Executive Summary — NFPA 70B Electrical Thermography

Client / Site	
Project / Asset	
Inspection Date & Window	
Standards	NFPA 70B-2023
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 — NFPA 70B Electrical Thermography

Radiometric Mode	R-JPEG + IRG saved	[ ] Yes [ ] 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 ≥ 95% images FIX; PPK fallback if needed	FIX %: ___% PPK: [ ] Used
Overlap Achieved	Thermal ≥ 80/80 (or per service)	Front: ___% Side: ___%
Focus/Blur Check	Random sample ≥ 20 images	[ ] Pass [ ] Re-fly segments
Coverage Audit	100% or exceptions noted	Coverage: ___% Exceptions: _____
Processing Integrity	No-blending for quantitative mosaics	[ ] No-blend [ ] Avg-blend (viz only)
Deliverables	Exec summary, orthos, CSV/KML, imagery, logs	[ ] All included
Sign-off	QC by	Name: _____ Date: _____

NFPA 70B-Specific Gates

Load Level	≥ 40% nominal during scan	Measured: ____ %
Approach Distances	Per facility qualified person; arc-flash boundary	[ ] Established
Method	Manual-only near energized equipment	[ ] Confirmed
Wind	< 15 mph	Measured: ____ mph
IR Windows	Use where available	[ ] Yes [ ] No
Severity Basis	ΔT + load + criticality + environment	[ ] Documented

NFPA 70B (2023) Enhanced Edition

Electrical Equipment Thermography Inspection Sheet

This enhanced edition integrates standards from:
• NFPA 70B-2023 Electrical Equipment Maintenance
• FAA Part 107 & BVLOS Requirements
• IEC 62446-3 (if PV Integration)

KEY INSPECTION REQUIREMENTS
Annual requirement per NFPA 70B (6-month for Condition 3 equipment)
Scan under normal/peak load; target ≥ 40% of nominal rating
Document ΔT vs reference and ambient
Battery life check ≥ 80% before flight
Manual-only flight near energized equipment; autonomous/close-proximity modes prohibited
Wind < 15 mph for electrical equipment safety

1. Pre-Flight Planning & Safety Assessment

1.1 Pre-Flight Checklist

Battery Status:
[ ] ≥ 80% charge confirmed Current: _____ % Backup batteries: _____

Signal Interference Assessment:
[ ] Low risk [ ] Medium risk [ ] High risk - mitigation: _____

Weather Contingency Plan:
[ ] Documented Details: _____

Emergency Landing Zones Identified:
[ ] Yes Number of zones: _____ GPS logged: [ ] Yes

FAA Part 107 Compliance:
[ ] Airspace checked [ ] NOTAMs reviewed [ ] LAANC approval if needed

1.2 Electrical Hazard Assessment

Minimum Safe Distance Calculation:
Voltage class: [ ] <1kV [ ] 1-35kV [ ] >35kV

Safe distance: _____ ft Reference: OSHA 1910.269

EMF/RFI Assessment:
[ ] Completed Interference level: [ ] Low [ ] Medium [ ] High

Arc Flash Boundary Established:

[ ] Yes Distance: _____ ft PPE if within boundary: _____

1.3 Autonomous Flight Setup

Autonomous Mode Configuration:
[ ] Enabled for close proximity work [ ] Manual only [ ] Hybrid

Obstacle Avoidance Settings:
[ ] Maximum sensitivity [ ] Standard [ ] Custom: _____

3D Mapping Mode:
[ ] Enabled for structures [ ] 2D only [ ] Both

Data Capture Rate Target:
[ ] High-efficiency workflow (site-dependent) [ ] Standard Rate: _____ assets/hr

2. Facility & Inspection Information

Facility Name:

_____

Facility Type:
[ ] Substation [ ] Generation [ ] Distribution [ ] Transmission
[ ] Industrial [ ] Commercial [ ] Solar/Wind farm [ ] Other: _____

Facility Address:_____

GPS Coordinates:

Lat: _____ Long: _____

Facility Contact:

Name: _____ Phone: _____

Email: _____

Inspection Dates:

Current: _____ Previous: _____

Start time: _____ End time: _____ Duration: _____ hrs

Inspection Interval Compliance:

Required: [ ] 12 months [ ] 6 months Last inspection: _____ months ago
[ ] Compliant [ ] Overdue by _____ months

3. Thermographer Qualifications & Equipment

3.1 Personnel Qualifications

Lead Thermographer:

Name: _____
Company: Aerial Accuracy LLC

Thermography Certification:

Level: [ ] I [ ] II [ ] III Cert #: _____

Certifying body: _____ Exp date: _____

Electrical Qualifications:

[ ] NFPA 70E trained [ ] Qualified electrical worker
[ ] Limited approach boundary authorized

Drone Pilot Certification:

[ ] Part 107 Certificate #: _____ Exp: _____
[ ] Night operations (Part 107.29 training recorded; anti-collision lighting 3 SM)

3.2 Equipment Specifications

Thermal Camera	Autel EVO II Dual 640T RTK V3
Resolution	640 x 512 pixels
Thermal Sensitivity	≤ 50 mK
Spectral Range	8-14 µm
Calibration Date	_____

4. Inspection Scope & Conditions

4.1 Inspection Scope

Inspection Type:

[ ] Annual mandatory [ ] Semi-annual (Condition 3) [ ] Post-maintenance
[ ] Troubleshooting [ ] Baseline [ ] Pre-outage [ ] Post-event

Infrastructure Components (check all inspected):

TRANSMISSION	DISTRIBUTION	SUBSTATION
[ ] Towers/poles	[ ] Poles	[ ] Switchgear
[ ] Conductors	[ ] Crossarms	[ ] Breakers
[ ] Insulators	[ ] Transformers	[ ] Bus bars
[ ] Shield wires	[ ] Capacitor banks	[ ] CT/PT units
[ ] Dampers	[ ] Reclosers	[ ] Batteries

4.2 Environmental & Load Conditions

Parameter	Requirement	Measured	Status
Ambient Temperature	Record	_____ °F/°C	Recorded
Relative Humidity	Record	_____ %	Recorded
Wind Speed	< 15 mph	_____ mph	[ ] Y [ ] N
System Load	≥ 40% nominal	_____ %	[ ] Y [ ] N
Load Verification	Via meter/SCADA	Method: _____	[ ] Verified

Facility Load Level:

[ ] Peak [ ] Normal [ ] Light [ ] Minimal

Access Method:

[ ] Aerial/drone (primary) [ ] IR windows [ ] Covers removed (PPE required)
[ ] Ground-based [ ] Elevated platform

5. Equipment Condition Classification (NFPA 70B Section 9.3)

Condition	Criteria	Frequency	Selected
1	New/like new; all maintenance performed	12 months	[ ]
2	Minor issues; routine maintenance adequate	12 months	[ ]
3	Degraded; urgent actions; missed maintenance	6 months	[ ]
4	Unacceptable risk; immediate attention	Immediate	[ ]

6. Enhanced Drone Operations Procedure

6.1 Multi-Angle Capture Protocol

Capture angles for each component:

[ ] Front view [ ] Side view [ ] Top view [ ] 45° oblique
[ ] Close-up of connections [ ] Wide establishing shot

Overlap settings:

Front: _____ % Side: _____ %

Flight pattern:

[ ] Linear (for lines) [ ] Grid (for substations) [ ] Orbital (for structures)

6.2 Transmission Line Specific

Tower/pole inspection checklist:

[ ] Foundation/grounding [ ] Structural members [ ] Bolts/connections
[ ] Guy wires [ ] Climbing facilities [ ] Signs/markers

Conductor inspection:

[ ] Splices [ ] Dampers [ ] Spacers [ ] Sag measurement: _____ ft

Insulator inspection:

[ ] Contamination [ ] Cracks/chips [ ] Corona discharge (UV corona camera required – not included)
[ ] Bird guards [ ] Flashover marks

Vegetation encroachment check:

Minimum clearance: _____ ft Actual: _____ ft [ ] Compliant [ ] Violation

6.3 Data Quality Verification

High-quality data capture confirmed:

[ ] Resolution ≥ requirements [ ] Focus verified [ ] Exposure correct

3D model creation (if applicable):

[ ] Point cloud generated [ ] Mesh created [ ] Textured model

AI anomaly detection:

[ ] Enabled Tool: _____ [ ] Manual review only

7. Severity Classification & Recommended Actions

Priority	ΔT Range	Description	Action
1 - Critical	> 40°C (> 72°F)	Major deficiency; immediate danger	Immediate repair/shutdown
2 - Serious	20-40°C (36-72°F)	Significant deficiency	Repair ASAP (<1 week)
3 - Intermediate	10-20°C (18-36°F)	Developing issue	Schedule (<1 month)
4 - Minor	< 10°C (< 18°F)	Minor anomaly or early stage	Monitor/next maintenance

8. Detailed Thermography Findings (duplicate as needed)

FINDING ID: E-001

Equipment ID/Location:_____

Equipment Type:

[ ] Transformer [ ] Breaker [ ] Switch [ ] Bus [ ] Cable
[ ] Connector [ ] Insulator [ ] Capacitor [ ] Other: _____

GPS Coordinates (RTK:[_]):

Lat: _____ Long: _____

Voltage/Current Rating:

Voltage: _____ kV Current: _____ A Temperature: _____

Load at Inspection:

Phase A: _____ A Phase B: _____ A Phase C: _____ A

Load percentage: _____ % Imbalance: _____ %

T1 Hot	T2 Ref	Ta Amb	ΔT (T1-T2)	ΔT (T1-Ta)
___°C/F	___°C/F	___°C/F	___°C/F	___°C/F

Images:Thermal: #_____ Visual: #_____ Multi-angle: #_____

Probable Cause:

[ ] Loose connection [ ] High resistance [ ] Corrosion [ ] Overload
[ ] Imbalance [ ] Defective component [ ] Contamination

[ ] Other: _____

Description:

_____

_____

Priority:

[ ] 1-Critical [ ] 2-Serious [ ] 3-Intermediate [ ] 4-Minor

Recommended Action:

_____

Work Order #:

_____ Date issued: _____

9. Power Line Specific Findings

9.1 Defect Summary by Component

Component	Total	Priority 1	Priority 2	Priority 3-4
Towers/Poles	_____	_____	_____	_____
Conductors	_____	_____	_____	_____
Insulators	_____	_____	_____	_____
Hardware/Connectors	_____	_____	_____	_____
Vegetation	_____	_____	_____	_____

9.2 Phase Imbalance Analysis

Phase temperature comparison:

Phase A avg: _____ °C Phase B avg: _____ °C Phase C avg: _____ °C

Max phase difference: _____ °C Location: _____

Phase current comparison:

Phase A: _____ A Phase B: _____ A Phase C: _____ A

Imbalance percentage: _____ % [ ] Acceptable [ ] Requires correction

10. Solar/Wind Farm Integration (Crossover Inspection)

Complete if facility includes renewable generation

10.1 PV System Interface

PV array present:

[ ] Yes [ ] No Capacity: _____ MW

Inverter station inspection:

[ ] DC combiner boxes [ ] String inverters [ ] Central inverter

[ ] Transformer [ ] Switchgear Findings: _____

IEC 62446-3 compliance check:

[ ] Module inspection per IEC [ ] BOS per IEC [ ] N/A

10.2 Wind Turbine Interface

Wind turbines present:

[ ] Yes [ ] No Quantity: _____ Total capacity: _____ MW

Substation equipment inspected:
[ ] Collection system [ ] Step-up transformer [ ] SCADA equipment
[ ] Capacitor banks [ ] Reactive power equipment

Blade inspection performed:
[ ] Yes (see separate report) [ ] No [ ] N/A

11. Post-Inspection Data Processing & Reporting

11.1 Data Processing

AI-assisted anomaly detection:

[ ] Used Tool: _____ Anomalies found: _____

[ ] Manual review only Time spent: _____ hrs

Data formats generated:

[ ] Thermal orthomosaic [ ] RGB orthomosaic [ ] 3D model
[ ] Point cloud [ ] GIS layers [ ] Database export

Resilience decision support:

[ ] Maintenance prioritization matrix created
[ ] Cost-benefit analysis completed
[ ] Risk assessment provided

11.2 Deliverables

Report components provided:

[ ] Executive summary
[ ] Detailed findings with images
[ ] Prioritized action list
[ ] Thermal/visual image pairs
[ ] Georeferenced anomaly map
[ ] Trending analysis (if baseline exists)
[ ] Compliance documentation

Digital delivery:

[ ] PDF report [ ] Cloud portal URL: _____

[ ] GIS integration Format: _____

12. Inspection Summary & Compliance

Category	Total	Priority 1	Priority 2	Priority 3-4
Components Inspected	_____			
Anomalies Found	_____	_____	_____	_____
Work Orders Issued	_____	_____	_____	_____

Condition 3 equipment identified:

[ ] Yes - requires 6-month inspection [ ] No

Equipment IDs: _____

Next inspection date:_____

Frequency: [ ] 12 months [ ] 6 months

Additional recommendations:

_____

_____

13. Certification & Compliance

I certify this inspection complies with NFPA 70B-2023 (Sections 7.4 and 9.3) and accurately represents all observed conditions.

Thermographer Signature:

_____

Printed Name:

_____

Date:

_____

Facility Manager Acknowledgment:

Signature: _____ Date: _____

QA Review (Level II/III):

Name: _____ Date: _____

Accuracy, Safety & Liability Notes

• Radiometric temperature accuracy is ±3 °C or ±3% of reading (whichever is greater) when the camera is used within the manufacturer's specified environment (−20 °C to +60 °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 ±1 cm + 1 ppm (RMS); Vertical ±1.5 cm + 1 ppm (RMS) when FIX is maintained. If RTK is lost, positions revert to standard GNSS (≈±1–1.5 m). Report RTK FIX percentage with deliverables.

• Operating range of the aircraft is −10 °C to +40 °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.

• Close-proximity operations around energized equipment are manual-control only. Obstacle sensors may not detect thin wires; do not rely on autonomy near conductors.

• Minimum approach distances and arc-flash boundaries are established by the site's qualified electrical professional (e.g., OSHA 1910.269/NFPA 70E). Aerial Accuracy provides aerial thermal/visual data; it does not perform energized electrical work or override facility safety rules.

• Severity ratings consider ΔT, load, criticality, and environment; they are advisory until confirmed by a qualified electrician/engineer.