

ISO 24581:2024-09 (E)

Road vehicles - General requirements and test methods of in-vehicle optical harnesses for up to 100 Gbit/s communication

Contents		Page
Foreword		vi
Introduction		vii
1	Scope	1
2	Normative references	1
3	Terms and definitions	2
4	Abbreviated terms	2
5	Optical channel	3
5.1	General	3
5.2	Optical harness	4
5.3	Optical harness application examples	5
6	Optical fibre and optical fibre cable	6
6.1	General	6
6.2	Optical fibre	6
6.2.1	GI-MMF	6
6.2.2	Buffered optical fibre structure	6
6.2.3	Requirements of optical fibre	7
6.3	Optical fibre cable	8
6.3.1	Cable structure	8
6.3.2	Requirements and test methods for optical fibre cable	8
6.3.3	Cable attenuation	9
6.3.4	High storage temperature exposure	10
6.3.5	Low storage temperature exposure	11
6.3.6	Operation temperature exposure	12
6.3.7	Minimum attenuation increase by the residual bending stress	14
6.3.8	Maximum bending attenuation	15
6.3.9	Tensile strength	17
6.3.10	Crush toughness	19
6.3.11	Impact resistance	20
6.3.12	Static torsion toughness	22
6.3.13	Resistance to flame propagation	23
7	Optical connector	25
7.1	General	25
7.2	Optical header connector	26
7.2.1	General	26
7.2.2	Dimension criteria	26
7.2.3	Mechanical coding	26
7.2.4	Requirements of optical header connector	26
7.2.5	High storage temperature exposure	27
7.2.6	Low storage temperature exposure	28
7.2.7	Operating temperature range (Informative)	29
7.3	Optical fibre cable plug	29
7.3.1	General	29
7.3.2	Dimension criteria	29

7.3.3	Mechanical coding	29
7.3.4	Requirements of optical cable plug	29
7.3.5	High storage temperature exposure	30
7.3.6	Low storage temperature exposure	31
7.3.7	Operating temperature range	32
7.4	Optical cable socket	32
7.4.1	General	32
7.4.2	Dimension criteria	32
7.4.3	Mechanical coding	32
7.4.4	Requirements of optical cable socket	33
7.4.5	High storage temperature exposure	33
7.4.6	Low storage temperature exposure	34
7.4.7	Operating temperature range	35
8	Optical harness performance	35
8.1	General	35
8.2	Measurement point	35
8.3	Substituted fibre optic transceiver	36
8.3.1	General	36
8.3.2	Substituted transmitter	36
8.3.3	Substituted receiver	37
8.4	Substitution method	38
8.4.1	General	38
8.4.2	Test procedure	38
8.5	Methodology	39
8.5.1	Measurement light source setup	39
8.5.2	Measurement equipment setup	39
8.6	Requirements of optical harness	40
8.6.1	Optical characteristics	40
8.6.2	Mechanical characteristics	41
8.6.3	Temperature environmental characteristics	41
8.7	Examination for optical in-line connection performance	41
8.7.1	Coupling attenuation at optical in-line connector	41
8.7.2	Optical return loss of optical in-line connector	43
8.7.3	High storage temperature exposure of optical in-line connector	43
8.7.4	Low storage temperature exposure of optical in-line connector	45
8.7.5	Operating temperature exposure of optical in-line connection	45
8.7.6	Vibration resistance of optical in-line connector	47
8.7.7	Minimum tensile strength of the coupling mechanism	48
8.7.8	Maximum insertion force	49
8.7.9	Maximum lock cancellation force for release	51
8.7.10	Durability of repeated mating and un-mating	52
8.7.11	Minimum cable retention	52
8.8	Examination for optical harness performance	54
8.8.1	Optical harness attenuation	54
8.8.2	High storage temperature exposure of optical harness	55
8.8.3	Low storage temperature exposure of optical harness	56
8.8.4	High operating temperature exposure of optical harness	57
8.8.5	Low operating temperature exposure of optical harness	58
8.9	Eye safety	59
8.9.1	General	59
8.9.2	Requirement	59
9	Combined environmental examination	60
9.1	General	60
9.2	Requirements of optical harness	61
9.2.1	Sequentially environmental examination	61
9.2.2	Specific environmental examination	61
9.3	Examination for sequentially environmental examination	61
9.3.1	General	61
9.3.2	Flow chart	62

9.3.3	Operation test after durability of mate and un-mate	62
9.3.4	Operation test after high temperature exposure	63
9.3.5	Operation test after high temperature exposure with vibration	63
9.3.6	Operation test after heat shock	63
9.3.7	Operation test after humidity/temperature cycle procedure	64
9.3.8	Operation test after specific vibration	64
9.3.9	Requirement of sequentially environmental examination	65
9.4	Examination for specific environmental examination	65
9.4.1	General	65
9.4.2	Operation test after specific physical shock	65
9.4.3	Operation test after chemical durability procedure	66
9.4.4	Operation test after noxious gas exposure	67
9.4.5	Operation test after specific dust condition exposure	67
9.4.6	Operation test after specific drop impact procedure	68
9.4.7	Requirements of specific environmental examination	68
Annex A (informative) System parameters of different transmission applications		70
Annex B (informative) Optical harness design guideline		72
Annex C (informative) Dimensions and reference planes of optical connectors		74
Annex D (informative) Modal noise penalty		80
Bibliography		84