AGREEMENT

Number:	V-DK-009
Titel:	**Requirements for oval-shaped hand, head and manhole closures of steam boiler plants**
Signatories:	BDH FDBR Vd-TÜV VGB
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Agreement Steam Boiler 009

2017-03

between

BDH	Bundesverband der Deutschen Heizungsindustrie e.V., Cologne
FDBR	Fachverband Anlagenbau e. V., Düsseldorf
VdTÜV	Verband der TÜV e. V., Berlin
VGB	VGB PowerTech e. V., Essen

on

Requirements for oval-shaped hand, head and manhole closures of steam boiler plants

Preamble

This agreement is intended to supplement the pertinent rules and regulations. It is a collection of experience made, recommendations and, where required, a concretization of the rules and regulations, which, to the best of our knowledge, reflects the state-of-the-art at its date of publication. This agreement aims at ensuring the operational safety of steam boiler plants and their components.

No liability will be taken for the correctness of the contents of this agreement. Patents and other protective rights shall be clarified under the responsibility of the user.

Content

1 Scope

The requirements hereafter apply to oval hand, head and manhole closure systems with internal covers on steam boiler plants for steam and hot water generation with maximum allowable working pressures of 40 bar.

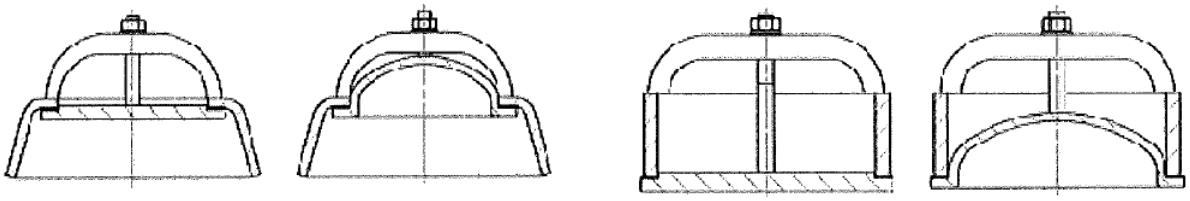
In addition, the requirements of EN 12952 for water-tube boilers and of EN 12953 for shell boilers apply.

2 Definitions

2.1 Closure system

The closure system consists of the gasket and the metallic closure parts with straight or conical set-in welding ring, with flat or dished cover and un-machined or machined sealing surfaces incl. bolts, nuts, washers, and clamps (see Figure 1).

Figure 1 Examples for closure systems



2.2 Closure shape

Oval-shaped closures with internal cover that is preloaded by a nut via bolt and clamp and, in case of internal pressure, will form a self-acting seal.

2.3 Function of the closure system

The closure system shall seal against overpressure.

2.4 Closure system failure

Failure will occur if any of the following criteria is met:

- Blow-out of the gasket from its seat;
- Inadmissible leakage;
- Inadmissible gasket damage[1)];
- Damage on sealing surfaces;
- Damage on bolts.

Any other possible damage that may lead to failure cannot be excluded.

[1)] Inadmissible damage occurs if gasket failure is to be expected within the intended service life due to the type of damage.

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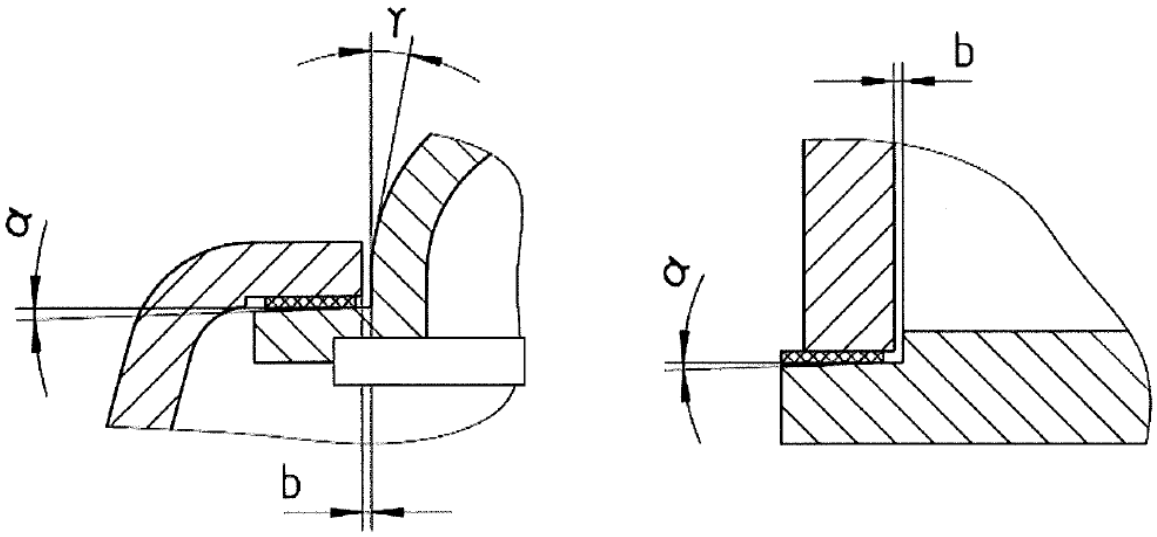
3 Requirements for metallic closure parts

Metallic closure parts of closure systems shall only be used if the following requirements have been met:

3.1 The metallic closure parts shall be suited for the intended operating conditions (pressure and temperature).

3.2 The ring and cover shall be designed such that the closure will not stuck and the gasket is seated correctly on the sealing surface (see figure 2).

Figure 2 Geometries for cover/ring connections



Legend: b: average clearance

α: flank angle

γ: inclination angle

3.3 Gross surface imperfections in radial direction (e.g. corrosion pits, mechanical damage, erosion) are not permitted.

3.4 For new closures the metallic closure parts shall be designed such that the gasket-specific minimum design seating stress is reliably obtained.

3.5 The required minimum torque shall be prescribed by the gasket manufacturer to satisfy the bolt geometry specification. The maximum allowable tightening torque for the metallic closure parts shall be provided by the closure manufacturer.

3.6 The clamps shall be dimensioned such that the available bolt forces can be fully utilized.

3.7 Closures shall meet the following requirements:

a) Closures shall be designed such that they seal tight against the inner sealing surface, and shall be fixed by bolts, nuts and clamps,

b) Closures for elliptical openings exceeding 250 mm x 175 mm should be and manholes shall be fixed with two bolts,

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c) the bolt used for closures shall be made from weldable steel with a minimum tensile strength [2)] of 355 MPa. The bolts, clamps and the connection between bolts and cover shall be sufficiently dimensioned to allow the application of the minimum gasket seating load,

d) the thread length shall be designed to permit safe engagement in due consideration of the ring, bolts, clamp and gasket.

Table 1 Requirements for oval-shaped closure systems

	Hand hole	**Head hole**	**Manhole**	**Remarks**
Minimum requirement for inside diameter (in mm)	100 x 150	220 x 320	320 x 420	Greater dimensions are not required
Bolts and clamps	1	1 or 2	2	
Sealing surface of ring and cover machined	X	X	X	Not required at TS ≤ 120 °C for hot-water boilers and PS ≤ 1.0 bar for steam boilers
Plane-parallelism of sealing surfaces of ring and cover in unrestrained condition (in mm)	0.5	1		Deviations are only permitted with the gasket manufacturer's approval
Average clearance b between ring and cover in installed condition (in mm)	≤ 2			See Figure 2
Flank angle α (in °)	≤ 2			
Inclination angle γ (in °)	≤ 20			

4 Requirements for gaskets

4.1 General requirements

Gaskets shall be suited for the intended operating conditions (pressure and temperature). Further essential characteristics are:

- Deformation resistance,
- Chemical resistance to boiler water,
- Aging resistance.

4.2 As a rule, the use of sealing compounds or release agents is not permitted. Exceptions shall be subject to approval by the gasket manufacturer.

4.3 Two types of gaskets may be used: moulded or continuous seals.

4.4 The suitability of gaskets/seals may e.g. be verified by means of type testing.

[2)] By determining the minimum tensile strength as design value instead of the minimum yield strength the use of bolts of strength class 5.6 is possible.

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4.5 Useful life of the gasket: as a rule, the useful life of the gasket referred to critical failure should cover a period between two subsequent internal inspections.

4.6 Each gasket shall be delivered with an operating manual wherein the gasket manufacturer shall describe in detail the assembly of the gasket, its operational behaviour (especially in case of boiler start-up) and maintenance. Reference shall be made to all safety-relevant aspects, especially to

- the allowable deviation from plane-parallelism of the sealing surfaces,
- instructions by the gasket manufacturer for fixing the gasket in case of difficult assembly conditions (e.g. overhead assembly),
- instructions by the closure and boiler manufacturers,
- check of gasket for proper condition and usability,
- boiler water quality,
- centric assembly of gasket,
- instructions on the admissibility of sealing compounds and release agents,
- bolt tightening of the closure system to satisfy the specifications of closure and gasket manufacturers, indication of guide values for tightening torques,
- minimum required and maximum allowable gasket seating stress,
- assembly of new gaskets upon any opening of the closure system,
- gasket useful life in case of closed closure system/load changes/outage periods,
- instructions for checking or re-tightening, where required, of the bolting connections of the closure system upon putting into operation of the boiler, if required limitation of pressures/temperatures where re-tightening is still permitted,
- storage conditions, expiry date.

5 Entry into force

This agreement V-DK-009 shall apply with immediate effect to oval hand, head and manhole closure systems as per Section 1. It replaces Agreement 1998/1.

Cologne, 13.4.2017

BDH Bundesverband der deutschen Heizungsindustrie e.V. Köln

Signed: Lücke

Essen, 16.3.2017

VGB PowerTech e.V.

Signed: Christensen

Berlin, 2.5.2017

VdTÜV Verband der TÜV e.V.

Signed: Dr. Brüggemann

Düsseldorf, 5.4.2017

FDBR e. V. Fachverband Anlagenbau

Signed: Dr. Maaß

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