



SLOVENSKI STANDARD
SIST-TP CEN/CLC/TR 17603-31-03:2021

01-oktober-2021

Vesoljska tehnika - Priročnik o toplotni zasnovi - 3. del: Površinska temperatura vesoljskih plovil

Space Engineering - Thermal design handbook - Part 3: Spacecraft Surface Temperature

Raumfahrttechnik - Handbuch für thermisches Design - Teil 3: Oberflächentemperatur von Raumfahrzeugen

Ingénierie spatiale - Manuel de conception thermique - Partie 3: Température de surface des véhicules spatiaux

iTeh STANDARD PREVIEW
(standards.iTeh.ai)

[SIST-TP CEN/CLC/TR 17603-31-03:2021](http://standards.iTeh.ai/catalog/standards/sist-tp-cen-clc-tr-17603-31-03-2021)

Ta slovenski standard je istoveten z: CEN/CLC/TR 17603-31-03:2021

<http://standards.iTeh.ai/catalog/standards/sist-tp-cen-clc-tr-17603-31-03-2021>

ICS:

49.140 Vesoljski sistemi in operacije Space systems and operations

SIST-TP CEN/CLC/TR 17603-31-03:2021 en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST-TP CEN/CLC/TR 17603-31-03:2021](https://standards.iteh.ai/catalog/standards/sist/77f1195e-e5ea-49f9-a3c3-985470178dfc/sist-tp-cen-clc-tr-17603-31-03-2021)

<https://standards.iteh.ai/catalog/standards/sist/77f1195e-e5ea-49f9-a3c3-985470178dfc/sist-tp-cen-clc-tr-17603-31-03-2021>

TECHNICAL REPORT
RAPPORT TECHNIQUE
TECHNISCHER BERICHT

**CEN/CLC/TR 17603-31-
03**

August 2021

ICS 49.140

English version

**Space Engineering - Thermal design handbook - Part 3:
Spacecraft Surface Temperature**

Ingénierie spatiale - Manuel de conception thermique -
Partie 3 : Température de surface des véhicules
spatiaux

Raumfahrttechnik - Handbuch für thermisches Design -
Teil 3: von Oberflächen auf Raumfahrzeugen

This Technical Report was approved by CEN on 14 June 2021. It has been drawn up by the Technical Committee CEN/CLC/JTC 5.

CEN and CENELEC members are the national standards bodies and national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

(standards.iteh.ai)

[SIST-TP CEN/CLC/TR 17603-31-03:2021](https://standards.iteh.ai/catalog/standards/sist/77f1195e-e5ea-49f9-a3c3-985470178dfc/sist-tp-cen-clc-tr-17603-31-03-2021)

<https://standards.iteh.ai/catalog/standards/sist/77f1195e-e5ea-49f9-a3c3-985470178dfc/sist-tp-cen-clc-tr-17603-31-03-2021>



**CEN-CENELEC Management Centre:
Rue de la Science 23, B-1040 Brussels**

Table of contents

European Foreword	10
1 Scope	11
2 References	12
3 Terms, definitions and symbols	13
3.1 Terms and definitions	13
3.2 Symbols.....	13
4 Solar radiation	15
4.1 General.....	15
4.2 Infinitely conductive planar surfaces.....	19
4.2.1 Flat plate emitting on one or both sides.....	19
4.3 Infinitely conductive spherical surfaces	21
4.3.1 Sphere	21
4.4 Infinitely conductive cylindrical surfaces.....	22
4.4.1 Two-dimensional circular cylinder	22
4.4.2 Three-dimensional circular cylinder.....	23
4.5 Infinitely conductive conical surfaces	25
4.5.1 Semi-infinite circular cone	25
4.5.2 Finite circular cone with insulated base. (axial configuration)	27
4.5.3 Finite height circular cone	29
4.6 Infinitely conductive cylindrical-conical surfaces	31
4.6.1 Cone-cylinder-cone	31
4.7 Infinitely conductive prismatic surfaces	49
4.7.1 Prism with an n-sided regular polygonal section.....	49
4.8 Infinitely conductive pyramidal surfaces.....	60
4.8.1 Pyramid with an n-sided regular polygonal section.....	60
4.9 Infinitely conductive prismatic-pyramidal surfaces.....	70
4.9.1.1 Pyramid-prism-pyramid with an n-sided regular polygonal	70
4.10 Thin-walled spherical bodies. Finite conductivity.....	80
4.10.1 Non-spinning sphere	80

4.10.2	Non-spinning sphere. Including internal radiation	82
4.11	Thin-walled cylindrical bodies. Finite conductivity.	83
4.11.1	Non-spinning two-dimensional circular cylinder	83
4.11.2	Spinning two-dimensional circular cylinder	85
4.11.3	Circular cylinder. solar radiation parallel to axis of symmetry	89
4.11.4	Cylindrical surface of rectangular cross section. Solar radiation normal to face	90
4.12	Thin-walled conical bodies. Conductivity	95
4.12.1	Non-spinning cone	95
5	Planetary radiation	99
5.1	General.....	99
5.2	Infinitely conductive planar surfaces	104
5.2.1	Flat plate absorbing and emitting on one side	104
5.3	Infinitely conductive spherical surfaces	105
5.3.1	Sphere	105
5.3.2	Hemispherical surface absorbing and emitting on outer face	106
5.4	Infinitely conductive cylindrical surfaces.....	108
5.4.1	Circular cylinder with insulated bases.....	108
5.4.2	Finite height circular cylinder.....	109
5.5	Infinitely conductive conical surfaces.....	119
5.5.1	Circular cone with insulated base.....	119
5.5.2	Finite height circular cone	122
6	Albedo radiation	125
6.1	General.....	125
6.2	Infinitely conductive planar surfaces	130
6.2.1	Flat plate absorbing and emitting on one side	130
6.3	Infinitely conductive spherical surfaces	135
6.3.1	Sphere	135
6.4	Infinitely conductive cylindrical surfaces.....	139
6.4.1	Circular cylinder with insulated bases.....	139
	Bibliography.....	144
Figures		
	Figure 4-1: The function $T_R(A_E/A_I)^{1/4}$ vs. the distance to the Sun. Calculated by the compiler.	16
	Figure 4-2: The function $T_R(A_E/A_I)^{1/4}$ vs. the optical characteristics of the surface. Shaded zone of <i>a</i> is enlarged in <i>b</i> . Calculated by the compiler.....	17

CEN/CLC/TR 17603-31-03:2021 (E)

Figure 4-3: Temperature T_R as a function of α_s / ε and $A_{ }/A_E$ for $d = 1$ AU. Shaded zone of a is enlarged in b . Calculated by the compiler.	18
Figure 4-4: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ , in the case of a flat plate. Calculated by the compiler.	20
Figure 4-5: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and H/R , in the case of a finite height circular cylinder. Calculated by the compiler.	24
Figure 4-6: Ratio $(A_{ }/A_E)^{1/4}$ as a function of δ , in the case of a semi-infinite circular cone. Calculated by the compiler.	26
Figure 4-7: Ratio $(A_{ }/A_E)^{1/4}$ as a function of δ , in the case of a finite circular cone with insulated base (axial configuration). Calculated by the compiler.	28
Figure 4-8: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a finite height cone. Calculated by the compiler.	30
Figure 4-9: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	32
Figure 4-10: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	33
Figure 4-11: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	34
Figure 4-12: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	35
Figure 4-13: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	36
Figure 4-14: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	37
Figure 4-15: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	38
Figure 4-16: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	39
Figure 4-17: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	40
Figure 4-18: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	41
Figure 4-19: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	42
Figure 4-20: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and δ , in the case of a cone-cylinder-cone. Calculated by the compiler.	43
Figure 4-21: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ for any value of H/R , in the case of a cone-cylinder-cone. Calculated by the compiler.	44
Figure 4-22: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and H/R , in the case of a cone-cylinder-cone. Calculated by the compiler.	45
Figure 4-23: Ratio $(A_{ }/A_E)^{1/4}$ as a function of γ and H/R , in the case of a cone-cylinder-cone. Calculated by the compiler.	46

Figure 4-24: Ratio $(A/A_E)^{1/4}$ as a function of γ and H/R , in the case of a cone-cylinder-cone. Calculated by the compiler.	47
Figure 4-25: Ratio $(A/A_E)^{1/4}$ as a function of γ and H/R , in the case of a cone-cylinder-cone. Calculated by the compiler.	48
Figure 4-26: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a prism. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Circular cylinder, $n = \infty$. Calculated by the compiler.	50
Figure 4-27: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a prism. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Circular cylinder, $n = \infty$. Calculated by the compiler.	51
Figure 4-28: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a prism. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Circular cylinder, $n = \infty$. Calculated by the compiler.	52
Figure 4-29: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a prism. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Circular cylinder, $n = \infty$. Calculated by the compiler.	53
Figure 4-30: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a prism. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Circular cylinder, $n = \infty$. Calculated by the compiler.	54
Figure 4-31: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a prism. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Circular cylinder, $n = \infty$. Calculated by the compiler.	55
Figure 4-32: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a prism. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Circular cylinder, $n = \infty$. Calculated by the compiler.	56
Figure 4-33: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a prism. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Circular cylinder, $n = \infty$. Calculated by the compiler.	57
Figure 4-34: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a prism. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Circular cylinder, $n = \infty$. Calculated by the compiler.	58
Figure 4-35: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a prism. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Circular cylinder, $n = \infty$. Calculated by the compiler.	59
Figure 4-36: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Circular cone, $n = \infty$. Calculated by the compiler.	61
Figure 4-37: Ratio $(A/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Circular cone, $n = \infty$. Calculated by the compiler.	62

CEN/CLC/TR 17603-31-03:2021 (E)

- Figure 4-38: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Circular cone, $n = \infty$. Calculated by the compiler.....63
- Figure 4-39: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Circular cone, $n = \infty$. Calculated by the compiler.....64
- Figure 4-40: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Circular cone, $n = \infty$. Calculated by the compiler.....65
- Figure 4-41: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Circular cone, $n = \infty$. Calculated by the compiler.....66
- Figure 4-42: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Circular cone, $n = \infty$. Calculated by the compiler.....67
- Figure 4-43: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Circular cone, $n = \infty$. Calculated by the compiler.....68
- Figure 4-44: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Circular cone, $n = \infty$. Calculated by the compiler.....69
- Figure 4-45: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Circular cone, $n = \infty$. Calculated by the compiler.....70
- Figure 4-46: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid - prism - pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Cone - cylinder - cone, $n = \infty$. Calculated by the compiler.71
- Figure 4-47: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid - prism - pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Cone - cylinder - cone, $n = \infty$. Calculated by the compiler.72
- Figure 4-48: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid - prism - pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Cone - cylinder - cone, $n = \infty$. Calculated by the compiler.73
- Figure 4-49: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid - prism - pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Cone - cylinder - cone, $n = \infty$. Calculated by the compiler.74

Figure 4-50: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid - prism - pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Cone - cylinder - cone, $n = \infty$. Calculated by the compiler.	75
Figure 4-51: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid - prism - pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Cone - cylinder - cone, $n = \infty$. Calculated by the compiler.	76
Figure 4-52: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid - prism - pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Cone - cylinder - cone, $n = \infty$. Calculated by the compiler.	77
Figure 4-53: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid - prism - pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. The values corresponding to $H/R \leq 1$ are also plotted in the previous figure. Cone - cylinder - cone, $n = \infty$. Calculated by the compiler.	78
Figure 4-54: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid - prism - pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Cone - cylinder - cone, $n = \infty$. Calculated by the compiler.	79
Figure 4-55: Ratio $(A_i/A_E)^{1/4}$ as a function of H/R , in the case of a pyramid - prism - pyramid. The curves plotted are those corresponding to the largest and smallest areas projected from the Sun. Cone - cylinder - cone, $n = \infty$. Calculated by the compiler.	80
Figure 4-56: Temperature distribution on sphere. No spin. No internal radiation. Calculated by the compiler.	81
Figure 4-57: Temperature distribution on sphere including internal radiation. No spin. Calculated by the compiler.	83
Figure 4-58: Temperature distribution on a two-dimensional cylinder. No spin. No internal radiation. Calculated by the compiler.	85
Figure 4-59: Temperature distribution on a two - dimensional spinning cylinder for several μ an γ values. No internal radiation. Calculated by the compiler.	87
Figure 4-60: Temperature distribution on a two - dimensional spinning cylinder for several μ an γ values. No internal radiation. Calculated by the compiler.	88
Figure 4-61: Temperature distribution on cylinder. No spin. No internal radiation. From Nichols (1961) [11].	90
Figure 4-62: Temperature distribution on a cylindrical surface whose cross section is a rectangle of aspect - ratio $\lambda = 0,5$. No internal radiation. Calculated by the compiler.	92
Figure 4-63: Temperature distribution on a cylindrical surface whose cross section is a rectangle on aspect - ration $\lambda = 1$. No internal radiation. Calculated by the compiler.	93
Figure 4-64: Temperature distribution on a cylindrical surface whose cross section is a rectangle on aspect - ration $\lambda = 2$. No internal radiation. Calculated by the compiler.	94

CEN/CLC/TR 17603-31-03:2021 (E)

Figure 4-65: Temperature distribution on cone. No spin. No internal radiation. From Nichols (1961) [11].	96
Figure 4-66: Temperature distribution on cone. No spin. No internal radiation. From Nichols (1961) [11].	97
Figure 4-67: Temperature distribution on cone. No spin. No internal radiation. From Nichols (1961) [11].	98
Figure 5-1: The ratio T_{RP}/T_P vs. the optical characteristics of the surface for different values of F_{SP} . Shaded zone of a is enlarged in b . Calculated by the compiler.	101
Figure 5-2: Radiation equilibrium temperature T_{RP} vs. ratio T_{RP}/T_P . Incoming radiation from different planets. After NASA - SP - 3051 (1965).	102
Figure 5-3: Different estimates of radiation equilibrium temperature T_{RP} vs. T_{RP}/T_P , for radiation from the Earth. Plotted from data by Johnson (1965) [9].	103
Figure 5-4: F_{SP} as a function of λ and h/R_P in the case of a flat plate absorbing and emitting on one side. Calculated by the compiler.	105
Figure 5-5: F_{SP} as a function of h/R_P in the case of a sphere. Calculated by the compiler.	106
Figure 5-6: F_{SP} as a function of λ and h/R_P in the case of a hemispherical surface absorbing and emitting on outer face. Calculated by the compiler.	107
Figure 5-7: F_{SP} as a function of λ and h/R_P in the case of a circular cylinder with insulated bases. Calculated by the compiler.	109
Figure 5-8: F_{SP} as a function of λ and h/R_P in the case of a finite height circular cylinder. Calculated by the compiler.	110
Figure 5-9: F_{SP} as a function of λ and h/R_P in the case of a finite height circular cylinder. Calculated by the compiler.	111
Figure 5-10: F_{SP} as a function of λ and h/R_P in the case of a finite height circular cylinder. Calculated by the compiler.	112
Figure 5-11: F_{SP} as a function of λ and h/R_P in the case of a finite height circular cylinder. Calculated by the compiler.	113
Figure 5-12: F_{SP} as a function of λ and h/R_P in the case of a finite height circular cylinder. Calculated by the compiler.	114
Figure 5-13: F_{SP} as a function of λ and h/R_P in the case of a finite height circular cylinder. Calculated by the compiler.	115
Figure 5-14: F_{SP} as a function of λ and h/R_P in the case of a finite height circular cylinder. Calculated by the compiler.	116
Figure 5-15: F_{SP} as a function of λ and h/R_P in the case of a finite height circular cylinder. Calculated by the compiler.	117
Figure 5-16: F_{SP} as a function of λ and h/R_P in the case of a finite height circular cylinder. Calculated by the compiler.	118
Figure 5-17: F_{SP} as a function of λ and h/R_P in the case of a circular cone with insulated base. Calculated by the compiler.	120
Figure 5-18: F_{SP} as a function of λ and h/R_P in the case of a circular cone with insulated base. Calculated by the compiler.	121

Figure 5-19: F_{SP} as a function of λ in the case of a finite height circular cone. Calculated by the compiler.....	123
Figure 5-20: F_{SP} as a function of λ in the case of a finite height circular cone. Calculated by the compiler.....	124
Figure 6-1: The ratio T_{RA}/T_A vs. the optical characteristics of the surface for different values of F . Shaded zone of a is enlarged in b . Calculated by the compiler.	126
Figure 6-2: Albedo equilibrium temperature, T_{RA} , vs. dimensionless ratio T_{RA}/T_A . Incoming albedo from different planets. After Anderson (1969) [1].	127
Figure 6-3: Different estimates of albedo equilibrium temperature T_{RA} , vs. T_{RA}/T_A in case of the Earth. Calculated by the compiler.	128
Figure 6-4: Albedo view factor F vs. h/R_P for different values of θ_S in the case of a flat plate ($\lambda = 0^\circ$, $\phi_c = 180^\circ$). From Bannister (1965) [2].	131
Figure 6-5: Albedo view factor F vs. h/R_P for different values of θ_S in the case of a flat plate ($\lambda = 30^\circ$, $\phi_c = 0^\circ$). From Bannister (1965) [2].	132
Figure 6-6: Albedo view factor F vs. h/R_P for different values of θ_S in the case of a flat plate ($\lambda = 30^\circ$, $\phi_c = 90^\circ$). From Bannister (1965) [2].	133
Figure 6-7: Albedo view factor F vs. h/R_P for different values of θ_S in the case of a flat plate ($\lambda = 30^\circ$, $\phi_c = 180^\circ$). From Bannister (1965) [2].	134
Figure 6-8: Albedo view factor F vs. h/R_P for different values of θ_S in the case of a sphere. From Cunningham (1961) [6].	136
Figure 6-9: Albedo view factor F vs. h/R_P for different values of θ_S in the case of a sphere. From Cunningham (1961) [6].	137
Figure 6-10: Albedo view factor F vs. h/R_P for different values of θ_S in the case of a sphere. Calculated by the compiler.	138
Figure 6-11: Albedo view factor F vs. h/R_P for different values of θ_S in the case of a cylinder ($\lambda = 0^\circ$, $\phi_c = 0^\circ, 180^\circ$). From Bannister (1965) [2].	140
Figure 6-12: Albedo view factor F vs. h/R_P for different values of θ_S in the case of a cylinder ($\lambda = 60^\circ$, $\phi_c = 0^\circ$). From Bannister (1965) [2].	141
Figure 6-13: Albedo view factor F vs. h/R_P for different values of θ_S in the case of a cylinder ($\lambda = 60^\circ$, $\phi_c = 90^\circ$). From Bannister (1965) [2].	142
Figure 6-14: Albedo view factor F vs. h/R_P for different values of θ_S in the case of a cylinder ($\lambda = 60^\circ$, $\phi_c = 180^\circ$). From Bannister (1965) [2].	143

Tables

Table 5-1: Relevant data on the Planets and the Moon.	104
Table 6-1: Relevant data on the Planets and the Moon.	129

European Foreword

This document (CEN/CLC/TR 17603-31-03:2021) 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 17603-31-03:2021) originates from ECSS-E-HB-31-01 Part 3A.

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).

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST-TP CEN/CLC/TR 17603-31-03:2021
<https://standards.iteh.ai/catalog/standards/sist/77f1195e-e5ea-49f9-a3c3-985470178dfc/sist-tp-cen-clc-tr-17603-31-03-2021>

1

Scope

Factors affecting the equilibrium temperature of a spacecraft surface are described in this Part 3 using simple geometrical configurations and basic assumptions.

Methods for conducting calculations on the affect of Solar, planetary and albedo radiation are given taking into consideration the internal and immediate environmental factors and incorporating the various configurations and dimensions of the constituent parts.

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

2 References

EN Reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS System - Glossary of terms

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

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST-TP CEN/CLC/TR 17603-31-03:2021](https://standards.iteh.ai/catalog/standards/sist/77f1195e-e5ea-49f9-a3c3-985470178dfc/sist-tp-cen-clc-tr-17603-31-03-2021)
<https://standards.iteh.ai/catalog/standards/sist/77f1195e-e5ea-49f9-a3c3-985470178dfc/sist-tp-cen-clc-tr-17603-31-03-2021>

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_E	emitting area of the spacecraft, [m ²]
A_I	area of the spacecraft projected from the sun, [m ²]
B_i	parameters of the truncated power series development of F_{SP} , see clause 6.1
F	Albedo view factor from spacecraft to planet
F_{SP}	view factor from spacecraft to planet
R_P	mean radius of the planet, [m]
S	solar flux, [W.m ⁻⁴] $S = S_0.d^{-2}$
S_0	solar constant, $S_0 = 1353 \text{ W.m}^{-2}$
T	temperature, [K]
T_A	Albedo temperature, [K] $T_A = [aS_0/\sigma d^2]^{1/4}$
T_R	radiation equilibrium temperature of the infinitely conductive spacecraft, [K]
T_{RA}	radiation equilibrium temperature of the infinitely conductive spacecraft under Albedo radiation, [K]
T_{RP}	radiation equilibrium temperature of the infinitely conductive spacecraft under planetary radiation, [K]
T_P	equivalent planet temperature, [K] $T_P = (e/\sigma)^{1/4}$
T_s	equivalent surrounding temperature, [K]
a	mean Albedo of the planet