

Title: Fire protection fastening device for fastening a door actuator

Description

The invention relates to a fire protection fastening device
5 for fastening a door actuator. Furthermore, the invention shows assemblies comprising a door actuator along with a fire protection fastening device.

Door actuators are used for closing and/or opening doors. In particular, door closers and door drives are designated
10 as door actuators. Generally, in a door closer, the manual opening movement charges a spring accumulator. In this case, the stored energy is used for closing the door. For example, in the door drive, electro-mechanics or hydraulics allow for automatically opening and/or closing the door.

15 Usually, door actuators are fastened to a mounting surface, namely on the door leaf or the casing, respectively the wall. In particular, with fire-rated doors, it should be noted that often combustible fluids, for example hydraulic oils, are used in the door actuators. In case of fire, as much as
20 possible, suitable measures should allow for preventing the fluid in the door actuator from heating up too much and from potential igniting.

It is the object of the present invention to indicate a fire protection fastening device for a door actuator, which
25 allows for operation-reliable fastening the door actuator

and simultaneously fulfils safety relevant requirements, in particular in case of fire.

The object is achieved with the features of the independent claim. Advantageous further configurations of the invention
5 are the subject matter of the dependent claims.

The invention describes a fire protection fastening device for fastening a door actuator. As mentioned in the introduction, a door closer or a door drive is a door actuator. The door actuator is to be fastened to a mounting
10 surface. In particular, a door, casing or wall forms said mounting surface.

The fire protection fastening device comprises a frame. According to an embodiment of the invention, the frame is formed for arrangement between the door actuator and the
15 mounting surface. When omitting a separate mounting plate, in this case, the door actuator rests directly on the front side of the frame. The back side of the frame faces the mounting surface; in particular, rests directly at the mounting surface. As will be described in more detail, a
20 mounting plate can be used between the frame of the fire protection fastening device and the door actuator. In particular in this case, the mounting plate is screwed to the frame of the fire protection fastening device and the door actuator is fastened to the mounting plate.

25 In an alternative configuration, it is provided that the frame of the fire protection fastening device is an integral

component of the door actuator. This configuration as well will be explained in more detail.

For describing the invention, a mounting axis is defined. The mounting axis is vertical to the frame, in particular
5 vertical to the back side of the frame. Furthermore, the mounting axis is vertical to the mounting surface. The mounting axis is parallel to the screws, for example, which are used for screwing the frame to the mounting surface. According to an alternative definition, the mounting axis is
10 vertical to the output axis of the door actuator. Via said output axis, the door actuator is to be connected to the door or the wall, for example via an arm assembly.

At least one reaction chamber is formed in the frame of the fire protection fastening device. In a preferred
15 configuration, the frame includes several reaction chambers. In particular, two, three, four, five, six, seven or eight reaction chambers are provided in the frame. For the sake of simplicity, the invention is mostly described based on one reaction chamber, wherein it is always intended that
20 the plurality of reaction chambers is formed identically. However, the reaction chambers can differ in size so that per geometric configuration of the fire protection fastening device, can be used the greatest possible number of reaction chambers with the greatest possible surface.

25 The frame delimits the respective reaction chamber on the entire circumference. With the depth thereof, the reaction chamber extends parallel to the mounting axis.

Accordingly, also the circumference of the reaction chamber is defined with regard to an axis parallel to the mounting axis. The reaction chamber is open on the back side and/or on the front side of the frame. If the reaction chamber is open on both sides, i.e. on the front side and on the back side, it is question of a passage clearance in the frame. If the reaction chamber is only open on one of the two sides, it is question of a pocket, formed in particular in the frame.

10 A drive element is disposed in each reaction chamber. The drive element is manufactured from thermally intumescent material. When thermally activated, namely when correspondingly heating, the drive element is formed for pressing the door actuator away from the mounting surface. In particular, it is provided that the thermally activatable material of the drive element is activatable in a temperature range of 90 °C to 200 °C.

The drive element is in particular a two-dimensional plate-shaped material, which is arbitrarily cuttable. As this material is available in certain thicknesses, preferably it is provided that several layers are placed one on top of the other for forming the drive element. Then, the plurality of layers together forms a drive element.

When activating the thermally intumescent material, the volume of said material increases, for example by foaming. As the drive element is disposed in the reaction chamber, and as the frame delimits the reaction chamber on the

entire circumference, the drive element just expands in a direction parallel to the mounting axis. On account of the circumferential delimitation, the frame blocks the expansion of the drive element in a direction vertical thereto.

5 As already described, as a discrete component, the frame can be disposed between the door actuator and the mounting surface. If required, a mounting plate can be located between the frame and the door actuator. In this arrangement of the frame, the reaction chamber can be
10 open both on the front side and on the back side. It is decisive that upon thermal activation, the drive element expands in the direction parallel to the mounting axis, whereby the door actuator is pushed away from the mounting surface. Whether or not the frame is pushed
15 away as well or remains on the mounting surface side, is not relevant for the basic functioning of the invention.

In the configuration, in which the frame is an integral component of the door actuator, it is in particular provided that the reaction chamber is open on the back side for thus
20 pushing the door actuator, together with the integral frame, away from the mounting surface.

When thermally activating the drive element, or the plurality of drive elements in the individual reaction chambers, pushing away the door actuator from the mounting surface
25 is realized, wherein for example the male threads on the screws or the associated female threads break. Thereby, the door actuator comes off of the mounting surface,

namely the door, casing or wall. In particular in this case, it is assumed that the door actuator is located on the side of the door facing away from the fire. The door actuator coming off of the mounting surface thereof prevents the door actuator from heating up too much, whereby the fluids in the door actuator are prevented from igniting.

In a preferred embodiment, it is provided that the fire protection fastening device includes a piston plate disposed in the reaction chamber. In particular, the piston plate is disposed such to the reaction chamber that the mounting axis is orthogonally to the piston plate. When employing several reaction chambers, one drive element and one respective preferably used piston plate are located in each reaction chamber.

In particular, the piston plate is formed from rigid material and serves for being displaced by the drive element, when thermally activating the drive element. In this case, it is in particular provided that the piston plate is guided in the reaction chamber. In particular, the displacement direction is parallel to the mounting axis. Preferably, the gap between the piston plate and the reaction chamber is to be kept as small as possible so that the intumescent material of the drive element does not squeeze through the gap past the piston plate. When being activated, namely upon expansion of the drive element, both the drive element and the piston plate can exit from the reaction chamber.

Basically the piston plate can be disposed on the front side or the back side of the drive element. Furthermore, it is possible to dispose one respective piston plate on both sides of the drive element. Accordingly then, two piston
5 plates are provided per each reaction chamber.

The piston plates can be referred to as pressure distribution plates or pressure modulating plates, as they ensure that pressure, the drive element deploys, is transferred to an as large as possible a surface.
10 Furthermore, they ensure that, when thermally activated, the drive element does not expand without use in hollow spaces, for example of the fissured back side of a door actuator.

Preferably, it is provided that the piston plate is
15 manufactured from metal, for example from aluminium. Thereby, providing a strong, light-built and easily manufactured piston plate.

However, it should be considered that in most application cases, a thermally insulating configuration of the fire
20 protection fastening device is advantageous. Basically, the heat input from the mounting surface into the drive element should be realized, if possible, without any resistance. However, any further heat conducting, in particular, in the direction of the door actuator, is to be prevented, if
25 possible, Preferably, therefore it is provided that a piston plate, which is disposed between the drive element and the door actuator, is not made from non-metallic, thermally

insulating material. As an alternative, the piston plate can have several layers, wherein at least one layer is made from non-metallic, thermally insulating material. Furthermore, it can be provided that a piston plate, which is
5 disposed between the drive element and the mounting surface, is manufactured from metallic, thermally conducting material. Hereby, it is achieved that heat input from the mounting surface into the drive element is speedy for insuring an early volume increase of the intumescent
10 material. Thus, it can be provided that the drive element be enclosed by two different piston plates, in particular by two piston plates having differing thermal conductivity.

In particular when manufacturing the piston plate exclusively from the thermally insulating material, it should
15 be observed using correspondingly stable material for embodying a rigid piston plate. Appropriate plastic materials are suitable for this purpose.

In addition or as an alternative to using the thermally insulating material in the piston plate, preferably, it is
20 provided that on at least one side of the piston plate, at least one insulating plate is placed, which is made from non-metallic, thermally insulating material. Preferably, the insulating plate is made from fibre composite.

If the insulating plate is placed between the piston plate
25 and the drive element, in particular, it is located in the reaction chamber. If the insulating plate is placed on the

side of the piston plate facing away from the drive element, it can be located outside the reaction chamber.

The individual reaction chamber has a cross-sectional area vertical to the mounting axis. In particular, said cross-sectional area of the reaction chamber is rectangular, as
5 this geometrical configuration allows for distributing over the frame as many reaction chambers as possible or reaction chambers having a large surface. However, also other cross-sectional areas are possible. Preferably,
10 however, it is provided that the drive element and/or the piston plate and/or the insulation plate extend/s over the entire cross-sectional area.

Preferably, the reaction chamber is open on both sides, i.e. on the front side and on the back side. In particular, the
15 reaction chamber is open on both respective sides over the entire cross-section. The open back side of the reaction chamber is advantageous in that herein the drive element can be directly in direct contact with the mounting surface. Thereby, in case of fire, realizing an as quick as possible
20 and sufficient warming of the drive element. Via the open front side, the drive element can expand in the direction of the door actuator, respectively push the piston plate in the direction of the door actuator.

The fire protection fastening device is formed as flat as
25 possible and, if possible, is configured so that it can be disposed inconspicuously between door actuator and mounting surface. A depth of the individual reaction

chambers is defined vertically to the mounting surface. Preferably, said depth of the reaction chamber is between 1 mm and 30 mm, in particular between 5 mm and 20 mm. Thereby, sufficient construction space is given for
5 disposing the drive element, if required also the piston plate, in the reaction chamber.

The cross-sectional area of the individual reaction chambers is defined vertically to the mounting axis. Preferably, the area amounts to between 400 mm^2 and
10 $50,000 \text{ mm}^2$, preferably between 900 mm^2 and $10,000 \text{ mm}^2$.

When using several reaction chambers, also the sum of all cross-sectional areas is of interest, as an as large as possible a cross-sectional area can deploy a
15 correspondingly high force for pushing the door actuator away. Thus preferably, the sum of all cross-sectional areas of all reaction chambers amounts at least to $2,500 \text{ mm}^2$, in particular at least to $5,000 \text{ mm}^2$.

According to an already described configuration, the frame
20 is not an integral component of the door actuator, but is disposed between mounting surface and door actuator, respectively mounting plate. In this case in particular, it is provided that the frame includes first fastening points for screwing to the mounting surface. Furthermore, second
25 fastening points are formed in the frame, at which the door actuator or a potential mounting plate can be fastened to the frame. In particular, the fastening points are through-

holes. In particular, for the second fastening points the through-holes preferably have a female thread. As an alternative to the configuration as holes, threaded rods can form the fastening points, for example.

- 5 For the herein described dimensions of the fastening points, respectively are relevant the centres thereof, namely the hole centres.

Respectively two first and second fastening points located next to each other preferably form a pair. For example, on
10 the right side of the frame are provided two first and two second fastening points. Correspondingly for example, on the left side of the frame are provided two first and two second fastening points. Thus resulting in respectively two pairs on both sides of the frame.

- 15 With the intention to achieve a possibly direct force input on the fastening points, when pushing away the door actuator, preferably, it is provided that the distance of the fastening points of one pair is as small as possible. In particular, the distance between first fastening points and
20 second fastening points of the respective pair is at most 5 times, preferably at most 4 times the thickness of the frame. In this case, the thickness of the frame is defined parallel to the mounting axis. Preferably in this case, the frame is crucial at the thickest point thereof. As an
25 alternative, respectively the averaged thickness of the frame is crucial in the area between the fastening points of a pair. If the distance of the fastening points of a pair is too

large, it can be that the frame just deforms, without the door actuator coming off of the frame.

Furthermore, the invention comprises a first assembly with a door actuator and the above-described fire protection fastening device, wherein the frame of the fire protection
5 fastening device is formed as an integral component of the door actuator. In particular, the door actuator includes a housing, for example made from die-casting. In particular, at least one hydraulic chamber with the inflammable fluid is
10 located in the housing. Preferably, the frame is formed on the back side of the door actuator, in particular of the housing. In particular in this case, it is intended just one reaction chamber is provided correspondingly with one drive element in the frame. In this case, the piston plate
15 can be located at the back side of the frame.

Furthermore, the invention comprises a second assembly with a door actuator and the described fire protection fastening device, wherein the door actuator can be fastened, in particular screwed, directly to the frame.
20 Preferably in turn, the frame of the fire protection fastening device can be directly fastened, in particular screwed to the mounting surface.

Furthermore, the invention comprises a third assembly with door actuator and described fire protection fastening device, as well as an additional mounting plate. In this
25 case, the mounting plate is to be disposed between fire protection fastening device and door actuator. The

mounting plate is fastened, in particular screwed to the frame of the fire protection fastening device. In turn the frame of the fire protection fastening device is to be screwed to the mounting surface. In this case, the door actuator can be connected, in particular screwed in a usual manner to the front side of the mounting plate. When thermally activated, the mounting plate is pushed away from the mounting surface. In this case, the door actuator together with the mounting plate comes off.

- 10 The advantageous configurations and dependent claims described in conjunction with the inventive fire protection fastening device find advantageous use for all three assemblies.

The invention is now described in more detail based on exemplary embodiments. In this case, it shows:

- Figure 1 an inventive assembly with inventive fire protection fastening device according to a first exemplary embodiment,
- Figure 2 an exploded illustration for Figure 1,
- 20 Figure 3 a frame of the inventive fire protection fastening device according to the first exemplary embodiment,
- Figure 4 the section A-A identified in the Figures 1 and 3,
- 25 Figure 5 an exploded illustration of an inventive assembly with inventive fire protection fastening

device according to a second exemplary embodiment,

Figure 6 an exploded illustration of an inventive assembly with inventive fire protection fastening device according to a third exemplary embodiment,

Figure 7 a detail to Figure 6.

In the following, are explained several exemplary embodiments of the invention. The same reference numerals identify the same, respectively functionally same structural components in all exemplary embodiments.

All exemplary embodiments show an assembly 100 with a door actuator 102. In the exemplary embodiments, the door actuator 102 is formed as a hydraulic door actuator. The door actuator 102 includes an output axis 103. Via said output axis 103, the door actuator can be connected to a door or a casing by means of an arm assembly, for example.

The door actuator 102 is to be fastened to a mounting surface 101. In particular, a door, casing or wall forms said mounting surface 101. A mounting axis 2 is vertical to the mounting surface 101.

A fire protection fastening device 1 is used for fastening the door actuator 102 to the mounting surface 101. The fire protection fastening device 1 comprises a frame 3. In the first two exemplary embodiments according to the Figures 1 to 5, said frame 3 is a separate structural part. In the third

exemplary embodiment according to the Figure 6 and 7, the frame 3 is an integral component of the door actuator 102.

5 The frame 3 includes at least one reaction chamber 4. The reaction chamber 4 accommodates a drive element 7 and a piston plate 8. Furthermore, partially are used insulating plates 9.

The side of the frame 3, facing the mounting surface 101, is referred to as the back side 5. The opposite side is referred to as the front side 6.

10

The Figures 1 to 4 show the fire protection fastening device 1 of the assembly 100 according to the first exemplary embodiment. In this case, the frame 3 with the back side 5 thereof is fastened to the mounting surface 101. The door actuator 102 is directly mounted on the front side 6 of the frame 3.

15

As revealed in Figures 2 and 3, the frame 3 has four reaction chambers 4. A sandwich of drive element 7, piston plate 8 and insulting plate 9 is located in each reaction chamber 4. In this case, as shown in the section of Figure 4, the insulating plate 9 can be disposed outside the reaction chamber 4.

20

Herein, the drive element 7 is formed from two layers of thermal intumescent material. The piston plate 8, for example made from aluminium, is disposed between the insulating plate 9 and the drive element 7.

25

As in particular the section of Figure 4 shows, the individual reaction chamber 4 is open on both sides. The drive element 7 is directly resting at the mounting surface 101. When thermally activating the drive element 7, the piston plate 8 is pressed in the direction of the door actuator 102. As the drive element 7 and the piston plate 8 are located in the reaction chamber 4, the expanding material of the drive element 7 does not get into the fissured back side of the door actuator 102, but the pressure is directly applied to the door actuator 102 via the piston plate 8.

Figure 3 shows a length 15 and a width 16 of the individual reaction chamber 4. Length 15 and width 16 are measured vertically to the mounting axis 2 and determine the cross-sectional area of the reaction chamber 4. Figure 4 reveals a depth 17 of the reaction chamber 4, measured parallel to the mounting axis 2. In this exemplary embodiment, the depth 17 of the reaction chamber 4 also corresponds to the thickness 18 of the frame 2 at the thickest spot.

As Figure 4 shows, the individual reaction chamber 4 has a border 10 on the entire circumference. Said border 10 extends parallel to the mounting axis 2 with an overhang 19. The overhang 19 is measured starting at a contact surface 20 between door actuator 102 and frame 3. The overhang 19 increases the depth 17 of the reaction chamber 4.

Figures 2, 3 and 4 show, that the frame 3 can include at least one pocket 11 on the front side 6. Said pocket 11

forms an air-filled space, which improves the thermal insulation of the frame 3, so that an as small as possible a heat input is realized directly onto the door actuator 102 via the mounting surface 101 and through the frame 3. Such a
5 pocket 11 can be disposed as well on the back side 5 of the frame 3. The pocket 11 can be filled as well, at least partially, with thermally insulating material, in particular firm material.

Figure 3 shows that the frame 3 includes four first fastening
10 points 12 and four second fastening points 13. The first fastening points 12 are used for screwing the frame to the mounting surface 101. The second fastening points 13 are used for screwing the door actuator 102 to the frame 3. In the second exemplary embodiment, it is not the door
15 actuator 102, which is screwed to the second fastening points 13, but a mounting plate 30.

Figure 3 reveals for the first and second exemplary embodiments, that one respective first fastening point 12 and one second fastening points 13, each formed as holes,
20 forms a pair. In this case, the distance 14 between two associated fastening points 12, 13 is selected as small as possible.

Figure 5 shows an exploded illustration of the fire protection fastening device 1 at the assembly 100
25 according to the second exemplary embodiment. Herein, the mounting plate 30 is disposed between door actuator

102 and frame 3. The mounting plate 30 is screwed to the frame 3 via the second fastening points 13.

In the second exemplary embodiment, the frame 3 has five reaction chambers 4. One drive element 7, herein for
5 example also made from two layers, is seated in each reaction chamber 4. A plate is disposed on the front side of the respective drive element 7; said plate can be formed as a piston plate 8 or as an insulating plate 9. Furthermore, at this position, also two sandwiched plates can be used,
10 namely a piston plate 8 and at least one insulating plate 9.

Also in the second exemplary embodiment, the reaction chambers 4 are open on the front side 6 and on the back side 5. On the back side 5, the drive element 7 directly rests at the mounting surface 101.

15 Figures 6 and 7 show the configuration of the fire protection fastening device 1 in the assembly 100 according to the third exemplary embodiment. In the third exemplary embodiment, the frame 3 of the fire protection fastening device 1 is an integral component of the door
20 actuator 102. This is in particular seen, when looking at the back side of the door actuator 102 and Figure 7. Herein, a reaction chamber 4 is formed in the frame 3. According to the exploded illustration in Figure 6, the drive element 7 and a piston plate 8 are seated in this reaction chamber 4.

List of references numerals

	1	fire protection fastening device
	2	mounting axis
	3	frame
5	4	reaction chambers
	5	back side
	6	front side
	7	drive element
	8	piston plate
10	9	insulating plate
	10	border
	11	pocket
	12	first fastening point
	13	second fastening point
15	14	distance
	15	length
	16	width
	17	depth
	18	thickness
20	19	overhang
	20	contact surface
	30	mounting plate
	100	assembly
	101	mounting surface
25	102	door actuator
	103	output axis

Patent claims

1. A fire protection fastening device (1) for fastening a door actuator (102), comprising:
 - a frame (3) with a back side (5), which is to be oriented to a mounting surface (101), in particular a door, casing or wall, wherein a mounting axis (2) is defined vertically to the back side (5), and wherein the frame (3) is formed for arrangement between a door actuator (102) and the mounting surface (101) or is an integral component of the door actuator (102),
 - at least one reaction chamber (4) formed in the frame (3), wherein the frame (3) delimits the reaction chamber (4) on the entire circumference, and wherein the reaction chamber (4) is open on the back side (5) and/or on a front side (6) of the frame (3) opposite the back side (5),
 - and a drive element (7) made from intumescent material disposed in the reaction chamber (4), which, when thermally activated, is formed for pushing away the door actuator (102) from the mounting surface (101).
2. The fire protection fastening device according to claim 1, comprising a piston plate (8) disposed in the reaction chamber (4), which, when thermally activating the drive element (7), is displaceable by the drive

element (7), in particular in relation to the frame and/or the door drive.

3. The fire protection fastening device according to claim 2, wherein the piston plate (8) is manufactured from non-metallic, thermally insulating material or wherein the piston plate (8) includes at least one layer of non-metallic, thermally insulating material.
4. The fire protection fastening device according to any of the claims 2 or 3, wherein, on at least one side of the piston plate (8), at least one insulating plate (9) is placed, which is manufactured from non-metallic, thermally insulating material.
5. The fire protection fastening device according to any of the preceding claims, wherein the drive element (7) and/or the piston plate (8) and/or the insulating plate (9) extend/s over the entire cross-sectional area of the reaction chamber (4) defined vertically to the mounting axis (2).
6. The fire protection fastening device according to any of the preceding claims, wherein the reaction chamber (4) is open on both sides, preferably on both sides over the entire cross-section thereof.
7. The fire protection fastening device according to any of the preceding claims, wherein the drive element (7) is exposed on the back side (5) of the frame (3) for direct contact with the mounting surface (101).

8. The fire protection fastening device according to any of the preceding claims,
- wherein a depth (17), defined parallel to the mounting surface (2), of the reaction chamber (4) amounts to between 1 mm and 30 mm, preferably between 5 mm and 20 mm,
 - and/or wherein a cross-sectional area, defined parallel to the mounting surface (2), of the reaction chamber (4) is between 400 mm² and 50,000 mm², preferably between 900 mm² and 10,000 mm².
9. The fire protection fastening device according to any of the preceding claims, wherein the sum of the cross-sectional areas, defined vertically to the mounting axis (2), of all reaction chambers (4) is at least 2,500 mm², preferably at least 5,000 mm².
10. The fire protection fastening device according to any of the preceding claims,
- wherein the frame (3) includes first fastening points (12), in particular formed as holes, for screwing to the mounting surface (101)
 - and wherein the frame (3) includes second fastening points (13), in particular formed as holes, for screwing the door actuator (102) or a mounting plate (30) to the frame (3).
11. The fire protection fastening device according to claim 10, wherein two respective first and second fastening points (12, 13) next to each other form a pair and the

distance between first fastening point (12) and second fastening point (13) of a pair is at most 5 times, preferably at most 4 times the thickness (18) of the frame (3).

- 5 12. An assembly (100), comprising a door actuator (102) and a fire protection fastening device (1) according to any of the claims 1 to 9, wherein the frame (3) is an integral component of the door actuator (102).
- 10 13. The assembly (100), comprising a door actuator (102) and a fire protection fastening device (1) according to any of the claims 1 to 11, wherein the door actuator (102) can be fastened, in particular screwed directly to the frame (3).
- 15 14. The assembly (100), comprising a door actuator (102), a mounting plate (30) and a fire protection fastening device (1) according to any of the claims 1 to 11, wherein the mounting plate (30) can be fastened, in particular screwed, directly to the frame (3), and wherein the door actuator (102) can be fastened, in particular screwed directly to the mounting plate (30).
- 20