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Vesoljska tehnika - Priročnik o toplotni zasnovi - 8. del: Toplotne cevi

Space Engineering - Thermal design handbook - Part 8: Heat Pipes

Raumfahrttechnik - Handbuch für thermisches Design - Teil 8: Wärmerohre

Ingénierie spatiale - Manuel de conception thermique - Partie 8: Caloducs

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ICS:

49.140	Vesoljski sistemi in operacije	Space systems and operations

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TECHNICAL REPORT

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TECHNISCHER BERICHT

CEN/CLC/TR 17603-31-08

August 2021

ICS 49.140

English version

Space Engineering - Thermal design handbook - Part 8: Heat Pipes

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This Technical Report was approved by CEN on 21 June 2021. It has been drawn up by the Technical Committee CEN/CLC/JTC 5.

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European Foreword

This document (CEN/CLC/TR 17603-31-08:2021) has been prepared by Technical Committee CEN/CLC/JTC 5 “Space”, the secretariat of which is held by DIN.

It is highlighted that this technical report does not contain any requirement but only collection of data or descriptions and guidelines about how to organize and perform the work in support of EN 16603-31.

This Technical report (TR 17603-31-08:2021) originates from ECSS-E-HB-31-01 Part 8A.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document has been developed to cover specifically space systems and has therefore precedence over any TR covering the same scope but with a wider domain of applicability (e.g.: aerospace).

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1 Scope

Heat pipes are a solution to many thermal dissipation problems encountered in space systems.

The types of heat pipes that can be used in spacecrafts are described. Details on design and construction, usability, compatibility and the limitations of each type are given.

The Thermal design handbook is published in 16 Parts

TR 17603-31-01	Thermal design handbook – Part 1: View factors
TR 17603-31-02	Thermal design handbook – Part 2: Holes, Grooves and Cavities
TR 17603-31-03	Thermal design handbook – Part 3: Spacecraft Surface Temperature
TR 17603-31-04	Thermal design handbook – Part 4: Conductive Heat Transfer
TR 17603-31-05	Thermal design handbook – Part 5: Structural Materials: Metallic and Composite
TR 17603-31-06	Thermal design handbook – Part 6: Thermal Control Surfaces
TR 17603-31-07	Thermal design handbook – Part 7: Insulations
TR 17603-31-08	Thermal design handbook – Part 8: Heat Pipes
TR 17603-31-09	Thermal design handbook – Part 9: Radiators
TR 17603-31-10	Thermal design handbook – Part 10: Phase – Change Capacitors
TR 17603-31-11	Thermal design handbook – Part 11: Electrical Heating
TR 17603-31-12	Thermal design handbook – Part 12: Louvers
TR 17603-31-13	Thermal design handbook – Part 13: Fluid Loops
TR 17603-31-14	Thermal design handbook – Part 14: Cryogenic Cooling
TR 17603-31-15	Thermal design handbook – Part 15: Existing Satellites
TR 17603-31-16	Thermal design handbook – Part 16: Thermal Protection System

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2 References

EN Reference	Reference in text	Title
EN 16603-00-01	ECSS-S-ST-00-01	ECSS System - Glossary of terms
TR 17603-31-10	ECSS-E-HB-31-01 Part 10	Thermal design handbook – Part 10: Phase-Change Capacitors
TR 17603-31-13	ECSS-E-HB-31-01 Part 13	Thermal design handbook – Part 13: Fluid Loops
TR 17603-31-14	ECSS-E-HB-31-01 Part 14	Thermal design handbook – Part 14: Cryogenic Cooling

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All other references made to publications in this Part are listed, alphabetically, in the **Bibliography**.

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3 Terms, definitions and symbols

3.1 Terms and definitions

For the purpose of this Standard, the terms and definitions given in ECSS-S-ST-00-01 apply.

3.2 Symbols

A_v	vapour core cross-sectional area, [m²]
A_w	wick cross-sectional area, [m²].
C	heat pipe thermal conductance, [W.K⁻¹]
C_i	heat capacity associated to node *i*, [J.K⁻¹]
D_i	inner wall diameter of the pipe, [m]
D_o	outer wall diameter of the pipe, [m]
D_P	diameter of particles, [m]
D_v	diameter of the vapour space, [m]
H	equilibrium capillary height, [m]
H_{ij}	heat transfer coefficient between nodes *i* and *j*, [W.K⁻¹]
K	permeability, [m²]
M	molar mass, [kg.mol⁻¹]
N	figure of merit, [W.m⁻²] $N = \rho_l h_{fg} \sigma / \mu_l$
Q	heat transfer rate, [W]
$(Q.l_{eff})$	integral heat transport factor, [W.m]
R	universal gas constant, R = 8,3143 J.K⁻¹.mol⁻¹
R_g	gas constant of a particular gas, [J.K⁻¹.kg⁻¹] $R_g = R/M$
Re	Reynolds number, $Re = \rho V D_i / \mu$

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