Report of EC Type-Examination

-Name and address of Notified Body : Liftinstituut
Buikslotermeerplein 381
1025 XE Amsterdam
The Netherlands

-Tested on request of : Schindler Elettronica SA
Via della Pace 22
CH-6600 Locarno
Switzerland

-EC Type-Examination number : NL-00-400-1002-004-22

-Product Description : Safety-circuit MXUET ,
part of printed circuit
board LONIC 1.Q-P3

-Applied Standards : EN-81 (August 1998)

-Date of Issue : March 2000

-Report number : 1002-004-22

-Application : The safety-circuit MXUET
is used for bridging of door-
contacts during levelling and
re-levelling

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-Operating Voltages	**: Safety-chain voltage 60 Volt** **Supply voltage safety-circuit 24 Volt**
-Pollution degree	**: The design of safety-circuit MXUET is based on pollution degree 3 and materialgroup III of IEC 664-1**
-Issued by	**:**

ing. D.A. Doolaard
manager technical support

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Annexes :

-Schindler Declarations
-Certificate PCB-material
-Technical Description Door-overbridging circuit MX-GC
(document 2000 DT 023)
-Test set-up Safety-circuit MXUET (document 99 DT 588)
-Sicherheitsrelevante Uberwachungen der Software , Test-instruktion
& Report (Doc-No CD 99168)
-Interruption of Ground-connection (Memorandum 2000 DT 021 , page 1)
-Message " Door Locking Device "
-Technical Data Safety-relay
-Technical Data Dual-comparator
-Technical Data Optocoupler

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1. Principal

Manufacturer Schindler Electronica SA (Locarno , Switzerland) has ordered the Liftinstituut (Amsterdam , the Netherlands) to examine the safety-circuit MXUET , part of the printed circuit board LONIC 1.Q-P3 , as a safety-component according to the requirements of the Lifts Directive (95 / 16 / EC) .

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2. Testsample

2.1. Manufacturer	Schindler Elettronica SA Via della Pace 22 CH-6600 Locarno Switzerland
2.2. Identification PCB	LONIC 1.Q-P3 (identification number on componentside 591376 and on solderside 205262)
2.3. Technical Data	-Voltage safety-chain 60 Volt AC/DC Current 1,0 A (maximum current) -Voltage safety-relays 24 Volt DC -see Technical Description Q 231 777 (PCB) and 2000 DT 023 (safety-circuit)
2.4. Testlaboratory	Liftinstituut Buikslotermeerplein 381 1025 XE Amsterdam The Netherlands Tecnolab Via dell ' Industria 20 28924 Verbania Italy
2.5. Acceptance code	AC 000300 / 1 = safety-circuit MXUET AC 000300 / 2 = printed circuit board LONIC 1.Q AC 000300 / 3 = simulator for safety-circuit
2.6. EC Type-examination number	NL-00-400-1002-004-22

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3. General Description

The safety-circuit MXUET is part of the printed circuit board LONIC 1.Q-P3 .
The safety-circuit is used for levelling and/or re-levelling with open doors (both for traction and hydraulic elevators) .

There are 2 safety-relays mounted on the printed circuit board for bridging of doorcontacts .
These relays are called RUET and RUET 1 .
Pulling on of these relays is perceptable by a light emitting diode (LED) .
The controlfunction of the bridging of doorcontacts takes place by electronic components and is also placed on the printed circuit board .

The safety-relays RUET and RUET1 are activated by 2 independent sensors which are mounted on the roof of the car ;
4 independent sensors are mounted on the roof of the car when there are 2 car-entrances .
Each sensor is activated by 2 magnets which are mounted on a rail in the shaft ;
the distance between 2 magnets is the length of the doorzone .

There are also several connections from the safety-chain to the printed circuit board .
These connections are not part of the safety-circuit MXUET and therefore not relevant for the EC type-examination .

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4. Technical Documentation

- Technical Description printed circuit board Q 231 777 (16 pages)
- Technical Description MX-GC door overbridging circuit MXUET 2000 DT 023 (10 pages)
- Schematical Drawings S 231 777 (5 pages , modification 0 , dated 2000-01)

  1.Block diagram , page 1 of 5
  2.Connectors , page 2 of 5
  3.Safety-chain and Safety-circuit , page 3 of 5
  4.LON , page 4 of 5
  5.INPUT , page 5 of 5

- Component List PCB LONIC 1.Q (7 pages)
- Electrical Drawings Miconic MX-GC S 194 306 (3 pages , modification 0 , dated 1999-12-10)
- Print Lay-out Y 231 778 (4 pages , modification 0 , dated 2000-03-10)
- Assembly Drawing Z 231 777 (1 page , modification 0 , dated 2000-01)
- Test set-up Safety-circuit MXUET (5 pages , 99 DT 588)
- Sicherheitsrelevante Uberwachungen der Software , Test-instruktion & Report (20 pages , Doc-No CD 99168 , dated 2000-03-06)
- Memorandum 2000 DT 021 (page 1 of 2)

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5. Test Description

5.1. Laboratory Tests according to Annex F.6. of the EN- 81

Arrangements were made to perform the tests in accordance with Annex F.6. of the EN-81 at Tecnolab , laboratory in Verbania Italy .
The following tests were performed , after approval of the test set-up (made by Schindler) :

- Vibration test
- Shock test
- Temperature test .

The mechanical tests (vibration and shock) were performed in horizontal direction (one axis) and in vertical direction (two axis) .

During the tests the safety-functions were operated and proper functioning of the safety-circuit was monitored by a person of Tecnolab .
In consultation with Schindler the safety-circuit MXUET on the printed circuit board was connected to the normal working voltage ;
there was also a current flowing and therefore relays were connected as load .
Before , during and after the tests voltages were measured (see also report Tecnolab) .

Tecnolab made a total report on these tests , with all the relevant technical data (g-values , time of testing , number of shocks , temperature-range etc.) .
A copy of the report is attached .

Note :

In contradistinction to Annex F.6. of the EN-81 , only the safety-circuit MXUET on the printed circuit board was connected to the normal working voltage during the tests .
Other parts were not connected as they can not influence the safety-circuit .

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5.2. Failure Analysis according to EN-81

The purpose of the failure analysis it to verify that one or more faults ca not lead to a dangerous situation ;
this means the bridging of doorcontacts outside the doorzone .

Any single fault listed in par. 14.1.1.1. of the EN-81 in the electric equipment of an elevator , if it can not be excluded under conditions described in par.14.1.1.2. and/or Annex H shall not , on its own , be the cause of a dangerous malfunction of the elevator .
For some (electronic) components short-circuit or open-circuit , change of value or change of function can not be excluded according to Annex H of the EN-81 .
It is necessary that the fuse in the safety-circuit is correctly rated and constructed according to the applicable IEC-standards to prevent a dangerous situation in case of short-circuit .

The required creepage and clearance distances are mentioned in Annex H and therefore part of the failure analysis .
All the relevant distances between the connections to the safety-chain and the tracks behind these connections and to other connections and their associated tracks are measured .

In Annex H there are some requirements about the used materials and (electronic) components ;
the manufacturer has to make an official declaration about these materials and components because the Notified Body can not verify these matters .

Note :

When the requirements of Annex H are not fulfilled , there is a possibility for the manufacturer to make his own risk analysis on the subject ;
the replacing technical solution has to be of equivalent safety .
It is to the Notified Body whether or not to accept this .

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6. Applied Standards

The following mentioned Standard includes the requirements for the type-examination of the safety-circuit MXUET , part of the printed circuit board LONIC 1.Q-P3 :

- European Harmonised Standard EN-81 (August 1998)
  (safety rules for the construction and installation of lifts)

  part 1 : Electric Lifts
  part 2 : Hydraulic Lifts

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7. Test Evaluation

7.1. Vibration Test

The total time for the Vibration tests took about 5 hours.
The printed circuit board was tested in horizontal direction (one axis) and in vertical direction (two axis) .

After the Vibration tests there were no defects (mechanical or electrical) in the safety-related (electronic) components .
The testresults were considered to be acceptable .

7.2. Shock Test

The total time for the Shock tests took about 2 hours .
The printed circuit board was tested in horizontal direction (one axis) and in vertical direction (two axis) .

After the Shock tests there were no defects (mechanical or electrical) in the safety-related (electronic) components .
The testresults were considered to be acceptable .

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7.3. Temperature Test

The total time for the Temperature tests took about 8.5 hours .
The printed circuit board was tested at a minimum temperature of 0 C and at a maximum temperature of +65 C .

After the Temperature tests there were no defects (mechanical or electrical) in the safety-related (electronic) components .
The testresults were considered to be acceptable .

Note :

In contradistinction to Annex F.6. of the EN-81 , only the safety-related parts on the printed circuit board were connected to their normal working voltage during the tests . Other parts were not connected as they can not influence the safety-circuit .

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7.4. Failure Analysis

The creepage and clearance distances have to be in accordance with 3.1. and 3.6. of Annex H of the EN-81 ;
3.1. and 3.6. of Annex H refer to the IEC 664-1 (table 2 for the clearances and table 4 for the creepages) with the following requirements :

-pollution degree 3
-material group III
-inhomogeneous electrical field
-overvoltage category III (see IEC 664-1 , table 1)
-printed wiring column not used .

The measured distances are the absolute minimum values in relation to the highest possible difference in potential between two circuits ;
at least one of these circuits is connected to or after the safety-chain .
In some cases it is not possible to determine the maximum difference in potential between two or more circuits ;
in these cases Schindler has to measure in practice with a true RMS-reading Voltmeter and afterwards they have to send the measured values to the Liftinstituut .
The results of these measurements will be evaluated by the Liftinstituut .

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7.4.1. Creepage Distances

According to Annex H of the EN-81 it is permitted to reduce the creepage distances to the clearance value when the used PCB- material is of higher quality (see 3.6. of Annex H) .

Schindler official declares that the base material and the solder resist are of higher quality (see Annex of this report) .

There are several connections from the safety-chain to the printed circuit board . Not all of these connections are part of the safety-circuit MXUET and therefore not relevant for the EC type-examination .

Note :

All the connector pin numbers refer to the Schematical Drawing S 231 777 .

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Connections to the safety-chain

-Connector KWL

pin 1 = 2,4mm / 60 Volt
pin 2 = 2,4mm / 60 Volt

-Connector SKT2

pin 1 = 2,4mm / 60 Volt
pin 2 = 2,4mm / 60 Volt
pin 3 = GND-connection
pin 4 = 2,4mm / 60 Volt
pin 5 = 2,4mm / 60 Volt

-Connector SKT1

pin 1 = 2,4mm / 60 Volt
pin 2 = 2,4mm / 60 Volt
pin 3 = GND-connection
pin 4 = 2,4mm / 60 Volt
pin 5 = 2,4mm / 60 Volt

-Connector KNA

pin 1 = 2,4mm / 60 Volt
pin 2 = 2,4mm / 60 Volt

-Connector KF

pin 1 = 2,4mm / 60 Volt
pin 2 = 2,4mm / 60 Volt

-Connector SKC

pin 1 = 2,4mm / 60 Volt
pin 2 = 2,4mm / 60 Volt
pin 3 = 2,4mm / 60 Volt
pin 4 = 2,4mm / 60 Volt
pin 5 = 2,4mm / 60 Volt

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-Connector SKREC

pin 1 = 2,4mm / 60 Volt
pin 2 = 2,4mm / 60 Volt
pin 3 = 2,4mm / 60 Volt
pin 4 = 2,4mm / 60 Volt
pin 5 = 2,4mm / 60 Volt

Connections to the doorzone-signals

-Connector KUET

pin 1 = not relevant
pin 2 = 1,3mm / 24 Volt
pin 3 = 1,3mm / 24 Volt
pin 4 = neutral

The creepage distance between the 2 channels is at least 1,4mm .

-Connector 2KUET

pin 1 = not relevant
pin 2 = 1,3mm / 24 Volt
pin 3 = 1,3mm / 24 Volt
pin 4 = neutral

The creepage distance between the 2 channels is at least 2,4mm .

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Connections to bridging of doorcontacts in safety-chain

-Connector SKT2

pin 1 = 2,4mm / 60 Volt
pin 4 = 2,4mm / 60 Volt

-Connector SKC

pin 3 = 2,4mm / 60 Volt
pin 5 = 2,4mm / 60 Volt

Distances between coil and contacts of the safety-relays

-safety-relay RUET

1,3mm / 24 Volt (coil / NC-contact)
> 4,5mm / 60 Volt (coil / NO-contact)

-safety-relay RUET1

1,3mm / 24 Volt (coil / NC-contact)
> 4,5mm / 60 Volt (coil / NO-contact)

Distances between different contact-sets of the safety-relays

-safety-relay RUET

3,4mm / 60 Volt (NC / NO-contact)

-safety-relay RUET1

3,4mm / 60 Volt (NC / NO-contact)

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Distances around LED , SMD-resistor and diode of safety-relays

-safety-relay RUET
1,3mm / 24 VDC
-safety-relay RUET1
1,3mm / 24 VDC

Connections to controlcircuit for safety-relays

The NC-contacts of relays RUET and RUET1 are connected to 2 different dual-comparators for fault detection .
The creepage distance between the 2 channels is more than the minimum required distance .

-testpins PP1 and PP3 (relay RUET1)
1,0mm / 24 Volt (see par. 7.4.3. point 38)
-testpins PP7 and PP9 (relay RUET)
1,0mm / 24 Volt (see par. 7.4.3. point 39)

Connections to controlcircuit for doorzone-signals

The doorzone-signals KUET / 2KUET and KUET1 / 2KUET1 are connected to 4 different comparators (2 dual-comparators) for fault detection .
The creepage distance between the 2 channels (first channel is KUET / 2KUET , second channel is KUET1 / 2KUET1) is more than the minimum required distance.

-doorzone-signal KUET (connector KUET pin 2)
2,0mm / 24 Volt
-doorzone-signal KUET1 (connector KUET pin 3)
1,2mm / 24 Volt (see point 40 of par. 7.4.3)
-doorzone-signal 2KUET (connector 2KUET pin 2)
2,0mm / 24 Volt
-doorzone-signal 2KUET1 (connector 2KUET pin 3)
1,2mm / 24 Volt (see point 40 of par. 7.4.3)

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Conclusion :

- Some of the creepage distances are not in accordance with table 4 , pollution degree 3 and material group III of IEC 664-1 .

  Schindler declares that the used base material and solder resist are of higher quality than the required specifications (see Annex of this report) ;
  therefore the creepage distances can be reduced to the clearance value .

  The creepage distances are according to the requirements of Annex H of the EN-81.

  Even when short-circuit takes place , there is no dangerous situation because this fault will be detected immediately (see par. 7.4.3. for failure analysis) .

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7.4.2. Clearance Distances

Connections to the safety-chain

-Connector KWL

pin 1 = > 3,5mm / 60 Volt
pin 2 = > 3,5mm / 60 Volt

-Connector SKT2

pin 1 = > 3,5mm / 60 Volt
pin 2 = > 3,5mm / 60 Volt
pin 3 = GND-connection
pin 4 = > 3,5mm / 60 Volt
pin 5 = > 3,5mm / 60 Volt

-Connector SKT1

pin 1 = > 3,5mm / 60 Volt
pin 2 = > 3,5mm / 60 Volt
pin 3 = GND-connection
pin 4 = > 3,5mm / 60 Volt
pin 5 = > 3,5mm / 60 Volt

-Connector KNA

pin 1 = > 3,5mm / 60 Volt
pin 2 = > 3,5mm / 60 Volt

-Connector KF

pin 1 = > 3,5mm / 60 Volt
pin 2 = > 3,5mm / 60 Volt

-Connector SKC

pin 1 = > 3,5mm / 60 Volt
pin 2 = > 3,5mm / 60 Volt
pin 3 = > 3,5mm / 60 Volt
pin 4 = > 3,5mm / 60 Volt
pin 5 = > 3,5mm / 60 Volt

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-Connector SKREC

pin 1 = > 3,5mm / 60 Volt
pin 2 = > 3,5mm / 60 Volt
pin 3 = > 3,5mm / 60 Volt
pin 4 = > 3,5mm / 60 Volt
pin 5 = > 3,5mm / 60 Volt

Connections to the doorzone-signals

-Connector KUET

pin 1 = not relevant
pin 2 = > 3,5mm / 24 Volt
pin 3 = > 3,5mm / 24 Volt
pin 4 = neutral

-Connector 2KUET

pin 1 = not relevant
pin 2 = > 3,5mm / 24 Volt
pin 3 = > 3,5mm / 24 Volt
pin 4 = neutral

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Connections to bridging of doorcontacts in safety-chain

-Connector SKT2

pin 1 = > 3,5mm / 60 Volt
pin 4 = > 3,5mm / 60 Volt

-Connector SKC

pin 3 = > 3,5mm / 60 Volt
pin 5 = > 3,5mm / 60 Volt

Distances between coil and contacts of the safety-relays

-safety-relay RUET

the clearance distances are more than the minimum required distance

-safety-relay RUET1

the clearance distances are more than the minimum required distance

Distances between different contact-sets of the safety-relays

-safety-relay RUET

the clearance distances are more than the minimum required distance

-safety-relay RUET1

the clearance distances are more than the minimum required distance

Distances around LED , SMD-resistor and diode of safety-relays

-safety-relay RUET

the clearance distances are more than the minimum required distance

-safety-relay RUET1

the clearance distances are more than the minimum required distance

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Connections to controlcircuit for safety-relays

The NC-contacts of relays RUET and RUET1 are connected to 2 different dual-comparators for fault detection .

-testpins PP1 and PP3 (relay RUET1)
> 1,5mm / 24 Volt
-testpins PP7 and PP9 (relay RUET)
> 1,5mm / 24 Volt

Connections to controlcircuit for doorzone-signals

The doorzone-signals KUET / 2KUET and KUET1 / 2KUET1 are connected to 4 different comparators (2 dual-comparators) for fault detection .

-doorzone-signal KUET (connector KUET pin 2)
> 3,5mm / 24 Volt
-doorzone-signal KUET1 (connector KUET pin 3)
> 3,5mm / 24 Volt
-doorzone-signal 2KUET (connector 2KUET pin 2)
> 3,5mm / 24 Volt
-doorzone-signal 2KUET1 (connector 2KUET pin 3)
> 3,5mm / 24 Volt

Conclusion :

The clearance distances are according to the requirements of Annex H of the EN-81.

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7.4.3. Bridging of Doorcontacts

The functioning of the safety-circuit is described by Schindler in the technical description 2000 DT 023 .
This description also contains a failure analysis on the subject (see Annex of this report) .

Practical tests are performed in Ebikon in the presence of the Liftinstituut .
During these tests all relevant faults are simulated by Schindler , according to the document CD 99168 (Sicherheitsrelevante Uberwachungen der Software , Test-Instruktion & Report , dated 2000-03-06) .

The following faults have to be considered :

1. When relay RUET does not fall off as a result of a failure (for example welding of NO-contact) , the processor-entrance IRUET detects the fault and the elevator is blocked .

2. When relay RUET does not pull on as a result of a failure , bridging of doorcontacts is not possible .

3. When relay RUET1 does not fall off as a result of a failure (for example welding of NO-contact) , the processor-entrance IRUET1 detects the fault and the elevator is blocked .

4. When relay RUET1 does not pull on as a result of a failure , bridging of doorcontacts is not possible .

5. When the processor-entrance IRUET stays continuous 1 (high level) as a result of a failure , the elevator is blocked after a normal ride .

6. When the processor-entrance IRUET stays continuous 0 (low level) as a result of a failure , the elevator is blocked .

7. When the processor-entrance IRUET1 stays continuous 1 (high level) as a result of a failure , the elevator is blocked after a normal ride .

8. When the processor-entrance IRUET1 stays continuous 0 (low level) as a result of a failure , the elevator is blocked .

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9. When the doorzone-signal (shaft) KUET does not open as a result of a failure , the processor-entrance IUET detects the fault and the elevator is blocked after a normal ride .

10. When the doorzone-signal (shaft) KUET1 does not open as a result of a failure , the processor-entrance IUET1 detects the fault and the elevator is blocked after a normal ride .

11. When the doorzone-signal (shaft) 2KUET does not open as a result of a failure , the processor-entrance 2IUET detects the fault and the elevator is blocked after a normal ride .

12. When the doorzone-signal (shaft) 2KUET1 does not open as a result of a failure , the processor-entrance 2IUET1 detects the fault and the elevator is blocked after a normal ride .

13. When the processor-entrance IUET stays continuous 1 (high level) as a result of a failure , the elevator is blocked after a normal ride .

14. When the processor-entrance IUET1 stays continuous 1 (high level) as a result of a failure , the elevator is blocked after a normal ride .

15. When the processor-entrance 2IUET stays continuous 1 (high level) as a result of a failure , the elevator is blocked after a normal ride .

16. When the processor-entrance 2IUET1 stays continuous 1 (high level) as a result of a failure , the elevator is blocked after a normal ride .

17. When the processor-entrance IUET stays continuous 0 (low level) as a result of a failure , the elevator is blocked .

18. When the processor-entrance IUET1 stays continuous 0 (low level) as a result of a failure , the elevator is blocked .

19. When the processor-entrance 2IUET stays continuous 0 (low level) as a result of a failure , the elevator is blocked .

20. When the processor-entrance 2IUET1 stays continuous 0 (low level) as a result of a failure , the elevator is blocked .

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21. When the doorzone-signal (shaft) KUET does not close as a result of a failure , relay RUET can not pull on and bridging of doorcontacts is not possible ; the elevator is blocked .

22. When the doorzone-signal (shaft) KUET1 does not close as a result of a failure , relay RUET1 can not pull on and bridging of doorcontacts is not possible ; the elevator is blocked .

23. When the doorzone-signal (shaft) 2KUET does not close as a result of a failure , relay RUET can not pull on and bridging of doorcontacts is not possible ; the elevator is blocked .

24. When the doorzone-signal (shaft) 2KUET1 does not close as a result of a failure , relay RUET1 can not pull on and bridging of doorcontacts is not possible ; the elevator is blocked .

25. When the neutral of relay RUET is not disconnected before a normal start as a result of a failure (short-circuit transistor or defect VUET-output) , relay RUET can not fall off and the elevator is blocked .

26. When the neutral of relay RUET1 is not disconnected before a normal start as a result of a failure (short-circuit transistor or defect VUET1-output) , relay RUET1 can not fall off and the elevator is blocked .

27. When the neutral of relay RUET is disconnected continuously as a result of a failure (open-circuit transistor or defect VUET-output) , relay RUET can not pull on and bridging of doorcontacts is not possible ; the elevator is blocked .

28. When the neutral of relay RUET1 is disconnected continuously as a result of a failure (open-circuit transistor or defect VUET1-output) , relay RUET1 can not pull on and bridging of doorcontacts is not possible ; the elevator is blocked .

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29. Short-circuit between the 2 doorzone-signals KUET and KUET1 can be excluded because the required creepage and clearance distances are in accordance with Annex H of the EN-81 .
Loss of redundancy is not possible .

30. Short-circuit between the 2 doorzone-signals 2KUET and 2KUET1 can be excluded because the required creepage and clearance distances are in accordance with Annex H of the EN-81 .
Loss of redundancy is not possible .

31. Short-circuit between the 2 processor-entrances IUET and IUET1 can be excluded because the required creepage and clearance distances are in accordance with Annex H of the EN-81 .
Loss of redundancy is not possible .

32. Short-circuit between the 2 processor-entrances 2IUET and 2IUET1 can be excluded because the required creepage and clearance distances are in accordance with Annex H of the EN-81 .
Loss of redundancy is not possible .

33. Short-circuit between the 2 processor-entrances IRUET and IRUET1 can be excluded because the required creepage and clearance distances are in accordance with Annex H of the EN-81 .
Loss of redundancy is not possible .

34. The safety-circuit is built up of 2 independent channels and a controlcircuit which monitors the equal status of the 2 channels .

The controlcircuit contains 6 independent comparators (IC's) .
A defect of one of the comparators can not lead to loss of redundancy
(loss of 2 channel-structure) .

35. The failure analysis for " backwards voltage " coming from electronics is described in par. 7.4.3.6.

36. The failure analysis for the diodes D1 , D2 , D3 and D4 (short-circuit) is described in par. 7.4.3.7.

37. The failure analysis for interruption of the GND-connection is described in par. 7.4.3.8.

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38. The creepage distance between the testpins PP1 and PP3 is only 1,0 mm .
The normally closed contact of relay RUET1 will be bridged in case of short-circuit between the testpins .
As a result of this failure , the processor-entrance IRUET1 stays continuous 1 (high level) , and the elevator is blocked .

Schindler declares that the used base material and solder resist are of higher quality than the required specifications (see Annex of this report) ; therefore the creepage distances can be reduced to the clearance value .

39. The creepage distance between the testpins PP7 and PP9 is only 1,0mm .
The normally closed contact of relay RUET will be bridged in case of short-circuit between the testpins .
As a result of this failure , the processor-entrance IRUET stays continuous 1 (high level) , and the elevator is blocked .

Schindler declares that the used base material and solder resist are of higher quality than the required specifications (see Annex of this report) ; therefore the creepage distances can be reduced to the clearance value .

40. The creepage distance between the track connected after the 2 doorzone-signals KUET1 and 2KUET1 and a LED is only 1,2mm .

Schindler declares that the used base material and solder resist are of higher quality than the required specifications (see Annex of this report) ; therefore the creepage distances can be reduced to the clearance value .

41. The printed circuit board LONIC 1.Q-P3 , including the safety-circuit MXUET , is protected against short-circuit by an electronic protection device.
This electronic protection device is mounted on the printed circuit board ASIX 3.Q , which is placed in the controller .

Short-circuit is simulated during the practical tests in Ebikon ;
the resetting to normal operation , after short-circuit , must be made by hand (see par. 14.1.1.3 of the EN-81) .

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7.4.3.1. Safety-circuit

The safety-circuit for bridging the doorcontacts is built up of 2 independent channels .
There are 6 independent comparators for monitoring the equal status of the 2 channels ;
the elevator is blocked in case of a different status of the 2 channels .

The safety-circuit is in accordance with par. 14.1.2.3.2.3. of the EN-81 .

7.4.3.2. Speed Control

The speed of the elevator during levelling and / or re-levelling has to be in accordance with par. 14.2.1.2-B and -C of the EN-81 .

7.4.3.3. Doorzone

The movement of the elevator , with open landing and car doors , is limited to the unlocking (door) zone by the doorzone-signals KUET / KUET1 and 2KUET / 2KUET1 .
The unlocking zone has to be in accordance with par. 7.7.1. of the EN-81 .

7.4.3.4. Levelling / Re-levelling operation

In case of levelling and/or re-levelling the relays RUET and RUET1 are pulled on .
The outputs VUET and VUET1 are activated when the car is decelerating (carspeed < 0,5 m/s) .
A normal start of the elevator can only take place when the relays are fallen off .

Levelling operation is in accordance with par. 14.2.1.2-A.4 of the EN-81 .

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7.4.3.5. Safety-relays

The relays RUET and RUET 1 are used in the safety-circuit for bridging the doorcontacts .
Welding of contacts can not be excluded according to Annex H of EN-81 and therefore mechanically forced guided contacts are required .

The relays are in accordance with par. 13.2.2.1. of the EN-81 .

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7.4.3.6.Backwards Voltage

According to the requirements of Annex H of the EN-81 , backwards voltage coming from electronics should be considered .

1.There is a possibility that backwards voltage is coming from the processor-entrances IRUET and IRUET1 .
The highest backwards voltage in case of a defect is 31 Volt DC (see declaration manufacturer) .
The isolation-voltage between coil and contacts should be at least 0,8 kV .
The isolation-voltage for the used Dold relay (type OA 5669.12) is 4 kV .

2.There is a possibility that backwards voltage is coming from the processor-entrances IUET , IUET1 , 2IUET and 2IUET1 .
Schindler made a calculation on this subject (see chapter 5 of the technical description door-overbridging circuit 2000 DT 023) .
The highest voltage coming back from the electronics in case of a defect , is not enough to keep the Dold relay (type OA 5669.12) in energized state .

3.There is a possibility that backwards voltage is coming from the LUET-circuit .
The isolation voltage of the Siemens optocoupler (type SFH 6156-2) is 5,3 kV .
The required isolation voltage is 0,8 kV .

Conclusion :

The safety-relays RUET and RUET1 can not be activated by backwards voltage coming from electronics , as a result of a failure .

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7.4.3.7.Short-circuit of diodes

In case of 2 car-entrances , there are 4 doorzone-signals required ;
each car-entrance has his own doorzone-signals (KUET and KUET1 for first entrance , 2KUET and 2KUET1 for second entrance).
A diode is connected after each doorzone-signal .
According to the requirements of Annex H , short-circuit of a diode has to be considered .

In case of short-circuit of 2 diodes simultaneously during a normal ride of the elevator the following situation could take place :

- The elevator is travelling to a floor with only one entrance (one landing door)
- The doorzone-signals KUET / KUET1 are used for this entrance
- Short-circuit of the 2 diodes D2 and D4 takes place during the normal ride
- The 4 processor-entrances IUET , IUET1 , 2IUET and 2IUET1 are activated by only 2 doorzone-signals KUET / KUET1
- Both car doors could be opened while only one landing door is located on this floor
- This situation can only take place when the car door is not mechanically locked (see Annex of this report regarding to " door locking device ") ; when the car door is mechanically locked because the horizontal distance between the shaftwall and the sill exceeds 0,15m , opening of the car door is not possible without the presence of a landing door

Conclusion :

In chapter 3 of the technical description of the door-overbridging circuit (document 2000 DT 023) , the conditions for opening the car door are mentioned .

There are 3 faults needed to open an unlocked car door without the presence of a landing door .
Even when this situation takes place , there is no danger for the passengers .
Schindler confirms that opening of a locked car door is not possible without the presence of a landing door .

The requirements of the EN-81 are fulfilled .

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7.4.3.8. Interruption of Ground-connection

According to the failure analysis of the EN-81 , interruption of the ground-connection has to be considered .

There are 3 ground-connections on the printed circuit board :

- GROUND 1 (IUET , 2IUET , IRUET)
- GROUND 2 (IUET1 , 2IUET1 , IRUET1)
- GROUND .

Ground 1 and ground 2 are connected separately to ground .

In memorandum 2000 DT 021 (page 1) , Schindler made a failure analysis on the subject (see Annex of this report) .
The conclusion is that interruption of the ground-connection can not lead to a dangerous situation .

Conclusion :

The failure analysis is accepted by the Liftinstituut and therefore the requirements of the EN-81 are fulfilled .

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7.4.4. Optocoupler LUET-circuit

- according to Annex H of the EN-81 internal short-circuit between the light emitting diode (LED) and the photo-transistor can be excluded if :

  1.the isolation voltage is at least according to IEC 664-1 , table 1 and overvoltage category III ;
  2.the optocoupler is according to IEC 747-5 (see declaration Schindler) ;

- manufacturer / type optocoupler : Siemens
  SFH 6156-2
  55 Volt
  isolation voltage = 5,3kV (> 0,8 kV)

Conclusion :

The optocoupler fulfils the requirements of Annex H of the EN-81 .

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7.4.5. Safety-relays for bridging of doorcontacts

- Simultaneously closing of NO- and NC-contacts can be excluded if the safety-relays for bridging of doorcontacts fulfil the requirements of par. 13.2.1.3. of the EN-81 (see 3.5 of Annex H)

- Short-circuit between contacts , and contacts and coil can be excluded if the relays fulfil the requirements of par. 13.2.2.3. (par. 14.1.2.2.3.) of the EN-81 (see 3.5. of annex H)

- Manufacturer / type :

  Dold 5669.12
  24 Volt DC
  250 Volt AC / 5A
  forced guided contacts (see technical data)
  clearance and creepage distances > 4,0 mm

Conclusion :

The relays RUET and RUET1 for bridging of doorcontacts fulfil the requirements of the EN-81 .

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7.4.6. Comparators

The controlfunctions for the doorzone-signals and the safety-relays are performed by 6 independent comparators (see technical data) .
The 2 independent channels for bridging the doorcontacts are :

channel 1 = doorzone-signals KUET / 2KUET (in case of second car-entrance)
safety-relay RUET
channel 2 = doorzone-signals KUET1 / 2KUET1 (in case of second car-entrance)
safety-relay RUET1 .

The controlfunction of the 2 doorzone-signals on one entrance-side (e.g. KUET / 2KUET) is performed by one dual-comparator ;
each dual-comparator contains 2 separate comparators .
When a dual-comparator fails , as a result of an internal defect , there is no risk for the loss of redundancy ;
the 2 independent channels (KUET / 2KUET and KUET1 / 2KUET1) are connected to 2 different dual-comparators .

The controlfunction of the safety-relays (RUET and RUET1) is performed by 2 different dual-comparators ;
only 1 comparator inside the dual-comparator is used for this purpose .
When a dual-comparator fails , as a result of an internal defect , there is no risk for the loss of redundancy .

Conclusion :

The requirements of par. 14.1.2.1.6. of the EN-81 are not fulfilled .
The safety-circuit is built up in such a way that loss of redundancy can not take place and therefore equivalent safety is guaranteed .

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7.4.7.Various Components

The following (electronic) components are connected to safety-related parts on the printed circuit board :

-Capacitor
-Dual-Comparator
-Diode
-Light Emitting Diode (LED)
-Optocoupler
-SMD-resistor

Conclusion :

Although short-circuit or open-circuit , change of function or change of value can not be excluded for the above mentioned (electronic) components , the requirements of par. 14.1.1. of the EN-81 are fulfilled .

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7.4.8. Multilayer Board

For multilayer boards comprising at least 3 prepreg or other thin sheet insulating materials , short circuit between different layers can be excluded (see 3.6. of Annex H) .

The printed circuit board LONIC 1.Q-P3 (including safety-circuit MXUET) is built up of 4 different layers .

Conclusion :

Schindler declares that the multilayer board is in compliance with EN 60950 (see Annex of this report) .

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7.4.9. Declarations Manufacturer

Schindler shall make the following declarations :

- The base material and the solder resist of the printed circuit board are of higher quality than the specifications of EN 60249-2-2 and / or EN 60249-2-3 (3.6. of Annex H) .
- The optocouplers are in accordance with IEC 747-5 (2.4. of Annex H) .
- The general specifications of the printed circuit board are in accordance with IEC 326.1. (3.6. of Annex H) .
- The safety-relays (for bridging of doorcontacts) are in accordance with EN 60947-5-1 and the relays have mechanically forced guided contacts (3.5. of Annex H) .

These declarations have to be added to the report as an inalienable document (see Annex of this report) .

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8. EMC Exclusion

The safety-circuit MXUET with all (electronic) components has not been tested in relation to the requirements of EMC-directive (emission and immunity).
Therefore this report of EC type-examination does not contain any information about EMC .

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9. Conclusion

After the laboratory-tests (according to Annex F.6.) and after the failure analysis (according to Annex H) the conclusion is that the safety-circuit MXUET , used for bridging of doorcontacts during levelling and/or re-levelling , is in accordance with the requirements of the european harmonised standard EN-81 (part 1 and 2) . Compliance with the relevant parts of the european standard provides one means of conforming with the requirements of the Lifts Directive (95 / 16 / EC) .

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10. General Remarks

- Any modification to the safety-circuit MXUET shall justify a new EC type-examination . A new certificate of EC type-examination will be issued after approval .
- This technical report is the result of testing a sample of the product submitted ; the report does not imply an evaluation of the same products coming from the complete production .
- The manufacturer has to make a statement of conformity for each identical product and place the CE-mark on the product .
- It is not permitted to multiply or to publish this report without permission of the Liftinstituut .

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ANNEXES

- **SCHINDLER DECLARATIONS**
- **CERTIFICATE PCB-MATERIAL**
- **TECHNICAL DESCRIPTION DOOR-OVERBRIDGING CIRCUIT MX-GC (document 2000 DT 023)**
- **TEST SET-UP SAFETY-CIRCUIT MXUET (document 99 DT 588)**
- **SICHERHEITSRELEVANTE UBERWACHUNGEN DER SOFTWARE , TEST-INSTRUKTION & REPORT (Doc-No CD 99168)**
- **INTERRUPTION OF GROUND-CONNECTION (Memorandum 2000 DT 021 , page 1)**
- **MESSAGE " DOOR LOCKING DEVICE "**
- **TECHNICAL DATA SAFETY-RELAY**
- **TECHNICAL DATA DUAL-COMPARATOR**
- **TECHNICAL DATA OPTOCOUPLER**

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