



International
Standard

ISO 17838-1

**Reactor technology — Design and
performance evaluation of the
emergency core cooling system
strainer in pressurized water
reactor nuclear power plants —**

**Part 1:
General principles**

*Technologie des réacteurs - Conception et évaluation de la
performance de la filtration des systèmes de recirculation post-
accidentelle pour les réacteurs à eau pressurisée —*

Partie 1: Principes généraux

**First edition
2026-09**

Sample Document

get full document from standards.iteh.ai



COPYRIGHT PROTECTED DOCUMENT

© ISO 2026

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols	5
5 Main tasks of ECCS strainer design and performance evaluation	5
6 Process steps and logical relationships	6
7 Process steps description and requirements	9
7.1 Step 1 - Initial data and requirements identification	9
7.1.1 General	9
7.1.2 Specific considerations when setting the head loss limit	10
7.1.3 Specific requirements for upstream DST analysis	11
7.1.4 Specific requirements for DST walkdown	11
7.2 Step 2 - Strainer design and test preparation	12
7.3 Step 3 - Strainer performance verification tests	13
7.3.1 Basic requirement	13
7.3.2 Head loss tests	13
7.3.3 Bypass tests	14
7.4 Step 4 - Core integrity verification and downstream equipment qualification pertaining to debris	14
7.4.1 In-vessel downstream effects compliance verification tests and analysis	14
7.4.2 Ex-vessel downstream equipment qualification pertaining to debris	15
7.5 Step 5 - Comprehensive safety assessment	15
8 Guideline for minimising DST	15
9 Guideline for determining margins	16
Bibliography	17

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 85, *Nuclear energy, nuclear technologies, and radiological protection*, Subcommittee SC 6, *Reactor technology*.

A list of all parts in the ISO 17838 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of this document is to provide guidance for the design and performance evaluation of the emergency core cooling system (ECCS) strainer(s) in pressurized water reactor (PWR) nuclear power plants (NPPs). While there are many types of PWRs (including existing and under-construction units), this document will focus on those that rely on ECCS pumps, which present enough similarities to allow a common approach. For other technologies, this document may be used selectively, depending on the specific design characteristics of their plants.

In the event of a relevant line break within the containment of a PWR, control or management of the accident relies on cooling such as emergency core cooling system (ECCS), or containment cooling, via containment heat removal system (CHRS), exemplified by the containment spray system (CSS), or reactor vessel cavity cooling via cavity injection system (CIS), or core melt cooling via the core catcher or other features.

All the above-mentioned cooling functions need to be achieved by water supplies, pumps, and filtration equipment to ensure the effectiveness of cooling water. The water can be obtained from locations such as the containment sump at the lower part of the containment or the in-containment refuelling water storage tank (IRWST). The functional requirements for the various components within these systems are derived from their safety claims.

DBA, DBE and DEC are typically initiated by a relevant line break. Moreover, in the event of a line break within the containment, the insulation and coatings surrounding the break can be damaged by blowdown fluids, possibly resulting in the generation of debris. The debris, together with the blowdown fluids from the pipe break and the water from the CSS, can flow and be directed towards the lower parts of the containment. As this occurs, although some of the debris may be caught by barriers such as compartments, thresholds, and steel gratings, other debris will continue to be transported by the water flow and will eventually accumulate in the containment sump or in the IRWST or in other water storage facilities. This accumulation of debris could render water unavailable to safety systems, thereby affecting their normal operation.

To ensure conformity with the operational requirements of the safety systems for water effectiveness, a set of strainers can be installed at the upstream inlet of the water supply pipe to filter out debris such as fibre and particles. In PWR NPPs, those strainers are commonly referred to as the Emergency Core Cooling System (ECCS) strainer. Depending on specific safety case requirements, the strainer may also be used for design extended conditions (DEC), where specific safety features are considered.

Accidents can disrupt the normal operation of various equipment, posing significant risks to plant safety. For example, as mentioned above, the accumulation of debris on the ECCS strainer following a design basis accident (DBA), a design basis accident (DBE) or a design basis accident (DEC) could result in the strainer being blocked. Such accumulation can increase the head loss across the strainer, which in turn reduces the available net positive suction head (NPSHa) to the safety systems pumps. If the NPSHa falls below the required net positive suction head (NPSHr) of the pumps, cavitation can occur, resulting in a reduction in pump flow rate and potentially rendering the safety functions of the system ineffective. Furthermore, the ECCS strainer can allow the passage of fine fibre and particles, which can clog and erode downstream equipment such as heat exchangers, valves, CSS spray nozzle(s) and orifices, and can also increase the head loss across the reactor core, impairing the core heat transfer efficiency and potentially damaging the fuel cladding. Additionally, fibre, particles and chemical debris can adhere to the fuel rod cladding, further degrading heat removal conditions.

Sample Document

get full document from standards.iteh.ai

Reactor technology — Design and performance evaluation of the emergency core cooling system strainer in pressurized water reactor nuclear power plants —

Part 1: General principles

1 Scope

This document specifies the requirements for the design and performance evaluation of the ECCS strainer, since the performance of the strainer is important for the maintenance of nuclear safety during DBA, DBE and DEC.

This document is applicable to the design and performance evaluation of the ECCS strainer in PWR NPPs, particularly those with primary design philosophies that rely on ECCS pumps. Its relevance for some PWR designs could nevertheless need some adaptations. Moreover, although tailored to PWR NPPs, it can also serve as a valuable reference for other reactor types, providing insight into the design and effectiveness of filtration systems in various nuclear power applications.

Additional information and insights on national practice can be found in References [1][2][3][4].

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitute 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.

ISO 12749-5, *Nuclear energy, nuclear technologies, and radiological protection — Vocabulary — Part 5: Nuclear reactors*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 12749-5 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

bypass

condition whereby debris carried by the flow to the strainer can percolate through and pass downstream

Note 1 to entry: This term is only relevant for designs that include such a system.