Inspections of Aerial Equipment

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Inspections of aerial equipment are a requirement as set forth by the American Nations Standards Institute (ANSI). Owners of aerial equipment need to make themselves familiar with the standards that apply to their particular make and model of equipment.

The purpose of this paper is to generate a basic understanding of inspection procedures for aerial equipment and to help owners and users develop inspection procedures that will ensure the safety of personnel charged with handling equipment.

OPERATION SYSTEMS AND COMPONENTS

Operating systems allow the aerial equipment to be positioned at work locations not normally accessible by means of ladders or scaffolding. To fully appreciate the importance of a sound inspection program for aerial equipment it helps to understand how aerial equipment works. The normal system configuration of an aerial device includes

- Chassis,
- Stabilizers,
- Counterweight,
- Boom(s),
- Turntable(s),
- Platform,
- Hydraulic system,
- Limit system,
- Remote control system, and
- Safety shutdown system.

Chassis

The chassis is used for transportation of the unit to the desired work location.

Stabilizers

Stabilizers differ in design and location. On some overhead aerial equipment, outriggers are used to prevent the equipment from becoming unstable during operation. Axle locks (spring locks) are used in some applications to prevent instability. Most stabilizer systems are engaged using a hydraulic valve. However, there are some stabilizers that are moved manually.

Counterweight

Installing a counterweight to aerial equipment is another means of stabilizing the unit. The location of the counterweight is dictated by the weight and configuration of the boom(s).

Boom(s)

Booms are an important feature of aerial equipment. The boom(s) are generally operated by hydraulic cylinders located at the pivot areas of the device. On units designed for high-voltage power line maintenance, a portion of the boom(s) will be made with fiberglass. When certain manufacturing processes are applied, fiberglass will take on an insulating quality, termed *dielectric* within the industry.

Turntable(s)

Most aerial devices have at least one turntable, which is usually operated by a hydraulic orbit motor mounted on a gearbox.

Platform

The platform is generally mounted on the outermost portion of the boom system. Personnel operate the boom(s) by means of electrical controls such as joysticks or valve handles mounted on the platform. Platforms are usually made of fiberglass or aluminum. A manufacturer's decal located on the platform notes the maximum rated platform capacity that should not be exceeded.

Hydraulic System

The hydraulic system usually consists of a hydraulic pump, which is mounted to a power take off system on the truck transmission or directly coupled to a drive shaft connected to the truck engine. In some cases, a hydraulic pump is directly coupled to an auxiliary engine. There are several variations on this system, to provide fluid hydraulic pressure for the operation of the booms. The main valve is generally located at the base control station, usually at or near the main turntable. This valve controls the hydraulic pressure and flow to the hydraulic cylinders and orbit motors, which move the boom(s) and turntable(s). The main hydraulic valve is usually considered to be the primary control point. Another feature of the hydraulic system is the override device, which allows operation of the boom(s) should the electrical system fail. Aerial equipment that allows the booms to travel overhead may incorporate a manual let down system (valve), which allows the booms to be lowered if the hydraulic system fails.

Limit System

Stability of some aerial equipment is controlled through a combination of electrical limit switches and the hydraulic system. If the booms are being moved near a position that could create an unstable condition, a limit switch is tripped and the hydraulic flow is shut

off for that function and the booms cannot be moved into a position that would allow the equipment to become unstable. In most cases, operation of the unit can continue if the function that was being operated when the unit shut down is reversed.

Remote Control System

The remote control system is located at the platform and is one of two varieties:

Electrical

Electrical control handles (some times called joysticks) may be used to control the functions of the unit from the platform. The sticks transmit an electrical signal to electrical solenoids mounted on the main control valve. These control sticks are usually proportional and allow the operator to vary the amount of deflection applied to the control handle in order to control boom movement speed.

Another version of this system is the use of toggle switches. Toggle switches are not proportional; however, some valve manufacturers have designed valves to work with toggle switches. These valves meter the hydraulic flow and are sometimes referred to as soft-touch valves.

Hydraulic

On some aerial equipment, a hydraulic valve with handles may be mounted on the platform to provide operational control of the boom(s). This type of system is commonly referred to as a full hydraulic system.

Safety Shutdown System

Safety shutdown systems are a very important feature of modern aerial equipment. Shutdown switches are usually located inside of the truck cab, main control valve, and platform. Location of these switches depends on what type of work the equipment is performing. For instance, in a mobile operation such as inspection of bridges, the booms may be deployed and the driver of the truck may not be able to see the entire length of the booms. The platform operator may shut down the truck to prevent the booms from hitting a portion of the bridge structure.

TYPES OF INSPECTIONS

There are four generally accepted types of inspections that are performed on aerial equipment:

- Daily Inspections,
- Vehicle Inspections,
- Frequent Inspections, and
- Annual Inspections.

Daily Inspections

The daily inspection is normally performed by the driver or the operator (or sometimes both) of the equipment. Before use each day or at the beginning of each shift, the mobile unit shall be given a visual inspection and functional test. A daily inspection checklist must be followed when performing this inspection. The manufacturer of the aerial device is required to provide the owner/user with a daily inspection checklist. While use of the checklist is required, keeping a record of the daily inspection may not be required. It is important to check with local government agencies to determine what standards apply to your equipment.

Vehicle Inspections

Most aerial equipment is mounted on a truck chassis. There are specific regulations that apply to trucks and truck inspections. It is important to have the truck inspected in accordance with these regulations.

Frequent Inspections

Frequent inspections and tests shall be conducted on a mobile unit

- When it has been in service for three months or up to 200 hours, whichever comes first.
- Prior to operation after the unit has been out of service for a period longer than three months.

The frequent inspection shall be made by a person qualified as a mechanic on the specific make and model of unit. The inspection shall include all items specified by the manufacturer for a frequent inspection. The mechanic must follow a frequent inspection checklist when performing this inspection. Written records of frequent inspections shall be retained for a minimum of three years. Records shall include the date of the inspection, the name and signature of the person(s) accomplishing the inspection, description of any deficiencies found, and corrective action accomplished, including the date and the identity and signature(s) of the person(s) performing any required repairs.

Annual Inspections

Twelve (12) months from the date of the prior annual inspection—or not to exceed 1,000 hours of operation beyond the prior annual inspection, whichever occurs first—an annual inspection shall be performed. Inspections shall be performed by one or more person(s) qualified as a mechanic on this specific make and model of unit. The inspection shall include all items specified by the manufacturer for the annual inspection. Prior to the operation, all malfunctions and problems identified shall be corrected and further inspection, if necessary, shall be accomplished. A written record of the annual inspection shall be retained for as long as the unit is owned (lifetime). The record shall include the name and signature of the person(s) accomplishing the inspection, a description of any

deficiencies found, and any corrective action accomplished, including the date and the identity and signature of the person(s) performing any required repairs.

QUALIFICATION OF ANNUAL INSPECTION PROVIDER: IMPORTANT CONSIDERATIONS

Goal of Inspection

If the right inspection firm is employed and a complete inspection performed, and the inspection report is concise, the report will be an important tool in properly maintaining the aerial equipment. Remember that the safety of the people who operate the equipment is the most important aspect of the inspection.

Qualification of Inspectors

Has the inspector been trained on your make and model of aerial equipment? Will the inspector know how the safety system is designed to operate?

Resources

Will the inspector have the resources necessary in order to properly rate the serviceability of your aerial equipment? Access to design information such as electrical and hydraulic schematics is important.

Operational Testing

Many testing firms can perform a structural inspection; however, their personnel may not understand how to operate the equipment and may not be capable of diagnosing operational problems.

Summary

The safety of the personnel who operate aerial equipment depends on proper safety inspections. Thorough inspections have important side benefits: they protect our investment.

Daily Inspection Form

The following pages contain a daily inspection checklist for Aspen Aerials or Reach All Underbridge Units.

ASPEN AERIALS OR REACH ALL UNDERBRIDGE UNIT
DAILY INSPECTION FORM

INSPECTION DATE:

INSPECTION PERFORMED BY:

COMMENTS:

MAIN ENGINE COMPARTMENT:	**OK**	**COMMENT**
Engine oil:		
Coolant:		
Washer fluid:		
Power Steering fluid:		
Transmission fluid:		
PTO and hydraulic pump:		
Drive belts:		

CAB INSPECTION:	**OK**	**COMMENT**
Hour meter/odometer reading:		
Decals:		
Air pressure:		
Oil pressure:		
12-volt charging system:		
Braking system:		
Unit power light and switch:		
PTO indicator light and system:		
Two speed system:		
Axle lock lights:		
Strobe lights:		
Start/stop system (transmission in neutral):		
Tag axle system and pressure (if installed):		
Intercom system:		
Lights: 4 ways, head, turn, tail:		
Fuel level:		

- Start the truck engine, engage the PTO, set the engine to the correct rpm setting, and turn on all systems for the walk around inspection.
- Make sure the parking brake is engaged.

***WALKAROUND INSPECTION* (proceed around the unit in a clockwise direction):**	**OK**	**COMMENT**
Lights: 4 ways, head, turn, tail:		
Strobes, beacons, or sign board:		
Transmission and axles:		
Tires: front and rear:		
Axle locks (front/rear):		
Axle lock switches (front/rear):		
Hydraulic pump and hoses:		
Electrical switches and cables:		
Air hoses, outlets:		
Body boxes:		
Ladders and rails:		
Chassis suspension (front/rear):		
Counterweights and switches:		

AIR COMPRESSOR:	**OK**	**COMMENT**
Operational test:		
Air system hoses and valves:		
Electrical switches and cables:		
Gauges:		

GENERATOR:	**OK**	**COMMENT**
Operational test:		
Electrical wires and connections:		
Circuit breakers and outlets:		
Instrument panel and meters:		

HYDRAULIC TANK AND OIL COOLER:	**OK**	**COMMENT**
Oil level and gauge:		
Filter and gauge:		
Structure:		
Hydraulic hoses:		
Electrical switches and cables:		

AUXILIARY ENGINE:	**OK**	**COMMENT**	**Hour meter:**
Fuel filter, oil level, and oil press:			
Coolant:			
Switches, wires, connections:			
Hydraulic pump and hoses:			

- Preheat and start auxiliary engine. Listen for unusual noises, and check engine oil pressure, charging rate.
- Shut down auxiliary engine: auxiliary engine will be started again during the operations check.

COMPONENT CHECKLIST:

***See component checklist explanations:**	T-1	B-1	T-2	B-2	B-3	CATRAC B-3 TELE	B-4	PLATFORM
Cylinder								
Cylinder anchor								
Structure								
Hydraulic lines and fittings								
Electrical cables								
Pivot pin								
Rotations: gear, bearing, gearbox, brake, motor								
Limit switches								
Pressure filter								
Hydraulic valves; Unit, axle lock, dump								
Leveling rods								
Boom/platform rests								
Boom/platform tie-down								
Decals								
Platform heaters								
Outlets: 12 volt, 110 volt								
Air hose outlet								
Platform controls								
Leveling system								

(Shaded boxes do not apply to that area of the unit.)

COMPONENT CHECK LIST EXPLANATIONS:	
COMPONENT:	**WHAT TO LOOK FOR:**
Cylinder	leaks, scoring, rust pitting, cracks at pivot points
Cylinder anchor	visible cracks or damage, rusting
Structure	visible cracks or damage, rusting
Hydraulic lines and fittings	oil leaks, chafing, kinks, abrasions
Electrical cables	loose or broken wires and connections, chafing, abrasions
Pivot pin	visible cracks or damage, rusting
Rotation: gear, bearing, gearbox, brake, motor (T-1 and T-2)	wear, damage, oil leaks, broken bolts
Limit switches	bent switch arms, loose wire connections, LED functions
Pressure filter	oil leaks; check indicator gauge
Hydraulic valves; unit, axle lock, dump	free movement of the handles, return to neutral position when released; oil leaks; wiring connections secure
Leveling rods	cracks at pivot points, damage to rods
Boom and platform rests	nylon wear pad secure, cracks, damage to structure
Boom tie-down device	damage to nylon strap or ratchet
Decals	unreadable, missing or damaged decals
Platform heaters	broken switches or wires, secured to platform
Outlets: 12 volt, 110 volt	damaged or broken wires, secured to platform, broken covers
Air hose outlet	damage to hoses, coupling, regulator, and gauge
Platform controls	proper operation of all functions, damage to components
Leveling system	hydraulic line; wire or switch; secured to the platform

OPERATIONS CHECK AND HOLDING VALVE TEST:

The truck should still be running with the PTO engaged.

1. Remove the boom/platform tie-down device(s).
2. Engage axle locks and counterweight (*red* axle lock engaged indicator light).
3. Place the unit/axle lock selector valve in the "UNIT" position (PULL OUT).
4. Close B-2 and B-3. If you don't close B-2 and B-3, these booms may open when you raise B-1.
5. Raise B-1, *one foot* above the boom rests.
6. Lower the platform rests to the deck.
7. Lower B-4 approximately 45 degrees (if installed).
8. Place the unit/axle lock selector valve in the "AXLE LOCK" position (PUSH IN).
9. Now, perform the holding valve test. Watch for drift.
   - Operate B-1 to the "DOWN" position for 5 seconds.*
   - Operate B-2 to the "OPEN" position for 5 seconds.*
   - Operate B-3 to the "OPEN" position for 5 seconds.*
   - Operate B-4 to the "DOWN" position for 5 seconds.*
10. Test the hydraulic air compressor and generator (shut them down when test completed).
11. Test the T-1 intercom.
12. Raise the platform rests and lock them into place.
13. Test the truck engine start/stop system at the platform (red button). Leave truck engine off.
14. Test the platform intercom.
15. Start the auxiliary engine.
16. Use the auxiliary engine to stow the unit; this will test the auxiliary engine.
17. Place the unit/axle lock selector valve in the "UNIT" position (PULL OUT).
18. Raise B-4 (if installed).
19. Lower B-1 tightly into the rests (about 900 psi on the hydraulic gauge at T-1).
20. Place the unit/axle lock selector valve in the "AXLE LOCK" position (PUSH IN).
21. Disengage the axle locks and counterweight (*green* axle lock disengaged indicator light).
22. Install the boom / platform tie-down device.
23. Shut down the auxiliary engine.

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* If any one of the booms moves (drifts) during the holding valve test, perform the test again in order to verify which boom is drifting. The problem holding valve(s) must be replaced before the unit is put into service.