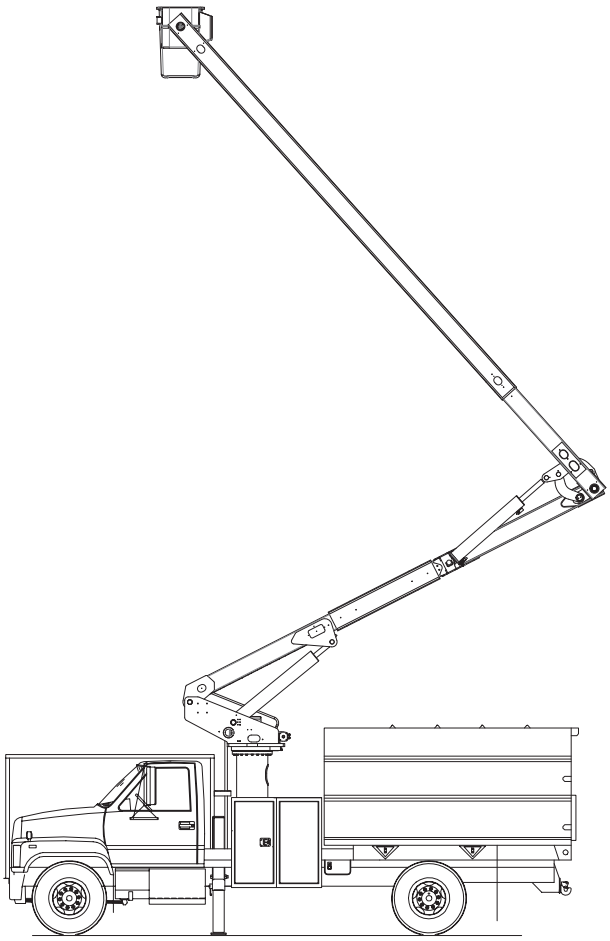
TEREX

HI–RANGER
XT PRO SERIES

MAINTENANCE MANUAL

This Maintenance Manual MUST BE READ prior to adjusting and repairing your XT PRO SERIES Overcenter Articulating Aerial Device.



PRINTED IN THE USA
Original Instructions in English

Terex South Dakota, Inc. **611447 05/2016**

Terex South Dakota, Inc.
500 Oakwood Road
Watertown, SD 57201

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QUICK REFERENCE

LUBRICANTS

Hydraulic system

-20–120 F (-29-49 C) ambient	ISO 15 Premium hydraulic oil
Leveling chain	SAE 30W Non-Detergent
Rotation speed reducer, worm	Mobilux EP023 or equivalent
Ring gear, pinion, bearings, and pivots	EP #2 Grease

MEASUREMENTS

Leveling chain stretch limit, length of 10 links

80N	10.15 in. (257.81 mm) maximum
Turntable deflection from centerline	0.160 at 14 in. (355.6 mm)
Turntable gear backlash	0.004– 0.007 in. (0.10-0.18 mm)

PRESSURES/FLOWS

Flow at idle	5 GPM (19 LPM)
Hydraulic tool pressure	2250 +/- 25 PSI @ 5 GPM
	(15.51 +/- .17 MPa) @ (19 LPM)
Rotation port relief	2000 +/- 50 PSI (13.79 +/- .34 MPa)
System pressure	2750 +/- 50 PSI @ 8 GPM
	(18.96 +/- .34 MPa) @ (30 LPM)

HOLDING VALVE SETTINGS

Elbow cylinder	3600 PSI (24.82 MPa)
Lift cylinder	3600 PSI (24.82 MPa)

BOOM SPEEDS

Lower boom

Down, 90–0º	33–48 seconds
Up, 0–90º	40–58 seconds
Rotation, 360º	55–75 seconds

Upper boom

Fold, 180–0º	32–45 seconds
Unfold, 0–180º	27–38 seconds

TORQUES

Control valve tie rods	15 ft. lbs. (20 N-m) dry
Elbow cylinder rod end pin fasteners	80 ft. lbs. (108 N-m) w/red loctite
Elbow linkage pin retainers (1/2”)	80 ft. lbs. (108 N-m) w/red loctite
Elbow linkage pin retainers (3/8”)	35 ft. lbs (47 N-m) w/red loctite
Elbow cylinder piston nut	1800 ft. lbs. (2441 N-m) w/oil
Leveling sprockets at elbow shaft	35 ft. lbs. (47 N-m) w/red loctite
Leveling rod	17-20 lbs. (76-89 N) of downward force
Lift cylinder piston nut	2900 ft. lbs. (3932 N-m) w/oil
Lower boom insert	110 ft. lbs. (149 N-m) w/oil

Outrigger cylinder piston nuts	350 ft. lbs. (475 N-m) w/oil
Rotation speed reducer bolts	170 ft. lbs. (231 N-m) w/Bowman anti-seize
Rotation speed reducer motor bolts	55 ft. lbs. (75 N-m) w/Red Loctite
Pedestal tie down bolts (7/8NC)	300 ft.lbs (407 N-m) w/oil
Platform to bracket bolts	25 ft. lbs. (34 N-m) dry
Turntable bearing bolts 56’-60’	180 ft. lbs. (244 N-m) w/Bowman anti-seize
Upper boom fiberglass joint	110 ft. lbs. (149 N-m) w/oil
Basket Shaft Sprocket Set Screw	11 ft. lbs (15 N-m) w/Red Loctite
Basket Bolts	25 ft. lbs. (34 N-m)

FORMS

The following pages have general forms that you may use for your inspection process. Depending on your specific needs you may need to add inspection items to the list. The Dielectric test forms include Periodic test forms and Qualification test forms.

ANSI A92.2 requires a written record of inspections and repairs following accidents, overload incidents, and Periodic Inspections. Frequent inspections do not need to be recorded but if a safety hazard is found it must be reported in writing as well as the corrective action. ANSI requires reports and records are maintained for 5 years or by applicable regulations, but it is recommended to keep them for the life of the machine.

Aerial Annual Inspection

In Accordance with ANSI A92.2

Immediate Repair Required (____Yes, ____No)

Owner/User is responsible to have repairs performed before use.

All other items marked can be addressed at the next maintenance interval

***Shop Order*_____ *Test Date* _____**

***Customer*_____**

***Location* _____**

***Inspector*_____ *Inspector Number* _____**

Chassis and Unit Information

***Chassis Year* _____ *Chassis Model* _____**
***VIN Number* _____**
***License* _____**
***Odometer* _____ *Eng. HR/Meter* _____**
***Unit Manufacturer* _____**
***Model Number* _____**
***Serial Number* _____**
***Unit Number* _____ *PTO HR/Meter* _____**

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Aerial Annual Inspection ***Unit Number*_____**

Symbols: ✓ = OK N/A = Not Applicable A = Adjusted/Repaired

X = See corresponding number on summary page

A. Chassis / Body	***Status***
1. Cab Controls	
Master Switch Panel	
Strobe Lights / Beacons	
PTO Shift Control (cable, air, electric)	
PTO Indicator Light	
PTO Warning Label Present	
Stowed Height Placard	
Start / Stop, Throttle Controls	
Auxiliary Brake Control	
Back Up Alarm	
Operators Manual With Truck	
2. Body / Flatbed	
Headlights, Stop, Tail, Turn, Hazard	
Fire Extinguisher	
Wheel Chocks	
Outrigger Pads	
Unit Grounding Equipment	
Cab Guard / Headache Rack	
Steps / Accessability	
All Safety Decals - Legible and Proper Location	
B. Aerial Unit	
1. Basic Hydraulics	
Reservoir - Oil Amount and Condition	
Filters, Breather Cap	
Gate Valves, Hoses, and Fittings	
2. PTO / Pump	
PTO / Pump Mounting	
PTO / Pump Noises and Leaks	
PTO / Pump Hoses and Fittings	

3. Outrigger / Torsion Bar System	***Status***
Welds, Metal Structure, and Mounting	
Anchor Bolts	
Hydraulic Cylinders - Leaks	
Cylinder Pins and Keepers	
Foot Assembly and Pins	
Holding Valves / Locks (Drift Test)	
Cylinder Lock - Out Valves	
Torsion Bar Structure	
Torsion Bar Bushings	
Hose Condition, Routing Under Chassis	
Control Valves	
Boom Interlock System-Jan. 2005 On	
Outrigger Motion Alarm-Feb. 2000 On	
Relief Valve Setting	
Auxiliary Let Down System	
Chassis Level Indicator-Jan. 2003 On	
Chassis Tire Pressures	
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Welds - Metal Structure and Mounting	
Elevator - Welds and Metal Structure	
Elevator Cylinders and Holding Valves	
Elevator Pins, Bushings, and Keepers	
Collector Block / Hoses / Fittings	
Rotation Bearing and Fasteners	
Rotation Gearbox	
Lower Control Valve / Shut-off Valve	
Relief Valve Setting	
Auxiliary Let Down System	
Accumulator Operation	
Nitrogen Setting / Charge	
Unloading Valve / Unit Cycling	
5. Booms and Platform	
All Fiberglass for Damage and Finish	
Booms - Cleanliness Inside and Out	
Boom Metal Sections	

Inspector Initials_____

Aerial Annual Inspection *Unit Number*_____

Symbols: ✓ = OK N/A = Not Applicable A = Adjusted/Repaired

X = See corresponding number on summary page

Booms and Platform (cont.)	***Status***
Hoses and Hose Protection	
Boom Pins, Bushings, and Nuts	
Boom Cylinders	
Boom Lift Rod and Lift Cable	
Compensation System	
Boom Cylinder Holding Valves	
Boom Rest and Hold Down System	
Platform - Mounting, Liner, and Cover	
Lanyard Anchor - Belt or Fixed	
Safety Harness and Lanyard	
Non - Skid Platform Step	
6. Platform Controls	
Control and Safety Decals / Placards	
All Upper Control Operations	
Start / Stop and/or Throttle Control	
Auxiliary Let Down System	
Hydraulic Tool Valve / GFI Outlet	
Control Guards / Covers	
Winch Gearbox	
Winch Rope and Safety Hook	
Jib and Jib Tilt Cylinder	
Load Chart, Boom Angle Indicator	
Control Valve - Leaks	
Control Valve - Vacuum Vent Valves	
Platform Rotator, Level, or Dump	
7. Platform Leveling System	
Leveling Cables and Chains	
Cable Pulleys and Chain Sprockets	
Cable Sheaves and Clamps	
Anchor Brackets	
Turnbuckles and Tie Wire or Lock Nut	
Hinge Points	
Leveling Cylinders and Shocks	
Cylinder Holding Valves	
Leveling Hoses	
Platform Drift	

8. Extension System	***Status***
Catrac, Hoses, and Wire Harness	
Hose / Wire Routing, and Protection	
All Wear Pads and Rollers	
All Cable Sheaves and Pulleys	
All Extension Cylinders	
All Pins and Retainers	
Cylinder Holding Valves	
All Limit Switches	
C. General	
1. General Lubrication	
Gearboxes - Pinion Gears, Oil Level	
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Rotation Bearing	
Control Linkages	
Cables Shaeves and Pulleys	
Hinge Points	
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Capstan	
Auxiliary Winch	
Pony Motor Hydraulics	
Chipper Body Dump	
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Hydraulic Tools	
3. Misc. Powered Equipment	
Generator - Condition	
Battery - Condition	
Hose and/or Wire Condition	

Inspector Initials_____

TEREX

Model / Serial# _____ **Summary Page** *Unit Number*_____

Number	*R/C/I*	*Description*

Legend:

(R) Repair required, Inspection Decal will be placed on the unit and marked as Immediate Repairs Required. Once repairs have been completed, the Owner/User shall date and sign the Decal before returning to service.

(C) Check and repair as necessary on scheduled routine maintenance. Inspection decal will be placed on the unit.

(I) For Information only, no corrective action required at this time. Inspection decal will be placed on the unit.

Note:

- **Owner/User is responsible to have repairs performed before use.**
- **Manufacturer's recommendations as to frequent and/or periodic inspection and maintenance schedules must be followed for safe operation of this unit.**
- **Immediate Repairs Required (_____Yes_____No)**
- **Customer declined torque check of critical fasteners (_____Yes_____No). If checked, work order #_____**
- **Do not consider this a pre-purchase inspection**

Customer Signature_____ **Print Name** _____

Inspector Signature _____**Date**_____

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TEREX

Aerial Platform Frequent Inspection/Maintenance

In Accordance with ANSI A92.2

Immediate Repair Required (____Yes, ____No)

Owner/User is responsible to have repairs performed before use.

All other items marked can be addressed at the next maintenance interval

Shop Order _____ ***Test Date*** _____

Customer _____

Location _____

Inspector _____ ***Inspector Number*** _____

Chassis and Unit Information

Chassis Year _____ ***Chassis Model*** _____

VIN Number _____

License _____

Odometer _____ ***Eng. HR/Meter*** _____

Unit Manufacturer _____

Model Number _____

Serial Number _____

Unit Number _____ ***PTO HR/Meter*** _____

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Aerial Frequent Inspection / Maintenance ***Unit Number_____***

Symbols: ✓ = OK N/A = Not Applicable A = Adjusted/Repaired

X = See corresponding number on summary page

A. Daily Inspection	***Status***
Check controls at platform and lower controls for proper operation	
Inspect fall protection equipment and attachments	
Inspect visual and audible devices	
Check condition, cleanliness, and dryness of fiberglass components	
Visually check for missing, damaged, or loose covers and guards	
Check for missing and illegible warning, operational, or instructional markings	
Visually check oil level in hydraulic reservoir	
Visually inspect for leaks in the hydraulic system	
Visually check all cylinders for leaks.	
Visually inspect leveling system (Chains and Insulator Assemblies)	
Visually inspect all fasteners for tightness.	
Visual inspection of all structural members for cracks and permanent deformation	
Check for rotational obstructions	
Visual inspection of all electrical wires	
Operational test of all boom functions	
Inspect winch line, hook, and slings	
Inspect / perform additional items as indicated in unit maintenance manual. Record on page 2	
B. 90 Day Inspection / Maintenance	
Replace return filter as specified	
Check tension on leveling system (if applicable)	
Visually inspect all sprockets, chains, pulleys, pins and retainers	
Lubricate all points per lubrication chart recommendations	
Apply lubricant to rotation gearbox pinion and turntable bearing	
Repair or replace items to be found worn or damaged	
Perform daily inspections	
Inspect / perform additional items as indicated in unit maintenance manual. Record on page 2	
C. 180 Day Inspection / Maintenance	
Inspect exposed hoses	
Clean hydraulic tank breather	
Check torque of rotation bearing bolts; turntable to bearing, and bearing to pedestal	
Perform Daily and 90 Day Inspection / Maintenance	
Inspect / perform additional items as indicated in unit maintenance manual. Record on page 2	

Inspector Initials_____ -2- TUFM 1069 Rev C, 9-2-14

Aerial Frequent Inspection / Maintenance ***Unit Number***_____

Symbols: ✓ = OK N/A = Not Applicable A = Adjusted/Repaired

X = See corresponding number on summary page

D. 12 Month Inspection / Maintenance	***Status***
Inspect and lubricate PTO drive shaft to pump	
Take samples of hydraulic oil and test	
Check all system pressure adjustments for proper setting	
Perform cylinder drift tests	
Perform visual inspection of structure and critical welds	
Perform dielectric tests	
Perform Daily, 90 Day, and 180 Inspections / Maintenance	
Perform periodic inspection using appropriate form	
Inspect / perform additional items as indicated in unit maintenance manual. Record below	
E. Additional Items Inpected / Performed	

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Inspector Initials_____ -3-

TEREX

Model / Serial# _____ ***Summary Page*** *Unit Number*_____

Number	*R/C/I*	*Description*

Legend:
(R) Repair required.
(C) Check and repair as necessary on scheduled routine maintenance.
(I) For Information only, no corrective action required at this time.

Note:
•Owner/User is responsible to have repairs performed before use.
•Manufacturer's recommendations as to frequent and/or periodic inspection and maintenance schedules must be followed for safe operation of this unit.

•Immediate Repairs Required (_____Yes_____No)

•Customer declined torque check of critical fasteners (_____Yes_____No). If checked, work order #_____
•Do not consider this a pre-purchase inspection

Customer Signature_____ **Print Name** _____

Inspector Signature _____**Date**_____

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TEREX
Utilities

PERIODIC/MAINTENANCE DIELECTRIC TEST

ANSI/SIA A92.2 AND A10.31

Aerials Category C and Digger Derricks Work Order No._____

Customer: _____ Date: _____
Unit No.: _____ License No: _____

Equipment Identification:
Manufacturer: _____ Model:_____ S/N: _____

Upper Boom Test: **Chassis Insulating Test:** Air Temp. _____°F
Upper Boom Angle _____° Upper Boom Angle _____° Humidity _____%
Lower Boom Angle _____° Lower Boom Angle _____° Time _____am pm
Telescopic/Digger Derrick: ☐ Fully Extended ☐ Fully Retracted ☐ To Minimum Extension Label
Test Equipment: Model-S/N: _____ **Calibration Date:** _____

Note: µA = Micro amp

1. CATEGORY C INSULATING AERIAL DEVICE & DIGGER DERRICK (without lower test electrode system)

Unit Qualification Voltage	AC TEST - 1 Minute			DC TEST - 3 Minutes			Initials	
	TEST VOLTAGE	Time	Leakage	TEST VOLTAGE	Time	Leakage	Accept	Reject
46 KV & Below	40KV	Start	µA	56 KV	Start	µA		
		Finish	µA		Finish	µA		
		Max. Leakage	400 µA		Max. Leakage	56 µA		
_____KV	_____KV	Start	µA	_____KV	Start	µA		
		Finish	µA		Finish	µA		
		Max. Leakage	µA		Max. Leakage	µA		

2. CHASSIS INSULATING SYSTEM (lower boom insert)

AC TEST - 1 Minute			DC TEST - 3 Minutes			Initials	
TEST VOLTAGE	Time	Leakage	TEST VOLTAGE	Time	Leakage	Accept	Reject
35 KV	Start	µA	50 KV	Start	µA		
	Finish	µA		Finish	µA		
	Max. Leakage	3000 µA		Max. Leakage	100 µA		

3. COMPONENT TEST

DESCRIPTION		AC TEST - 1 Minute		DC TEST - 3 Minutes		Initials	
	TEST VOLTAGE	KV	KV	KV	KV	Accept	Reject
_____	Start	µA	µA	µA	µA		
S/N _____	Finish	µA	µA	µA	µA		
	Max. Leakage	µA	µA	µA	µA		

Tested by: _____ _____ **Location:** _____

Comments:_____

_____

_____

_____

FM5101
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TEREX Utilities

PERIODIC/MAINTENANCE DIELECTRIC TEST

ANSI/SIA A92.2

Aerial – Category A and B

Work Order No._____

Customer:_____ Date:_____

Unit No.:_____ License No.:_____

Equipment Identification:

Manufacturer:_____ Model:_____ S/N:_____

Upper Boom Test: **Chassis Insulating Test:** Air Temp._____°F

Upper Boom Angle _____° Upper Boom Angle _____° Humidity_____%

Lower Boom Angle _____° Lower Boom Angle _____° Time_____am pm

Telescopic Booms: ☐ Fully Extended ☐ Fully Retracted ☐ To Minimum Extension Label

Test Equipment: Model-S/N _____ **Calibration Date:** _____

1. CATEGORY A & B INSULATING AERIAL DEVICE (with lower test electrode system)

Note: µA = Micro amp

Unit Qualification Voltage	AC TEST - 1 Minute			DC TEST - 3 Minutes			Initial	
	TEST VOLTAGE	Time	Leakage	TEST VOLTAGE	Time	Leakage	Accept	Reject
46KV & Below	40KV	Start	µA	56KV	Start	µA		
		Finish	µA		Finish	µA		
		Max. Leakage	40 µA		Max. Leakage	28 µA		
69KV	60KV	Start	µA	84KV	Start	µA		
		Finish	µA		Finish	µA		
		Max. Leakage	60 µA		Max. Leakage	42 µA		

2. LOWER TEST ELECTRODE SYSTEM:

Test for "Electrical Continuity" between the center core of the test terminal and the following:

Outer Test Band ☐ Less than 100 OHMS Inner Test Band ☐ Less than 100 OHMS

Hose Assembly Bulkhead ☐ Less than 100 OHMS Leveling Rod Bands ☐ Less than 100 OHMS

PVC Tube Bands ☐ Less than 100 OHMS Other _____ ☐ Less than 100 OHMS

Test for "Electrical Insulation" between the center core of the test terminal and steel elbow:

☐ More than 10,000 OHMS

3. CHASSIS INSULATING SYSTEM (lower boom insert)

AC TEST - 1 Minute			DC TEST - 3 Minutes			Initial	
TEST VOLTAGE	Time	Leakage	TEST VOLTAGE	Time	Leakage	Accept	Reject
35KV	Start	µA	50KV	Start	µA		
	Finish	µA		Finish	µA		
	Max. Leakage	3000 µA		Max. Leakage	100 µA		

4. COMPONENT TEST

DESCRIPTION	AC TEST – 1 Minute			DC TEST – 3 Minutes		Initial	
	Test Voltage	KV	KV	KV	KV	Accept	Reject
_____ S/N _____	Start	µA	µA	µA	µA		
	Finish	µA	µA	µA	µA		
	Max. Leakage	µA	µA	µA	µA		

Tested by: _____ **Location:** _____

Comments: _____

_____

FM5100
01/06

TEREX

TEREX TELELECT

Aerial - Upper control Handle Test

Periodic Maintenance Test

Customer:_____ Ack No._____ S/N: _____

Description:_____ P/N: _____

Control handle electrical test: The single stick control will be tested to determine it has insulating properties This test does not certify the handle is capable of any voltage while in use because of limited clearance, cleanliness, and contamination. Connect test equipment as shown.

Single Stick Control Test:

Test time: AM / PM 3 minutes		AC test (40KVAC)	Leakage
Start			µA
Finish			µA
		Allowable	400 µA

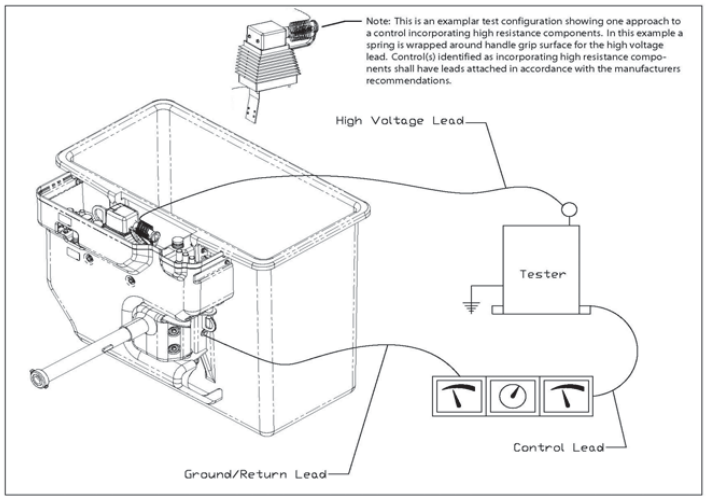
DC Test 56KVDC	Leakage
	µA
	µA
Allowable	56 µA

Accept	Reject

Verify all valve control handles are non-conductive materials:		
Individual levers:		
Hydraulic Stop, Start/Stop, Two Speed		

Note: Microampere = µA

Connect as shown for AC: Meter can be in power line for DC tests.



Procedure

1. Elevate boom tip so there is no contact to ground except through boom.
2. Wrap a metal spring around the handle of the single stick.
3. Attach the High Voltage lead to the spring with the clamp and cable upward.
4. Attach the return test lead to the platform bracket or mounting bracket. If mounted on platform attach to bracket attaching to basket.
5. To test: a. Gradually increase the voltage to 40KVAC or 56KVDC, Hold at voltage for 3 minutes.
   b. If flashover occurs or the leakage rate exceeds allowable it is a failure.
6. Record the results and file report.

Tested By:_____ Date: _____

Comments:_____

Note: Do not depend on covers or plastic control handles to provide electrical protection for the operator. Primary protection can only be provided by tested and rated protective equipment such as rubber gloves, rubber sleeves, cover-up, or proper clearance distance from all conductive components of the boom tip. Plastic, fiberglass, and rubber covers or handles may provide some limited insulation protection depending on condition and cleanliness. However, covers are not tested, and handles and covers are not certified or maintained as insulating.

TEREX TELELECT

FM5099 03/01/10

TEREX Utilities

QUALIFICATION DIELECTRIC TEST
ANSI/SIA A92.2 AND A10.31

Customer:_____ Ack No.:_____ S/N:_____
Product Code:_____ Description:_____ P/N:_____
Overcenter/Non-Overcenter Unit Qualification Voltage:_____kv Test Date: _____
Upper Boom Test: Insert Test: Test Performed: Inside _____
Upper Boom Angle:_____deg Upper Boom Angle:_____deg Outside _____
Lower Boom Angle:_____deg Lower Boom Angle:_____deg Temperature: _____ deg F
Telescopic/Digger Derrick Humidity: _____ %
Main Boom Angle:_____deg ☐ Fully Extended ☐ Fully Retracted ☐ To Minimum Extension Label

1. CATEGORY A & B INSULATING AERIAL DEVICE WITH LOWER TEST ELECTRODE SYSTEM

UNIT QUALIFICATION VOLTAGE AC	***TEST TIME***	1 MINUTE AC TEST VOLTAGE				10 Sec. Momentary Withstand Voltage Test(No Flashover Allowed)		INITIAL	
		Rated		Double Rated					
	AM/PM	27 kv	40 kv	54 kv	80 kv	80 kv	120 kv	Accept	Reject
46 kv & below	Start	µA		µA		µA			
	Finish	µA		µA		µA			
S/N_____	Max Leakage	27 µA		54 µA		80 µA			
69kv	Start		µA		µA		µA		
	Finish		µA		µA		µA		
S/N_____	Max Leakage		40 µA		80 µA		120 µA		

2. CATEGORY C INSULATING AERIAL DEVICE AND DIGGER DERRICK

UNIT QUALIFICATION VOLTAGE AC	***TEST TIME***	3 MINUTE AC TEST VOLTAGE	INITIAL	
	AM/PM	100 kv	Accept	Reject
46 kv & below	Start	µA		
	Finish	µA		
S/N_____	Max Leakage	1000 µA		

3. CHASSIS INSULATING SYSTEM (Lower Boom Inserts)

	TEST TIME	3 MINUTE AC TEST VOLTAGE	INITIAL	
	AM/PM	50 kv	Accept	Reject
	Start	µA		
	Finish	µA		
S/N_____	Max Leakage	3000 µA		

4. COMPONENT TEST

DESCRIPTION AND SERIAL NO.	***TEST TIME***	3 MINUTE AC TEST VOLTAGE		3 MINUTE AC TEST VOLTAGE		INITIAL	
	AM/PM	50 kv	100 kv	75 kv	150 kv	Accept	Reject
	Start	µA	µA	µA	µA		
	Finish	µA	µA	µA	µA		
	Max Leakage	1000 µA	1000 µA	100 µA	100 µA		
	Start	µA	µA	µA	µA		
	Finish	µA	µA	µA	µA		
	Max Leakage	1000 µA	1000 µA	100 µA	100 µA		

NOTES: µA=Micro amp

Comments: _____

Tested By:_____

Reviewed By:_____

FMPN352136 Rev B 2/01/06

TEREX TELELECT

Aerial - Upper control Handle Test

Qualification Test

Customer:_____ Ack No._____ S/N: _____

Description:_____ P/N: _____

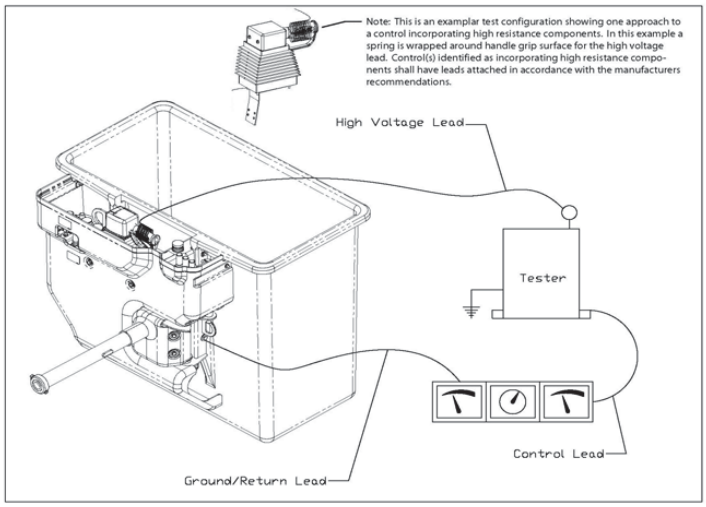
Control handle electrical test: The single stick control will be tested to determine it has insulating properties in new clean condition. This test does not certify the handle is capable of any voltage while in use because of limited clearance, cleanliness, and contamination. Connect test equipment as shown.

Single Stick Control Test:

40KVAC	Test time: AM / PM	3 min Test Voltage **A** or **B**		Micro Amps leakage		Accept (<400 µA)	Reject
No Flashover <400 µA	Start		KV		µA		
	Finish		KV		µA		
Verify all valve control handles are non-conductive materials:							
Individual levers: (Qty)							
Hydraulic Stop, Start/Stop, Two Speed							

Note: Microampere = µA

Connect as shown:



Procedure

1. Elevate boom tip so there is no contact to ground except through boom.
2. Wrap a metal spring around the handle of the single stick.
3. Attach the High Voltage lead to the spring with the clamp and cable upward.
4. Attach the return test lead to the platform bracket or mounting bracket.
   If mounted on platform attach to bracket attaching to basket.
5. To test:
   a. Gradually increase the voltage to 40KVAC, Hold at voltage for 3 minutes.
   b. If flashover occurs or the leakage rate exceeds 400µA it is a failure.
6. Record the results and file report in machine test folder.

Tested By:_____ Date: _____ Reviewed:_____ Date: _____

Comments:

Failure cause: _____ KV Voltage of flashover _____ exceeds 400 µA

Note: Do not depend on covers or plastic control handles to provide electrical protection for the operator. Primary Primary protection can only be provided by tested and rated protective equipment such as rubber gloves, rubber sleeves, cover-up, or proper clearance distance from all conductive components of the boom tip. Plastic fiberglass and rubber covers or handles may provide some limited insulation protection depending on condition and cleanliness. However, covers are not tested, and handles and covers are not certified or maintained as insulating.

TEREX TELELECT

FMPN352192 Rev D
03/01/10

SECTION 10

INTRODUCTION

OWNERS, USERS AND OPERATORS

Thank you for choosing Terex South Dakota, Inc. equipment for your application. User safety is our number one priority and this is best achieved by our joint efforts.

As equipment users and operators, you make a major contribution to safety if you:

1. Comply with OSHA, federal, state, ANSI, local and your company regulations.
2. Read, understand and follow the instructions in this manual and other manuals supplied with this vehicle.
3. Only allow trained operators, directed by informed and knowledgeable supervision, to run the unit.

If there is anything in this manual that is not clear or you believe should be added, please send your comments to:

Manager of Publications
Terex South Dakota, Inc.
500 Oakwood Road
Watertown, South Dakota 57201

You may also contact us by phone at: (605) 882-4000

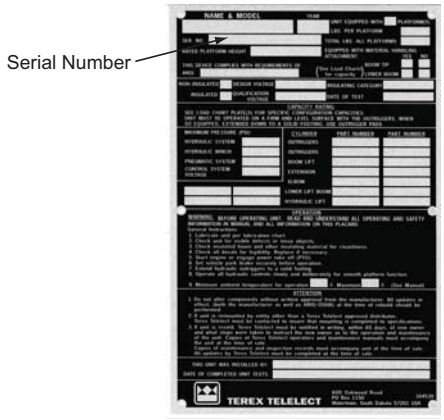
This is the safety alert symbol. It is used in this manual to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

This manual contains important information on the safe use of your Terex South Dakota, Inc. equipment. Your failure to read, understand and follow all safety rules, warnings and instructions will unnecessarily expose you and others to dangerous situations. For your safety and the safety of those around you, you **must** operate your Terex South Dakota, Inc. equipment as instructed in this manual.

This manual shall be stored on the vehicle for access by the operator. The Operators manual is required to be stored on the vehicle by ANSI and OSHA regulations.This manual, along with the AEM Aerial Devices Safety Manual and ANSI A92.2 Manual of Responsibilities for Dealers, Owners, Users, Operators, Lessors and Lessees should be considered a permanent part of your machine and should remain with the machine at all times.

PRODUCT IDENTIFICATION

The serial number is located on the ID plaque. It may be located on the turntable, pedestal or lower boom, depending on options and features. The serial number of the vehicle (VIN) will be different than the serial number for the Aerial Device. Please refer to the Aerial Device serial number when contacting Terex South Dakota, Inc. for service and parts information. Refer to the ID plaque for capacity and dielectric information.



INTENDED USE

This machine is intended to be used to lift personnel, along with tools to an aerial work site within the rated platform capacity. Use of this product in any other way is prohibited and contrary to its intended use. This machine is not designed or equipped with material handling features for lifting any type of loads or pulling loads with the booms or platform.

BULLETIN DISTRIBUTION AND COMPLIANCE

It is the owners responsibility to comply with all bulletins issued by Terex South Dakota, Inc. or the vehicle manufacturer. Safety of product users is of paramount importance to Terex South Dakota, Inc. Various bulletins are used by Terex South Dakota, Inc. to communicate important safety and product information to dealers and machine owners. The information contained in bulletins is tied to specific machines using the machine model number and serial number. Distribution of these bulletins is based on the most current owner on record along with their associated dealer, so it is important to register your machine and keep your contact information up to date and changes in ownership. To ensure safety of personnel and the reliable continued operation of your machine, compliance with the information and actions in the bulletins are mandatory.

CONTACTING THE MANUFACTURER

If it is necessary to contact the manufacturer of the machine, supply the unit model number, serial number, and your name and contact information. At minimum, the manufacturer should be contacted for:

- Accident Reporting
- Questions regarding product applications and safety
- Standards and regulations compliance information
- Questions regarding product modifications
- Current owner updates, such as changes in machine ownership or changes in your contact information (See Transfer of Machine Ownership below)

TRANSFER OF MACHINE OWNERSHIP

If you are not the original owner of this machine, use the following form to provide information on the ownership change.

This information will ensure that you are the owner on record for this machine and you will receive applicable notices and advisories in a timely manner.

You can mail information on changes in ownership to Terex South Dakota, Inc., 500 Oakwood Road, PO Box 1050, Watertown, SD 57201 or email the information to: utilities.warranty@terex.com.

REGISTRATION CARD

Owner's Name			
Address			
City		State	Zip
Signed		Title	
Terex South Dakota, Inc. Model		Ser. #	
VIN #	Customer Truck #		
Check: ( ) Operation & Maintenance Manual Received.			
Date Placed in Service:			
Previous Owner			
Address			

Note: It is the sellers responsibilty to provide the Operator's manual to the purchaser. Replacements can be ordered from Terex, South Dakota.

SECTION 20
SAFETY

The operator is the single most important factor for safety when using any piece of equipment. Learn to operate your Terex South Dakota, Inc. equipment in a safe manner.

NOTE: The best method to protect yourself and others from injury or death is to use common sense. If you are unsure of any operation, do not continue until you are satisfied that it is safe to proceed.

HAZARD CLASSIFICATION SYSTEM

This machine contains safety signs to assist in hazard recognition and prevention. The hazard classification system is a multi-tier system used to alert you to potential personal injury hazards. Signal words used with the safety alert symbol indicate a specific level of severity of the potential hazard. To help you recognize important safety information, we have identified **warnings** and **instructions** that directly impact safety.

This is the safety alert symbol. It is used in this manual to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Danger is always used with the safety alert symbol and white letter on red background.

⚠ DANGER	Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

Warning is always used with the safety alert symbol and black letters on orange background.

⚠ WARNING	Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

Caution is used with the safety alert symbol and black letters on yellow background.

⚠ CAUTION	Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

PROPERTY DAMAGE MESSAGES

The signal word NOTICE, shown without the safety alert symbol, is used to address specific practices or draw attention to supplemental information that is not related to personal injury.

Notice does not use the safety alert symbol and text is white italic letters on blue background.

NOTICE	Indicates information considered important, but not hazard related (e.g., messages related to property damage).

In addition to maintenance and operating instructions in this manual, the operator must read and understand all the instructions in the following safety guidelines.

1. Study all safety messages and apply them on the job.
2. Modifications to this Terex South Dakota, Inc. equipment from the original design specifications without written permission from Terex South Dakota, Inc. are strictly forbidden. A modification may compromise the safety of the Terex South Dakota, Inc. equipment, subjecting users to serious injury or death. Any such modification will void any remaining warranty.
3. Terex South Dakota, Inc. reserves the right to change, improve, modify or expand features of its equipment at any time. Specifications, model or equipment are subject to change without notice and without incurring any obligations to change, improve, modify or expand features of previously delivered equipment.
4. Comply with manufacturer's instructions and requirements of current OSHA regulations and ANSI standards.

GENERAL SAFETY GUIDELINES

1. The use of this Aerial Device is subject to certain potential dangers that cannot be protected against by mechanical means. Only the exercise of intelligence, care, and common sense can eliminate these dangers. It is essential to have competent, careful operators who are physically and mentally fit, and thoroughly trained in the safe operation of this Aerial Device. Learn, understand and practice safe use of all equipment and controls - before operating this Aerial Device.
2. Never exceed the rated load capacity. Know the total weight - including the operator, platform liner, tools, and equipment, and/or other items before entering platform.
3. Conduct a thorough pre-operation of the machine and test all functions through their complete cycle before each work shift. Immediately tag and remove from service a damaged or malfunctioning machine.
4. Do not operate this Aerial Device if any interlock or safety device is malfunctioning.
5. Do not bypass or remove any interlock or safety device.
6. Never operate with damaged leveling chain or components.
7. Stop in position if you become aware of any dangerous conditions or hear any unusual noise (such as grinding, cracking or grating) while operating the Aerial Device. Do not move the Aerial Device until the problem has been resolved.
8. Do not operate the Aerial Device if it is not functioning properly or a leak is detected. Repair, document repairs performed and inspect the unit before returning to service.
9. Never operate from the ground controls with personnel in the platform. Operation must be controlled by the platform operator, except in case of an emergency.
10. Keep the vehicle free of obstructions that may interfere with the controls or personnel who may have to operate them in an emergency.
11. All ground personnel must be trained in the proper procedure to follow in case of emergency.
12. Do not operate the Aerial Device in an electrical storm.
13. The hydraulic fluid is petroleum based and will burn.

BEFORE OPERATION

1. Survey the conditions of the work area. Identify situations such as; soft ground, ditches, drop-offs, holes, debris, overhead obstructions, electrical conductors, underground utilities, stored fuels, toxic dust and gases.
2. Plan the job (tailgate session) and clear the area of unauthorized personnel.
3. Set the vehicle parking brake and chock the wheels.
4. Make certain tire pressures are proper for operation.
5. Visually inspect condition of tires, truck suspension, and torsion bars (if equipped) for any damage.
6. The vehicle must be securely parked and stabilized before any operation is performed. If equipped with outriggers, set all outriggers.
7. If not equipped with outriggers, or only one set of outriggers, the truck tires must equally support the weight of the truck. One tire cannot be in a hole or depression.
8. Do not lower outriggers unless you can see that all personnel are clear of the outrigger path of movement and its ground contact point. Lower all outriggers onto solid footing.
9. Do not place outriggers on ice as slippage may occur regardless of solid footing. Operation on snow or slippery surfaces requires extra care during set up to ensure Aerial Device and vehicle have sufficient traction to prevent sliding.
10. The Aerial Device has been tested per the stability requirements of ANSI A92.2 and may be operated on firm, flat, non-level surfaces up to a 5 degree slope.
11. Ground and/or barricade the vehicle per OSHA, ANSI and your company policies.
12. Only operate the aerial device if there is sufficient lighting at the job site to accomplish task safely.
13. Inspect controls before operation, do not operate the aerial device with malfunctioning controls.
14. Conduct a thorough pre-operation inspection of the machine and test all functions through their complete cycle before each work shift. Immediately tag and remove from service a damaged or malfunctioning machine.
15. Barricade or cover up any overhead electrical lines that have the potential for contact during operation.
16. Inspect and maintain personal protective equipment.
17. Perform inspections and maintenance as specified in the Maintenance Guidelines.
18. If this Aerial Device is equipped with platform tilt, an inspection must be made before entering the platform to insure all locks and pins are properly in place.
19. Operator’s Manual must be on the vehicle available to the operator.

DURING OPERATION

1. Never operate the Aerial Device unless you know the location, function, and operation of all the controls, including emergency and accessory operation.
2. Avoid abrupt starts, stops and reversal of direction. Operate all controls slowly for smooth motion.
3. Keep all parts of your body away from all moving parts to avoid injury.
4. Operator(s) must wear an OSHA approved fall protection system with a lanyard attached to the anchor(s) provided.
5. Wear personal protective equipment such as: Insulated hard hat, rubber gloves with leather protectors, and rubber sleeves. Hearing and eye protection, proper boots and suitable clothing may also be required. Follow OSHA and employer's policies for fire retardant (FR) clothing and arc flash protection.
6. Do not place the boom in open traffic lanes. Stop traffic or barricade lanes to divert traffic from area.
7. Do not allow boom, platform, or any part of the Aerial Device to contact fixed objects.
8. Do not tie off to an adjacent structure, pole, or other equipment.
9. Never exceed rated capacity of platform for men, tools, and liner if equipped.
10. Do not pass tools, equipment, or other objects between the occupant of the platform and other personnel on poles or other platforms.
11. Do not sit or climb onto edge of platform or use planks, ladders, or other devices for a work position. Always stand with both feet on the floor of the platform.
12. Do not wear climbers while in the platform.
13. Do not allow ground personnel under the platform work area.
14. Do not operate with platform leveling malfunctioning.
15. Do not move the vehicle with personnel in the platform.
16. This is not a material handling Aerial Device. The platform was designed for lifting personnel and tools within the platform capacity only.
17. Never tie loads to the platform or booms. This machine has no material handling capabilities. Never lift loads with the boom or platform.
18. This aerial device is not equipped with a lifting attachment and cannot be used to lift loads, branches or pull poles.
19. High speeds should only be used when moving the platform to an aerial job site. Low speed should be used to move into, or within the aerial job site.
20. Low engine speed, if available, should be used when operating tools or maneuvering near obstructions such as trees, poles or lines.
21. If, when operating the Aerial Device, you become aware of any dangerous condition, unusual operation, or hear any unusual noise, such as grinding, cracking, or grating sounds-STOP-in position. Do not move the Aerial Device until the problem has been diagnosed and resolved with your safety in mind. No matter how long it may take to get help, waiting is better than a serious or fatal accident.
22. Do not adjust outriggers while booms are out of rest.
23. Do not operate boom controls while standing on the ground or other structures.

ELECTRICAL HAZARDS

ELECTRICITY OBEYS NO LAW, BUT ITS OWN.

1. Electricity is an ever-present danger when using an Aerial Device. Follow all OSHA, ANSI, state, federal and company rules and regulations when working on or near energized power lines.
2. Always maintain proper clearance from energized power lines. This Aerial Device cannot protect you from phase-to-phase or phase-to-ground contact occurring above the insulating boom section.
   - Allow for platform sag, sway or rocking.
   - If any part of the boom-tip, everything beyond band of arrows on boom, contacts an energized conductor, the controls handle(s) and the entire boom tip must be considered energized.
   - If any part of the boom-tip, everything beyond band of arrows on boom, contacts a grounded object, the controls handle(s) and the entire boom tip must be considered grounded.
3. The booms and operators shall be properly insulated from any contact with electrical conductors; including neutral or ground lines, poles, cross arms and guy wires. Utilize proper insulation such as line covers, rubber blankets and hot line tools.
4. All metal components at the boom tip beyond the band of arrows are interconnected. Contact of any part to an energized conductor will energize the entire boom tip, including the controls.
5. DO NOT contact energized conductors or operate your Aerial Device with missing or damaged covers or exposed metal fasteners. Even though covers are plastic or fiberglass, they are not tested or maintained for dielectric protection. Always cover conductors with line hose and maintain minimum approach distance from conductive items.
6. Never place booms, platforms, or personnel between energized conductors or between an energized conductor and a grounded conductor without proper cover up.
7. Wear proper clothing designed to reduce the extent of injury when exposed to flames or electric arcs. Follow your employer's policies for FR clothing.
8. Never operate the Aerial Device in an electrical environment unless the unit has been properly maintained with frequent and periodic inspections and a current annual dielectric test. If the fiberglass boom components are contaminated by moisture or dirt or improperly maintained the dielectric protection will be compromised.
9. Never allow ground personnel to come in contact with the Aerial Device, vehicle, or vehicle attachments while in operation near energized power lines.
10. When working on or near energized power lines or equipment, the vehicle must be grounded and/or barricaded and considered as energized.
11. Never rely on the fiberglass platform insulation when in the platform. It may contain small unseen cracks that will allow an electrical path into the platform. Always use a platform liner.
12. Never touch the controls or boom tip area when in the platform without using proper protection (wear insulating rubber gloves with leather protectors) while holding any conductors, neutrals, grounds, or other structures.
13. Ground and neutral conductors are current carrying conductors and must be treated as energized (wear insulating rubber gloves with leather protectors).
14. Wear insulating rubber gloves when handling duplex and triplex wires.
15. Do not increase the chance of accidental contact when working on or near energized structures or power lines, defeating the purpose of the liner:
    - All tools, accessories and other objects must be contained within the platform.
    - Do not attach any metal objects from outside the platform to the inside of the platform
    - Do not hang metal objects from the lip of the platform. This includes extension cords, guy wires or conductors.
16. Use only non-metallic tool holders and tool trays.

17. Check the boom tip area for any exposed conductive material and do not allow boom tip to come in contact with an energized phase or ground.
18. Do not carry or allow a conductor to touch your body. Handle conductors only with insulating rubber gloves even if grounded.
19. Never use leather work gloves or bare hands on grounded conductors when energized conductors are on the same structure. Wear insulating rubber gloves with leather protectors.
20. Do not lift conductors with the boom tip or platform.
21. Do not operate boom controls while standing on the ground or other structure. Operating the machine while standing on the ground or other structure could result in electrocution.
22. Do not touch the truck or any attachments such as chippers or trailers when booms are elevated near energized power lines.

ACCESSORIES

1. Only use hydraulic tools equipped with orange hoses marked NON-CONDUCTIVE. The hoses must be kept clean, dry and inspected before use.
2. All accessories must be inspected, maintained and operated with the same care and safety rules that apply to the Aerial Device.
3. Tools selected for use with this Aerial Device must be open-center and operate satisfactorily at 2250 PSI (15.51 MPa) and 5 GPM (19 LPM).
4. If this Aerial Device is equipped with platform tilt, an inspection must be made before entering the platform to insure all locks and pins are properly in place.
5. Do not place booms or platform under trees or limbs while trimming to avoid possible damage or overloading.
6. Operation of tools at high speed for extended periods will cause tools and the hydraulic system to overheat, damaging the tool and hydraulic system resulting in hose damage.
7. Do not use lower hydraulic tools or feed the chipper when platform or booms are near energized lines.

TRAVELING

1. Never travel with personnel in the platform.
2. Never travel with the booms raised.
3. Store booms properly in the boom rest. Lower the lower boom fully before lowering upper boom into the rest.
4. Lock boom(s) in place with hold down system.
5. Keep all tools or other items properly stored on the vehicle while traveling. Otherwise, they may fall onto the roadway.
6. Fully retract the outriggers, store outrigger pads, and wheel chocks.
7. Disengage the power take-off to prevent damage.
8. Verify platform liner is retained during travel with platform cover or clips to prevent loss.
9. Follow the vehicle manufacturer's instructions for operating the vehicle. All operators and passengers must at all times travel in seating positions designated by the vehicle manufacturer. They shall use seat belts and/or all other personal restraint systems provided.

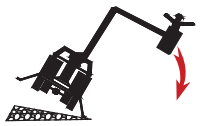
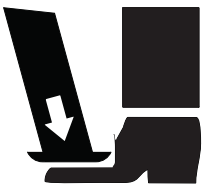
Drive Carefully!

MAINTENANCE

1. Inspect, maintain, and repair the Aerial Device in accordance with this section and the maintenance manual for your Aerial Device.
2. Only knowledgeable, authorized and qualified personnel shall be allowed to perform maintenance on the Aerial Device.
3. Never drill holes in the platform.
4. Replace all missing or illegible decals.
5. Any changes or modifications to the Aerial Device must be approved by the manufacturer in writing.
6. Do not alter the insulated portion of the Aerial Device. Alterations may reduce the insulating value.
7. Do not search for hydraulic leaks with your hands or any other part of your body. Hydraulic fluid injection could occur requiring immediate medical attention.
8. All hoses must meet or exceed the working pressure of the Aerial Device.
9. Only use orange hoses marked NON-CONDUCTIVE for tool hoses, at the boom tip, and areas that bridge the insulation gap.
10. Do not use replacement components that are not equal to the original components.
11. Before doing any work on the hydraulic system, secure the booms and outriggers. Release any hydraulic pressure before attempting repairs or disassembly of hoses, valves, cylinders or any other hydraulic components.
12. Fuel or oil spills may require notification of appropriate Federal, State, or Local officials.
13. Do not operate the Aerial Device after adjustments or repairs until all guards and covers have been reinstalled, trapped air removed from the hydraulic system, safety devices reactivated, and maintenance equipment removed.
14. Inspect the unit following the frequent and periodic inspection intervals.
15. The subframe, outriggers, boom rest, and vehicle mounting must be inspected following the frequent and periodic inspection intervals for fastener tightness, damaged components and weld inspections.
16. Inspect, maintain, and operate the vehicle and components following the manufacturer’s guidelines.
17. A post event inspection, testing, and documentation is required when the unit has been overloaded, shock loaded, overturned, in an accident, experienced electrical contact or any application of an unintended external force.

OVERVIEW OF POTENTIAL HAZARDS AND SYMBOLS

The Aerial Device is a heavy moving machine capable of extending its reach vertically and horizontally. There are potential hazards associated with the use of this Aerial Device. These hazards will be minimized if the machine is properly inspected, maintained and operated. The operators shall read and understand this manual and be trained to use the machine in an appropriate and safe manner. Should any questions arise concerning the maintenance or operation of the machine contact Terex South Dakota, Inc..

SYMBOL	HAZARD	DESCRIPTION
Alert Symbol 	DANGER: Failure to follow will cause serious injury.	Your safety is involved.
Operators Manual 	DANGER: Failure to follow will cause serious injury.	Read and follow operator's manual for safe operation.
Maintenance Manual 	DANGER: Failure to follow will cause serious injury.	Follow all inspection and maintenance to prevent failure.
Electrical Contact 	DANGER: Will cause Serious Injury Maintain minimum clearance from or Death.	Maintain minimum clearance from overhead high voltage power lines. Refer to "Minimum Clearance for High Voltage Lines" chart in Appendix A. Maintain minimum approach distance as appropriate for your qualifications. Do not dig near underground power lines. Use machine only within its electrical rating. Consult the ID Placard for dielectric rating.
Unit Overturn 	WARNING: Can Cause Serious Injury or Death.	Do not travel on steep inclines or crosswise to grades. Do not travel on soft or unstable ground or close to unsupported excavations. All tires must remain on the ground. Set outriggers (if equipped) so indicator remains in green area.
Crushing 	WARNING: Will Cause Serious Crushing Injury.	Do not operate outriggers unless you can verify all personnel and obstructions are clear. Operator must watch the outrigger while in motion.

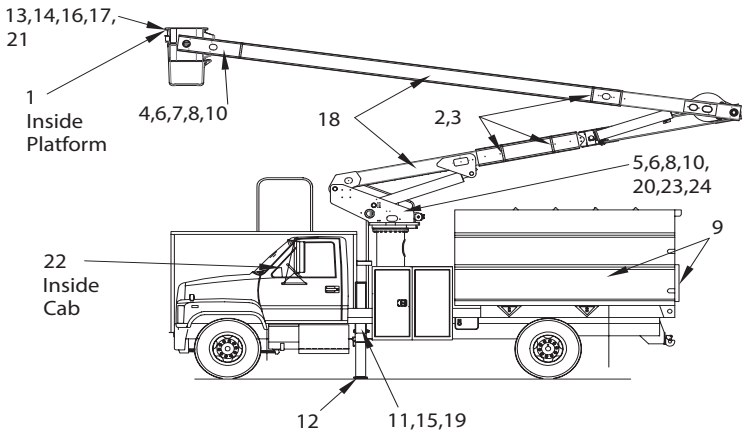
High Pressure Air or Fluid 	WARNING: Can Cause Serious Injury or Death.	Relieve pressure on hydraulic and pneumatic systems before loosening hoses or connections. Do not check for leaks with your hand.
Lanyard Attach. 	WARNING: Failure to Attach Can Cause Serious Injury or Death.	Attach lanyard to the anchor provided.
Lanyard Attach. 	WARNING: Failure to Attach Can Cause Serious Injury or Death.	Attach lanyard to the anchor provided.
Fall 	DANGER: Will cause Serious Injury or Death.	Always wear an OSHA approved fall protection system with lanyard attached to anchor provided.

SECTION 90
SAFETY RELATED DECALS

Safety signs are designed and fitted to the product to warn of possible dangers, and MUST be replaced immediately if they become unreadable or lost. If the product is repaired and parts have been replaced on which safety signs were fixed, be sure new safety signs are fitted before the product is put into service.

Use mild soap and water to clean safety signs - DO NOT use solvent based cleaners, as they may damage the safety sign material.

Operating this equipment without all safety and control decals in place can be hazardous.



NOTE: *Use decal 419265 and 465703 when Aerial Device is not certified in accordance with latest ANSI A92.2 revision or booms are not insulated.

NOTE: **Use 612455 for platform dump with controls mounted between boom and platform.

ITEM #	DECALS	QTY	PART #
1.	PLATFORM NOT INSULATED	1	47988
2.	ARROWS	13’	H21503
3.	NOT INSULATED BEYOND ARROWS	8	402236
4.	READ CAREFULLY	2	414590
5.	FAILURE TO OBEY	1	419262
6.	ELECTROCUTION HAZARD	3	419263
7.	FALLING FROM PLATFORM	2	419264
8. *	ELECTROCUTION HAZARD - NOT INSULATED	3	419265
9.	ELECTROCUTION HAZARD - KEEP CLEAR	3	419266
10.	UNTRAINED OPERATOR	3	419267
11.	OUTRIGGER - CRUSHING - DO NOT OPERATE	2	419268
12.	OUTRIGGER - CRUSHING - STAND CLEAR	2	419269
13.	CONDUCTIVE HOSE	2	419270
14. **	PLATFORM DUMP PIN AND RETAINER	1	612455
15.	OVERTURNING HAZARD	2	458696
16.	SLOPE INDICATOR	2	486277
17.	CONTROLS NOT INSULATED	1	463602
18. *	NOT INSULATED	4	465703

19.	ANSI WARNING	1	468476
20.	MAINTENANCE RECORD	1	489119
21.	LANYARD ATTACHMENT, X1	1	495441
22.	TRUCK COMPUTER	1	495845
23.	FALL HAZARD - MAINTENANCE	1	495892
24.	ESCAPING FLUID UNDER PRESSURE	1	H23877

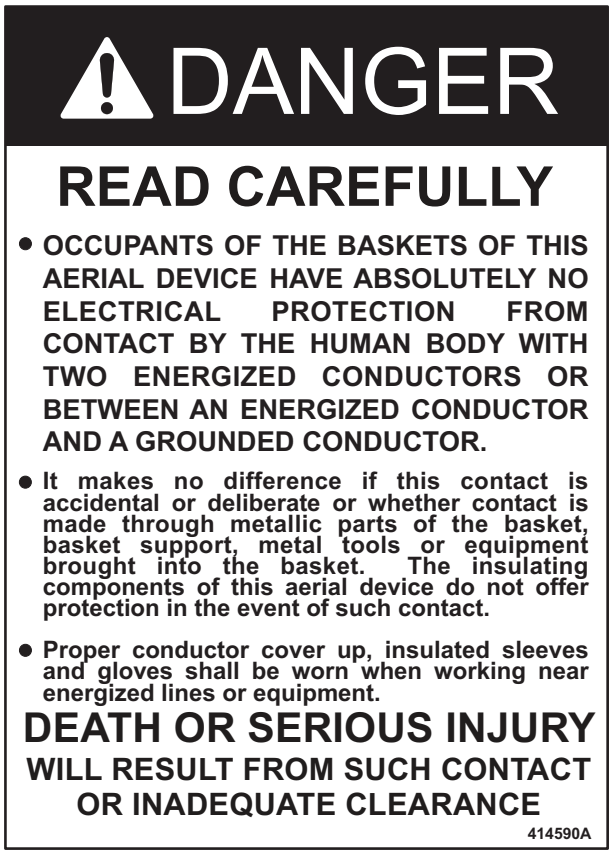
1.

THIS BASKET, WITHOUT AN INSULATING LINER, IS NOT CERTIFIED AS AN ELECTRICAL INSULATING BARRIER.

47988D

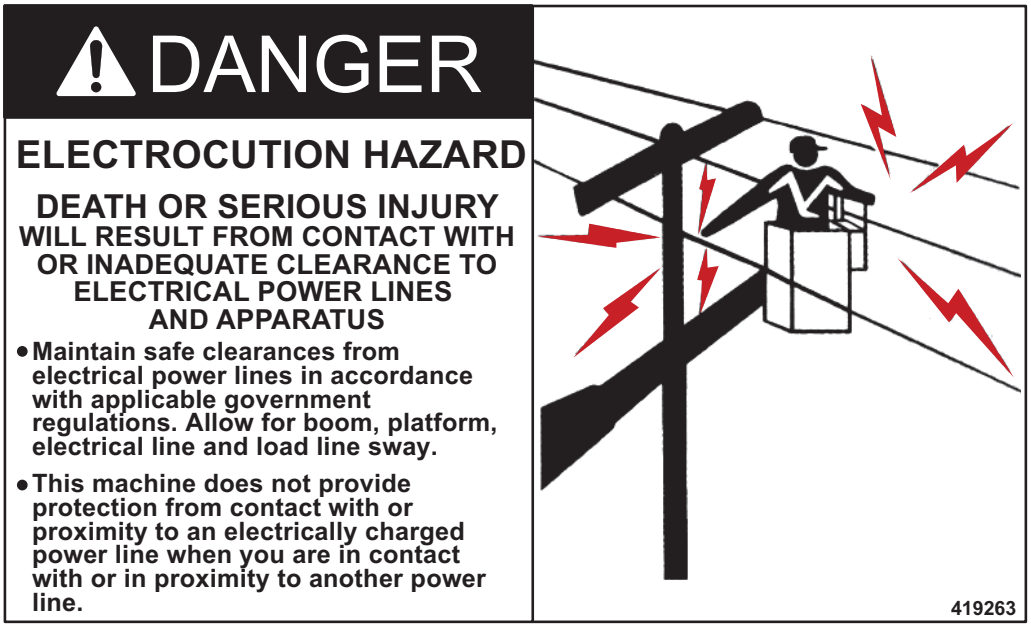
2. & 3.

4.



5.

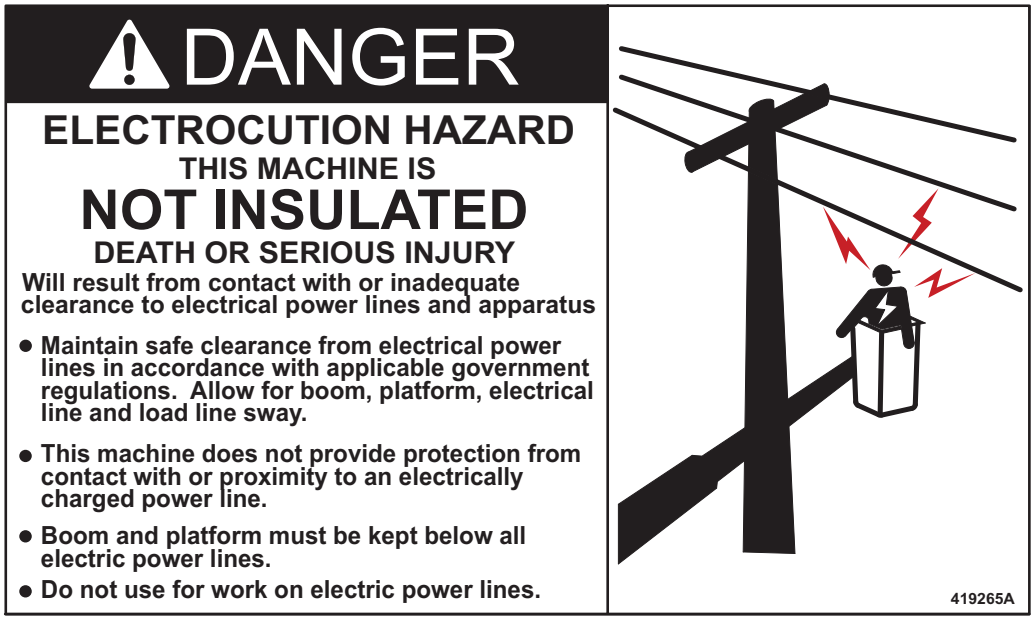
6.


DANGER
ELECTROCUTION HAZARD
DEATH OR SERIOUS INJURY
WILL RESULT FROM CONTACT WITH OR INADEQUATE CLEARANCE TO ELECTRICAL POWER LINES AND APPARATUS
• Maintain safe clearances from electrical power lines in accordance with applicable government regulations. Allow for boom, platform, electrical line and load line sway.
• This machine does not provide protection from contact with or proximity to an electrically charged power line when you are in contact with or in proximity to another power line.
419263

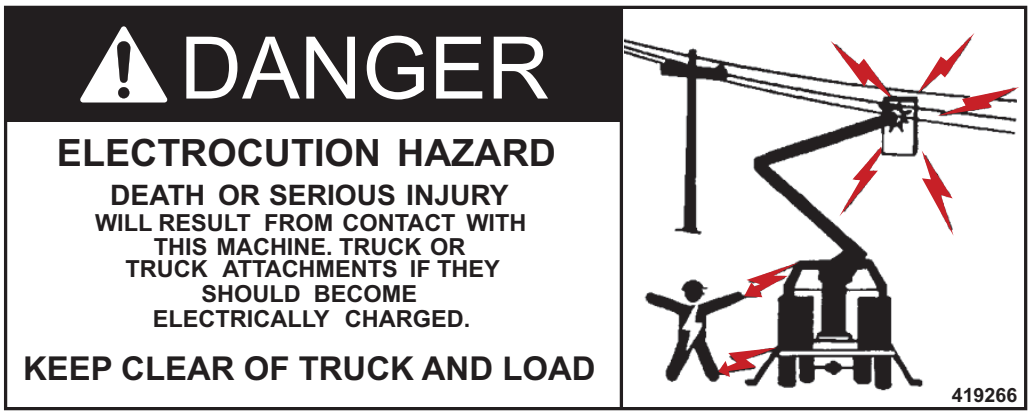
7.


DANGER
FALLING FROM PLATFORM WILL RESULT IN
DEATH OR SERIOUS INJURY
• Platform personnel must wear an OSHA approved fall protection system with lanyard attached to anchor provided.
• Platform doors, if provided, must be securely latched.
419264A

8.


DANGER
ELECTROCUTION HAZARD
THIS MACHINE IS
NOT INSULATED
DEATH OR SERIOUS INJURY
Will result from contact with or inadequate clearance to electrical power lines and apparatus
● Maintain safe clearance from electrical power lines in accordance with applicable government regulations. Allow for boom, platform, electrical line and load line sway.
● This machine does not provide protection from contact with or proximity to an electrically charged power line.
● Boom and platform must be kept below all electric power lines.
● Do not use for work on electric power lines.
419265A

9.


DANGER
ELECTROCUTION HAZARD
DEATH OR SERIOUS INJURY
WILL RESULT FROM CONTACT WITH THIS MACHINE. TRUCK OR TRUCK ATTACHMENTS IF THEY SHOULD BECOME ELECTRICALLY CHARGED.
KEEP CLEAR OF TRUCK AND LOAD
419266

10.

DANGER

AN UNTRAINED OPERATOR SUBJECTS HIMSELF AND OTHERS TO

DEATH OR SERIOUS INJURY

YOU MUST NOT OPERATE THIS MACHINE UNLESS

- You have been trained in the safe operation of this machine.
- You have read, understand and follow the safety and operating recommendations contained in the machine manufacture's manuals, safety signs attached to equipment, your employer's work rules and applicable government regulations.
- You are sure the machine is operating properly and has been inspected and maintained in accordance with manufacturer's manuals.
- You are sure that all safety signs, guards and other safety features are in place and in proper condition.

419267

11.

DANGER

OUTRIGGER CONTACT WILL CAUSE SERIOUS CRUSHING INJURY

- Do not operate any outrigger unless you or a signal person can see that personnel and obstructions are clear of the outrigger and its contact point.

419268A

12.

DANGER

OUTRIGGER CONTACT WILL CAUSE

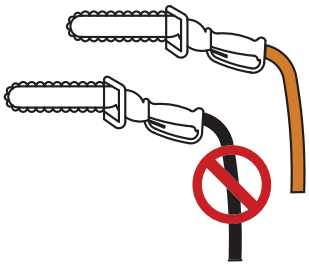
SERIOUS CRUSHING INJURY

STAND CLEAR

419269

13.

DANGER



ELECTROCUTION HAZARD
FIRE HAZARD

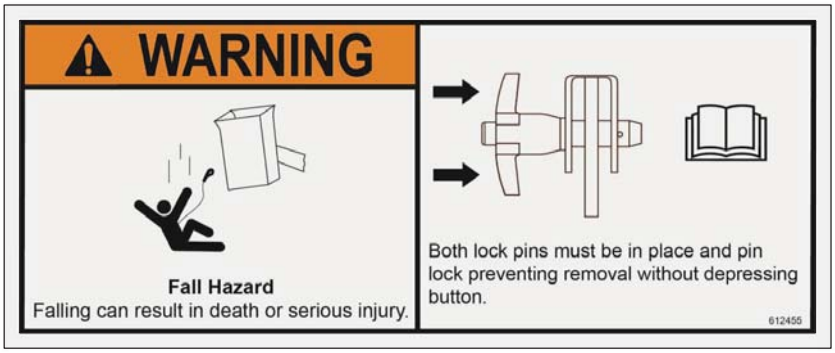
USE ONLY ORANGE, NON-CONDUCTIVE HOSE FOR TOOL, PLATFORM AREA, AND INSULATED SECTIONS.

FAILURE TO DO SO MAY CAUSE

DEATH OR SERIOUS INJURY.

419270A

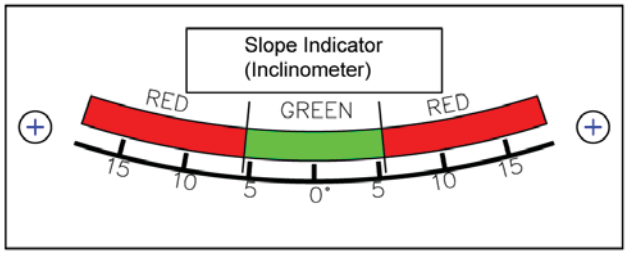
14.


WARNING
Fall Hazard
Falling can result in death or serious injury.
Both lock pins must be in place and pin lock preventing removal without depressing button.
612455

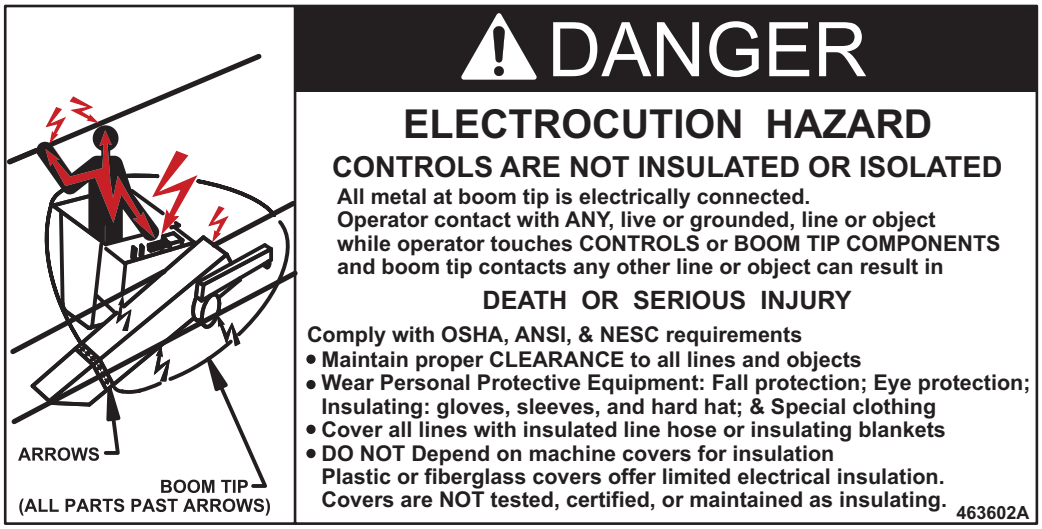
15.


DANGER
OVERTURNING HAZARD
DEATH OR SERIOUS INJURY
May result from overturning machine
• This unit has been tested for stability on a maximum slope of 5 degrees.
• Working on slopes that exceed 5 degrees may result in truck tipping over.
• All tires must remain on the ground.
• Position or park truck so indicator is in the green area.
• Set Outriggers (if equipped) so indicator remains in green area.
458696A

16.


Slope Indicator
(Inclinometer)
RED
GREEN
RED
15
10
5
0°
5
10
15

17.


DANGER
ELECTROCUTION HAZARD
CONTROLS ARE NOT INSULATED OR ISOLATED
All metal at boom tip is electrically connected.
Operator contact with ANY, live or grounded, line or object
while operator touches CONTROLS or BOOM TIP COMPONENTS
and boom tip contacts any other line or object can result in
DEATH OR SERIOUS INJURY
Comply with OSHA, ANSI, & NESC requirements
• Maintain proper CLEARANCE to all lines and objects
• Wear Personal Protective Equipment: Fall protection; Eye protection;
Insulating: gloves, sleeves, and hard hat; & Special clothing
• Cover all lines with insulated line hose or insulating blankets
• DO NOT Depend on machine covers for insulation
Plastic or fiberglass covers offer limited electrical insulation.
Covers are NOT tested, certified, or maintained as insulating.
463602A
ARROWS
BOOM TIP
(ALL PARTS PAST ARROWS)

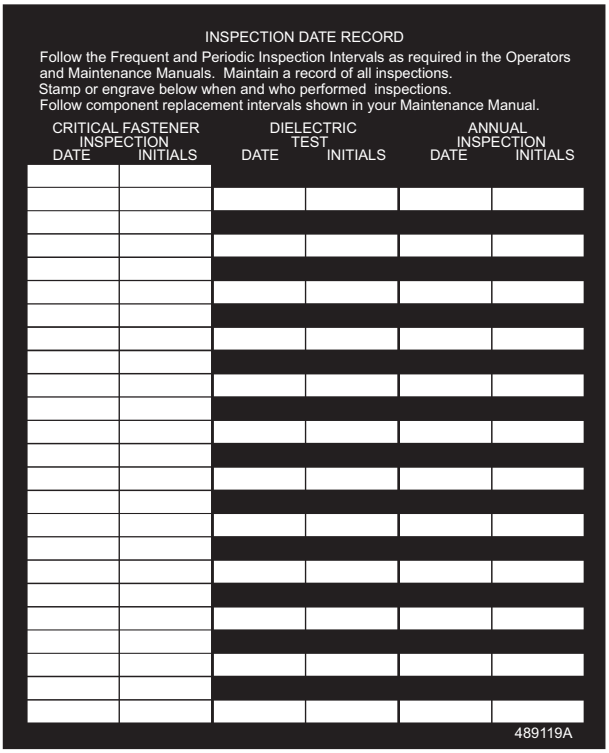
18.


NOT INSULATED

19.


WARNING
FAILURE TO FOLLOW
PROPER PROCEDURES
Could Result In
DEATH OR SERIOUS INJURY
If YOU sell, install, offer for use, use,
operate or maintain this Aerial Device
You MUST COMPLY with the requirements of:
American National Standards Institute A92.2,
National Electric Safety Code, and OSHA
468476

20.

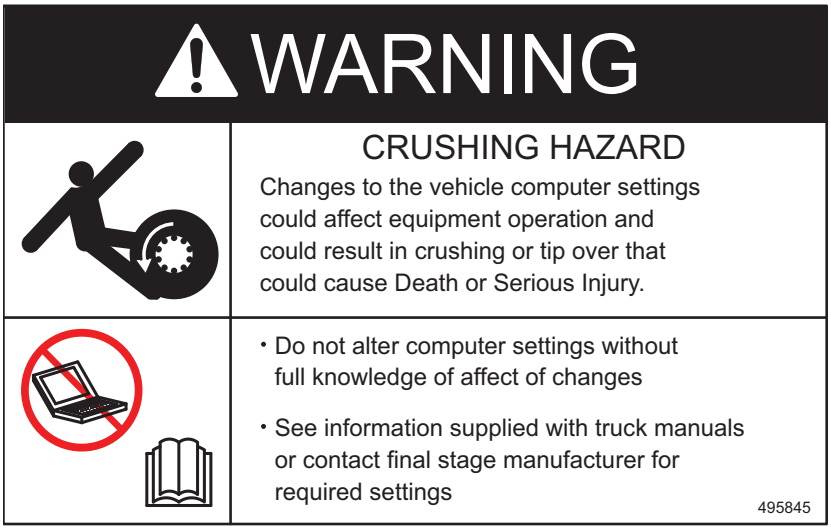

INSPECTION DATE RECORD
Follow the Frequent and Periodic Inspection Intervals as required in the Operators
and Maintenance Manuals. Maintain a record of all inspections.
Stamp or engrave below when and who performed inspections.
Follow component replacement intervals shown in your Maintenance Manual.
CRITICAL FASTENER INSPECTION
DATE
INITIALS
DIELECTRIC TEST
DATE
INITIALS
ANNUAL INSPECTION
DATE
INITIALS
489119A

21.


X1

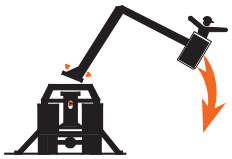
495441

22.


WARNING
CRUSHING HAZARD
Changes to the vehicle computer settings could affect equipment operation and could result in crushing or tip over that could cause Death or Serious Injury.
• Do not alter computer settings without full knowledge of affect of changes
• See information supplied with truck manuals or contact final stage manufacturer for required settings
495845

23.

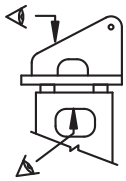
⚠ WARNING



FALL HAZARD

FAILURE TO PROPERLY MAINTAIN THIS MACHINE CAN LEAD TO STRUCTURAL FAILURE AND RESULT IN DEATH OR SERIOUS INJURY

Read and follow all inspection and maintenance schedules in the manual(s). Do not operate machine unless all deficiencies are corrected. Proper maintenance and inspection is required for safe and reliable operation.



Daily Visual Inspection
- all structural components and welds
- all fasteners for damage, signs of looseness or missing from required location.
- damaged or missing covers or guards

Check torque on fasteners as required in manual(s). Fasteners include turntable to rotation bearing, pedestal to rotation bearing, cylinder and boom pivot pins and retainers, subframe mounting bolts and leveling components.

The Aerial Device or Digger Derrick you are operating must be maintained by a qualified person.

495892A

24.

⚠ WARNING

Escaping fluid under pressure can penetrate skin causing serious injury.

Relieve pressure before disconnecting hydraulic lines. Keep away from leaks and pin holes. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

Fluid injected into skin must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene will result.

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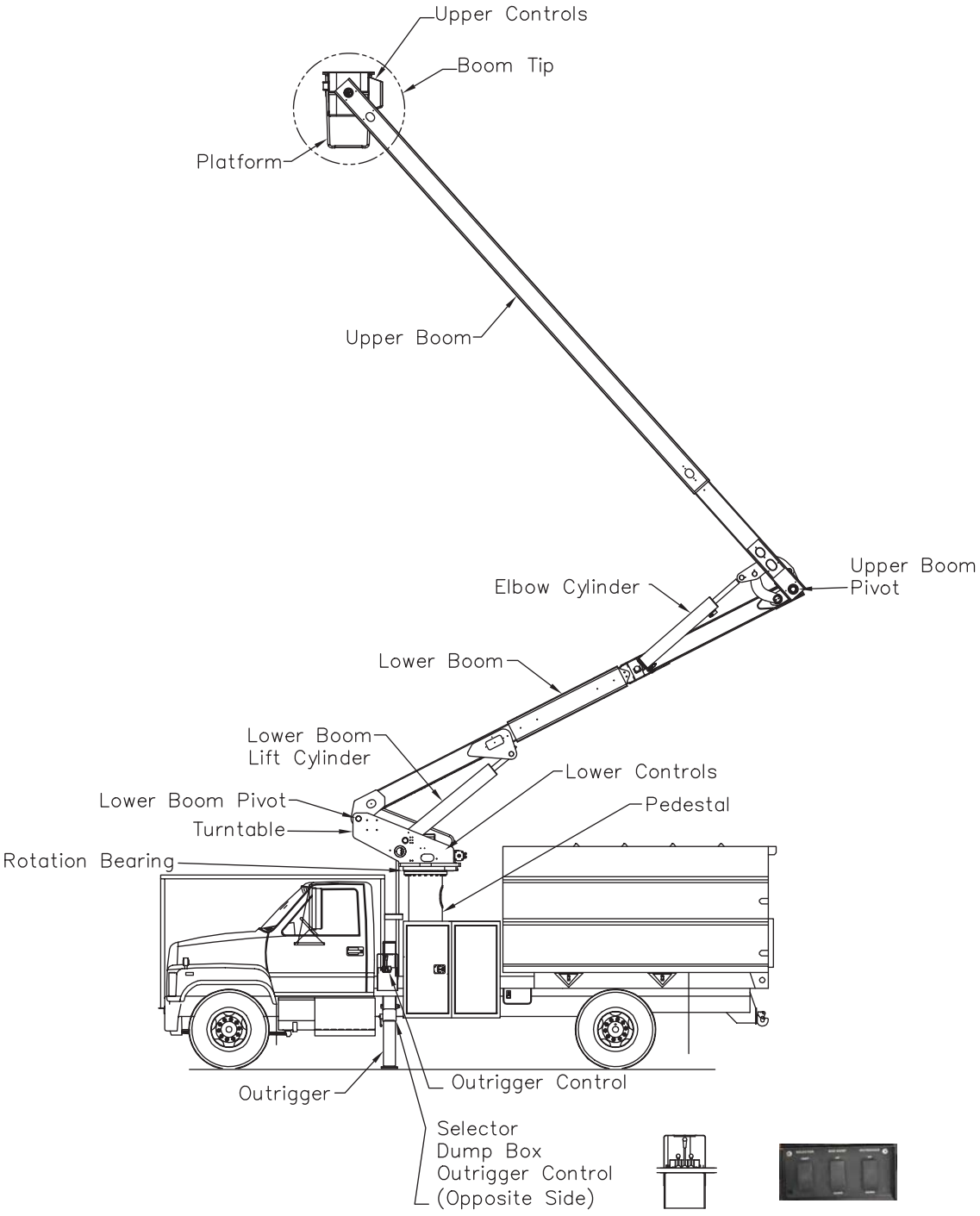
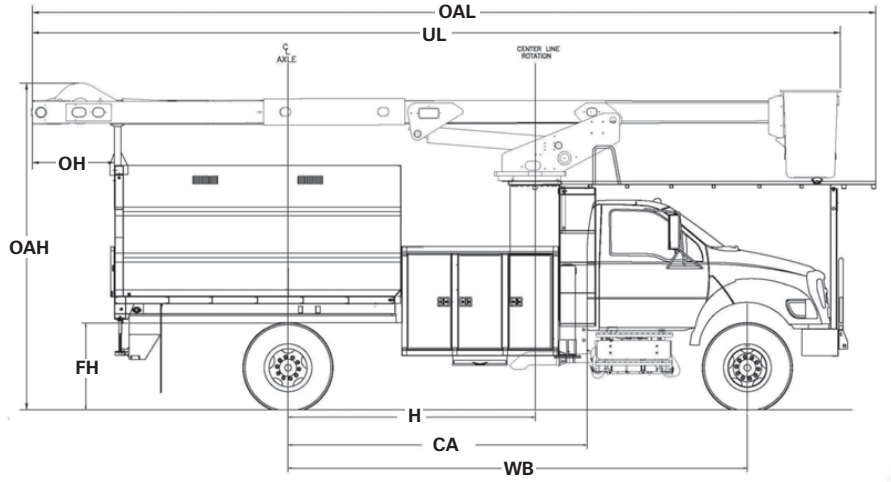
SAFETY RELATED DECALS

SECTION 100
NOMENCLATURE

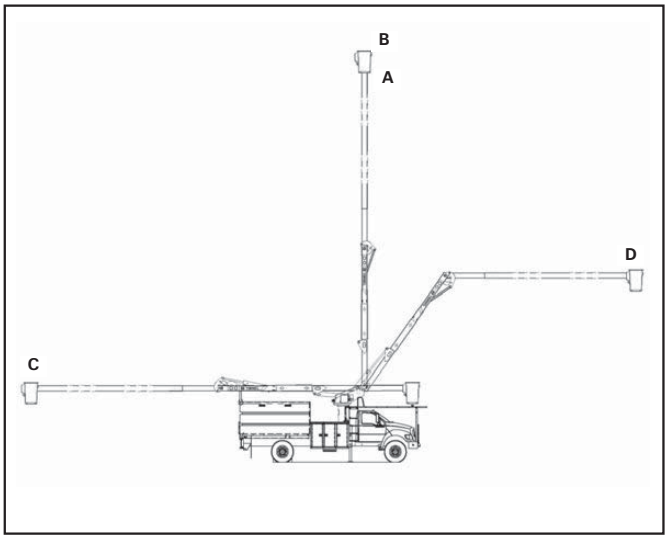


SPECIFICATIONS

The following specifications are for common units. Each installation can be custom to purchasers requirements. They are reference only.



Measurements	XT PRO 56	XT PRO 60	XT PRO 60/70
	BC	BC	BC
Typical Frame Height (FH)	40 in. *(101.6 cm)*	40 in. *(101.6 cm)*	40 in. *(101.6 cm)*
Typical Cab Height (CH)	108 in. *(274.3 cm)*	108 in. *(274.3 cm)*	108 in. *(274.3 cm)*
Offset (O)	94.8 in. *(240.8 cm)*	106.8 in. *(271.3 cm)*	140.8 in. *(357.6 cm)*
Overall Height (OAH)	12′ 6″ *(3.8 m)*	12′ 6″ *(3.8 m)*	12′ 6″ *(3.8 m)*
Overall Length (OAL)	30′ 4″ *(9.2 m)*	32′ 5″ *(9.9 m)*	32′ 5″ *(9.9 m)*
Unit Length (UL)	27′ 8″ *(9.0 m)*	31′ 1″ *(9.5 m)*	31′ 1″ *(9.5 m)*
Overhang Length (OH)	3′ 11″ *(1.2 m)*	3′ 2″ *(1.0 m)*	3′ 2″ *(1.0 m)*
Center of Rotation (H)	96.0 in. *(244.6 cm)*	114.0 in. *(290.0 cm)*	114.0 in. *(290.0 cm)*
Cab to Axle (CA)	120 in. *(304.8 cm)*	138 in. *(350.5 cm)*	138 in. *(350.5 cm)*
Wheel Base (WB)	192 in. *(487.7 cm)*	210 in. *(533.4 cm)*	210 in. *(533.4 cm)*
Front Axle (FA)	9,000 lb. *(4,082 kg)*	10,500 lb. *(4,763 kg)*	13,000 lb. *(5,897 kg)*
Rear Axle (RA)	17,000 lb. *(7,711 kg)*	17,000 lb. *(7,711 kg)*	19,000 lb. *(8,618 kg)*
Gross Vehicle Weight Rating (GVWR)	26,000 lb. *(11,793 kg)*	27,500 lb. *(12,474 kg)*	33,000 lb. *(14,969 kg)*
Recommended Weight for Stability	19,000 lb. *(8,618 kg)*	21,000 lb. *(9,525 kg)*	21,000 lb. *(9,525 kg)*
Frame Section Modulus	18.0 in^3	18.0 in^3	18.0 in^3
Frame Yield Strength	50,000 psi	50,000 psi	50,000 psi
Frame RBM	900,000 in-lbs	900,000 in-lbs	900,000 in-lbs



CAPACITIES & DIMENSIONAL DATA (Based on a 40 Inch Frame Height)

	A Bottom of Platform Height	B Working Height	C Overcenter Side Reach	D Non-Overcenter Side Reach	E Upper Boom Articulation	F Lower Boom Articulation
XT PRO 56	56.0 ft *(17.0 m)*	61.0 ft *(18.6 m)*	45.6 ft *(13.9 m)*	41.5 ft *(12.6 m)*	250°	125°
XT PRO 60	60.0 ft *(18.3 m)*	65.0 ft *(19.8 m)*	49.9 ft *(15.2 m)*	45.0 ft *(13.7 m)*	250°	125°
XT PRO 60/70*	70.0 ft *(21.3 m)*	75.0 ft *(22.9 m)*	49.9 ft *(15.2 m)*	45.0 ft *(13.7 m)*	250°	125°

** Includes Optional 10' Longitudinal Elevator*

NOMENCLATURE

SECTION 101
MAINTENANCE GUIDELINES
PREVENTATIVE MAINTENANCE

A preventative maintenance program based on the manufacturer's recommendations shall be established. Dated and detailed inspection and repair records shall be maintained.

Failure to inspect and maintain equipment endangers operators and crew. Not performing inspections and maintenance is false economy.

It is recommended that the replacement parts for your Aerial Device be obtained from a Terex South Dakota, Inc. distributor or Terex South Dakota, Inc.

MAINTENANCE PROCEDURE

Before maintenance, adjustments, and repairs are started the following precautions shall be taken as applicable:

- You must be authorized by owner to operate unit.
- Place vehicle where it will cause the least interference with other equipment or operations in the area.
- All controls at the off position.
- Starting means rendered inoperative.
- Warning or “OUT OF ORDER” signs placed on the vehicle.
- Power plant stopped or disconnected at power takeoff.
- Relax all hydraulic cylinders used for boom lift and articulation.
- Relieve hydraulic oil pressure from all hydraulic circuits before loosening or removing hydraulic components.

After adjustments and repairs have been made, the Aerial Device shall not be operated until all guards have been reinstalled, trapped air removed from hydraulic system, safety devices reactivated, and maintenance equipment removed.

Warning or “OUT OF ORDER” signs shall be placed and removed by authorized personnel only.

ADJUSTMENTS AND REPAIRS

Any unsafe conditions disclosed by the inspection requirements of this section shall be corrected before operation of the Aerial Device is resumed. Adjustments and repairs shall be done only by qualified personnel.

Adjustments shall be maintained to assure correct functioning of components. The following are examples:

- All functional operating mechanisms.
- Safety devices.
- Control systems.
- Power plants.

Repairs or replacements shall be provided promptly as needed for safe operation. The following are examples:

- All critical parts of functional operating mechanisms which are cracked, broken, corroded, bent or excessively worn. This is for all parts of the Aerial Device, pedestal, subframe, outrigger, and attachments to the vehicle.
- All critical parts of the vehicle structure which are cracked, bent, broken or excessively corroded.
- Hooks showing defects disclosed by “Frequent Inspection” requirements in the maintenance manual shall be discarded. Field repairs by welding or re-shaping shall not be permitted.

All replacement parts or repairs shall have at least the original safety factor. Do not alter, modify, remove or replace any part of the Aerial Device without the approval of the manufacturer.

NOTE: Do not use hoses having less than the correct pressure rating for the working pressure of the hydraulic circuit the hose is installed on. Only use orange hoses marked "Non-Conductive" for hydraulic tools, at the boom tip and in areas that bridge the insulation gap.

LUBRICATION

All moving parts of the Aerial Device and vehicle, for which lubrication is specified, shall be regularly lubricated. Lubricating systems shall be checked for proper delivery of lubricant. Particular care should be taken to follow manufacturer's recommendations as to points and frequency of lubrication, maintenance of lubricant levels and types of lubricant to be used.

The preferred lubes are listed in the lube chart. The following are acceptable for the Aerial Device:

1. Gun Grease: Lithium, Sodium, or Calcium base with EP additives, with no more than 5% molybdenum or graphite filled white grease. Do not use fluorocarbon based lubricants or zinc oxide filled white grease.
2. Gear Grease: If Mobil EP023 is not available, EP85W-140 can be used. More seal leakage may result because of thinner consistency.

Machinery shall be stationary while lubricants are being applied and protection provided as called for in "Maintenance Procedure".

The modification, rework, replacement, or substitution of any part of the Aerial Device with a means not equal to the original equipment provided by the manufacturer may cause serious personal injury.

GENERAL INFORMATION

1. Keep inspection records up-to-date.
2. Record and report all discrepancies to your supervisor.
   a. Records of frequent inspections do not need to be retained unless a discrepancy is found. In that case, a record of the discrepancy and the corrective action must be retained for five (5) years.
   b. Periodic inspections must be dated, signed and kept for five (5) years.
3. A dirty Aerial Device and vehicle cannot be properly inspected. Keep your Aerial Device and vehicle clean!
4. Follow vehicle manufacturer's requirements for inspection, maintenance, and repairs.
5. Only qualified personnel shall do repairs and inspections.
6. Oil spills may require notifying Local, State, or Federal Authorities**.**
7. A post event inspection or test is required if the unit has been overloaded, shock loaded, overturned, in an accident, experienced electrical contact or applications of unintended external force.

The following checklists must be used daily, 180 days (1000 hours), 12 months (2,000 hours), 5 years (10,000 hours) and 10 years (20,000 hours). Failure to do so could endanger the life of the operator. Always remember, preventive maintenance can save much more than it costs.

NOTE: The following check points listed are the minimum recommended by Terex South Dakota, Inc. They are subject to supplementation to conform with your own company regulations.

NOTE: Remember that the safety of all personnel and the operational efficiency of the Aerial Device are dependent upon good inspection checks and maintenance practices.

NOTE: Dirty or dusty conditions or unusual weather conditions may require more frequent maintenance.

Changes to the vehicle computer settings could affect equipment operation and could result in crushing or tip over that could cause death or serious injury.

- Do not alter computer settings without full knowledge of affect of changes.
- See information supplied with truck manuals and contact final stage manufacturer for required settings.

FREQUENT AND PERIODIC INSPECTION INTERVALS

DAILY, PRIOR TO EACH SHIFT

1. Check controls at platform and lower controls for proper operation.
2. Inspect fall protection equipment and attachments.
3. Inspect visual and audible devices.
4. Verify operation of interlocks.
5. Check cleanliness and dryness of fiberglass components.
6. Visually check for missing, damaged, or loose covers and guards.
7. Check for missing and illegible warning, operational, or instructional markings.
8. Visually check oil level in hydraulic reservoir.
9. Visually inspect for leaks in hydraulic system.
10. Visually check all cylinders for leaks.
11. Visually inspect leveling system. (Chains and Insulator Assemblies)
12. Visually inspect all pin retainers and all fasteners for tightness.
13. Visual inspection of all structural members for cracks and permanent deformation.
14. Check for rotational obstructions.
15. Visual inspection of all electrical wires.
16. Operational test of all boom functions.
17. Inspect winch line, hook, and slings.
18. Visually inspect all sprockets, chains, pulleys, and pins.
19. Repair or replace items found to be worn or damaged.

180 DAYS (1,000 HOURS)

1. Inspect exposed hoses.
2. Clean hydraulic tank breather.
3. Check tightness of rotation bearing bolts, turntable to bearing, and bearing to pedestal for proper torque. (see maintenance manual)
4. Daily inspections.
5. Replace return filter. (First 180 day inspection only)
6. Check tension on leveling system.
7. Lubricate all points per lubrication chart recommendations.
8. Apply lubricant to rotation gearbox pinion and turntable bearing.

12 MONTHS (2,000 HOURS)

1. Inspect and lubricate PTO drive shaft to pump.
2. Take samples of hydraulic oil and test.
3. Check all system pressure adjustments for proper setting.
4. Perform cylinder drift tests.
5. Perform structural and critical weld inspections.
6. Perform dielectric tests.
7. Visually inspect any vacuum prevention system and verify proper operation.
8. Daily and 180 days (1,000 hours) inspections.
9. Inspect leveling chain, master links, and leveling rods.
10. Replace return filter.

10 YEARS (20,000 HOURS)

1. Remove leveling chain and leveling rods for inspection. Replace all chains and master links. Inspect leveling rods and replace as needed.
2. Daily, 180 days (1,000 hours), and 12 months (2,000 hours) inspections.

OPERATIONAL TESTS

Perform all of the tests and checks that follow. Cycle times must be within limits. Repair the problem that is evident in the component.

SPEED TESTS

Speed tests should be taken with one man in platform and hydraulic fluid at normal operating temperature. Check that all times are within the limits specified in the Quick Reference Guide.

1. Check that boom(s) operate smoothly over full travel, without squeaking or other noise.
2. Check that all moveable hydraulic and control hoses operate over full range of boom and turntable movements without stretching, kinking or rubbing on sharp corners.

CONTROL SYSTEM

1. Check that all moveable hydraulic and control hoses operate over full range of boom and turntable movements without stretching, kinking or rubbing on sharp corners.
2. Check that control handle returns to neutral when released from any position.
3. Check that all movements can be made to start smoothly, without jerking or sudden motion when control handle is moved slowly.
4. Check that control head trigger energizes and de-energizes system so no movement of the booms occurs if not actuated.

ELECTRICAL TESTS

Dielectric integrity of the booms must be tested every year or 2,000 hours of operation, whichever occurs first, or if insulating components are replaced or if the insulation value is in question.

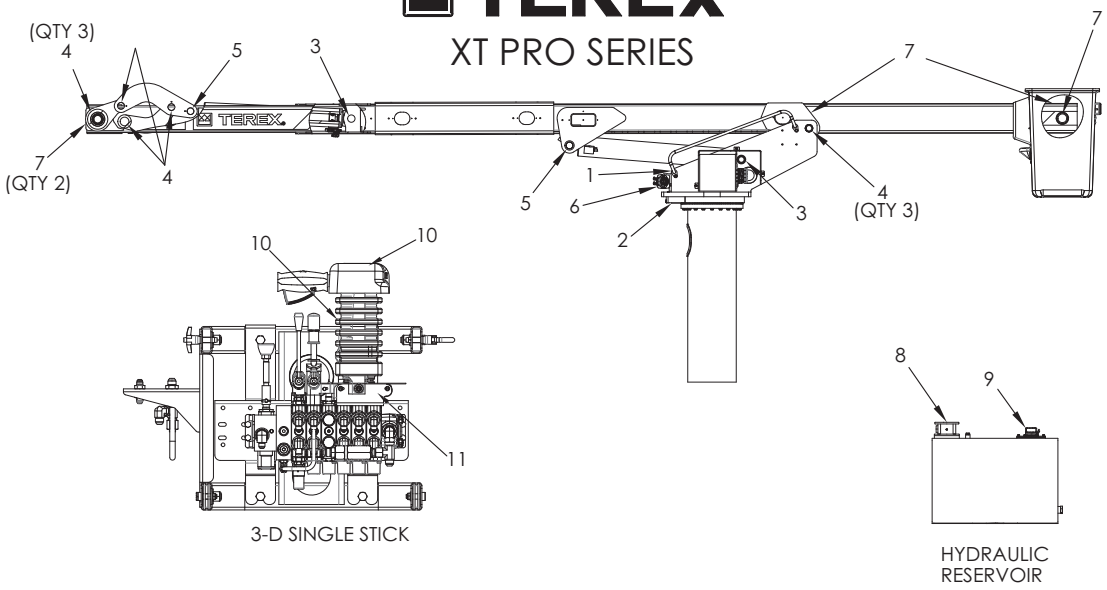
Platform insulation must never be depended upon when operating in an electrical environment, and platform must be considered as having no insulation value without a tested and certified liner installed.

Follow electrical test specifications as prescribed by ANSI A92.2 for proper test procedure for the classification of unit being tested. See Maintenance Manual for proper dielectric testing.

POST EVENT INSPECTION AND TEST

After any event where the aerial is subject to excessive loading or stress such as; overturning, unintended external mechanical or electrical forces, shock loading or overload, the aerial device shall be removed from service and a periodic inspection performed. In addition to the periodic inspection other non-destructive inspection procedures may be required to detect possible structural damage. All damaged items shall be replace or repaired before the unit is returned to service. Return to service shall be approved by a qualified person and the inspection and repair information recorded and retained.

LUBRICATION CHART



ITEM	LUBRICATION POINT		LUBRICANT RECOMMENDED	SERVICE	
				INTERVAL	METHOD
1	ROTATION BEARING	**	LITHIUM-BASE EP #2 GREASE	180 DAYS 1000 HRS	GREASE GUN
2	ROTATION GEAR TEETH				
3	CYL. BALL BUSHINGS				
4	PIVOT BUSHINGS				
5	CYL. BUSHINGS				
6	ROTATION SPEED REDUCER		MOBILUX® EP 023	180 DAYS 1000 HRS	† FILL IF LOW
7	CHAINS		NON-DETERGENT SAE 30	180 DAYS 1000 HRS	BRUSH
8	RETURN LINE FILTER		SEE MAINTENANCE MANUAL		
9	HYDRAULIC RESERVOIR	*	PREMIUM ISO 15 HYDRAULIC FLUID	DAILY	† FILL IF LOW
10	CONTROL HANDLE PIVOTS		LUBRICATING OIL	AS REQ'D.	SPRAY
11	VALVE LINKAGE				
12	BASKET SHAFT				

USE THE ABOVE PRODUCTS OR EQUIVALENT:

† ALWAYS DRAIN AND REFILL WHEN DISASSEMBLED OR REBUILT.

NOTE: ALL MOVING PARTS NOT EQUIPPED WITH GREASE FITTINGS SHOULD BE LUBRICATED WITH A PENETRATING TYPE LUBRICANT AS REQUIRED.

DUSTY AND DIRTY CONDITIONS WILL REQUIRE MORE FREQUENT LUBRICATION.

* DRAIN & FILL WHEN CONTAMINATED.

** LUBRICATE SPARINGLY EVERY 1/8 REVOLUTION, FOR TWO REVOLUTIONS IF UNIT HAS CONTINUOUS ROTATION.

FOR COLD WEATHER APPLICATIONS:
USE AIRCRAFT HYDRAULIC FLUID MIL-5606A - SEE MANUAL FOR PROPER FLUID SELECTION.

611901B

Inspect recovery winch rope and hooks before use according to the winch and rope manufacturer's recommendations.

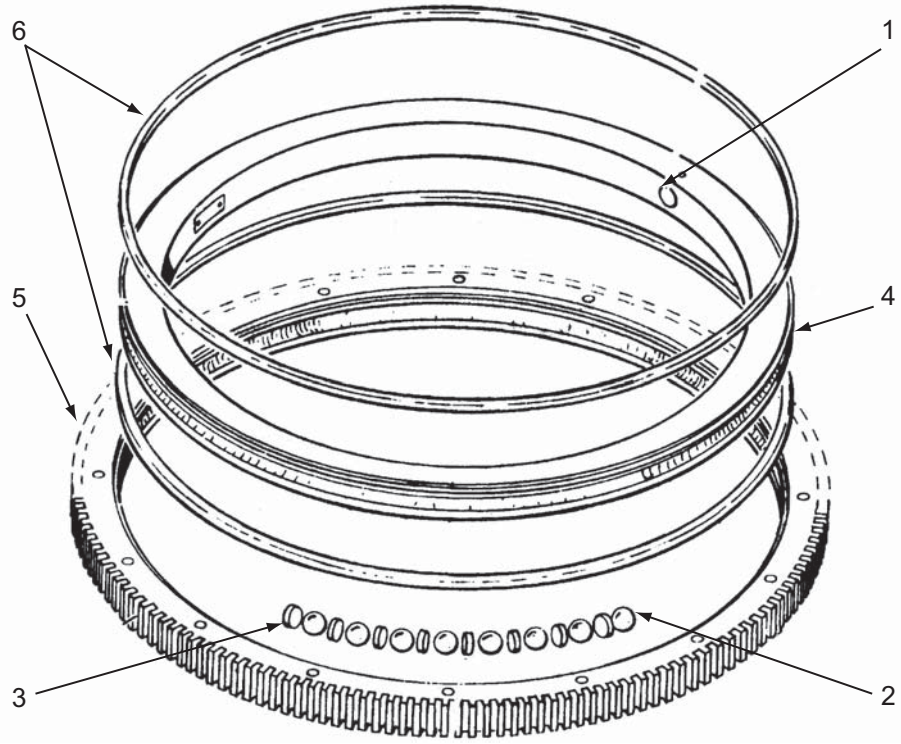
STORAGE PROCEDURE

When a unit will not be used for a period of time, it should be prepared for storage to reduce the deteriorating effects of the environment. This includes the following:

- Wash and clean to remove accumulated road grime. It can discolor the paint if left on for long periods of time.
- Clean and wax the fiberglass components. If storage is in the sun, cover the booms.
- Clean and coat the exposed cylinder rods with grease, preservative spray or heavy preservative oil.
- Clean and grease the exposed valve spools and linkage.
- Lubricate the entire Aerial Device following the lube chart.
- Check the oil for pH level and water content. Acidic oil or water in the oil may settle out during storage and can rust the interior of the hydraulic system.
- Cover the platform to prevent water from accumulating. A platform full of water can weigh over 900 lbs. (408 kg) and exceed the capacity of the platform.
- Ensure the hydraulic tank filler-breather filter is intact to prevent dirt entering the tank when the temperature changes.
- Grease all sliding surfaces where there is metal contact to prevent rust.
- Touch up any bare metal and where the paint is chipped or cracked.
- Spray the electric collector commutators with LPS 1 or CRC 5-56 to prevent corrosion of the surface.
- Service the truck as recommended by the manufacturer.

NOTE: The period of time between uses when the unit should be prepared for storage varies with the location. If the climate is temperate and dry it may be 4 months. If it is in a humid area next to the ocean with the salt air it may be only 2 weeks. Cylinders which are not cycled fully in normal use must be cycled through a full stroke weekly to maintain on oil film on the exposed rod surface.

SECTION 102
GENERAL MAINTENANCE
ROTATION BEARING MAINTENANCE



1. Unloading Plug
2. Bearings
3. Spacers
4. Inner Ring
5. Outer Ring
6. Seal

During normal inspections the seal (6) should be checked for proper retention to keep dirt and moisture from entering the bearing. If the bearing seals have come out of place they may be visible through the rotation bearing bolt access holes located in the pedestal and turntable.

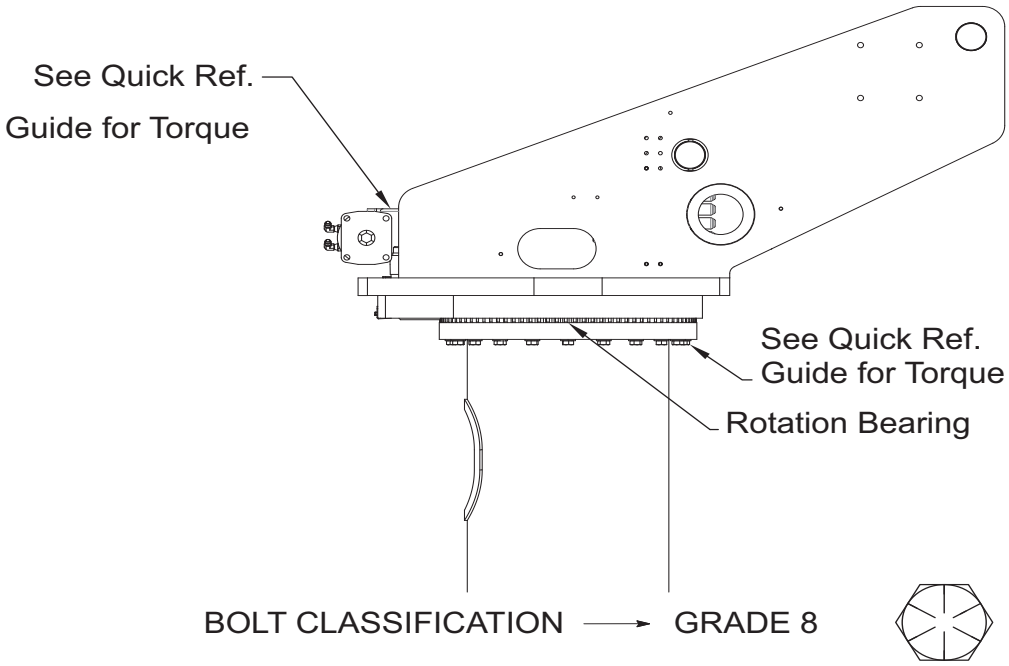
Bearing lubrication should be done at the intervals specified on the Lubrication Chart. Lubricate the bearing in eight different locations around the circumference by repositioning the boom rotation after lubrication is performed at each location; repeat for two rotations. Lubricate sparingly, seals can be pushed out by over lubrication of the rotation bearing.

Do not lubricate while moving boom.

Refer to the Quick Reference Guide for the bearing bolt torque and lubricant to use. Check the bearing bolt torque per maintenance schedule.

NOTE: In cold weather, do not apply excessive pressure during lubrication of the rotation bearing, this may result in damage to the seals.

ROTATION BEARING BOLT MAINTENANCE



The fasteners connecting the upper rotating structure to the turntable bearing and the turntable bearing to the pedestal are critical fasteners that must be inspected and maintained periodically as specified in the Operators and Maintenance Manuals. If one or more bolts loosen or stretch, the loading is transferred to the adjacent bolts making them support more than their share of the load. Should the unit be allowed to operate in this manner, the fasteners will eventually fatigue and failure will occur.

Improperly torqued or incorrect bearing bolts can cause death or serious injury.

Failure to properly inspect and maintain fasteners can result in failure of the fasteners, causing death or serious injury.

To prevent failure of the turntable bearing fasteners, they must be inspected at intervals specified in the Operator's and Maintenance Manuals for the unit.

This requires:

- Daily visual inspection for loose or missing fasteners.
- Periodically verify the torque of all turntable bearing bolts.

Daily visual inspection is observing for indicators, such as:

- Missing or broken fasteners.
- Loose washers or gaps under fastener heads.
- Indications of looseness, such as shiny areas on washer or mounting surfaces.

If any conditions above are observed, stop operation immediately. Notify the appropriate individuals in your company and have the machine repaired, it is not safe to use. Check the torque on all bearing fasteners and correct as required.

The daily and periodic inspection also must include a visual inspection of all pins, retainers and other fasteners in addition to the turntable bearing fasteners.

Verify the torque of the turntable bearing fasteners at 180 day intervals, (or by hour of operation), to the torque shown in the Quick Reference Guide.

- Use a calibrated torque wrench. It can be a clicker or dial type.
- Use extensions, socket, or crowfoot wrenches as required.
- Determine the proper torque from the Quick Reference Guide.
- Check ALL bearing fasteners, turntable to bearing and bearing to pedestal. If items prevent access to the bolt head with a socket it will require using a crow foot wrench or removing the item that interferes. When a crow foot wrench is used the torque setting of the wrench must be adjusted to account for the variation in leverage. See the information supplied with your torque wrench to determine adjustment.
- Mark a corner of the fastener to determine movement. Apply the torque to the head of the fastener, slowly increase the torque on the fastener until the torque wrench clicks or shows you have reached the required torque. Do not exceed the torque value in the Quick Reference Guide. Do not jerk the wrench. If the fastener does not move continue to next fastener.
  - First torque check at 180 days: Due to variations in torque wrench calibrations at the first 180 day torque interval if the fastener moves less than 1/8” measured at a point of the hex and holds torque mark this fastener and continue to the next fastener.
  - Torque checks after first check: Any torque checks after the first 180 day interval if the movement at a point is less than 1/16” and it holds torque mark the fastener and continue to the next. If the fastener moves at the next torque interval it must be replaced.
- If the fastener does not hold torque or moves more than allowed it must be removed and replaced. If the fastener is a bolt using a nut, both must be replaced. We recommend using only Terex South Dakota, Inc. supplied fasteners to ensure the proper grade and reduce the chance of counterfeit fasteners. There are several finishes used on fasteners that cause the tension to vary. Replace fasteners only with the same grade and finish.
- The bolting surfaces, holes and threads must be cleaned thoroughly before installing a new fastener.
- Lubricate fastener with appropriate lube shown in the Quick Reference Guide.
- Washers (if equipped) used with bearing fasteners are hardened flat washers. If damaged, replace with a hardened flat washer, do not use lock washers.
- Replace all covers and items moved or removed and verify operation before returning to service.
- Document the service performed as required by ANSI A92.2.

Torque intervals:

- The Frequent and Periodic inspection intervals for turntable bearing fasteners is to check the torque at the 180 day intervals.
- This 180 day interval can be increased to annually only if all fasteners do not move on two successive 180 day torque inspections.
- If at subsequent annual inspections any fasteners move the interval must be reduced and performed at the 180 day interval until the fasteners do not have movement during two successive torque inspections. Then the interval can be increased to annually.
- When the turntable bearing, weldments or fasteners are replaced, the same criteria would apply as for new machines. The torque must be checked at 180 day intervals. If two successive torque checks at 180 day intervals do not have any fastener movement, the interval can be increased to annually.

The information above is related to the turntable bearing fasteners. The daily visual inspection, continuous observation for unusual noise or operation, and following the maintenance Frequent and Periodic Inspection Intervals apply to all fasteners, pins and pin retainers of all units.

NOTE: Torque values are based on torquing the bolt head in all applications with the proper washer. Lubricate the washer under the bolt head and the threads with the indicated lubricant.

NOTE: If the rotation bearing is removed, ensure the mounting surfaces are smooth and clean to ensure full contact between the bearing and mounting surface. Apply RTV (room temperature vulcanizing) in bolt holes as indicated in the illustration above.

NOTE: There are three different finishes used on turntable bearing bolts. They are black oxide, yellow zinc, and bright zinc. The bolts must be the same for one bearing race. There are slight torque tension differences that would not evenly load the bolts if they are mixed on one bearing race.

FASTENERS AND TORQUE VALUES

BOLT TIGHTENING DATA

The Aerial Device utilizes fasteners of different grades, sizes, and types. Each fastener is selected, installed, and tightened to perform a specific function.

NOTE: Some fasteners used on the Aerial Device require special torque values. Consult the Quick Reference Guide or the appropriate section for torque values.

1. Use the torque charts on the following pages for all other threaded fasteners which do not specify a torque.
2. Torque chart values, when applied, must not distort components being fastened.
3. Sheet metal screws are not subject to torque chart values and need not be monitored for proper tightening. For all other applications, where the fastener performs a structural function and where holding of the joined members is ESSENTIAL, torque chart values must be applied.
4. SAE Grade 2 fasteners are soft and have no marking on the head. SAE Grade 5 fasteners have three equally spaced hash marks on the head. SAE Grade 8 fasteners have six equally spaced hash marks on the head (See illustration on following page).
5. The chart values for lubricated fasteners use oil unless otherwise specified.

At least annually inspect all fasteners for tightness or damage. This includes but not limited to: pins and pin retainers, wear pad fasteners, all mounting hardware, tie down bolts, and torsion bar fasteners.

NOTE: The turntable bearing fasteners require more frequent inspection.

CRITICAL FASTENERS

Many fasteners on an Aerial Device are critical for operation. If the daily visual inspection finds any suspect fasteners that may be loose, damaged or missing, then further inspection is required. The Rotation bearing bolts, both turntable to bearing and pedestal to bearing also require a torque check every 6 months. Refer to the General Maintenance section of this manual for frequency and values for rotation bearing bolts. A more thorough inspection of all fasteners is to be done at the annual inspection.

The daily visual inspection for loose, missing or damaged fasteners shall include:

1. Rotation bearing bolts, both turntable to bearing and pedestal to bearing.
2. Gearbox and winch fasteners
3. Platform rotation fasteners
4. All pivot pins
5. All pin retainers
6. All cylinder attaching fasteners
7. Cover and guard attaching fasteners
8. Subframe to truck mounting bolts and fasteners
9. Outrigger pins and retainers

BOLT TORQUE CHART

	SAE GRADE 2		SAE GRADE 5		SAE GRADE 8	
	ASSEMBLY TORQUE		ASSEMBLY TORQUE		ASSEMBLY TORQUE	
SIZE	DRY	LUBRICATED	DRY	LUBRICATED	DRY	LUBRICATED
1/4 - 20	66 in. lbs. (7 N-m)	49 in. lbs. (6 N-m)	8 ft. lbs. (11 N-m)	75 in. lbs. (8 N-m)	12 ft. lbs. (16 N-m)	9 ft. lbs. (12 N-m)
1/4 - 28	76 in. lbs. (9 N-m)	56 in. lbs. (6 N-m)	10 ft. lbs. (14N-m)	86 in. lbs. (10 N-m)	14 ft. lbs. (19 N-m)	10 ft. lbs. (14 N-m)
5/16 - 18	11 ft. lbs. (15 N-m)	8 ft. lbs. (11 N-m)	17 ft. lbs. (23 N-m)	13 ft. lbs. (18 N-m)	25 ft. lbs. (34 N-m)	18 ft. lbs. (24 N-m)
5/16 - 24	12 ft. lbs. (16 N-m)	9 ft. lbs. (12 N-m)	19 ft. lbs. (26 N-m)	14 ft. lbs. (19 N-m)	25 ft. lbs. (34 N-m)	20 ft. lbs. (27 N-m)
3/8 - 16	20 ft. lbs. (27 N-m)	15 ft. lbs. (20 N-m)	30 ft. lbs. (41 N-m)	23 ft. lbs. (31 N-m)	45 ft. lbs. (61 N-m)	35 ft. lbs. (47 N-m)
3/8 - 24	23 ft. lbs. (31 N-m)	17 ft. lbs. (23 N-m)	35 ft. lbs. (47 N-m)	25 ft. lbs. (34 N-m)	50 ft. lbs. (68 N-m)	35 ft. lbs. (47 N-m)
7/16 - 14	30 ft. lbs. (41 N-m)	24 ft. lbs. (33 N-m)	50 ft. lbs. (68 N-m)	35 ft. lbs. (47 N-m)	70 ft. lbs. (95 N-m)	55 ft. lbs. (75 N-m)
7/16 - 20	35 ft. lbs. (47 N-m)	25 ft. lbs. (34 N-m)	55 ft. lbs. (75 N-m)	40 ft. lbs. (54 N-m)	80 ft. lbs. (108 N-m)	60 ft. lbs. (81 N-m)
1/2 - 13	50 ft. lbs. (68 N-m)	35 ft. lbs. (47 N-m)	75 ft. lbs. (102 N-m)	55 ft. lbs. (75 N-m)	110 ft. lbs. (149 N-m)	80 ft. lbs. (108 N-m)
1/2 - 20	55 ft. lbs. (75 N-m)	40 ft. lbs. (54 N-m)	90 ft. lbs. (122 N-m)	65 ft. lbs. (88 N-m)	120 ft. lbs. (163 N-m)	90 ft. lbs. (122 N-m)
9/16 - 12	65 ft. lbs. (88 N-m)	50 ft. lbs. (68 N-m)	110 ft. lbs. (149 N-m)	80 ft. lbs. (108 N-m)	150 ft. lbs. (203 N-m)	110 ft. lbs. (149 N-m)
9/16 - 18	75 ft. lbs. (102 N-m)	55 ft. lbs. (75 N-m)	120 ft. lbs. (163 N-m)	90 ft. lbs. (122 N-m)	170 ft. lbs. (231 N-m)	130 ft. lbs. (176 N-m)
5/8 - 11	90 ft. lbs. (122 N-m)	70 ft. lbs. (95 N-m)	150 ft. lbs. (203 N-m)	110 ft. lbs. (149 N-m)	220 ft. lbs. (298 N-m)	170 ft. lbs. (231 N-m)
5/8 - 18	100 ft. lbs. (136 N-m)	80 ft. lbs. (108 N-m)	180 ft. lbs. (244 N-m)	130 ft. lbs. (176 N-m)	240 ft. lbs. (325 N-m)	180 ft. lbs. (244 N-m)
3/4 - 10	160 ft. lbs. (217 N-m)	120 ft. lbs. (163 N-m)	260 ft. lbs. (353 N-m)	200 ft. lbs. (271 N-m)	380 ft. lbs. (515 N-m)	280 ft. lbs. (380 N-m)
3/4 - 16	180 ft. lbs. (244 N-m)	140 ft. lbs. (190 N-m)	300 ft. lbs. (407 N-m)	220 ft. lbs. (298 N-m)	420 ft. lbs. (570 N-m)	320 ft. lbs. (434 N-m)
7/8 - 9	140 ft. lbs. (190 N-m)	110 ft. lbs. (149 N-m)	400 ft. lbs. (542 N-m)	300 ft. lbs. (407 N-m)	600 ft. lbs. (814 N-m)	460 ft. lbs. (624 N-m)
7/8- 14	155 ft. lbs. (210 N-m)	120 ft. lbs. (163 N-m)	440 ft. lbs. (597 N-m)	320 ft. lbs. (434 N-m)	660 ft. lbs. (895 N-m)	500 ft. lbs. (678 N-m)
1 - 8	220 ft. lbs. (298 N-m)	160 ft. lbs. (217 N-m)	580 ft. lbs. (786 N-m)	440 ft. lbs. (597 N-m)	900 ft. lbs. (1220 N-m)	680 ft. lbs. (922 N-m)
1 - 12	240 ft. lbs. (325 N-m)	170 ft. lbs. (231 N-m)	640 ft. lbs. (868 N-m)	480 ft. lbs. (651 N-m)	1000 ft. lbs. (1356 N-m)	740 ft. lbs. (1003 N-m)
1 1/8 - 7	300 ft. lbs. (407 N-m)	220 ft. lbs. (298 N-m)	800 ft. lbs. (1085 N-m)	600 ft. lbs. (814 N-m)	1280 ft. lbs. (1736 N-m)	960 ft. lbs. (1302 N-m)
1 1/8 - 12	340 ft. lbs. (461 N-m)	260 ft. lbs. (353 N-m)	880 ft. lbs. (1193 N-m)	660 ft. lbs. (895 N-m)	1440 ft. lbs. (1953 N-m)	1080 ft. lbs. (1464 N-m)
1 1/4 - 7	420 ft. lbs. (570 N-m)	320 ft. lbs. (434 N-m)	1120 ft. lbs. (1519 N-m)	840 ft. lbs. (1139 N-m)	1820 ft. lbs. (2468 N-m)	1360 ft. lbs. (1844 N-m)
1 1/4 - 12	460 ft. lbs. (624 N-m)	360 ft. lbs. (488 N-m)	1240 ft. lbs. (1681 N-m)	920 ft. lbs. (1248 N-m)	2000 ft. lbs. (2712 N-m)	1500 ft. lbs. (2034 N-m)
1 3/8 - 6	560 ft. lbs. (759 N-m)	420 ft. lbs. (570 N-m)	1460 ft. lbs. (1980 N-m)	1100 ft. lbs. (1491 N-m)	2380 ft. lbs. (3227 N-m)	1780 ft. lbs. (2414 N-m)
1 3/8 - 12	640 ft. lbs. (868 N-m)	460 ft. lbs. (624 N-m)	1680 ft. lbs. (2278 N-m)	1260 ft. lbs. (1709 N-m)	2720 ft. lbs. (3688 N-m)	2040 ft. lbs. (2766 N-m)
1 1/2 - 6	740 ft. lbs. (1003 N-m)	560 ft. lbs. (759 N-m)	1940 ft. lbs. (2631 N-m)	1460 ft. lbs. (1980 N-m)	3160 ft. lbs. (4285 N-m)	2360 ft. lbs. (3200 N-m)
1 1/2 - 12	840 ft. lbs. (1139 N-m)	620 ft. lbs. (841 N-m)	2200 ft. lbs. (2983 N-m)	1640 ft. lbs. (2224 N-m)	3560 ft. lbs. (4827 N-m)	2660 ft. lbs. (3607 N-m)

NOTE: The above is for reference, some fasteners will require special torque values. Consult the Quick Reference Guide or the appropriate section for torque values.

SOCKET HEAD SCREWS TORQUE CHART

Bolt head identification marks as per grade. NOTE: Manufacturing marks will vary.	SOCKET HEAD SCREWS TORQUE		SOCKET HEAD SHOULDER SCREWS TORQUE	
BOLT SIZE INCHES & MILLIMETERS	FT. LBS.	N-M	FT. LBS.	N-M
1/4.....6.35	14	19	9	12.2
5/16.....7.94	30	40.7	20	27.7
3/8.....9.53	50	68	33	44.9
7/16.....11.11	80	108.8		
1/2.....12.70	120	163.2	83	112.9
9/16.....14.29	170	231.2		
5/8.....15.88	240	326.4	165	
3/4.....19.05	400	544	290	394.4
7/8.....22.23	630	856.8	465	632.4
1.....25.40	960	1305.6		
1-1/8.....25.58				
1-1/4.....31.93	2120	2883.2		
1-3/8.....34.93				
1-/12.....38.10	3000	4080		

JIC SWIVEL NUT (37 DEGREE SEAT) TORQUE CHART

THREAD SIZE	SIZE	OD TUBE	TORQUE FT. LBS. (N-M)
7/16 - 20	4	1/4	9 (12)
1/2 - 20	5	5/16	17 (23)
9/16 -18	6	3/8	20 (27)
3/4 - 16	8	1/2	30 (41)
7/8 - 14	10	5/8	40 (54)
1 1/16 - 12	12	3/4	85 (115)
1 3/16 - 12	14	7/8	100 (136)
1 5/16 - 12	16	1	110 (149)
1 5/8 -12	20	1-1/4	150 (203)
1 7/8 - 12	24	1-1/2	170 (231)
2 1/2 - 12	32	2	300 (407)
	40	2-1/2	400 (542)
	48	3	500 (678)

The torque required to seal swivel female fittings or hose couplings to a male connector depends on many variables such as fluid medium, surface finish, etc.

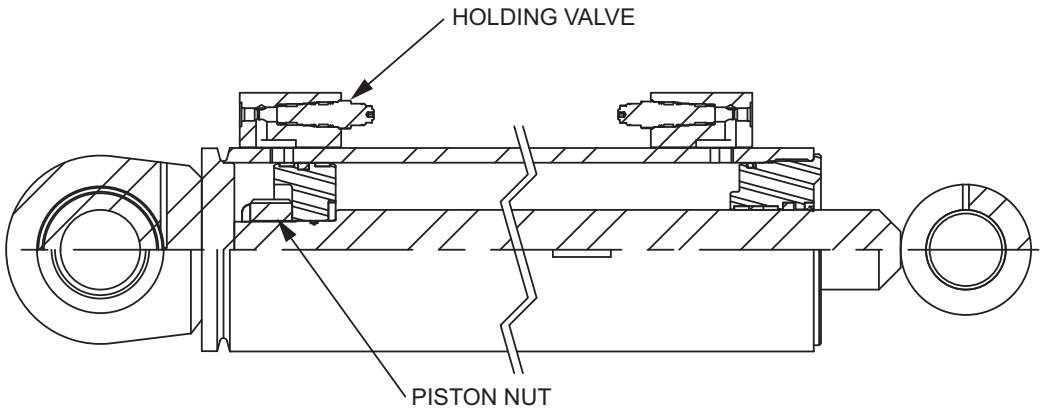
The above values are intended only as a guide for the maximum values the fittings may be subjected to.

These values are the recommended torque values for JIC (37 degree Seat) Swivel nuts either swaged or brazed type. The swivel nuts will normally withstand this torque for a minimum of 15 repeated assemblies.

SAE O-RING BOSS FITTING TORQUE CHART

		O-RING		
SAE #	TUBE SIZE	ARP #	T.T. P/N	TORQUE IN-LBS (N-M)
4	1/4 in.	904	55638	107 (12) +/- 10 (1)
5	5/16 in.	905	79994	145 (16)+/- 20 (2)
6	3/8 in.	906	55639	225 (25)+/- 25 (3)
8	1/2 in.	908	15690	420 (47)+/- 50 (6)
10	5/8 in.	910	438594	660 (75)+/- 50 (6)
12	3/4 in.	912	55641	900 (102)+/- 50 (6)
16	1 in.	916	18586	1200 (136)+/- 80 (9)
20	1-1/4 in.	920	415240	1600 (181)+/- 80 (9)
24	1-1/2 in.	924	438595	2000 (226)+/- 80 (9)
32	2 in.	932	421348	2800 (316)+/- 120 (14)

CYLINDER PISTON LOCKNUT TORQUE CHART



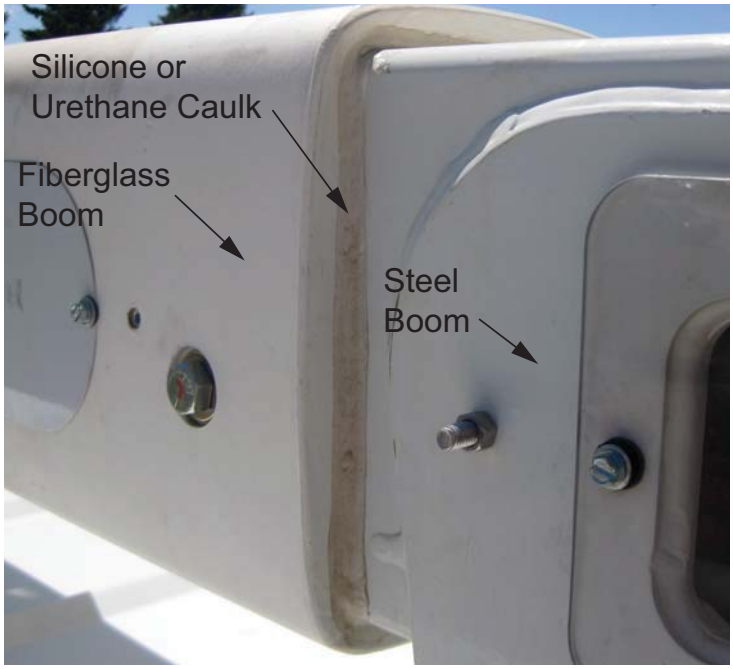
NOTE: Consult the Quick Reference Guide or the appropriate section for torque values.

WELD SEAM

For design reasons some welds are intermittent or not welded at all seams. These areas are caulked and also need to be inspected to insure a seal to keep water out and prevent rust.

STEEL/FIBERGLASS JOINT CAULKING

The joint at the fiberglass and steel sections of the upper boom and the lower boom insert must be sealed with a bead of urethane or silicone caulk to prevent moisture entering the joint. Clean the area and apply a bead all around. Smooth so it bonds to both the steel and the fiberglass.



NOTE: The seal must be inspected periodically. If rust develops underneath the caulk, remove caulk, remove rust, apply rust inhibiting paint, and reseal

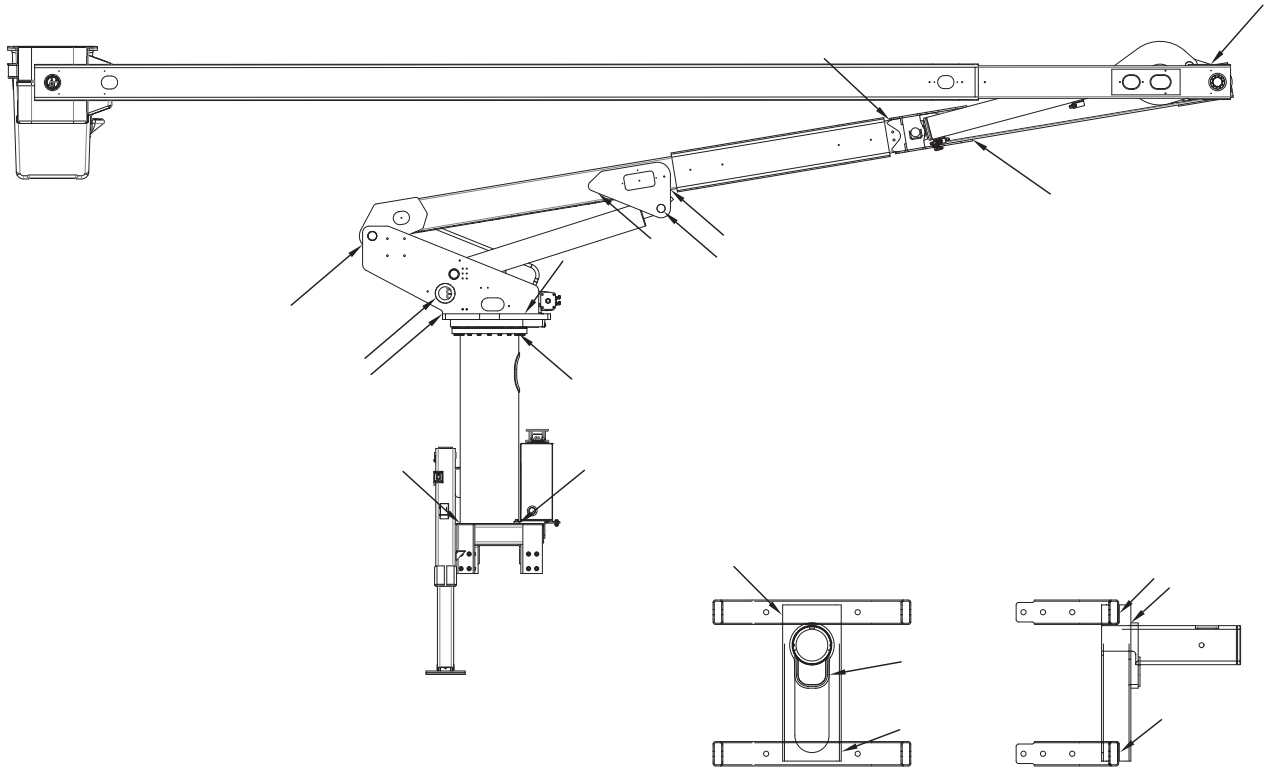
CRITICAL WELDS

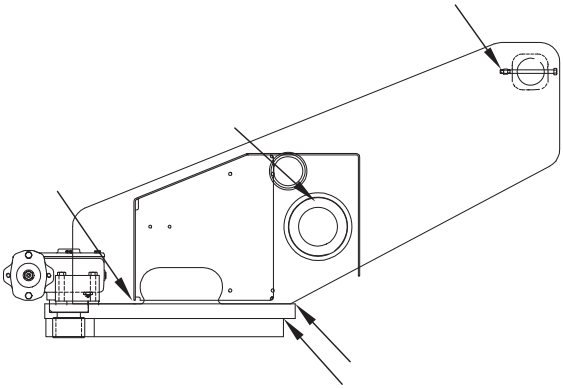
The structual integrity of the aerial device must be verified. Certain structural components or areas of the aerial lift are termed critical. These items should be visually inspected for signs of deformation, cracks, electrical contact marks, fatigue or impending failure. Any suspect areas should be further inspected using an acceptable non-destructive test procedure such as magnetic particle or dye penetrant testing. Repair or replace any defective items found. Contact Terex Utilities for repair procedures on the defective component.

The following diagrams show specific areas that must be inspected. Inspection areas include: any welds, all boss locations, weldment assemblies which pivot, side plates attached to boom tubes, turntable weldments, cylinder attachments, elbow weldments, cylinder case and rod weldments must be inspected. Also inspect the pedestal to subframe weldments, subframe to outrigger weldments, and outrigger components and outrigger feet.

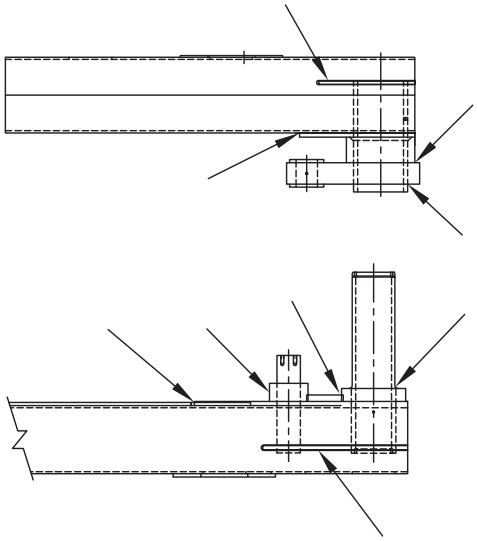
If excessive motion is detected during operation or inspection, stop in position. Do not operate until the problem has been diagnosed and resolved with operator safety in mind. Remove covers as necessary to examine the supporting structures thoroughly.

Keep unit clean to properly inspect structural components. Components cannot be inspected properly when covered in grease and dirt.

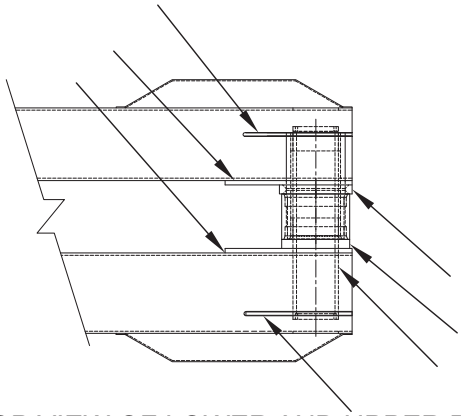




TURNTABLE

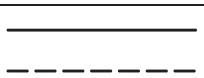
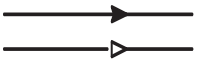
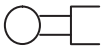
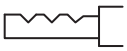
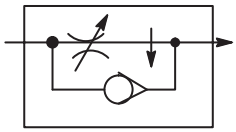
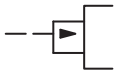
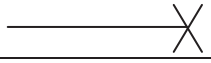
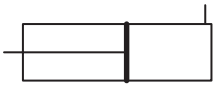
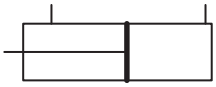


LOWER AND UPPER BOOM

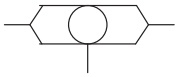
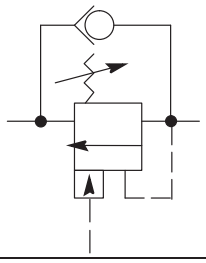
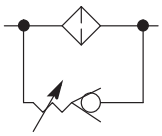
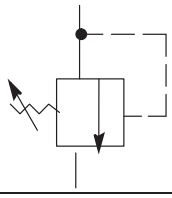
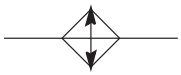
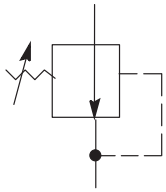
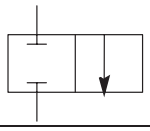
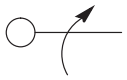
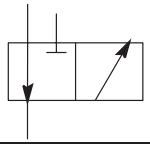
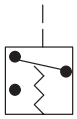
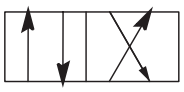
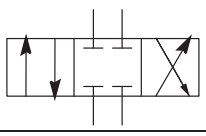


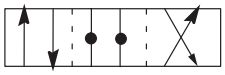
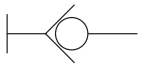
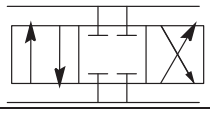
TOP VIEW OF LOWER AND UPPER BOOM

SYMBOLS

	Line, pressure or return line, sense (Pilot Control)		Spring
	Component enclosure		Rotary operation
	Hydraulic flow of direction Pneumatic flow of direction		Push button operation
	Line crossing		Pedal operation
	Line crossing		Mechanical operation
	Lines connected		2 position detent
	Line with fixed restriction		3 position detent
	Adjustable flow control, non-compensated		Solenoid, single winding operation
	Adjustable flow control pressure compensated with reverse flow check		Pilot pressure
	Fluid conductor blocked		Vented reservoir
	Single acting, single rod cylinder		Pressurized reservoir
	Double acting, single rod cylinder		Line to reservoir above fluid level
	Uni-directional hydraulic motor (fixed displacement)		Line to reservoir below fluid level
	Hydraulic motor (bi-directional) (fixed displacement)		Atmospheric check valve with filter

	Electric motor	
	Uni-directional hydraulic pump (fixed displacement)	
	Uni-directional hydraulic pump (variable displacement)	

	Check valve		Shuttle valve
	Counterbalance valve		Filter with adjustable bypass
			Filter strainer
	Pressure relief valve		Heater
			Cooler
	Pressure reducing valve		Variable flow pressure compensated flow control
	2 position, 2 way valve		Direction of shaft rotation
	2 position, 3 way valve		Pressure switch
	2 position, 4 way valve		Pressure gauge
	3 position, 4 way valve		Temperature gauge

	2 position, in transition 4 way valve		Quick disconnect
	Valves capable of infinite positioning		Manual shut-off valve

SECTION 110
CHAIN MAINTENANCE

CHAIN LIFE

Chain replacement is required when the chain does not engage properly with the sprocket due to damage, elongation or when an inspection of the chain detects problems.

The service life of the chain can be influenced by a variety of factors. The chain is a critical linkage, the following information provides the care and maintenance required to help maintain the chain's integrity. Systematic inspections, cleaning and lubrication are key to achieve proper service life.

To help prevent premature wear or damage, the following points should be checked. Observe the chain and sprockets for these items.

ITEMS TO OBSERVE

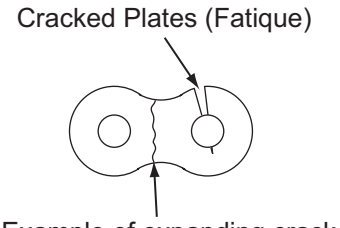
1. Abnormal noise.
2. Vibration of the chain.
3. Chain rising on the sprocket.
4. Chain winding around the sprocket.
5. Stiff bending of chain, or kinks.
6. Amount and state of lubrication.
7. The appearance of the chain. Check for dirt, corrosion, damage on the outside surface of roller, contact marks, turned pins, etc. Also check the inside and edge surfaces of the link plate and edge surface of the pin.
8. Damage on the sprocket tooth surface and side surface of tooth and engaging area.
9. Bending of chain and rotation of roller.

MAINTENANCE

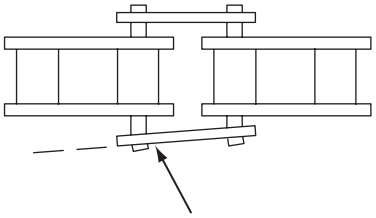
Inspection

Chains must be inspected per guidelines outlined in the inspection section of this manual. Signs of chain deterioration to be looked for are as follows:

1. A crack or complete break of a link plate, particularly an outer plate on either side of the chain. Replace chain immediately.

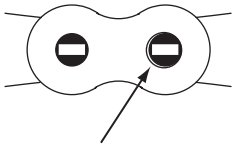


2. Distortion or spreading of an outside link plate, evidenced by increased clearance between overlapping link plates and roller. This indicates a hidden break in a pin. Replace chain immediately.



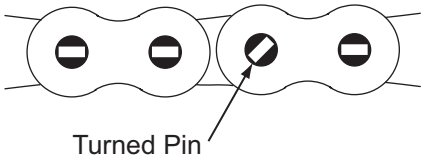
Link Plate Distortion

3. Looseness between the riveted ends of a chain pin and the outer link plates. If a pin has broken, the normally rigid riveted joint may loosen, leaving visible clearance around the exposed ends on the pin. Replace chain immediately.



Clearance at Riveted Chain Pin

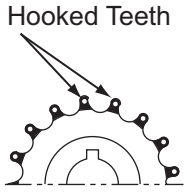
4. The pin head rivets should be examined to determine if the flats are still in correct alignment. Chain with rotated or displaced heads or abnormal pin protrusion indicates deformed pin or bushing fit. Replace chain immediately.



Turned Pin

5. Seizing and galling of rollers. All rollers must rotate freely by hand. If chain joints or rollers are seized, but not yet damaged, lubricate per instruction in ”LUBRICATION” Section.

6. Worn or misaligned idler sprocket(s) or sector sprocket(s). Worn idler sprocket bearing, sprocket hinge pin or abnormal wear on sprocket teeth can cause chain overload and accelerate the wear rate. Replace the sprocket when teeth show excessive wear or are hook-shaped. Replace sprocket bearing or hinge pin if worn.



7. Inspect for accumulation of foreign matter such as dirt, grit, dust, etc., which can close off the clearance at the suggested points of lubrication.
   If accumulation is evident, the chains should be cleaned by flushing and brushing with a suitable solvent such as diesel fuel or kerosene to remove all foreign material and then re-lubricated thoroughly.

   If the accumulation is severe, the chain should be removed and purged of foreign matter by soaking and flushing in suitable solvent, followed by immersion in proper lubricant before reinstallation.

8. DO NOT exceed the service life period of the chain. The maximum service life of a compensating chain should never exceed five years. The maximum service life of a leveling chain is determined by measuring chain elongation. Leveling chains which exceed the maximum elongation must be replaced.

LUBRICATION

One of the most important but often overlooked factors causing premature wear or breakage is inadequate lubrication. In addition to reducing internal friction, maintaining a film of lubricant on all chain surfaces will inhibit rusting and corrosion.

Under normal operating conditions, especially in dusty environments, lubricated chains will accumulate a paste-like build-up of grime. This build-up should never be permitted to accumulate sufficiently to seal off the clearances, thereby restricting the lubricant to the bearing areas. At periodic intervals, this build-up must be removed by cleaning and the chain immediately re-lubricated. DO NOT steam clean or use degreasers; use a brush and a safe petroleum solvent such as diesel fuel or kerosene.

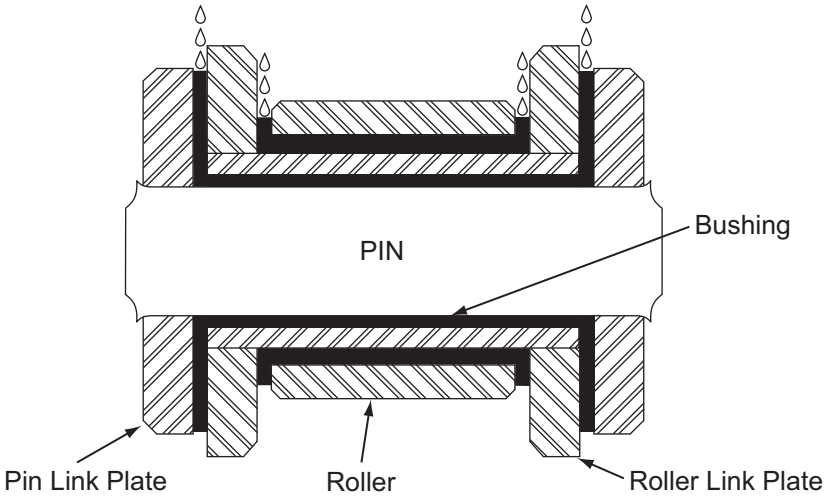
Lack of lubrication will result in galling and corrosion of the chain pins and can cause breakage of the pins, with resulting failure of the leveling system and may result in serious personal injury or death.

The internal bearings between the pins and rollers in the chain should be lubricated on the unit per the lubrication chart and/or Quick Reference Guide.

Lubricant should be room temperature to provide better penetration to the chain joints.

Apply ample lubricant at each pin, between inner and outer side plates and between inner side plates and roller. DO NOT, under any circumstance, apply grease lubricant to the chain, as grease will not penetrate to the pin bearings.

Lack of lubrication in the pin bearings is usually indicated by squealing or groaning sound when the boom is operated.

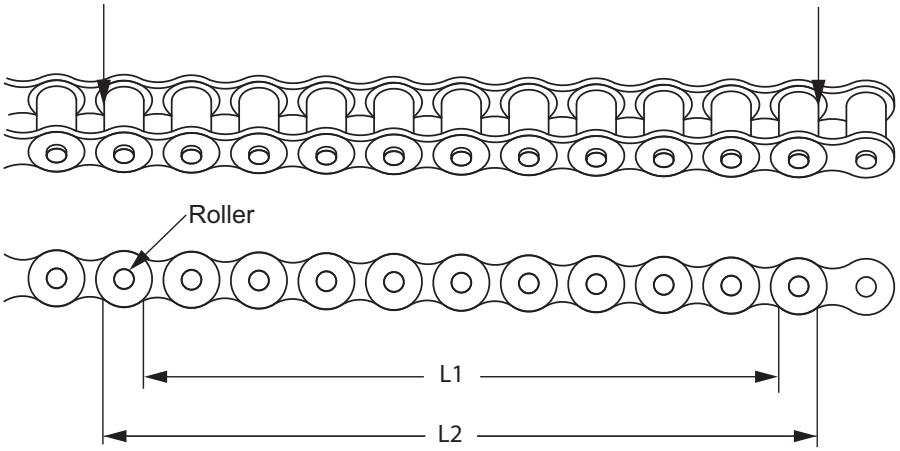


PROPER PENETRATION OF LUBRICANT

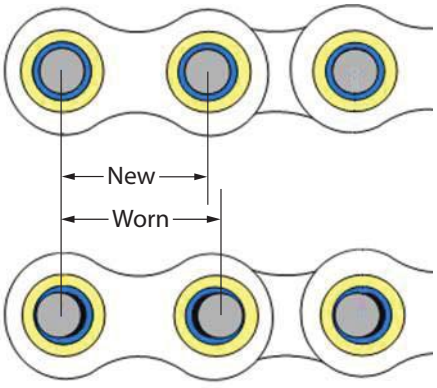
If lubrication has been neglected to the point of causing any chain joint to seize, the entire chain must be removed from the unit, thoroughly cleaned with a safe solvent, such as diesel fuel or kerosene, then soaked overnight in a container of recommended lubricant, providing that the chain has been thoroughly inspected for the absence of any kind of damage. Replace the chain if any defects are found.

MEASURING CHAIN ELONGATION

1. The chain should be measured by stretching it slightly.
2. Measure the distance, using a vernier, on the inside (L1) and outside (L2) of rollers at both ends of the measured links, to get measurement (L).
   L = (L1+ L2)/2
3. Calculate the standard length.
   Standard Length = Chain Pitch x Number of Pitches
4. Chain elongation can then be calculated.
   Chain Elongation = (Measured Length - Standard Length) / Standard Length x 100%



MEASURING CHAIN ELONGATION



CHAIN ELONGATION

NOTE: When measuring, use at least 10 pitches to help keep any measuring error to a minimum.

MAXIMUM ALLOWABLE CHAIN ELONGATION

Determine the chain size from the kitsheet or by examination of the chain to determine wear limit.

STANDARD LENGTH AND ALLOWABLE 1.5% ELONGATION

CHAIN SIZE		80N
PITCH		1.00
10 Pitch Measure	Original	10.000
	1.5% Elongation	10.150

CHECKING CHAIN ACCESSORIES

Check for damage to any master links and metal fittings. It is also important to make sure any metal fittings are as secure as possible. Loose fitting attachments may reduce the life of the chain.

REPLACEMENT OF CHAINS

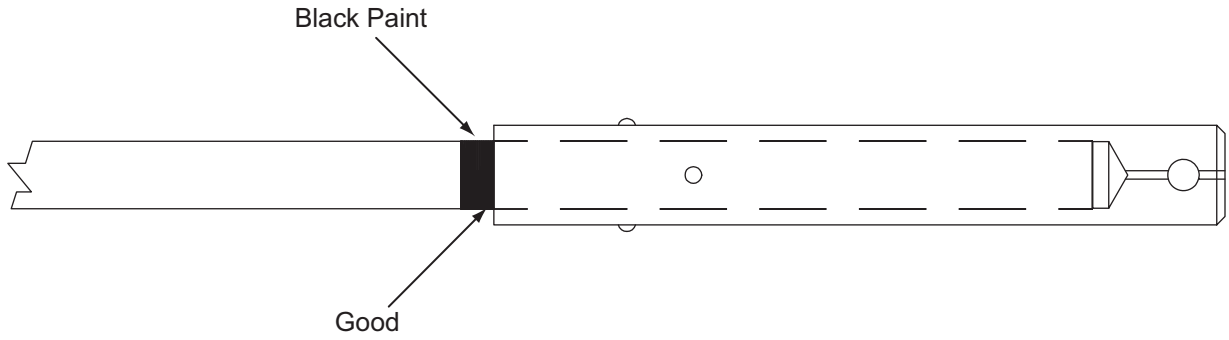
1. When replacing a chain, replace the entire chain including master links. DO NOT replace links or build lengths of chain from individual components.
2. DO NOT paint the chain. Although paint may help inhibit external corrosion, it will seal off critical clearances and restrict oil from reaching the internal pin surfaces where it is needed for adequate joint lubrication. Always protect chain from paint when painting unit, especially during new unit installation or unit transfer.
3. Protection from corrosion is important in storage as well as in service. A factory lubricant has been applied to new chains. After installation, the recommended lubricant must be applied to the entire chain.
4. Ensure that other component parts, sprocket, bearing and idler assembly are installed properly per Maintenance and Service Manuals.

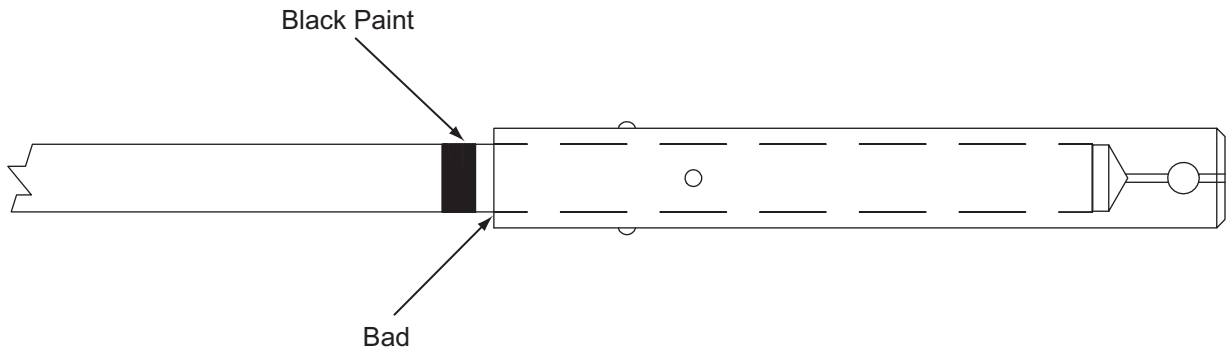
CHAIN MAINTENANCE

SECTION 111
FIBERGLASS ROD INSPECTION

FIBERGLASS LEVELING RODS

The leveling rods maintain the platform level and must be inspected and maintained. Follow the Frequent and Periodic schedule for intervals. The fiberglass material should be clean and dry. If there is any exposed glass, it must be coated with resin. If damage or wear is more than .156 in. (3.96 mm) deep along the length of the rod, it must be replaced. Any damage, cuts or scrapes across the width of the rod is reason to replace.





TERMINAL CONNECTOR

The fiberglass rod is bonded to the terminal with epoxy and 2 pins. The rod is painted black next to the terminal. If there is a white band between the black paint and the terminal, the rod must be replaced.

Replace fiberglass rods immediately if white gap exists. A white gap indicates that the bond has slipped and may fail at any time, causing the platform to upset, resulting in death or serious injury.

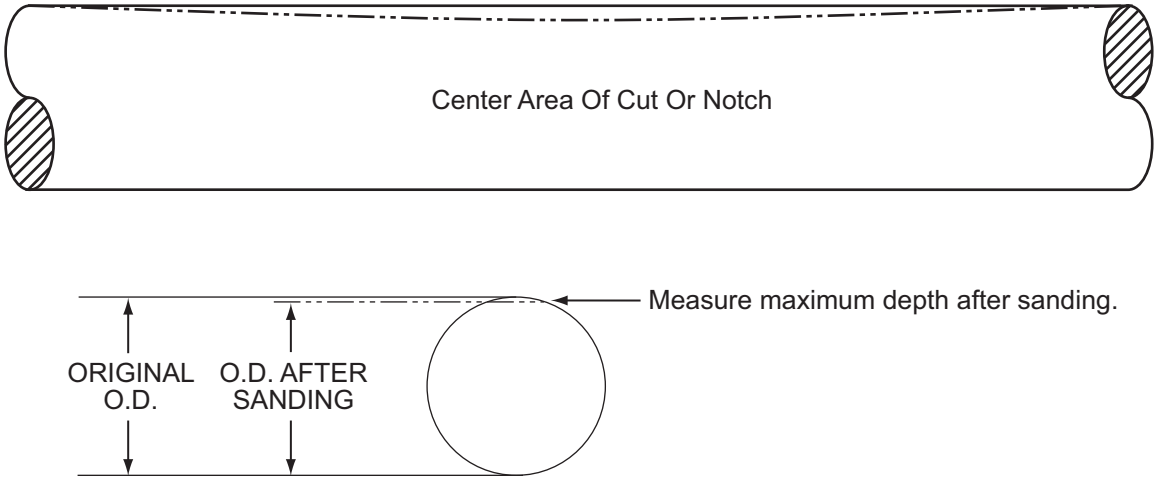
FIBERGLASS ROD INSPECTION/REPAIR

Plastic chain or rod guides are used to prevent contact with the metal portions of the boom. Replace if they show wear which will allow metal contact.

The leveling rod should be replaced if the maximum depth of the damaged area after clean-up exceeds .156 in. (3.96 mm) from original O.D. of .750 inch (19.05 mm).

Sand to remove damage.

Feather to distribute the removal and to avoid an abrupt notch in the fiberglass rod.



The sanded area should be resurfaced with an epoxy or marine type gelcoat to inhibit moisture wicking.

SECTION 130
ROTATION MAINTENANCE

BOOM ROTATION SYSTEM

The turntable rotation assembly consists of turntable, turntable bearing, rotation speed reducer, hydraulic motor and the collector block assembly. The hydraulic components are described in various sections of this manual.

TURNTABLE ROTATION SPEED REDUCER

The rotation speed reducer has a worm gear set which rotates on tapered roller bearings. Gears and bearings are given lubricant by the grease in the gearbox. The gearbox drives a pinion, which in turn drives the ring gear.

TURNTABLE BEARING

Using the “Shear Ball” principal, the turntable bearing consists of inner and outer steel raceways, with a continuous row of steel balls and spacers in machined races between the two sections. The bearing race is sealed against dirt and weather and is provided with a lubrication fitting.

TURNTABLE

The turntable is attached to the inner race of the bearing ring with 5/8 - 18NF hex head bolts and the outer race with 5/8 - 18NF hex head bolts.

COLLECTOR BLOCK ASSEMBLY

The multiple port collector block assembly permits unrestricted continuous rotation of the turntable.

CHECK ROTATION GEARBOX OIL LEVEL

Maintain oil level for lubrication and dissipation of heat. Consult the lubrication chart for frequency and method of lubrication.

OIL CHANGE INFORMATION

1. Change oil as indicated by condition during inspection.

WORM GEAR SHAFT

The worm gear requires no service or adjustment.

If the tooth has been severely worn, it will appear to be leaning in one direction. Dismantle the worm gear assembly, thoroughly clean the housing, inspect the worm for damage and replace all damaged parts.

INSPECT BREATHER PLUG

The rotation speed reducer is equipped with a breather plug which is located on top of the gear housing. The purpose of the plug is to release the gases which form from oil heating when the gearbox is in operation. If the plug is clogged, pressure will build up within the housing and cause excessive heating and oil leakage.

Support boom assembly to prevent rotation when the speed reducer is removed. Failure to support the boom assembly can result in unintended rotation and possible damage or injury

WORM SHAFT END PLAY MEASUREMENT

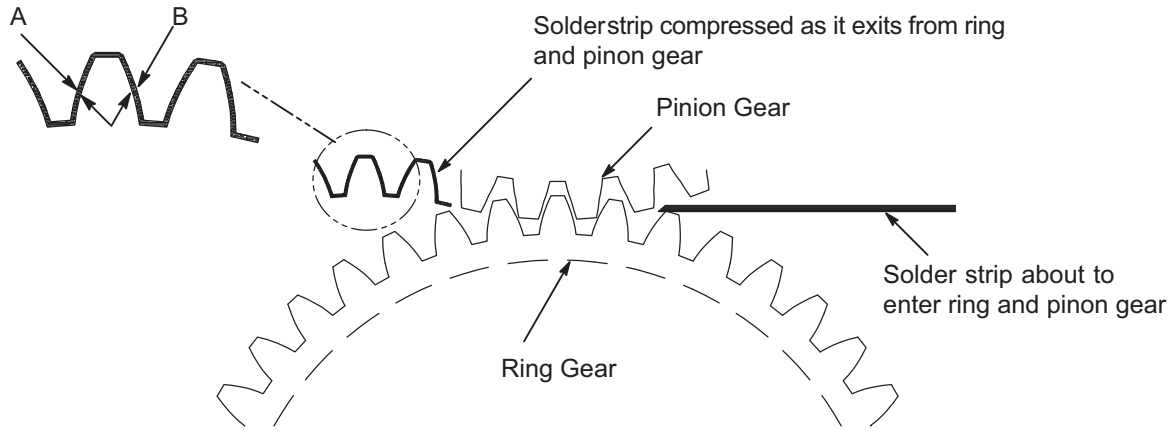
Worm shaft end play should be checked whenever the speed reducer has been disassembled for any reason or if excessive rotation of the pinion shaft is experienced while the gearbox is at rest.

1. Remove the hydraulic motor.
2. Attach a dial indicator to the gear housing, placing the probe squarely against the end of the worm shaft.
3. Firmly rotate the pinion shaft in one direction and hold constant tension. Zero the dial indicator and rotate the pinion shaft in the other direction, again holding constant tension. Read the shaft end play on the dial indicator. Proper end play is 0.002–0.007 inches (0.05-0.18mm).

To check worm shaft end play with the gearbox installed, place dial indicator on motor end of worm shaft and rotate the opposite end of the worm shaft with a socket until it stops. Zero the dial indicator while maintaining tension on the worm shaft. Rotate the worm shaft in the opposite direction until it again stops and read shaft end play on the dial indicator.

MEASURING TOOTH CLEARANCE

1. Remove the pinion guard.
2. Rotate the turntable so the position of the boom is located in the work area most often used. This is generally the rear of the vehicle or the curb side of vehicle.
3. Use a strip of solid solder approximately 12 inches (304.8 mm) in length, do not use acid or rosin core solder. Insert the solder as indicated in the illustration below.
4. Place the strip of solder between the pinion gear and rotation bearing ring gear.
5. Very carefully, rotate the boom allowing the solder to feed into the gear teeth until the compressed solder exits from opposite side.
6. Measure the solder thickness as indicated at points A and B in the illustration below. Add these two dimensions. See Quick Reference Guide for turntable gear backlash measurement. The total value (A+B) should not be more than twice the recommended value.
7. Repeat steps 2–6 with booms rotated in non-working area. Compare measurements from working and non-working areas.
8. When clearance exceeds twice the recommended value in the Quick Reference guide, it will generally indicate a need for adjustment or possible ring and or pinion gear replacement.



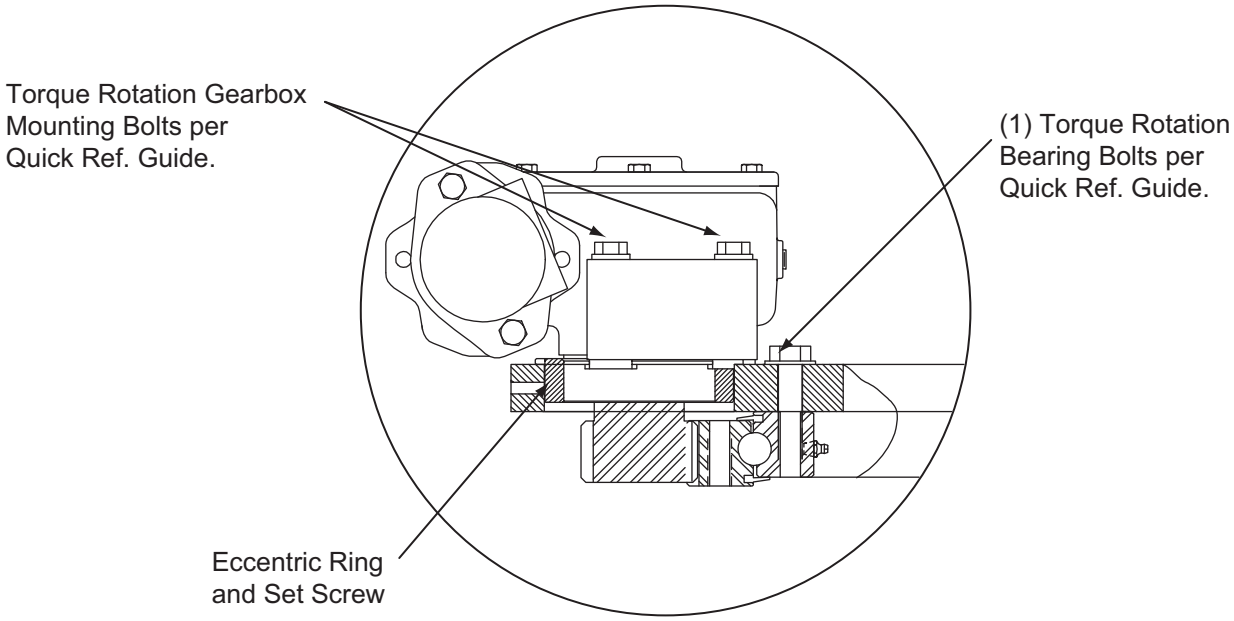
Keep hands clear of gear pinch point.

ROTATION SPEED REDUCER PINION ADJUSTMENT

The speed reducer pinion operates against the rotation bearing ring gear to rotate the boom. It is necessary for the pinion gear to have a slight clearance where teeth mesh between the pinion gear and ring gear. However, excessive clearance can cause too much backlash in the boom. The gear backlash must be set on the unit with the lower boom horizontal and the upper boom fully articulated.

To adjust the rotation speed reducer pinion, proceed as follows.

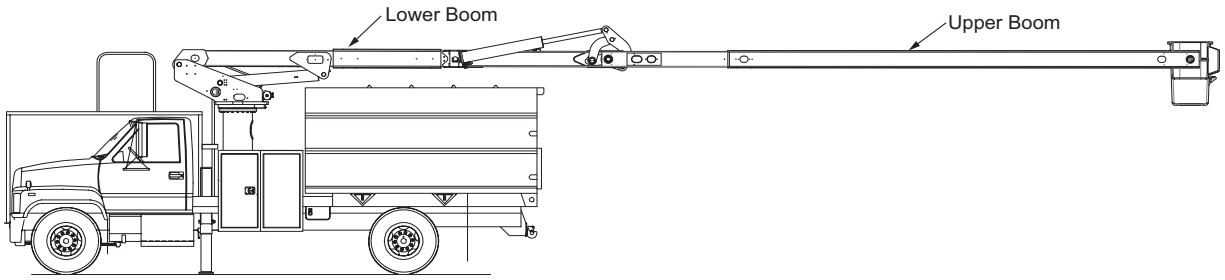
1. Position the unit as indicated in the above paragraph.
2. Remove any protective covers which may interfere with adjustment.
3. Loosen the four mounting bolts which secure the gearbox to the pedestal.
4. Loosen the set screw which locks the eccentric ring.
5. Rotate the eccentric ring either clockwise or counterclockwise to establish the required backlash.
   NOTE: Do not become confused with clearance that exists within the speed reducer (worm and worm gear clearance).
6. When the required backlash is established, tighten the four rotation speed reducer mounting bolts. Lubricate washer and threads and torque per Quick Reference Guide.
7. Tighten eccentric ring set screw.



ECCENTRIC RING AND SET SCREW

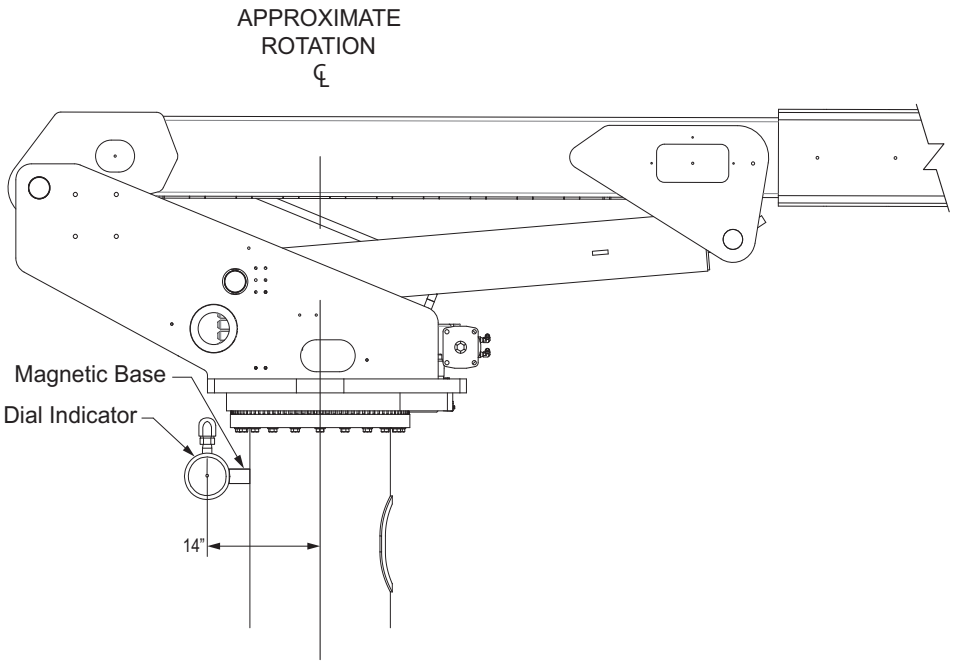
ROTATION BEARING DEFLECTION CHECK

1. Check the rotation bearing bolt torque and lubricate before test.
2. Position truck in suitable working area, extend outriggers. Rotate boom off rear vehicle. Place lower boom at 0 degrees horizontal and upper boom at 180 degrees from lower boom.



VERIFY THE OUTRIGGERS ARE PROPERLY EXTENDED

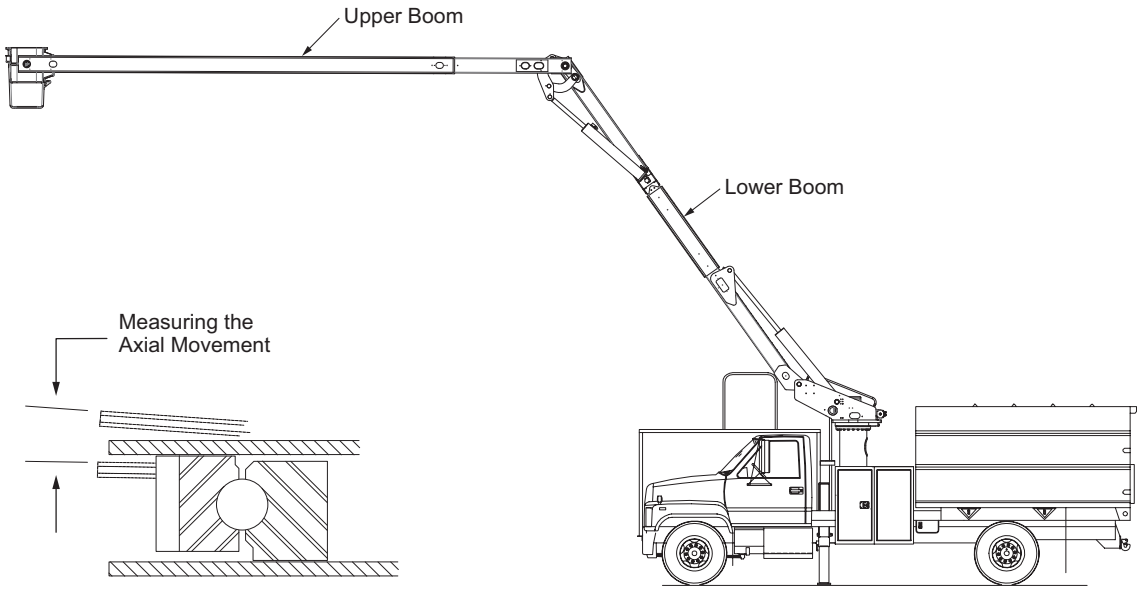
3. Remove pinion cover on the bottom of the turntable.
4. Attach dial indicator base (magnetic) to the pedestal.



NOTE: See Quick Reference Guide for allowable axial movement.

5. Position dial indicator vertical, in-line with the boom, touching the bottom of the turntable.
6. Set the dial indicator at zero.
7. Read the dial indicator. Record the reading.

8. Position lower boom fully articulated as indicated in illustration below and upper boom horizontal relative to the pedestal. Do not rotate the turntable. Read the dial indicator for total deflection. Record the reading.



When the total axial movement exceeds the recommendation in the quick reference section, it is generally an indication that ball and ball path wear is occurring. It is recommended the bearing be monitored for further wear. If a significant axial movement increase occurs in a short time frame it indicates ball path deterioration is occurring. The bearing should be replaced.

ROTATION MAINTENANCE

SECTION 135
MAINTENANCE AND REPAIR OF FIBERGLASS BOOMS

The following preventative maintenance program is recommended for fiberglass booms.

1. The boom should be inspected for damage at the start of each shift and again at the end of each shift if boom condition has changed. Inspect for scratches, surface cracks and other abrasions which may lead to further deterioration. Report any damage found on the daily inspection. Damage must be inspected by a qualified person.
2. Wipe boom frequently with a lint free cloth to keep it clean and dry. Keeping the boom clean will help keep electrical leakages to a minimum and facilitate the visual inspection for damage.

Do not use steam heat to clean the boom. The extreme heat that can build up in a concentrated area will affect the integrity of the fiberglass.

3. Where the damage observed is limited to surface damage (minor damage), clean the boom surface by washing with Simple Green (Sunshine Makers, Inc.) or hot line tool cleaning products, rinse clean, dry thoroughly and sand the damaged area to remove foreign material. Resurface the damaged area with polyester gelcoat. If the unit was originally coated with a high dielectric acrylic paint or an epoxy paint, thoroughly clean as described above and resurface damaged area with the same material.

The following are materials proven acceptable for use in repairing fiberglass boom surfaces:

- Polyester resin compatible with epoxy
- White NPG (NeoPentyl Glycol) gelcoat with wax - available from Glidden, PPG and Cooks paints
- Silicone spray

4. Fiberglass boom surfaces can be effectively maintained against weathering by the use of Carnauba Hotstick Wax or silicone spray. Clean the boom surfaces (inside and outside) by washing with Simple Green or hot line tool cleaning products. Rinse clean and dry thoroughly. Spray the inner and outer surfaces of the boom with a thin coating of silicone material and rub down the sprayed surface with a lint free cloth to remove excess material or apply a thin coating of hotstick wax to the outer surface. Perform the silicone spray treatment once every 2–6 months, depending upon the climatic and atmospheric operating conditions.
   NOTE: Whenever the boom is cleaned with a cleaner which will remove the silicone, the boom should be resurfaced with the silicone spray.
5. Test the fiberglass insulating components on a regular schedule for excessive leakage current in accordance with ANSI (American National Standard Institute) A92.2. If a significant change (increase) in the leakage current is detected when comparing with the previous test results, or if the leakage current is approaching leakage of 1 micro-Ampere per KV, examine boom surfaces thoroughly for evidence of deterioration. If surface damage is observed, proceed with Step 1 and 3 above. If surface weathering is the apparent cause, proceed with Step 4 above.
6. If it is determined during inspection or dielectric testing that there is a delamination or fracture in the basic fiberglass structure, or the current leakage cannot be brought within the specification limits through implementation of Steps 1-4, contact the factory to determine if the boom is repairable. **THE REPAIRABILITY OF THE DEFECTIVE BOOM SHOULD ONLY BE DETERMINED BY THE FACTORY AND IF REPAIRABLE, SHOULD BE REPAIRED ONLY BY THE FACTORY OR QUALIFIED FACTORY REPRESENTATIVE.**

Proper care and maintenance of your fiberglass components is important to protect the insulating and structural qualities of the fiberglass boom.

RESURFACING EPOXY RESIN BASE

Fiberglass booms which have been subjected to prolonged periods of weathering without adequate field maintenance and preservation can develop a deteriorated surface which is humidity sensitive. When this condition is reached, the fiberglass boom may no longer pass the dielectric test, which limits current leakage in accordance with OSHA 1926.556 and ANSI (American National Standards Institute) A92.2 - latest edition. Fiberglass booms and tubes manufactured with an epoxy base resin that have surface deterioration to the extent resulting in dielectric test failure might be reclaimed in accordance with the following process and procedure.

1. Clean the boom surfaces thoroughly with a cleaner that is not abrasive and does not leave a residue on the surface such as; Simple Green (Sunshine Makers, Inc.), (dilute 2 to 1) or Hot Line Tool Cleaning products.
2. Dry the boom out for 24 hours in an environment of less than 25 percent relative humidity at a minimum of 60 degrees Fahrenheit.
3. Perform a dielectric test on the boom as specified in ANSI (American National Standards Institute) A92.2. IF THE LEAKAGE CURRENT IS LESS THAN 50% OF VALUE SPECIFIED, THE BOOM MAY BE REPROCESSED. If the leakage current is more, it should be subjected to a second 24 hour drying out period. IF THE TEST LEAKAGE IS BROUGHT DOWN BELOW SPECIFICATION, CONTINUE TO STEP 4. If the leakage current appears to be coming down significantly (by at least 25 percent) with each drying out cycle, this process can be continued until the boom leakage current is below allowable specification as indicated in ANSI (American National Standards Institute) A92.2 - latest edition, at which point Step 4 can be performed. If the leakage current remains out of specifications after the third drying out cycle and has not shown at least a 25 percent reduction in leakage with each drying cycle, the boom shall be considered permanently defective and must be replaced or reclassified and operated as non-insulated.
4. Sand thoroughly the outside surfaces of the boom only long enough to remove the outer surface material (not more than .015 inches/.38 mm).
   NOTE: Do not handle the sanded boom with bare hands since the oils and salts from the skin will contaminate the boom surface and will prevent adherence of the coating. HANDLE THE BOOMS IN THIS CONDITION ONLY WITH CLEAN GLOVES.

   NOTE: Do not subject sanded booms that have not been resurfaced to humidity conditions above 40 percent humidity. Booms should be moved as quickly as possible from unfinished to refinished.
5. Resurface the boom with the white NPG gelcoat activated by the addition of the catalyst. The application should be made with regular industrial spray equipment where pressure pots are included. This is important since this is spraying with 100 percent solids. A minimum coat thickness of .010 in. (.25 mm) to a maximum of .020 in. (.51 mm) shall be applied. Up to .012 in. (.30 mm) of coating can be made in one application. However, it is acceptable to coat with more than one application of lesser thicknesses if desired. The material requires 12–24 hours at 77 degrees F (25 degrees C) for complete drying. Don't apply gelcoat in high humidity conditions (40 percent or above). Air dry only.
   NOTE: Obtain detailed application instructions and supply from manufacturer of acceptable resins.

   NOTE: Any surfaces of the fiberglass boom which have been broken after coating, such as holes drilled through glass, etc., shall have the surfaces sealed with polyester resin, epoxy or a material equivalent in surface sealing characteristics.
6. After the boom has thoroughly dried (at least 12 hours), perform a dielectric test on the boom - as specified in ANSI A92.2. To simulate adverse weather conditions if humidity is under 60 percent, spray the boom inside and outside surfaces with clear tap water, tip the boom to 45 degrees angle from horizontal and allow water to drain off for 30 minutes, then test as specified in accordance with ANSI A92.2. If the humidity is over 60 percent wipe the boom dry, inside and outside. After water spray let surface condition dry for 15 minutes and then test full length.

7. If the leakage current in Step 6 tests (above) over the allowable leakage, wipe the boom dry and allow it to stand for one hour in a 40 percent or less humidity condition and retest. If the leakage current has dropped below, it indicates the surface finish is not of a sufficient gloss and is still humidity sensitive. The method of applying a new surface coating should be evaluated to determine the cause for the resultant unsatisfactory finish. When the cause is determined and eliminated the boom can be resurfaced again with Steps 2–6. Should the boom still fail the surface condition test, contact a qualified factory representative for analysis and evaluation.

DETERMINING TYPE AND DEGREE OF DAMAGE

Structural damage can be generally classified as resulting from cuts, bruises or overloads. Some types of damage cannot be easily identified, careful inspection of damaged area is necessary. They are caused and recognized as follows:

- Cuts are usually caused by tools or collision with sharp edges. These are easily seen as holes or grooves and often with broken and exposed glass fibers.
- Bruises are caused by a blunt force impact; tree branches, poles, etc. They are recognized as lightened craze marks that are not always obvious.
- Loads in excess of the design limit will tend to make the boom buckle near the base end on the side opposite from the applied force (or load) or traffic accidents. Cracks, swelling or creasing will be found at or near the steel attachment and usually on the bottom.

Damage from these sources can be classed as minor, major and critical in terms of their location and extent. CRITICAL DAMAGE MUST BE CONSIDERED NON-REPAIRABLE AND REFERRED TO THE FACTORY FOR REPLACEMENT.

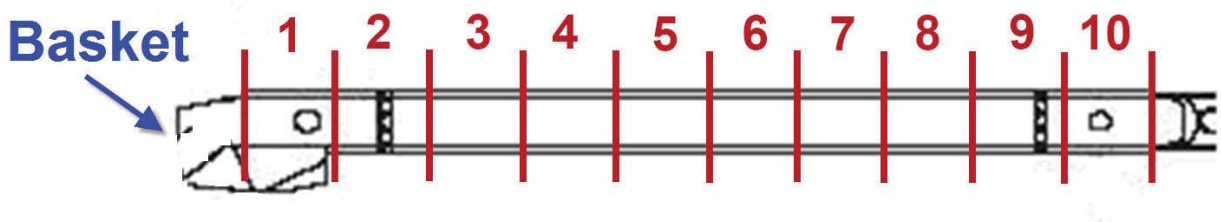
The following conditions are considered to be critical damage:

- Any overload damage,
- Through penetration of the wall anywhere,
- Major damage within 24 inches (609.6 mm) of previously repaired major damage and
- Bruises or cuts that fall beyond the limits for major damage.

Damage not already diagnosed as critical may be identified as either a bruise or a cut and classified as described below.

First, identify the quadrant in which the damage has been done - top, bottom or side. If the damage is in the corner, classify it as top or bottom

Second, identify where along the length of the boom the damage has occurred. Divide the fiberglass boom in ten equal segments with segment number one at the boom tip and segment number ten at the base or mounting end.



Third, define the size or depth of the damage by:

- Measuring the smallest diameter circle that will contain all of the visible damage from a bruise.
- By estimating the percentage of the wall thickness that has been penetrated. This is determined by dividing the depth of a cut by the wall thickness and multiplying by 100. (Ergo: 1/8 in./3.18 mm deep cut 5/8 in./15.88 mm thick wall x 100 = 20 percent). The wall thickness should be measured at the closest end of the fiberglass to the damaged area.

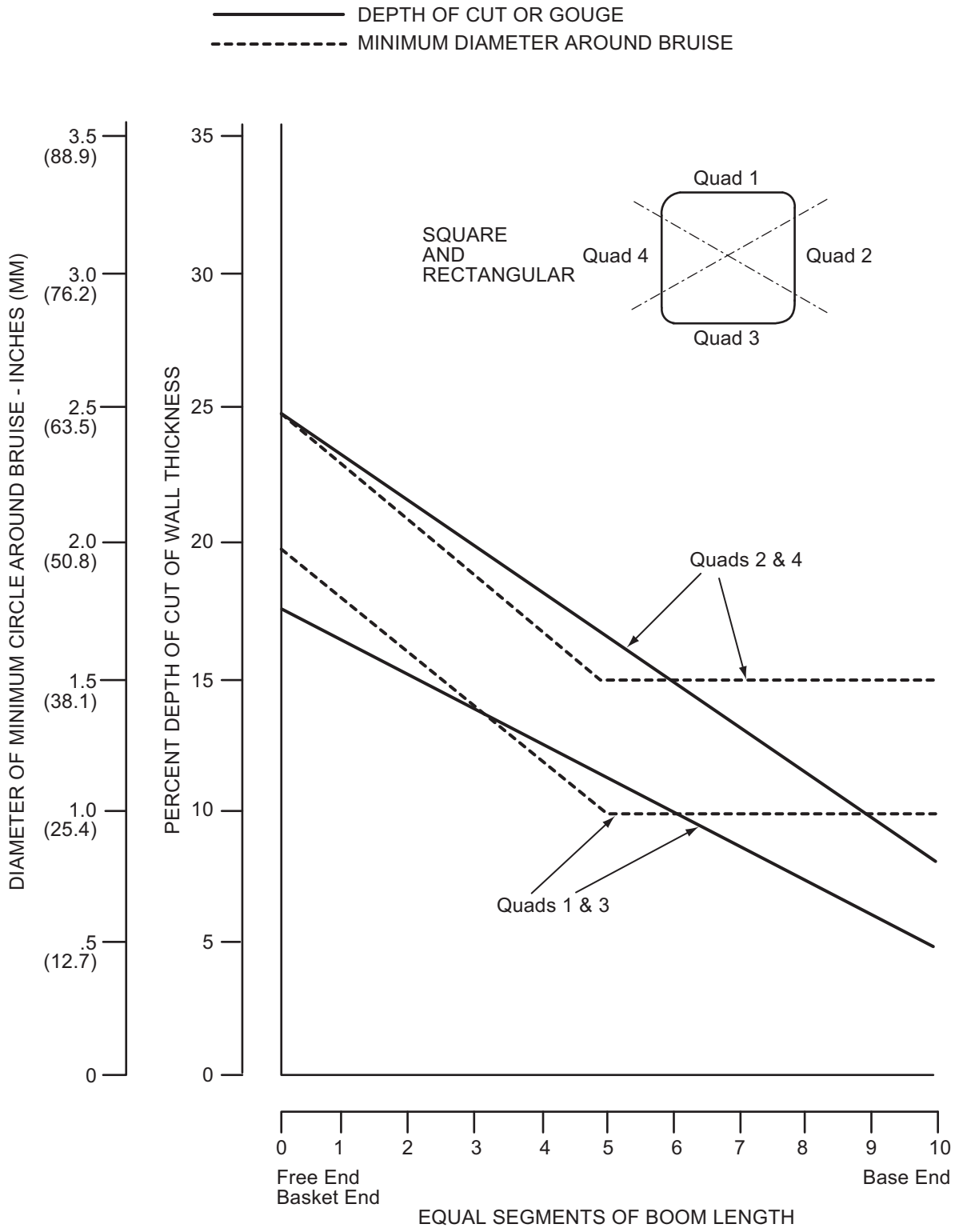
Fourth, classify the damage by using the appropriate charts. These are based on the fact that the top and bottom quadrants of a boom are more highly stressed than either side and the bending stress in the boom increases from a minimum at the free end (bucket end) to a maximum at the base.

On either Illustration, draw a vertical line at the segment in which the damage has been located. Depending on the percentage of penetration or the minimum diameter of the bruise, draw a horizontal line through the vertical line at that value. If the point of intersection is on or below the appropriate line, the damage can be classified. If the point falls above the line, it is not minor damage. If the same point is not above the corresponding line, it may be classified as major damage. Points falling above the proper line are critical damage.

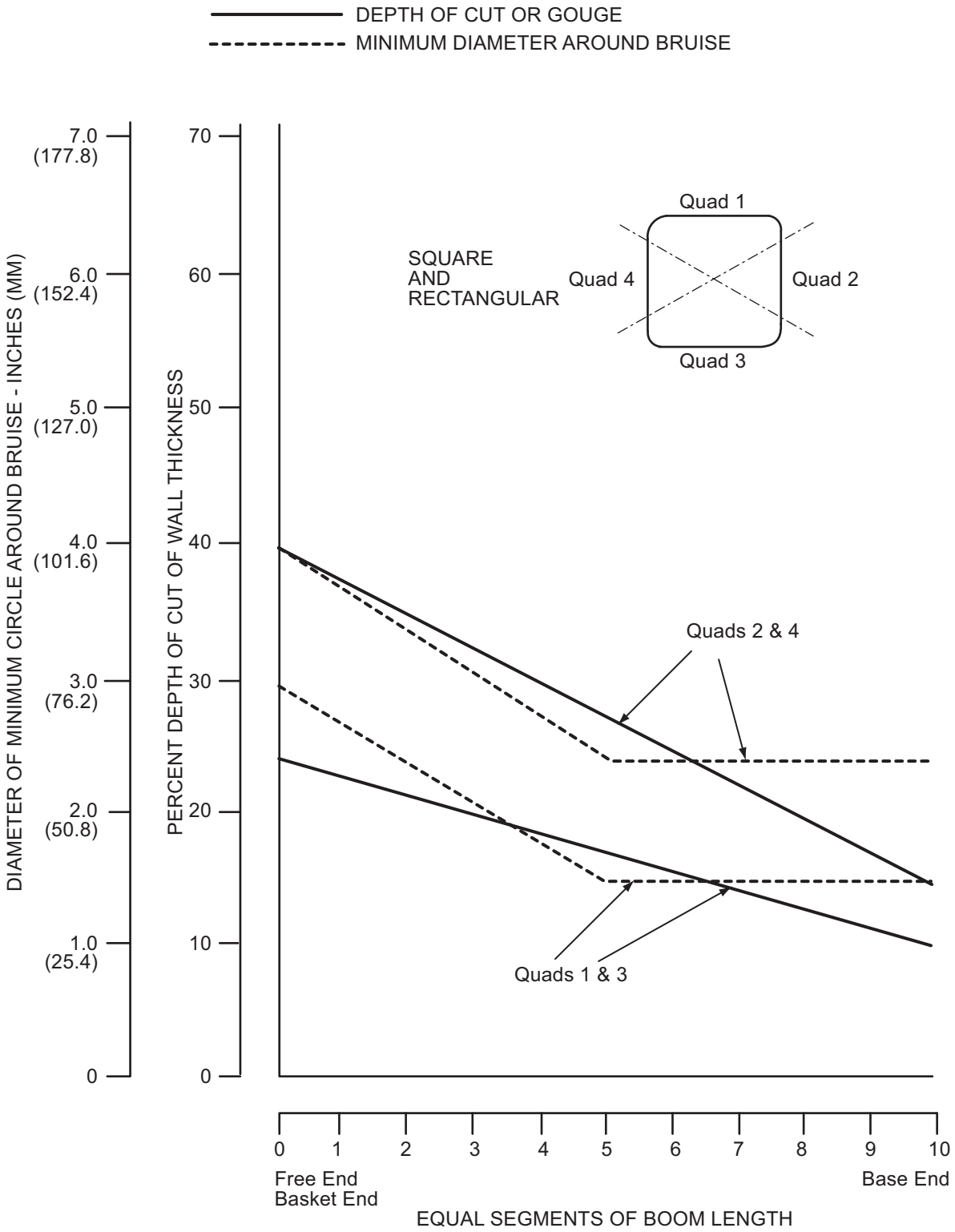
NOTE: Major damage to the boom must be reported to the factory or dealer for analysis.

NOTE: Critically damaged booms must be replaced.

LIMITS OF MINOR BOOM DAMAGE



LIMITS OF MAJOR BOOM DAMAGE



SECTION 140
MAINTENANCE OF BEARINGS AND BUSHINGS

BEARINGS

The correct fitting of the various hinge pins and bearings is of extreme importance for continued trouble-free operation of the Aerial Device. The following data will explain the various hinge pins and bearings.

Proper maintenance is essential if maximum life and performance is to be obtained from bearings.

Regular schedules for inspection and lubrication of bearings should be established and maintained. The frequency of the inspection and lubrication periods will depend on the type and design of the unit and the operating conditions. Refer to the lubrication chart in this manual for lubrication frequency and type of lubricant.

SELF-ALIGNING TYPE BEARINGS

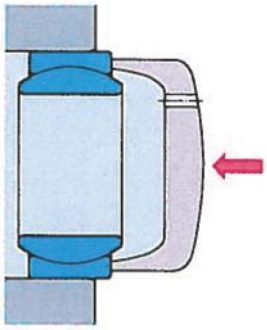
The spherical ball bushings are used in two different functions:

A. Where loads are relatively light, the bushing is allowed to turn on a hardened hinge pin. In this case, the pin made .001–.002 in. (.03-.05 mm) smaller than the bushing bore, to allow a free fit on the pin.

B. On more heavily loaded bearings, rotation on the pin tends to wear the pin excessively. To avoid this, the bushing is locked to the pin to cause relative rotation only between the two sections of the spherical bushing. Two methods of locking the bushing to the pin are used:

   a. Ends of the bushing hub are clamped between two sliding sleeves on each end of the pin. The spherical bushing and sleeves may be a free sliding fit on the pin - the pin nut is drawn up tightly to prevent rotation of the pin and inner section of bushing.

   b. The bushing is made a press fit on an accurately ground hinge pin to prevent rotation of the hub. The aim is to obtain an interference fit of .0008 in. (.020 mm), or a little less than .001 inch (.03 mm). However, because of necessary tolerances in both parts, this fit may vary from about .0003–.0013 in. (.008-.033 mm) interference. With interference at maximum, difficulty may be experienced in assembly, due to restricted space around the bearing. In this case, the bore of the bushing may be polished out to reduce interference (difference between O.D. of pin and I.D. of bushing) to .0005 inch (.013 mm). DO NOT fit the parts to a sliding fit, or light tap fit, as the bushing will rotate on the pin, causing premature wear.



NOTE: Push only on outer ring to remove or install. Pushing in the inner race (ball) causes outer race to expand.

BALL AND ROLLER BEARINGS

Ball and roller bearings require the most exacting fit of all types. The thin races of these bearings will shrink or expand along with the interference fits in housing and shaft, causing binding of the balls or rollers, with resulting rapid failure. Bearings should always be a sliding, or push fit in the housing, if positive retaining methods such as lock rings are provided.

In applications where the bearing is held in place only by a press fit, an interference fit of about .0005 in. (.013 mm) is required. DO NOT guess at fit - measure I.D. of housing and O.D. of bearing. When driving or

pressing a bearing into a housing ALWAYS use a machined sleeve as a tool, to prevent damage to the bearing. NEVER drive a ball bearing over a shaft with a tool on outer race, or into the housing with a tool on inner race, as Brinelling (pitting) of the races will cause rapid wear.

PLAIN STEEL BUSHINGS

This type, consisting of a soft steel outer surface on a hardened steel pin, is used only on the blind end of hydraulic cylinders, where the very slow movement keeps wear within acceptable limits. Since binding due to misalignment will cause seizing of this type bearing, fits are made 1/64 in. (.40 mm), or .015/.020 in. (.38/.51 mm) loose. DO NOT assemble this type if hinge pin must be forced through the cylinder eye.

PLAIN BRONZE BUSHINGS

These bushings are fitted much closer than steel bushings. However, sufficient clearance must be left for entry of lubricant from pressure fittings, or rapid wear and seizing will result. DO NOT assemble pins that must be twisted through the bushing - ream or hone bushing to give diametric clearance of .001–.004 in. (.03-.10 mm), with .002 in. (.05 mm) the ideal clearance. Bronze bushings must be a press fit of .002–.003 in. (.05-.08 mm) interference in the housing. DO NOT center punch or peen a bushing to fit an oversize housing.

PRELUBRICATED COMPOSITE BEARINGS

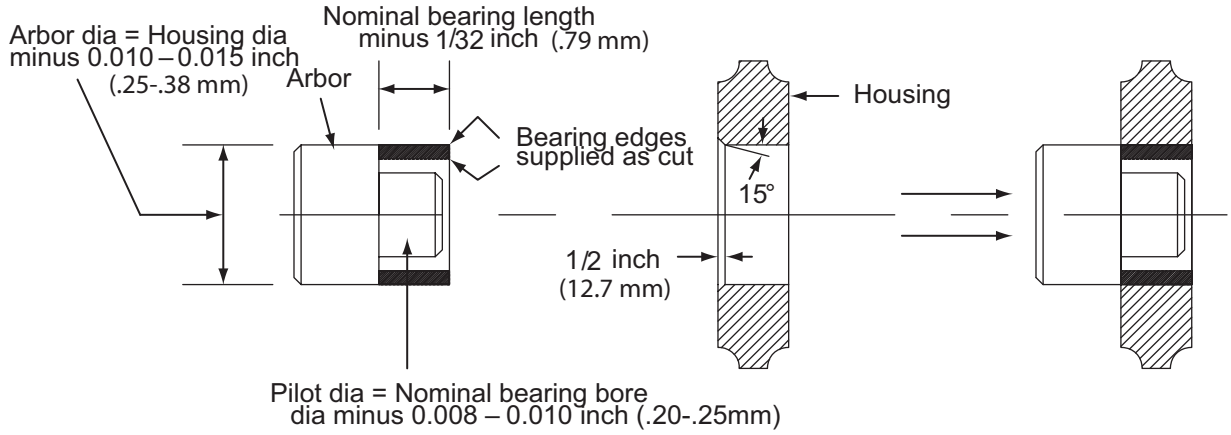
Composite bearings consist of two types. PTFE wear surface with a fiberglass backing or steel, porous bronze, and a modified acetal resin polymer. These bearings can be used in slow speed, oscillatory applications, or conditions of intermittent operation.

During operation, the bearing exhibits extremely low friction and is highly resistant to wear. The composite bearing is used extensively through out the Aerial Device at various pivot locations. See lubrication chart for specific location and lubricating instructions.

This bearing requires only a trace of lubricant to operate satisfactorily, running for long periods by drawing only upon the lubricant introduced on initial assembly. Grease zerks are provided at the bearing locations to provide lubrication if needed to extend the life of the bearing. When the bearing is lubricated per instructions, it will aid in the prevention of dirt and any other foreign material from contaminating the bearing.

INSTALLATION

Bearings are usually installed by means of a shouldered arbor plug inserted in an arbor press. A chamfer in the housing bore is necessary to serve as a lead for the bearing. An un-chamfered edge might shear fiber from the bearing O.D., seriously reducing the press fit. The O.D. chamfer on the lead end of the bearing acts as a pilot. Likewise, the I.D. chamfer in the bearings serves as a lead when the shaft is inserted.



Before installing, verify there are no burrs or sharp corners that can gouge or damage the bearing during installation.

SELF-LUBRICATING BEARINGS

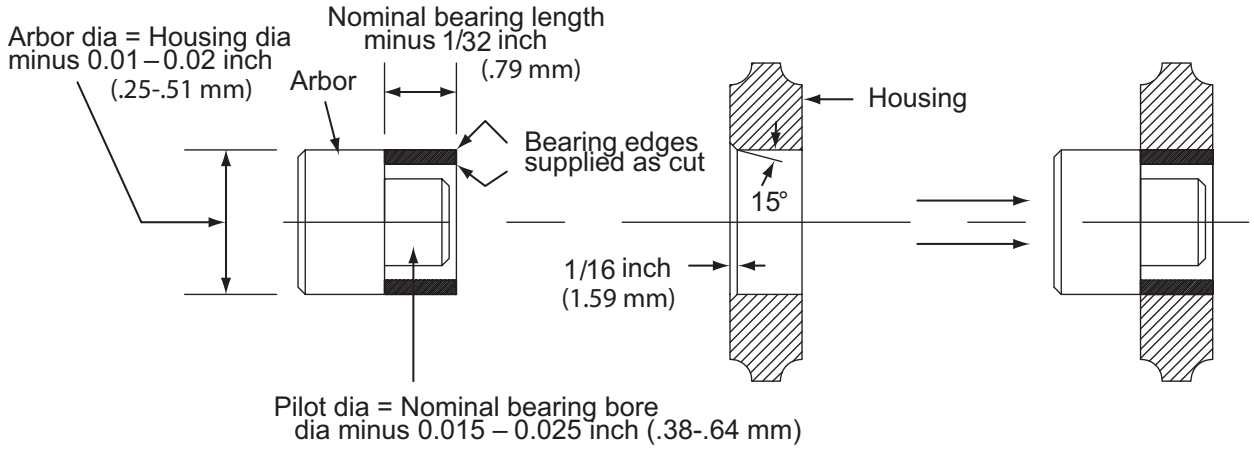
Self-lubricating bearings are used at various pivot location on the Aerial Device. The bearing is a combination fiber surface liner made of a controlled filament wound pattern of PTFE and high strength fibers. The properties of this bearing include: high load capacity, impact resistance, dimensional and thermal stability, and corrosion and abrasion resistance.

LUBRICATION

Self-lubricating bearings are almost always used dry, however grease can be used to reduce wear and/or to purge the bearing zone of contaminants. Liquid lubricants and greases attract contaminating particles which may migrate into the bearing. To minimize bearing contamination, lubricate sparingly at the time of installation.

INSTALLATION

Bearings are usually installed by means of a shouldered arbor plug inserted in an arbor press. A chamfer in the housing bore is necessary to serve as a lead for the bearing. An un-chamfered edge might shear fiber from the bearing O.D., seriously reducing the press fit. The O.D. chamfer on the lead end of the bearing acts as a pilot. Likewise, the I.D. chamfer in the bearings serves as a lead when the shaft is inserted.



Extreme care must be taken when installing pins to ensure they have no burrs or sharp corners which will catch and gouge the bearing at installation.

SELF-LUBRICATING BRONZE BUSHINGS

These bushings provide lifetime lubrication, making them ideal in applications where proper lubrication maintenance is uncertain, difficult or sometimes impossible. They are vacuum impregnated with oil during manufacturing to approximately 18 percent (by volume). The oil is supplied to the shaft through thousands of interconnected, oil impregnated pores. Due to capillary action present in the material, the shaft is always wet with oil, whether in motion or not.

Bearings are usually installed by means of a shouldered arbor plug inserted in an arbor press. A chamfer in the housing bore is necessary to serve as a lead for the bearing. An un-chamfered edge might shear metal from the bearing O.D., seriously reducing the press fit. The O.D. chamfer on the lead end of the bearing acts as a pilot. Likewise, the I.D. chamfer in the bearings serves as a lead when the shaft is inserted. Out-of-roundness is corrected when the bearing is pressed into the housing.

The I.D. size is controlled by the method selected. The several methods commonly employed are:

1. No Tool Contacting I.D.
   This method allows the I.D. to close-in without restraint. The approximate amount of close-in may be determined in advance.
2. Combination Insertion and Sizing Plug
   The amount of close-in may be controlled by use of a combination insertion and sizing tool. The plug diameter should be approximately .0003 in. (.008 mm) greater than the desired final bearing I.D. Bearing must be such that the plug fits freely in the bearing before installation. When the bearing is pressed into the housing, its I.D. will close-in on the plug. Oilite bearings generate their own oil film so there is no difficulty in extracting the plug. Upon its withdrawal, the bearing I.D. will spring back approximately .0003 inches (.008 mm) in most cases but the exact amount must be determined by trial. Springback data are impractical in nature and can only be used as a guide; springback is not calculated.
3. Drill Rod, Steel Ball, etc.
   Efficient accurate and economical sizing in small quantities can be accomplished by the use of a piece of drill rod, shaft, a ball, mandrel or an arbor.
4. Roller-Type Burnisher
   Roller-type burnishing tools are desirable for high production work, especially where I.D. tolerances are to be held within .0005 inch (.013 mm).

CLEANING OF BEARINGS

If bearings are going to be reused, they should be thoroughly cleaned with non-flammable solvent, dried and then inspected. Coat bearings with the lubrication specified in the lubrication chart.

When drying bearings with air, never spin bearings at high speed as this can seriously damage the bearing.

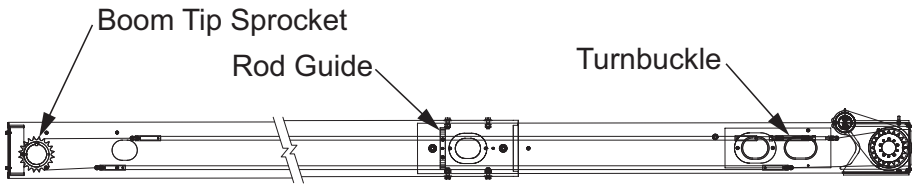
SECTION 160
LEVELING

PLATFORM LEVELING SYSTEM

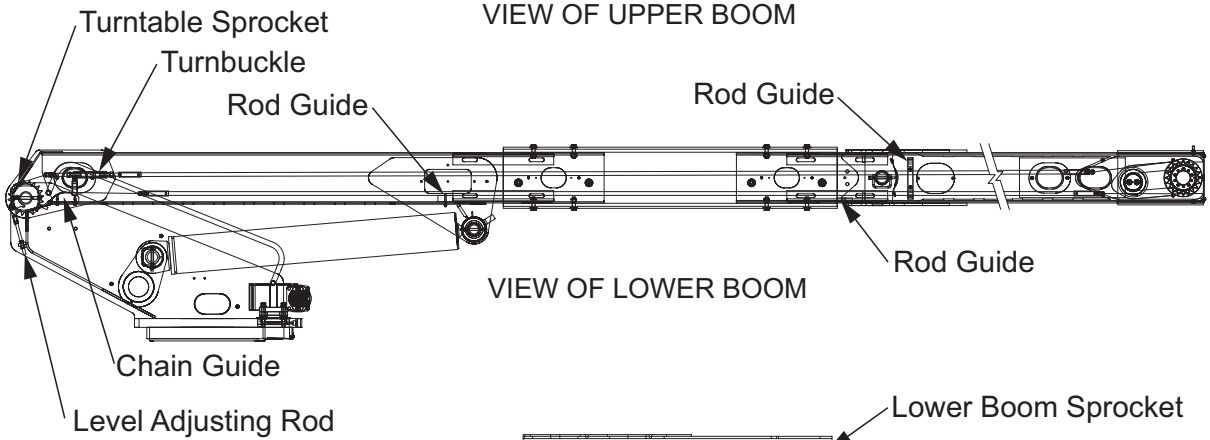
The platform is held level to the turntable by chains and fiberglass rods through the upper and lower boom. At the elbow, a cross tube transfers the motion between the booms. The sprocket at the turntable is anchored to the turntable through an adjusting rod. Adjustments to level are made at the turntable.

Tension for each boom is adjusted by a turnbuckle in each boom. They are located at the turntable in the lower boom and at the elbow in the upper boom.

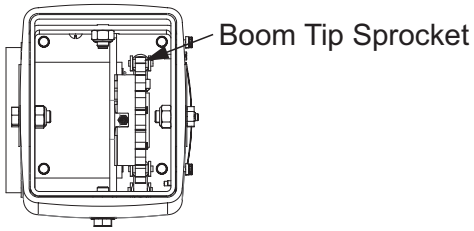
The leveling system is anchored at the back of the turntable. As the lower boom or upper boom is articulated, the leveling system keeps the platform at the same angle to the turntable.



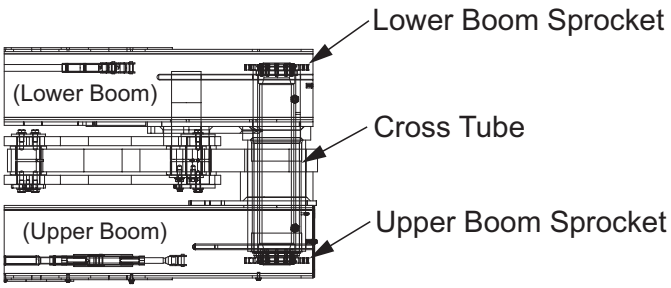
VIEW OF UPPER BOOM



VIEW OF LOWER BOOM



UPPER BOOM TIP



ELBOW

NOTE: Upper boom is shown seperate from the lower boom for clarity.

LEVELING CIRCUIT COMPONENT LOCATION

FALL PROTECTION

Fall protection is required whenever in an aerial or digger derrick platform. An OSHA compliant fall arrest system with the lanyard attached to the provided anchor at the boom tip must be used. The issue is not falling from the platform; but being ejected. You can be ejected by failure of a component causing unexpected motion, sudden release of energy from catching or snagging and releasing, or an external force on the vehicle, boom or boom tip.

RESPONSE TO A FALL

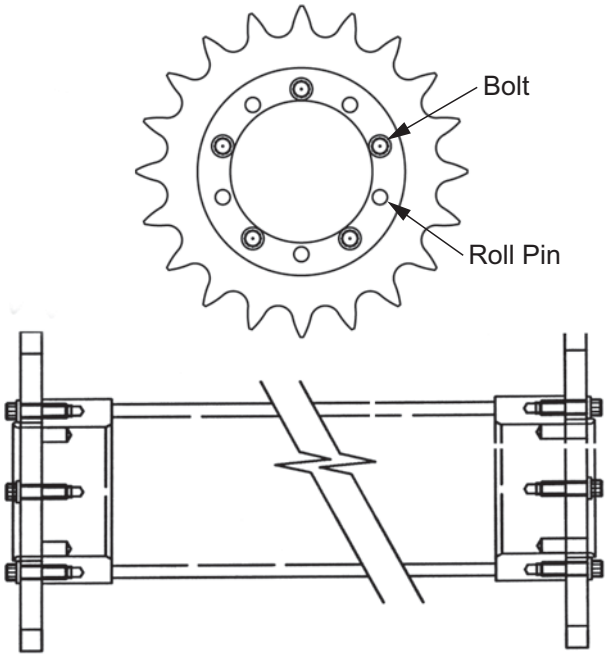
ANSI and OSHA state that no more than 6 minutes should pass from the time a worker falls to when he is reached. These time limits are to mitigate the risks of unconsciousness or further injury of the suspended worker. Each company must have a rescue plan in place to recover a suspended worker. Practice the rescue plan with all workers including the ground persons in this training, who may be the only ones available to perform the rescue. Train all employees to follow your rescue plan to recover the fallen person as quickly as safely possible without endangering the rescue personnel. Determine whether first aid is required as quickly as possible. Notify emergency services if the worker needs to be transported to the hospital according to your companies policies.

One of the dangers of being suspended in a safety harness is suspension trauma (orthostatic intolerance). Immobile workers suspended in their harness may lead to fainting or an unconscious state. Depending on the length of time, anywhere from few minutes to about 20 minutes, the suspended worker may become unconscious and depending on the level of venous pooling, the result may lead to death. Because the person will have limited ability to move their legs, blood will pool and not be available for circulation to the other parts of the body and brain. Communicate with the fallen worker to encourage them to move their arms and legs to promote blood circulation to the extremities. If the worker has signs of physical injury, or signs of suspension trauma such as; dizziness, fainting, nausea, sweating, paleness, hot flashes, increased heart rate, breathlessness, unusually low heart rate, unusually low blood pressure, or loss of vision contact emergency medical services immediately. A dangerous condition that sometimes occurs with suspension trauma is compartment syndrome. Also watch the fallen person carefully after rescue. A condition known at Reflow Syndrome can occur. The return of pooled, hypoxic blood and its metabolic byproducts from the extremities to the heart can cause medical issues even after rescue. Refer to your safety department, rescue plan, or local health providers for more information.

MATCH DRILLING INSTRUCTIONS

Use pre-drilled holes in sprocket to locate and drill 0.308/.3125 (7.82/7.94 mm) (5/16 in.-7.94 mm) hole 1.00 in. (25.4 mm) deep in locations indicated below on each side of assembly. Drill through sprocket and into cross tube. Install roll pin flush to 1/16 in. (1.59 mm) above surface of sprocket.

Leveling systems with MF #80 chain and 3/4 in. leveling rods require 5 bolts each side and 5 roll pins on each side.



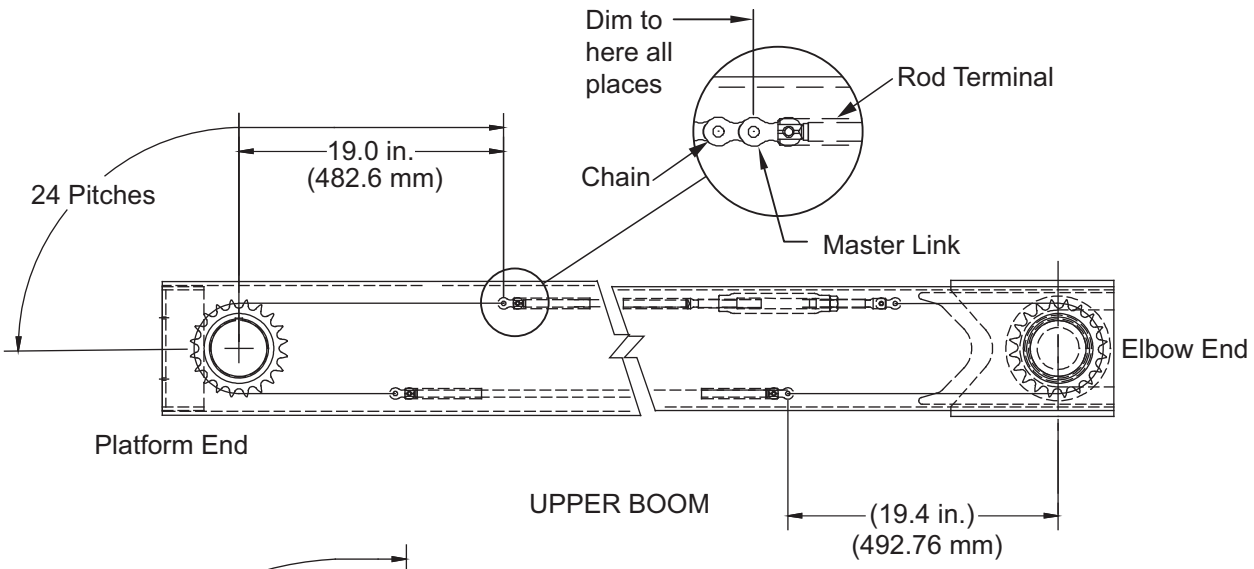
NOTE: It is recommended to replace the cross tube assembly if damaged sprockets, damaged threads in the cross tube, elongated roll pin holes in sprocket or cross tube are found. Contact your Terex South Dakota, Inc. dealer for replacement of cross tube assembly.

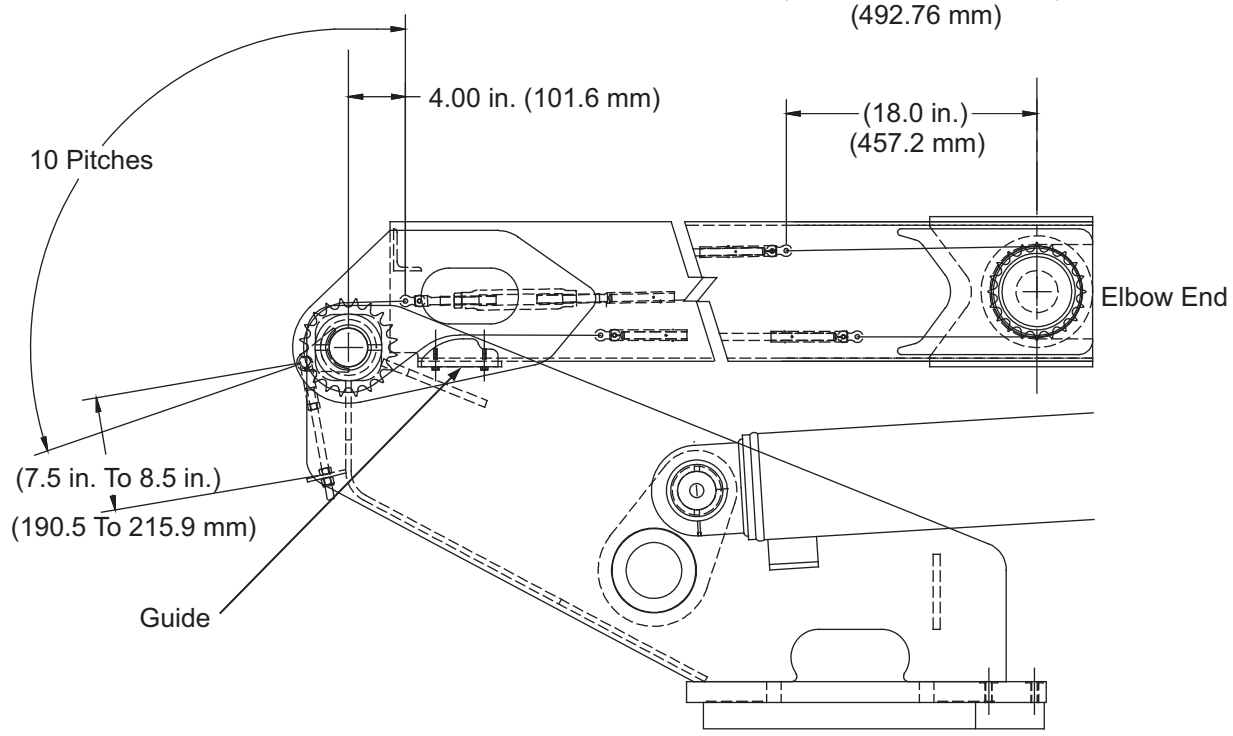
NOTE: The sprockets installed on the cross tube assembly are matched drilled for the spiral pins. Ensure whenever the sprockets are removed for any reason, they are marked prior to disassembly for ease of reassembly.

Assembly must be checked every 180 days or if the leveling has been subjected to a shock load such as pushing the platform against a fixed object.

When checking the assembly, ensure the fasteners are tight including the roll pins. If fasteners are loose, remove and check the threads for damage. If the threads are OK, clean and lubricate with ample amount of red loctite and torque to value in Quick Reference section with a 5/16 in. 12 point socket.

LEVELING WITH 80N CHAIN





NOTE: Install the leveling rods and chain per instructions. Align guide with the chain before tightening.

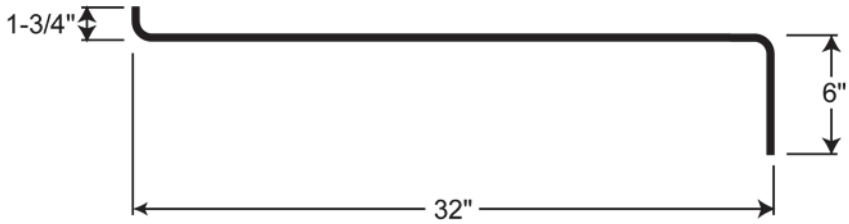
REMOVAL

1. Platform must be supported by a suitable lifting device to prevent movement.
2. Mark the chains and rods to allow reassembly in the same order as they were originally installed.
3. Loosen the locknut securing the turnbuckle. The turnbuckles are located near the turntable in the lower boom and near the elbow in the upper boom.
4. Unscrew the turnbuckle fully.
5. Pull the chains with the rods attached out the elbow end of the lower boom and the platform end of the upper boom.
6. Place in suitable work area.
7. If the elbow cross tube is to be removed, the hoses must be disconnected and pulled through the elbow. Follow the procedure for upper boom removal.
   NOTE: Inspect the chains following the chain inspection procedure. Inspect fiberglass rods and rod terminal for slippage.

   NOTE: The master link must be properly installed and the cotter keys can not be deformed or sheared

INSTALLATION

1. Install upper boom fiberglass rods and chains according to the diagram on the previous page with the platform in a level position. The elbow sprocket is a free-floating shaft transitioning the leveling from the lower boom to the upper boom, no indexing is required.
2. Snug up the chain by tightening the turnbuckle. Use diagram below for adjustment tool configuration. The tool is used for turnbuckle adjustment for the upper and lower boom leveling rod tension.

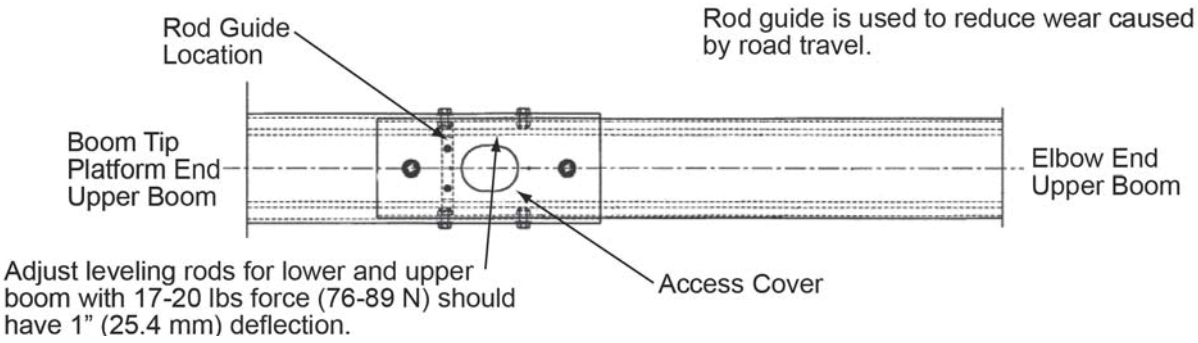


Use a 3/8 inch rod for adjusting leveling rods.

3. Adjust the sprocket at the turntable according to the diagram. Do not tighten the adjusting nuts.
4. Install lower boom fiberglass rods and chains according to the diagram on the previous page. Rotate the sprocket at the elbow to remove all of the slack out of the lower leveling rod in the upper boom.
5. Snug up the chain by tightening the turnbuckle in the lower boom.
6. Align chain guide in lower boom at turntable to the chain. The boom is slotted to allow the adjustment side to side before tightening guide fasteners. The guide must allow the chain to run straight from the turntable sprocket to the elbow sprocket.
7. Measure the dimensions for the upper and lower chains to verify they did not move during installation. If the dimensions are incorrect, loosen the turnbuckle, walk the chain on the sprocket in the required direction, and re-tighten the turnbuckle.
8. When tensioning turnbuckles, hold leveling rod and chain to prevent twisting during tightening.
9. The leveling should be tightened with the turnbuckle to achieve a deflection of 1 inch (25.4 mm) at the center-most access opening. See Quick Reference for required force.
10. Tighten the lock nuts on both turnbuckles.

11. Level the platform by moving the adjusting rod anchoring the turntable sprocket to the turntable. If the length of the adjusting rod is out of the range shown the chain must be jumped on the sprockets as needed to keep all three dimensions in spec.
12. Inspect chains to verify they have not twisted during assembly.
13. Install rod guide in the upper boom over the insulator rods and secure with fasteners (See diagram below).

If the chains are not timed properly, the rod terminals will ride up on the sprocket. This puts undue strain on the system and may cause damage. Failure of the leveling systems may cause the platform to upset and eject the operator, causing death or serious injury.



LEVELING ANCHOR

SECTION 200

INTRODUCTION TO THE HYDRAULIC SYSTEM

All Aerial Devices are vehicle-mounted, hydraulically powered, mechanical devices. The truck must have adequate stability, strength and mobility.

The Aerial Device uses a hydraulic system, which is powered by the truck engine or auxiliary engine, which drives a hydraulic pump by means of a power take off (PTO) connected to the truck transmission or output shaft.

The hydraulic system is open center. When a control is actuated, the pump output is directed to the motor or cylinder dictated by the control, which in turn, increases the pressure as needed to operate the functions. All control valves are open center, four-way, with spring return to the neutral position.

HYDRAULIC PUMP OPERATION

The hydraulic system may be equipped with a vane type pump, a simple gear pump, or piston pump. When trouble–shooting a hydraulic circuit, it is helpful to remember that a pump does not produce pressure. It only produces fluid flow; resistance to fluid flow is what produces pressure.

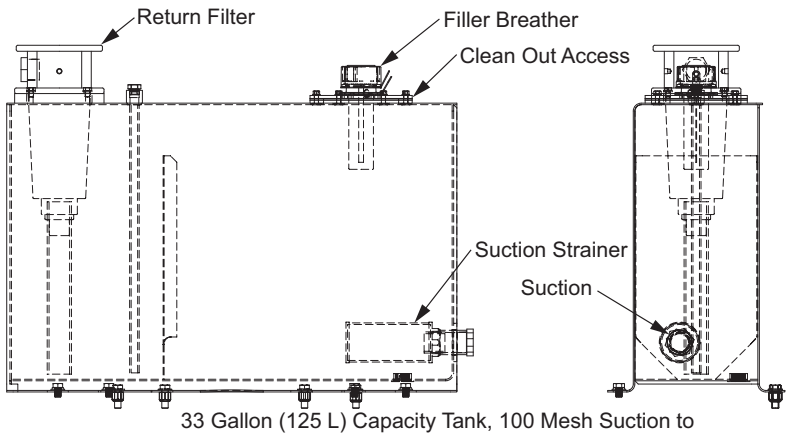
HYDRAULIC RESERVOIR

The oil reservoir has two important functions, storage and cooling. The first function is to supply the hydraulic system with clean oil to operate the Aerial Device efficiently as the volume of oil to fill the cylinders changes. The oil level should be checked daily, do not overfill. While the pump is operating, oil will surge over the top of the center reservoir baffle. This automatically purges the system of any trapped air and vents it out the breather in the reservoir cover.

The standard reservoir size is 33 gallons (125 L). A 40 gallon (151 L) reservoir is installed on units equipped with a lift or additional options.

Cooling is the second function of the reservoir tank. During operation the contents of the tank cycles about once every three minutes. The circulation of oil continually dissipates heat through the walls of the reservoir. Hot weather operation above 100 degrees F (38 degrees C) may require intermittent operation to allow the oil to cool or the addition of oil coolers. Do not exceed an oil temperature of 150 degrees F (66 degrees C). It is important to keep the reservoir and the area around the reservoir and the area around the reservoir clear to allow air circulation.

EXTERNAL RESERVOIR



33 Gallon (125 L) Capacity Tank, 100 Mesh Suction to Pump and 30 Mesh Filler Screen, and 10 Micron Breather.

Fluid level should be checked with outriggers and booms stored.

SLUGGISH OIL IN COLD WEATHER

Cold weather operation below 10 degrees F (-12 degrees C) requires:

- The hydraulic system must be filled with hydraulic fluid having a pour point suitable for the temperature.
- The hydraulic system must be properly warmed up:
  - Operate the pump at idling speed to allow the oil to warm up gradually. Cold, thick, sluggish oil may not move fast enough and will starve the pump, thus causing severe damage.
  - Circulate the oil through the outrigger system by cycling each outrigger several times before setting up for boom operation.
  - Circulate the oil through the system by cycling each function from the lower controls before operation from the platform.
  - The addition of oil heaters may be required.
- Operate the boom and functions slowly to prevent jerking and shock loading.
- Functions may operate sluggish and not be as responsive, so allow more time and distance when starting and stopping movements.

HYDRAULIC OIL FILTER OPERATION

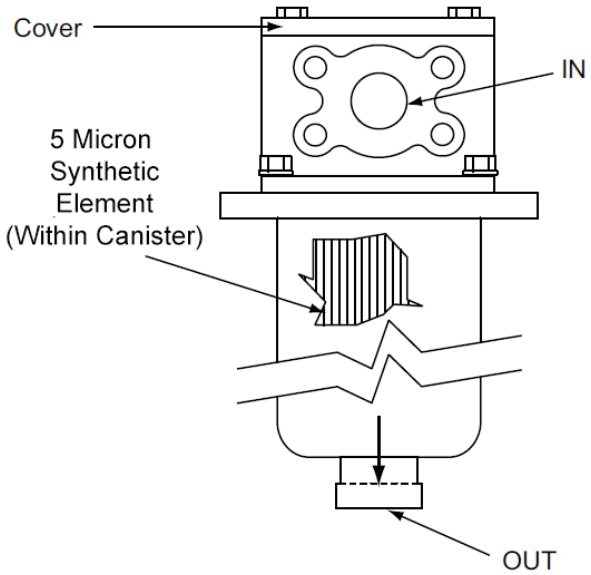
This Aerial Device is equipped with a return filter located at the top of the reservoir. This filter protects the hydraulic system by removing harmful particles and other foreign material.

The unfiltered oil enters the filter inlet side, flows downward, around and through the filter element. As the oil passes through the element, particles of dirt and other materials as small as 5 microns are trapped. The clean oil enters the center passage and is returned to the reservoir. Each filter element has an operating temperature from -65 degrees F (-54 degrees C) to 300 degrees F (149 degrees C). and an operating pressure of 100 PSI (.69 MPa) maximum.

The return line filter is equipped with a bypass valve to prevent blocking the system flow, should the filter element become clogged, or at cold start-up when the oil is too thick to pass through the element.

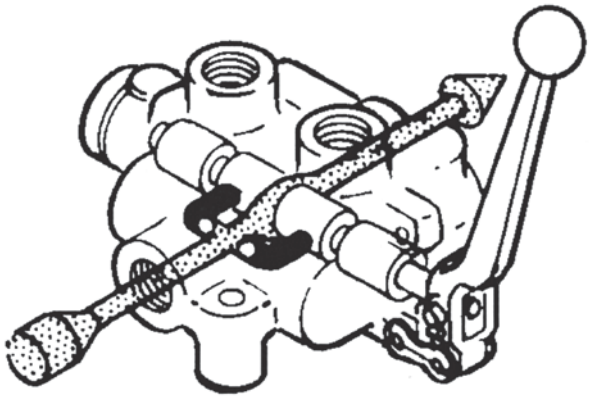
All new or recently worked on Aerial Devices should be run at idle speed for 30 minutes with a NEW FILTER CARTRIDGE, to thoroughly filter the oil. It's a good idea to purge all cylinders and motors at the same time. Next remove the filter cartridge and throw it away. Replace with a new filter cartridge.

The 5 micron synthetic return line filter filters 100 percent of the system oil flow when at operating temperature and not in bypass mode.



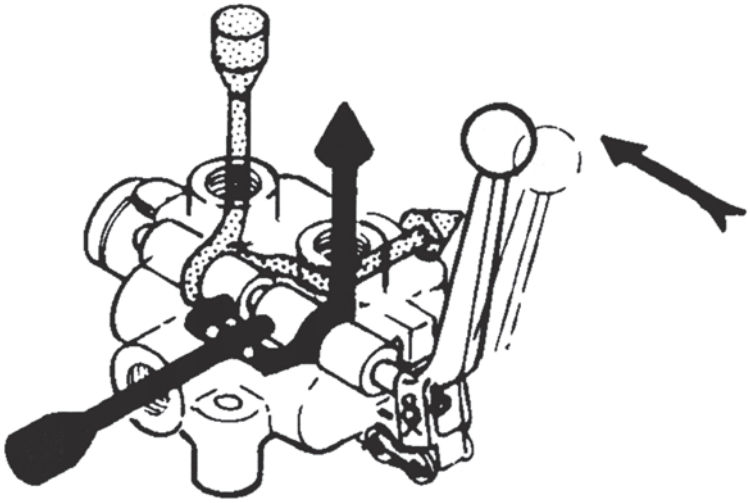
DIRECTIONAL CONTROL VALVE OPERATION

The accompanying illustrations shows an open center valve with only one spool for simplicity. In the illustration below, the control lever is in neutral, the center ports are open and no work is done. (The oil flows freely through the valve from pump to tank.)



CONTROL LEVER IN NEUTRAL

When the control lever is moved inward (as in the illustration below), the oil flows through the only open passage (to operate the outrigger). By the same lever action, the return outlet is opened to allow the return flow to go to the hydraulic tank.



OIL FLOWS THROUGH OPEN PASSAGE

CHECKS at the inlet port of both the boom and outrigger valves prevent the load from dropping. (This is done by checking any back flow from the cylinders.)

COLLECTOR BLOCK ASSEMBLY OPERATION

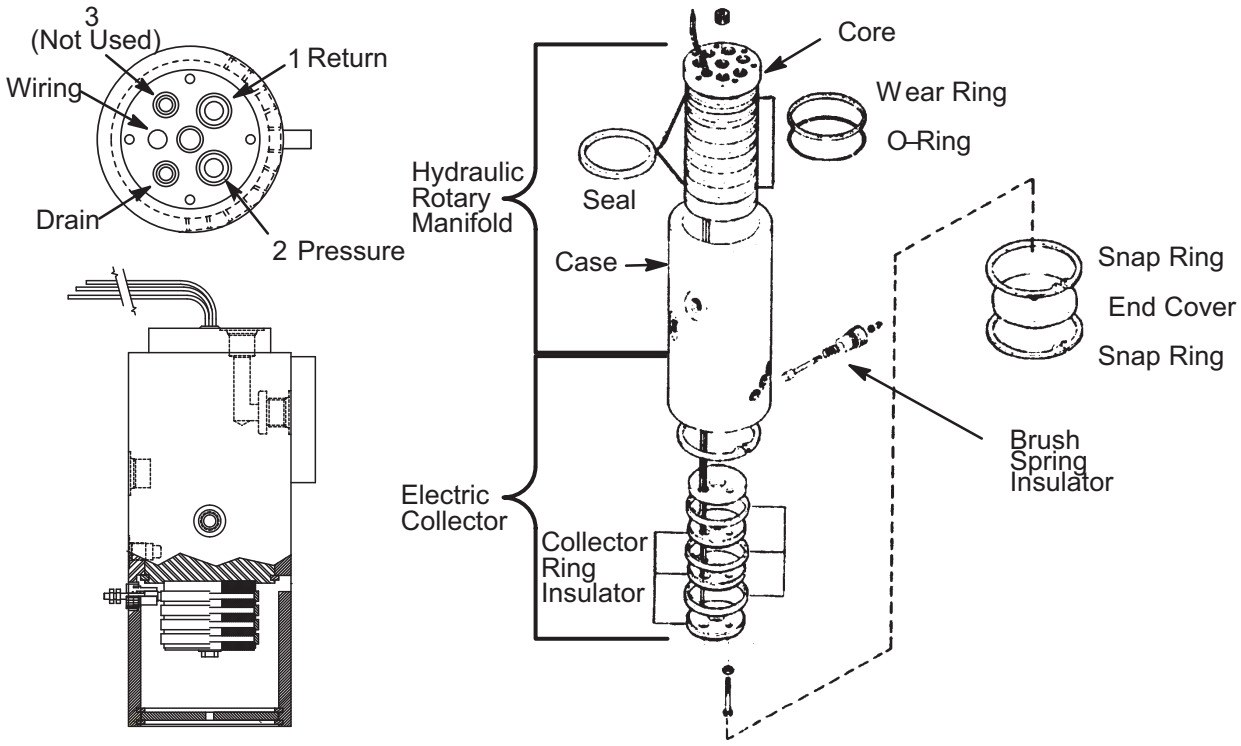
The collector block assembly consists of a continuous 360 degree rotating fluid transfer manifold and electric collector components. The collector block makes it possible to operate any or all functions of the Aerial Devices, even while rotating - without twisting or abrading the hoses or wires.

HYDRAULIC ROTARY MANIFOLD

The inner core is fastened to the turntable with hydraulic lines connecting to the core. The surrounding ported housing is mounted to the pedestal. O-rings in the top and bottom channels prevent external leakage. Glass reinforced teflon rings with backup o-rings are used as seals between channels.

All input and output ports are numbered on the inner block and the outer housing for quick, easy channel identification.

The drain port is intended to return any seepage past the seals back to tank. It must be connected or leakage will occur.



NOTE: Refer to your parts breakdown for correct manifold installed on your machine.

HYDRAULIC SHUT OFF VALVES (OPTIONAL)

A shut off valve can be provided in the hydraulic system adjacent to the hydraulic tank to allow replacement or servicing of the pump without draining the reservoir. This valve is hand operated and will totally block off the hydraulic lines for servicing the pump.

Serious damage to hydraulic components will result if the unit is placed in operation with the shut off valve closed or partially closed.

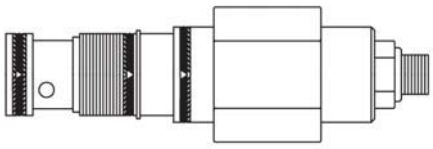
HOLDING VALVES OPERATION

Cartridge type holding valves are integral components in the cylinder. Holding valves provide two important safety features. First, if a hydraulic line is accidentally damaged, causing a rupture, the holding valves prevent the booms from coming down. The holding valves also assist in the smooth operation of the booms.

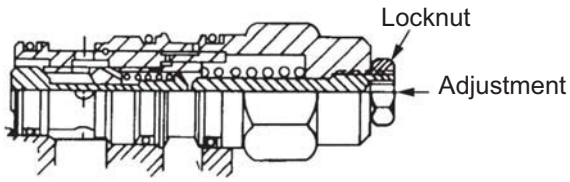
Holding valves are set for the cylinder they are installed in to match the operating pressure and have relief valve capabilities which respond to thermal expansion. The holding valve is designed to hold oil in the cylinder, until opened by pilot pressure from the directional control valve.

Prior to the removal of any holding valve, be certain the component or assembly is properly supported. Removing the holding valves will cause the load of the cylinder to free-fall unless supported.

Before holding valves are removed, relieve as much trapped pressure inside the cylinder as possible. This will prevent damage to the holding valve seals. Always stow the booms, disengage the PTO so the hydraulic pump is not operating. Move the valve function (retract, up, down) back and forth several times to relieve the pressure in the lines to the cylinder. Pressure may still be trapped in the cylinder.



TYPICAL HOLDING VALVE



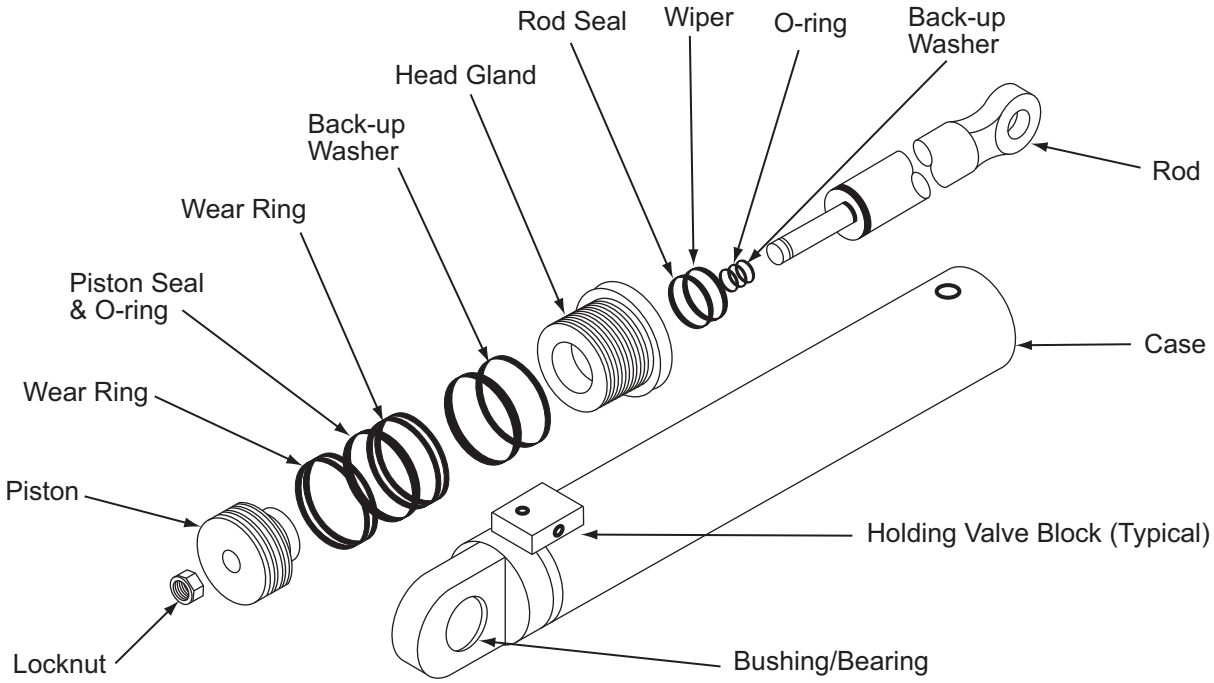
CROSS SECTION TYPICAL HOLDING VALVE

NOTE: Use a test block for any adjustments of holding valves.

HYDRAULIC CYLINDER OPERATION

The function of a hydraulic cylinder is the opposite of a hydraulic pump. It converts the hydraulic force into mechanical force. The cylinder is actuated by the fluid in the hydraulic system, performing work in a straight line. The cylinder is attached directly or through linkages to the load.

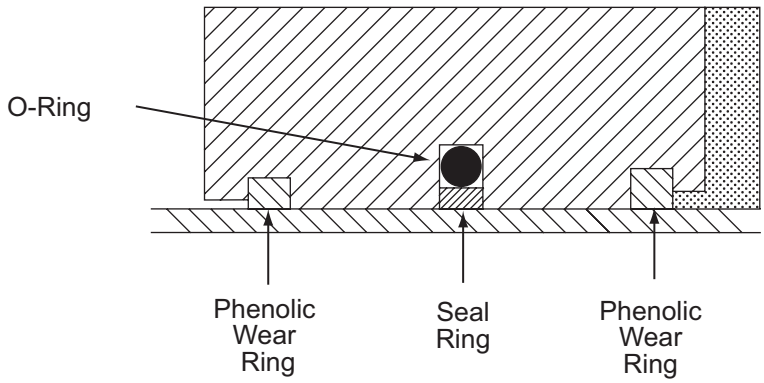
Standard cylinders consist of an outer case, a piston rod, piston, and seals to prevent oil leakage.



Cylinder cases are machined to a smooth finish for long wear and good sealing characteristics. Piston rods are made of high strength alloy steel. Piston rods are polished and chrome plated. Various types of seals, o-rings and oil wipers are used in the cylinders.

Seals used in cylinders include: U-cup wipers, Teflon piston rings, o-rings and wear rings. The pistons and head glands are made of steel or cast iron. The piston rod wiper is designed to keep dirt out of the cylinder, not to seal oil in the cylinder. The seal inside the cylinder head gland forms the pressure seal against the sliding piston rod to keep oil in. In most cases, seal rings are used in conjunction with nylon or phenolic wear rings.

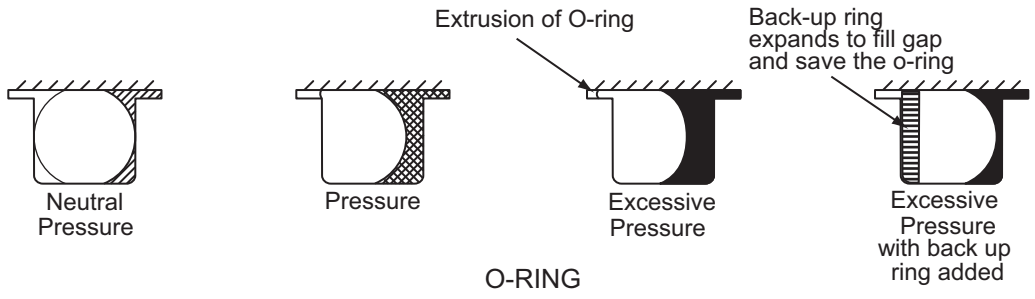
Typical application of seal ring with wear rings is shown below.



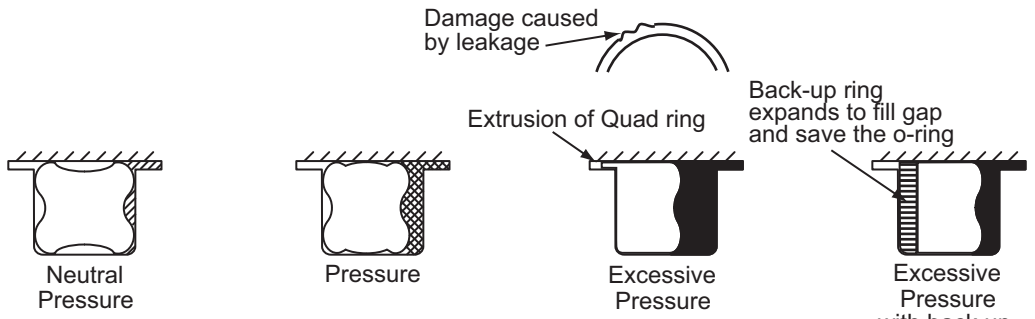
USE OF OIL SEALS

Various oil seals are used to prevent seepage in control valves, hydraulic cylinders and fittings.

The most commonly used seals are o-rings, quad rings, poly pacs and t-seals. These types and how they react to various pressures are illustrated below. Backup washers are often used to prevent damage to seals as shown.

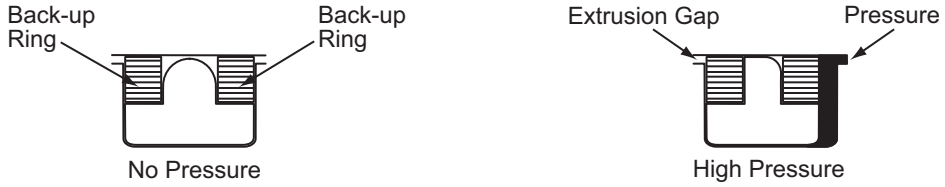


O-RING

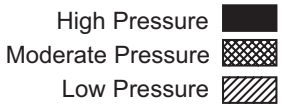


QUAD RING

POLY PACS



T-SEALS



INTRODUCTION TO THE HYDRAULIC SYSTEM

SECTION 205
GENERAL HYDRAULIC SYSTEM MAINTENANCE

Performing daily inspections are the responsibility of a competent operator. Items requiring daily inspection given in the operator's manual include: visual inspection guidelines, lubrication instructions, hydraulic oil level, and field adjustments. Any failure or malfunction should be reported to authorized personnel for corrective action.

Contamination is responsible for more hydraulic system failures than any other single factor. It is vitally important that every precaution be taken when filling the reservoir tank, when removing or replacing filters or components and when connecting quick couplers to prevent dirt or impurities from entering the system.

Do not introduce water or contaminants into the system when you change or add oil. Use only oils recommended by the manufacturer. Filter new oil to help prevent entry of contaminants into the system. Verify that the system has the recommended amount of oil for proper operation at all times.

When a hydraulic system is opened, cap or plug all ports to keep out dirt and moisture-laden air. Reservoir openings should always be sealed immediately following a cleaning. Examine pipe fittings, hoses and tubing to be certain there are no nicks, burrs, moisture or dirt present. Use an air hose to clean fittings. Hoses and tubes should be capped when stored.

Maintain the required filter element change schedule outlined in the manuals and your employer's policy. Following the recommendations above will help achieve the expected life of the pumps, motors, cylinders and subsequent hydraulic components.

Refer to “TROUBLESHOOTING” in this manual for hydraulic troubleshooting.

The operational efficiency of the unit are dependent upon good inspection checks and maintenance practices. Failure to maintain hydraulic system may result in damage or structural failure.

RETURN LINE FILTER REPLACEMENT

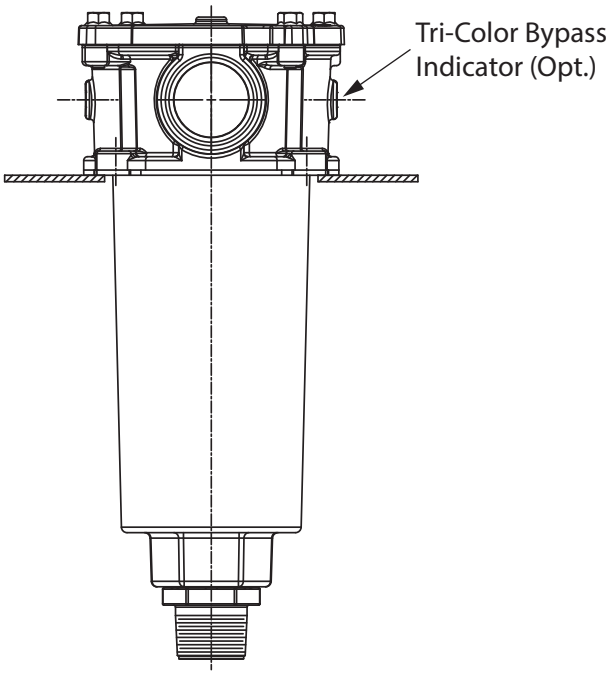
The return line filter element must be changed using the following guidelines.

1. After the first 30 days or 120 hours of operation, whichever occurs first. Change more frequently if working in dusty or dirty environments.
2. Every 180 days or 1000 hours of operation, whichever occurs first.
3. Whenever the filter indicator (if available) indicates replacement.
4. Whenever changing the hydraulic oil.
5. When there is a major hydraulic component failure.

When installing the new filter element, first apply a film of oil to the gasket, then hand tighten the cartridge. Place the appropriate filter wrench onto the filter and tighten additional 1/4 of a turn. Operate hydraulic system and check for leaks at filter cartridge.

Before changing filter, close shutoff valve (optional) to prevent loss of hydraulic oil. Also, remove keys from truck so engine cannot accidentally be started, thus damaging hydraulic system.

The 5 micron return line filter (shown below) filters 100 percent of the system oil flow when at operating temperature and not in bypass mode.



INTERNAL RESERVOIR FILTER

NOTE: If equipped with an optional filter indicator, read the Tri-Color gauge when at normal operating temperature. It is normal to go into bypass mode when oil is cold.

RED - BYPASS, NEED TO CHANGE FILTER.

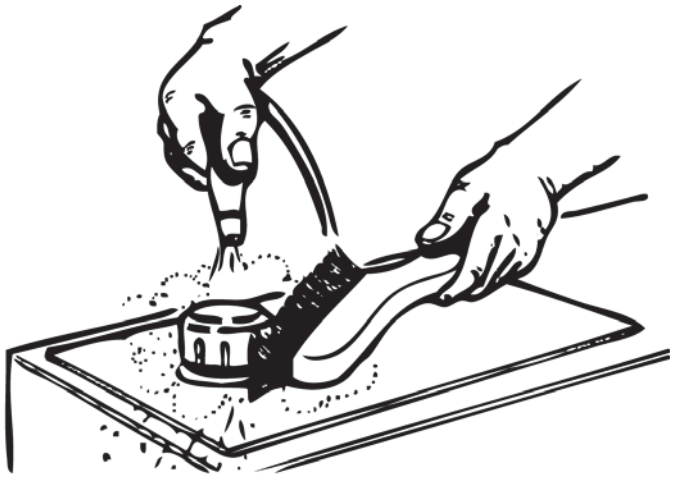
YELLOW - NEAR TIME TO CHANGE ELEMENT.

GREEN - ELEMENT GOOD.

RESERVOIR, BREATHER, FILLER AND OUTLET SCREENS

HYDRAULIC RESERVOIR

The oil level in the hydraulic reservoir must be checked daily to maintain the required oil level. While the pump is operating, oil will surge over the top of the reservoir baffle. This automatically purges the system of any trapped air and vents it out the breather cap located on the reservoir.



BREATHER

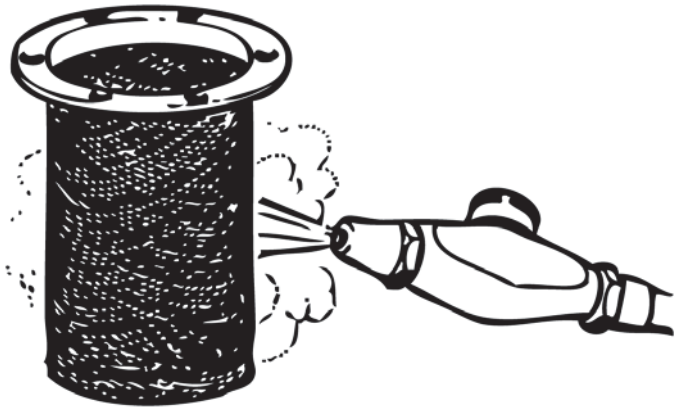
Clean the 10 micron breather every 180 days or 1000 hours of operation, whichever occurs first. Clean more frequently if working in a dusty or dirty environment. Cleaning allows the system to breathe, preventing cavitation.

HYDRAULIC TANK FILLER SCREEN

The 30 mesh screen under the breather cap must be used to prevent large particles from entering the system.

Clean the filler screen every 2,000 hours or 12 months of service, whichever occurs first. Clean more frequently if working in dusty or dirty environment. Remove the filler screen (located under breather cap) from the tank and wash it out with solvent and use high pressure air to blow it dry. Replace screen in filler inlet and secure breather cap.

Replace the gaskets on each side when you re-assemble the filler screen, to eliminate the possibility of any moisture seeping into the reservoir.



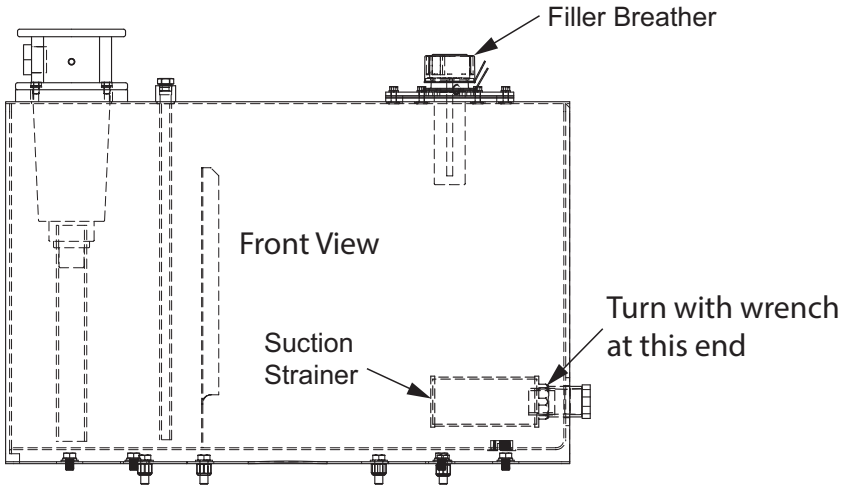
MAGNETIC DRAIN PLUG

The hydraulic tank is equipped with a magnet in the drain plug to attract and hold any metallic particles. Remove and clean whenever the oil is changed or whenever a failure occurs in the system.

HYDRAULIC TANK OUTLET SUCTION SCREEN FOR PUMP

NOTE: When removing the screen, use a wrench on the hex. Do not turn by the wire mesh.

The one piece 100-mesh screen, located in the hydraulic tank at the outlet, is further protection against large particles circulating in the system. Remove tank cover and reach down into the oil and turn the one piece screen counterclockwise to remove. Clean by washing with solvent and dry using high pressure air. Replace by reversing above steps.



HYDRAULIC OIL SPECIFICATIONS

HYDRAULIC SYSTEM

Follow the maintenance guidelines to maximize the efficient operation of the hydraulic system.

Hydraulic oil for your Aerial Device must meet the following requirements listed below.

1. A petroleum based or biodegradable.
2. Anti-wear additives to ensure the long life of the hydraulic components.
3. Anti-foam additives to minimize air entrapment.
4. Good chemical stability at anticipated operating temperatures.
5. A flash point above anticipated operating temperatures.
6. Good demulsibility or water separation characteristics.
7. Dielectric strength.

OIL TYPE

Oil used in the hydraulic system performs the dual function of lubrication and transmission of power. Oil must be selected with care and with the assistance of a reputable supplier.

Terex South Dakota, Inc. does not guarantee the quality or characteristics of any hydraulic oil for usage. A reputable distributor or supplier should be consulted in any hydraulic oil application. Mixing different oils or additives must be done only by the supplier. Serious damage to a hydraulic system can result from mixing incompatible hydraulic oils or additives.

Contaminated fluid may cause damage to the pump and/or control valve. Filter the fluid through a 10-micron (absolute) or less filter before adding fluid to the system.

The following chart is a list of suitable hydraulic oils with their respective properties. This information will be helpful in the selection of a hydraulic oil or an equivalent oil for a particular application.

AMBIENT TEMPERATURE RANGE	RECOMMENDED ISO VISCOSITY GRADE
-20º F (-29º C) To 120º F (49º C)	15

BRAND NAME	ISO GRADE	VISCOSITY				VISCO-SITY INDEX	POUR POINT		FLASH POINT	
		SUS		CST						
		@ 100ºF	@ 210ºF	@ 40ºC	@ 100ºC		ºF	ºC	ºF	ºC
TEXACO RANDO	15	77	40	15.9	4.1	170	-50	-46	300	149
EXXON UNIVIS J-13*	15	75.1	43.5	14.1	5.2	374	-75	-59	200	93
KENDALL GLACIAL	15	90	42	17	4.5	200	-50	-46	300	149
NORTHLAND TALAMAR EXTREME LTT	15	76	36.5	14.5	3.7	150	-60	-51	365	185
MOBIL DTE 11 M	15	80	43	15	4.1	140	-40	-40	330	166
MOBIL AERO HFA *	15	79	45	14	5.6	199	-75	-59	200	93
American Synthol PGHD 15** Planet Green	15	77.4	38.6	15	3.8	151	-51	50	370	188

** BIODEGRADABLE HYDRAULIC OIL

* MEETS MIL-H-5606 SPECIFICATIONS

Hydraulic oil is flammable and will burn.

OPERATING TEMPERATURES

These temperature ranges for each grade of oil are satisfactory if suitable procedures are followed for low temperature start-up conditions and if sustained operation is avoided at the upper temperature limits. Operation in excess of these temperatures results in increased wear of the system components and causes more rapid deterioration of the oil, and may cause hose failure. The recommended maximum operating temperature for the units hydraulic system is 150 degrees F (66 degrees C).

VISCOSITY

Viscosity is the measure of the thickness of a fluid and its ability to flow. The oil must have sufficient film thickness to provide adequate sealing between working parts of the pump, valving, cylinders, etc., but not too thick to cause pump intake cavitation, sluggish valve action, or excessive back pressure. Viscosity recommendations must take into consideration the working temperature range. Refer to table of oil viscosity recommendations for more information.

VISCOSITY INDEX

The viscosity index is a measure of the rate at which temperature changes effect oil viscosity. The oil viscosity should remain as nearly constant as possible under the wide range of temperature conditions encountered in operating mobile and construction machinery. The viscosity index (V.I.) of hydraulic oil is recommended to not be less than 140 for this type of application.

ADDITIVES

Research has developed a number of additive agents that improve various characteristics of oils for hydraulic systems. They may be selected for reducing wear, increasing chemical stability, inhibiting corrosion, depressing pour point and improving the anti-foam characteristics. Proper use of additive agents requires specialized knowledge, and should be incorporated by the oil manufacturer only to avoid hydraulic problems. Using additives with high metallic content will reduce dielectric strength.

POUR POINT

The pour point of the hydraulic oil must be below the minimum anticipated temperature to prevent cavitation damage to the pump. If pour point specifications are not met, an auxiliary heating method is required.

DIELECTRIC STRENGTH

The dielectric strength of the oil in new condition shall be higher than 25 KV, used oil shall be higher than 15 KV, when measured per ASTM D877 (kv/0.1).

OIL STORAGE AND HANDLING

STORAGE

To prevent oil contamination during storage, select a clean, dry, temperature controlled environment to prevent condensation. Store the drums on their sides to prevent water from collecting on the top and seeping in through the plug. Cover the drum to prevent dust and moisture accumulation.

HANDLING

Before opening a drum, carefully wipe the top to remove any dust or dirt. When drawing oil out of storage, transport oil in clean, covered containers. If the oil drawn out of storage is not used immediately, make sure it is kept tightly covered. Components on transfer pumps, including suction pipe, must be clean when transferring hydraulic oil.

FILLING

Before removing filler cap to add oil to a system, wipe off the fill plug and the filler nozzle with a clean, lint-free cloth. Filter the new oil added to the reservoir with a 10 micron filter, new oil may not meet the cleanliness specifications for this unit depending on transport and storage. The reservoir should be tightly closed after filling the system.

CONCLUSION

Dust, water, lint or contaminants of any kind can seriously impair the operation of a system. A PREVENTATIVE MAINTENANCE PROGRAM AIMED AT KEEPING OIL CLEAN WILL PAY OFF. Following the procedures outlined in this section can prevent material from contaminating oil.

Terex South Dakota, Inc. equipment is designed to minimize dirt from entering the system during operation. Understand your operating conditions and initiate practices to minimize the contamination of the hydraulic system.

NOTE: Hydraulic oil spills may require notification of local, state or federal agencies. Be aware of the requirements in your area.

GENERAL HYDRAULIC SYSTEM MAINTENANCE

SECTION 210
HYDRAULIC PROCEDURES

TURNTABLE ROTATION CIRCUIT

The turntable rotation circuit includes a hydraulic motor, gearbox, collector block assembly, main control valve, and the necessary hydraulic lines and fittings.

OPERATION

Right Rotation (CW): Hydraulic oil sent to the designated port of the hydraulic motor rotates the turntable clockwise. Hydraulic oil from the opposite port on the motor will return to the control valve section and to the reservoir.

Left Rotation (CCW): Hydraulic oil sent to the designated port of the hydraulic motor rotates the turntable counter-clockwise. Hydraulic oil from the opposite port on the motor will return to the control valve section and to the reservoir.

UPPER BOOM CYLINDER CIRCUIT

The upper boom cylinder hydraulic circuit includes the upper boom cylinder, holding valves, flow control valve, directional control valves and the necessary hydraulic lines and fittings.

OPERATION

The elbow cylinder operates the upper boom. The directional control valve sends oil to the holding valve allowing oil into the cylinder while the pilot pressure generated opens the holding valve on the opposite side to allow the oil out of the opposite end of the cylinder. To prevent the load from overrunning the oil supply, the holding valves will modulate, controlling the oil flow.

The XT Pro is an overcenter machine. The operator must follow the operational decal of fold and unfold, not up and down. Moving the control in the designated Unfold direction while in a non-overcenter position, the platform is moving upward. Moving the control in the Unfold direction while in an overcenter position, the platform is moving downward.

LOWER BOOM CYLINDER CIRCUIT

The hydraulic, lower boom cylinder circuit includes the lower boom cylinder, holding valves, control valve, and the necessary hydraulic lines and fittings.

OPERATION

Lower Boom Up: Hydraulic oil is sent to the base end of the lower boom cylinder from the control valve. The hydraulic oil passes through the holding valve cartridge at the base end of the cylinder. The incoming hydraulic oil forces the cylinder rod to extend, raising the boom. Pilot pressure releases the holding valve cartridge at the rod end of the cylinder allowing the oil to return through the lower control valve and to the reservoir.

Lower Boom Down: Hydraulic oil is sent to the rod end of the lower boom cylinder from the control valve through the holding valve. The incoming oil forces the cylinder rod to retract, lowering the upper boom. Pilot pressure will release the holding valve at the base end of the cylinder allowing the oil to flow through the lower control valve and to the reservoir.

The XT Pro lower boom goes past 90 degrees. The operator must follow the operational decal of fold and unfold, not up and down. Moving the control in the designated Unfold direction while in a position between stowed and vertical, the platform is moving upward. Moving the control in the Unfold direction while in an position beyond vertical, the platform is moving downward.

OUTRIGGER CIRCUIT

The outrigger circuit includes the outrigger cylinders each with integral check valves, directional control valves, selector valve, chipbox directional control valve and the necessary hydraulic lines and fittings.

OPERATION

The pump supplies hydraulic oil to the inlet of the open-center outrigger control valve. To operate outriggers move selector to O/R position actuating the outrigger valve, hydraulic oil will flow to the outrigger cylinder.

Outriggers Down: The outrigger directional control valve directs oil to the base end of the outrigger cylinder when extending. The hydraulic oil flows freely through the pilot check valve into the cylinder base of the outrigger cylinder. Hydraulic oil pilots the check valve open on the rod side of the cylinder and returns oil to the reservoir through the outrigger control valve.

Outriggers Up: The outrigger directional control valve directs oil to the rod side of the outrigger cylinder when retracting or raising. When pressure is sufficient to overcome the load on the cylinders and open the pilot check valves, hydraulic oil is released from the cylinder base and the outrigger retracts. Loss of pilot pressure from the rod side of the cylinder closes the check valve and holds the hydraulic oil in the cylinder base, preventing further retraction of the cylinder.

UNIT SELECTOR

The unit selector is located in the outrigger control valve, typically the first selection. It selects between providing oil between the unit and the outriggers. If the unit is equipped with lower tool circuit, the tool circuit directional control valve will be between the valve inlet and the unit selector section, providing priority to the tool. When the outriggers are selected, no oil flows to the unit and the outriggers will operate. If the unit is selected, it stops all oil from going to the outrigger valve sections and sends all the oil to the unit. When a pressure compensated piston pump is not used, a relief valve is required in the inlet to the outrigger valve if a fixed displacement pump (vane or gear) is used.

WATER IN THE OIL

Water in the oil will reduce the lubrication capabilities of the oil, reduce or eliminate the dielectric properties of the oil, and corrode the pump and components, reducing the life of the hydraulic system.

Water in the oil will make the hydraulic oil conductive and death or serious injury may result.

TAKING AN OIL SAMPLE FOR INSPECTION

A sample of hydraulic oil should be taken and inspected every year or 2000 hours of operation, whichever occurs first, or whenever it is suspected the hydraulic oil is contaminated.

The fluid must be taken at operating temperature and the sample taken while the system is operating. In no case should the fluid sample be taken at the bottom of the reservoir, which could introduce water and heavy contaminants. The sample should not be taken near the top surface, which could sample fluid that is not representative of what is passing through the system.

Follow the procedure below.

1. Use a clean sample bottle
2. Oil must be at operating temperature.
3. Clean and flush fittings and sampling hose before drawing the sample from circulating oil from a supply line tap.
4. Have a hydraulic oil sample tested for contamination. If the sample shows contamination greater than ISO 18/15, change the hydraulic oil or perform off-line filtration.

CHANGING AND PURGING THE HYDRAULIC OIL SYSTEM

The hydraulic oil must be changed if it is known to be contaminated and cannot be filtered off-line, or when a major component fails, such as a hydraulic pump.

Before draining the fluid, if the system is operational, run until the fluid reaches operating temperature and all actuators are cycled to put contaminants in suspension. The oil must then be drained before the system cools to prevent contaminants from settling out of the fluid. Block any machine members that might fall.

Remove the reservoir inspection cover (filler/breather) to access the fluid. Use a portable pump to transfer the fluid from the reservoir to a container. Place a container under the reservoir and drain the remaining fluid from the bottom of the reservoir.

Remove the clean out plate on the reservoir and wipe out the sludge and foreign material that has settled in the bottom of the reservoir with lint-free shop towels. Continuing wiping out the reservoir until it is clean. Replace the inspection plate and drain plug.

Drain and clean replaceable filter housings and replace filter elements in the system. Fill the system with clean hydraulic oil by pumping it into the reservoir through a filter. Verify that the pump is full of oil and primed before starting the pump. Check the outlet for flow and low pressure (less than 1000 PSI/6.90 MPa.) Warm up the system, cycle all actuators in one direction. Drain and replace with clean oil. Cycle all actuators in the opposite direction. Drain and replace with clean oil.

Shut off the system, relieve system pressure and replace all filter elements.

Cycle the clean fluid through the system several times and recheck the fluid level. Check the system for leakage. Verify the system pressure setting. Record the fluid change in the unit records.

Do not ride the platform while the hydraulic system is being flushed or charged. Serious personal injury or death could result.

CHECKING FOR HYDRAULIC LEAKS

The hydraulic system must be checked daily for hydraulic leaks.

Check hydraulic system for leaks using a piece of cardboard only. NEVER use your hands.

When checking the hydraulic system for leaks, observe only, NEVER use your hands to locate a leak. Hydraulic oil from a pin-hole leak can puncture your skin and cause serious injury requiring immediate medical attention.

If a component or fitting is leaking, repair or replace immediately.

IMPORTANT: Never operate the unit when leaks are present.

SECTION 230
HYDRAULIC CYLINDER REPAIR

All hydraulic cylinders should be periodically tested for internal leakage. Refer to “LEAKAGE TEST” in this section for testing procedure.

Check cylinders for external leakage daily. If leakage is detected, identify the source of the leak and repair or replace as necessary.

Shut down the hydraulic system before removing any cylinder. Remove lines to cylinder and plug or cap them to prevent loss of fluid. Also plug cylinder ports to prevent loss of fluid. Tag or mark lines to prevent reversing connections when reassembling.

See the appropriate section in this manual for the removal of cylinders.

Outrigger cylinders shall be repaired if they drift down during road travel or drift up when extended in a working position with the holding valves functioning correctly. Immediate attention should be given to any outrigger cylinder that drifts. Drifting outriggers can indicate that the cylinder seals are leaking. Damage could result if an outrigger should drift down during road travel.

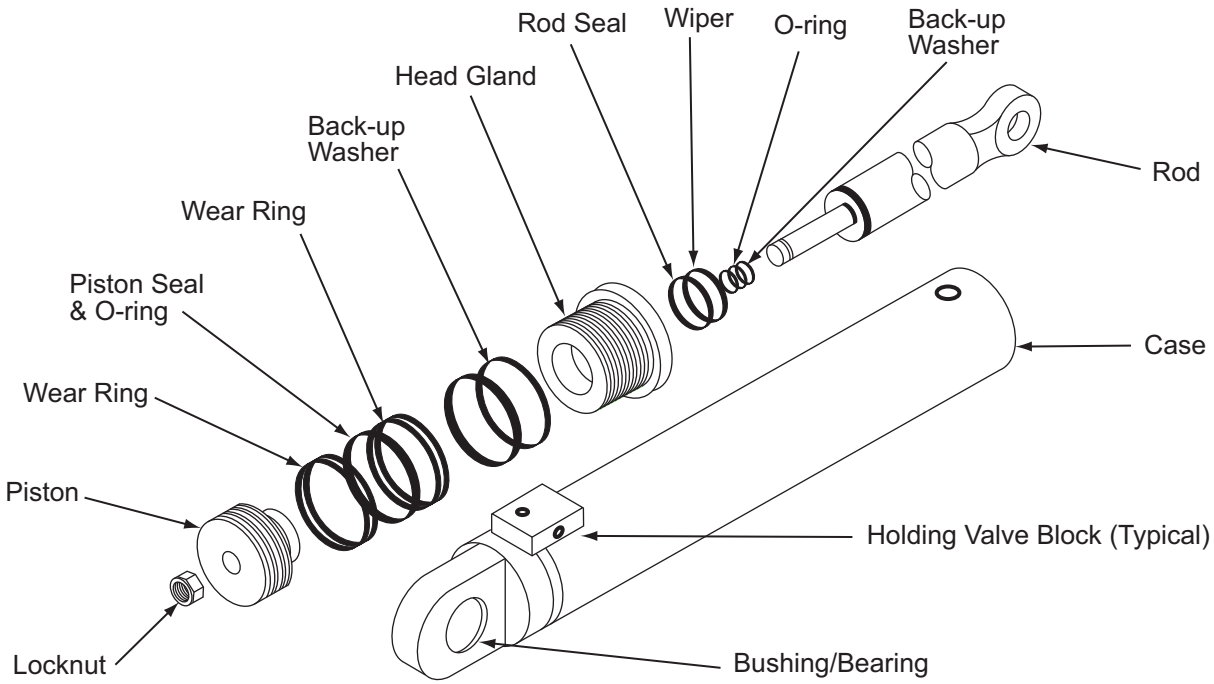
Care should be exercised when removing cylinders, as some are heavy. Heavy cylinders should be removed by means of a hoist, if available. Do not scratch or mar surface. Use rope slings or other soft material. Never allow chains or wire rope to contact any parts that could be damaged. Support structure before removing cylinder.

1. Position the cylinder on a rail (if available) or a work bench and place the open port over a container in order to catch the hydraulic fluid. Release (pressure) holding valves and extend the piston to the end of its stroke to purge the hydraulic fluid into the container. This can be done by using the rail (if available) or by manually pulling out the piston rod. Next, push piston rod approximately one-half way back in.

Do not use air pressure to disassemble hydraulic cylinders. Air is very compressive and serious injury could result.

When cylinder is disassembled, check cylinder rod bearings/bushings for possible wear and replace if necessary.

2. Remove the head gland at the end of the cylinder. Carefully pull on the rod eye to remove the internal assembly, avoid scratching the inner finish. Inspect the inside of the case for damage requiring replacement of the cylinder case.
3. Remove all components from rod, examining for wear, rust or other signs of deterioration. Clean all components of rust, dirt and contamination. After cleaning, coat all components with light grease.
4. Install new seals, packing or other parts as needed. Assemble the cylinder rod components: gland, piston, and seals, and install new piston nut and torque to the specified value, refer to Quick Reference Guide. Lubricate the inside of cylinder case, seals, and threads. Pack the threads of the gland with heavy grease. Avoid introducing contamination or scratching the cylinder wall when reassembling. When reassembling, protect seals from damage on the threads.
5. Cycle cylinder on work bench or test stand to purge air from cylinder. Test cylinder for leakage.
6. Reset or replace holding valves.
7. Install cylinder on machine.



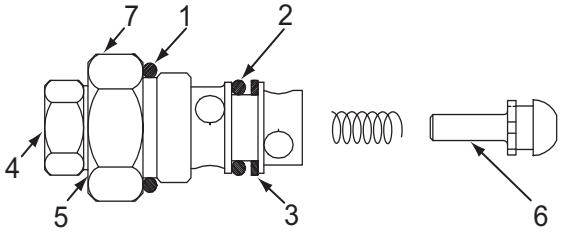
Air in a hydraulic cylinder creates a hazardous situation. After repair, the cylinder must be purged of air. Do not ride the platform while air is being purged, serious injury or death could result. With all cylinders retracted, fill the hydraulic reservoir to the full level as needed.

DO NOT weld or cut anywhere on the cylinder, consult manufacturer for recommended repair procedures.

If rust is found on the threads in the gland area, only clean with a wire brush. The part must be replaced if threads are damaged. Dressing the threads may structurally weaken the threads, leading to failure.

OUTRIGGER CYLINDER LOCK VALVE CARTRIDGE

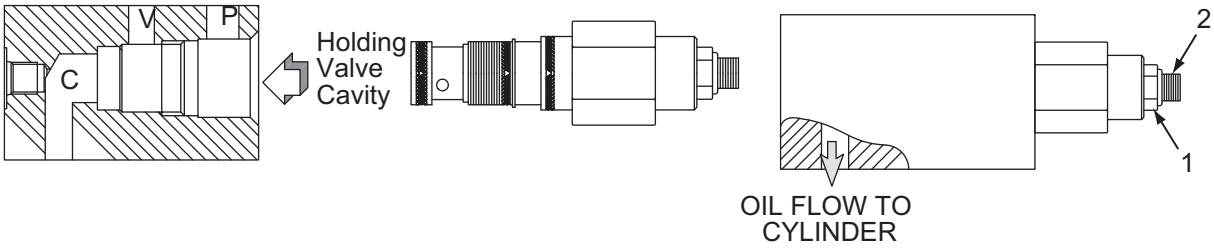
1. O-ring
2. O-ring
3. Backup Ring
4. Plug
5. O-Ring
6. Poppet (Inside Cartridge)
7. Cartridge Body



To remove and inspect valve cartridge, proceed as follows:

1. Remove all load from cylinder.
2. If external leakage exits around the cartridge body (7), replace thread seal, and see if leak stops.
3. Remove valve cartridge with socket and wrench (7/8 in. hex).
4. Inspect o-rings and backup ring (1, 2 and 3). Replace as necessary.
5. To inspect internal components of cartridge, place valve cartridge in a soft jawed vise and remove plug (9/16 in. hex). Inspect o-ring (5) on plug (4) and replace if necessary.
6. Remove both springs and poppet from inside of cartridge. Inspect the round end of poppet. If end has groove worn in it, replace valve cartridge.
7. Inspect seat in cartridge body where poppet (6) rests in body. If seat doesn't have a good square edge, replace valve cartridge.
   NOTE: Do not repair poppet or cartridge body. Replace valve cartridge if repair is required to these items. Replace o-ring and backup as necessary.

SUN HOLDING VALVE CARTRIDGE



NOTE: DO NOT attempt to make any repair to the holding valve cartridge other than replacement of o-rings and back-up rings. Always replace the complete holding valve with new o-rings and back-up rings when found to be defective.

1. Place boom on boom rest or otherwise remove weight from cylinder.
   a. Place a container near the holding valve that will contain the hydraulic fluid.
   b. Relieve the pressure from the cartridge by loosening the locknut (1) and turning the adjustment (2) clockwise.
2. Remove valve from cylinder.
3. Inspect body to cylinder o-ring and replace if necessary.
4. Inspect seat. If seat is faulty, complete valve should be replaced.
5. Inspect o-rings and replace as required.
6. Assemble valve and replace on cylinder.
7. Reset holding valve using a "test block". See Quick Reference Guide for proper setting.

HOLDING VALVE SETTINGS

See Quick Reference Guide.

HOLDING VALVE ADJUSTMENT PROCEDURE

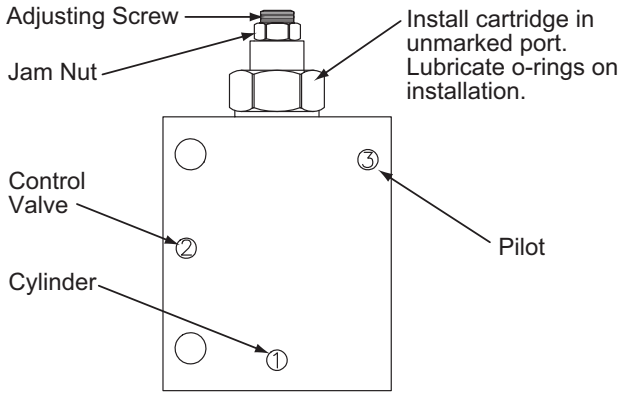
RELIEF METHOD

The valve cartridge may be removed from the cylinder and adjusted in a test block using the “RELIEF” method of adjustment.

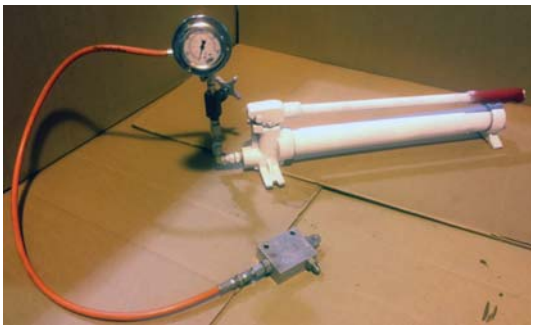
Boom must be supported and cylinder pressure relieved prior to removing holding valve cartridge or boom can fall or inject fluid.

Follow the procedure below to adjust holding valve cartridge.

1. Connect the hydraulic power source along with a quality, calibrated pressure test gauge to port number one (1) of the test block.
   NOTE: A hydraulic source capable of producing up to 4000 PSI (27.58 MPa) will be required to set the relief setting using this method.
2. Install a straight adapter fitting in port number two (2) of the test block. The fitting will aid in observing more closely the oil flow from port two (2) during the set procedure. Leave port number three (3) open.
3. Gradually increase the pressure in port one (1) and watch for drops of oil to appear at port two (2).
4. The “holding valve relief setting” is the point where the individual drops form into a fine stream of oil. Turn adjusting screw clockwise to decrease relief setting or counter-clockwise to increase relief setting.
5. Repeat the procedure several times to remove any residual twist in the counter balance main spring and to assure an accurate setting. Tighten jam nut.



Port #1 is the port normally connected to the cylinder.
Port #2 is the port normally connected to the control valve.
Port #3 is the pilot port.



HOLDING VALVE TEST BLOCK

Do not loosen holding valve, only jam nut and adjusting screw.

LOWER BOOM CYLINDER DRIFT TEST

Never remove holding valves or disconnect any hydraulic lines from holding valves until boom or booms are fully supported from falling.

NOTE: A drift test must be performed on all hydraulic cylinders annually.

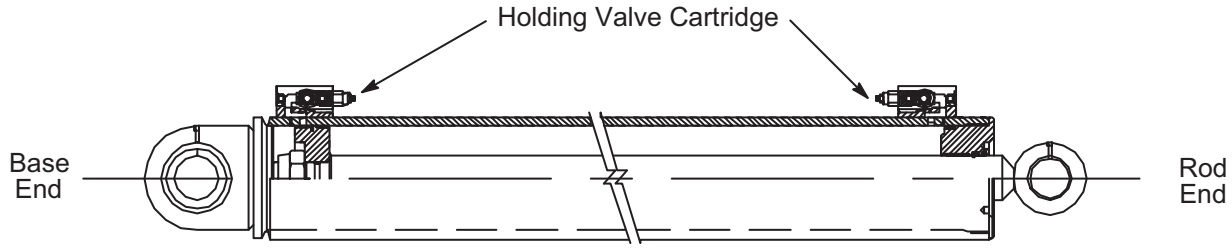
NOTE: To check settings on holding valves, follow the procedure in this manual.

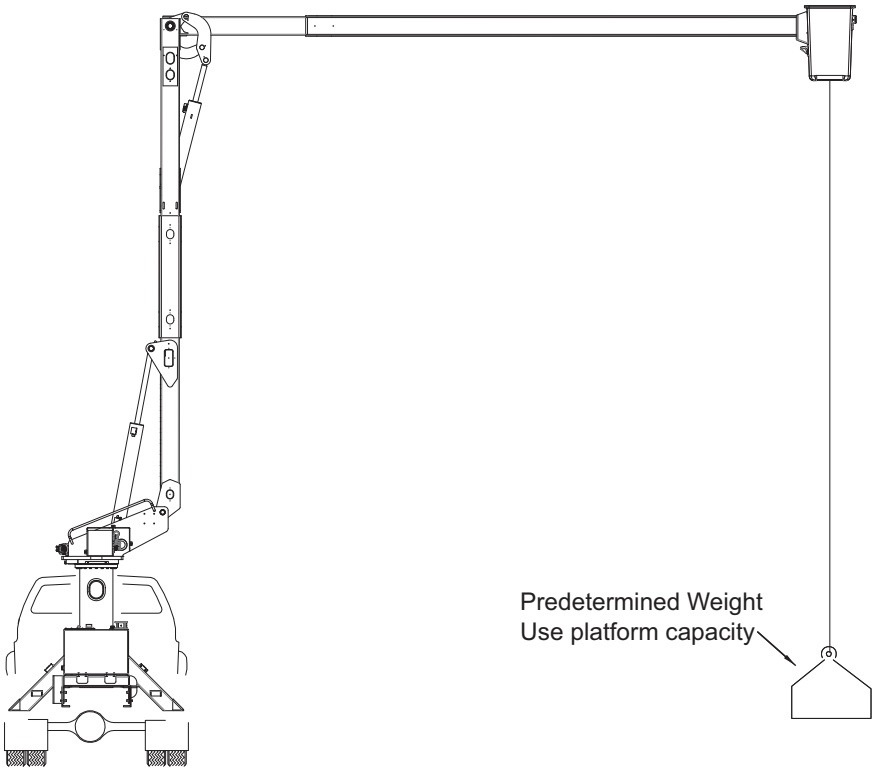
NOTE: When placing a weight at platform, ALWAYS refer to your ID Placard to determine the proper weight allowance.

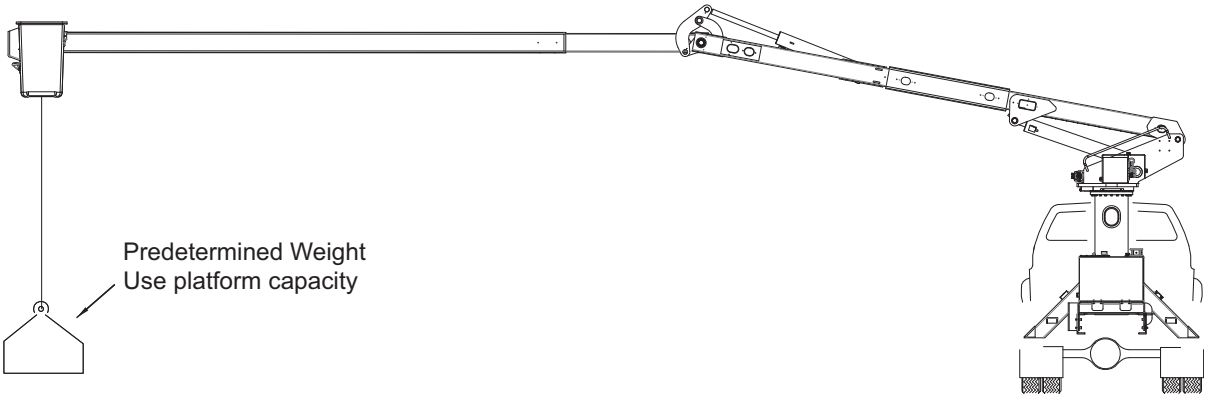
1. Place the hydraulic system into operation.
2. Unfold the upper boom.
3. Place a predetermined load on a stable braid rope.
4. Raise lower boom approximately 15 degrees from horizontal and unfold (Raise) the upper boom to horizontal.
5. The unit's identification placard determines the capacity. Platform capacity does not include the weight of the platform liner. Keep the load close to the ground during testing.
   NOTE: Valve manufacturers provide permissible leakage rates for holding valves.

Acceptable leakage rates are typically less than 5 drops per minute, which would not allow a boom to drift any appreciable distance within 5–10 minutes. Extended test periods may not be representative of the condition of a holding valve.

6. If the boom moves downward:
   a. Remove the suspended load.
   b. Properly support the upper and lower booms from falling.
   c. Either replace the valve with new or test the holding valve as described in “SUN VALVE CARTRIDGE” inspection procedure in this section.
7. If the boom still moves downward:
   a. The cylinder is leaking internally and requires resealing or replacing.
8. Reposition boom so lower boom is unfolded to 90 degrees and upper boom is horizontal. This position will load the cylinder in the opposite direction to check for leakage. Repeat steps 4–7.




Predetermined Weight
Use platform capacity


Predetermined Weight
Use platform capacity

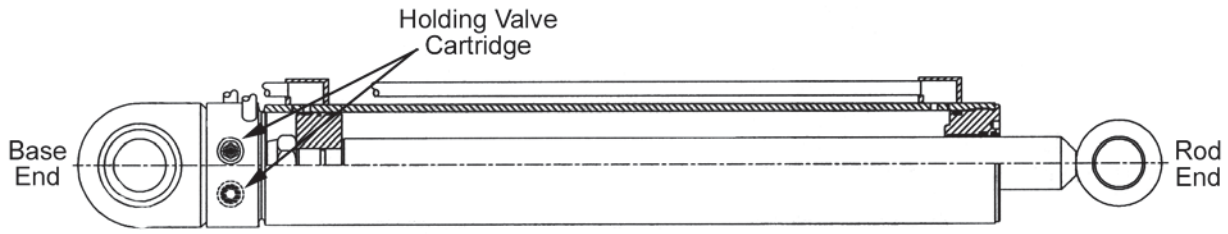
UPPER BOOM CYLINDER LEAKAGE TEST

Never remove holding valves or disconnect any hydraulic lines from holding valves until boom or booms are fully supported from falling.

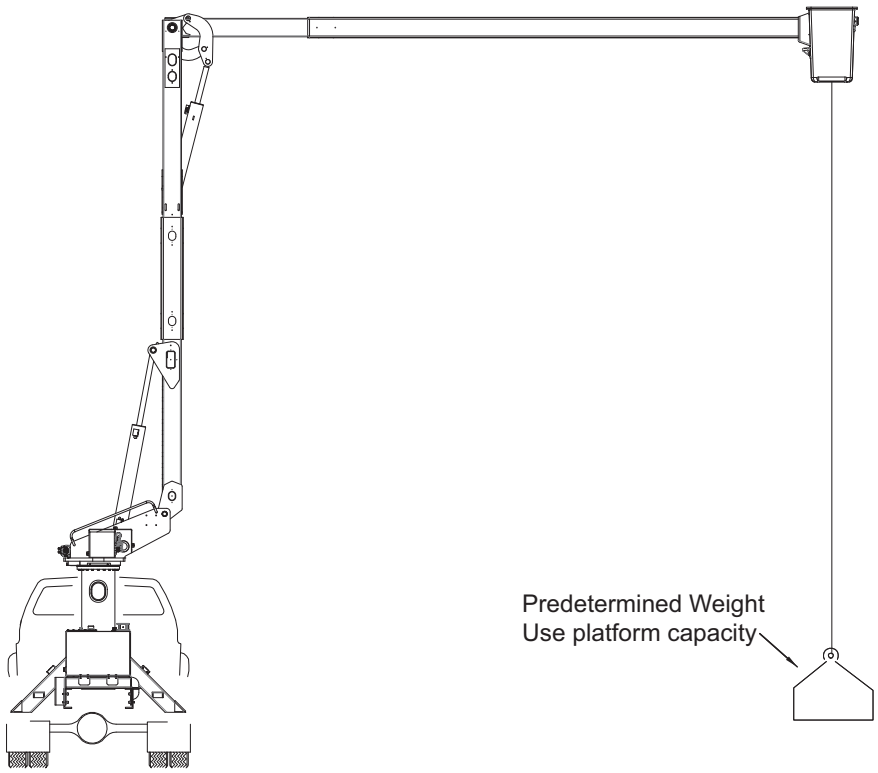
1. Place the hydraulic system in operation.
2. Unfold the upper boom.
3. Place a predetermined load on a stable braid rope.
4. Raise the lower boom approximately 90 degrees from horizontal, and upper boom 0 degrees relative to horizontal as shown.
5. The unit's identification placard determines the capacity. Platform capacity does not include the weight of the platform liner. Keep the load close to the ground during testing.
   NOTE: Valve manufacturers provide permissible leakage rates for holding valves.

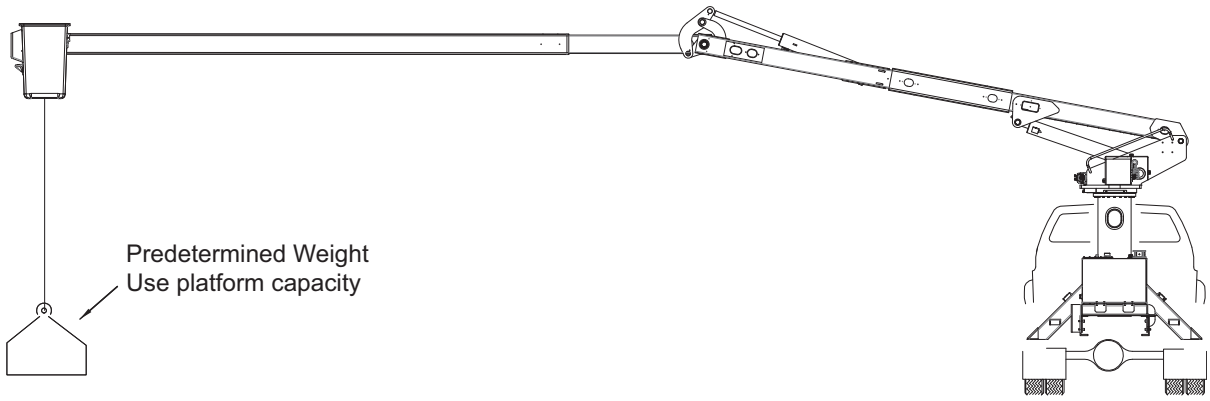
Acceptable leakage rates are typically less than 5 drops per minute, which would not allow a boom to drift any appreciable distance within 5–10 minutes. Extended test periods may not be representative of the condition of a holding valve due to changing oil temperature.

6. If the boom moves downward:
   a. Remove the suspended load.
   b. Properly support the upper and lower booms from falling.
   c. Either replace the valve with new or test the holding valve as described in “SUN VALVE CARTRIDGE” inspection procedure in this section.
7. If the boom still moves downward:
   a. The cylinder is leaking internally and requires resealing or replacing.
8. Reposition boom so lower boom is unfolded to 15 degrees and upper boom is open 180 degrees. This position will load the cylinder in the opposite direction to check for leakage. Repeat steps 4–7.



Upper Boom Cylinder


Predetermined Weight
Use platform capacity

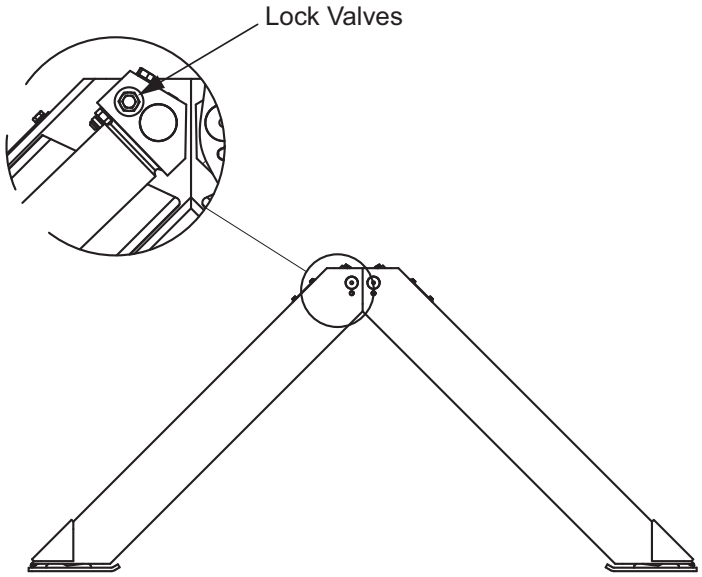

Predetermined Weight
Use platform capacity

OUTRIGGER CYLINDER LEAKAGE TEST

Never remove holding valves or disconnect any hydraulic lines from holding valves until boom or booms are fully supported from falling.

A-FRAME

1. Place the hydraulic system in operation. Oil must be close to ambient temperature to perform an accurate test.
2. Place outriggers firmly on the ground.
3. Unfold the lower boom approximately 15 degrees from horizontal.
4. Place the rated load on a stable braid rope.
5. Unfold upper boom approximately 180 degrees to horizontal and place directly over either outrigger.
6. If outrigger cylinder creeps in or retracts, proceed as follows:
   a. Remove load on outrigger leg. (Rotate turntable so the booms are horizontal to truck).
   b. Shut down hydraulic system.
   c. Disconnect and cap hydraulic lines leading to lock valve.
   d. Replace load on outrigger leg. (Rotate turntable so boom is over outrigger.)
7. If movement no longer occurs, or if oil leaks from lock valve ports, replace or repair lock valve.
8. If movement inward still occurs, cylinder seals are leaking and require resealing or cylinder replacement.



HYDRAULIC CYLINDER REPAIR

SECTION 250
SYSTEM HYDRAULIC PUMP

NOTE: See Quick Reference Guide for specifications.

GENERAL INSTRUCTIONS

The hydraulic pump can be a pressure compensated piston, vane, or gear pump. These service instructions will familiarize you with single and multiple pumps, their component parts, the relative position of each part, proper methods for assembly or disassembly of the units, care and use of these oil hydraulic power units - so that best performance and longer working life will result for our benefit.

To facilitate the repair of this unit and before any work is done, we suggest that you first read all of the steps used in disassembly and all of the steps used In building up the unit.

Contamination is the enemy of any hydraulic system. The best way to fight contamination is to prevent its entry into the system. Make sure the pump is disassembled and assembled in clean surroundings.

It is important to air blast all parts and wipe them with a clean cloth before assembly. All hydraulic systems need a means to limit the maximum pressure developed. The gear and vane pumps require a relief valve in the outrigger control valve to limit pressure. The pressure compensated piston pump compensating setting is used to limit the maximum pressure.

PISTON PUMP

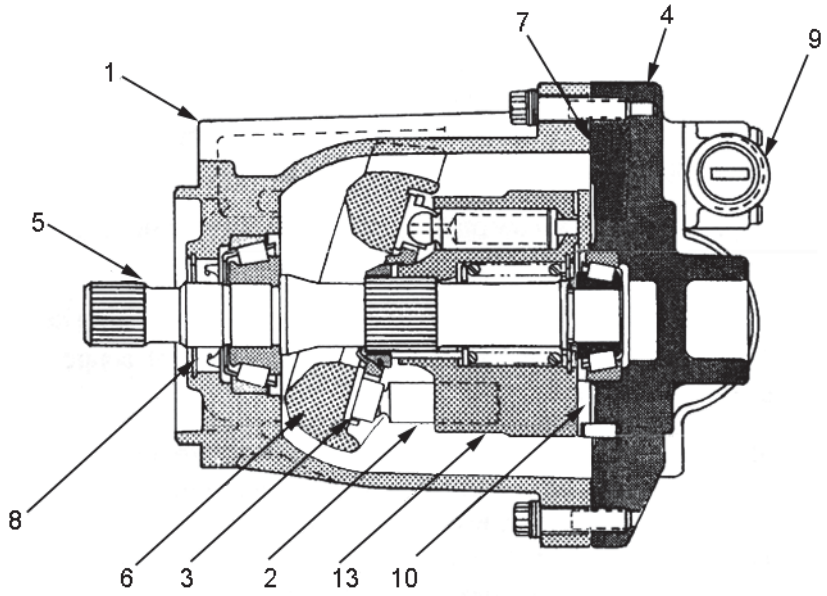
The pump that is used in the hydraulic system is a variable displacement axial piston pump, swashplate design.

The pump generates a fluid flow and imparts to that fluid the necessary pressure forces to obtain the hydraulic system pressure.

The pump basically consists of the housing (1), cylinder barrel (13), piston and shoes (2 and 3), port plate (4), drive shaft (5), swash plate (6), control piston (7), shaft seal (8) and a compensator control (9).

Rotation of the drive shaft (5) causes a linear piston movement as the piston shoe (3) slides along the tilted swashplate (6). As the piston retracts in the cylinder bore (2), hydraulic oil from the hydraulic tank fills the developing vacuum cavity by way of the suction kidney in the valve plate (10). At maximum retraction of the piston, shaft rotation causes the piston to go beyond the suction kidney and begin communication with the pressure kidney. Continuing rotation then extends the piston into the cylinder bore, forcing oil into the pressure port and out to the system.

The stroke length of the piston is directly related to the swashplate angle, which swivels up to a maximum of 15 degrees for step-less flow adjustment.



HYDRAULIC PUMP CROSS SECTION

1. Housing
2. Piston
3. Shoes
4. Port Plate
5. Drive Shaft
6. Swash Plate
7. Control Piston
8. Shaft Seal
9. Compensation Control
10. Valve Plate
11. Spring (not shown)
12. Stroking Piston (not shown)
13. Cylinder Barrel

PRESSURE REGULATION

The swashplate is normally held at maximum angle by a spring (11)(not shown), as well as system pressure working on the stroking piston (12)(not shown).

System pressure is also working on the pressure compensator against a setting spring. When system pressure overcomes the spring force, the spool shifts allowing system pressure into the control piston (7). This causes the pump to de-stroke to a regulating point sufficient to maintain compensator setting (system pressure) and lubrication fluid flow.

When system pressure setting is reached, only the amount of fluid necessary to satisfy the load conditions is delivered. If the load condition is such that no flow is required, only cooling and lubricating fluid is delivered. Power usage and heating of the fluid are kept to a minimum.

When system pressure falls below the compensator setting, spring force returns the spool back to normal position, which drains piston (2) to the pump case. The swashplate (6) is then forced on stroke by spring (11) and stroking piston (12).

NOTE: Refer to Quick Reference Guide for pressure settings.

COMPENSATOR CONTROL REPLACEMENT

(See exploded view)

The Pressure Compensator built into the pump is set to de-stroke the pump at the specified pressure. The adjustment is made on the pump itself. If the outrigger valve is equipped with a relief valve install a “NR Plug” (a no relief plug) or set the relief setting at least 300 PSI (2.07 MPa) above the compensating setting to prevent interaction and chattering between the relief and the pump.

1. Mark position of compensator control with pump housing. Remove the four socket head screws (57) while holding the control.
2. With the control valve removed, inspect sealing surface on the pump port plate, o-rings and grooves.
3. Remove the o-ring (55) and install a new o-ring with a small amount of Lubriplate #130AA to hold in place. Replace gasket (54).
4. Locate control in correct position and install socket head capscrews (57).

COMPENSATOR CONTROL SPOOL AND SEAL REPLACEMENT

(See exploded view)

1. Remove wire and seal (59 and 60).
2. Remove adjusting plug (47), BU ring (48), o-ring (49), spring (50), seat (58) and spool (51).
3. Inspect control spool for scoring or excessive wear. Control lands should be sharp edged. Replace if necessary. Check that orifice passages in front end of spool is free of contamination.
4. Replace BU ring (48) and o-ring (49).
5. Lubricate spool assembly and install into housing.