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Power transformer and reactor fittings -- Part 8: Butterfly valves for insulating liquid circuits

Zubehr fr Transformatoren und Drosselspulen -- Teil 8: Drosselklappen fr Rohrleitungskreise mit Isolierflssigkeit

Accessoires pour transformateurs de puissance et bobines d'inductance -- Partie 8: Vannes papillon pour circuits liquides isolants

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Power transformer and reactor fittings
Part 8: Butterfly valves for insulating liquid circuits

Accessoires pour transformateurs de puissance et bobines d'inductance
Partie 8: Vannes à papillon pour circuits à liquides isolants

Zubehör für Transformatoren und Drosselspulen
Teil 8: Drosselklappen für Rohrleitungskreise mit Isolierflüssigkeit

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CENELEC
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Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 14, Power transformers.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50216-8 on 2004-12-01.

This EN 50216-8 is to be read in conjunction with EN 50216-1.

The following dates were fixed:

–	latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2005-12-01
–	latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2007-12-01

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1 Scope

This standard covers the butterfly valves used on the pipelines, in which the insulating liquid of power transformers or reactors flows, in order to allow the replacement of components, without removing the whole or a large amount of the insulating liquid from the conservator and the tank.

This standard defines the general overall dimensions and some functional and manufacturing characteristics to guarantee interchangeability.

2 Normative references

Addition to EN 50216-1:

EN 1092-1 2001 Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 1: Steel flanges

3 Requirements and characteristics

3.1 Description

The main components of a butterfly valve are:

- a “flanged body”, which allows the mounting on the pipe according to one of the assembly layouts listed in Clause 4. The free passage in the body gives the nominal dimension of the valve, which should be preferably within the range shown in the attached dimension tables. Except for the few exceptions shown in the tables, the flanged body has PN10 fixing dimensions, according to EN 1092-1;
- the “butterfly” which opens or shuts the opening of the body;
- the “drive assembly”, which allows to open or shut the butterfly and to block it in the open or closed position.

3.2 Operating characteristics

The butterfly valves are intended to be mounted on the pipelines in any position and with any orientation. They shall be capable to withstand mechanically to a overpressure of 200 kPa either on the flanged body or on the butterfly in closed position, indifferently in both directions, without any obstacle to the operation of the butterfly.

The sealing of the butterfly should not be subject to ageing, so that a metal to metal design is preferable, in order to avoid components subject to ageing problems such as rubber gaskets.

The operation of opening or shutting the butterfly must be done using only spanners.

All the characteristics are related to valves having the butterfly in fully open or fully closed position.

3.3 Components characteristics

3.3.1 Flanged body

The flanged body must be metallic, free from porosity or defoliation which may cause leakage; it is preferable to use forged steel bodies or bodies cut from sheet steel or big bars; cast bodies must be individually tested for tightness.

The faces of the flanged body, in contact with the flanges of the pipeline or of the component to be connected, have a seat for an O-Ring gasket. Recommended dimensions of gaskets and gasket seats are shown in the tables "Gasket Seat Dimensions" in Clause 5; other dimensions may be used upon agreement between manufacturer and purchaser.

3.3.2 Butterfly

The butterfly shall be capable to perform in the long run its sealing properties within the maximum permitted leakage values and to resist mechanically to the maximum permitted overpressure.

3.3.3 Drive assembly

The drive assembly shall

- be completely contained within the thickness of the flanged body up to the limit of the flange diameter when the butterfly is in open or closed position,
- assure the mechanical resistance necessary to withstand the test pressure on the closed butterfly; for ND ≥ 125 mm the butterfly should be guided also on the lower part,
- indicate the butterfly position with standard symbols or in writing,
- open the butterfly anticlockwise, shut the butterfly clockwise,
- have full oil tightness towards the outside of the pipeline; the gaskets of the drive assembly, if any, must be easily replaced in case of gasket failure or wear,
- be capable to withstand, eventually with the help of an adequate mask, to all the surface protection process of the transformer tank, like sandblasting and painting, particularly for the radiator valves of the weld-on type,
- preferably be arranged to accept a padlock (or a lead seal) in open and closed position, to avoid unattended operations by non authorized personnel.

3.3.4 Protection against corrosion

All the screws exposed to the atmosphere shall be of stainless steel.

The butterfly valves and their components shall be supplied adequately protected against the corrosion which may occur during transport and warehousing.

The body of the valves to be mounted between flanges shall be zinc-plated and passivated (cold process), with the function of protection against corrosion, and to allow an easy painting process. The bore of the valve shall be cleared of the zinc-plating before assembling.

The body of the welding type radiator valves shall be self colour.

4 Assembly arrangements and dimensions

4.1 Types of assembly

The butterfly valve types differ in the way they are assembled on the pipeline; the following layouts are foreseen:

- Assembly by welding:
  - Types A1 (short type) and A2 (long type) - assembly layout according to Figure 1;
- Assembly between tank wall and flange:
  - Types B1 (circular flange with recessed body) and B2 (square flange with recessed body) - assembly layout according to Figure 2 b) and c);
- Assembly between two flanges:
  - Types B1 (circular flange with recessed body) and B2 (square flange with recessed body) - assembly layout according to Figure 2 a),
  - Types C1 (circular flange with full thickness body) and C2 (square flange with full thickness body) - assembly layout according to Figure 3 a).

4.2 Overall dimensions

Butterfly valves dimensions are ranged by nominal diameter (ND). Standardized nominal diameters are 25 mm, 50 mm, 80 mm, 100 mm, 125 mm, 150 mm, 175 mm, 200 mm, 250 mm and 300 mm.

Overall dimensions are as follows:

- for types A1 (short type) and A2 (long type) – Table 4 in Figure 4,
- for types B1 (circular flange with recessed body) – Table 5 in Figure 5,
- for types B2 (square flange with recessed body) – Table 6 in Figure 6,
- for types C1 (circular flange with full thickness body) – Table 7 in Figure 7,
- for types C2 (square flange with full thickness body) – Table 8 in Figure 8.

5 Dimensions and types of gaskets, dimensions of gasket seats

5.1 General

Gaskets have to be considered parts subjected to wear, therefore their replacement shall be made as easy as possible. The gasket material is furthermore the main responsible in complying with the admitted operating conditions.

5.2 Gaskets and gasket material

Gaskets shall be wherever possible standard O-Ring gaskets.

Standard gasket material is nitrile rubber (NBR); other gaskets materials for operating conditions outside the operating range of nitrile rubber may be used upon agreement between supplier and purchaser.

Gaskets should be colour coded according to gasket material to avoid confusions; colour of gaskets of nitrile rubber is black.

5.3 Admissible operating conditions

Operating conditions depend mainly from the type of the gasket material. Standard nitrile rubber gaskets (NBR) shall comply with the following operating conditions.

- Ambient conditions:
  - ambient temperature -25 °C to +40 °C,
  - relative humidity 95 % at 20 °C – 80 % at 40 °C – 50 % at 50 °C.
- Insulating liquid and it's temperature:
  - mineral oil -25 °C to +115 °C,
  - silicone oil -25 °C to +115 °C.

5.4 Design criteria for gasket seats – Choice of flange gaskets

The gasket references and the gasket seat dimensions indicated by the following Table 1 are not compulsory; other gasket references and gasket seat dimensions can be agreed upon between manufacturer and purchaser.

Following criteria have been adopted in designing the gasket seats of Table 1:

- gaskets are to be centred either on the internal or external diameter of the gasket seat for easier mounting;
- internal gasket seat diameter shall allow to adopt standard slip-on flanges on pipeline;
- radial compression of gasket tore shall be uniformly 33 % (± 2 %) of the tore diameter;
- gasket seat cross section and volume shall be from a minimum of 12 % to a maximum of 17 % higher than the gasket cross section and volume.

Exceptions to these criteria are indicated as notes to the table.

Table 1 – Flange gasket types and dimensions – [mm]

ND	Gasket seat	Gaskets		Notes
	Int Ø x Ext Ø x h	**Reference** [a]	**Int Ø x tore Ø x Ext Ø**	
25	37,0x51,0x3,6	OR 6150 - BS 325	37,47x5,34x48,15	
		R 28	37,47x5,33x48,13	
40	55,0x69,0x3,6	OR 6225 – BS 331	56,52x5,34x67,20	
		R 34	56,52x5,33x67,18	
		ISO 3601/1 – DIN 3771/1	56,00x5,30x66,60	
50	68,5x82,5x3,6	OR 6275 – BS 335	69,22x5,34x79,90	
		R 38	69,22x5,33x79,88	
		ISO 3601/1 – DIN 3771/1	69,22x5,33x79,88	
65	84,0x98,0x3,6	OR 6337 – BS 340	85,09x5,34x95,77	
		R 43	85,09x5,33x95,75	
		ISO 3601/1 – DIN 3771/1	85,09x5,33x95,75	
80	99,5x113,5x3,6	OR 6400 – BS 345	101,00x5,34x111,68	
		R 48	100,97x5,33x111,63	
		ISO 3601/1 – DIN 3771/1	100,00x5,30x110,60	
100	119,0x137,8x4,7	OR 8475 – BS 427	120,00x6,99x133,98	
		R 55	120,02x6,99x134,00	
	119,0x133,0x3,6	ISO 3601/1 – DIN 3771/1	122,00x5,30x132,60	
125	144,0x162,8x4,7	OR 8575 – BS 435	145,42x6,99x159,40	
		R 63	145,42x6,99x159,40	
	144,0x158,0x3,6	ISO 3601/1 – DIN 3771/1	145,00x5,30x155,60	
150	175,5x194,3x4,7	OR 8700 – BS 441	177,20x6,99x191,18	A
		R 69	177,17x6,99x191,15	A
	178,0x192,0x3,6	ISO 3601/1 – DIN 3771/1	180,00x5,30x190,60	A
175	201,0x219,8x4,7	OR 8800 – BS 445	202,60x6,99x216,58	
		R 73	202,57x6,99x216,55	
	199,0x213,0x3,6	ISO 3601/1 – DIN 3771/1	200,00x5,30x210,60	
	202,0x220,8x4,7	ISO 3601/1 – DIN 3771/1	206,00x7,00x220,00	A
200	226,0x244,8x4,7	OR 8900 – BS 447	227,90x6,99x241,88	
		R 75	227,97x6,99x241,95	
		ISO 3601/1 – DIN 3771/1	230,00x7,00x244,00	
250	277,0x295,8x4,7	OR 81100 – BS 451	278,70x6,99x292,68	
		R 79	278,77x6,99x292,75	
	277,0x291,8x3,6	ISO 3601/1 – DIN 3771/1	278,76x5,33x289,42	
	270,0x288,8x4,7	ISO 3601/1 – DIN 3771/1	272,40x6,99x286,38	B
300	328,0x346,8x4,7	OR 81300 – BS 455	329,50x6,99x343,48	B
		R 83	329,57x6,99x343,55	B
	331,0x349,8x4,7	ISO 3601/1 – DIN 3771/1	335,00x7,00x349,00	

Notes:
A = acceptable for valves Type B1 and B2 with limitations
B = not acceptable for slip on flange

[a] The column “reference” is given for quick relation to customary commercial denominations.

6 Performances

6.1 Tightness of the mounted valve

The valves mounted on the pipeline, in steady state condition either in open or in closed position, shall not show any leakage towards the external ambient, under pressure.

During the operation of closing or opening of the valve, small leakages are accepted at the shaft.

The valve in open condition shall be capable to withstand the general vacuum test applied to the transformer with radiators.

6.2 Tightness of the butterfly blade

Leakage is admitted at the closed butterfly; the following Table 2 shows the admitted leakage according to the nominal diameter. The values of Table 2 apply with oil at 20 °C, 100 kPa and viscosity of 30,5 cSt.

Table 2 – Maximum admissible leakage value

Nominal diameter of valve in mm	**≤ 100**	**>100 - ≤175**	**>175**
Admitted leakage in dm^3/h measured in 1 hour	≤ 0,5	≤ 1,0	≤ 2,0

6.3 Operating torque

The operating torque should not exceed values shown in the following Table 3.

Table 3 – Operating torque

Nominal diameter of valve in mm	**≤ 100**	**>100 - ≤150**	**>150**
Operating torque in Nm	≤ 10	≤ 30	≤ 30
Closing torque in Nm	≤ 70	≤ 100	≤ 150
Opening torque in Nm	≤ 40	≤ 50	≤ 50

The following additional definitions apply:

6.3.1
operating torque
torque necessary to turn the shaft from the open to the closed position

6.3.2
closing torque
torque necessary to obtain the complete closure of the valve

6.3.3
opening torque
torque necessary to open the valve, after complete closure

6.4 Maximum working overpressure with the butterfly valve in open and closed position

The fully mounted valve, in service conditions, shall withstand and operate with any pressure inside the pipe from vacuum to 100 kPa in open position and 80 kPa in closed position. In addition, the pressure or vacuum can be applied on only one side of the closed butterfly. Higher pressure values may be agreed between purchaser and manufacturer.