



Executive Summary — ASTM C1153+ Roof Thermography

Client / Site

Project / Asset

Inspection Date & Window

ASTM C1153

Standards

UAS & Payload

Autel EVO II Dual 640T RTK V3 — 640×512 radiometric; thermal FOV 33°×26° (13 mm); 50 MP stills / 4K video; RTK ±1 cm + 1 ppm (H), ±1.5 cm + 1 ppm (V).

Radiometric Settings

Mode: ON (R-JPEG + IRG); Emissivity: ____; Trefl: ____°C; Gain: [High/Low]; Palette: ____.

Key Environmental Gates

Wind ≤ spec; standoff 2–20 m for quantitative temps; record ambient, humidity, ΔT/irradiance/load (per service).

Team & Contacts

Lead: _____ Thermographer Level: [I/II/III]

Part 107 Cert#: _____

Key Findings (top 3)

-
-
-

Options & Recommendation

A) _____ B) _____ C) _____ Recommended: _____

Risks & Mitigations

-
-

Approval / Next Steps

Approve _____ by _____ ; follow-up scan date _____ ; point of contact _____.



QC Worksheet — ASTM C1153+ Roof Thermography

Radiometric Mode	R-JPEG + IRG saved	<input type="checkbox"/> Yes <input type="checkbox"/> No
Emissivity (ϵ)	Material-specific	Value: _____
Reflected App. Temp (Trefl)	Per environment	_____ °C
Measurement Distance	2–20 m required for quantitative temps	Min: _____ m Max: _____ m % within band: _____%
Altitude Above Roof/Target (ARL)	Service-specific (see below)	Level 1: _____ ft L2: _____ ft L3: _____ ft
RTK FIX Quality	Target \geq 95% images FIX; PPK fallback if needed	FIX %: _____% PPK: <input type="checkbox"/> Used
Overlap Achieved	Thermal \geq 80/80 (or per service)	Front: _____% Side: _____%
Focus/Blur Check	Random sample \geq 20 images	<input type="checkbox"/> Pass <input type="checkbox"/> Re-fly segments
Coverage Audit	100% or exceptions noted	Coverage: _____% Exceptions: _____
Processing Integrity	No-blending for quantitative mosaics	<input type="checkbox"/> No-blend <input type="checkbox"/> Avg-blend (viz only) _____
Deliverables	Exec summary, orthos, CSV/KML, imagery, logs	<input type="checkbox"/> All included
Sign-off	QC by	Name: _____ Date: _____

ASTM C1153-Specific Gates

Timing	\geq 1 hr after sunset through sunrise	Start: ____:____ End: ____:____
Dryness	No rain 24–48 h; roof dry/clean	<input type="checkbox"/> Yes <input type="checkbox"/> No
ΔT (inside/outside)	\geq 18 °F (10 °C)	Measured: _____ °F/°C
Wind	< 15 mph	Measured: _____ mph
Anomaly Verification	Core-cut plan documented	<input type="checkbox"/> Yes <input type="checkbox"/> N/A (client-provided)
Notes	Emissivity 0.90–0.95 typical; DDE OFF	



ASTM C1153+ Enhanced

Advanced Roof Moisture Survey Template

Exceeding ASTM C1153 with Drone Technology & Advanced Analytics

This template exceeds ASTM C1153 requirements by incorporating:

- RTK GPS for centimeter-level anomaly positioning
 - 640×512 radiometric thermal resolution
- Drone safety protocols significantly reducing roof access
 - Digital orthomosaic deliverables
- AI-assisted anomaly detection capabilities

KEY INSPECTION REQUIREMENTS

- Night-only: ≥ 1 hour after sunset through sunrise
- Best 2-4 hours after hot days; dry roof required
- No rain prior 24 hours (48 hours after extreme events)
 - Wind < 15 mph (25 km/h)
- Inside/outside temperature difference $\geq 18^{\circ}\text{F}$ (10°C)
- UAV replaces dangerous roof walking and ladder access
- Annual inspection minimum; bi-annual for critical facilities
 - Core verification required per ASTM C1153

1. Pre-Flight Planning & Safety Assessment

1.1 Traditional Access Methods Being Replaced

Conventional inspection methods eliminated:

- Walking on roof Ladder inspection Scaffolding
 Lift/cherry picker Manual binocular inspection from ground

Estimated safety improvement: _____ % Insurance savings: \$ _____/year

Safety objectives achieved:

- Eliminated fall hazards No personnel on roof
 Reduced liability exposure OSHA compliance improved

Inspection frequency plan:

- Annual (standard) Bi-annual (critical facilities)
 Post-event (hail/storm) Pre-warranty expiration

Previous method cost: \$ _____ Drone inspection cost: \$ _____



1.2 Building/Facility Assessment

Building type:

- Commercial office Industrial/warehouse Educational
 Healthcare Data center Retail Government
 Multi-family residential Other: _____

Critical facility considerations:

- 24/7 operations Data center (moisture sensitive)
 Healthcare facility Historical building
 High-value inventory below Food processing/storage

Roof access assessment:

- Ground launch feasible Adjacent building launch
 Parking lot available Rooftop launch required

Roof hazards/obstacles:

- HVAC units Solar panels Antennas/dishes
 Parapets Skylights Rooftop equipment
 Power lines nearby Trees overhanging

1.3 Previous Inspection History

Previous roof inspections:

- Last inspection date: _____ Method: _____
 Previous IR survey available Core cut records available
 Repair history documented Warranty claims filed

Known issues:

- Active leaks Location: _____
 Previous repairs Location: _____
 Ponding water areas Damaged flashing reported



2. Project Information

Client Name:

Property Address:

GPS Coordinates (decimal degrees):

Lat: _____ Long: _____

Building Use:

Primary: _____ Secondary: _____

Building/Roof Age:

Year built: _____ Roof installed: _____ Age: _____ years

Last major repair/restoration: _____

Report Date:

Inspection Date & Time:

Date: _____ Start: _____ End: _____

Time after sunset:

_____ hours (optimal: 2-4 hours after sunset)

Reason for inspection:

- Routine/preventive Active leaks Pre-purchase
 Insurance claim Warranty requirement Post-storm



3. Provider & Methodology

Company: Aerial Accuracy LLC

Inspector Name: _____

Thermographer Certification:

Level: I II III Cert #: _____

Certifying body: _____ Exp: _____

Drone Pilot Certificate (Part 107):

Certificate #: _____ Exp: _____

Roofing Industry Credentials:

RCI (IIBEC) member NRCA certified Local licensed

IR certified for roofing Other: _____

Method:

Aerial UAS thermal imaging (primary)

Supplemental ground verification Core cuts for validation

4. Environmental Conditions & Compliance (Critical)

Condition	ASTM Requirement	Measured	Compliant?
Timing	1+ hr after sunset	_____ hrs	<input type="checkbox"/> Y <input type="checkbox"/> N
Precipitation (24h)	None	_____	<input type="checkbox"/> Y <input type="checkbox"/> N
Roof Surface	Dry, clean	_____	<input type="checkbox"/> Y <input type="checkbox"/> N
Wind Speed	< 15 mph	_____ mph	<input type="checkbox"/> Y <input type="checkbox"/> N
Inside/Outside ΔT	$\geq 18^{\circ}F$ ($10^{\circ}C$)	_____ $^{\circ}F$	<input type="checkbox"/> Y <input type="checkbox"/> N
Previous Day	Sunny/clear	_____	<input type="checkbox"/> Y <input type="checkbox"/> N
Cloud Cover	< 50%	_____ %	<input type="checkbox"/> Y <input type="checkbox"/> N

Additional conditions recorded:

Outside temp: _____ $^{\circ}F$ Inside temp: _____ $^{\circ}F$ ΔT : _____ $^{\circ}F$

Humidity: _____ % Barometric: _____ inHg Dew point: _____ $^{\circ}F$

HVAC status: Heating Cooling Off Set point: _____ $^{\circ}F$



5. Equipment Specifications

5.1 Thermal Imaging Equipment

IR Camera	Autel EVO II Dual 640T RTK V3
Detector Resolution	640 x 512 pixels
Spectral Range	8-14 μm (LWIR)
NETD	$\leq 50 \text{ mK @ } 30^\circ\text{C}$
FOV	$40^\circ \times 30^\circ$
Calibration Date	_____
Visual Camera	8K resolution for detail capture

5.2 Drone Platform & Flight Parameters

Drone Platform:

Autel EVO II Dual 640T RTK V3

Positioning System:

RTK-enabled (centimeter-level positioning) Standard GPS

Horizontal accuracy: $\pm 1 \text{ cm} + 1 \text{ ppm}$ Vertical: $\pm 1.5 \text{ cm} + 1 \text{ ppm}$

Flight Parameters:

Altitude AGL: _____ ft

Altitude Above Roof Level: _____ ft (typical 40-50 ft for IR)

Ground speed: _____ mph GSD: _____ cm/pixel

Image overlap: Front _____ % / Side _____ % ($\geq 80/80$ recommended for thermal; increase if low contrast)



6. Roof System Information

Total Roof Area:

_____ sq ft (_____ m²)

Number of Roof Sections: _____ **Different levels:** _____ **Different ages:** _____

Height Level 1: _____ Height Level 2: _____ Height Level 3: _____ Height Level 4: _____

Configuration:

Flat Low-slope (<2:12) Steep-slope (>2:12)

Actual slope: _____ :12 Drainage direction: _____

Membrane Type:

EPDM TPO PVC Modified bitumen BUR

Metal Shingle Tile Other: _____

Manufacturer: _____ Product: _____

Color: _____ Thickness: _____ mils

Insulation Type:

Polyisocyanurate (ISO) XPS EPS Mineral wool

Perlite Wood fiber Other: _____

Insulation Details:

Thickness: _____ inches R-value: _____ Layers: _____

Tapered: Yes No Direction: _____

Deck Type:

Steel Concrete Wood Gypsum Cementitious

Attachment Method:

Fully adhered Mechanically attached Ballasted

Hybrid: _____

Warranty Information:

Type: Manufacturer Contractor NDL

Years: _____ Expires: _____ Status: Active Expired



7. Enhanced Inspection Procedure

7.1 Pre-Inspection Checklist

Task	Complete	Notes
Review building plans and previous reports	<input type="checkbox"/>	_____
Conduct daylight visual inspection	<input type="checkbox"/>	_____
Document visible damage, patches, equipment	<input type="checkbox"/>	_____
Verify HVAC operating for thermal differential	<input type="checkbox"/>	_____
Set camera emissivity (0.90-0.95 typical)	<input type="checkbox"/>	$\epsilon =$ _____
Plan flight grid with adequate overlap	<input type="checkbox"/>	_____
Check airspace (B4UFLY) and obtain approvals	<input type="checkbox"/>	_____
Notify building occupants/security	<input type="checkbox"/>	_____

8. Thermal Anomaly Findings & Classification

8.1 ASTM C1153 Pattern Classification

Pattern Type	Description	Count	Area (sq ft)
Board-stock	Rectangular; board-by-board wetting	_____	_____
Picture-frame	Edge wetting; slow-wetting ISO/XPS	_____	_____
Amorphous	Irregular; monolithic or active leaks	_____	_____
Non-moisture	Equipment, repairs, air leakage	_____	_____
TOTALS		_____	_____

Summary Statistics:

Total anomaly area: _____ sq ft (_____ % of total roof)

Estimated wet insulation: _____ sq ft

Replacement costs: provided by licensed contractor (Aerial Accuracy does not furnish cost estimates)

Repair costs: provided by licensed contractor (Aerial Accuracy does not furnish cost estimates)



9. Detailed Anomaly Documentation (repeat as needed)

ANOMALY ID: A-001

Location/Roof Section:

GPS Coordinates (RTK):

Lat: _____ Long: _____ Accuracy: ± 2 cm

Dimensions:

_____ ft \times _____ ft Area: _____ sq ft

Pattern Type (ASTM C1153):

Board-stock Picture-frame Amorphous Non-moisture

Temperature Data:

Anomaly temp: _____ $^{\circ}$ F Background: _____ $^{\circ}$ F ΔT : _____ $^{\circ}$ F
 Warmer (typical moisture) Cooler (air infiltration/wet surface)

Probability of Subsurface Moisture:

<10% (minor) 10-25% (moderate) >25% (saturated)

Probable Cause:

Membrane puncture Seam failure Flashing defect
 Drain blockage Mechanical damage Age deterioration

Previous repair failure Other: _____

Recommended Action:

Core sample verification Immediate repair
 Remove/replace wet insulation Monitor

Temporary patch Timeline: _____



10. Solar/Green Roof Considerations

Complete if building has rooftop solar or vegetative systems

10.1 Rooftop Solar

Solar PV system present:

Yes No Type: Flush mount Ballasted BIPV

Coverage: _____ % of roof Capacity: _____ kW

Solar-related moisture issues found:

Penetration leaks Ballast displacement damage
 Drainage interference Membrane wear under racking
 None observed

10.2 Green/Vegetative Roof

Green roof system:

Extensive Intensive None

Coverage: _____ % Drainage visible: Yes No

11. Verification Procedures (Mandatory per ASTM C1153)

ASTM C1153 requires physical verification. Minimum: one core per roof section, one in dry area, and one in each anomaly type.

Core ID	Location	Purpose	Anomaly	Moisture	Result
C-001	_____	Dry control	N/A	_____ %	<input type="checkbox"/> Dry
C-002	_____	Anomaly verify	A-____	_____ %	<input type="checkbox"/> Wet

IR findings correlation:

100% confirmed _____ % confirmed Discrepancies: _____

12. Certification & Compliance

I certify this inspection complies with ASTM C1153 Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging, enhanced with UAV technology and RTK positioning, and accurately represents all findings.

Inspector Signature:

Printed Name:

Date:



Accuracy, Safety & Liability Notes

- Radiometric temperature accuracy is $\pm 3^{\circ}\text{C}$ or $\pm 3\%$ of reading (whichever is greater) when the camera is used within the manufacturer's specified environment (-20°C to $+60^{\circ}\text{C}$). Measurements outside this environment have unspecified accuracy.
- The thermal camera's accurate measurement distance is 2–20 m (≈ 6.5 –65 ft). Temperature readings taken beyond 20 m should be treated as qualitative unless otherwise validated.
- Thermal sensitivity (NETD) is specified at 30°C ; apparent ΔT detection will vary with target temperature, wind, and atmosphere. Small temperature differences on very hot or very cold scenes may be harder to resolve.
- Wind limits in these templates are set to protect radiometric integrity (convective cooling, plume effects), not to reflect the drone's maximum wind resistance rating.
- RTK-enabled positioning: Horizontal $\pm 1\text{ cm} + 1\text{ ppm}$ (RMS); Vertical $\pm 1.5\text{ cm} + 1\text{ ppm}$ (RMS) when FIX is maintained. If RTK is lost, positions revert to standard GNSS ($\approx \pm 1$ –1.5 m). Report RTK FIX percentage with deliverables.
- Operating range of the aircraft is -10°C to $+40^{\circ}\text{C}$ (14 – 104°F). Operations may be postponed if ambient or surface conditions exceed equipment limits.
- All findings represent conditions at the time of inspection only. Thermal anomalies indicate areas for further investigation; they are not a guarantee of defect, remaining life, or performance.

Verification by qualified professionals (e.g., roof cores per ASTM, IV-curve/electrical testing per IEC/NFPA) is recommended before remediation.

- ASTM C1153 timing: flights may begin ≥ 1 hour after local sunset and continue through sunrise, weather permitting.
- Per ASTM C1153, physical verification is required. Minimum: one core in a dry control area and one in each anomaly type/section. This report identifies locations for verification rather than quantifying moisture percentage volumetrically.
- For quantitative temperature reads, maintain 2–20 m standoff and record emissivity and reflected apparent temperature (Trefl) per survey notes.