

ICS 27.140
CCS K 55



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 43683.2-2024

**Guidance for installation procedures and tolerances of
hydroelectric machines - Part 2: Vertical generators**

水轮发电机组安装程序与公差导则 第2部分：立式发电机

Issued on: March 15, 2024

Implemented on: April 1, 2025

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

Table of Contents

1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Preparation	1
5 Installation flow chart	1
6 Installation steps	3
6.1 Step 1: turbine shaft in the free state	3
6.2 Step 2: check of the generator foundation	3
6.3 Step 3-1: assembly of the lower bracket	3
6.4 Step 3: installation of the lower bracket	4
6.5 Step 4: concreting of the lower bracket foundation	4
6.6 Step 5-1: assembly of the stator	4
6.7 Step 5: installation of the stator	5
6.8 Step 6: assembly of the thrust and guide bearing	5
6.9 Step 7: installation of the braking and jacking equipment	5
6.10 Step 8: installation of the lower shaft	6
6.11 Step 9: installation of the thrust head	6
6.12 Step 10-1: assembly of the rotor	6
6.13 Step 10: lifting of the rotor	7
6.14 Step 11: installation of the upper shaft	7
6.15 Step 12-1: assembly of the upper bracket	8
6.16 Step 12: installation of the upper bracket	8
6.17 Step 13: separate barring of the generator	8
6.18 Step 14: connection of the turbine shaft and the generator shaft	9
6.19 Step 15: shaft line adjustment	9
6.20 Step 16: concreting of the upper bracket and/or stator frame foundation	12
6.21 Step 17: assembly and adjustment of the upper guide bearing	12
6.22 Step 18: installation of the slip ring (collector ring) and run-out check	13
6.23 Step 19: installation of the brush supporting structure and the brushes	13
6.24 Step 20: completion of the installation of the remaining generator components	13
6.25 Step 21: cleaning, painting and inspection before the first test	14
6.26 Step 22: completion of the generator installation	14

6.27 Step 23: commissioning	14
Bibliography	15

1 Scope

The document gives the installation procedure and the tolerance requirements common to vertical generators. There are many methods of installing a generator, and the document presents one generic installation process. The dimensions of the components of the set, the design of the set, the layout of the power station or the delivery time of the components may lead to additional steps, to the cancellation of certain steps or to a change in the order of installation.

The document is binding only where the contracting parties agree that it shall be.

It applies to the vertical generators specified in IEC 60034-7.

It does not apply to purely commercial uses, unless these are inseparably connected with the installation of the set.

The tolerances specified by different standards may differ; the tolerances in the document are determined from the most common practice and experience.

The document does not cover brushless excitation systems.

Whether or not the document requires the manufacturer to supply documents, drawings or information, every manufacturer shall supply the necessary related material for the equipment it supplies.

2 Normative references

One document is cited: IEC 60034-7, Rotating electrical machines, Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM Code). For dated references only the edition corresponding to that date applies; for undated references the latest edition, including all amendments, applies.

3 Terms and definitions

The document states that it has no terms and definitions that need to be defined. It gives the addresses at which ISO and IEC maintain their terminological databases.

4 Preparation

Components such as the pipework and the foundation plates are covered in the clauses on the embedded parts of the turbine.

5 Installation flow chart

The installation flow chart shown in Figure 1 is drawn up mainly for vertical generators whose thrust bearing lies below the rotor. Where the thrust bearing of the generator lies above the rotor or is supported by the head cover, the flow chart needs to be modified.

Figure 1 separates the work carried out in the machine pit from the work carried out in the erection bay. In the pit the sequence runs from the free state of the turbine shaft and the check of the generator foundation, through the installation of the lower bracket, the concreting of the lower bracket foundation, the installation of the stator, the assembly of the thrust and guide bearing, the installation of the braking and jacking equipment, the lower shaft and the thrust head, the lifting of the rotor, the installation of the upper shaft and of the upper bracket, the separate barring of the generator, the connection of the turbine shaft to the generator shaft and the shaft line adjustment, the concreting of the upper bracket and/or stator frame foundation, the assembly and adjustment of the upper guide bearing, the installation of the slip ring and of the brushgear, the completion of the remaining generator components, the cleaning, painting and inspection before the first test, the completion of the generator installation and, last, the commissioning. In the erection bay the assembly of the lower bracket, of the stator, of the rotor and of the upper bracket is carried out and fed into the corresponding steps in the pit. A key distinguishes the standard tasks, the important events, the steps where turbine and generator work together, the completion of the current installation flow and the references to other flow charts or activities.

Note 1: the flow chart applies to generators whose thrust bearing lies below the rotor. For generators whose thrust bearing lies above the rotor, the starred steps are carried out, wholly or in part, between step 11 and step 12 of the flow chart.

Note 2: the installation of the generator is bound up with the installation of the turbine.

6 Installation steps

Each step is set out under four headings: a) work objective, b) work description, c) points requiring attention and d) additional explanation.

6.1 Step 1, turbine shaft in the free state: see the related content of the turbine part of the document.

6.2 Step 2, check of the generator foundation. Objective: to check the foundation of the upper bracket and/or of the lower bracket, where present, and the stator foundation; to check the openings for the main lead-out and neutral point cables and busbars; to check the pre-embedded oil, air and water pipework. Description: to check the foundations of the upper bracket, the lower bracket and the stator; to check the size of the openings; to check the position of the pipework, and of the second-stage concrete where there is any; to install the foundation bolts; to install the foundation plates. Points requiring attention: the

tolerances are supplied by the generator manufacturer; where single-stage concreting is used, the position, the elevation and the orientation of the foundation plates are checked; where two-stage concreting is used, the anchor bolts, the embedded parts and the position, elevation and orientation of the first-stage pit are checked. Additional explanation: there are two concreting methods for the embedment of the base plate, single-stage and two-stage concrete; care is taken during concreting to avoid displacement of the generator foundation; where the two-stage concrete method is used, the whole surface of the first-stage pit is prepared accordingly, so that the first-stage and second-stage concrete bond together; generators of other constructions follow the requirements of IEC 60034-7, and may have no lower bracket or no upper bracket.

6.3 Step 3-1, assembly of the lower bracket. Objective: to assemble the lower bracket. Description: to connect the arms to the centre body as the design requires, by welding, by bolting or otherwise; this work is usually carried out outside the machine pit. Points requiring attention: the tolerances are supplied by the generator manufacturer; where the arms of the lower bracket are connected to the centre body by welding, non-destructive testing (NDT) is required according to the inspection and test plan (ITP). Additional explanation: the installing party should take preventive measures to control welding deformation effectively, so that the lower bracket can be connected to the embedded parts; the lower bracket, the upper bracket, the rotor and the stator are usually the largest components of the set, their assembly takes a long time and is usually carried out in parallel, and the assembly stations are planned and used sensibly, the key point being the planning of the assembly stations and effective cooperation between the parties involved.

6.4 Step 3, installation of the lower bracket. Objective: to install the lower bracket in its design position. Description: to place the lower bracket on the foundation plates; to adjust and control the elevation, the level and the concentricity of the lower bracket. Points requiring attention: the elevation, the level and the concentricity of the lower bracket are checked, the tolerances being supplied by the generator manufacturer; in determining the correct installation elevation of the lower bracket, account is taken of the deflection produced together by the total mass of the rotating parts and by the axial hydraulic thrust acting on the runner under the given operating conditions. Additional explanation: different designs need different tolerances, so the tolerances are recommended to be supplied by the generator manufacturer; the lower bracket is concentric with the bottom ring, and the turbine shaft may be used as a relative reference, while other reference points may also be used to adjust the centre of the lower bracket; in some cases step 7, the installation of the braking and jacking equipment, is completed within this step.

6.5 Step 4, concreting of the lower bracket foundation. Objective: to concrete the lower bracket foundation. Description: grouting and concreting of the anchor bolts or foundation bolts and of the foundation plates. Points requiring attention: before the foundation is concreted, it is checked that the reinforcing measures cannot affect the foundation plates and the foundation bolts. Additional explanation: it is ensured that air can escape upwards