PN100	PN160	PN250	PN320	PN400
25										
32										
40										
50										
65										
80										
100										
125										
150										
200										
250										
300										
400										
Article 3 paragraph 3										
Category I					Category II					

Figure 13.7.2.1.-9: Piping Diagram 8 - Liquid Fluid Group 1 - DIN

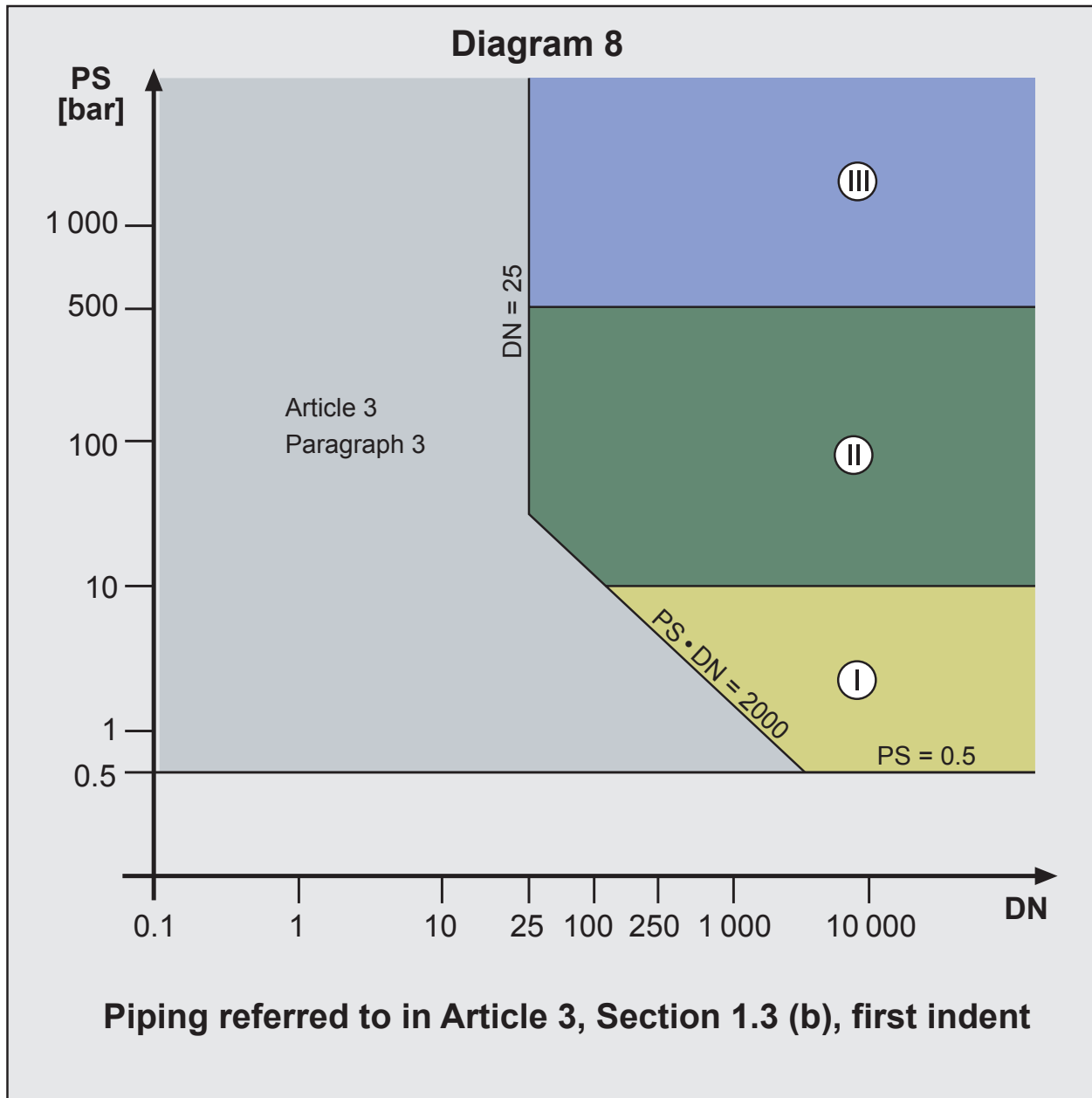


Figure 13.7.2.1.-10: Diagram 8: Piping referred to in Article 3, Section 1.3 (b), first indent

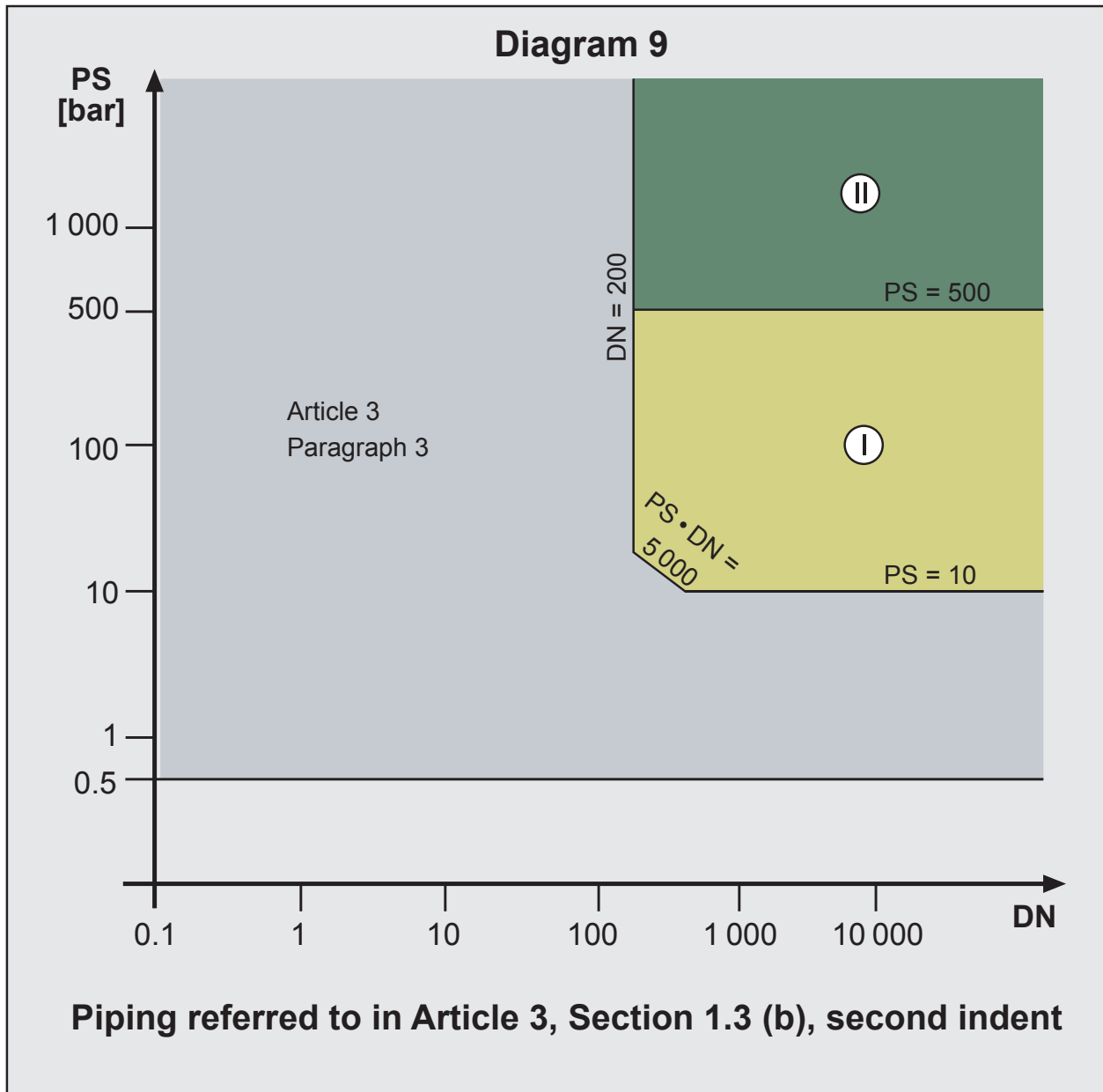


Figure 13.7.2.1.-11: Diagram 9: Piping referred to in Article 3, Section 1.3 (b), second indent

Piping Diagram 9 - Liquid Fluid Group 2 - DIN										
DN	PN10	PN16	PN25	PN40	PN63	PN100	PN160	PN250	PN320	PN400
25										
32										
40										
50										
65										
80										
100										
125										
150										
200										
250										
300										
400										
Article 3 paragraph 3										
Category I										

Figure 13.7.2.1.-12: Piping Diagram 9 - Liquid Fluid Group 2 - DIN

### 13.7.2.2 The conformity assessment modules

The conformity assessment modules available for the different categories of equipment are detailed below, along with a brief description in the key (fuller details are provided in Annex E). Manufacturers may choose the module(s) which best suit them, e.g. a manufacturer of Category II equipment may choose A1, D1 or E1.

Conformity assessment modules			
Category I	Category II	Category III	Category IV
Module	Module	Module	Module
A	A1	B1 + D	B + D
	D1	B1 + F	B + F
	E1	B + E	G
		B + C1	H1
		H	

Table 13.7.2.2.-1: Conformity assessment modules

Module	Design	Production
A	Technical documentation	Internal production control
A1	Technical documentation	Internal production control with monitoring of the final assessment
B	Type examination	
B1	Design examination	
C1		Monitoring of final assessment
D		Quality assurance for production, final inspection and test
D1	Technical documentation	Quality assurance for production, final inspection and test
E		Quality assurance for final inspection and test
E1	Technical documentation	Quality assurance for final inspection and test
F		Product verification
G	Unit verification	Unit verification
H	Quality assurance for design,	Manufacture, final inspection and test
H1	Quality assurance for design, with design examination and manufacture, final inspection and test monitoring of final assessment	

Table 13.7.2.2.-2: Module Key