ABSTRACT: Anchor blocks for a steam turbine in an electric power plant are embedded in a concrete foundation supplied by the customer. The anchor blocks are provided with keying portions utilized to maintain axial and transverse alignment of one or more cylinders or casings of the turbine units and the generator driven by the turbine. After final alignment of the equipment, L-shaped liners are snugly fitted between the keying portions of the anchor blocks and lugs on the turbine casing, also the generator frame.
TRANSVERSE ANCHOR ARRANGEMENT FOR A TURBINE POWERPLANT

BACKGROUND OF THE INVENTION

This invention relates, generally, to elastic fluid machines and, more particularly, to the anchoring of low-pressure cylinders or casings of turbines and electric generators of turbine power plant installations.

The stationary parts, namely, the turbine casings and the generator, of a turbine installation are not rigidly bolted to the customer's foundation. Axial and transverse movement, due to thermal gradients during normal operation of an elastic fluid turbine, has been controlled by anchoring seating plates to the foundation and then utilizing keys to maintain the required alignment between the seating plates and the turbine casings and the generator frame.

Henceforth, a customer of a turbine manufacturer has been required to install steel backing plates in the foundation to the correct centerline and elevation during the construction stages of the foundation. The manufacturer furnished transverse anchor blocks which were bolted and dowelled to the customer's backing plates. After final alignment of the equipment, L-shaped liners were fitted between the anchor blocks and the cylinder seating plates, and also the generator frame to maintain coaxial alignment of the turbine of the turbine casings and the generator.

The prior method has caused the customer considerable concern because of the difficulty in maintaining the backing plates at the correct elevation and in a level plane during the construction of the foundation. In order to have a level plate it has often been necessary to machine the backing plate after it has been anchored in place in the foundation. Also, field bolting and dowelling is an expensive operation.

An object of this invention is to simplify the alignment of a turbine and generator assembly on a fixed foundation.

Another object of the invention is to provide for maintaining the assembly in position after it has been aligned.

Other objects of the invention will be explained fully hereinafter or will be apparent to those skilled in the art.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the invention, the purchaser of a steam turbine builds a concrete foundation for the turbine and generator assembly. Transverse anchor blocks are cast into the foundation at substantially the axial centerline of the turbine. Upwardly extending projections on the blocks extend above the seating plates bolted to the foundation to support the turbine low-pressure cylinders or casings. After final alignment of the turbine casings and the generator, L-shaped liners are fitted between the anchor blocks and lugs on the casings and the generator frame to maintain coaxial alignment of the turbine casings and the generator. The anchor blocks also serve as axial keys for the low-pressure cylinder bases by being fitted directly to the bases instead of the seating plates.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the nature and objects of the invention, reference may be had to the following detailed description, taken in conjuction with the accompanying drawings, in which:

FIG. 1 is a view, in plan, of a portion of a steam turbine and generator assembly, installed in accordance with the present invention;

FIG. 2 is an enlarged isometric view, partly in section, showing the manner of installing a transverse anchor block and a seating plate for the turbine in accordance with the prior art;

FIG. 3 is a view, similar to FIG. 2, showing the manner of installing the transverse anchor block, the seating plate and the turbine casing in accordance with the present invention; and

FIG. 4 is an enlarged isometric view of one of the liners utilized in the installation.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, particularly to FIG. 1, the apparatus shown therein includes a steam turbine cylinder or casing 10 and a portion of an electric generator 11 driven by the turbine. The casing 10 may be a low-pressure unit of a compound turbine including one or more low-pressure units and a high-pressure unit (not shown) connected to each other in tandem through which high-temperature steam flows before entering the low-pressure unit. The casing 10 and the generator 11 are mounted on a concrete foundation 12. As shown more clearly in FIG. 3, the casing 10 is supported on a steel seating plate 13 which may be secured to the foundation 12 by a plurality of bolts 14 embedded in the foundation 12.

As previously explained, the stationary parts of a steam turbine installation, namely, the turbine cylinders or casings and the generator are not rigidly bolted to the customer's foundation. Henceforth, movement, axial and transverse, due to the thermal gradients in the normal operation of elastic fluid turbines, has been controlled by anchoring seating plates to the foundation and then utilizing keys to maintain the required alignment between the seating plates and the casings and the generator.

As shown in FIG. 2, which is representative of the prior art, a customer of a turbine manufacturer has been required to install steel backing plates 15 in the foundation 12 to the correct centerline and elevation during the construction stages of the foundation. The manufacturer has supplied transverse anchor blocks 16 (only one being shown) which are bolted and dowelled to the backing plates 15 by means of a plurality of bolts 17 and dowel pins 18. A keyway 19 is shown in the seating plate 13 for receiving one of the axial keys previously utilized in the installation.

As explained hereinbefore, the prior method of installation has caused a customer considerable concern because of the difficulty in maintaining the backing plate at the correct elevation and in a level plane during the construction of the foundation. In order to have a level plate, it often has been necessary to machine the backing plate after it has been installed in place in the foundation. Furthermore, the bolting and dowelling of the anchor block to the backing plate in the field is an expensive operation, since the backing plate must be drilled in place to receive the anchor block.

In accordance with the present invention, the backing plates previously utilized are eliminated, together with the drilling and dowelling, and the transverse anchor blocks 16 are cast in the foundation 12 during its construction. As shown more clearly in FIG. 1, an anchor block 16 is disposed at one end of the casing 10 and a similar block 16a is disposed at the other end of the casing. The anchor blocks are substantially on the axial centerline L-L of the turbine. It will be understood that an additional anchor block may be provided at the other end of the generator 11 and an additional block would also be provided at the other end of another low-pressure turbine casing when utilized.

As shown in FIG. 3, the block 16 has a keying portion 21 which extends upwardly past the seating plate 13 and between a pair of transversely spaced, axially extending projections or lugs 22 on the turbine casing 10. Preferably, the lugs 22 are formed integrally with the base of the casing 10.

As shown in FIG. 1, the anchor block 16a is similar to the block 16 except that at least the keying portion of block 16a is of sufficient thickness axially to extend between axially extending lugs 23 on the frame of the generator 11 and the neighboring lugs 22 on the turbine casing 10, thereby enabling the one block 16a to cooperate with both the turbine casing 10 and the frame of the generator 11 to maintain them in coaxial alignment. Likewise, when an additional turbine unit is provided in tandem, the block 16 would be of sufficient thickness axially to extend between lugs 22 on the adjacent casing of the additional turbine unit.

The projections 21 are of narrower width than the spacing between the associated lugs 22 to facilitate alignment, and after final alignment of the equipment, snug-fitting L-shaped
liners 24 are fitted in the gaps between the anchor blocks and the lugs on the turbine casing and the generator to maintain coaxial alignment of the turbine and the generator. As shown in FIG. 3, the liners 24 may be attached to the anchor blocks by means of bolts 25 threaded into the anchor block through holes 26 in one leg of the L-shaped liner as shown in FIG. 4. The liners 24 restrain transverse movement of the turbine casing and generator, but limited axial movement is permitted since sufficient clearance 27 is provided between the anchor block and the base of the turbine casing to accommodate thermal expansion of the casing. Thus, the anchor block herein described serves as an axial key for the turbine casing since it is fitted directly to the casing instead of to the seating plate, as in prior constructions. Furthermore, the steel backing plates and the difficulties of installing them are eliminated by utilizing the transverse anchor blocks in the manner herein described.

From the foregoing description it is apparent that the manner of installing and coaxially aligning turbine units and a generator driven thereby is simplified as compared with the prior manner of installing the equipment. Furthermore, the present manner of installation requires less material than the prior manner.

Since numerous changes may be made in the above-described construction and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all subject matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:
1. In an elastic fluid turbine installation, in combination, an elastic fluid turbine casing, a concrete foundation for the casing, a seating plate supporting the casing on the foundation, at least two axially spaced anchor blocks embedded in the foundation in planes transverse to the axial centerline of the casing substantially at the axial centerline, one of said blocks disposed on each side of each turbine, axially extending projections on said casing, said projections formed in pairs at opposite ends of said casing and being in spaced relation in a plane transverse to the axial centerline of said casing, one of said anchor blocks disposed between each pair of projections, said blocks having keying portions extending upwardly above the seating plate and between said projections, to thereby facilitate alignment of said casing.
2. The combination defined in claim 1, wherein said projections are lugs formed integrally on the casing.
3. The combination defined in claim 1, including liners angularly disposed between the keying portions of the anchor blocks and the projections on the casing to retain the casing in an aligned position and to restrain transverse movement of the casing but permit limited axial movement of the casing.
4. The combination defined in claim 3, wherein each liner is L-shaped with one leg retaining the liner in position.
5. The combination defined in claim 1, including a generator with a frame mounted on the foundation, and at least one of said blocks cooperating with the generator frame to retain it in coaxial alignment with the turbine casing.
6. The combination defined in claim 5, including transversely spaced projections on the generator from extending axially toward the projections on the turbine casing to cooperate with said one anchor block.
7. The combination defined in claim 6, wherein at least the keying portion of said one anchor block is of sufficient thickness axially to extend between the projections on the casing and on the generator frame.