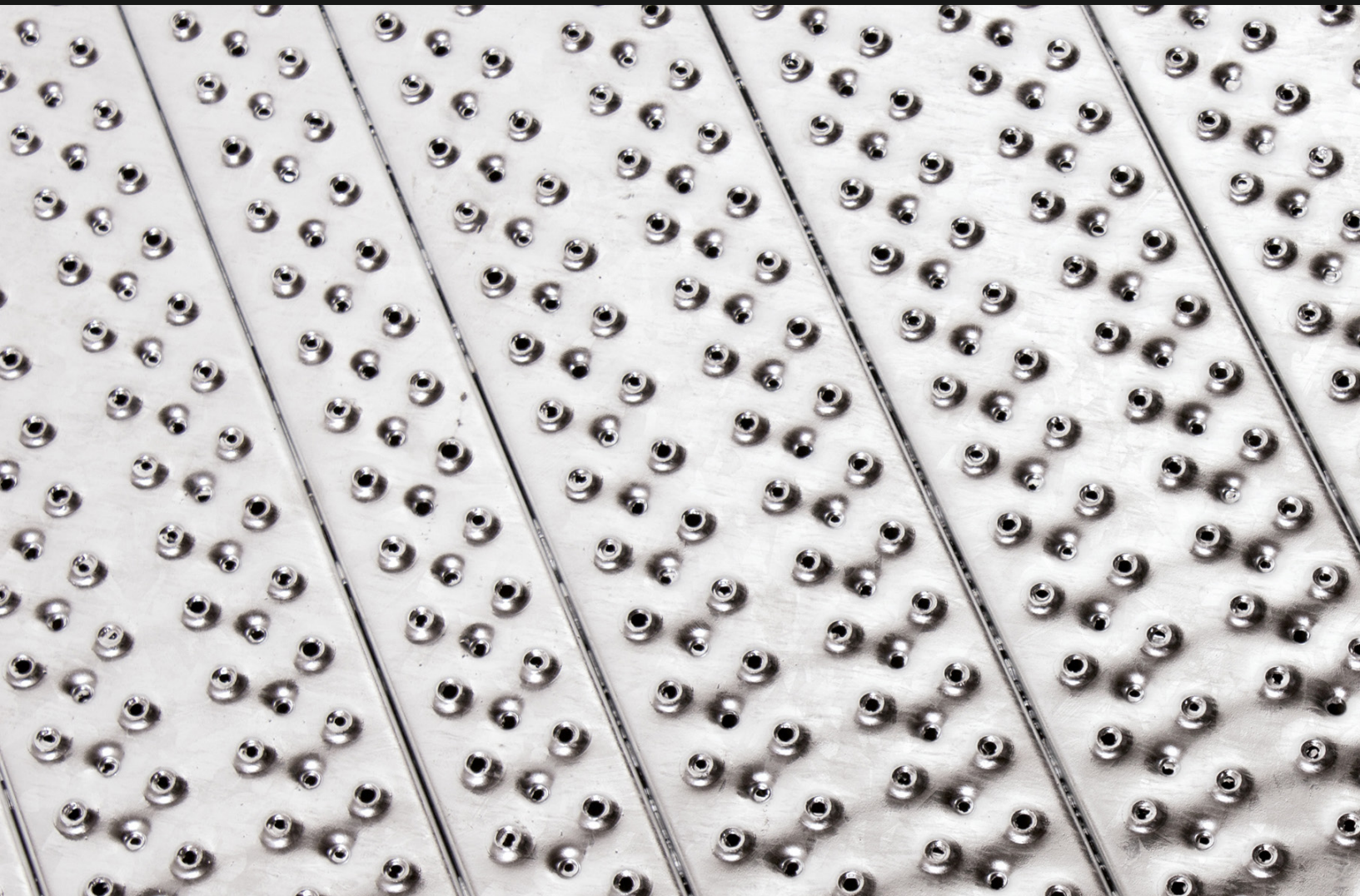




Transformer Bund Fire Mitigation



Designed for Critical Infrastructure

LHD® has been supplied to electricity transmission and distribution projects throughout the United Kingdom, Ireland and mainland Europe, supporting transformer bund applications where asset protection, operational resilience and personnel safety are critical considerations.

Developed specifically for critical energy infrastructure, LHD® combines proven transformer fire performance with effective drainage and safe maintenance access. Its durable, low-maintenance design supports the long-term operational and lifecycle requirements of modern electricity networks.

Why LHD®?

- Independently tested and proven to rapidly extinguish transformer oil fires.
- Passive protection with no power, controls or activation systems.
- Eliminates the need for traditional 300 mm stone-filled bunds.
- Simplifies inspection, maintenance and cleaning activities.
- Designed for long-term performance in critical energy infrastructure.

PcP
Engineering Safety™

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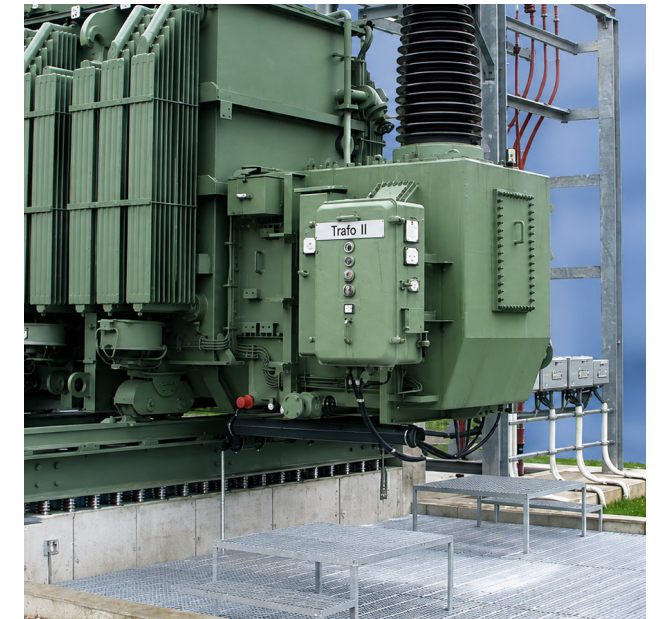
Passive Transformer Fire Mitigation

Transformer failures can result in the release and ignition of insulating oil, creating risks to personnel, critical assets and network resilience. Effective fire mitigation within transformer bunds and containment areas is therefore essential.

LHD® is a passive fire mitigation solution developed for transformer installations and critical energy infrastructure. By restricting oxygen reaching the source of a fire whilst allowing oil to drain safely into the containment area below, LHD® helps reduce the consequences of transformer oil fires without the need for power, controls or active intervention.

Independent testing by SP Technical Research Institute of Sweden (now RISE) demonstrated that LHD® successfully extinguished transformer oil fires under test conditions, achieving complete flame-out above the grating within six seconds.

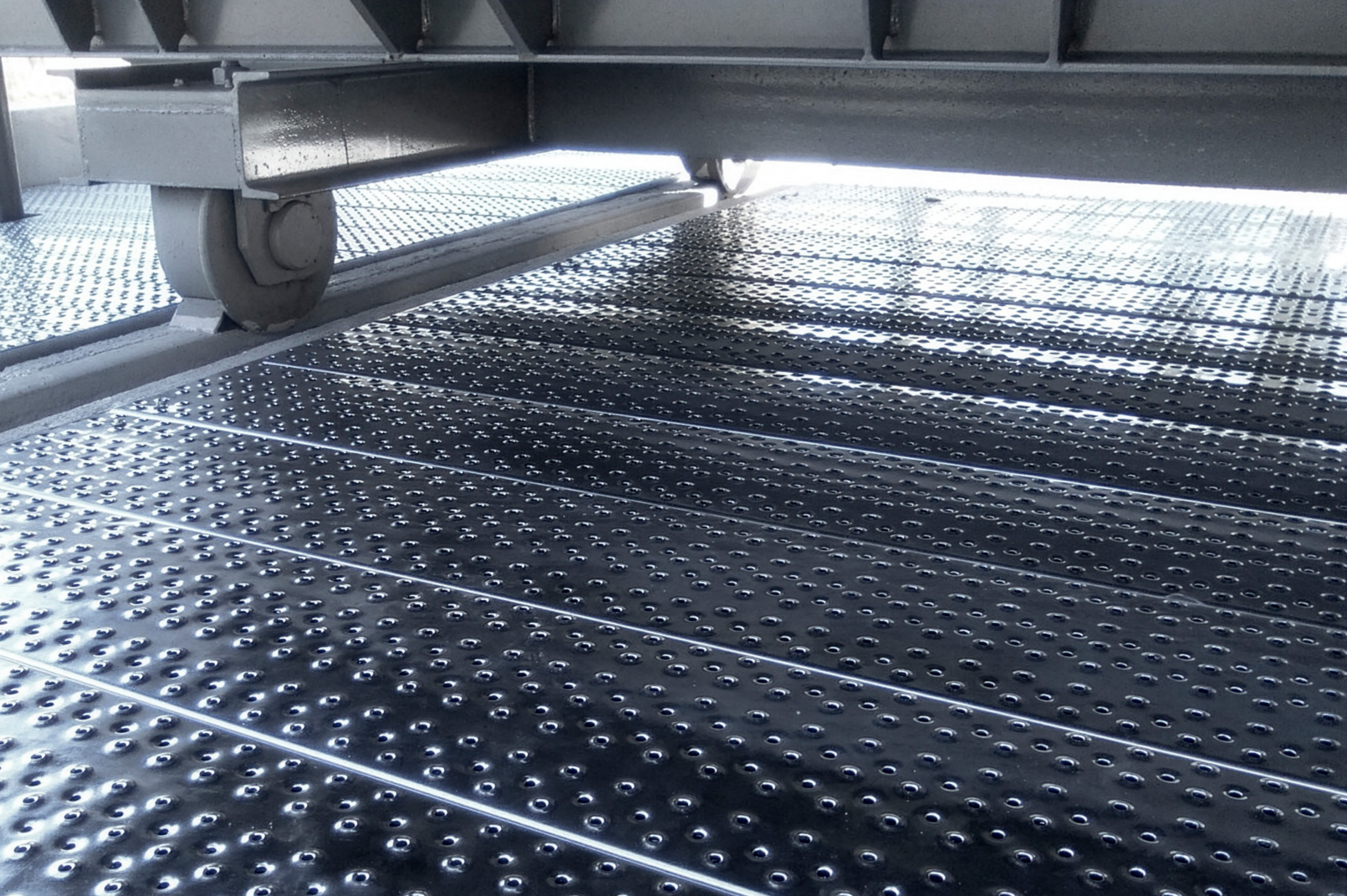
Unlike traditional stone-filled bunds, LHD® eliminates the need for a 300 mm gravel layer, helping reduce bund depth requirements, optimise civil construction and simplify inspection and maintenance. Manufactured from hot-dip galvanised steel, LHD® is designed to provide long-term durability and performance in demanding substation environments.



Trusted by Energy Network Operators

LHD® has been supplied to electricity transmission and distribution projects throughout the United Kingdom, Ireland and mainland Europe, supporting transformer bund applications where asset protection, operational resilience and personnel safety are critical considerations.

Combining passive fire mitigation, effective drainage, simplified maintenance access and long service life, LHD® is a proven alternative to traditional stone-filled bund solutions for critical energy infrastructure.



How LHD® Rapidly Extinguishes Transformer Oil Fires

LHD® restricts the oxygen available to a transformer oil fire whilst allowing insulating oil to drain safely into the containment area below. This passive design creates an oxygenstarved environment that allows combustion to be rapidly extinguished without the need for power supplies, controls or active fire suppression systems.

Independent testing by SP Technical Research Institute of Sweden (now RISE) demonstrated that LHD® successfully extinguished transformer oil fires under test conditions, achieving complete flame-out above the grating within six seconds. The testing confirmed oxygen restriction as the primary mechanism responsible for extinguishing the fire.

The design combines proven fire performance with effective drainage, allowing oil to flow freely into the containment area whilst maintaining safe access for inspection, maintenance and cleaning activities. The robust metal construction also provides additional protection from falling debris and burning objects.

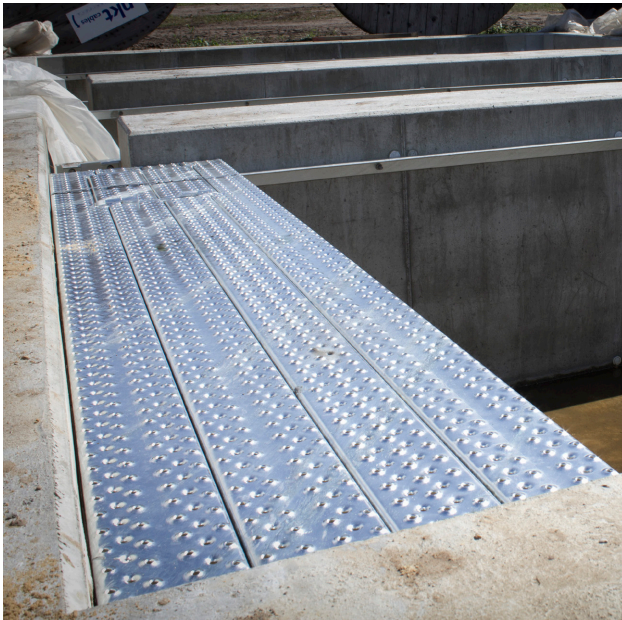
Available in galvanised steel, stainless steel and aluminium, LHD® provides a durable, low-maintenance and fully recyclable solution for transformer bunds and critical energy infrastructure.

Designed for Critical Infrastructure

LHD® has been developed specifically for transformer bunds and critical energy infrastructure where asset protection, operational resilience and personnel safety are essential.

Available in galvanised steel, stainless steel or aluminium, LHD® is engineered to provide long-term performance in demanding operating environments. Its prefabricated panel design enables rapid installation and safe, efficient access for inspection, maintenance and cleaning.

The open containment area enables straightforward inspection of bund conditions whilst simplifying maintenance and cleaning activities. Combined with low maintenance requirements and durable, corrosion-resistant materials, LHD® supports the operational and lifecycle requirements of modern electricity networks.



Key Advantages for Energy Infrastructure

- Independently tested and proven to extinguish transformer oil fires.
- Complete flame-out achieved within 6 seconds under test conditions.
- Passive operation with no power, controls or activation systems required.
- Effective oil drainage whilst maintaining fire performance.
- Safe access for inspection, maintenance and cleaning.
- Additional protection from falling debris and burning objects.
- Available in galvanised steel, stainless steel and aluminium.
- Durable, low-maintenance and fully recyclable construction.

Why Energy Operators Specify LHD®

- Independently tested and proven to rapidly extinguish transformer oil fires.
- Passive protection with no power, controls or activation systems.
- Eliminates the need for traditional 300 mm stone-filled bunds.
- Supports optimised bund design and reduced civil costs.
- Simplifies inspection, maintenance and cleaning activities.
- Designed for long-term performance in critical energy infrastructure.



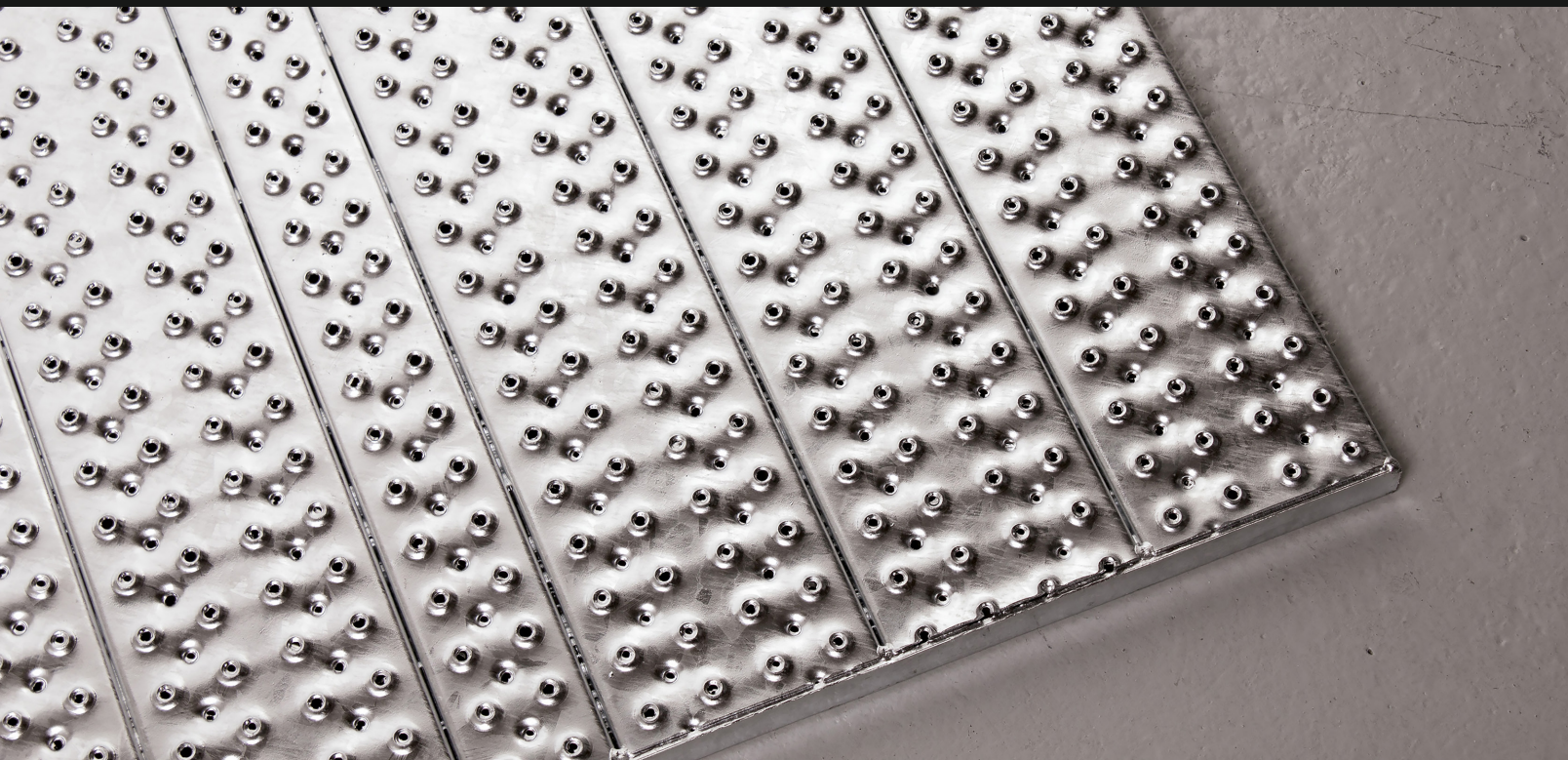
Design Standards, Testing and Compliance

- AGI J 21 part 2 - Transformer platforms
- EN ISO 1461 – Hot-Dip Galvanised Coatings
- Slip Resistance: R11 Classification (DIN 51130)
- Minimum Wet Pendulum Test Value (PTV): 47 (BS 7976-2)
- BS 4592 - Industrial Flooring and Stair Treads
- EN ISO 14122 - Permanent Means of Access to Machinery

 Successfully extinguished transformer oil fires
Complete flame-out within 6 seconds
Independent RISE testing

 Slip Classification

 AGI J21 Part 2 – Transformer Platforms



Technical details

Panel width Type LHD® laid out for a max. load per unit area 5 kN/ m²

LHD Plank (width/height)	Clear Span (mm)	Max Point Load (kN) 300x150mm	Weight (kg/m²)
225/35	825	2.70	31.80
207/35	950	2.30	32.20
189/35	1075	2.00	33.00
171/35	1300	2.10	33.60
153/35	1550	1.75	34.50
225/44	1600	2.00	34.60
135/35	1675	1.50	35.40
117/35	1750	1.70	36.90
207/44	1775	1.80	35.10
99/35	1825	2.20	39.10
189/44	1875	1.70	36.10
171/44	1950	2.20	36.90
153/44	2050	2.00	38.10
225/53	2075	2.20	37.30
135/44	2125	1.90	39.50
207/53	2175	2.10	38.10
117/44	2225	2.10	41.40
189/53	2275	1.90	39.20
99/44	2300	2.75	44.40
171/53	2375	2.50	40.30
153/53	2475	2.40	41.80
135/53	2550	2.30	43.50
117/53	2675	2.50	46.00
99/53	2725	3.00	49.60
117/62	2850	3.40	50.50

Fire Testing of Fire Protection Gratings Type LHD®

Test Report by SP Technical Research Institute of Sweden (now RISE) – Abbreviated Version



REPORT

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Date
2015-08-28

Reference
5P05551

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1 (19)

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Fire Testing of fire protection gratings Type LHD (Appendices 1)



SP Technical Research Institute of Sweden

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1 Introduction

A review of national and international standards and guidelines shows that several documents address the problem of a fire in leaking transformer oil to various degrees but with no specific performance requirement [1] [2] [3] [4]. A traditional method for improving fire safety at transformer stations is to fill the transformer pit with gravel. In the Swedish standard SS 421 01 01 [5] it is written (translated to English below):

“Preferably arrangements that contribute to extinguish the fire in the leaked liquid shall be used, for example the use of a layer of stones (approximately 300 mm deep and with a grain size of about 40/60 mm) that extinguishes the burning liquid that enters the layer.”

There is a lack of a technology neutral requirements concerning the performance of the arrangement described above that should contribute to extinguish the fire of leaking flammable fluid. Fire protection gratings is one technology that has been developed for these purpose. This report presents quantitative tests of a specific scenario, simulating a transformer rupture where the burning transformer oil is rapidly flowing into the transformer pit. The tests are performed in order to investigate how well PcP.s fire protection grating Type LHD is able to extinguish the fire under these specific conditions. The test scenario was developed and tested 2013 by SP as described in SP report 2013:09 [6].

2 Fire test

The scenario modeled correlates to a sudden accidental release and ignition of large oil quantities from a transformer. The maximum stipulated temperature increase inside the transformer under normal conditions is 60°C [6]. The oil temperature is not expected to exceed 90°C, thus the oil temperature was increased to 90°C in this test before ignition. The amount of oil corresponds to a depth of 3 cm in the pit. The fire test was performed two times - both times under same conditions. The test should not be regarded as representative for all possible failure scenarios.

2.1 Experimental setup

The transformer pit was 3.75 meters by 3.2 meters and 1 meter deep. The pit is built in concrete at PcPs facilities in Vildbjerg (Denmark) . During tests the oil was stored in a tippable cart with a total volume of 600 liters. Transformer oil used in the tests was the Nynas Transformer Oil – Nytro 10XN. Technical data sheet for the oil is attached in Appendix 1. Sketches and photo of transformer pit and placement of measuring instruments are presented in Figure 1 to 3. The temperature measurement was conducted with five thermocouple piles. The thermocouple piles are named A-E and their location are shown in Figure 1. Each pile contained six thermocouples at 1, 20, 50, 75, 90 and 130 cm above the ground level. Fire protection gratings were installed at 0.80 m from the ground, i.e. the thermocouples at 90 cm and 130 cm were located above the fire protection gratings. Gas sampling for O₂ analysis was conducted at two positions, at the center of the pit and at 1 m from the back end of the pit, as shown in Figures 1 and 2. The inlet of the gas sampling pipe was located 10 cm below the fire protection gratings. The symbols in the figures represents:

- **O** are the thermocouple trees, placed at the positions A-E.
- **X** are the locations of the gas sampling pipes, placed 10 cm below the fire protection gratings.

SP Technical Research Institute of Sweden

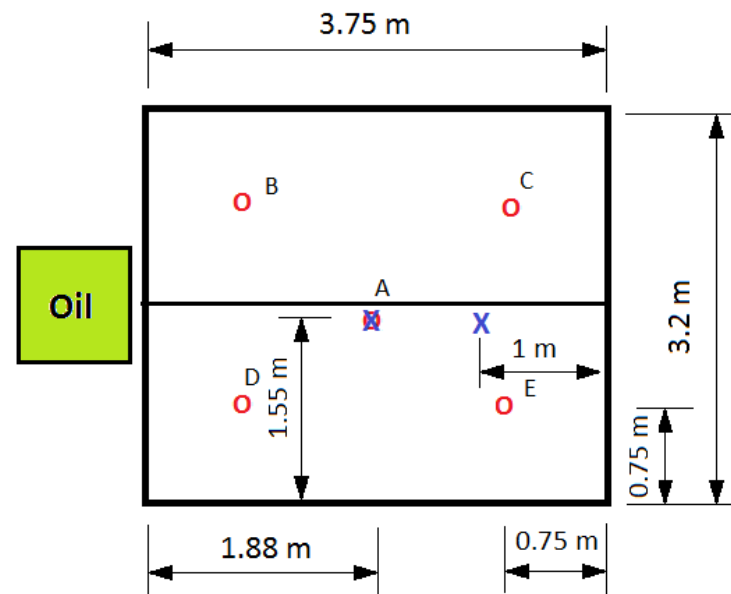


Figure 1. Top view of the experimental setup.

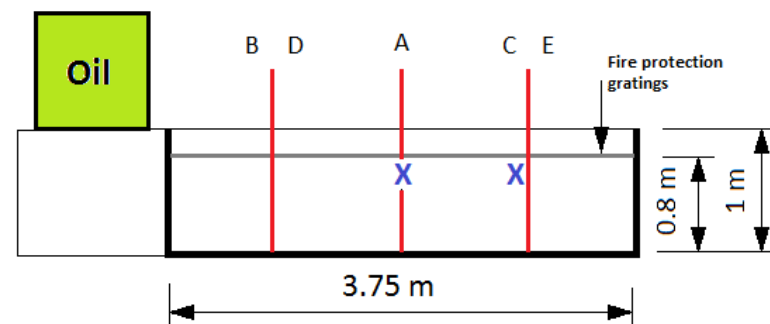


Figure 2. Side view of the experimental setup.

4 Conclusion

The tests were performed in order to investigate how well the PcP.s fire protection grating Type LHD is able to extinguish an oil fire under a specific fire scenario. The scenario modeled correlates to a sudden accidental release and ignition of large oil quantities from a transformer.

The fire protection gratings Type LHD managed to successfully extinguish the fire during the performed tests. Complete flameout above the fire protection gratings occurred within 6 seconds under the conditions tested. Shortly after, the temperature and oxygen concentration measurements indicate that the fire was extinguished in the entire pit, also under the fire protection gratings.

The rapid quenching of the fire is partly due to the reduced oxygen concentration and it is therefore important that the fire grid protection is covering the complete pit and is fastened tight to the concrete wall to minimize leakage of air around the edge of the construction.



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References

- [1] "980-1994 R2001 - IEEE Guide for Containment and Control of Spills in Substations," 2001.
- [2] "NFPA 850: Recommended practice for fire protection for electric generating plants and high voltage direct current converter stations," 2010.
- [3] "NFPA 70: National Electric Code," 2011.
- [4] "FM Global Property Loss Prevention Data Sheets 5-4 TRANSFORMERS," 2012.
- [5] SEK Svenska Elektriska Kommissionen, "SS 421 01 01 Starkströmanläggningar med nominell spänning överstigande 1 kV AC," 2004.
- [6] J. Lindström och M. Försth, "Fire test Profile Plank for transformer pit fire protection," SP Fire Research, Borås, 2013.
- [7] "IEC 60076-2 Power Transformers - Part 2: Temperature rise," 1993.

SP Technical Research Institute of Sweden Fire Research - Fire Dynamics

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See the LHD® fire test in action

See how PcP. fire protection grating type LHD® performs under fire test conditions.

Scan the QR code to watch the fire test video.



Want to know more?

Visit our website to learn more about LHD® and our fire protection solutions, or contact PcP. to discuss your specific application and requirements.

www.pcp-corp.com

Engineering Safety™



Safety is at the very heart of our products and through everything we do. Our drive is to enable our customers - no matter their industry - to safely operate in their business routine, supported and surrounded by innovative PcP solutions.

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