

Method and equipment for aligning shaft doors of a lift

The invention relates to a method and equipment for aligning shaft doors of a lift with an assembly jig which can be mounted on guide rails of a lift cage and which consists of an electro-optical sighting instrument for vertical aligning of shaft door parts and of a line set for horizontal aligning of the shaft door parts.

Equipment for alignment of shaft doors of a lift has become known from the specification CN 101537959 A. Guide rails for a lift cage are mounted in a lift shaft and aligned by a template. The template consists of a fork part which can be plugged onto one guide rail. Arranged at the fork part is a first part which determines the spacing between the guide rail and a door post of a mounted storey door. Arranged on the door post side at the first part is a second part which determines the right-angle position of the first part relative to the door post. The template is of awkward construction and does not allow precise alignment of the guide rails.

The equipment, as characterised in the main claims, fulfils the object of creating a method and equipment enabling precise alignment of shaft fittings with little effort.

The alignment of shaft fittings is simplified by the proposed method and by the proposed equipment. The method, also like the equipment, is suitable for different shaft cross-sections and simplifies assembly operations in the lift shaft. The equipment is economic in production and easy to handle and needs little space in the toolbox of the engineer.

The proposed equipment is an assembly jig which is mountable on guide rails and which consists of an electro-optical sighting instrument, such as, for example, a laser beam instrument, and of a line set.

In the proposed method the shaft doors are aligned according to the aligned guide rails of the lift cage. Before mounting of the guide rails the shaft door opening is determined with the smallest spacing in horizontal direction from the guide rails in plan view. If the smallest spacing is insufficient for passage of the lift cage, the guide rails are mounted closer to the shaft wall opposite the door opening. After alignment of the guide rails in horizontal direction the shaft door opening with the smallest spacing can be furnished, as first shaft door opening, with a shaft door. Thereafter, the remaining shaft door openings are furnished with shaft doors, wherein compensation for a greater spacing in horizontal direction from the guide rails is provided by the door sill.

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The present invention is explained in more detail by way of example on the basis of the accompanying figures, in which:

Fig. 1 shows a plan view of an exemplifying lift shaft,

Fig. 2 shows a side elevation of the lift shaft,

Fig. 3 shows a view of a shaft door opening as seen from the lift shaft.

Fig. 4, Fig. 5 and Fig. 6 show an embodiment of an assembly jig used in the lift shaft,

Fig. 7, Fig. 8 and Fig. 9 show a sill girder placed by means of the assembly jig,

Fig. 10, Fig. 11 and Fig. 12 show preparatory measures for setting a sill and

Fig. 13, Fig. 14 and Fig. 15 show alignment of the sill.

Fig. 1 shows a plan view of a lift shaft 1 which is formed at least partly by shaft walls or by

constructions similar to shaft walls. At least one shaft wall 2 has, per storey, a shaft door opening 3 through which a lift cage 1.1 movable up and down in the lift shaft 2 can be reached. The lift cage 1.1 is guided along guide rails 4 arranged in the lift shaft.

The guide rails 4 span, over the entire shaft height, a first plane E1 extending parallel to the shaft wall 2. Prior to mounting the guide rails 4, the shaft door opening with the smallest spacing a1 according to Fig. 1 from a first plane E1 of the guide rails of the plan view is determined. If the smallest spacing a1 is insufficient for passage of the lift cage the guide rails 4 are mounted closer to the shaft wall opposite the door opening and aligned in vertical direction. After alignment of the guide rails 4 the shaft door opening 3 with the smallest spacing a1 according to Fig. 1 can be furnished, as first one, with a shaft door. The remaining shaft door openings of the lift shaft 1 have, depending on the respective accuracy of the lift shaft, a slightly larger spacing from the plane E1, wherein the difference from the smallest spacing a1 can be accommodated by alignment of the door sill of the respective shaft door. The spacing of the cage sill from the shaft door sill is thus the same for each storey.

Fig. 2 shows a side elevation of the lift shaft 1 with a metre mark 5 in the shaft door opening 3 and with a storey floor 6 in bare construction. The metre mark 5 (bench mark) is a marking, which is usually applied after finishing of the basic build, at a door opening, in which, for example, a door frame or a storey door is inserted. The metre mark 5 gives a height of a metre above the finished floor or the finished storey floor 6 and is a reliable reference height for the participants in the construction such as, for example, floor layers, door constructors, lift constructors, electricians, plasterers, etc.

Fig. 3 shows a view of the shaft door opening 3 as seen from the lift shaft 1. A first marking A is provided at a first vertical spacing y1 from the metre mark 5 and a second marking B is provided at a second vertical spacing y2. The first marking A is a reference height for the drill holes for fastening a sill girder to the shaft wall 2 and the second marking B is a reference height for a door sill arranged at the sill girder. In addition, a centre M1 in vertical direction of all shaft door openings 3 has to be determined by means of, for example, a plumb bob.

Fig. 4, Fig. 5 and Fig. 6 show an embodiment of a two-part assembly jig 7 used in the lift shaft 1, wherein a first part 7.1 is provided at one guide rail 4 and a second part 7.2 at the other guide rail 4. A sighting instrument, for example an electro-optical sighting instrument such as, for example, a laser beam instrument 8, which generates a horizontal laser beam 8.1, is arranged at the first part

7.1. The laser beam instrument 8 can also be arranged at the second part 7.2. The first part 7.1 and the second part 7.2 of the assembly jig 7 are so arranged in vertical direction that the horizontal laser beam 8.1 hits the first marking A or is oriented to this and is visible on the shaft wall 2 as a horizontal laser line 8.11. The first drill hole 9.1 for fastening the sill girder is produced at the intersection of the centre M1 of the shaft door opening 3 with the laser line 8.11. Further drill holes 9.2, 9.3 for fastening the sill girder to the shaft wall 2 are produced at a spacing x from the first drill hole 9.1.

Fig. 7, Fig. 8 and Fig. 9 show, by way of example, the sill girder 10 placed by means of the assembly jig. Bolts are placed in the drill holes 9.1, 9.2, 9.3 and the sill girder 10 fixed at these. Instead of the drill holes 9.1, 9.2, 9.3 it is also possible to provide an embedded anchor rail with which the sill girder 10 can be screw-connected. After placing the sill girder 10, the spacings x from the centre M1 of the shaft door opening 3 are re-measured and the position in vertical direction checked and, if necessary, aligned or corrected by means of the laser line 8.11.

Fig. 10, Fig. 11 and Fig. 12 show preparatory measures for placing a sill. The assembly jig 7 with the first part 7.1 and with the second part 7.2 is, as shown in Fig. 11 by a first arrow P1, pushed upwardly along the guide rail 4 until the horizontal laser beam 8.1 hits the second marking B or is aligned therewith and is visible at the shaft wall 2 as a horizontal laser line 8.11.

Fig. 13, Fig. 14 and Fig. 15 show the alignment of the sill 11 placed on the sill girder 10. The sill 11 is mounted on the aligned sill girder 10 and checked in vertical direction by the laser line 8.11. The alignment of the sill 11 in horizontal direction is symbolised by a second arrow P2 and by a third arrow P3 and is undertaken by a line set 12 of the assembly jig 7. The line set 12 consists of a first line 12.1 and a second line 12.2. For better understanding, the second line 12.2 is illustrated by a dashed line. The first line 12.1 runs by a first run 12.11 from the first part 7.1 of the assembly jig 7 up to a third marking C of the first line 12.1 and from there by a second run 12.2 up to the second part 7.2 of the assembly jig 7. The tightened first line 12.1 extends to the third marking C at a first corner SE1 of the sill 11. The second line 12.2 runs from the second part 7.2 and extends, in the tightened state, at the free end to a second corner SE2 of the sill 11. If the lines 12.1, 12.2 are tightened and the third marking C is at the first corner SE1 of the sill 11 and the free end of the second line 12.2 at the second corner SE2 of the sill 11 the sill 11 is aligned in horizontal direction. The length of the first run 12.11, the length of the second run 12.12 and the length of the second line 12.2 are predetermined by the position of the guide rails 4 in the lift shaft 1, by the shaft dimensions, by the cage plan view and by the sill dimensions. The lengths of the runs 12.11, 12.12

and the length of the third line 12.2 can be calculated or prepared at the factory in accordance with the plan view of the lift to be mounted or are determined by measurement taken at a pattern sill. As pattern sill use can be made, for example, of the sill of the above-mentioned first-mounted shaft door, wherein this shaft door in this case will have been aligned without the proposed assembly jig. The spacing a_2 measured at right-angles to and from the sill 11 up to the plane E1 is critical for the pattern sill.

A roller device for the first line 12.1 can be provided at the first part 7.1 and a roller device for the second line 12.2 can be provided at the second part 7.2, so that the lines 12.1, 12.2 can be unrolled for the alignment procedure and rolled up again after the alignment procedure.

In a further variant of embodiment the line set 12 can consist of three lines, in that the first line 12.1 is separated at the third marking C. By comparison with the above-illustrated line set, in the case of the three-line variant the second run 12.2 is by the separation of the first line 12.1 at the third marking C the third line. In this variant of embodiment each line has a fixed end and a free end at the first part 7.1 or at the second part 7.2. In handling and in use the three-line variant is comparable with the two-line variant explained above.

After placing and alignment of the sill 11 the door posts are plugged onto the sill girder 10 and a door header is plugged onto the door posts and the door header is fixed to brackets arranged above the shaft door opening 3. The door header serves as a support for, for example, guides and coupling devices and locking devices for the shaft doors. In analogous manner the door header has to be aligned relative to the sill 11. This can be carried out by the above-mentioned method steps and by the above-mentioned assembly jig.

Patent claims:

1. Method of aligning shaft doors of a lift according to the following steps:
 - a) applying a reference height (5) to a shaft door opening (3),
 - b) applying a first marking (A) at a first vertical spacing (y1) from the reference height (5) and applying a second marking (B) at a second vertical spacing (y2) from the reference height (5),
 - c) mounting an assembly jig (7) with an electro-optical sighting instrument (8) at guide rails (4) arranged in a lift shaft (1), orienting a horizontal beam (8.1) of the sighting instrument (8) to the markings (A, B) and vertical aligning of shaft door parts (11) according to the horizontal beam (8.1) and
 - d) horizontal aligning of the shaft door parts (11) by means of a line set (12) of the assembly jig (7).
2. Method according to claim 1, wherein the shaft door parts (11) are horizontally aligned by means of at least two lines (12.1, 12.2) of the line set (12).
3. Equipment for aligning shaft doors of a lift with an assembly jig (7) which can be mounted on guide rails (4) of a lift cage (1.1) and which consists of a first part (7.1) mountable on one guide rail (4), a second part (7.2) mountable on the other guide rail (4), an electro-optical sighting instrument (8) for vertical alignment of shaft door parts (11) and a line set (12) with at least two lines (12.1, 12.2) for horizontal alignment of the shaft door parts (11).
4. Equipment according to claim 3, wherein the line set (12) consists of a first line (12.1) and a second line (12.2), wherein the first line (12.1) is integral and has a first run (12.11), a second run (12.12) and a third marking (C) between the runs (12.11, 12.12).
5. Equipment according to claim 4, wherein the first line (12.1) is connected at one end with one of the parts (7.1) and at another end with the other part (7.2) and the second line (12.2) is connected at one end with the other part (7.2).

6. Equipment according to any one of claims 3 to 5, wherein the shaft door parts (11) are horizontally alignable by means of the third marking (C) and by means of the other end of the second line (12.2).
7. Equipment according to claim 3, wherein the line set (12) consists of a first line (12.11), a second line (12.2) and a third line (12.12) and the first line (12.11) is connected at one end with one of the parts (7.1) and the second line (12.2) and third line (12.12) are connected at one end with the other part (7.2).
8. Equipment according to claim 7, wherein the shaft door parts (11) are horizontally alignable by means of the other end of the first, second and third lines (12.11, 12.2, 12.12).
9. Equipment according to any one of claims 3 to 8, wherein the sighting instrument (8) is arranged at one of the parts (7.1, 7.2) and is a laser beam instrument (8) which generates a horizontal laser beam (8.1).