

Table of contents

Foreword	6
1 Scope	7
2 Normative references	8
3 Terms, definitions and abbreviated terms	10
3.1 Terms from other standards.....	10
3.2 Terms specific to the present standard	11
3.3 Abbreviated terms.....	17
4 Principles	19
5 Fracture control programme	21
5.1 General.....	21
5.2 Fracture control plan.....	21
5.3 Reviews.....	22
5.3.1 General	22
5.3.2 Safety and project reviews	23
6 Identification and evaluation of PFCI	25
6.1 Identification of PFCIs.....	25
6.2 Evaluation of PFCIs	26
6.2.1 Damage tolerance.....	26
6.2.2 Fracture critical item classification	28
6.3 Compliance procedures	28
6.3.1 General	28
6.3.2 Safe life items	28
6.3.3 Fail-safe items.....	29
6.3.4 Contained items	30
6.3.5 Low-risk fracture items	31
6.4 Documentation requirements	36
6.4.1 Fracture control plan	36
6.4.2 Lists	36
6.4.3 Analysis and test documents.....	36

6.4.4	Fracture control summary report	36
7	Fracture mechanics analysis.....	38
7.1	General.....	38
7.2	Analytical life prediction	39
7.2.1	Identification of all load events	39
7.2.2	Identification of the most critical location and orientation of the crack.....	39
7.2.3	Derivation of stresses for the critical location.....	40
7.2.4	Derivation of the stress spectrum.....	40
7.2.5	Derivation of material data	41
7.2.6	Identification of the initial crack size and shape.....	41
7.2.7	Identification of an applicable stress intensity factor solution.....	42
7.2.8	Performance of crack growth calculations	43
7.3	Critical crack-size calculation.....	43
8	Special requirements	45
8.1	Introduction.....	45
8.2	Pressurized hardware.....	45
8.2.1	General.....	45
8.2.2	Pressure vessels.....	45
8.2.3	Pressurized structures	48
8.2.4	Pressure components	48
8.2.5	Low risk sealed containers	49
8.2.6	Hazardous fluid containers.....	49
8.3	Welds	50
8.3.1	Nomenclature.....	50
8.3.2	Safe life analysis of welds	50
8.4	Composite, bonded and sandwich structures.....	51
8.4.1	General.....	51
8.4.2	Defect assessment.....	51
8.4.3	Damage threat assessment	53
8.4.4	Compliance procedures	54
8.5	Non-metallic items other than composite, bonded, sandwich and glass items	57
8.6	Rotating machinery.....	58
8.7	Glass components.....	58
8.8	Fasteners	59
9	Material selection	61
10	Quality assurance and Inspection	62

10.1	Overview	62
10.2	Nonconformances.....	62
10.3	Inspection of PFCI	62
10.3.1	General	62
10.3.2	Inspection of raw material	63
10.3.3	Inspection of safe life finished items	64
10.4	Non-destructive inspection of metallic materials	65
10.4.1	General	65
10.4.2	NDI categories versus initial crack size	65
10.4.3	Inspection procedure requirements for standard NDI	69
10.5	NDI for composites, bonded and sandwich parts	72
10.5.1	General	72
10.5.2	Inspection requirements.....	73
10.6	Traceability	74
10.6.1	General	74
10.6.2	Requirements.....	75
10.7	Detected defects.....	75
10.7.1	General	75
10.7.2	Acceptability verification	76
10.7.3	Improved probability of detection.....	77
11	Reduced fracture control programme	78
11.1	Applicability.....	78
11.2	Requirements	78
11.2.1	General	78
11.2.2	Modifications	78
	Annex A (informative) The ESACRACK software package.....	80
	Annex B (informative) References	81
	Bibliography.....	82
	Figures	
	Figure 5-1: Identification of PFCI	22
	Figure 6-1: Fracture control evaluation procedures	27
	Figure 6-2: Safe life item evaluation procedure for metallic materials	33
	Figure 6-3: Safe life item evaluation procedure for composite, bonded and sandwich items	34
	Figure 6-4: Evaluation procedure for fail-safe items.....	35

Figure 8-1: Procedure for metallic pressure vessel and metallic liner evaluation	47
Figure 10-1: Initial crack geometries for parts without holes	71
Figure 10-2: Initial crack geometries for parts with holes	72
Figure 10-3: Initial crack geometries for cylindrical parts	72

Tables

Table 8-1: Factor on stress for sustained crack growth analysis of glass items	59
Table 10-1: Initial crack size summary, standard NDI	68