

# ISO 10825-1:2022-05 (E)

## Gears - Wear and damage to gear teeth - Part 1: Nomenclature and characteristics

<b>Contents</b>		<b>Page</b>
<b>Foreword</b>		<b>v</b>
<b>Introduction</b>		<b>vi</b>
<b>1</b>	<b>Scope</b>	<b>1</b>
<b>2</b>	<b>Normative references</b>	<b>1</b>
<b>3</b>	<b>Terms and definitions</b>	<b>1</b>
<b>4</b>	<b>Classes and modes of failure</b>	<b>2</b>
<b>5</b>	<b>Tribological damages (non-fatigue)</b>	<b>4</b>
5.1	General information on wear	4
5.2	Polishing wear	5
5.2.1	General	5
5.2.2	Mild polishing wear	5
5.2.3	Moderate polishing wear	5
5.2.4	Severe polishing wear	5
5.3	Scratches	6
5.4	Abrasive wear	7
5.4.1	General	7
5.4.2	Mild abrasive wear	9
5.4.3	Moderate abrasive wear	10
5.4.4	Severe abrasive wear	10
5.5	Scuffing	10
5.5.1	General	10
5.5.2	Hot scuffing	11
5.5.3	Cold scuffing	11
5.5.4	Mild scuffing	11
5.5.5	Moderate scuffing	12
5.5.6	Severe scuffing	15
5.6	Adhesive wear	18
5.6.1	General	18
5.6.2	Mild adhesive wear	18
5.6.3	Moderate adhesive wear	18
5.7	Fretting corrosion	19
5.8	Interference wear	19
<b>6</b>	<b>Fatigue damage</b>	<b>20</b>
6.1	Fatigue cracks	20
6.2	Contact fatigue	20
6.2.1	General	20
6.2.2	Micropitting	20
6.2.3	Macropitting	25
6.2.4	Case crushing (Subcase fatigue)	32
6.2.5	White layer flaking	34
6.2.6	Tooth flank fracture (TFF)	35
6.2.7	Tooth interior fatigue fracture, TIFF	39
6.3	Bending fatigue	40
6.3.1	Tooth root fatigue fracture	40
6.3.2	Rim, web, and hub cracks	45
<b>7</b>	<b>Non-fatigue fracture</b>	<b>47</b>
7.1	General	47

	7.1.1	Overview .....	47
	7.1.2	Brittle fracture.....	48
	7.1.3	Ductile fracture.....	49
	7.1.4	Semi-brittle fracture.....	50
	7.2	Tooth root rupture.....	50
	7.3	Tooth end rupture .....	53
	7.4	Tooth shear fracture.....	54
<b>8</b>	<b>Plastic deformation</b> .....		<b>54</b>
	8.1	General.....	54
	8.2	Indentation.....	54
	8.3	Brinelling.....	55
	8.4	Cold flow.....	55
	8.5	Hot flow.....	55
	8.6	Root fillet yielding.....	56
	8.7	Fracture after plastic deformation.....	56
	8.8	Rolling.....	57
	8.9	Tooth hammer.....	58
	8.10	Rippling.....	58
	8.11	Ridging.....	60
	8.12	Burr.....	61
	8.13	Interference deformation.....	62
<b>9</b>	<b>Manufacturing issues</b> .....		<b>63</b>
	9.1	Forging cracks.....	63
	9.2	Hardening cracks.....	63
	9.3	Grinding cracks.....	64
	9.4	Hydrogen and internal residual stress failures.....	65
	9.5	Grinding burn (temper due to grinding).....	65
	9.6	Grinding notch (not a failure mode).....	67
	9.7	Scaling.....	67
	9.8	Case/core separation.....	68
<b>10</b>	<b>Other surface damage</b> .....		<b>69</b>
	10.1	Corrosion.....	69
	10.2	Cavitation.....	69
	10.3	Erosion.....	72
	10.4	Electric discharge.....	73
	10.5	Overheating.....	77
	<b>Bibliography</b> .....		<b>78</b>