

ISO/TR 15655:2020-02 (E)

Fire resistance - Tests for thermo-physical and mechanical properties of structural materials at elevated temperatures for fire engineering design

Contents		Page
Foreword		vi
Introduction		vii
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Tests for thermal properties at elevated temperatures	1
4.1	Metals	1
4.1.1	General	1
4.1.2	Specific heat	1
4.1.3	Thermal conductivity	2
4.1.4	Thermal diffusivity	2
4.1.5	Thermal strain (expansion and contraction)	3
4.1.6	Emissivity	3
4.2	Concrete	4
4.2.1	General	4
4.2.2	Specific heat	4
4.2.3	Thermal conductivity	4
4.2.4	Thermal diffusivity	5
4.2.5	Thermal strain (expansion and contraction)	5
4.2.6	Density	6
4.2.7	Emissivity	6
4.2.8	Spalling	7
4.2.9	Expansion/shrinkage	7
4.2.10	Moisture	7
4.3	Masonry	7
4.3.1	Specific heat	7
4.3.2	Thermal conductivity	8
4.3.3	Thermal diffusivity	9
4.3.4	Thermal strain (expansion and contraction)	9
4.3.5	Density	10
4.3.6	Emissivity	10
4.3.7	Spalling	10
4.3.8	Expansion/shrinkage	11
4.3.9	Moisture content	11
4.4	Wood	11
4.4.1	General	11
4.4.2	Specific heat	11
4.4.3	Thermal conductivity	12
4.4.4	Thermal diffusivity	12
4.4.5	Density	13
4.4.6	Charring rate	13
4.4.7	Emissivity	14
4.4.8	Moisture	14
4.5	Plastics, fibre reinforcement, organic and inorganic materials	14
4.5.1	General	14
4.5.2	Specific heat	15

4.5.3	Thermal conductivity	15
4.5.4	Thermal diffusivity	16
4.5.5	Thermal strain (expansion and contraction)	16
4.5.6	Density	16
4.5.7	Emissivity	17
4.6	Adhesives	17
4.6.1	General	17
4.6.2	Specific heat	17
4.6.3	Thermal conductivity	18
4.6.4	Thermal diffusivity	18
4.6.5	Thermal strain (expansion and contraction)	18
4.6.6	Density	18
4.6.7	Emissivity	19
5	Tests for mechanical properties at elevated temperatures	19
5.1	Metals	19
5.1.1	General	19
5.1.2	Elastic modulus	19
5.1.3	Creep	20
5.1.4	Stress relaxation	20
5.1.5	Bauschinger effect	21
5.1.6	Stress-strain (steady state)	21
5.1.7	Stress-strain (transient state)	21
5.1.8	Ultimate strength (tension)	22
5.1.9	Ultimate strength (compression)	22
5.1.10	Joints -- Bolts (ultimate capacity: shear, slip and tension under steady state and transient heating)	23
5.1.11	Joints -- Bolts (stress-strain under transient heating)	23
5.1.12	Joints -- Welds (ultimate capacity: steady state and transient heating)	24
5.1.13	Joints -- Welds (stress-strain under transient heating)	24
5.2	Concrete	25
5.2.1	General	25
5.2.2	Elastic modulus (compression)	25
5.2.3	Transient creep (under compression)	25
5.2.4	Stress relaxation	26
5.2.5	Stress-strain (steady state)	26
5.2.6	Stress-strain (transient)	26
5.2.7	Ultimate strength (compression)	26
5.2.8	Ultimate strength (tension)	27
5.3	Masonry	27
5.3.1	General	27
5.3.2	Elastic modulus	27
5.3.3	Shear modulus	28
5.3.4	Modulus of rupture	28
5.3.5	Creep (in compression)	28
5.3.6	Stress-strain (steady state)	29
5.3.7	Stress-strain (transient state)	29
5.3.8	Ultimate strength in compression	30
5.3.9	Ultimate strength in shear	30
5.3.10	Bond/frictional strength	30
5.3.11	Bending/flexure strength	30
5.4	Wood	31
5.4.1	General	31
5.4.2	Elastic modulus	31
5.4.3	Creep	31
5.4.4	Ultimate strength in compression	31
5.4.5	Ultimate strength in shear	32
5.4.6	Ultimate strength in tension	32
5.4.7	Adhesive strength (tensile shear)	32
5.4.8	Adhesive strength (delamination)	33
5.4.9	Bending strength	33

5.4.10	Joints (mechanical fixings)	33
5.5	Plastics, fibre reinforcement, organic and inorganic materials	34
5.5.1	General	34
5.5.2	Elastic modulus	34
5.5.3	Shear modulus	34
5.5.4	Poisson's ratio	34
5.5.5	Flexural creep	35
5.5.6	Tensile creep	35
5.5.7	Stress-strain (steady state heating)	35
5.5.8	Stress-strain (transient heating)	35
5.5.9	Ultimate strength (compression)	36
5.5.10	Ultimate strength (shear)	36
5.5.11	Ultimate tension	36
5.6	Adhesives	36
5.6.1	General	36
5.6.2	Elastic modulus in compression	37
5.6.3	Modulus of elasticity	37
5.6.4	Creep (tension and compression)	37
5.6.5	Ultimate strength (compression)	37
5.6.6	Ultimate strength (shear)	37
5.6.7	Ultimate strength (tension)	38
5.6.8	Bond strength (slant shear)	38
5.6.9	Bond strength (tensile lap-shear)	38
5.6.10	Bond strength (shear)	38
5.6.11	Bond strength (direct tension)	39
5.6.12	Bending strength	39
5.6.13	Flexural strength	39
	Bibliography	40