INSPECTION REPORT

Fire Safety Inspection according to DIN EN 45545-2

Limit Switches
NGCM, NGCP, NGCQ, GLA, GLF, GLE and GLC Series

Report-No.: HF88700T, Version 3.0

Scope: 12 pages

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Order Date: 2025-02-12

Project No.: 717516749 / 717531904

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Revision history

Version	Date	Author	Amended sections	Amendment and reason for amendment
1.0	2016-05-27	Michael Dallmer	all	Initial
2.0	2018-06-08	Michael Dallmer	all	Adding AGCP, NGCQ
3.0	See release date	Kangyi Xu	all	new template, update test reports

Version 3.0 replaces all previous versions.

Assessors involved in this report

Name	Activity
Kangyi Xu	Execution of inspection Preparation of inspection report
Christian Dettlaff	Review of inspection report

1. Client

Honeywell International Inc.

315 E Stephenson St.

61032 FREEPORT IL

United States

2. General

2.1. Contract

The fire safety assessment for the Honeywell Limit Switches NGCM, NGCP, NGCQ, GLA, GLF, GLE and GLC Series was commissioned by the company Honeywell International Inc. to TÜV SÜD Rail GmbH on 2025-02-12.

The assessment was carried out in the period from 2025-02-12 to date of release by inspection of the documents provided by the client Honeywell or its subcontractors.

2.2. Regulations

This document deals with the assessment of the Honeywell Limit Switches NGCM, NGCP, NGCQ, GLA, GLF, GLE and GLC Series in respect to compliance with the fire safety requirements according to the following acknowledged rules of technology:

Table 1: Regulations

No.	Regulations	Title
[R1]	DIN EN 45545-1: 2013-08*	Bahnanwendungen – Brandschutz in Schienenfahrzeugen – Teil 1: Allgemeine Regeln (Railway applications – Fire protection on rail vehicles – Part 1: General)
[R2]	DIN EN 45545-2: 2016-02*	Bahnanwendungen – Brandschutz in Schienenfahrzeugen – Teil 2: Anforderungen an das Brandverhalten von Materialien und Komponenten (Railway applications – Fire protection on rail vehicles – Part 2: Requirements for fire behaviour of material and components)
[R3]	DIN EN 45545-2: 2020-10*	Bahnanwendungen – Brandschutz in Schienenfahrzeugen – Teil 2: Anforderungen an das Brandverhalten von Materialien und Komponenten (Railway applications – Fire protection on rail vehicles – Part 2: Requirements for fire behaviour of material and components)
[R4]	DIN EN 45545-2: 2023-12	Bahnanwendungen – Brandschutz in Schienenfahrzeugen – Teil 2: Anforderungen an das Brandverhalten von Materialien und Komponenten (Railway applications – Fire protection on rail vehicles – Part 2: Requirements for fire behaviour of material and components)

* This standard is part of the accreditation D-IS-11190-01-00

2.3. Abbreviations

Table 2: Abbreviations

Abbreviation	Definition
HL	Hazard Level
max.	Maximum
min.	Minimum
N/A	Not Applicable
OC	Operation category
OI	Oxygen Index
PCB	Printed circuit board

2.4. Management system at the time of inspection

The inspection was executed under application of the valid quality management system [M1] of the inspection body TÜV SÜD Rail GmbH accredited according to DIN EN ISO/IEC 17020:2012 [M2].

Table 3: Management System

Ref.	Designation	Title
[M1]	QMS	Quality management system of TÜV SÜD Rail GmbH
[M2]	D-IS-11190-01-00	Accreditation by the DAkkS according to DIN EN ISO/IEC 17020:2012 as a Type A inspection body. The accreditation is only valid for the scope of accreditation listed in the document annex D-IS-11190-01-00.

3. Documents

Table 4: Documents

ID	Title	Author	Doc./File ID	Date	Rev.
[D1]	List of plastic parts	Honeywell	List of plastic parts from GLA, GLE, GLF, GLC and NGC R05.pdf	–	05
[D2]	MICRO SWITCH Global Limit Switches, GLA Series	Honeywell	002408-5-EN	2021-04	5
[D3]	MICRO SWITCH GLS Global Miniature Limit Switches, GLC GLD GLE Series	Honeywell	107147-20-EN	2023-12	20
[D4]	MICRO SWITCH Compact Limit Switches, NGC Series	Honeywell	002409-13-EN	2021-04	13
[D5]	UL-Certificate PA66-A30H2V25	UL	E44716	2025-01-01	–
[D6]	UL-Certificate A3X2G5	UL	E36632	2025-01-01	–
[D7]	UL-Certificate FR72G25VO	UL	E41938	2025-01-01	–
[D8]	UL-Certificate B4239	UL	E245249	2025-01-01	–
[D9]	UL-Certificate 310SE0	UL	E45329	2025-01-01	–
[D10]	UL-Certificate 420SE0	UL	E207780	2025-01-01	–
[D11]	UL-Certificate B4406 G6	UL	E36632	2025-01-01	–
[D12]	Test report cable WDZ-DC-B-H-105 1E 300V 4x0.75 MM	ISTCW	TN25-1761E	2025-04-07	–

4. Equipment under inspection

4.1. Description of equipment

The Limit Switches NGCM, NGCP, NGCQ, GLA, GLF, GLE and GLC Series was developed for application in rolling stock.

The Limit Switches are used in various configurations. Some switches are available with plastic housings.



Figure 1 Limit Switches NGCM, NGCP, NGCQ, GLA, GLF, GLE and GLC Series – source: [D2]

4.2. Technical data

Table 5: Limit Switches NGCM, NGCP, NGCQ, GLA, GLF, GLE and GLC Series - Technical data

Parameter	Data
Voltage	up to 400 V
Fuse	up to 10 A
Power	4000 W

4.3. Installation Conditions

The Limit Switches NGCM, NGCP, NGCQ, GLA, GLF, GLE and GLC Series are used in various areas. Mainly the switches are not accessible for passengers although the access for passengers cannot be excluded in all installation conditions (e.g. entrance doors).

5. Conformity assessment acc. to DIN EN 45545

5.1. Classification according to DIN EN 45545-1

The Limit Switches NGCM, NGCP, NGCQ, GLA, GLF, GLE and GLC Series are to be used in vehicles of all design categories and for operation in all environments corresponding to operation categories 1 to 4.

The safety objectives according to DIN EN 45545-1, Section 4.2 “Fire resulting from accidental ignition or arson”, Section 4.3 “Fires caused by technical defects” as well as Section 4.4 “Fire resulting from larger ignition models than those described in 4.2 and 4.3” have been incorporated in the assessment in a risk-oriented approach.

Section 4.2 refers to typical ignition models involving newspaper, matches, cigarettes and gas lighters. Those will be taken into consideration for any areas that are freely accessible to passengers and staff (ignition models 1 and 2 in accordance with Annex A, DIN EN 45545-1). According to the intended installation conditions in 4.3 of this report, the access for passengers is regularly not intended. Hence this ignition model has not been considered in the following assessment.

Section 4.3 refers to ignition models comparable to electrical arcing or overheating and the spread of fire by any potentially flammable gases and liquids present (ignition models 3 and 4 in accordance with Annex A, DIN EN 45545-1).

Section 4.4 refers to larger ignition models (model 5 in accordance with Annex A, DIN EN 45545-1) than those defined in sections 4.2 and 4.3 of DIN EN 45545-1. The assessment of this ignition model was made with focus on the material selection and the intended installation conditions.

According to section 8, the proof of conformity must be provided for the defined fire protection requirements. Proof of conformity for the fire behaviour of materials and/or components can be provided in the form of test reports or certificates.

- Test reports must be issued by testing laboratories that are accredited for the respective tests according to EN ISO/IEC 17025.
- Certificates must be issued by certification bodies, which are accredited for the respective testing or classification standards according to EN ISO/IEC 17065.

Annex ZA presents the correlation between DIN EN 45545-2 and Interoperability Directive (EU)2016/797 as well as the TSI LOC&PAS (Regulation EU 1302/2014). For a vehicle approval according to the TSI LOC&PAS, test reports or certificates, with a maximum validity of 5 years from the date of issue, must be submitted.

For test reports or certificates with an issue date older than 5 years, the verification can alternatively be issued by a corresponding manufacturer's declaration according to chapter 4.2.10.2.1, paragraph 3 in connection with the application guideline for the TSI LOC&PAS (GUI/LOC&PAS TSI/2021) in addition to the present test report or certificate.

5.2. Assessment according to DIN EN 45545-2

5.2.1. Requirements

Based on the classification according to DIN EN 45545-1, the materials / components shall meet the requirements of Hazard Level 3 (HL3). The components are to be regarded as electrotechnical equipment covered by the DIN EN 45545-2 standard. Generally, the requirement sets are listed in section 4.4 “Listed products”. The applicable requirements are the following:

Table 6: Requirement sets

No.	Name	Details	Requirement
EL9	Printed circuit boards	Printed circuit boards with all applied coatings but without any attached technical equipment	R26 [R3] [R4] EN 60695-11-10 Classification = V0 or R25 EN 60695-2-11 Glow Wire 850 °C or R24 ISO 4589-2 OI ≥ 32 %
EL10	Low-power electrical and electronic components	All electrotechnical low power equipment, including protection against contact and similar	R26 EN 60695-11-10 Classification = V0
EL1A	Cables for interior	Cables not compliant with one of the standards referenced in 4.2 c)	R15 EN 60332-1-2 burned part ≤ 540 mm and unburned part > 50 mm EN 50305 burned part ≤ 1.5 m EN 61034-2 Transmission ≥ 70% EN 50305 ITC ≤ 6

In addition to the requirements of listed products, the grouping rules according to section 4.3 for components with low combustible mass and / or surfaces are applicable.

No requirements apply to products with a combustible mass of ≤ 10 g not in touching contact with another unclassified product (DIN EN 45545-2 section 4.3.1).

Table 7: Grouping rule 1

No.	Section	Requirement	Remark
1-1	4.3.2. Grouping rule 1 Products without requirements	≤ 100 g for interior grouped products	No requirements
1-2		≤ 400 g for exterior grouped products	No requirements

Table 8: Grouping rule 2

No.	Section	Requirement	Remark
2-1	4.3.3. Grouping rule 2 Products tested according to R24	≤ 500 g for interior grouped products tested according to R24	Proof R24 Oxygen index
2-2		≤ 2000 g for exterior grouped products tested according to R24	Proof R24 Oxygen index

The following general rules shall be considered:

Table 9: General requirements

Section	Requirement
4.2. a) General	Products which comply with the highest level of reaction to fire performance and therefore need no further testing are - products classified as A1 according to EN 13501-1 - all products described in commission decision 96/603/EC (as amended)
4.2. c)	Electrical cables which satisfy the fire safety requirements of EN 50306, EN 50264 or EN 50382 are considered to satisfy the requirements of R15 and R16 for the corresponding hazard level (no further testing required).
4.2 m) [R2] 4.2. l) [R3] [R4] Size of test specimen	If the end use condition does not allow sizes of test specimen for ISO 5658-2 (if this is part of the requirement set): - R6 interior use - R9 exterior use
4.2. n) [R2] 4.2. m) [R3] [R4]	If listed products are used in an application below the mass and area thresholds given in 4.3, they may be treated as non-listed products.
4.5 non-listed products	Any product not listed in DIN EN 45545-2 Table 2 shall be considered as a non-listed product or shall be assessed using the grouping rules stipulated in DIN EN 45545-2 section 4.3. The requirements of non-listed products are the following: > 0.2 m² R1 (interior), R7 (exterior) ≤ 0.2 m² R22 (interior), R23 (exterior)
4.7 Products to be approved on functional necessity	If it can be shown that any of the requirements specified above are not technically achievable with functionally suitable products, then existing commercially available products can be used until and unless a suitable product is developed. There shall be no requirement to consider products made available after the date after the date of the contract.
5.3.6 [R2] 5.3.7 [R3] [R4] Fire integrity test	There shall not be more than one hole after the test T03.01. or T03.02. This hole shall have no dimension in the plane of the test piece greater than 3 mm. Alternatively, the material fulfils the requirements of Conventional Classified Products acc. to DIN EN 45545-3. Those products are considered to meet the integrity requirements.

5.2.2. Material verification

The combustible materials are listed in the material list [D1].

According to the available documentation the combustible material required to be verified by test are small electrotechnical products and cables. The relevant requirements according to DIN EN 45545-2 as well as the test results are listed in Table 10. All other combustible materials can be grouped or have a combustible mass of not more than 10 g with no touching contact with any other unclassified material and are therefore not required for verification by test.

Table 10: Listing of material testing

Material	Requirement	Result	Certificate	HL
EL10 - Low-power electrical and electronic com-ponents	R26			
PA66-A30H2V25		fulfilled	[D5]	HL3
A3X2G5		fulfilled	[D6]	HL3
FR72G25VO		fulfilled	[D7]	HL3
B4239		fulfilled	[D8]	HL3
310SE0		fulfilled	[D9]	HL3
420SE0		fulfilled	[D10]	HL3
B4406 G6		fulfilled	[D11]	HL3
EL1A – Cable interior	R15	fulfilled		
WDZ-DC-B-H-105 1E 300V 4x0.75 MM		(4.2. c)	[D12]	HL3

Material treated according to the grouping rules > 10 g but ≤ 100 g for interior:

Table 11: Listing of interior groups

No.	Group name	Components / Materials	Total combustible mass
1	GLA	Actuator Head: 11.6 g Lever assembly: 33.6 g Case: 25.6 g Cover: 10.1 g	80.9 g
2	GLF	Actuator Head: 11.6 g Lever assembly: 33.6 g Case: 25.6 g Cover: 10.1 g	80.9 g
3	GLC	Case: 17.4 g Cover: 10.1 g Seal: 13.7 g Actuator assembly: 19.3 g	60.5 g
4	GLE	Case: 17.4 g Cover: 10.1 g Seal: 13.7 g Actuator assembly: 19.3 g	60.5 g

The grouped combustible mass needs to be considered when integrated into the vehicle.

The combustible materials used for the Limit Switches NGCM, NGCP, NGCQ, GLA, GLF, GLE and GLC Series fulfil the requirements according to DIN EN 45545-2 for HL3.

6. Summary

As result of this assessment, the Limit Switches NGCM, NGCP, NGCQ, GLA, GLF, GLE and GLC Series meets the requirements of the listed acknowledged codes of practice:

- DIN EN 45545-2:2016 hazard levels HL1 to HL3
- DIN EN 45545-2:2020 hazard levels HL1 to HL3
- DIN EN 45545-2:2023 hazard levels HL1 to HL3

Groupings to be considered for installation in the vehicles, if the distance of the grouped components from a non-qualified component is less than ≤ 20mm horizontally or ≤ 200mm vertically (see section 5.2.2):

- GLA: 80.9 g
- GLF: 80.9 g
- GLC: 60.5 g
- GLE: 60.5 g

For regular intended operation the required level of safety for passengers and staff is ensured.

The assessment was carried out based on the documents provided by the client (see list of documents). At the time of the inspection and based on the test reports provided, the validity of the fire protection technical verification within the framework of EC conformity test procedures (see section 5.1) is confirmed until 2030-01-01 [D5] to [D11].

This inspection report was written under the specified accreditation without influence of third party.