DIN EN 14607-1:2006-12 (E)

Space engineering - Mechanical - Part 1: Thermal control; English version EN 14607-1:2004

Contents

page

Foreword 5

1 Scope 6

2 Normative references 6

3 Terms, definitions and abbreviated terms 7
3.1 Terms and definitions 7
3.2 Definitions for unit internal thermal design 12
3.3 Abbreviated terms 13

4 Requirements 15
4.1 Mission 15
4.1.1 General 15
4.1.2 Ground and pre-launch 15
4.1.3 Launch and ascent 15
4.1.4 Planetary orbital phases 16
4.1.5 Interplanetary phases 16
4.1.6 Docking, docked and separation phases 16
4.1.7 Descent, (re-)entry and landing 16
4.1.8 Post-landing phases 17
4.2 Performance 17
4.2.1 General 17
4.2.2 Temperatures 17
4.2.3 Functionality 17
4.2.4 Additional and other performance requirements 17
4.3 Interfaces 17
4.3.1 General 17
4.3.2 Mechanical interface 18
4.3.3 Electrical interface 18
4.3.4 AOCS interface 18
4.3.5 TM/TC interface 19
4.3.6 OBDH and S/W interface 19
4.3.7 Launcher interface 19
4.3.8 GSE interface 19
4.4 Design 19
4.4.1 General 19
4.4.2 Budgets 20
4.4.3 Parts, materials and processes (PMP) 20
4.4.4 EEE components 20
4.4.5 Lifetime 20
4.4.6 Predictability and testability 20
4.4.7 Flexibility 20
4.4.8 Accessibility 20
4.4.9 Reliability 21
4.4.10 Redundancy 21
4.4.11 Interchangeability 21
4.4.12 Maintenance 21
4.4.13 Cleanliness 21
4.4.14 Safety 21
4.4.15 Availability 21
4.5 Verification 21
4.5.1 General 21
4.5.2 Review of design 22
4.5.3 Verification by similarity 22
4.5.4 Verification by inspection 22
4.5.5 Verification by analysis 22
4.5.6 Verification by test 22

4.5.7 Thermal Balance (TB) test 23
4.6 Production and manufacturing 24
4.6.1 General 24
4.6.2 Manufacturing process 24
4.6.3 Manufacturing drawings 24
4.6.4 Quality management 24
4.6.5 Cleanliness 25
4.6.6 Procurement 25
4.6.7 Tooling 25
4.6.8 Integration 25
4.6.9 Marking 26
4.6.10 Packaging, handling, transportation 26
4.6.11 Storage 26
4.6.12 Repair 26
4.6.13 In-service requirements 26
4.7 Product assurance 26
4.8 Deliverables 26
4.8.1 General 26
4.8.2 Hardware 27
4.8.3 Documentation 28
4.9 Use standard to define project requirements 29

Annex A (normative) Development approach 30
A.1 Uncertainties 30
A.1.1 Uncertainty philosophy 30
A.1.2 Sources for temperature uncertainties 31
A.1.3 Sensitivity analysis and temperature uncertainty 32
A.2 Margins 33
A.3 Test approach and test success criteria 33
A.3.1 Test approach 33
A.3.2 Test success criteria 34
A.4 Correlation approach and correlation success criteria 34
A.4.1 General 34
A.4.2 Temperature level criteria 34
A.4.3 Standard deviation criteria 35
A.4.4 Individual unit success criteria 35
A.5 Analysis approach 35
A.5.1 Objectives of thermal analysis 35
A.5.2 Thermal analysis methods 35
A.5.3 Interfaces and deliverables 36
A.5.4 Quality 37

Annex B (normative) Cryogenic temperature range 38
B.1 Applicability 38
B.1.1 General 38
B.1.2 Cryogenic definitions (exceptions) 38
B.2 Complementary terminology for the cryogenic temperature range 38
B.3 Applicability matrix 39

Annex C (normative) High temperature range 41
C.1 Applicability 41
C.2 Complementary terminology for the high temperature range 41
C.3 Applicability matrix 43

Annex D (informative) TCS development methodology 45
D.1 Conventional temperature range 45
D.1.1 General 45
D.1.2 First stage (preliminary) configuration 45
D.1.3 Final thermal design 45
D.1.4 Reason for thermal analyses 48
D.1.5 Typical parameter inaccuracies 49
D.2 Cryogenic temperature range 51
D.2.1 General 51
D.2.2 Reason for thermal analyses 51

D.2.3 Typical parameter inaccuracies **51**

Bibliography **52**

Figures

Figure 1 — Temperature definitions for thermal control system (TCS) 7

Figure 2 —Temperature definitions for unit thermal design 13

Figure 3 — Product exchange between the system, TCS and the supplier or manufacturer 27

Figure D.1 — TCS development approach (first stage) 46

Figure D.2 —: TCS development approach (final design) 47

Figure D.2 - (continued): TCS development approach (final design) 48

Figure D.3 —: Modelling philosophy 49

Figure D.4 — CCS development approach 51

Tables

Table 1 — Documentation schedule 29

Table D.1 —: Parameter inaccuracies (pre-phase A and phase B) 50

Table D.2 —Parameter inaccuracies (phase B and phase C/D) 50