IEC 63132-4

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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Guidance for installation procedures and tolerances of hydroelectric machines – Part 4: Vertical Kaplan or propeller turbines

Lignes directrices des procédures et tolérances d'installation des machines hydroélectriques – Partie 4: Turbines Kaplan ou à hélice verticales

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GUIDANCE FOR INSTALLATION PROCEDURES AND TOLERANCES OF HYDROELECTRIC MACHINES –

Part 4: Vertical Kaplan or propeller turbines

FOREWORD

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The text of this International Standard is based on the following documents:

FDIS	Report on voting
4/383/FDIS	4/393/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 63132 series, published under the general title *Guidance for installation procedures and tolerances of hydroelectric machines*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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GUIDANCE FOR INSTALLATION PROCEDURES AND TOLERANCES OF HYDROELECTRIC MACHINES –

Part 4: Vertical Kaplan or propeller turbines

1 Scope

The purpose of this this part of IEC 63132 is to establish, in a general way, suitable procedures and tolerances for the installation of a vertical Kaplan or propeller turbine. This document presents a typical assembly and whenever the word “turbine” is used in this document, it refers to a vertical Kaplan or propeller turbine. There are many possible ways to assemble a unit. The size of the machine, design of the machine, layout of the powerhouse or delivery schedule of the components are some of the elements that could result in additional steps, the elimination of some steps and/or assembly sequences.

It is understood that a publication of this type will be binding only if, and to the extent that, both contracting parties have agreed upon it.

This document excludes matters of purely commercial interest, except those inextricably bound up with the conduct of installation.

The tolerances in this document have been established upon best practices and experience, although it is recognized that other standards specify different tolerances.

Wherever this document specifies that documents, drawings or information is supplied by a manufacturer (or by manufacturers), each individual manufacturer will furnish the appropriate information for their own supply only.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Installation flowchart

4.1 Turbine embedded parts

Figure 1 shows a generic installation flowchart for vertical Kaplan or propeller turbine embedded parts.

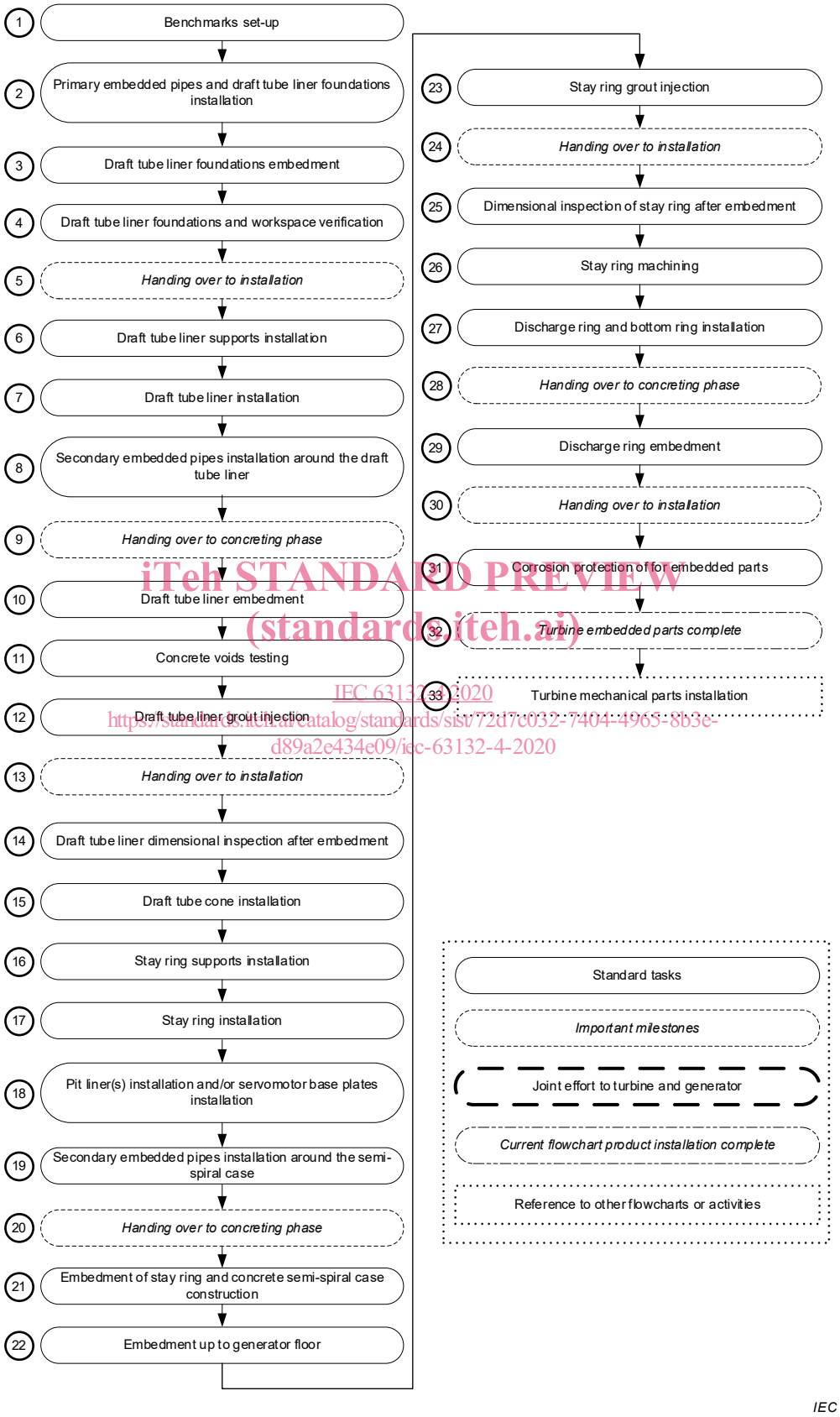
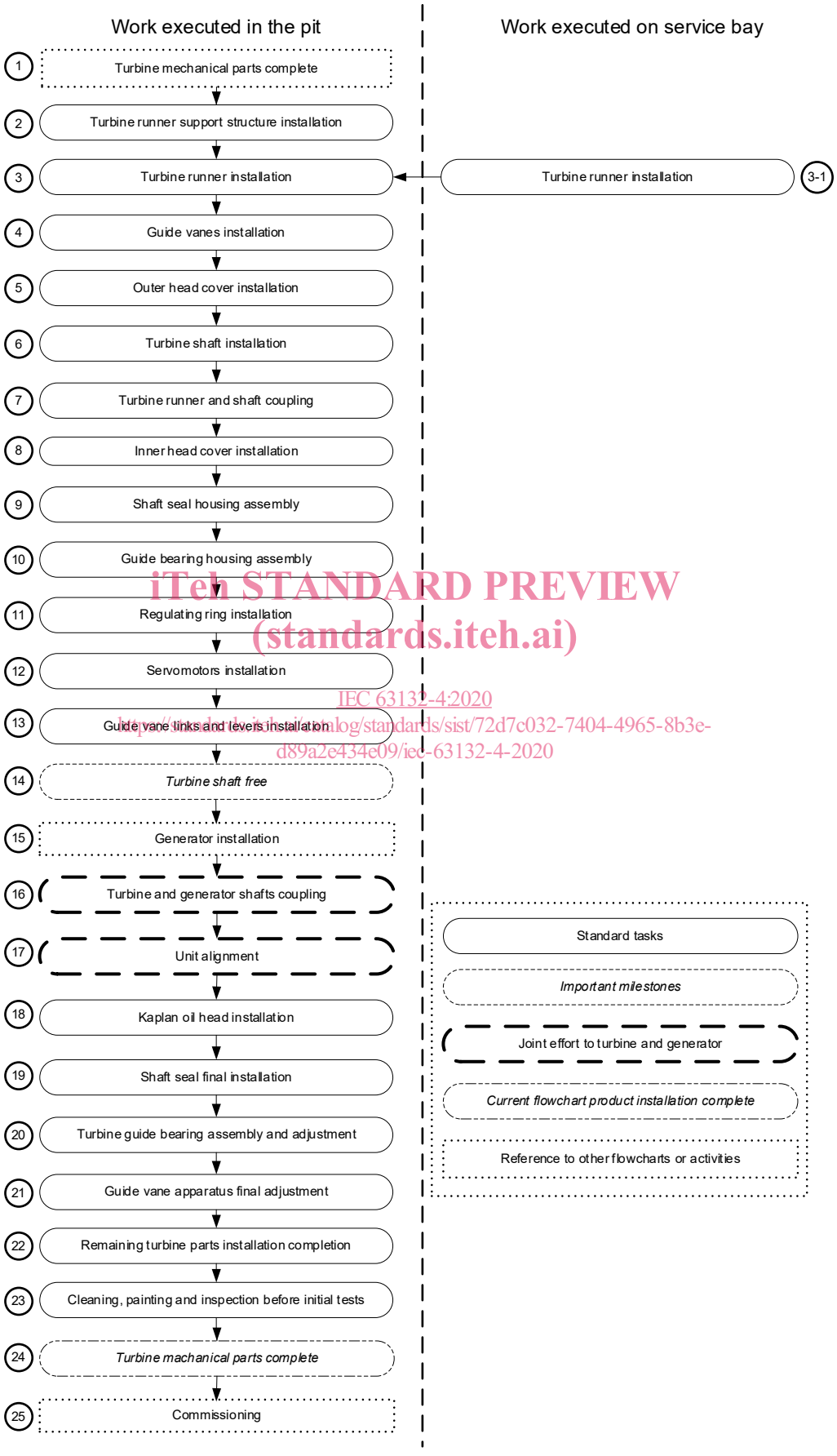


Figure 1 – Generic installation flowchart – Vertical Kaplan or propeller turbine embedded parts

4.2 Turbine mechanical parts

Figure 2 shows a generic installation flowchart for vertical Kaplan or propeller turbine mechanical parts.



NOTE The generator installation is linked to the turbine installation.

Figure 2 – Generic installation flowchart – Vertical Kaplan or propeller turbine mechanical parts

5 Steps

5.1 Turbine embedded parts

5.1.1 Step 1: Benchmarks set-up

a) Objective of work in the step

– Set-up benchmarks to be used for starting proper installation of the turbine.

b) Explanation of work

– Sufficient benchmarks should be provided to establish the unit centreline, axis and elevation.

c) Recommendations

N/A

d) Additional information

Depending on the project delivery system (EPC, design build, etc.), the benchmarks or their reference points could be provided by the owner, civil contractor, etc. Whoever provides the benchmarks or reference points is responsible to make sure they are correct.

The benchmark type (x, y, z coordinates, defining axis and elevations, etc.) should be agreed to prior to the work commencing.

The turbine supplier should take care to transfer the necessary benchmarks throughout the erection and/or concreting processes so that the benchmarks remain accessible as the unit is assembled.

5.1.2 Step 2: Primary embedded pipes and draft tube liner foundation installation

a) Objective of work in the step

– Install primary embedded pipes and steel foundations in the correct locations.

b) Explanation of work

– Install the primary embedded pipes and supporting systems.

– Install the foundation components of the draft tube liner.

c) Recommendations

Different designs require different tolerances; therefore, it is recommended that the turbine supplier should provide the tolerances. It is considered as a best practice to perform:

– NDT as applicable (i.e. Visual inspections, pressure tests of the piping, test of welding seams);

– measures to prevent the concrete from entering the pipes or contaminating the machined surfaces of foundations during concreting.

d) Additional information

The contract should define which party is responsible to install the primary embedded pipes and/or the draft tube liner foundation components.

5.1.3 Step 3: Draft tube liner foundation embedment

a) Objective of work in the step

– Embed the foundation components of the draft tube liner and the primary embedded piping in the concrete.

b) Explanation of work

– Embed the foundation components of the draft tube liner.

c) Recommendations

Care should be taken not to damage any of the embedded components or piping when placing concrete

d) Additional information

N/A

5.1.4 Step 4: Draft tube liner foundation and workspace verification

a) Objective of work in the step

– Confirm that the draft tube liner foundations have been installed in the correct place, verifying that the draft tube pit for placing the draft tube liner is per the design and there is sufficient access to the workplace.

b) Explanation of work

– Ensure that the dimensions of the draft tube pit match the design.

– Ensure that there will be no interference between the concrete structures, the reinforcing steels, the scaffolding, etc., and the foundation anchors, the embedded pipes and the draft tube liner.

– Once the workplace is acceptable the turbine installation work can start.

c) Recommendations

It is recommended to check that the foundation components of the draft tube liner and the primary embedded pipes were installed within the tolerances provided by the turbine supplier.

d) Additional information

N/A

5.1.5 Step 5: Handing over to installation

a) Objective of work in the step

– The work space is transferred to the turbine supplier/installer.

b) Explanation of work

– There is normally an official transfer of the working area of the draft tube from the civil contractor to the turbine supplier/installer. Typically, the transfer is documented with some types of signed form.

c) Recommendations

N/A

d) Additional information

N/A

5.1.6 Step 6: Draft tube liner supports installation

a) Objective of work in the step

– Install the draft tube liner supports.

b) Explanation of work

– Install the supports and installation devices (if required) for fixing of the draft tube liner to the base plates.

c) Recommendations

The following items should be checked:

– NDT of the site welded portion of supports (if applicable);

– dimensional checks of supports.

d) Additional information

In some cases, it will be advantageous for the civil contractor to be able to store the reinforcement steel that will be installed in the draft tube and/or around the draft tube. It can be significantly easier to move the reinforcement steel into this area prior to installation of the draft tube liner. If this is the case, it should be discussed and agreed between parties.

5.1.7 Step 7: Draft tube liner installation

a) Objective of work in the step

– Install the draft tube liner (see Figure 3).

b) Explanation of work

– Transportation of the draft tube liner segments to the foundation and placing them on the supports.

– Tack-welding of the draft tube liner segments.

– Inspection of the alignment and principal dimensions of the draft tube liner before welding.

– Welding of the draft tube liner.

– Inspection of alignment and measurement of principal dimensions of the draft tube liner after welding.

c) Recommendations

The following items should be checked:

– NDT of the welding seams;

– the junction, concentricity of inlet, elevation, level, inclination (if required) and principal dimensions of the draft tube liner should be checked and be within the tolerances listed in Step 9: Handing over to concreting phase;

– proper fixation of the draft tube liner.

d) Additional information

The sequence for the installation of the draft tube liner should be provided by the turbine supplier.

In some designs, steel pier nose(s) are required and will be installed in this step.

If the downstream concrete portion of the draft tube cannot be completed prior to the installation of the draft tube liner, the outlet position of the draft tube liner cannot be determined by the junction method. Therefore, another method will be required to position the outlet of the draft tube liner. The downstream concrete portion would then be adapted to the draft tube liner outlet.

Adequate supports or bracing are required to prevent the draft tube liner from moving or changing shape during placing of the secondary concrete.

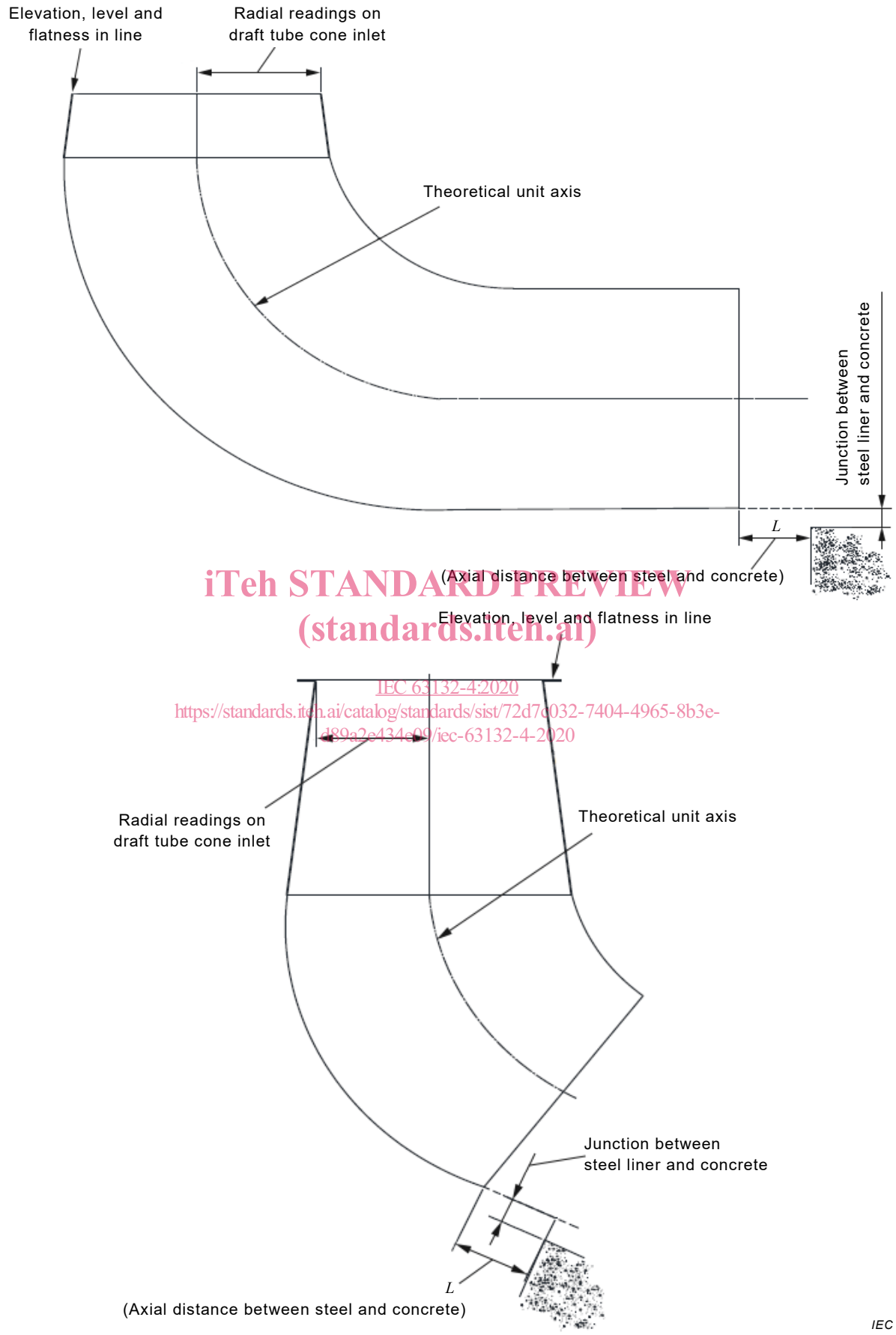


Figure 3 – Draft tube liner installation