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Inotek – Detection Catalogue

Innholdsfortegnelse

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1 Introduction

This document provides an overview of common defects and anomalies that can be detected through thermal and visual drone inspections.

The purpose of this catalogue is to illustrate the range of building and structural conditions that can be identified when combining thermographic imaging with engineering analysis.
The examples listed here represent the most frequently observed issues related to building envelopes, materials, and technical installations.

They include findings connected to moisture intrusion, insulation performance, structural integrity, air leakage, surface degradation, and safety-related conditions.
However, this catalogue should not be considered exhaustive.

The range of possible defects will vary depending on construction type, materials, environmental exposure, and maintenance history.

Each inspection and analysis must therefore be evaluated within its specific context and supported by professional engineering assessment.

The catalogue is intended as a reference for understanding the diagnostic potential of thermal and visual inspection techniques, and for promoting a consistent terminology and approach to condition evaluation across projects.

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2 Roof Systems:

2.1 Roofing Membranes

- Moisture accumulation under membrane
- Blisters, punctures or tears in roofing material
- Poor overlap or welding of seams
- Age-related brittleness and UV degradation
- Incorrect detailing at parapets and terminations
- Loss of adhesion between membrane and substrate
- Vegetation or organic buildup on surface
- Insulation soaked or compressed beneath membrane
- Mechanical damage from snow removal or maintenance traffic

2.2 Roof Drainage

- Ponding water and insufficient slope
- Blocked drains, scuppers or gutters
- Poor fall direction causing standing water
- Ice formation due to poor insulation around outlets

2.3 Roof Structures

- Deformation or sagging in roof deck
- Corrosion on steel fasteners and joints
- Leaks through skylights and roof penetrations
- Heat leakage around HVAC or vent openings
- Air leakage at eaves and roof–wall junctions

3 Facade and Wall Systems

3.1 Concrete / Brick / Rendered Facades

- Cracks in render, plaster or concrete surfaces
- Thermal bridges at floor slabs and columns
- Delamination of render layers
- Moisture absorption or rising damp
- Efflorescence (salt deposits from trapped water)
- Loose plaster, brick or stone (fall hazard)
- Frost/Temperature damage in porous materials
- Fungal or algal growth on damp zones
- Poor sealing around expansion joints
- Corroded facade anchors or fixings

3.2 Sandwich- and Steel-Panel Façades

- Delamination between sheet and insulation core
- Air leakage in joints or at panel ends
- Wet or degraded insulation within panels
- Corrosion around screws, washers or hidden frames
- Thermal discontinuity at fastening points
- Damaged or deformed metal plates
- Loose flashings or cover strips

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3.3 Timber-Clad or Composite Walls

- Moisture retention behind cladding (insufficient ventilation)
- Rot or fungal attack in battens or sub-structure
- Cracks and swelling in timber boards
- Warping from thermal stress or moisture cycles
- Missing or failed sealing at joints and corners

3.4 Facade Elements and Details

- Failed joint sealants or gaskets
- Air leakage around penetrations (vents, cables, pipes)
- Missing or loose fixings
- Corrosion in facade brackets or tie-backs
- Detachment of decorative panels or facade stones
- Missing flashing at parapet transitions
- Heat leakage along edge beams and spandrels

4 Balconies, Terraces and Parapets

4.1 General

- Water infiltration under tiles or membrane
- Corrosion in balcony reinforcement or supports
- Poor slope leading to ponding
- Thermal bridges at balcony-to-wall junction
- Cracked tiles or grout lines
- Loose railings or anchoring bolts (safety hazard)
- Moisture behind upstand flashings
- Air leakage into interior junctions

5 Windows, Glazing and Doors

5.1 Windows

- Thermal leakage at frame-to-wall junction
- Moisture ingress in sill or corner joints
- Broken or aged sealing gaskets
- Condensation or fogging between panes (failed glazing unit)
- Thermal bridging in aluminum frames
- Loose or corroded fixings (safety risk)
- Deformation of frame or sash (closing issues)
- Mechanical damage or cracks in glass
- Heat loss through non-insulated glazing (high U-value)
- Water leakage from incorrect installation

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5.2 Glazed Curtain Walls

- Failed silicon joints and weather seals
- Air leakage between glass units and mullions
- Moisture infiltration in drainage channels
- Glass delamination or cracked laminate
- Thermal stress zones from solar exposure
- Frame corrosion or deformation
- Insulation voids behind spandrel panels

5.3 External Doors / Entrances

- Poor sealing at thresholds and door perimeters
- Heat leakage around aluminum frames
- Warping or deformation in door leaf
- Worn hinges or loose fittings (security risk)
- Air loss in automatic sliding doors (energy waste)

6 Penetrations, Flashings and Interfaces

- Inadequate sealing around ducts, vents or cables
- Damaged or displaced flashings (metal, rubber, or bitumen)
- Corrosion in flashing joints
- Improper overlap between roof and facade membranes
- Heat leakage along parapet and coping joints
- Cracks at chimney or vent transitions
- Failed sealant at skylight perimeters

7 Drainage and Waterproofing Systems

- Insufficient slope on balconies or flat roofs
- Blocked downpipes or gutters
- Leaks in roof drains and overflow outlets
- Capillary water along facade base
- Defective waterproofing membranes at foundations
- Thermal detection of hidden leaks in underground piping

8 Foundations, Basement & Ground Contact Zones

- Moisture intrusion in basement walls
- Insufficient insulation against ground temperature loss
- Cracks in retaining walls or foundation slabs
- Rising damp (capillary action through masonry)
- Heat leakage through floor slab (thermal bridge)
- Water penetration in service penetrations

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9 Structural Components

- Concrete cracks at load-bearing joints and slabs
- Thermal stress zones in beams and columns
- Corrosion of reinforcement (rebar heating in IR)
- Structural deflection or bending in floors and roofs
- Water infiltration along structural joints
- Settling cracks in foundations or retaining walls
- Separation between precast elements
- Insufficient insulation between structural and envelope zones

10 Insulation and Air-Tightness

- Missing or compressed insulation zones
- Air leakage through facades, eaves and parapets
- Poor continuity between wall and roof insulation
- Unsealed electrical and pipe penetrations
- Leaky vapor barriers
- Cold bridges at beams, balcony connections and window frames
- Non-insulated HVAC or service ducts through envelope

11 HVAC, Mechanical & Technical Systems

- Heat loss from ducts or pipes due to poor insulation
- Overheated electrical cabinets, switchboards or transformers
- Blocked exhaust vents or air inlets
- Leaking condensate from HVAC units
- Overheating in ventilation fans or heat exchangers
- Energy waste due to air leakage in shafts

12 Solar Installations

- Hotspots on PV modules (cell failure or shading)
- Cracked glass panels
- Temperature imbalance between strings or modules
- Overheated inverters or combiner boxes
- Dirty or misaligned modules (yield loss)
- Damaged mounting structures causing shadowing
- Corroded grounding or cable routing

13 Wind Turbines

- Blade delamination or internal moisture pockets
- Erosion on leading edges and tips
- Hotspots at bearings, hubs or gearboxes
- Surface cracks or UV degradation in composite structure
- Overheating in power electronics or converters
- Alignment errors between nacelle and blades

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14 Operational and Lifecycle Indicators

- Quantified energy loss (kWh/year) via Inotek AI Energy Model
- Corresponding CO_2 impact per defect
- Estimated cost of energy loss (€ per year)
- Projected lifespan extension (years)
- Estimated avoided repair cost (€)
- Risk rating for safety-critical findings

15 Safety-Related Elements

- Loose facade elements or cladding panels (fall hazard)
- Degraded render or stone at pedestrian height
- Missing or rusted anchors in facades or railings
- Unstable parapets or roof edges
- Damaged lightning protection cables
- Broken or misaligned roof safety hooks
- Cracked or unstable glass panels over entrances
- Blocked emergency vents or fire exhausts
- Corrosion of steel stairs or exterior ladders

16 Oil, Gas and Chemical Installations

- Localised heat anomalies on pipelines indicating product flow restriction or internal corrosion
- Surface temperature variance showing insulation loss or degradation on process pipes
- Hotspots on pressure vessels, separators or exchangers indicating internal turbulence or thinning walls
- Leakage detection from flanges, valves and couplings (thermal or visual trace)
- Corrosion or pitting on storage tanks and structural components
- Delamination or coating failure on steel or composite surfaces
- Moisture intrusion beneath protective coatings or insulation jackets
- Uneven thermal distribution across tank shells revealing level stratification or product layering
- Deformation in tank roofs or walls caused by vacuum or overpressure events
- Sediment buildup visible through thermal differential on tank bottoms
- Air leakage or gas seepage around venting systems (detectable through convective patterns)
- Surface overheating on electrical or control panels indicating overload conditions
- Elevated temperatures on rotating machinery bearings or gearboxes (predictive maintenance indicator)

17 Cranes, Lifting Equipment and Mechanical Structures

- Fatigue cracks at weld seams, pivot joints and boom sections
- Overheating in hydraulic systems, motors or winches
- Corrosion or loss of material on load-bearing beams and anchor points
- Misalignment or deformation of structural components under load
- Friction heat on bearings and pulleys due to insufficient lubrication
- Overstressed or loosened bolts visible through thermal contrast after operation
- Electrical connection heating in control boxes or motor relays
- Paint and coating degradation exposing steel to accelerated corrosion
- Residual heat zones after lifting cycles indicating mechanical wear

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18 Transmission Towers, Antenna Masts and High-Voltage Systems

- Overheating at electrical insulators, connectors and termination points
- Corrosion or mechanical fatigue at bolt joints and anchoring flanges
- Cracked welds or deformation in steel lattice structures
- Moisture ingress or corrosion at foundation bolts and grounding systems
- Loose connection or increased resistance in conductors (visible as local hotspots)
- Uneven temperature distribution along cables indicating phase imbalance
- UV and coating degradation on structural surfaces
- Ice accumulation zones detected by low thermal emissivity
- Thermal evidence of stray currents or arcing in high-voltage lines

19 Process Plants and Industrial Piping Systems

- Thermal leakage from steam lines, heat exchangers and condensate traps
- Blockages or flow restrictions detected through abnormal temperature gradient
- Energy loss from uninsulated valves, elbows and flanges
- Leakage of heated or chilled fluids detected through differential patterns
- Corrosion under insulation (CUI) indicated by irregular surface temperature
- Uneven heating of vessels suggesting internal fouling or baffle failure
- Misaligned pipe supports or sagging detected visually
- Motor and pump overheating caused by mechanical or electrical stress
- Heat loss quantification for system-wide energy optimisation

20 Storage and Containment Structures

- Temperature stratification in liquid tanks (thermal layering)
- Insulation failure causing heat transfer through tank shells
- Moisture ingress at tank bases or secondary containment walls
- Corrosion mapping along tank circumference and weld seams
- Structural deformation in floating roofs or dome tops
- Air leakage at venting or breather systems detectable by turbulence heat patterns
- Ground settlement or differential foundation movement visible by façade alignment changes
- Delamination of internal coating indicated by uneven surface emissivity