

CAT D6N DOZER

AI INSPECTION TRAINING DATA

Pass / Fail Example Set v1.0

Critical (FAIL) — Do not operate	Moderate (MONITOR) — Schedule service
Normal (PASS) — No action required	8 scenarios — 8 examples total

Purpose and Failure Taxonomy

This document provides labelled training examples for the CAT D6N dozer inspection AI pipeline. Each example contains a simulated image context, a raw technician voice note transcript, the known failure patterns that a poorly-prompted AI produces, and the correct JSON output that the pipeline must emit. Examples are drawn directly from observed prompt failures in the field.

The Two Core Failure Modes Observed

#	Failure Mode	Consequence
F-01	Hallucination — Describing invisible components	AI outputs findings for components not present in the image (e.g. cab glass when only an access ladder is visible). Directly observed in FailPrompt1.
F-02	Severity Downgrade — Critical misclassified as Moderate/Low	Structural failures (missing snap ring, broken ladder step, missing final drive bolt) output as Moderate. Directly observed in FailPrompt2.
F-03	Schema Mismatch — Wrong field names	Output uses 'risk_level' instead of 'severity', 'anomaly' instead of 'issue', etc. Breaks downstream JSON parsing.
F-04	Vague Language — Non-actionable descriptions	'Appears worn', 'may require inspection', 'address soon'. These cannot drive a work order. Every finding must have a specific, timed action.
F-05	False Positives on Healthy Components	Adding speculative Low-severity notes on components with no observed anomaly. Creates maintenance noise and erodes technician trust.

Evidence Backing Rules

evidence_backed: true	BOTH voice note AND image confirm same component and same finding.
evidence_backed: false	Voice note only — no image provided, or image does not show the component.
technician_review_require d: true	Voice and image conflict, or technician states they cannot directly see the component.
confidence_score < 70	Use when image quality is poor, component is partially obscured, or finding is inferred rather than directly observed.

Inspection Examples

EX-001 | Left Track — Cracked Master Link Pin Retainer

MACHINE STATUS: FAIL

SEVERITY: Critical

Image Context

Close-up of left-side track at ground level showing the master link. Rust streaks visible around pin retainer. One snap ring is absent from its groove.



Technician Voice Note (raw transcript):

"Uh, so I'm looking at the left track on the D6N, and the master link — I can see the snap ring is missing on the outboard side. There's heavy rust around the pin too. This thing could throw the track mid-operation. Um, yeah, this is a do-not-operate for me."



KNOWN FAILURE PATTERN — What bad AI output looks like:

- ✗ Calls it "Moderate" — missing snap ring on a master link is always Critical.
- ✗ Vague description: "track appears worn" — does not mention the missing snap ring or rust at the pin seat.
- ✗ Wrong component: outputs "Track Shoe" instead of "Master Link Pin Retainer".
- ✗ Wrong action: "Monitor at next service" — machine must not move.

✓ CORRECT OUTPUT — What the AI should produce:

component: "Master Link Pin Retainer — Left Track"

severity: "Critical"

condition_description: "Snap ring absent from outboard groove of master link. Significant rust oxidation visible at pin seat and retainer face. Pin retainer shows lateral movement indicating loss of positive retention."

safety_impact_assessment: "Loss of track retention. Track ejection risk during operation — immediate personnel injury hazard."

estimated_timeline: "Replace immediately before next operation"

evidence_backed: true

Correct JSON Output

```
{  
  "inspection_summary": {  
    "asset": "CAT D6N Dozer",  
    "status": "fail",  
    "overall_operational_impact": "Left track at immediate ejection risk. Equipment must not be operated."  
  },  
  "anomalies": [  
    {  
      "component": "Master Link Pin Retainer",  
      "component_location": "Left track, master link – outboard face",  
      "issue": "Missing snap ring – track ejection risk",  
    }  
  ]  
}
```

```

    "condition_description": "Snap ring absent from outboard groove. Rust oxidation at pin seat. Visible lateral pin movement indicating loss of retention.",
    "severity": "Critical",
    "safety_impact_assessment": "Track ejection during operation. Immediate personnel injury and machine damage risk.",
    "operational_impact": "Machine must not be moved under any load.",
    "estimated_timeline": "Replace immediately before next operation",
    "recommended_action": "Install correct snap ring (part ref PT-D6N-TRK-001). Inspect adjacent links for pin wear before reinstating operation.",
    "part_number": "PT-D6N-TRK-001",
    "evidence_backed": true,
    "technician_review_required": false,
    "confidence_score": 96
  }
]
}

```

EX-002 | Blade Lift Cylinder — Active Hydraulic Leak at Rod Seal

MACHINE STATUS: FAIL

SEVERITY: Critical

Image Context

Right-side blade lift cylinder. Oily sheen and droplets visible on the chrome rod surface just above the wiper seal. Hydraulic fluid accumulation on the cylinder body below the seal gland.



Technician Voice Note (raw transcript):

"Okay so the right blade lift cylinder, I can see hydraulic fluid weeping from the rod seal. The rod itself is — there's scoring on it too, like two or three scratches that go longitudinal. That scoring is probably what killed the seal. Active drip, not just residue."



KNOWN FAILURE PATTERN — What bad AI output looks like:

- ✗ Misidentifies component as "Hydraulic Hose" — the source is the rod seal, not a hose.
- ✗ Rates as "Moderate" because it sees only small drops — active rod seal leak with scoring = Critical.
- ✗ Ignores rod scoring entirely, which is the root cause and dictates the repair scope.
- ✗ Recommended action: "Top up hydraulic fluid and monitor" — does not address seal or scored rod.

✓ CORRECT OUTPUT — What the AI should produce:

component: "Blade Lift Cylinder Rod Seal — Right Side"

severity: "Critical"

condition_description: "Active weeping at rod wiper seal. Chrome rod surface exhibits 2–3 longitudinal scoring marks consistent with debris ingestion. Fluid accumulation on lower cylinder body confirms active bypass."

safety_impact_assessment: "Blade drift risk under load. Fire hazard from hydraulic fluid on hot exhaust surfaces."

estimated_timeline: "Replace immediately before next operation"

Correct JSON Output

```
{  
  "inspection_summary": {  
    "asset": "CAT D6N Dozer",  
    "status": "fail",  
    "overall_operational_impact": "Active hydraulic leak at blade lift cylinder. Blade drop risk under load. Do not operate."  
  },  
  "anomalies": [  
    {  
      "component": "Blade Lift Cylinder Rod Seal",  
      "component_location": "Right-side blade lift cylinder, rod seal gland",  
      "issue": "Active rod seal failure with rod scoring",  
      "condition_description": "Active hydraulic fluid weeping at wiper seal. Chrome rod has 2-3 longitudinal scores from debris ingestion, consistent root cause of seal failure. Fluid accumulation confirmed on lower cylinder body.",  
      "severity": "Critical",  
      "safety_impact_assessment": "Blade may drift or drop under load. Hydraulic fluid ejection and fire risk from proximity to exhaust.",  
      "operational_impact": "Loss of blade position control. Hydraulic system pressure loss will worsen under load.",  
      "estimated_timeline": "Replace immediately before next operation",  
      "recommended_action": "Replace rod seal kit. Inspect and re-chrome or replace rod if scoring depth exceeds 0.3mm. Check hydraulic fluid level and contamination before restart.",  
      "part_number": "PT-D6N-HYD-003",  
      "evidence_backed": true,  
      "technician_review_required": false,  
      "confidence_score": 94  
    }  
  ]  
}
```

EX-003 | Operator Access Ladder — Broken Step

MACHINE STATUS: FAIL

SEVERITY: Critical

Image Context

Right-side access ladder. The second step from the bottom shows a clean fracture across the full width of the step plate. One side weld has separated. Ladder handrail is intact.



Technician Voice Note (raw transcript):

"Right side ladder, the second step is broken clean off — well not off, but the weld on the left side has let go and the step is just hanging at an angle. Someone could put their weight on it and go straight down. Handrail looks fine though."



KNOWN FAILURE PATTERN — What bad AI output looks like:

- ✗ This is the exact scenario from FailPrompt1 — AI ignored the access ladder and described cab glass instead.
- ✗ Never outputs "CRITICAL" for a broken structural step — falls are a personnel safety emergency.

- ✗ Describes components not in the image (hydraulic cylinder mounting) — hallucination.
- ✗ Recommended action: "Clean glass panel" — completely unrelated to what is visible.

✓ **CORRECT OUTPUT — What the AI should produce:**

component: "Access Ladder Step — Right Side, Step 2"

severity: "Critical"

Do NOT describe cab glass, hydraulic mounts, or any component not visible in the image.

condition_description must name the fracture, the failed weld, and the angular displacement of the step plate.

safety_impact_assessment must reference fall/injury risk to personnel.

Correct JSON Output

```
{
  "inspection_summary": {
    "asset": "CAT D6N Dozer",
    "status": "fail",
    "overall_operational_impact": "Access ladder structurally unsafe. Personnel must not mount or dismount machine until repaired."
  },
  "anomalies": [
    {
      "component": "Access Ladder Step",
      "component_location": "Right-side access ladder, second step from ground",
      "issue": "Full-width step fracture with weld separation",
      "condition_description": "Step plate shows complete transverse fracture across full width. Left-side weld has separated from stringer. Step is angularly displaced and will not support operator weight.",
      "severity": "Critical",
      "safety_impact_assessment": "Fall from height risk. Step will collapse under operator weight causing potential serious injury.",
      "operational_impact": "Machine cannot be safely boarded or exited. Equipment is out of service until repaired.",
      "estimated_timeline": "Replace immediately before next operation",
      "recommended_action": "Replace step plate and re-weld to both stringers per CAT structural repair spec. Do not allow personnel to climb ladder until repair is certified.",
      "part_number": "PT-D6N-STP-013",
      "evidence_backed": true,
      "technician_review_required": false,
      "confidence_score": 98
    }
  ]
}
```

EX-004 | Right Drive Sprocket — Tooth Wear at 70% Life

MACHINE STATUS: MONITOR	SEVERITY: Moderate
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Image Context	Right-side drive sprocket viewed from rear quarter. Sprocket teeth show hook-shaped wear profile on the drive faces. No cracking. Sprocket is clean enough to
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assess tooth geometry clearly.

💡 **Technician Voice Note (raw transcript):**

"Right sprocket, I'm seeing hook wear on the drive faces — probably, I'd say 70% life gone. Teeth aren't cracked or broken, but the profile has gone from flat to hooked. I'd schedule this in the next 50 hours, wouldn't pull the machine today."



⚠ KNOWN FAILURE PATTERN — What bad AI output looks like:

- ✗ Rates as "Low" because no cracks are visible — hook-form sprocket wear at 70% is Moderate.
- ✗ Says "replace immediately" — technician explicitly assessed 50-hour window, not immediate.
- ✗ Uses vague language: "teeth appear worn" — does not describe the hook profile geometry.
- ✗ Missing operational_impact on track pitch mismatch that accelerates track wear.

✓ **CORRECT OUTPUT — What the AI should produce:**

severity: "Moderate" — no cracks, but hook-form wear drives track pitch mismatch and accelerates bushing wear.
estimated_timeline: "Address within 50 operating hours or 2 weeks" — matches technician assessment.
condition_description must name the hook-form wear profile on drive faces specifically.
operational_impact must note accelerated track bushing wear from pitch mismatch.

Correct JSON Output

```
{
  "inspection_summary": {
    "asset": "CAT D6N Dozer",
    "status": "monitor",
    "overall_operational_impact": "Right sprocket at 70% service life. Operation permitted with scheduled replacement within 50 hours."
  },
  "anomalies": [
    {
      "component": "Drive Sprocket",
      "component_location": "Right-side final drive, sprocket assembly",
      "issue": "Hook-form tooth wear at approximately 70% service life",
      "condition_description": "Drive face geometry has progressed from flat to hook-form profile. Tooth tips show rounding. No cracks or fractures detected. Wear pattern is symmetric, consistent with normal service load.",
      "severity": "Moderate",
      "safety_impact_assessment": "No immediate personnel risk. Continued operation beyond service limit risks track throw.",
      "operational_impact": "Hook-form profile creates pitch mismatch with track bushings, accelerating bushing wear and increasing track throw risk if interval is exceeded.",
      "estimated_timeline": "Address within 50 operating hours or 2 weeks",
      "recommended_action": "Schedule sprocket replacement at next planned service window. Re-measure tooth profile at 25-hour interval to confirm wear rate.",
      "part_number": "PT-D6N-SPR-007",
      "evidence_backed": true,
      "technician_review_required": false,
      "confidence_score": 88
    }
  ]
}
```

EX-005 | Engine Cooling Hose — Surface Cracking at Clamp Zone

MACHINE STATUS: MONITOR

SEVERITY: Moderate

Image Context

Upper radiator hose visible, showing surface craze-cracking near the engine-side hose clamp. Clamp is seated and tight. No active coolant leakage visible. Hose is not bulging or collapsed.



Technician Voice Note (raw transcript):

"Upper radiator hose — I can see crazing on the rubber near the clamp on the engine side. No active leak that I can see, hose isn't bulging, clamp looks tight. But the surface cracking is there, it'll go eventually. I'd get this done in the next 50 hours."



KNOWN FAILURE PATTERN — What bad AI output looks like:

- ✗ This is the FailPrompt2 scenario — AI rated actual hose cracking as "Low" and added a fictitious "Limited Reservoir Visibility" anomaly not present in the image.
- ✗ Used wrong schema: "anomalies_detected", "anomaly", "risk_level" — must match the exact target schema.
- ✗ Said coolant reservoir not visible — reservoir was not in the image, AI hallucinated this finding.
- ✗ Recommended action was vague: "inspect and replace if necessary" — must give specific timeline.



CORRECT OUTPUT — What the AI should produce:

severity: "Moderate" — surface crazing without active leak is Moderate, not Low.

Only describe what is actually visible: the hose and clamp. Do NOT mention the coolant reservoir if it is not in frame.

Schema fields must match exactly: component, condition_description, severity, estimated_timeline, etc.

estimated_timeline: "Address within 50 operating hours or 2 weeks"

Correct JSON Output

```
{  
  "inspection_summary": {  
    "asset": "CAT D6N Dozer",  
    "status": "monitor",  
    "overall_operational_impact": "Cooling hose showing age-related surface degradation.  
Schedule replacement before hose failure causes engine overtemperature event."  
  },  
  "anomalies": [  
    {  
      "component": "Upper Radiator Hose",  
      "component_location": "Engine-side clamp zone, upper radiator hose",  
      "issue": "Surface craze-cracking at hose clamp interface",  
      "condition_description": "Rubber outer layer shows craze-cracking pattern in the  
compression zone adjacent to engine-side clamp. No active leakage. Hose is not bulging or  
collapsed. Clamp is properly seated and torqued.",  
      "severity": "Moderate",  
    }  
  ]  
}
```

```

        "safety_impact_assessment": "No immediate personnel risk. Hose failure would result
        in coolant loss and engine overtemperature, potentially stranding machine.",
        "operational_impact": "Continued operation risks hose rupture, sudden coolant loss,
        and engine shutdown from overtemperature.",
        "estimated_timeline": "Address within 50 operating hours or 2 weeks",
        "recommended_action": "Replace upper radiator hose and inspect clamp for corrosion.
Check lower hose condition during same service event.",
        "part_number": "PT-D6N-CLH-011",
        "evidence_backed": true,
        "technician_review_required": false,
        "confidence_score": 85
    }
]
}

```

EX-006 | Bottom Rollers — Normal Wear, No Anomalies

MACHINE STATUS: PASS	SEVERITY: Normal
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Image Context	Forward section of left-side undercarriage showing three bottom rollers. Roller flanges are intact. No visible fluid weeping from end caps. Roller shells show even wear with no flat spots or gouging.
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Technician Voice Note (raw transcript):

"Looking at the left track rollers at the front — three of them in view. Flanges look good, no leaking end caps, wear looks even across all three. Nothing to report here."



KNOWN FAILURE PATTERN — What bad AI output looks like:

- ✗ AI invents a "Minor oil seepage" anomaly when none is visible — false positive that wastes maintenance resources.
- ✗ Rates rollers as "Low" severity pre-emptively "in case" — if nothing is wrong, output normal status.
- ✗ Adds a "monitor at next service" note with no basis — do not add anomalies that are not observed.
- ✗ Does not confirm what normal condition actually looks like — a PASS entry is training data too.

✓ CORRECT OUTPUT — What the AI should produce:

status: "pass" — no anomalies means no anomalies array entries.

The findings for a passing component confirm the normal condition positively, not vaguely.

Do not add speculative Low-severity anomalies on healthy components.

overall_operational_impact should confirm no restrictions.

Correct JSON Output

```
{
  "inspection_summary": {
    "asset": "CAT D6N Dozer",
    "status": "pass"
  }
}
```

```
        "status": "pass",
        "overall_operational_impact": "No anomalies detected. Undercarriage rollers in normal
operating condition. No restrictions."
    },
    "anomalies": []
}
```

EX-007 | Left Final Drive — Active Oil Leak at Cover Gasket

MACHINE STATUS: FAIL

SEVERITY: Critical

Image Context

Left-side final drive cover. Dark oil film covering the lower half of the cover face. Fresh oil drip trail on the machine frame below. Bolts appear present but cover shows uneven seating on the lower edge.



Technician Voice Note (raw transcript):

"Left final drive cover is weeping — well more than weeping, there's an active trail running down the frame. Cover looks like it's not seated right on the bottom, maybe a warped gasket or a missing bolt. I count the bolts and — yeah there's one missing on the lower left. That's Critical, final drive runs dry you're looking at a total rebuild."



KNOWN FAILURE PATTERN — What bad AI output looks like:

- ✗ Rates as "Moderate" because "machine is still driveable" — missing bolt on a final drive cover is Critical.
- ✗ Does not enumerate the missing bolt as a separate finding — it is the root cause of the leak.
- ✗ Calls it a "Final Drive Seal" leak when the technician identified a cover bolt as missing and cover misalignment.
- ✗ Timeline: "schedule within a week" — an actively leaking final drive risks catastrophic gearbox failure.

✓ CORRECT OUTPUT — What the AI should produce:

Two anomaly objects required: (1) missing bolt, (2) active oil leak as downstream consequence.
severity: "Critical" for both — final drive running low on oil risks total gearbox destruction.
estimated_timeline: "Replace immediately before next operation" for both findings.
Root cause (missing bolt) must be listed first in the anomalies array.

Correct JSON Output

```
{
    "inspection_summary": {
        "asset": "CAT D6N Dozer",
        "status": "fail",
        "overall_operational_impact": "Left final drive cover unseated due to missing bolt.
Active oil loss. Risk of total gearbox destruction if operated."
    },
    "anomalies": [
        {
            "component": "Final Drive Cover",
            "severity": "Critical"
        }
    ]
}
```

```

    "component_location": "Left-side final drive, cover plate lower-left bolt position",
    "issue": "Missing cover bolt – final drive cover unseated",
    "condition_description": "One bolt absent from lower-left position of final drive cover. Cover shows visible gap and angular misalignment on lower edge consistent with loss of clamping load at that point.",
    "severity": "Critical",
    "safety_impact_assessment": "Cover may displace under vibration. Final drive oil loss risks bearing and gear destruction.",
    "operational_impact": "Active oil loss will deplete final drive lubricant. Continued operation risks catastrophic gearbox failure and loss of drive.",
    "estimated_timeline": "Replace immediately before next operation",
    "recommended_action": "Install correct-spec bolt and torque to CAT spec. Inspect gasket face for warping before reseating. Check final drive oil level before restart.",
    "part_number": "PT-D6N-FDR-005",
    "evidence_backed": true,
    "technician_review_required": false,
    "confidence_score": 95
},
{
    "component": "Final Drive Cover Gasket",
    "component_location": "Left-side final drive, cover gasket – lower edge",
    "issue": "Active oil leak from unseated cover",
    "condition_description": "Oil film covering lower half of cover face. Fresh oil drip trail on machine frame below cover. Leak is active, not residual.",
    "severity": "Critical",
    "safety_impact_assessment": "Oil on ground and frame creates slip hazard and fire risk near exhaust.",
    "operational_impact": "Oil loss rate will accelerate under operating load and heat.",
    "estimated_timeline": "Replace immediately before next operation",
    "recommended_action": "Replace gasket on reassembly. Clean oil from frame and ground. Dispose of contaminated materials per site environmental procedure.",
    "part_number": "PT-D6N-FDR-005",
    "evidence_backed": true,
    "technician_review_required": false,
    "confidence_score": 93
}
]
}

```

EX-008 | Voice Note Only — No Image Provided (Idler Seal)

MACHINE STATUS: MONITOR

SEVERITY: Moderate

Image Context

NO IMAGE PROVIDED. Audio only.



Technician Voice Note (raw transcript):

"Uh, checking the front idler on the right side — I can't get a good angle on it from here but I can hear it squealing when the track moves. There's also what looks like oil residue on the inside of the track, which usually means the idler end seal is going. I can't see the seal directly. I'd say it needs pulling and inspecting."



KNOWN FAILURE PATTERN — What bad AI output looks like:

- ✗ Sets evidence_backed: true when the technician explicitly said they cannot see the seal — audio only.
- ✗ Sets severity to "Critical" based on guesswork — no visual confirmation means this is Moderate at most.
- ✗ Treats the transcript as visual evidence — "oil residue on inside of track" is reported by tech, not seen by AI.

✓ CORRECT OUTPUT — What the AI should produce:

```
evidence_backed: false — no image was provided, finding is from voice note only.  
technician_review_required: true — technician stated they could not see the seal directly.  
severity: "Moderate" — audible squeal and reported residue without visual confirmation.  
condition_description must reflect that this is a technician report, not a visual observation.
```

Correct JSON Output

```
{  
    "inspection_summary": {  
        "asset": "CAT D6N Dozer",  
        "status": "monitor",  
        "overall_operational_impact": "Suspected right front idler seal failure based on  
technician audio report. Visual inspection required before confirming severity."  
    },  
    "anomalies": [  
        {  
            "component": "Front Idler End Seal",  
            "component_location": "Right-side front idler",  
            "issue": "Suspected idler end seal failure – audio and residue report only",  
            "condition_description": "Technician reports audible squealing from right front  
idler during track movement and oil residue on track interior surface. Direct visual of  
the seal was not possible from inspection position. No image captured.",  
            "severity": "Moderate",  
            "safety_impact_assessment": "No immediate personnel risk. Seal failure will  
progress to idler bearing damage if unaddressed.",  
            "operational_impact": "Idler bearing lubrication loss will cause premature bearing  
failure and possible idler seizure.",  
            "estimated_timeline": "Address within 50 operating hours or 2 weeks",  
            "recommended_action": "Remove track guard and visually inspect idler end seal. If  
leak confirmed, replace seal group. Check idler bearing play.",  
            "part_number": "PT-D6N-IDL-008",  
            "evidence_backed": false,  
            "technician_review_required": true,  
            "confidence_score": 62  
        }  
    ]  
}
```