SLOVENSKI STANDARD
SIST EN 18110:2025

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Kakovost vode - Ocena poškodb rib pri prehodu skozi črpalne postaje in hidroelektrarne - Metode, ki temeljijo na preskusu preživetja rib in modelu udarca z lopatico

Water quality - Assessment of damage to fish passing through pumping stations and hydropower plants - Methods based on live fish passage survival test and blade strike model

Wasserbeschaffenheit - Verfahren zur Ermittlung der Fischdurchgängigkeit von Wasserförderschnecken, Pumpen und Spiralturbinen, die in Pumpwerken und Wasserkraftwerken verwendet werden

Qualité de l’eau - Évaluation des dommages causés aux poissons transitant par les stations de pompage et les centrales hydroélectriques - Méthodes basées sur les tests de survie de poissons vivants lors du transit et le modèle de collision avec des pales

Ta slovenski standard je istoveten z: **EN 18110:2025**

ICS:

13.060.01	Kakovost vode na splošno	Water quality in general
93.160	Vodogradnja	Hydraulic construction

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EUROPEAN STANDARD
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ICS 93.160

English Version

Water quality - Assessment of damage to fish passing through pumping stations and hydropower plants - Methods based on live fish passage survival test and blade strike model

Wasserbeschaffenheit - Verfahren zur Ermittlung der Fischdurchgängigkeit von Wasserförderschnecken, Pumpen und Spiralturbinen, die in Pumpwerken und Wasserkraftwerken verwendet werden

This European Standard was approved by CEN on 13 July 2025.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 18110:2025) has been prepared by Technical Committee CEN/TC 230 "Water analysis", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2026, and conflicting national standards shall be withdrawn at the latest by March 2026.

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Introduction

Purpose of the standard

In recent years, there has been a growing focus on enhancing ecological water quality, with a specific emphasis on fish populations. International legal frameworks, such as the Water Framework Directive (WFD) [1], the European Eel Regulation [2], and the Benelux Free Fish Migration Decision [3], have played a pivotal role in shaping the measures adopted in this regard. Human activities related to water management, drinking water supply, irrigation, and electricity production require the installation of pumps and turbines that can have significant environmental impacts on fish populations. For the environmental sustainability of these sectors, their impact must be studied and, if needed, the best available mitigation measures must be applied. It is the reason why significant efforts are being made by various stakeholders, including water management authorities, resource agencies, pump and turbine manufacturers, ecological consultancy firms, and research institutions, to enhance the chances of survival for fish passing through pumping stations and hydropower plants.

To address these environmental challenges and ensure the effective protection of fish populations, it is crucial to establish standardized procedures for assessing the impact of new and existing turbomachines on fish survival. This standard aims at providing a basis for planning, conducting, and reporting fish survival studies in pumps and turbines. It will lead to more consistency in results among study sites and machines.

Mechanisms of fish mortality

Damage to fish in pumping stations or hydropower plants can have different causes [13]. Mechanical injury by blade strike is generally regarded as the primary cause of injury and mortality in pumps and turbines with low to moderate heads. Grinding of fish along rough walls or entrapment in small gaps and clearances can also lead to damage. Other causes are rapid pressure changes that can result in barotrauma, and excessive shear forces in a fluid flow with high velocity gradients. The actual pump or turbine system is often where the risk is highest, but also other parts of a plant can be the source of damage, for instance at trash racks, in nearly closed guide vanes, long pipelines, or siphons, near butterfly valves, or oscillating no-return valves.

Methods to assess fish survival

Water management authorities are increasingly transitioning to the use of pump and turbine systems that pose fewer risks to fish. Decisions to that effect are usually based on survival tests done in the field at existing plants, or on laboratory experiments done in test facilities for new designs of pumps and turbines that are safer for fish. These survival tests can use either live fish or artificial, dummy fish with integrated sensors. Another alternative route to estimating fish survival is to use computational models that are well-validated with information from prior tests. Each of these methods has its advantages and disadvantages. The final choice depends on the stage of development and the desired level of accuracy.

1. *Fish survival tests in the field*

Fish survival tests conducted in the field at the actual plant site, using live fish and real environmental and operational conditions, yield results that most closely reflect what will be experienced in practice. The fish should be representative of the population for which the survival is being estimated, and operating conditions should reflect the most common modes of operation, or worst-case conditions if such conditions occur on a regular basis. Survival tests like these come closest to reality, where resident fish are entrained naturally into the intake structure of a plant, are subjected to all stressors during passage, and can display their natural behaviour. The use of artificial dummy fish with integrated sensors [17], can give additional information but they cannot replace tests with live fish. While the recorded values of acceleration, rotation, and pressure changes may give valuable information about stressors along a trajectory, these readings alone are (as of yet) difficult to correlate with actual damage to fish. Current studies are expected to improve their predictive powers.