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Fatigue assessment of hydraulic turbine runners: from design to quality assurance

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

Draft	Report on voting
4/544/FDIS	4/552/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

– reconfirmed,
– withdrawn, or
– revised.

1 Scope

This International Standard applies to runners of reaction turbines, regardless of their size and capacity. These can include radial turbines such as Francis turbines, axial turbines such as Kaplan and propeller turbines, as well as diagonal turbines, in all possible configurations. In the case of turbine runners with adjustable blades, the internal mechanical components of the blades' adjustment mechanism are excluded from this document. Pelton turbines, storage pumps and pump-turbines are not covered in this first edition, even though several topics are applicable to these types of hydraulic machines. Specificities and applicability to Pelton turbine and pump-turbines will be discussed in a later revision of the standard

This document outlines the methodologies for conducting a fatigue assessment of turbine runners. It encompasses several key aspects, such as defining the load events to be considered during the assessment, determining stresses for each of these load events, as well as the detailed approaches for assessing fatigue of new and existing runners. Additionally, it includes manufacturing and quality assurance requirements to be complied with to achieve the desired material fatigue properties and effectively apply the proposed fatigue assessment methodologies. This document also contains best practices for performing and analysing on-site strain gauge measurements performed on existing runners to evaluate their fatigue life.

The purpose of this document is to provide guidelines to assess fatigue in new and existing turbine runners. It does not specify if a fatigue assessment should be performed or not for a given runner. However, Annex B provides guidance to evaluate the necessity of realizing a fatigue assessment or not for a given new runner. The methods described in this document can also be used for remaining life assessments of in-service runners. However, it is important to consider that the assessed runner materials' fatigue properties and quality level could differ from the prescriptions found in the manufacturing and quality assurance section of this document which have been defined for new runners. It is also important to mention that fatigue assessment alone is not sufficient for a complete validation of the mechanical integrity of a new runner design. Other mechanical validations not covered in this document are typically conducted.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60193:2019, *Hydraulic turbines, storage pumps and pump-turbines - Model acceptance tests*

BS 7910:2019, *Guide to methods for assessing the acceptability of flaws in metallic structures*

CCH 70-4, *Specification for Inspection of Steel Castings for Hydraulic Machines*

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