

Service Manual

X-Series

X20N • X20W • X26N • X26UN • X31N

Serial Numbers 20000 - Current

Publication Number: 114111-000

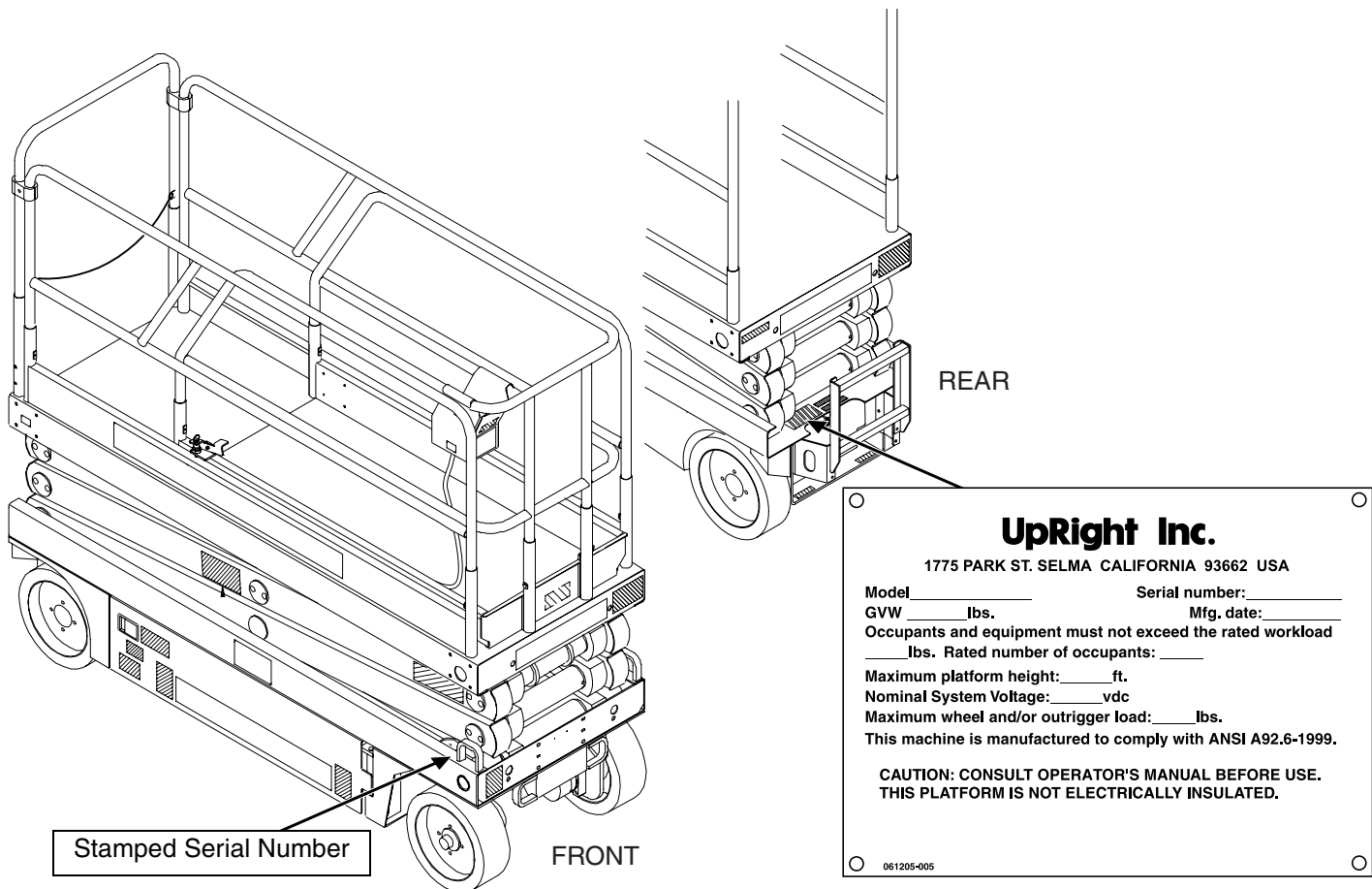
UpRight

X-Series

X20N • X20W • X26N • X26UN • X31N

Serial Number 20000 – Current

When contacting UpRight for service or parts information, be sure to include the MODEL and SERIAL NUMBERS from the equipment nameplate. Should the nameplate be missing, the SERIAL NUMBER is also stamped on top of the chassis above the front axle pivot.



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FOREWORD

This manual contains instructions for the maintenance of the machine. Referring to the Operator Manual will aid in understanding the operation and function of the various components and systems of the machine, and help in diagnosing and repair of the machine.

All information contained in this manual is based on the latest product information available at the time of printing. We reserve the right to make changes at any time without notice. No part of this publication may be reproduced, stored in retrieval system, or transmitted, in any form by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher. This includes text, figures and tables.

This manual consists of five (5) parts.

OPERATOR MANUAL

A copy of the Operator Manual that is stored on every UpRight Aerial Work Platform.

SECTION 1 - GENERAL INFORMATION

Contains generic information relevant to all UpRight Aerial Work Platforms.

SECTION 2 - SERVICE AND REPAIR

Detailed information specific to this UpRight Aerial Work Platform.

SECTION 3 - TROUBLESHOOTING

Causes and solutions to typical problems.

SECTION 4 - SCHEMATICS

Electric and Hydraulic schematics.


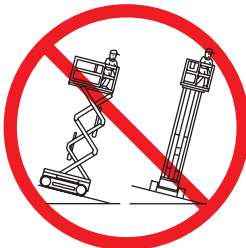


NOTES:

OPERATOR MANUAL

WARNING

All personnel shall carefully read, understand and follow all safety rules, operating instructions, and the Scaffold Industry Association's MANUAL OF RESPONSIBILITIES of ANSI A92.6-1999 before performing maintenance on or operating any UpRight Aerial Work Platform.

Safety Rules

Electrocution Hazard	Tip Over Hazard	Collision Hazard	Fall Hazard
			
NEVER operate the machine within ten (10) feet of power lines. THIS MACHINE IS NOT INSULATED.	NEVER operate the boom or drive with the platform elevated unless on firm, level surface.	NEVER position the machine without first checking for overhead obstructions or other hazards.	NEVER climb, stand or sit on the platform guardrails or midrail.

- **NEVER** operate the machine without first surveying the work area for surface hazards such as holes, drop-offs, bumps, curbs, or debris.
- **NEVER** operate the machine if all guardrails are not properly in place and secured.
- **ALWAYS** close and secure the entrance after entering the platform.
- **NEVER** use ladders or scaffolding on the platform.
- **NEVER** exceed the maximum platform load. See "Specifications" on page 20.
- **NEVER** attach overhanging loads or increase platform size.
- **LOOK** up, down and around for overhead obstructions and electrical conductors.
- **DISTRIBUTE** all platform loads evenly on the platform.
- **NEVER** use damaged equipment. (Contact UpRight for instructions. See toll free phone number on inside cover.)
- **NEVER** change operating or safety systems.
- **INSPECT** the machine thoroughly for cracked welds, loose or missing hardware, hydraulic leaks, damaged cables or hoses, loose wire connections, and wheel bolts.
- **NEVER** climb down elevating assembly when the platform is elevated.
- **IF ALARM SOUNDS** while the platform is elevated, **STOP**, carefully lower the platform. Move the machine to a firm, level surface.
- **IN CASE OF EMERGENCY** push the Emergency Stop Switch to cut power to all machine functions.
- **NEVER** perform service on the machine while the platform is elevated without blocking the elevating assembly.
- **NEVER** recharge batteries near sparks or open flame; batteries that are being charged emit explosive hydrogen gas.
- **NEVER** replace any component or part with anything other than original UpRight replacement parts without the manufacturer's written consent.
- **VERIFY** that all labels are in place and legible before using.
- **NEVER** tow the machine. Transport by truck or trailer only.
- **AFTER USE**, secure the machine against unauthorized use by turning the Chassis Key Switch OFF and removing the key.

California Proposition 65 Warning

Battery posts, terminals and related accessories contain lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

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INTRODUCTION

This manual covers the X-Series Aerial Work Platform. **This manual must be stored on the machine at all times.**

Read, understand and follow all safety rules and operating instructions before attempting to operate the machine.

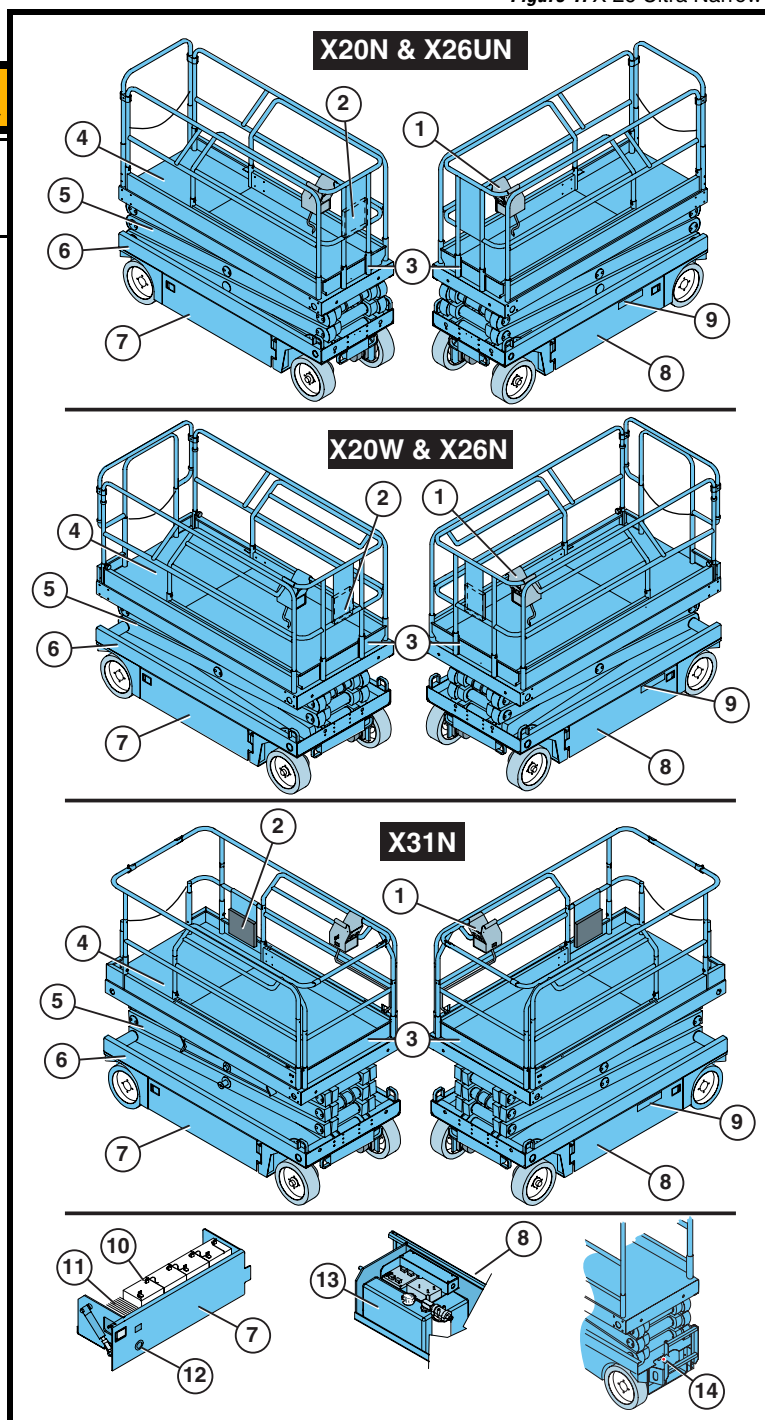
GENERAL DESCRIPTION

! WARNING !

DO NOT use the machine if all guardrails are not properly in place and secured.

1. Platform Controls
2. Manual Case
3. Platform Extension
4. Platform
5. Elevating Assembly
6. Chassis
7. Power Module
8. Control Module
9. Chassis Controls
10. Batteries
11. Battery Charger
12. Charger Outlet Plug
13. Hydraulic Fluid Reservoir
14. Emergency Lowering Valve Knob

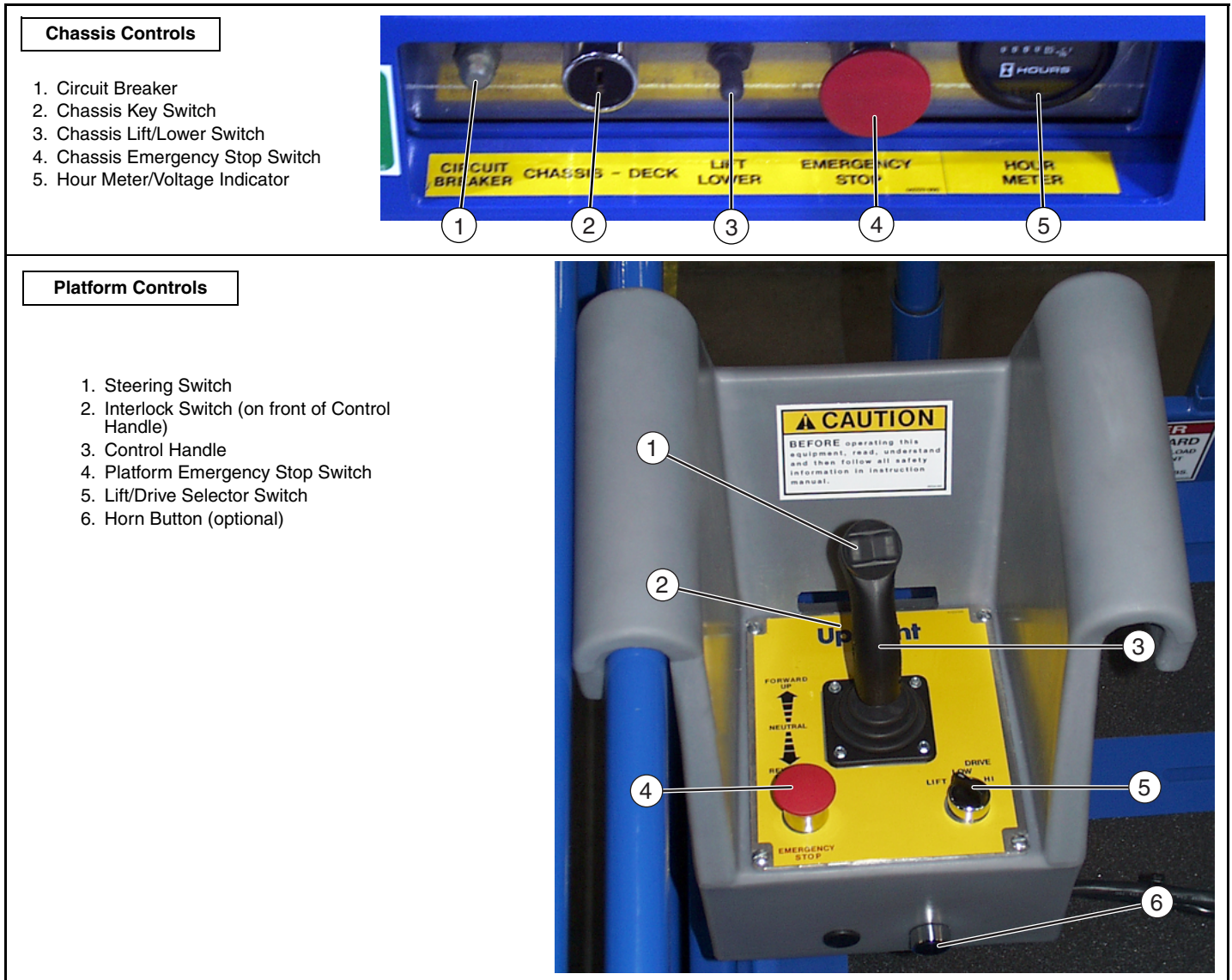
Figure 1: X 26 Ultra Narrow



CONTROLS AND INDICATORS

The operator shall know the location of each control and indicator and have a thorough knowledge of the function and operation of each before attempting to operate the unit.

Figure 2: Controls and Indicators



PRE-OPERATION SAFETY INSPECTION

NOTE: Carefully read, understand and follow all safety rules, operating instructions, labels, and the Scaffold Industry Association's **MANUAL OF RESPONSIBILITIES** of ANSI A92.6-1999. Perform the following steps each day before use.

1. Open modules and inspect for damage, fluid leaks or missing parts.
2. Check the level of the hydraulic fluid with the platform fully lowered. See "Hydraulic Fluid" on page 15. Add recommended hydraulic fluid if necessary. See "Specifications" on page 20.
3. Check that fluid level in the batteries is correct. See "Battery Maintenance" on page 15.
4. Verify that the batteries are charged.
5. Check that the A.C. extension cord has been disconnected from the charger plug.
6. Check that all guardrails are properly in place and secured.
7. Inspect the machine thoroughly for cracked welds, loose or missing hardware, hydraulic leaks, damaged cables or hoses, loose wire connections and wheel bolts.

SYSTEM FUNCTION INSPECTION

Refer to Figure 1 and Figure 2 for the locations of various controls and indicators.



STAND CLEAR of the machine while performing the following checks.

Before operating the machine, survey the work area for surface hazards such as holes, drop-offs, bumps, curbs, or debris.

LOOK up, down and around for overhead obstructions and electrical conductors.

Protect the control cable from possible damage while performing checks.

1. Move the machine, if necessary, to an unobstructed area to allow for full elevation.
2. Turn the Chassis and Platform Emergency Stop Switches ON by pulling the buttons out.
3. Turn and hold the Chassis Key Switch to CHASSIS.
4. Push the Chassis Lift/Lower Switch to the LIFT position and elevate the platform approximately 2,1 m (7 ft.).
5. Install the scissor brace as described on page 13.
6. Visually inspect the elevating assembly, lift cylinder, cables, and hoses for cracked welds and structural damage, loose hardware, hydraulic leaks, and loose wire connections. Check for missing or loose parts.
7. Verify that the Depression Mechanism Supports have rotated into position under the machine.
8. Check Level Sensor operation (see "Level Sensor" on page 14).
9. Remove the scissor brace as described on page 13.
10. Turn and hold the Chassis Key Switch to CHASSIS.
11. Push the Chassis Lift/Lower Switch to the LIFT position and fully elevate the platform.
 - Check for erratic operation.
12. Partially lower the platform by pushing Chassis Lift/Lower Switch to LOWER, and check for proper operation of the audible lowering alarm.
13. Check the Emergency Lowering Valve for proper operation (see "Emergency Lowering" on page 7).
14. Lower the platform.
15. Push the Chassis Emergency Stop Switch to check for proper operation. All machine functions should be disabled. Pull out the Chassis Emergency Stop Switch to resume.
16. Turn the Chassis Key Switch to DECK.
17. Check that the route is clear of surface hazards such as holes, drop-offs, bumps, curbs, or debris, and is level and capable of supporting the wheel loads.
18. Mount the platform and properly close and secure the entrance.
19. Turn the Lift/Drive Switch to DRIVE.
20. Check for speed and directional control.
 - While engaging the Interlock Switch, slowly position the Control Handle to FORWARD then REVERSE. The farther you push or pull the Control Handle from center the faster the machine will travel.
 - **X20W – X26N – X26UN – X31N:** Perform this test in both HI and LOW DRIVE.
21. Push the Steering Switch RIGHT, then LEFT, to check for steering control.
22. Check clearances above, below, and to the sides of machine.
23. Turn the Lift/Drive Switch to LIFT to check platform lift controls.
 - While engaging the Interlock Switch, move the Control Handle to UP to raise the platform.
 - While engaging the Interlock Switch, move the Control Handle to DOWN to lower the platform. The platform should descend and the audible lowering alarm should sound.
24. Push the Platform Emergency Stop Switch to check for proper operation. All machine functions should be disabled. Pull out the Platform Emergency Stop Switch to resume.

OPERATION

Before operating the work platform, ensure that the Pre-Operation Safety Inspection and System Function Inspection have been completed and that any deficiencies have been corrected. **Never operate a damaged or malfunctioning machine.** The operator must be thoroughly trained on this machine.

PLATFORM EXTENSION

1. Mount the platform and properly close and secure the entrance.
2. Depress the foot lever located at the rear of the platform extension. Push the platform extension forward until the pin engages the front stop.
3. To retract the platform extension, depress the foot lever and pull the platform extension toward the rear of the machine until the pin engages the rear stop.

TRAVEL WITH THE PLATFORM LOWERED

1. Check that the route is clear of surface hazards such as holes, drop-offs, bumps, or debris.
2. Check that the route is level, and is capable of supporting the wheel loads.
3. Verify that the Chassis Key Switch is turned to DECK and the Chassis Emergency Stop Switch is ON (pulled out).
4. Mount the platform and properly close and secure the entrance.
5. Check clearances above, below, and to the sides of machine.
6. Pull the Platform Emergency Stop Switch out to the ON position.
7. Turn the Lift/Drive Switch to DRIVE.

NOTE: Turn Lift/Drive Switch to HI for traveling on level ground, or to LOW when extra torque is required for climbing grades.

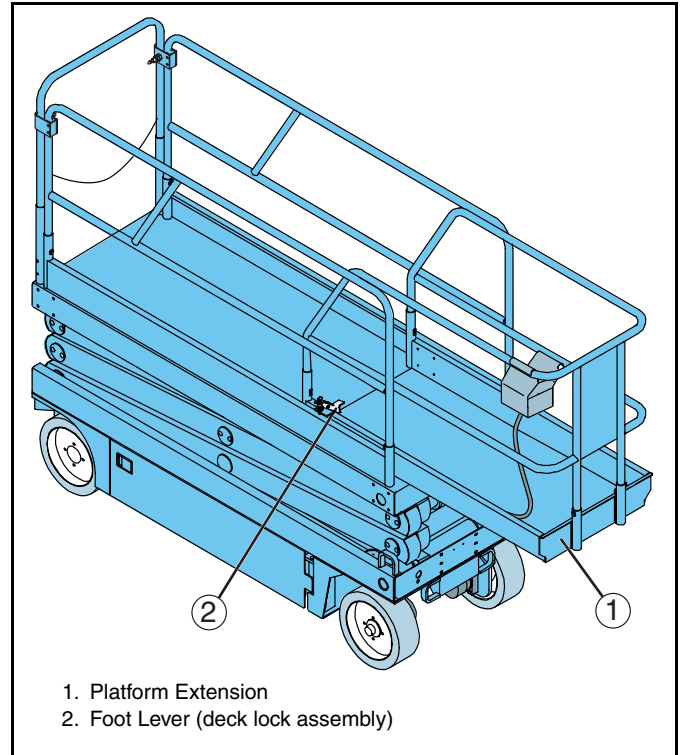
8. Engage the Interlock Switch and move the Control Handle to FORWARD or REVERSE to travel in the desired direction. The speed of the machine will vary depending on how far from center the Control Handle is moved.

STEERING

1. Turn the Lift/Drive Switch to DRIVE.
2. While engaging the Interlock Switch, push the Steering Switch to the RIGHT or LEFT to turn the wheels in the desired direction. Observe the tires while maneuvering the machine to ensure proper direction.

NOTE: Steering is not self-centering. Wheels must be returned to the straight ahead position by operating the Steering Switch.

Figure 3: Platform Extension



1. Platform Extension
2. Foot Lever (deck lock assembly)

ELEVATING THE PLATFORM

1. Locate a firm, level surface.
2. Check clearances above, below, and to the sides of platform.
3. Turn the Lift/Drive Switch to LIFT.
4. While engaging the Interlock Switch, push the Control Handle FORWARD.
5. If the machine is not level the level sensor alarm will sound and the machine will not lift or drive. **If the level sensor alarm sounds the platform must be lowered and the machine moved to a firm, level surface before attempting to elevate the platform.**

NOTE: The Depression Mechanism supports will deploy automatically as the platform elevates and will retract after the platform has been lowered completely and has been driven.

TRAVEL WITH WORK PLATFORM ELEVATED

NOTE: The machine will travel at reduced speed when the platform is elevated.

1. Check that the route is clear of surface hazards such as holes, drop-offs, bumps, curbs, or debris.
2. Check that the route is level, and is capable of supporting the wheel loads.
3. Check clearances above, below, and to the sides of platform.
4. Turn the Lift/Drive Switch to DRIVE.
5. Engage the Interlock Switch and move the Control Handle to FORWARD or REVERSE to travel in the desired direction. The speed of the machine will vary depending on how far from center the Control Handle is moved.
6. If the machine is not level the level sensor alarm will sound and the machine will not lift or drive. **If the level sensor alarm sounds the platform must be lowered and the machine moved to a firm, level surface before attempting to elevate the platform.**

LOWERING THE PLATFORM

1. Turn the Lift/Drive Switch to LIFT.
2. Check around the base of the platform to ensure that no one is in contact with the machine. Engage the Interlock Switch and pull back on the Control Handle to lower the platform.

EMERGENCY LOWERING

The Emergency Lowering Valve control is located at the rear of the machine, behind the ladder.

Figure 4: Emergency Lowering Knob



If the platform should fail to lower, NEVER climb down the elevating assembly.

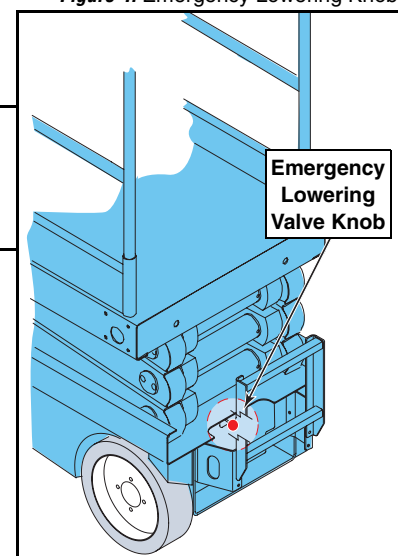
Stand clear of the elevating assembly while operating the Emergency Lowering Valve.

X20N – X20W – X26N – X26UN

1. Open the Emergency Lowering Valve by pulling and holding the knob.
2. To close, release the knob. The platform will not elevate if the Emergency Lowering Valve is open.

X31N

1. Open the Emergency Lowering Valve by pushing down on the toggle switch and holding it.
2. Once the platform is fully lowered, release the toggle switch to close the valve. The platform will not elevate if the Emergency Lowering Valve is open.



GUARDRAILS, X20N – X26UN

Figure 5: Guardrails

The guardrails may be lowered for the purpose of passing through a standard doorway. **Guardrails must be returned to proper position before using the machine.**

WARNING

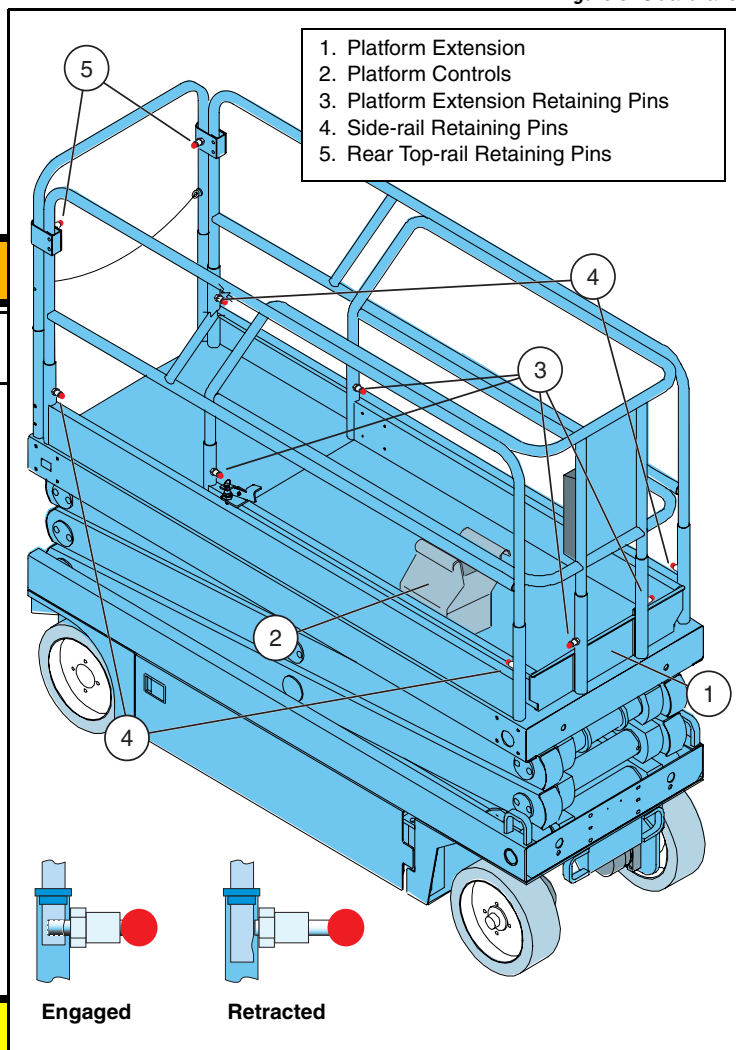
DO NOT use the machine if all guardrails are not properly in place and secured.

LOWERING PROCEDURE

1. Ensure that the platform extension is fully retracted and the deck lock pin is engaged (see "Platform Extension" on page 6).
2. Place the Platform Controls on the deck of the platform extension.
3. Lower the platform extension guardrail;
 - a. Pull to retract the retaining pins.
 - As the retaining pin is pulled, the rail will drop slightly and hold the pin in the retracted position.
 - b. Hold the midrail with one hand as you retract the final retaining pin.

CAUTION

The guardrail could drop suddenly when the final retaining pin is retracted. Keep hands away from the slide tubes to prevent injury.



- c. Push down on the platform extension guardrail to lower it completely.
 - The retaining pins will remain in the retracted position.
4. Lower the side guardrails and rear guardrail as a single unit;
 - Repeat steps 3a through 3c.
5. Lower the rear top-rail;
 - Pull the two retaining pins and lower the rear top-rail completely.

RAISING PROCEDURE

1. Raise the side guardrails and rear guardrail as one unit;
 - Pull up on the side guardrails and raise them until all the retaining pins engage.
2. Raise the rear top-rail;
 - Pull up on the rear top-rail until the retaining pins engage.
3. Raise the platform extension guardrail;
 - Pull up on the platform extension guardrail and raise it until all the retaining pins engage.
4. Hang the controller on the platform extension guardrail.

GUARDRAILS, X20W – X26N

The guardrails may be lowered for the purpose of passing through a standard doorway. Guardrails must be returned to proper position before using the machine.

LOWERING PROCEDURE

1. Ensure that the slide-out deck extension is fully retracted and the deck pin is locked. Place the Platform Controls on the floor of the platform.
2. Remove and retain the set screws from the side guardrails and the slide-out deck guardrails.
3. Lower the slide-out deck guardrail completely.
4. Lower the rear guardrail until it rests on the stop screws.
5. Lower the side guardrails completely.
6. Raise the rear guardrail until the retaining pins engage. Remove and retain the stop screws and nuts from the rear guardrail.
7. Pull the two retaining pins and lower the rear guardrail completely.

RAISING PROCEDURE

1. Raise the rear guardrail until the retaining pins engage.
2. Install the stop screws and nuts on the rear guardrail and torque to 20 N-m (15 ft. lbs.).
3. Pull the two retaining pins and lower the rear guardrail until it rests on the stop screws.
4. Raise the side guardrails until the tops are level with the rear guardrail.
 - Install the set screws
5. Raise the slide-out deck guardrail until the top is level with the side guardrails.
 - Install the set screws
6. Hang the controller on the slide-out deck guardrail.
7. Torque all set screws to 20 N-m (15 ft. lbs.).



DO NOT use the machine if all guardrails are not properly in place and secured.

FOLD DOWN GUARDRAILS, X31N

The guardrails may be lowered for the purpose of passing through a standard doorway. Guardrails must be returned to proper position before using the machine.

FOLD DOWN PROCEDURE

1. Unhook the controller from the side guardrail and place it on the floor of the platform.
2. Pull the retaining pin on the front guardrail and rotate inwards.
3. Pull the retaining pin on the rear guardrail and rotate inwards.
4. Starting with the slide-out deck guardrails and then the outer guardrails, lift up on each guardrail and fold inward.

ERECTION PROCEDURE

1. Starting with the outer guardrails and then the slide-out deck guardrails, raise each guardrail and drop it down, securing it in the vertical position.
2. Rotate the front and rear upper guardrails outward and secure them to the opposite side guardrails, using the retaining pins.
3. Hang the controller on the side guardrail.

PARKING BRAKE RELEASE

Perform the following only when the machine will not operate under its own power and it is necessary to move the machine or when winching onto a transport vehicle (see “Transporting the Machine” on page 11).

IMPORTANT: *Do Not* release the parking brakes if the machine is on a slope.



Never winch or move the machine faster than 0,3 m/sec. (1 ft./sec.).

Never operate the machine with the parking brakes released. Serious injury or damage could result.

The parking brakes are integral to the drive motors. Each drive motor has two brake release nuts. Release and engage the parking brakes one wheel at a time. Turn the brake release nuts in stages ($\frac{1}{2}$ turn at a time) to prevent possible binding of the brake mechanism.

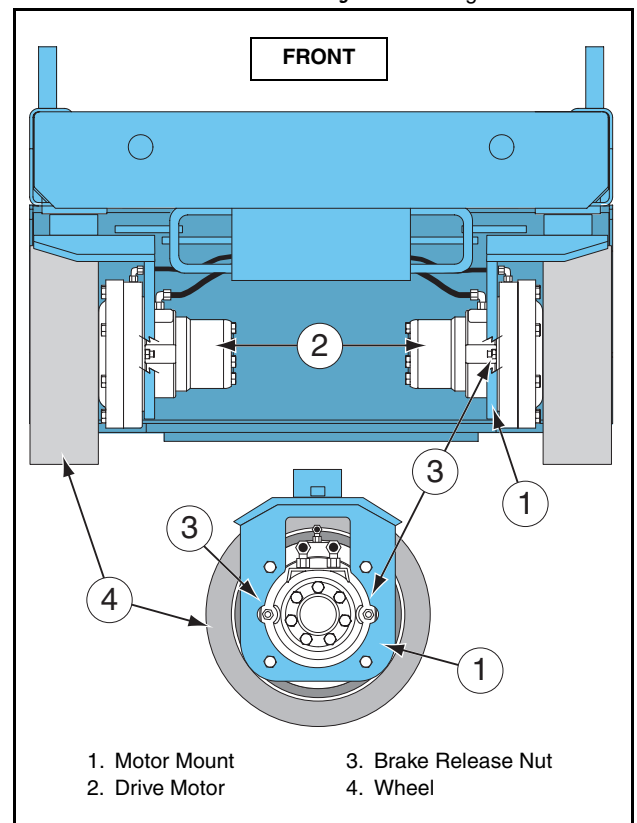
Figure 6: Parking Brake Release

RELEASE THE PARKING BRAKE

The front wheel motors each have two brake release nuts.

IMPORTANT: Turn the nuts alternately in $\frac{1}{2}$ turn increments to insure uniform adjustment and prevent binding.

1. Chock the rear wheels to prevent the machine from rolling.
2. Using a 13 mm socket wrench, turn the brake release nuts clockwise until they contact the motor body.
3. Alternately turn each nut clockwise in $\frac{1}{2}$ turn increments until resistance is felt (approximately two turns).
4. The brake is released.



ENGAGE THE PARKING BRAKE

1. Chock the rear wheels to prevent the machine from rolling.
2. Using a 13 mm socket wrench, alternately turn the brake release nuts counter-clockwise in $\frac{1}{2}$ turn increments.
 - Repeat until there is approximately 3.2 mm ($\frac{1}{8}$ in.) between the brake release nuts and the drive motor body.
3. Verify that the brakes have fully engaged before operating the machine by testing their ability to hold the machine on a 14.5° (26%) grade.

AFTER USE EACH DAY

1. Ensure that the platform is fully lowered.
2. Park the machine on a firm, level surface, preferably under cover, secure against vandals, children and unauthorized operation.
3. Turn the Chassis Key Switch to OFF and remove the key to prevent unauthorized operation.

TRANSPORTING THE MACHINE

Always use a transport vehicle when moving a machine to a work site. Towing the machine over long distances will damage the machine and void the warranty.

LIFTING BY CRANE

⚠ DANGER ⚠

See specifications for the weight of the machine and be certain that the crane is of adequate capacity to lift the machine.

Secure straps to chassis tie down/lifting points only (see Figure 7).

MOVING BY FORKLIFT

⚠ DANGER ⚠

Forklifting is for transport only.

See specifications for the weight of the machine and be certain that the forklift is of adequate capacity to lift the machine.

Forklift from the rear of the machine using the forklift pockets provided. If necessary, the machine may be forklifted from the side by lifting under the Chassis Modules (refer to Figure 8).

Figure 7: Secure Crane Straps

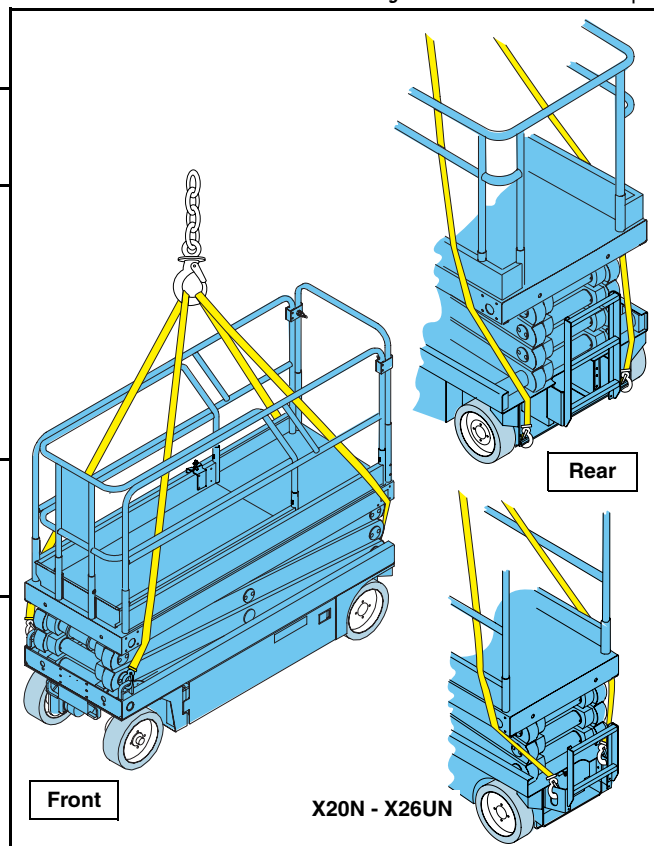
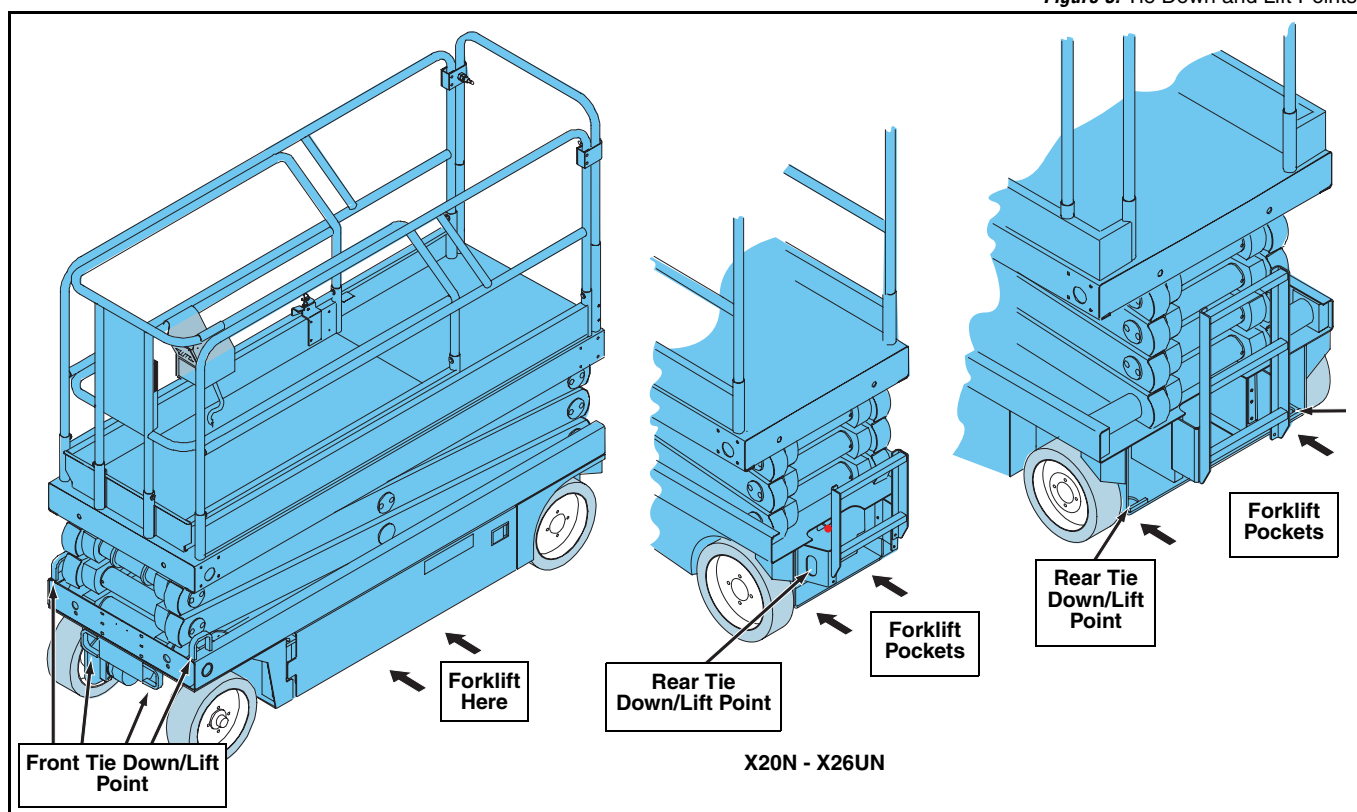


Figure 8: Tie Down and Lift Points



DRIVING OR WINCHING ONTO A TRUCK OR TRAILER

W A R N I N G

Never winch faster than 0,3 m/sec. (1 ft./sec.).

Never operate the machine with the parking brakes released. Serious injury or damage could result.

1. Loading the machine onto the truck or trailer;
 - A. To **Drive** the machine onto the transport vehicle:
 - a. Turn the Lift/Drive Switch to DRIVE LOW (hi-torque mode) and drive the machine up the ramp and into transport position.
 - b. Set the wheels straight and turn off the machine.
 - c. Chock the wheels.
 - B. To **Winch** the machine onto the transport vehicle:
 - a. Drive the machine up to the ramp.
 - b. Attach the winch cable to the tie down/lifting points.
 - c. Release the parking brakes (refer to "Parking Brake Release" on page 10).
 - d. Winch the machine into transport position
 - e. Chock the wheels.
 - f. Re-engage the parking brakes.
2. Secure the machine to the transport vehicle with chains or straps of adequate load capacity attached to the chassis tie down/lifting points (refer to Figure 8).

C A U T I O N

Overtightening chains or straps attached to the Tie Down points may result in damage to the machine

MAINTENANCE

⚠ WARNING ⚠

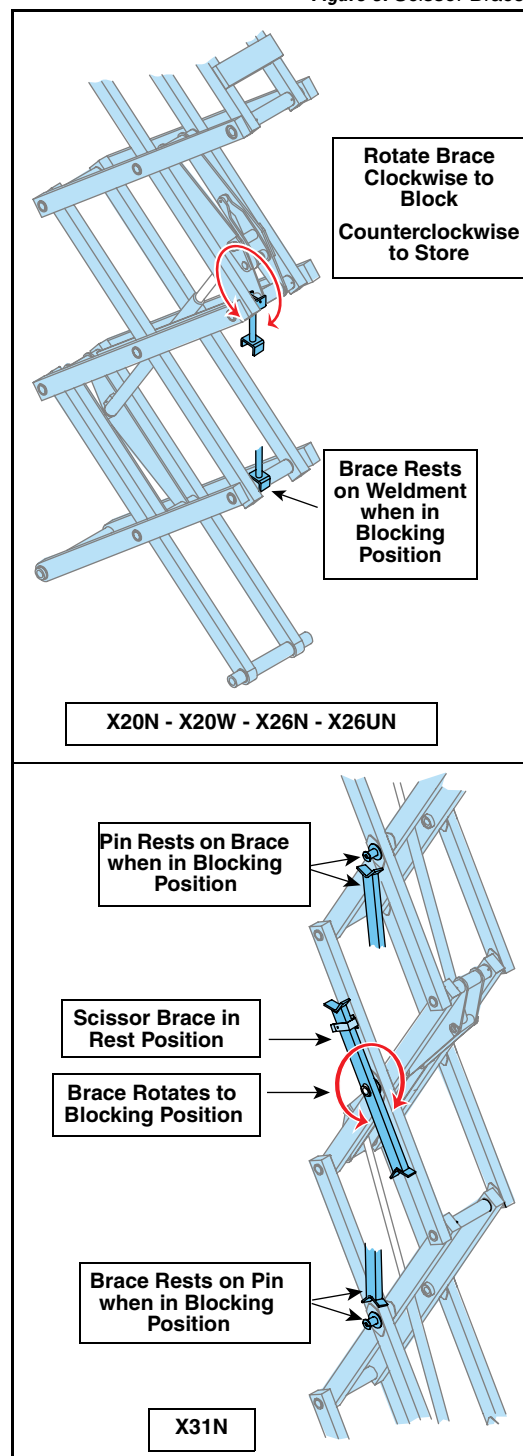
Never perform service while the platform is elevated without first blocking the elevating assembly.
DO NOT stand in the elevating assembly area while deploying or storing the brace.

BLOCKING THE ELEVATING ASSEMBLY

SCISSOR BRACE INSTALLATION

1. Park the machine on a firm, level surface.
2. Pull Chassis Emergency Stop Switch to the ON position.
3. Pull Platform Emergency Stop Switch to the ON position.
4. Turn and hold the Chassis Key Switch to CHASSIS.
5. Push the Chassis Lift/Lower Switch to LIFT to elevate the platform until the scissor brace can be rotated to the vertical position.
6. **X20N, X20W, X26N and X26UN** – From the rear of the machine, lift the scissor brace from its stowed position. Rotate upward and outward, then down until it is hanging vertically below its attachment point.
7. **X31N** – From the left side of the machine, pull the locking pin securing the brace. Rotate the scissor brace counterclockwise until it is in the vertical position.
8. Lower the platform by pushing the Chassis Lift/Lower Switch to LOWER and gradually lower the platform until the scissor brace is supporting the platform.

Figure 9: Scissor Brace



SCISSOR BRACE STORAGE

1. Using the Chassis Controls, gradually elevate the platform until the scissor brace is clear.
2. **X20N, X20W, X26N and X26UN** – Rotate the scissor brace outward and upward over its mounting point until it rests in the stowed position.
3. **X31N** – Rotate the scissor brace clockwise until the locking pin engages.
4. Lower the platform by pushing the Chassis Lift/Lower Switch to LOWER to completely lower the platform.

LEVEL SENSOR

! WARNING !

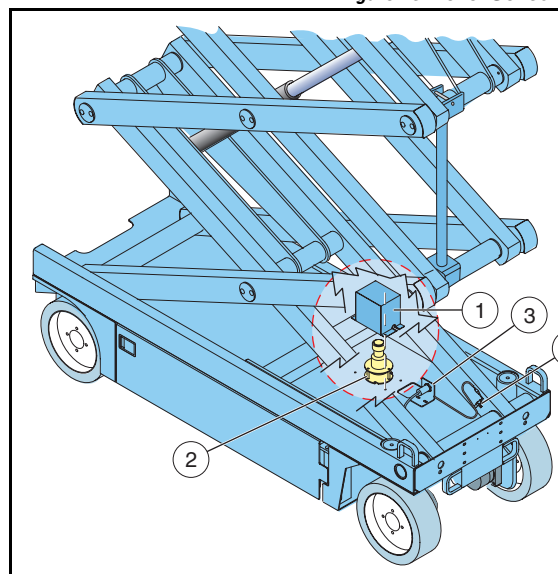
*Never perform service while the platform is elevated without first blocking the elevating assembly.
DO NOT stand in the elevating assembly area while deploying or storing the brace.*

The Level Sensor is located on the chassis between the scissor sections and is covered with a protective metal box. To verify the sensor is working properly there are two LED's under the sensor; green indicates the sensor is ON (has power), red indicates the sensor is LEVEL.

TESTING THE LEVEL SENSOR

1. Place machine on firm level surface.
2. Use the Chassis Controls to raise the platform to approximately 2,1 m (7 ft.).
3. Install the scissor brace (see "Blocking The Elevating Assembly" on page 13).
4. Remove the Level Sensor electrical box cover near the front of machine.
5. Push the Level Sensor off of level.
6. The alarm should sound, and the red LED should turn OFF.
 - If the alarm does not sound, take the machine out of service until the Level Sensor has been adjusted or repaired.
7. Replace the Level Sensor electrical box cover.
8. Store the scissor brace and lower the Platform.

Figure 10: Level Sensor



HYDRAULIC FLUID

The hydraulic fluid reservoir is located in the control module door.

Figure 11: Hydraulic Fluid Reservoir and Dipstick

NOTE: Never add fluid if the platform is elevated.

CHECK HYDRAULIC FLUID

1. Make sure that the platform is fully lowered.
2. Open the chassis door.
3. Remove the filler cap from the hydraulic fluid reservoir.
4. Check the fluid level on the dipstick on the filler cap.
5. Add the appropriate fluid to bring the level to the FULL mark. See "Specifications" on page 20.



BATTERY MAINTENANCE



Hazard of explosive gas mixture. Keep sparks, flame, and smoking material away from batteries.

Always wear safety glasses when working near batteries.

Battery fluid is highly corrosive. Thoroughly rinse away any spilled fluid with clean water.

Always replace batteries with UpRight batteries or manufacturer approved replacements weighing [X20N - X20W - X26N] 26,3 kg (58 lbs.) — [X26UN - X31N] 30 kg (66 lbs.) each.

- Check the battery fluid level daily, especially if the machine is being used in a warm, dry climate.
- If electrolyte level is lower than 10 mm ($\frac{3}{8}$ in.) above the plates add distilled water only. DO NOT use tap water with high mineral content, as it will shorten battery life.
- Inspect the battery regularly for signs of cracks in the case, electrolyte leakage and corrosion of the terminals.
- Inspect cables regularly for worn spots or breaks in the insulation and for broken cable terminals.
- Keep the terminals and tops of the batteries clean.
- Refer to the Service Manual to extend battery life and for complete service instructions.

BATTERY CHARGING

Charge the batteries at the end of each work shift or sooner if the batteries have been discharged.

WARNING

Charge the batteries in a well ventilated area.

Do not charge the batteries when the machine is near a source of sparks or flames.

Permanent damage to the batteries will result if the batteries are not immediately recharged after discharging.

Never leave the battery charger operating for more than two days.

Never disconnect the cables from the batteries when the charger is operating.

Keep the charger dry.

1. Check the battery fluid level. If the battery fluid level is lower than 10 mm ($\frac{3}{8}$ in.) above the plates add distilled water only.
2. Connect an extension cord (1,5 mm² [12 gauge] minimum conductor diameter; 15 m (50 ft.) maximum length) to the charger plug located at the left side of the chassis.
3. The charger turns on automatically after a short delay. Look through the charge indicator cutout to check the state of charge.
 - 0 - 50% charge:
 - First Light -BLINKING-
 - Second and Third Light -OFF-
 - 50% - 75% Charge:
 - First Light -ON-
 - Second Light -BLINKING-
 - Third Light -OFF-
 - 75% - 100% Charge:
 - First and Second Light -ON-
 - Third Light - BLINKING-
 - Charge Complete
 - All Lights -ON-
 - The charger automatically shuts down to low current after charging is complete and all lights turn ON.
 - The charger continues at low current (equalizing charge) for 3-4 hours, then charging current shuts off completely.
 - Lights remain ON until the AC power supply is disconnected.

NOTE: The battery charger circuit must be used with a GFI (Ground Fault Interrupt) outlet.

NOTE: DO NOT operate the machine while the charger is plugged in.

Figure 12: Battery Charger

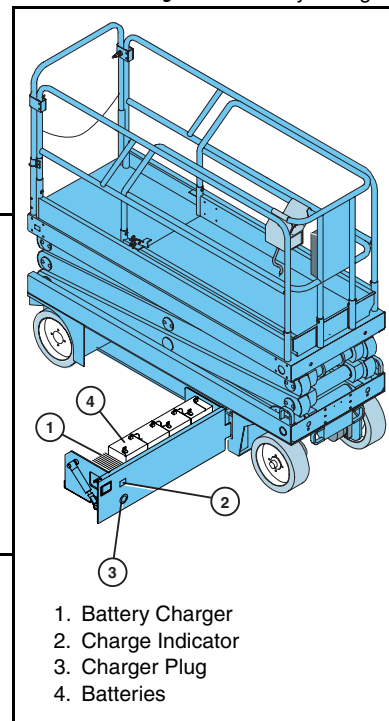
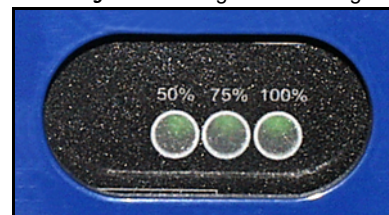


Figure 13: Charge Indicator Lights



DAILY INSPECTION AND MAINTENANCE SCHEDULE

The Complete Inspection consists of periodic visual and operational checks, along with periodic minor adjustments that assure proper performance. Daily inspection will prevent abnormal wear and prolong the life of all systems. Perform the inspection and maintenance items daily. Inspection and maintenance shall be performed by personnel who are trained and familiar with mechanical and electrical procedures.

⚠ WARNING ⚠

Before performing preventative maintenance, familiarize yourself with the operation of the machine.

Always block the elevating assembly whenever it is necessary to perform maintenance while the platform is elevated.

The daily preventative maintenance checklist has been designed for machine service and maintenance. Please photocopy the Daily Preventative Maintenance Checklist and use the checklist when inspecting the machine.

DAILY PREVENTATIVE MAINTENANCE CHECK LIST

MAINTENANCE TABLE KEY

Y = Yes/Acceptable

N = No/Not Acceptable

R = Repaired/Acceptable

MAINTENANCE REPORT

Date: _____

Owner: _____

Model No: _____

Serial No: _____

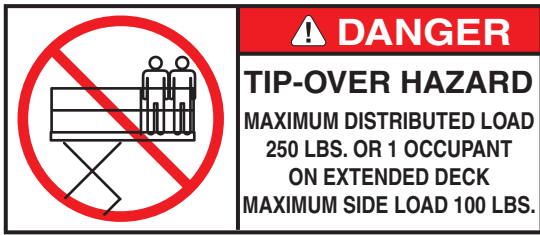
Serviced By: _____

COMPONENT	INSPECTION OR SERVICES	Y	N	R
Battery	Check electrolyte level			
	Check battery cable condition			
Chassis	Check hoses for pinch or rubbing points			
	Check welds for cracks			
Control Cable	Check the exterior of the cable for pinching, binding or wear			
Controller	Check switch operation			
Drive Motors	Check for operation and leaks			
Elevating Assembly	Inspect for structural cracks			
Emergency Hydraulic System	Operate the emergency lowering valve and check for serviceability			

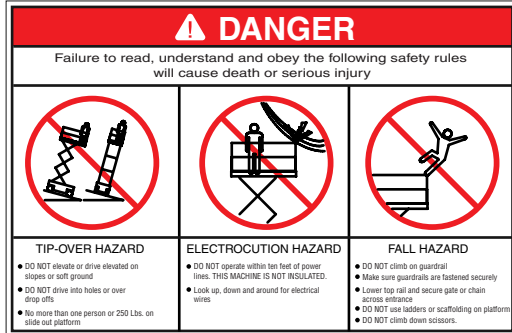
COMPONENT	INSPECTION OR SERVICES	Y	N	R
Entire Unit	Check for and repair collision damage			
Hydraulic fluid	Check fluid level			
Hydraulic Pump	Check for hose fitting leaks			
Hydraulic System	Check for leaks			
Labels	Check for peeling, missing, or unreadable labels & replace			
Platform Deck and Rails	Check welds for cracks			
	Check condition of platform			
Tires and Wheels	Check for damage			

LABELS

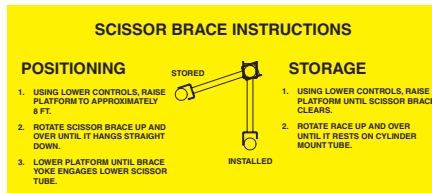
These labels shall be present and in good condition before operating the machine. Be sure to read, understand and follow these labels when operating the machine.



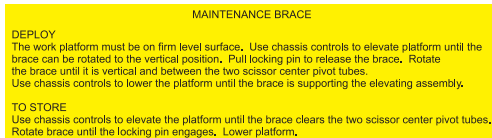
1) 101251-000



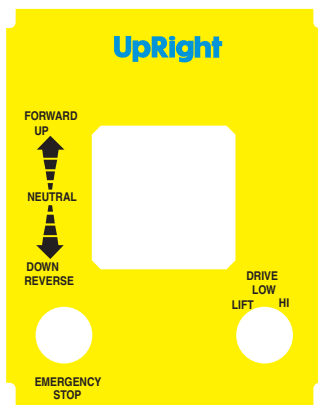
2) 066550-000



3) 066561-000



3) 066561-002 – X31N



4) 101222-005



5) 066559-000

HYDRAULIC FLUID

6) 060197-000



7) 101250-000 – X26UN



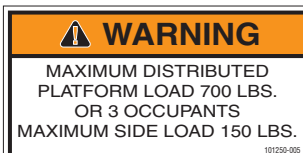
7) 101250-002 – X20N



7) 101250-003 – X20W



7) 101250-004 – X26N



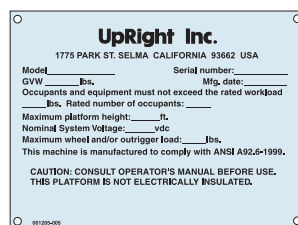
7) 101250-005 – X31N



8) 014222-003-99



9) 066553-000



10) 061205-005



11) 061787-001



12) 066558-000



12) 066558-002
 X31N



13) 101252-004
 X20W



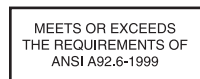
13) 101252-005
 X20N-X26N&UN



13) 101252-006
 X31N



14) 068639-000



15) 061220-002



16) 066556-000



17) 066554-000



18) 066561-003



19) 107051-000



20) 010076-001



21) 066552-000



22) 062562-001
 X20N-X20W-X26N



22) 062562-001
 X26UN-X31N



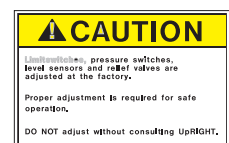
23) 005221-000



24) 066522-000

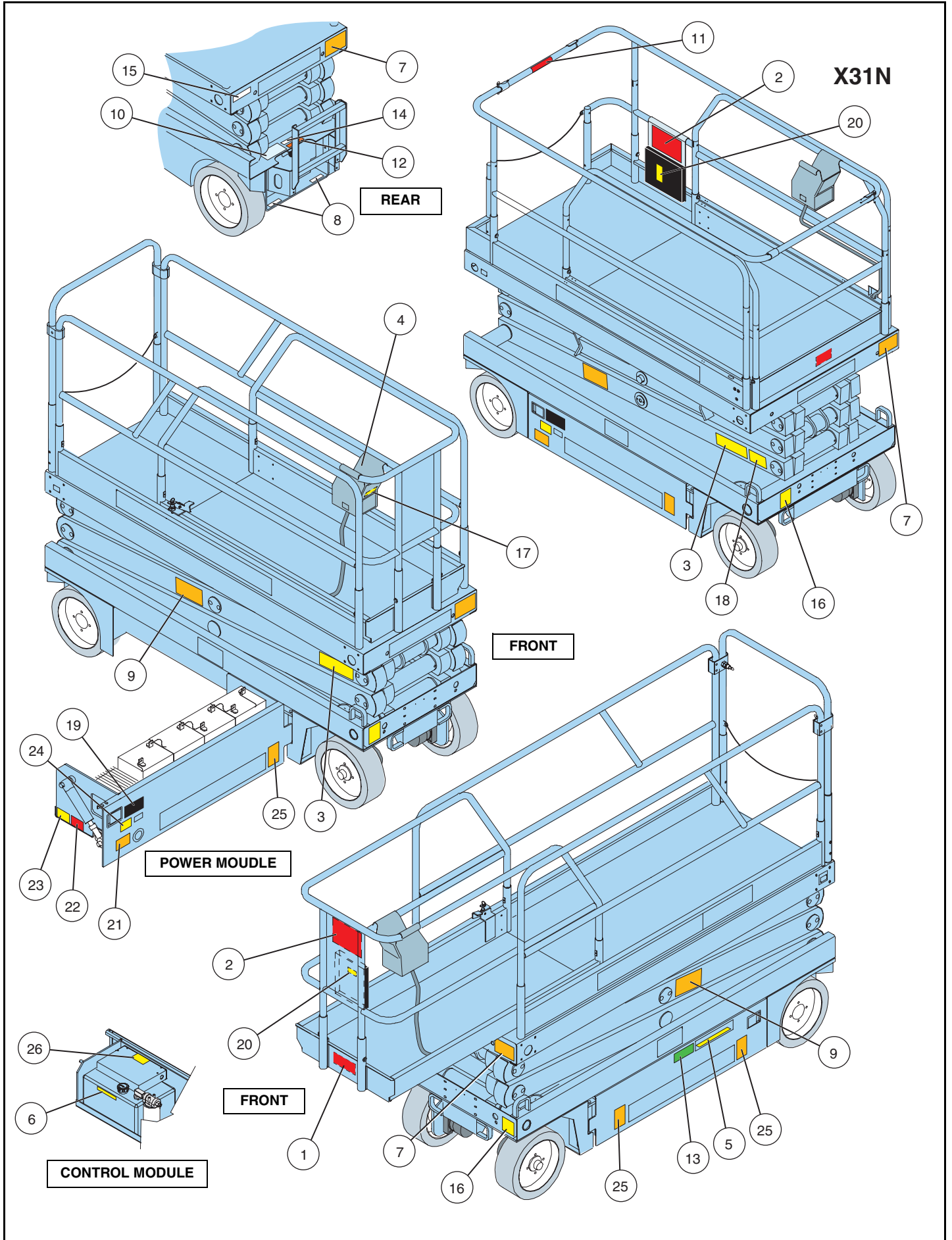


25) 066556-001



26) 066555-000

Figure 14: Safety Labels Locations



SPECIFICATIONS

ITEM	X20N	X20W	X26N	X26UN	X31N
Platform Size					
Platform Extension In	0,71 m x 2,21 m [28 in. x 87 in.]	1,17 m x 2,21 m [46.25 in. x 87 in.]	1,17 m x 2,21 m [46.25 in. x 87 in.]	0,71 m x 2,21 m [28 in. x 87 in.]	1,17 m x 2,21 m [46.25 in. x 87 in.]
Platform Extension Out	0,71 m x 3,2 m [28 in. x 126 in.]	1,17 m x 3,2 m [46.25 in. x 126 in.]	1,17 m x 3,2 m [46.25 in. x 126 in.]	0,71 m x 3,2 m [28 in. x 126 in.]	1,17 m x 3,2 m [46.25 in. x 126 in.]
Max. Platform Capacity					
Standard	340 kg [750 lbs.]	455 kg [1000 lbs.]	455 kg [1000 lbs.]	227 kg [500 lbs.]	318 kg [700 lbs.]
on Extension	110 kg [250 lbs.]	110 kg [250 lbs.]	110 kg [250 lbs.]	110 kg [250 lbs.]	110 kg [250 lbs.]
Max. No. of occupants					
Standard (total)	2 people	4 people	3 people	2 people	3 people
on Extension	1 person	1 person	1 person	1 person	1 person
Height					
Working Height	7,9 m [26 ft.]	7,9 m [26 ft.]	9,8 m [32 ft.]	9,7 m [31 ft. 10 in.]	11 m [36 ft.]
Max. Platform Height	6,1 m [20 ft.]	6,1 m [20 ft.]	7,9 m [26 ft.]	7,87 m [25 ft. 10 in.]	9,4 m [30 ft. 7 in.]
Min. Platform Height	0,96 m [38 in.]	0,96 m [38 in.]	1,09 m [43 in.]	1,09 m [43 in.]	1,22 m [48 in.]
Dimensions					
Weight	1736 kg [3828 lbs.]	1938 kg [4273 lbs.]	2153 kg [4747 lbs.]	2358,7 kg [5200 lbs.]	2486 kg [5480 lbs.]
Overall Width	0,82 m [32.5 in.]	1,22 m [48 in.]	1,22 m [48 in.]	0,82 m [32.5 in.]	1,22 m [48 in.]
Overall Height	2,06 m [78.5 in.]	2,06 m [78.5 in.]	2,19 m [83.5 in.]	2,19 m [86 in.]	2,25 m [88.5 in.]
Overall Height, Rails Lowered	N/A	N/A	N/A	1,99 m [78.25 in.]	1,88 m [74 in.]
Overall Length, Extension In	2,35 m [92.5 in.]	2,35 m [92.5 in.]	2,35 m [92.5 in.]	2,35 m [92.5 in.]	2,35 m [92.5 in.]
Overall Length, Extension Out	3,26 m [128.5 in.]	3,26 m [128.5 in.]	3,26 m [128.5 in.]	3,26 m [128.5 in.]	3,26 m [128.5 in.]
Drivable Height	6,1 m [20 ft.]	6,1 m [20 ft.]	7,9 m [26 ft.]	7,87 m [25 ft. 10 in.]	9,4 m [30 ft. 7 in.]
Drive Speed					
Platform Lowered	0 to 3,2 km/h [0 to 2.0 mph]	0 to 3,2 km/h [0 to 2.0 mph]	0 to 3,2 km/h [0 to 2.0 mph]	0 to 3,2 km/h [0 to 2.0 mph]	0 to 3,2 km/h [0 to 2.0 mph]
Platform Raised	0 to 1,0 km/h [0 to 0.62 mph]	0 to 1,0 km/h [0 to 0.62 mph]	0 to 1,0 km/h [0 to 0.62 mph]	0 to 0,8 km/h [0 to 0.50 mph]	0 to 1,0 km/h [0 to 0.62 mph]
Energy Source	24 Volt Battery Pack (4-235 A Hour, 6 Volt Batteries, min. wt. 30 kg [66 lbs.] each)				
Motor	24 Volt 4 Horse Power DC Electric Motor				
System Voltage	24 Volt DC				
Battery Charger	25 A, 110/220 VAC				
Hydraulic Reservoir Capacity	15 L [4 US Gallons]	15 L [4 US Gallons]	15 L [4 US Gallons]	15 L [4 US Gallons]	18,9 L [5 US Gallons]
Maximum Hydraulic Pressure	207 bar [3000 psi]				
Hydraulic Fluid					
Normal Temperature (0° C [>32° F])	ISO #32				
Low Temperature (0° C [<32° F])	ISO #32				
Extreme Temperature (-17° C [<0° F])	ISO #15				
Lift System	One Single Stage Lift Cylinder	One Single Stage Lift Cylinder	One Single Stage Lift Cylinder	One Single Stage Lift Cylinder	Two Single Stage Lift Cylinders
Lift Speed	Lift, 30 sec. Lower 30 sec.	Lift, 40 sec. Lower 30 sec.	Lift, 45 sec. Lower 40 sec.	Lift, 42 sec. Lower 40 sec.	Lift, 65 sec. Lower 40 sec.
Control System	Proportional Control Handle with Interlock Switch, Rotary Lift/Drive Switch, and Red Mushroom Emergency Stop Switch				
Drive System	Dual Front Wheel Hydraulic Motors				
Tires	381 mm [15 in.] Diameter Solid Rubber, non-marking				
Parking Brake	Dual Spring Applied, Hydraulic Release				
Turning Radius	203 mm [8 in.] Inside				
Maximum Gradeability	14° [25%]	15,5° [28%]	15° [27%]	14,5° [26%]	14° [25%]
Wheel Base	1,9 m [74.75 in.]				
Guardrails	1,1 m [43.25 in.] High				
Toe Boards	15,2 cm [6 in.]				
Ground Clearance	89 mm [3.5 in.]				

Specifications are subject to change without notice. Hot weather or heavy use may affect performance.

Refer to the Service Manual for complete parts and service information.

GENERAL INFORMATION

This section contains generic instructions for the repair and maintenance of UpRight Aerial Work Platforms. Referring to the Operator Manual will aid in understanding the operation and function of the various components and systems of the machine, and help in diagnosing and repair of the machine.

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1-1 HAZARD INDICATORS



Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



Indicates a potentially hazardous situation which, if not avoided, may result in damage to the machine.

1-2 WORKSHOP PROCEDURES

Detailed descriptions of standard workshop procedures, safety principles and service operations are not included. Please note that this manual does contain warnings and cautions against some specific service methods which could cause personal injury, or could damage a machine or make it unsafe. Please understand that these warnings cannot cover all conceivable ways in which service, whether or not recommended by UpRight, Inc., might be done, or of the possible hazardous consequences of each conceivable way, nor could UpRight Inc. investigate all such ways. Anyone using service procedures or tools, whether or not recommended by UpRight Inc., must satisfy themselves thoroughly that neither personal safety nor machine safety will be jeopardized.



Be sure to read, understand and follow all safety rules, operating instructions, and the Scaffold Industry Association's MANUAL OF RESPONSIBILITIES of ANSI A92.6-1999 before performing maintenance on or operating any UpRight Aerial Work Platform.



Never perform service on the machine in the elevating assembly area while platform is elevated without first blocking the elevating assembly.
DO NOT stand in elevating assembly area while deploying or storing brace.
Refer to the Operator Manual for elevating assembly blocking instructions.

1-3 TORQUE SPECIFICATIONS

HYDRAULIC COMPONENTS

NOTE: Always lubricate threads with clean hydraulic fluid prior to installation

Use the following values to torque hydraulic components used on UpRight Aerial Work Platforms.

Table 1-1: Torque Specifications for Hydraulic Components

Type: SAE Port Series	Cartridge Poppet		Fittings		Hoses	
	Ft/Lbs	Nm	Ft/Lbs	Nm	In/Lbs	Nm
#4	N/A	N/A	N/A	N/A	135-145	15-16
#6	N/A	N/A	10-20	14-27	215-245	24-28
#8	25-30	34-41	25-30	34-41	430-470	49-53
#10	35-40	47-54	35-40	47-54	680-750	77-85
#12	85-90	115-122	85-90	115-122	950-1050	107-119
#16	130-140	176-190	130-140	176-190	1300-1368	147-155

FASTENERS

This standard applies to the preloading of fasteners measured by installation torque.

NOTE: For other preloading methods or fasteners consult UpRight Engineering Department.

This general standard applies to all SAE and Metric fasteners unless otherwise specified.

THREAD CONDITION

- For lubricated or zinc plated fasteners use $K = .15$
- For dry unplated fasteners use $K = .20$

TORQUE TABLES

Table 1-2: Torque Specifications for SAE Fasteners



		 SAE J429 Grade 5			 SAE J429 Grade 8		
Nominal Thread Size		Clamp Load	Tightening Torque		Clamp Load	Tightening Torque	
			K=,15	K=,20		K=,15	K=,20
		lbs.	in-lbs.	in-lbs.	lbs.	in-lbs.	in-lbs.
Unified Coarse Thread Series	1/4 -20	2,000	75	100	2850	107	143
	5/16 - 18	3,350	157	210	4700	220	305
		lbs.	ft-lbs.	ft-lbs.	lbs.	ft-lbs.	ft-lbs.
	3/8-16	4,950	23	31	6950	32.5	44
	7/16-14	6,800	37	50	9600	53	70
	1/2-13	9,050	57	75	12800	80	107
	9/16-12	11,600	82	109	16400	115	154
	5/8-11	14,500	113	151	20300	159	211
	3/4-10	21,300	200	266	30100	282	376
	7/8-9	29,435	321	430	41550	454	606
	1-8	38,600	483	640	54540	680	900
Nominal Thread Size		Clamp Load	Tightening Torque		Clamp Load	Tightening Torque	
			K=,15	K=,20		K=,15	K=,20
		lbs.	in-lbs.	in-lbs.	lbs.	in-lbs.	in-lbs.
Unified Fine Thread Series	1/4 -28	2,300	85	115	3250	120	163
	5/16-24	3,700	173	230	5200	245	325
		lbs.	ft-lbs.	ft-lbs.	lbs.	ft-lbs.	ft-lbs.
	3/8-24	5,600	26	35	7900	37	50
	7/16-20	7,550	42	55	10700	59	78
	1/2-20	10,200	64	85	14400	90	120
	9/16-18	13,000	92	122	18300	129	172
	5/8-18	16,300	128	170	23000	180	240
	3/4-16	23,800	223	298	33600	315	420
	7/8-14	32,480	355	473	45855	500	668
	1-12	42,270	528	704	59670	745	995

Table 1-3: Torque Specifications for Metric Fasteners, U.S. Customary Units

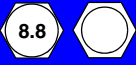
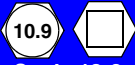

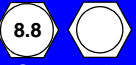
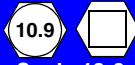

Nominal Thread Size	 Grade 8.8			 Grade 10.9			 Grade 12.9		
	Clamp Load	Tightening Torque		Clamp Load	Tightening Torque		Clamp Load	Tightening Torque	
		K =,15	K =,20		K =,15	K =,20		K =,15	K =,20
mm	lbs.	in-lbs.	in-lbs.	lbs.	in-lbs.	in-lbs.	lbs.	in-lbs.	in-lbs.
3	-	-	-	-	-	-	823	14.6	19.5
3.5	-	-	-	-	-	-	1,109	22.9	30.5
4	-	-	-	-	-	-	1,436	33.9	45.2
5	1,389	41.0	54.7	1,987	58.7	78.2	2,322	68.6	91.2
6	1,966	69.7	92.9	2,813	100.0	132.8	3,287	116.8	155.8
7	2,826	116.8	155.8	4,044	167.3	223.0	4,727	195.6	260.2
		ft-lbs.	ft-lbs.		ft-lbs.	ft-lbs.		ft-lbs.	ft-lbs.
8	3,579	14.1	18.8	5,122	20.1	26.9	5,986	23.6	31.4
10	11,742	27.9	37.2	8,117	39.9	53.3	9,486	46.7	62.3
12	8,244	48.7	64.9	11,797	69.7	92.2	13,787	81.1	108.4
14	11,246	77.4	103.3	16,093	110.6	147.5	18,808	129.1	172.6
16	15,883	125.4	166.7	21,971	173.3	230.9	25,677	202.1	269.2
18	19,424	171.9	229.4	26,869	238.2	317.2	31,401	278.1	371.0
20	2,304	243.4	325.3	34,286	337.8	449.9	40,070	394.6	525.9
22	30,653	331.9	442.5	42,403	458.8	612.2	49,556	536.2	715.4
24	35,711	420.4	562.0	49,400	583.4	778.1	57,733	682.2	909.4
27	46,435	617.3	84.8	64,235	853.4	1138.1	75,069	997.2	1329.8
30	56,753	837.9	1117.4	78,509	1159.4	1545.2	91,751	1354.9	1807.0
33	70,208	1140.3	1520.1	97,121	1576.9	2102.8	113,503	1843.9	2457.5
36	82,651	1464.1	1952.3	114,334	2025.3	2700.9	133,620	2367.6	3156.0

Table 1-4: Torque Specifications for Metric Fasteners, SI Units

Nominal Thread Size	 Grade 8.8			 Grade 10.9			 Grade 12.9		
	Clamp Load	Tightening Torque		Clamp Load	Tightening Torque		Clamp Load	Tightening Torque	
		K =,15	K =,20		K =,15	K =,20		K =,15	K =,20
mm	N	N-m	N-m	N	N-m	N-m	N	N-m	N-m
3	-	-	-	-	-	-	3660	1,65	2,2
3.5	-	-	-	-	-	-	4932	2,59	3,45
4	-	-	-	-	-	-	6387	3,83	5,11
5	6177	4,63	6,18	8840	6,63	8,84	10330	7,75	10,3
6	8743	7,87	10,5	12512	11,3	15	14623	13,2	17,6
7	12570	13,2	17,6	17990	18,9	25,2	21025	22,1	29,4
8	15921	19,1	25,5	22784	27,3	36,5	26626	32	42,6
10	52230	37,8	50,5	36105	54,1	72,2	42195	63,3	84,4
12	36670	66	88	52475	94,5	125	61328	110	147
14	50025	105	140	71587	150	200	83663	175	234
16	70650	170	226	97732	235	313	114218	274	365
18	86400	233	311	119520	323	430	139680	377	503
20	10250	330	441	152513	458	610	178238	535	713
22	136350	450	600	188618	622	830	220433	727	970
24	158850	570	762	219743	791	1055	256808	925	1233
27	206550	837	115	285728	1157	1543	333923	1352	1803
30	252450	1136	1515	349223	1572	2095	408128	1837	2450
33	312300	1546	2061	432015	2138	2851	504885	2500	3332
36	367650	1985	2647	508582	2746	3662	594368	3210	4279

1-4 DATE CODE IDENTIFICATION ON HOSES

GATES uses an eight digit code: Plant, Month, Day, Year.
i.e.: XX 01 07 01 - means Plant XX January 07 2001.

PARKER uses a 4 digit code indicating Quarter and Year.
i.e.: 2Q01 - means Second Quarter of 2001.

DAYCO stamps month, day and year on each hose.

1-5 SPECIAL TOOLS

The following is a list of special tools which may be required to perform certain maintenance procedures on the machine.

- 0-100 bar (**0-1000 psi**) Hydraulic Pressure Gauge with Adapter Fittings
- 0-200 bar (**0-3000 psi**) Hydraulic Pressure Gauge with Adapter Fittings
- 0-500 bar (**0-6000 psi**) Hydraulic Pressure Gauge with Adapter Fittings
- Small UpRight Connector Field Kit (UpRight P/N 030899-000)
- Large UpRight Connector Field Kit (UpRight P/N 030898-000)
- Inclinator (UpRight P/N 010199-000-00)
- MOS90 Calibrator (UpRight P/N 057128-000)
- Optimizer with adapter (UpRight P/N 100329-000)
- Flow Meter Kit (UpRight P/N 067040-000)
- Quadragauge with fitting (UpRight P/N 063971-000)
- 0-25 kg (**0-50 Lbs.**) Chain Tension Scale (UpRight P/N 107078-000)

UPRIGHT LIFT TOOL LIST

- Gland Nut Wrench (UpRight P/N 062521-000)
- Strap Wrench (UpRight P/N 062482-000)
- Tierod Tensioner (2 required) (UpRight P/N 062738-000)
- Tensioner Bracket (2 required) (UpRight P/N 062739-000)

1-6 UPRIGHT CONNECTORS

UpRight connectors are designed so that connector parts, contacts or electrical cables may be replaced without replacing the entire connector.

Figure 1-1: UpRight Connector Kits



Small Kit

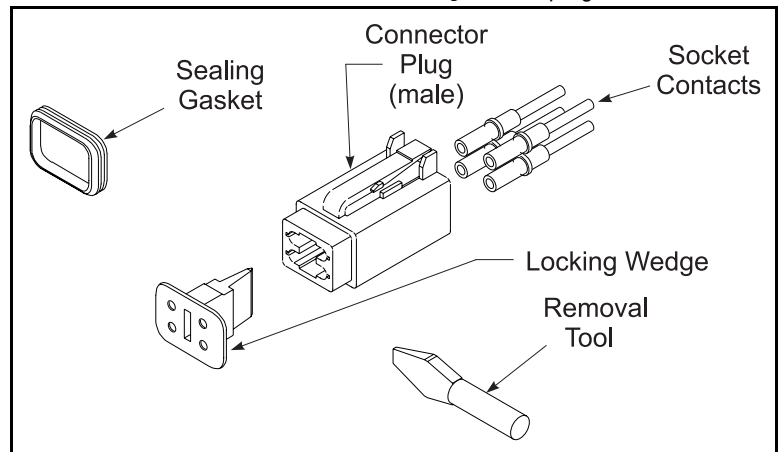


Large Kit

MALE CONNECTOR (PLUG)

1. Disconnect the male connector (plug) from the female connector (receptacle).
2. Using the flat end of the Removal Tool (or flat blade screwdriver), pry the Locking Wedge from the Male Connector. Care should be taken that the Sealing Gasket is not damaged during this procedure.
3. Check all parts for damage. Replace all parts which are damaged or worn.
4. Replace or re-crimp the wires and contacts. Refer to "Crimping" procedure.

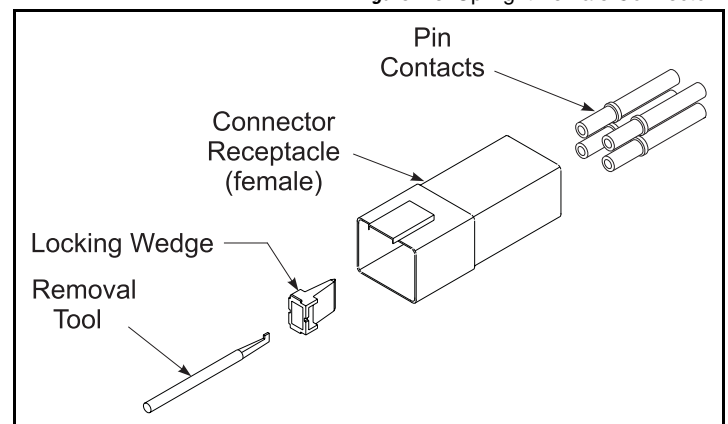
Figure 1-2: UpRight Male Connector



FEMALE CONNECTOR (RECEPTACLE)

1. Disconnect the male connector (plug) from the female connector (receptacle).
2. Using the notched end of the Removal Tool (or a wire hook), pull the Locking Wedge from the Female Connector.
3. Check all parts for damage. Replace all parts which are damaged or worn.
4. Replace or re-crimp the wires and contacts. Refer to "Crimping" procedure.

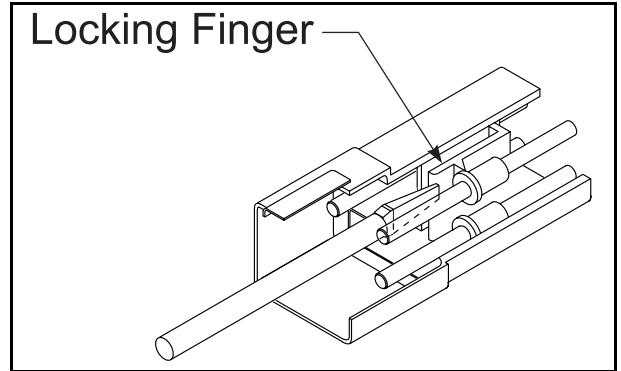
Figure 1-3: UpRight Female Connector



RELEASING LOCKING FINGERS

1. The Locking Fingers can be released following the removal of the Locking Wedge of either the male or female connector.
2. Use the removal tool (or flat bladed screwdriver) to push the Locking Fingers aside. This will release the grip on the contact.
3. Pull the wire and contact out of the connector.

Figure 1-4: Locking Finger, UpRight Connector



CRIMPING

1. Strip 6 mm ($\frac{1}{4}$ in.) from the wire.

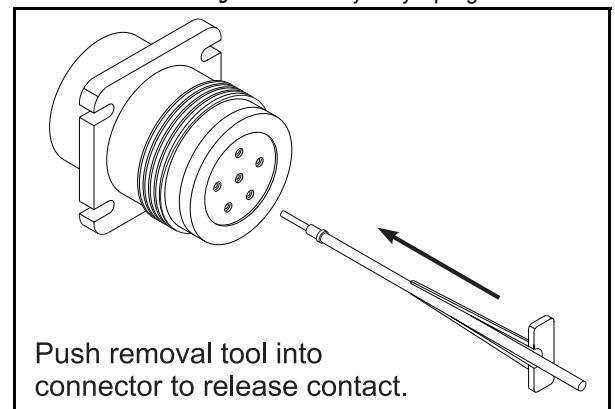
NOTE: Complete crimping instructions are included in each Field Kit.

2. Insert the contact into the crimping tool.
3. Insert the stripped wire into the contact. Copper strands should be visible in the bleed hole of the contact and no copper strands should be loose (outside) of the contact barrel.
4. Completely close the handles of the crimping tool. Release the handles of the crimping tool and remove the crimped contact.
5. Inspect the crimped contact to ensure that all strands are secure in the crimp barrel.

REMOVING CONTACT FROM HEAVY DUTY PLUG

Figure 1-5: Heavy Duty UpRight Connector

1. Slip the removal tool along the wire to be replaced.
2. Push the removal tool into the connector until the contact is released.
3. Pull the wire and contact out of the plug.



1-7 HYDRAULIC MANIFOLD REPAIR

REMOVAL

Refer to the *Service and Repair* section for model specific information.

1. Disconnect the battery.
2. Tag and disconnect the solenoid valve leads.
3. Tag, disconnect, and plug hydraulic hoses.
4. Remove the bolts that hold the manifold to the mounting bracket.
5. Remove the manifold block.

DISASSEMBLY

NOTE: Mark all components as they are removed so as not to confuse their location during assembly.

1. Remove coils from solenoid valves.
2. Remove valves.
3. Remove fittings, plugs, springs, balls, and orifices.

CLEANING AND INSPECTION

1. Wash the manifold in cleaning solvent to remove built-up contaminants, then blow out all passages with clean compressed air.
2. Inspect the manifold for cracks, thread damage and scoring where O-rings seal against internal and external surfaces.
3. Wash and dry each component and check for thread damage, torn or cracked O-rings, and proper operation.
4. Replace parts and O-rings found unserviceable.

ASSEMBLY

Refer to the *Service and Repair* section for assembly drawings, and the *Parts Manual* for illustrated parts breakdowns.

NOTE: Lubricate all O-rings before installation to prevent damage to O-rings. Seat all balls in manifold block by lightly tapping on the ball with a brass drift punch.

1. Install fittings, plugs, springs, balls, and orifices. Use one drop of Loctite #242 on each screw-in orifice.
2. Install valves.

INSTALLATION

Refer to the *Service and Repair* section for model specific information.

1. Attach manifold assembly to mounting plate with bolts.
2. Connect solenoid leads (as previously tagged).
3. Connect hydraulic hoses. Be certain to tighten hoses to manifold.
4. Reconnect the battery.
5. Operate each hydraulic function and check for proper operation and leaks.
6. Adjust valve pressures according to the *Service and Repair* section.

1-8 CYLINDER REPAIR

⚠ WARNING ⚠

Cylinders may be very heavy. Support heavy cylinders before removing pins which secure the cylinder to the machine.

REMOVAL

NOTE: Refer to the *Service and Repair* section for the location of cylinders, and the *Parts Manual* for a list of parts which secure the cylinders.

1. Mark and disconnect hoses and IMMEDIATELY cap the openings to prevent contamination.
2. Remove the cylinder from the machine as described in the *Service and Repair* section.

DISASSEMBLY

1. Remove the head from the cylinder body.
2. Carefully slide the rod assembly out of the cylinder.
3. Remove the seal kit components (wipers, rod seals, o-rings and backup rings) from the head and piston.
4. Inspect parts for scratches, pits or polishing. Check seal grooves and sealing surfaces. Scratches or pits deep enough to catch the fingernail are unacceptable; replace the cylinder. Polishing is a sign of uneven loading. When this occurs, the surface should be checked for roundness. Cylinders not round within 0,18 mm (.007 in.) should be replaced.

ASSEMBLY

Refer to the *Service and Repair* section for seal-kit assembly drawings, and the *Parts Manual* for illustrated parts breakdowns.

NOTE:

- To avoid cutting the seals, do not use sharp edged tools during seal replacement. After installing seals allow at least one hour for the seals to elastically restore to their original shape before assembling the cylinder.
- Torque all hardware to torques according to Table 1-1, "Torque Specifications for Hydraulic Components," on Page 1-3 unless otherwise specified.

1. Lubricate all components with clean hydraulic fluid.
2. Install new seal kit components.
3. Lubricate the rod wiper and seal with hydraulic fluid and slide the head onto the rod.
4. Lubricate the seals on the piston and head.
5. Carefully slide the rod assembly into the cylinder.
6. Secure the head into the cylinder.

INSTALLATION

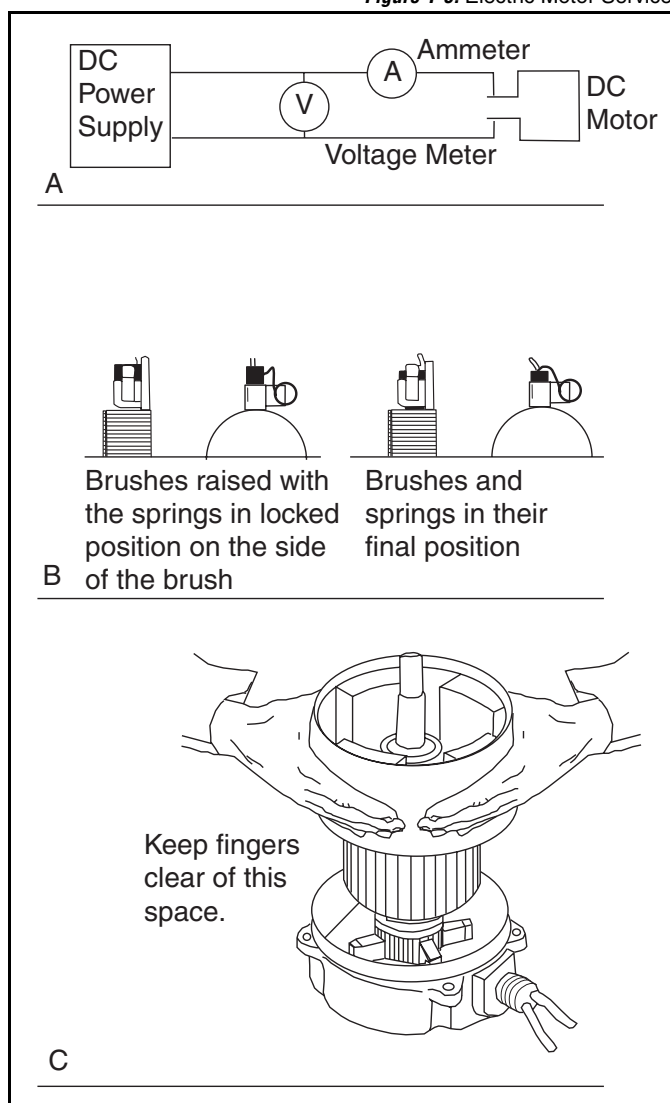
1. Installation is reverse of removal.
2. Carefully remove the elevating assembly support.
3. Slowly cycle the cylinder several times to remove air from the hydraulic system.
4. Check for proper cylinder operation. Check hydraulic connections for leaks.

1-9 ELECTRIC MOTORS

TROUBLESHOOTING

1. Read the nameplate to become familiar with the motor, especially the rated voltage.
2. Try to turn the shaft by hand. Keep motor leads separated while doing this. If the shaft turns freely go to Step 3. If the shaft won't turn, proceed to Step A.
- A. The shaft could be tight for a number of reasons, this check is to determine if the tightness is of a temporary nature only.
 - a. Obtain power to produce the nameplate voltage. **Do not Make a Permanent Connection.**
 - b. First touch the motor leads quickly to the power supply just long enough to observe if the shaft turns.
 - c. If it does turn, then hold the motor leads on the power supply for a longer time. If the motor sounds normal, go to Step 3..
 - d. If the motor sounds noisy, it should be taken apart as described in the disassembly section.
3. If the motor turned freely, connect an ammeter in the circuit as shown in Figure 1-6A. With rated voltage applied and the shaft running free, the ammeter should read less than 20% of the nameplate full load current. If the motor meets the above conditions, then it can be assumed that the original problem is external to the motor.

Figure 1-6: Electric Motor Service



DISASSEMBLY

1. Remove the through bolts.
2. Remove the pulley end cover.
3. Pull the armature out of the assembly in one swift motion.
4. Remove the commutator end cover.

NOTE: Do not place the stator ring in any mechanical holding device during the disassembly or assembly operation. Permanent distortion or other damage will result.

INSPECTION

Once the motor has been disassembled, go through the following check-list steps to determine where the problem lies.

1. Bearings should spin smoothly and easily and have ample lubrication and be free of corrosion.
2. The armature should be checked for grounds and shorted turns. Re-finish the commutator surface if it is pitted or excessively worn. (This procedure should be performed by a qualified electric motor shop.)
3. Brushes should be checked for wear and to ensure that they are free in the brush holders.

NOTE: Observe how the brushes are assembled in the brush holders, and the position of the brush lead. New brushes must be installed in the same manner. Brushes should be removed as follows:

- a. Remove the brush spring clip from its mounting on the brush assembly.
 - b. Lift the brush assembly from the brush holder.
 - c. Disconnect the brush assembly lead.
 - d. Install the new brush assembly by reversing the above procedure.
4. Inspect the wire harness and all connections for signs of damage due to overheating.
 5. Check the stator to see if it is securely mounted.

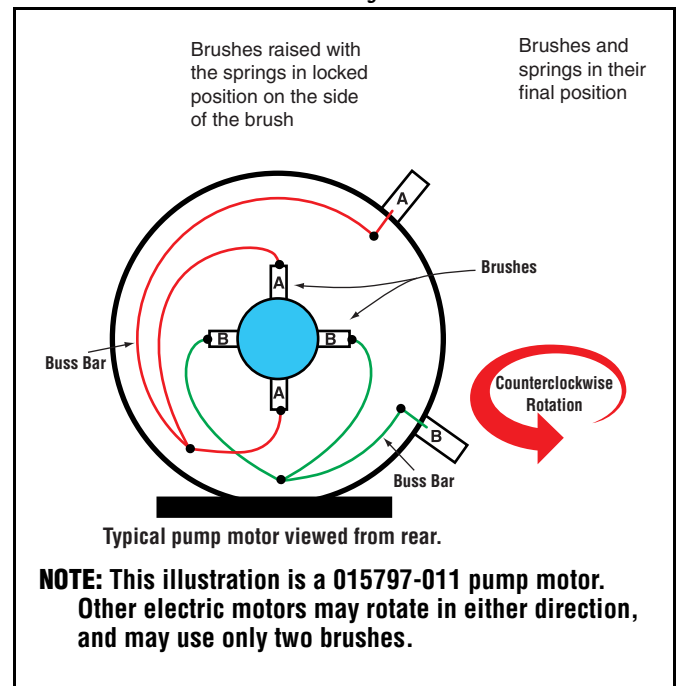
REASSEMBLY

1. Install new brushes and be sure they are free in the holder. Install the brush with the lead wires positioned as when received. Raise all brushes to the locked position. (See Figure 1-7 and **Inspection** Step 3.).
2. Place the commutator cover on a work bench with the brush assembly facing upward.
3. Place the bearing spring into the bearing bore.
4. Take a complete armature assembly, including bearings, and insert the commutator end bearing into the bearing bore.

NOTE: Do not re-use bearings which have been removed from the armature shaft. Keep the assembly in a vertical position. Use extreme care not to damage the armature with bearing pullers. New bearings should be installed by pressing the inner race of the bearing onto proper position on the armature shaft.

5. Set the brushes into their final position as shown in Figure 1-7.
6. Place the complete stator down over the vertical armature, and into position on the commutator cover.
7. The stator assembly must be placed in a definite relationship with the commutator covers in order to obtain a neutral brush setting. There is a match-mark on both items. These two marks must line up exactly. Rotate until they do.
8. Assemble the pulley end cover in the proper relationship. Insert the mounting bolts and tighten alternately to ensure a good mechanical alignment.
9. Spin the shaft by hand to see if it is free. Be sure motor leads (if used) are not touching together. If the leads are touching, a generator action will give the effect of friction in the motor. A no-load test can now be performed. At the rated voltage, observe the no-load current. It should be less than 20% of the name-plate full load current. Anything higher indicates:
 - Brushes are not on neutral setting (check match-marks for exact alignment).
 - Faulty armature.

Figure 1-7: Electric Motor Brushes



1-10 BATTERY MAINTENANCE

CAUTION

If battery water level is not maintained, batteries will not fully charge, creating a low discharge rate.

WARNING

Hazard of explosive gas mixture. Keep sparks, flame and smoking materials away from batteries.

Always wear safety glasses when working with batteries.

Battery fluid is highly corrosive. Thoroughly rinse away any spilled fluid with clean water.

Always replace batteries with UpRight batteries or manufacturer approved replacements.

Before disconnecting the battery negative (-) lead, make sure all switches are OFF. If ON, a spark will occur at the ground terminal which could cause an explosion if hydrogen gas or fuel vapors are present.

- Check battery fluid level daily.
- If electrolyte level is lower than 10 mm (**3/8 in.**) above plates, add distilled water only. DO NOT use tap water with high mineral content. It will shorten battery life. DO NOT overfill. Battery acid expands during charging and can overflow.
- Keep terminals and tops of batteries clean.
- The battery and cables should be inspected regularly for signs of cracks in the case, electrolyte leakage and corrosion of the terminals. Inspect the cables for worn spots or breaks in the insulation and for broken cable terminals.
- Clean batteries whenever there are signs of corrosion at the terminals, or when electrolyte has overflowed during charging. Use a baking soda solution to clean batteries, taking care not to get the solution inside the cells. Rinse thoroughly with clean water.
- Clean battery and cable contact surfaces to a bright metal finish whenever a cable is removed.

BATTERY CHECK

Electric UpRight Aerial Work Platforms use deep cycle batteries. If poor service life is experienced, batteries should be checked for bad cells. Fully charge batteries for 14 hours minimum, ensuring that the charger has completed its cycle (see 'Battery Charging' on page 1-14).

Deep cycle batteries do not have their full potential until they have been through 50 charge/discharge cycles. Normal 5-day weeks, charging batteries every day, equals 50 cycles in ten weeks.

If bad cells are found in any battery in a battery pack more than two years old, all batteries in the pack should be replaced for balance.

BATTERY CELL EQUALIZATION

The specific gravity of the electrolyte in the battery cells should be equalized monthly. To do this, charge batteries as outlined in 'Battery Charging' on page 1-14. After this initial charge, recheck the electrolyte level in all cells and add distilled water as necessary. Then, turn on the charger for an additional eight hours.

SPECIFIC GRAVITY

Check the specific gravity of all cells with a hydrometer. The temperature corrected specific gravity of a fully charged battery should be 1.260. If any corrected readings are below 1.230, the batteries containing such cells should be replaced.

Do not check the specific gravity in a cell to which water has just been added. If there is not enough electrolyte in a fully charged cell to obtain a sample for the hydrometer, add water and complete a discharge/charge cycle before checking.

Table 1-5: Specific Gravity and Battery Voltage

SPECIFIC GRAVITY		VOLTS DC				
	Each Cell	Per Cell	6V Battery	12V Battery	24V Battery Pack	48V Battery Pack
Fully Charged	1.270	2.10	6.30	12.60	25.20	50.40
Fully Discharged	1.130	1.75	5.25	10.50	21	42

LOAD TESTING BATTERY PACKS

1. Fully charge the battery pack.
2. With the battery pack at rest and under full load, perform steps 3 and 4.
 - a. To put the battery pack under full load,
 - Activate the steering switch to turn the wheels fully in either direction.
 - Continue to hold the steering switch while performing steps 3 and 4.
3. Measure the potential across each battery.
4. Measure the potential across the entire battery pack.
5. Compare the measured results

Any battery that measures 10% lower voltage than the others has a bad cell and should be replaced.

BATTERY CHARGING

CAUTION

Permanent damage will result if the battery is not immediately recharged after discharging.

WARNING

Charge batteries only in a well ventilated area.

DO NOT charge batteries when sparks or open flames are present.

Never leave the connected charger unattended for more than two days.

Never disconnect the cables from the battery when the charger is operating.

Keep the charger dry.



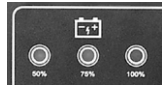
- Charge batteries at the end of each work shift or sooner if the batteries have been discharged.
- Discharging a deep cycle battery to less than 1.75 Volts per cell can cause permanent damage.

NOTE: Do not operate the machine when the battery charger is plugged in.

When night temperatures fall below 65°F (18°C), batteries charged in unheated areas should be charged as soon after use as possible. Under such conditions a four hour charge cycle once a week in the early afternoon will improve the state of charge and battery life.

1. Check the battery fluid level. If electrolyte level is lower than 10 mm (**3/8 in.**) above plates, add distilled water only.
2. Check the charger to determine the AC charging current. If equipped, set the AC voltage selector switch to match the AC power source.
3. Connect an extension cord that meets or exceeds the charger AC current onto the charger plug.
4. Connect the other end of the extension cord to a grounded AC outlet of proper current, voltage and frequency rating.
5. The charger turns on automatically after a short delay. Table 1-6 illustrates charging indicators.

Table 1-6: Battery Charging, UpRight Electric and BiEnergy Machines

Charger Display	AC Charging Current		Charging Indicator	Charger Shutdown
	068574-000	8 Amp - 115 VAC	Ammeter <ul style="list-style-type: none"> • Charging current is displayed on ammeter. • Current drops off as batteries charge. 	<ul style="list-style-type: none"> • Charger shuts off automatically. • Ammeter shows "0" current.
	069112-000	4 Amp - 230 VAC		
	063944-001	7 Amp - 115 VAC	Green Light <ul style="list-style-type: none"> • ON during charging cycle. • Blinking at charge completion. 	<ul style="list-style-type: none"> • Charger automatically shuts down to 1 amp trickle charge. • Green Light continues to blink.
	063948-003	4 Amp - 230 VAC		
	069199-000 & 069199-001 Dual Voltage	8 Amp - 115 VAC 4 Amp - 230 VAC	Three Lights <ul style="list-style-type: none"> • 0 - 50% charge: First Light -Blinking- Second and Third Light -OFF- • 50% - 75% Charge: First Light -ON- Second Light -Blinking- Third Light -OFF- • 75% - 100% Charge: First and Second Light -ON- Third Light - Blinking- • Charge Complete All Lights -ON- 	<ul style="list-style-type: none"> • Charger automatically shuts down to low current after charging is complete and all Lights turn ON. • Charger continues at low current (equalizing charge) for 3-4 hours, then charging current shuts off completely. • Lights remain ON until the AC power supply is disconnected.

BATTERY CHARGER TROUBLESHOOTING

CAUTION

Ensure that battery chargers with voltage selector switches are set on the correct AC line voltage before placing chargers in service to avoid charger failure.

Connect battery leads in correct polarity to avoid charger damage.

WARNING




Remove all power before working on electrical parts to avoid shock.

Shock hazard can exist if AC plugs are wired incorrectly.

The battery charger troubleshooting procedure is outlined in Table 1-7. The table shows various conditions for each charger type with the problem to be investigated. Follow the table from the top down when troubleshooting. If the problem is not resolved after going through the entire table, the charger should be replaced.

NOTE: The majority of chargers returned to UpRight as “failed” test good. Please follow the troubleshooting procedures carefully.

Table 1-7: Battery Charger Troubleshooting

				
Problem	068574-000 (115V) 069112-000 (110/230V)	063944-001 (115V) 063948-003 (110/230V)	069199-000 & 069199-001 (115/230V auto)	Solution
Battery voltage is below 18 Volts (too low to allow the charger to turn on).	<ul style="list-style-type: none"> • Ammeter does not move. • No hum from charger. 	<ul style="list-style-type: none"> • No green Light. • No hum from charger. 	<ul style="list-style-type: none"> • Not Applicable. • Charger turns on even with very low battery voltage. 	Charge batteries to at least 24 Volts with an external charger, then disconnect the external charger and plug in the internal charger.
The charger has been plugged into an AC outlet with different voltage than the AC switch setting on the charger.	<ul style="list-style-type: none"> • Ammeter does not move. • No hum from charger. 	<ul style="list-style-type: none"> • No green Light. • No hum from charger. 	<ul style="list-style-type: none"> • Not Applicable. • Charger automatically adjusts to the incoming AC current. 	063944-001 ONLY <ul style="list-style-type: none"> • Check the fuse inside the switch box - replace if bad. • If the fuse is good, the charger has failed. All Others <ul style="list-style-type: none"> • Check the AC main circuit breaker and reset if necessary. • Set the voltage selector switch to the proper voltage.
Fuse visible on front of charger has failed.	<ul style="list-style-type: none"> • Ammeter does not move. • No hum from charger. 	<ul style="list-style-type: none"> • Not Applicable. 	<ul style="list-style-type: none"> • Not Applicable. 	Check for DC output short circuit and replace the fuse.
AC power problem.	<ul style="list-style-type: none"> • Ammeter does not move. • No hum from charger. 	<ul style="list-style-type: none"> • No green Light. • No hum from charger. 	<ul style="list-style-type: none"> • No Lights ON. • No Lights blinking. 	<ul style="list-style-type: none"> • AC outlet is bad. • Extension cord is bad • Plug is bad or wired wrong. • AC wire is broken. Check and repair as necessary.
DC connection to batteries.	<ul style="list-style-type: none"> • Ammeter does not move. • No hum from charger. 	<ul style="list-style-type: none"> • No green Light. • No hum from charger. 	<ul style="list-style-type: none"> • All three Lights blink once. 	Connection to battery; <ul style="list-style-type: none"> • missing. • corroded. • wrong polarity. • DC wire broken. Check and repair as necessary, and check Fuse.
One or more batteries is bad.	<ul style="list-style-type: none"> • Ammeter never shuts off, even after 14 hours of charging. 	<ul style="list-style-type: none"> • Green Light ON but never starts blinking, even after 14 hours of charging. 	<ul style="list-style-type: none"> • Lights one and two are ON or blinking, but all three Lights ON never occurs, even after 14 hours of charging. 	<ul style="list-style-type: none"> • Check water level. • Check for shorted cells. • Replace bad batteries.
AC input voltage too high.	<ul style="list-style-type: none"> • Not Applicable. 	<ul style="list-style-type: none"> • Not Applicable. 	<ul style="list-style-type: none"> • All three Lights blink two times. 	Check and correct AC source.
Overheated charger.	<ul style="list-style-type: none"> • Not Applicable. 	<ul style="list-style-type: none"> • Not Applicable. 	<ul style="list-style-type: none"> • All three Lights blink three times. 	Move the machine to a cooler area. Allow the machine to cool before connecting to AC source.
High current in DC charging output.	<ul style="list-style-type: none"> • Not Applicable. 	<ul style="list-style-type: none"> • Not Applicable. 	<ul style="list-style-type: none"> • All three Lights blink four times. 	<ul style="list-style-type: none"> • Check for shorted DC output wires. • Check for bad batteries.

1-11 FLOOR LOADING

Floor Loading is defined as pressure imposed onto load-bearing surfaces, and can be measured as **Localized Pressure** or **Occupied Pressure**. To calculate Floor Loading, find the Total Weight of the machine.

TOTAL WEIGHT = MACHINE WEIGHT + MAXIMUM PLATFORM CAPACITY.

Refer to the machine specifications or contact UpRight or your UpRight dealer.

LOCALIZED PRESSURE

KG/CM² OR PSI

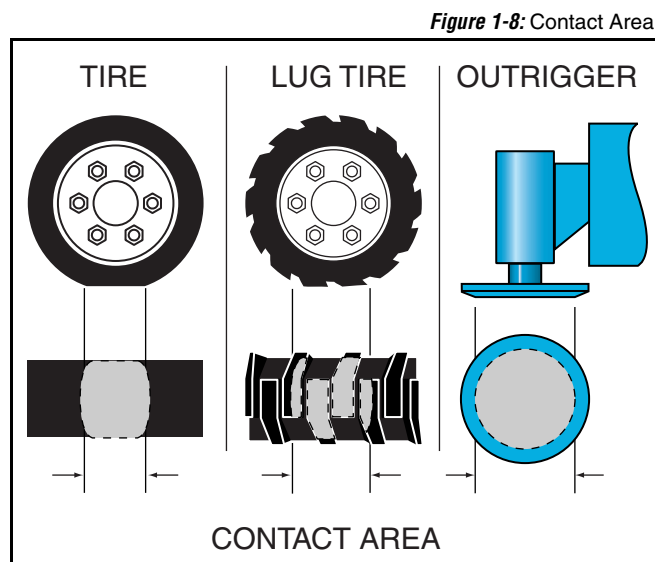
Localized Pressure is measured in *kilograms per square centimeter (pounds per square inch)*. It is the pressure exerted onto a small area (contact area). Each tire and/or outrigger imposes Localized Pressure which can cause damage to the load-bearing surface.

NOTE: The formulas shown here are for vertical lift machines. Applying these formulas to machines with extending platforms will yield average pressures for machines in stowed position. Extending a platform causes increased localized pressure in the direction of extension, and decreased localized pressure at the opposite end.

MEASURE THE CONTACT AREA

Measure the contact area of the contacting surface (tire or outrigger).

The tire contact area can be determined by placing the loaded tire on a clean surface. The tire will leave an imprint from which an area can be determined.



CALCULATE THE LOCALIZED PRESSURE

Find the pressure exerted at each contacting surface.

NOTE: The wheel load can usually be found on a label on the machine, or on the serial plate.

If you know the wheel load, use this formula:

LOCALIZED PRESSURE = WHEEL LOAD ÷ CONTACT AREA

If you do not know the wheel load, use this formula:

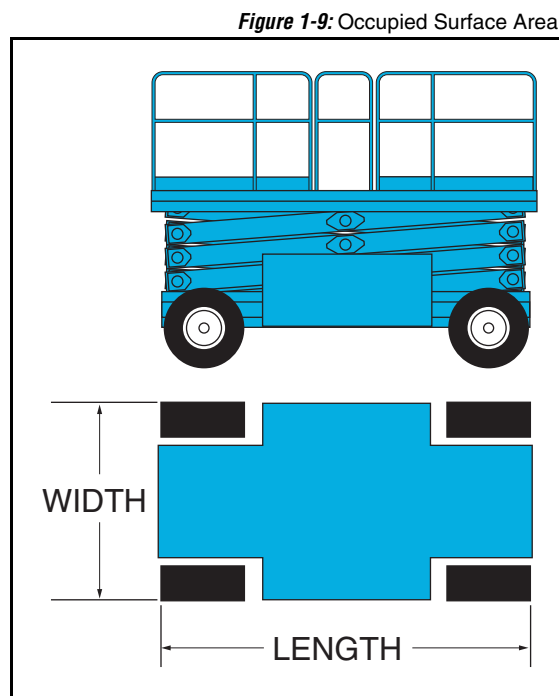
LOCALIZED PRESSURE = (TOTAL WEIGHT ÷ 4) ÷ CONTACT AREA

OCCUPIED PRESSURE

KPA OR PSF

Occupied Pressure is measured in *kilopascals or pounds per square foot*. It is the total pressure imposed onto the work surface over the area of the machine (occupied surface area). This is especially important when the work surface is supported by beams. The Occupied Pressure *must not exceed* the maximum load that the surface can support.

OCCUPIED PRESSURE = TOTAL WEIGHT ÷ (LENGTH X WIDTH)



1-12 HYDRAULIC FLUID

FLUID LEVEL

With the platform fully lowered, check the hydraulic fluid level. If the fluid is NOT in operating range, add hydraulic fluid until the fluid level is in operating range.

- DO NOT fill above operating range.
- DO NOT add fluid when the platform is elevated.

RECOMMENDED HYDRAULIC FLUID

CAUTION

Unless recommended by UpRight, do not mix hydraulic fluids of different brands or types. The required additives and fluid viscosities may vary.

If the use of hydraulic fluids other than listed below is desired please contact UpRight Product Support.

MOBILFLUID 424

- Viscosity Grade: ISO 46 High V.I. (similar to SAE 10W-30).
- Viscosity index: 152.
- Operating Range: -10° C to +96° C (+15° F to +205° F) Reservoir Temperature.
- Ambient Conditions*: Above -10° C (+15° F).

MOBIL DTE 13 M

- Viscosity Grade: ISO 32 High V.I. (similar to SAE 5W-20).
- Viscosity index: 140.
- Operating Range: -18° C to +80° C (-4° F to +176° F) Reservoir Temperature.
- Ambient Conditions*: -18° C to +30° C (-4° F to +86° F).

MOBIL DTE 11 M

- Viscosity Grade: ISO 15.
- Viscosity index: 140.
- Operating Range: -35° C to +45° C (-30° F to +115° F) Reservoir Temperature.
- Ambient Conditions*: -35° C to +20° C (-30° F to +70° F).

MOBIL EAL ENVIROSYN 46 H

For use where a *biodegradable non-toxic hydraulic fluid is required*.

- Viscosity Grade: ISO 46 High V.I. (similar to SAE 10W-20).
- Viscosity Index: 153.
- Operating Range: -14° C to +90° C (+6° F to +195° F) Reservoir Temperature.
- Ambient Conditions*: -14° C to +41° C (+6° F to +105° F).
- Synthetic Ester Base.

The anti-wear quality of hydraulic fluid must meet or exceed API Service Classification GL-3. The chemical stability of the hydraulic fluid must be sufficient for mobile hydraulic system service.

*Ambient Conditions are for reference only and may vary by model. Refer to operating temperature for final determination of correct fluid.

1-13 LONG TERM STORAGE

NOTE: Do not drain the hydraulic system prior to long term storage.

If the machine is to be placed in long term storage, follow these recommended preservation procedures.

PRESERVATION

1. Clean painted surfaces. If paint is damaged, repaint.
2. Fill the hydraulic reservoir to operating level.

IMPORTANT: Do not fill the hydraulic reservoir while the platform is elevated.

3. Coat exposed portions of cylinder rods with a preservative such as multipurpose grease and wrap with a barrier material.
4. Coat all exposed unpainted metal surfaces with preservative.
5. **Internal Combustion Models:** Service the engine according to the manufacturers recommendations.
6. **Electric And BiEnergy Models:** Remove the batteries and place them in alternative service.

SERVICE AND REPAIR

This section contains instructions for the maintenance of the aerial work platform. Refer to the General Information section for information relevant to all UpRight Aerial Work Platforms. Referring to the Operator Manual will aid in understanding the operation and function of the various components and systems, and help in diagnosing and repair of the machine.

WARNING

Be sure to read, understand and follow all information in the Operator Manual before attempting to operate or perform service on any UpRight Aerial Work Platform.

DANGER

Never perform service on the machine in the elevating assembly area while the platform is elevated without first blocking the elevating assembly.

DO NOT stand in elevating assembly area while deploying or storing maintenance brace.

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2-1 GENERAL DESCRIPTION

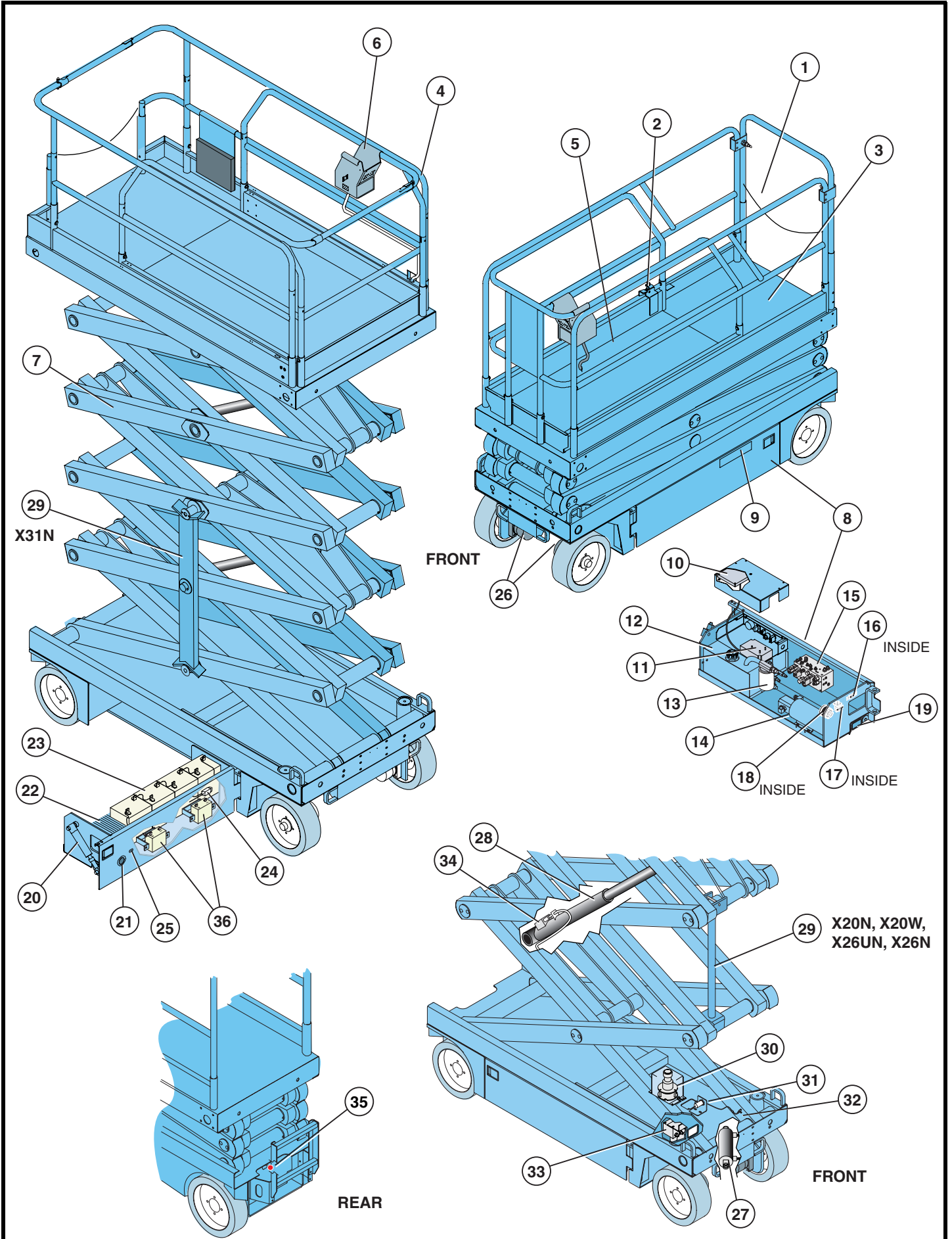
The X-Series Work Platforms are self-propelled aerial work platforms designed to provide mobility with the platform elevated or lowered. The elevating function shall only be used when the platform is on a firm, level surface. Travel with the platform elevated is limited to the low speed range. The machine is intended to be self-propelled only when in relatively close proximity to the work area.

COMPONENT LOCATIONS

Refer to Figure 2-1 to locate the components of the X-Series Work Platforms.

1. Entry Way
2. Deck Lock Assembly
3. Work Platform
4. Guardrails
5. Platform Extension
6. Platform Controls
7. Elevating Assembly
8. Control Module
9. Chassis Controls
10. Circuit Board
11. Motor Controller
12. Hydraulic Fluid Reservoir
13. Hydraulic Fluid Filter
14. Hydraulic Pump and Motor
15. Main Valve Manifold
16. 175 AMP Fuse, Overload Protection
17. Solenoid, Motor Relay
18. Audible Alarm
19. Depression Mechanism
20. Depression Mechanism Cylinder
21. Battery Charger Plug
22. Battery Charger
23. Battery Pack
24. Cable Connector
25. Power Module
26. Drive Motors
27. Steering Cylinder
28. Lift Cylinder (X31N: 2 Lift Cylinders)
29. Maintenance Brace
30. Level Sensor
31. Proximity Switch
32. Height Limit Switch (X26UN and X31N only)
33. Series Parallel Valve (X20W, X26N, X26UN and X31N only)
34. Emergency Lowering Valve
35. Emergency Lowering Valve Control
36. Auxiliary Batteries (Emergency Lowering Power, X31N only)

Figure 2-1: X-Series Component Locations



2-2 PREVENTATIVE MAINTENANCE

The complete inspection consists of periodic visual and operational checks, along with periodic minor adjustments to assure proper performance. Daily inspection will prevent abnormal wear and prolong the life of all systems. The inspection and maintenance schedule is to be performed at regular intervals. Inspection and maintenance shall be performed by personnel who are trained and familiar with mechanical and electrical procedures.



Before performing preventative maintenance, familiarize yourself with the operation of the machine.

Always block the elevating assembly whenever it is necessary to enter the elevating assembly to perform maintenance while the platform is elevated.

The preventative maintenance table has been designed for machine service and maintenance repair. Please photocopy the following page and use the table as a checklist when inspecting the machine for service.

PREVENTATIVE MAINTENANCE CHECK LIST

MAINTENANCE TABLE KEY

Interval

Daily = each shift or every day

30d = every 30 days or 30 days

3m = every 125 hours or 3 months

6m = every 250 hours or 6 months

2y = every 1000 hours or 2 years

Y = Yes/Acceptable

N = No/Not Acceptable

R = Repaired/Acceptable

PREVENTATIVE MAINTENANCE REPORT

Date: _____

Owner: _____

Model No: _____

Serial No: _____

Serviced By: _____

Service Interval: _____

COMPONENT	INSPECTION OR SERVICES	INTERVAL	Y	N	R
Batteries	Check electrolyte level	Daily			
	Clean exterior	3m			
	Clean terminals	3m			
Hydraulic Fluid	Check fluid level	Daily			
	Change filter	6m			
	Drain and replace hydraulic fluid	2y			
Hydraulic System	Check for leaks	Daily			
	Check hose connections	30d			
	Check hoses for exterior wear	30d			
Controller	Check operation of all controls	Daily			
Control Cable	Check the exterior of the cable for pinching, binding or wear	Daily			
Platform Floor and Rails	Check fasteners for proper torque	Daily			
	Check welds for cracks	Daily			
	Check condition of platform	Daily			
	Check condition of anchorage points	Daily			
	Check condition of operators manual	Daily			
Tires	Check for damage	Daily			
	Check lug nuts (torque to 123 N-m [90 ft.lbs.])	30d			
Hydraulic Drive System	Check hydraulic drive motor operation	Daily			
	Check hoses, fittings, and valve manifold for leaks	Daily			
Hydraulic Pump	Check for leaks at mating surfaces	30d			
	Check for hose fitting leaks	Daily			
	Check mounting bolts for proper torque	30d			
	Wipe clean	30d			

COMPONENT	INSPECTION OR SERVICES	INTERVAL	Y	N	R
Steering System	Check hardware & fittings for proper torque	6m			
	Check linkage for wear areas	30d			
	Check for missing/loose retainers	30d			
	Check steering cylinder for leaks	Daily			
Elevating Assembly	Inspect for structural cracks	Daily			
	Check pivot points for wear	30d			
	Check pivot pin retaining bolts for proper torque	30d			
Chassis	Check members for deformation	Daily			
	Check hoses for pinch or rubbing points	Daily			
	Check component mounting for proper torque	6m			
Lift Cylinders	Check welds for cracks	Daily			
	Check the cylinder rods for wear	30d			
	Check lift cylinder pin retaining bolts for proper torque	30d			
	Check seals for leaks	30d			
	Inspect pivot points for wear	30d			
	Check fittings for proper torque	30d			
Entire Unit	Check for and repair collision damage	Daily			
	Lubricate steering pivots	30d			
	Check fasteners for proper torque	3m			
	Check for corrosion-remove and repaint	3m			
Labels	Check for peeling, missing, or unreadable labels & replace	Daily			

2-3 BLOCKING THE ELEVATING ASSEMBLY

⚠ WARNING ⚠

*Never perform service while the platform is elevated without first blocking the elevating assembly.
DO NOT stand in the elevating assembly area while deploying or storing the maintenance brace.*

X20W, X20N, X26N, X26UN

Figure 2-2: Maintenance Brace

INSTALLATION

1. Park the machine on a firm, level surface.
2. Pull Chassis Emergency Stop Switch to the ON position.
3. Pull Platform Emergency Stop Switch to the ON position.
4. Turn and hold the Chassis Key Switch to CHASSIS.
5. Push the Chassis Lift/Lower Switch to LIFT to elevate the platform until the maintenance brace can be rotated to the vertical position.
6. From the front of the machine, lift the maintenance brace from its stored position. Rotate upward and outward, then down until it is hanging vertically below its attachment point.
7. Lower the platform by pushing the Chassis Lift/Lower Switch to LOWER and gradually lower the platform until the maintenance brace is supporting the platform.



STORAGE

1. Using the Chassis Controls, gradually elevate the platform until the maintenance brace is clear.
2. Rotate the maintenance brace outward and upward over its attachment point until it rests in the stored position.
3. Lower the platform by pushing the Chassis Lift/Lower Switch to LOWER to completely lower the platform.

X31N

Figure 2-3: Blocking the Elevating Assembly - X31N

INSTALLATION

1. Park the work platform on firm level ground.
2. Verify that both Emergency Stop Switches are ON.
3. Turn the Chassis Key Switch to CHASSIS.
4. Push the Chassis Lift Switch to UP and elevate the platform approximately 2,7 m (9 ft), leaving enough room to freely rotate the Scissors Brace.
5. Pull out on the retaining pin and rotate the Scissors Brace into the vertical position.
6. Push the Chassis Lift Switch to the DOWN position and gradually lower the platform until the upper and lower pivot pins rest on the Scissors Brace.



REMOVAL

1. Push the Chassis Lift Switch to the UP position and gradually raise the platform until the Scissors Brace will clear the pivot pins.
2. Rotate the Scissors Brace counterclockwise until it locks into position parallel with the scissor arm.
3. Push the Chassis Lift Switch to the DOWN position and completely lower the platform.

2-4 LUBRICATION

⚠ WARNING ⚠

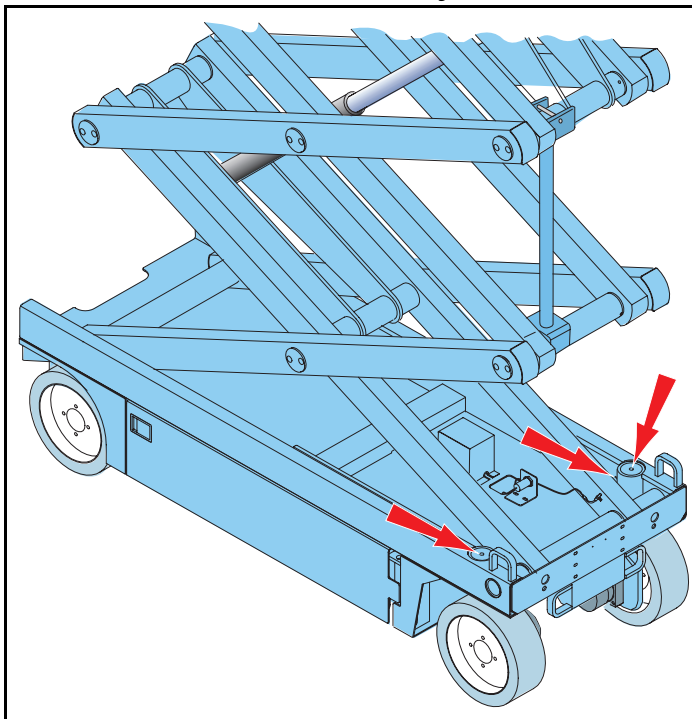
*Never perform service while the platform is elevated without first blocking the elevating assembly.
DO NOT stand in the elevating assembly area while deploying or storing the maintenance brace.*

There are four lubrication points on the machine - two on each steering pivot (see Figure 2-4).

Lubricate the steering pivots every 125 hours or three months.

1. Deploy the maintenance brace (see "Blocking the Elevating Assembly" on page 2-8).
2. Clean the grease fittings and surrounding area.
3. Using multipurpose grease in a grease gun, pump the grease into the fitting until grease just begins to appear at the edges of the pivot.
4. Wipe off any excess grease.

Figure 2-4: Lubrication Points



2-5 CONTROLS

PLATFORM CONTROLS

Refer to *Section 4 - Schematics* for wiring diagrams.

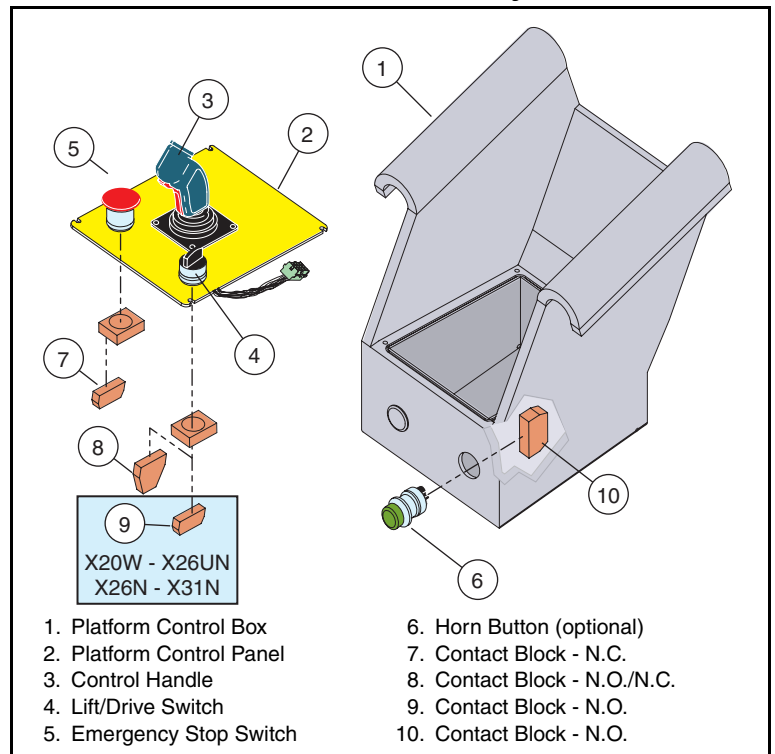
Refer to the *Parts Manual* for replacement part numbers.

NOTE: The X20N uses a two-position Lift/Drive Switch with one control block. All other models use a three-position Lift/Drive Switch with two control blocks.

ACCESS TO SWITCHES

1. Remove the four screws from the control panel and lift the assembly from the Platform Control box.
2. Unplug the Control Handle wiring harness.

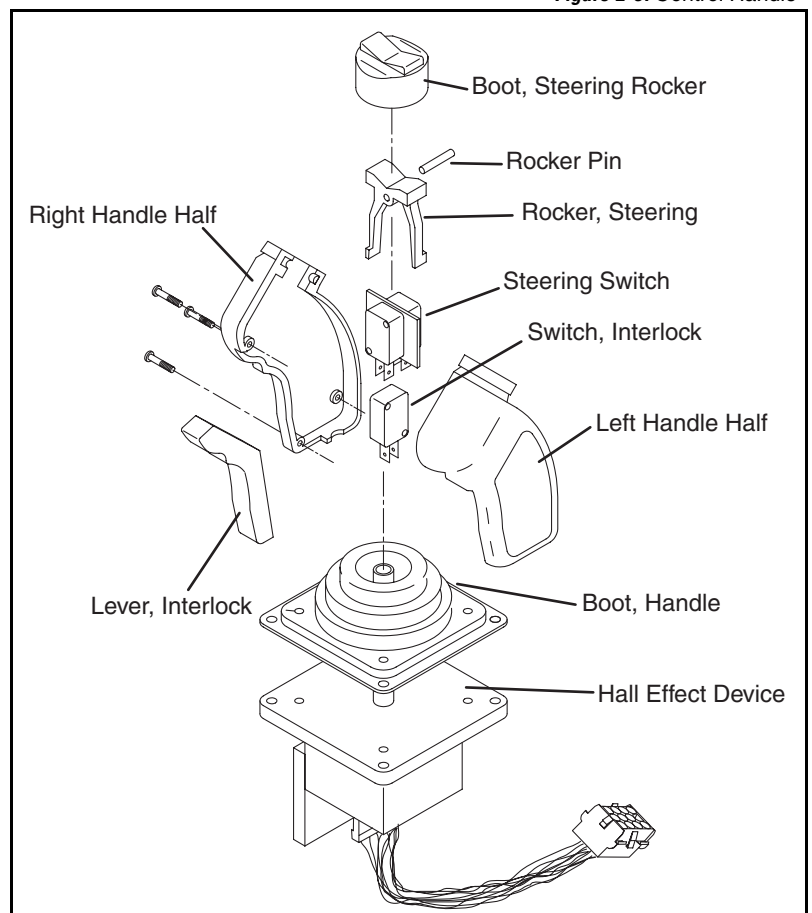
Figure 2-5: Platform Controls



CONTROL HANDLE

1. Remove the Control Handle, if necessary, from Platform Control box.
 - a. Remove the control panel.
 - b. Unplug the control handle wiring harness.
 - c. Remove the four screws from the control handle mounting plate.
 - d. Lower the control handle through the control panel.
2. Remove and replace defective parts. Refer to the *Parts Manual* for repair parts numbers.

Figure 2-6: Control Handle



CHASSIS CONTROLS

Refer to *Section 4 - Schematics* for wiring diagrams.

Refer to the *Parts Manual* for replacement part numbers.

To access the switches and components for repair or replacement;

1. Open the control module.
2. Remove the four screws from the control box cover and lift the cover.
 - Be careful not to damage the cable that connects the circuit board and the motor control.
3. Place the control cover top-side-down.

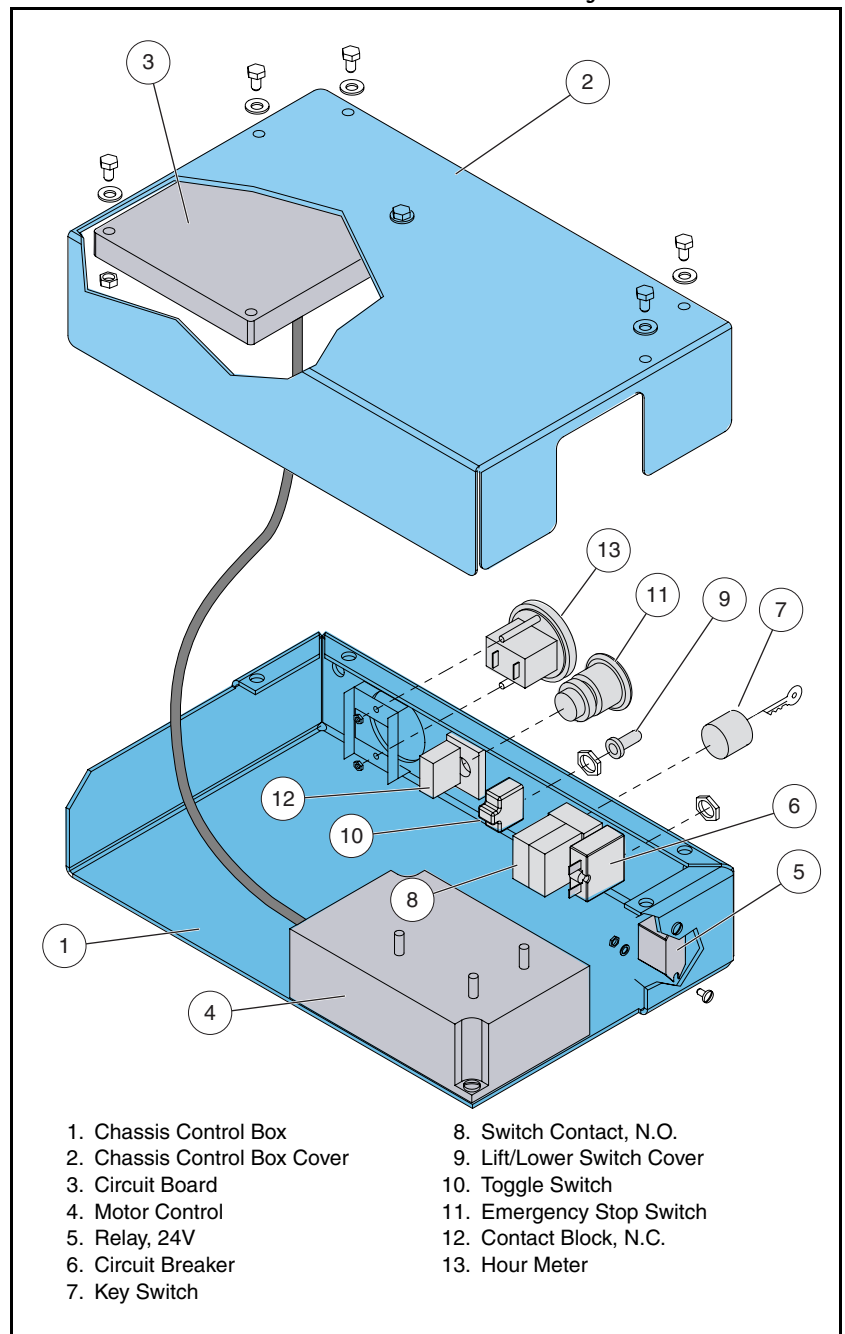
MOTOR CONTROLLER AND CIRCUIT BOARD

Refer to *Section 3 - Troubleshooting* for motor controller and circuit board dip switch settings.

To access the Motor Controller Dip Switches, open the control module as described in "Chassis Controls".

The circuit board is mounted inside the control box cover.

Figure 2-7: Chassis Controls



LEVEL SENSOR

INTRODUCTION

The Level Sensor is located near the front of the chassis between the elevating assembly sections, and is covered with a protective metal box. It has three wires; red-power (24V in), black-ground, white-output (24V out). To verify the sensor is working properly there are two LED's under the sensor; green indicates the sensor is on (has power), red indicates the sensor is level and the white wire is 'hot' (24V out).

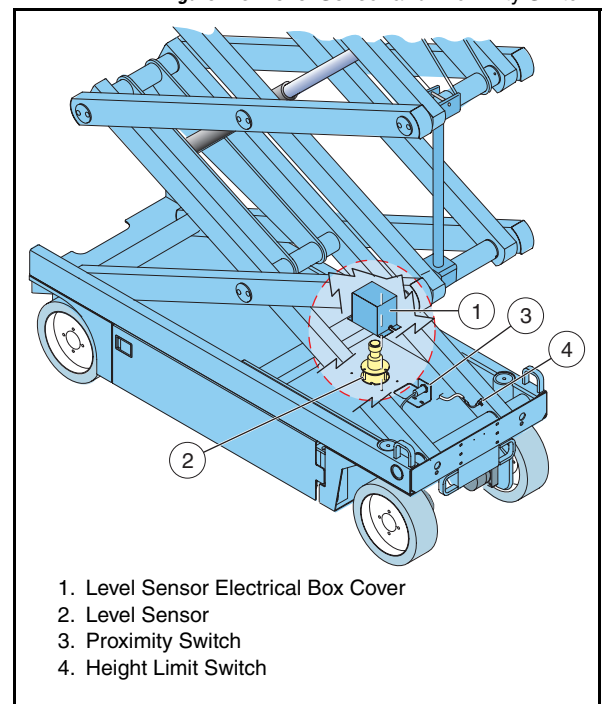


*Never perform service while the platform is elevated without first blocking the elevating assembly.
DO NOT stand in the elevating assembly area while deploying or storing the maintenance brace.*

LEVEL SENSOR ADJUSTMENT

1. Place machine on firm, level surface.
2. Use an Inclinometer (P/N: 10119-000-00) to ensure that the Chassis is level from front to rear and side to side.
3. Deploy the maintenance brace (see "Blocking the Elevating Assembly" on page 2-8).
4. Remove the Level Sensor electrical box cover near the front of machine.
5. Adjust the three leveling locknuts until the bubble is centered in the circle on the attached bubble level.
6. Replace the Level Sensor electrical box cover.
7. Store the maintenance brace and lower the platform.

Figure 2-8: Level Sensor and Proximity Switch



HEIGHT LIMIT SWITCH - X26UN AND X31N

The Height Limit Switch is only used on the X26UN and X31N models. It is a mercury switch that prevents the lift cylinder from reaching the end of its stroke and results in a smooth stop at full elevation. If the Height Limit Switch is out of adjustment or not functioning, the platform will stop abruptly when it reaches full elevation (the end of the lift cylinder stroke).

CAUTION

Do not disable or bypass the Height Limit Switch as it may allow the platform to exceed the safe operating height.

To disable or bypass any control will void the warranty.

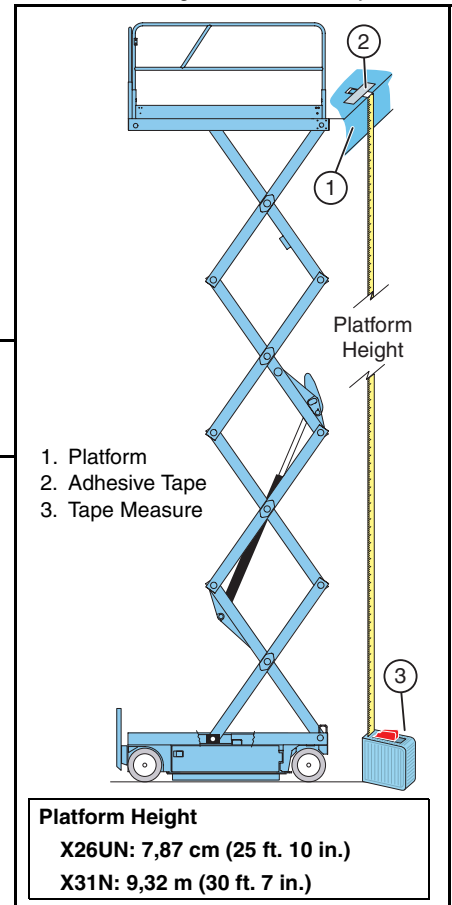
CHECK AND TEST

A tape measure capable of measuring the height of the machine is required to check the operation of the Height Limit Switch.

Check Operation

1. Place the machine on a firm, level surface.
2. Use adhesive tape to attach the tab of a tape measure to the front edge of the platform. Ensure that the locking device on the tape measure is disengaged and extend the tape measure to the surface.
3. Fully elevate the platform. The tape measure should un-roll as the platform elevates.
4. Measure the distance from the platform deck to the surface (refer to Figure 2-9).
 - If the distance is more, the switch is out of adjustment or not functioning.
 - If the distance is less, the switch is out of adjustment.

Figure 2-9: Height Limit Switch Adjustment



Test the Mercury Switch

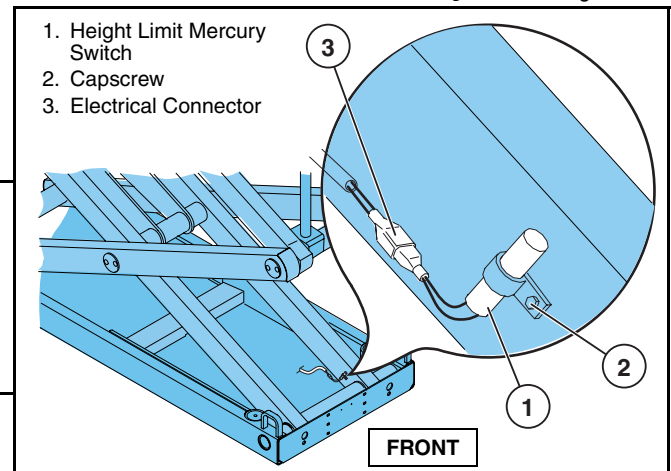
WARNING

Never perform service while the platform is elevated without first blocking the elevating assembly.

DO NOT stand in the elevating assembly area while deploying or storing the maintenance brace.

1. Deploy the maintenance brace (see "Blocking the Elevating Assembly" on page 2-8).
2. Place a reference mark alongside the switch to establish its position.
3. Disconnect the electrical connector.
4. Connect a continuity tester to the Height Limit Switch.
5. Loosen the capscrew and rotate the switch clockwise until it opens. The continuity tester light should turn OFF when the switch opens.
 - If the continuity tester light remains ON, replace the switch.
 - If the continuity tester light turns OFF, adjust the switch.

Figure 2-10: Height Limit



REMOVAL AND INSTALLATION



*Never perform service while the platform is elevated without first blocking the elevating assembly.
DO NOT stand in the elevating assembly area while deploying or storing the maintenance brace.*

Refer to Figure 2-10 for the location of the Height Limit Switch.

1. Deploy the maintenance brace (see “Blocking the Elevating Assembly” on page 2-8).
2. Place a reference mark alongside the switch to establish its position.
3. Disconnect the electrical connector.
4. Remove the capscrew from the switch bracket, and remove the switch.
5. Install the new switch, align it with the reference mark and tighten the capscrew.
6. Connect the electrical connector.
7. Check the Height Limit Switch and adjust if necessary.

HEIGHT LIMIT SWITCH ADJUSTMENT

Adjust the Height Limit Switch to stop elevation at the specified height. A tape measure of sufficient length is required to adjust the Height Limit Switch (refer to Figure 2-9).

1. Place the machine on a firm, level surface.
2. Use adhesive tape to attach the tab of a tape measure to the front edge of the platform (see Figure 2-9). Ensure that the locking device on the tape measure is disengaged and extend the tape measure to the surface.
3. Deploy the maintenance brace (see “Blocking the Elevating Assembly” on page 2-8).
4. Place a reference mark alongside the Height Limit Switch to establish its position.
5. Fully elevate the platform. The tape measure should un-roll as the platform elevates.

NOTE: Do not return the maintenance brace to the stored position at this time.

6. Measure the distance from the platform deck to the surface (see Figure 2-9).
 - If the distance is correct, store the maintenance brace and fully lower the platform.
 - If the distance is not correct, proceed to Step 7.
7. Lower the platform until the maintenance brace is properly set.
8. Loosen the capscrew and adjust as follows:
 - If the distance is **more than** Figure 2-9, rotate the switch slightly clockwise and tighten the capscrew.
 - If the distance is **less than** Figure 2-9, rotate the switch slightly counter clockwise and tighten the cap-screw.
9. Repeat Step 5 through Step 6.

PROXIMITY SWITCH

Refer to Figure 2-8.

The Proximity Switch is located near the front of the chassis between the elevating assembly sections, and forward of the Level Sensor. Its function is determined by the location of the lower elevating assembly tube.

PROXIMITY SWITCH FUNCTION

A red LED at the rear of the switch should be ON when the elevating assembly tube is next to the switch (the platform is lowered). The Proximity Switch controls the machine operation based upon the proximity of the elevating assembly tube to the Proximity Switch.

When Elevating:

- The Level Sensor is enabled.
- The Depression Mechanism is enabled.
- Power to the High Speed Circuit is cut, preventing the machine from travel faster than 0,8 km/h (0.5 mph).

When Completely Lowered:

- Power is supplied to the High Speed Circuit, allowing the machine to travel up to 3,2 km/h (2.0 mph) when the Platform Controls Lift/Drive Switch is set to DRIVE HI.

TEST THE PROXIMITY SWITCH



Never perform service while the platform is elevated without first blocking the elevating assembly. DO NOT stand in the elevating assembly area while deploying or storing the maintenance brace.

1. Turn the Chassis Key Switch ON.
 - The red LED should be ON. If not, the Proximity Switch may be out of adjustment.
2. Elevate the platform until the elevating assembly tube is clear of the Proximity Switch.
 - The red LED should turn OFF.
3. Deploy the Maintenance Brace.
4. Place a piece of steel next to the Proximity Switch.
 - The red LED should turn ON. If it was OFF in Step 1, the Proximity Switch requires adjustment.
 - If the red LED remains OFF, replace the Proximity Switch.

TEST HIGH SPEED CIRCUIT

1. Elevate the platform 30 cm (12 in.).
2. Turn the Lift/Drive Switch to DRIVE HI and attempt to drive the machine.
 - If the machine will drive faster than 3,2 km/h (0.5 mph), adjust or replace the switch.

REMOVAL AND INSTALLATION

1. Deploy the maintenance brace (see “Blocking the Elevating Assembly” on page 2-8).
2. Disconnect the switch leads.
3. Remove the defective switch and install a new one.
4. Adjust the switch-to elevating assembly tube clearance (see “Proximity Switch Adjustment” on page 2-17).
5. Connect the switch leads.
6. Store the maintenance brace and lower the platform.

PROXIMITY SWITCH ADJUSTMENT

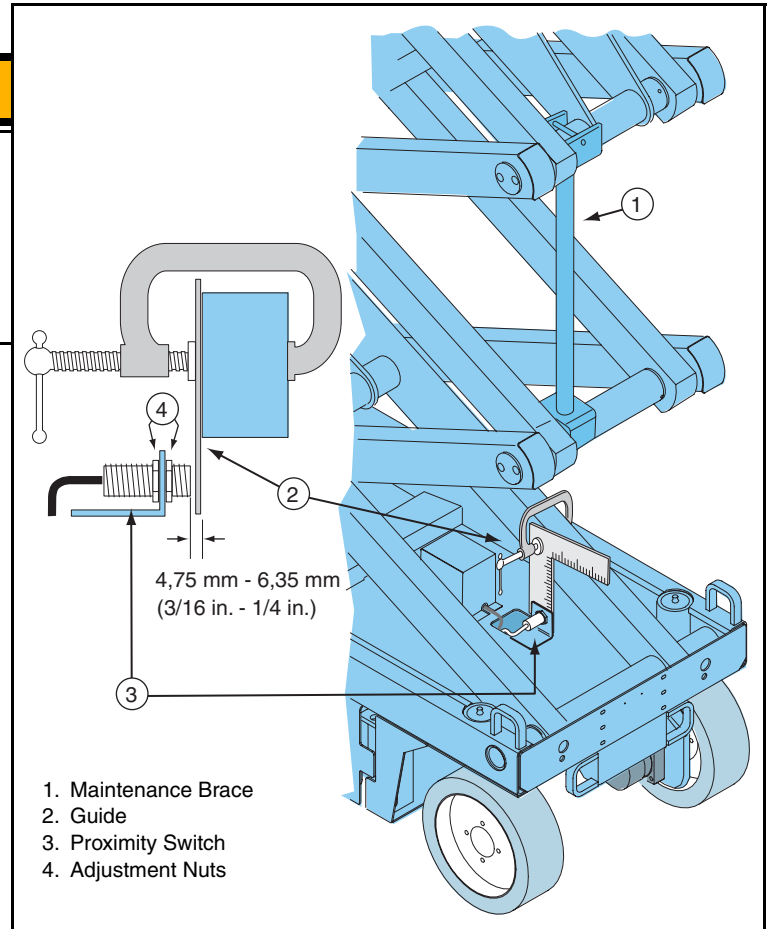
Figure 2-11: Proximity Switch Adjustment

⚠ WARNING ⚠

Never perform service while the platform is elevated without first blocking the elevating assembly.

DO NOT stand in the elevating assembly area while deploying or storing the maintenance brace.

1. Deploy the maintenance brace (see "Blocking the Elevating Assembly" on page 2-8).
2. Use a clamp to attach a straight guide to the elevating assembly tube.
3. Measure the distance from the face of the Proximity Switch to the side of the guide that faces the elevating assembly tube.
4. Turn the adjusting nuts on the Proximity Switch to adjust to within 4,76 mm to 6,35 mm (3/16 in. to 1/4 in.).
5. Remove the clamp and guide and repeat the test.
 - If the test fails, the Proximity Switch is defective and must be replaced.



2-6 BATTERIES

Electrical Energy for the motor is supplied by four 6 volt batteries wired in series for 24 volts DC. Proper care and maintenance of the batteries and motor will ensure maximum performance from the machine.

BATTERY MAINTENANCE

Check the electrolyte level daily. Clean the battery exterior and terminals every 125 hours or three months.

Refer to *Section 1: General Information* for complete battery maintenance instructions.

Refer to the *Operator Manual* included in this Service Manual for specific maintenance and charging instructions.

NOTE: If system voltage drops below 17 volts (on a 24 volt system), the charger will not recharge the batteries. If this extreme voltage drop occurs, disconnect and recharge each battery separately using a 6 volt charger to bring the voltage in each up to at least 4 1/2 volts.

CAUTION

If battery water level is not maintained, batteries will not fully charge, creating a low discharge rate.

⚠ WARNING ⚠

Hazard of explosive gas mixture. Keep sparks, flame and smoking materials away from batteries.

Always wear safety glasses when working with batteries.

Battery fluid is highly corrosive. Thoroughly rinse away any spilled fluid with clean water.

Always replace batteries with UpRight batteries or manufacturer approved replacements.

Before disconnecting the battery negative (–) lead, make sure all switches are OFF. If ON, a spark will occur at the ground terminal which could cause an explosion if hydrogen gas or fuel vapors are present.

BATTERY REPLACEMENT

REMOVAL

1. Turn the Chassis Key Switch to the OFF position and push the Chassis and Platform Emergency Stop Switches down to the OFF position. Open the power module.

NOTE: If switches are ON, a spark will occur at the ground terminal which could cause an explosion if hydrogen gas or fuel vapors are present.

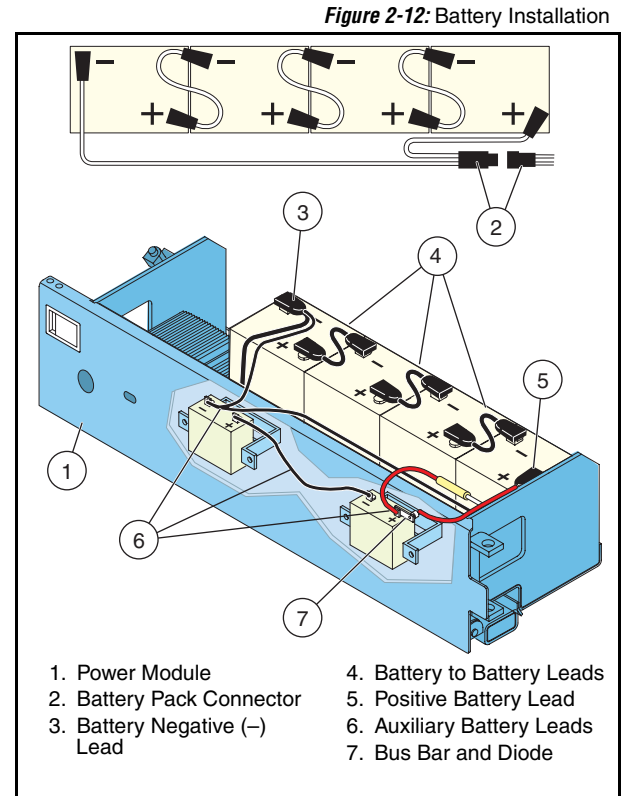
2. Disconnect battery pack connector.
3. Disconnect the battery negative (–) lead.

IMPORTANT: Disconnect the battery negative (–) lead first.

4. Disconnect the remaining battery leads.
5. Lift the batteries out of the module.

Auxiliary Emergency Lowering Batteries (X31N only)

6. Disconnect the auxiliary battery leads.
7. Disconnect the bus bar and diode.
8. Lift out the auxiliary batteries.



INSTALLATION

NOTE: Replacement batteries must be equal to or greater than the weight of the originals to maintain stability when the platform is elevated. Always replace batteries with UpRight batteries or manufacturer approved replacements weighing [X20N-X20W-X26N] 26,3 kg (58 lb.) or [X26UN-X31N] 30 kg (66 lbs.) each.

Battery cables must be installed as shown in Figure 2-12.

IMPORTANT: Connect the battery negative (–) lead last.

CAUTION

X31N Auxiliary Batteries - The bus bar and diode must be installed or damage to the charging system may occur.

1. Verify that the Chassis Key Switch and the Chassis and Platform Emergency Stop Switches are in the OFF position.
2. Place the batteries into the power module.
3. Connect the battery to battery leads.
4. X31N - Auxiliary Batteries:
 - a. Connect the battery to battery lead.
 - b. Install the bus bar and diode.
 - c. Connect the positive cables.
 - d. Connect the negative cable.
5. Connect the battery positive (+) lead.
6. Connect the battery negative (–) lead last.
7. Connect the battery pack connector.

2-7 HYDRAULICS

HYDRAULIC FLUID RESERVOIR AND FILTERS

FLUID LEVEL

Check the fluid level daily.

With the platform fully lowered, open the control module and remove the reservoir breather/cap. Fluid should be at the maximum mark (Figure 2-13).



The hydraulic fluid may be of sufficient temperature to cause burns. Wear safety gloves and safety glasses when handling hot fluid.

RESERVOIR BREATHER/CAP

Clean the breather/cap at the same time that the fluid filter is replaced. Use cleaning solvent and blow dry with clean dry compressed air.

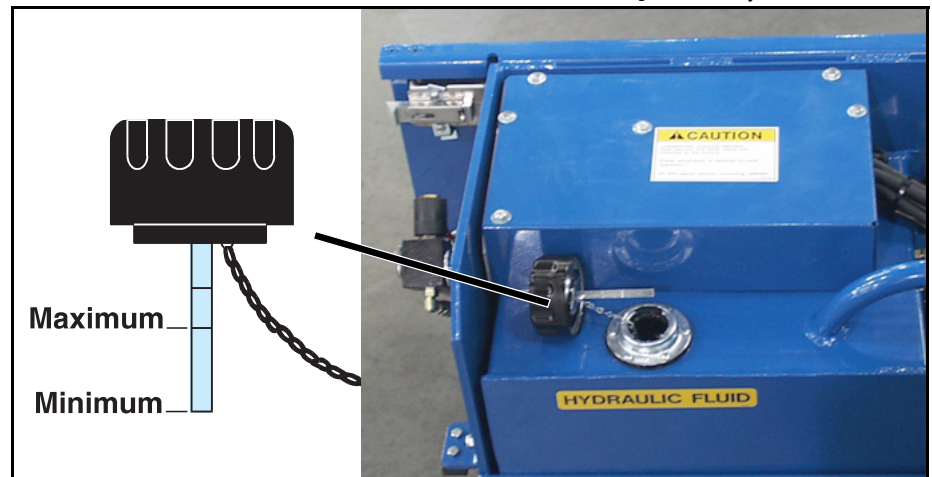


Figure 2-13: Hydraulic Reservoir

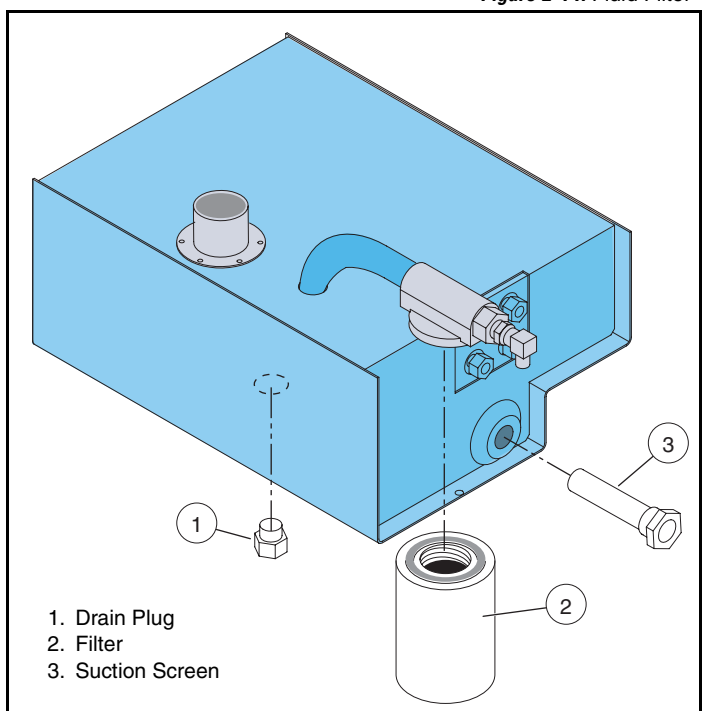
FILTER REPLACEMENT

Replace the filter every 250 hours or six months.

1. Unscrew the filter from the filter assembly.
2. Apply a thin film of clean hydraulic fluid to the gasket of the replacement filter.

Screw the replacement filter onto the filter head until the gasket makes contact, then turn the filter $\frac{3}{4}$ of a turn further.

Figure 2-14: Fluid Filter



FLUID REPLACEMENT

Replace the hydraulic fluid every 1000 hours or two years.

1. Operate the machine for 10-15 minutes to bring the hydraulic fluid up to normal operating temperature.
2. Provide a suitable container to catch the drained fluid.
 - Hydraulic reservoir capacity: 15 L (4 U.S. gal).
3. Open the control module door.
4. Remove the drain plug and allow all the fluid to drain. Dispose of hydraulic fluid properly (contact your local fluid recycler).
5. Install the drain plug.
6. Fill the hydraulic reservoir with the appropriate hydraulic fluid until the fluid is up to the maximum mark on the dipstick.
 - Refer to “Specifications” at the end of the *Operator Manual* included in this Service Manual to identify the proper fluid for your conditions.

FLUID OUTLET SCREEN

Clean or replace the outlet screen at the same time that the fluid is changed.

1. Drain the fluid (see “Fluid Replacement”).
2. Disconnect and plug the outlet hose to prevent foreign material from entering the hose.
3. Remove the suction screen. Clean or replace as necessary.
4. Install the suction screen.
5. Fill the hydraulic reservoir (see “Fluid Replacement”).

HYDRAULIC PUMP AND MOTOR

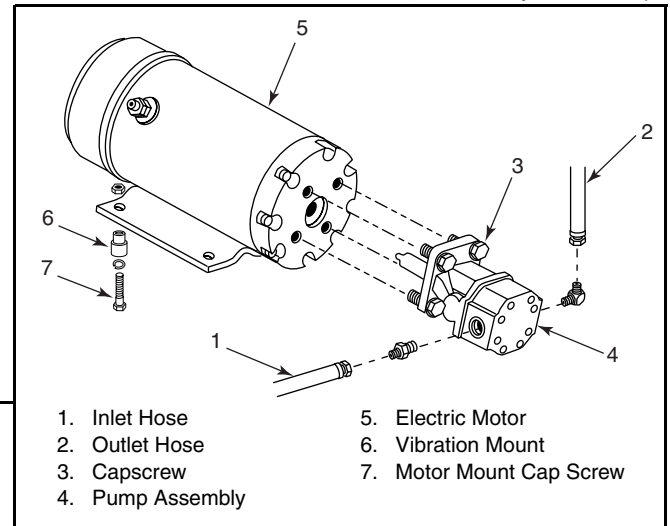
The hydraulic pump is located in the control module.

REMOVAL

NOTE: If the hydraulic reservoir has not been drained, suitable means for plugging hoses should be provided to prevent excessive fluid loss.

⚠ WARNING ⚠

Before disconnecting the battery negative (–) lead, make sure all switches are OFF. If ON, a spark will occur at the ground terminal which could cause an explosion if hydrogen gas or fuel vapors are present.



1. Disconnect the battery pack connector and the battery negative (–) lead.
2. Open the control module.
3. Mark, disconnect and plug the hose assemblies.

NOTE: It may not be necessary to remove the motor to service or remove the pump.

4. Disconnect the power supply from the motor.
5. Remove the four cap screws from the vibration mounts and lift the motor and pump assembly from the control module.
6. Loosen the capscrews and remove the pump assembly from the motor.

INSTALLATION

Pump to Motor

1. Lubricate the pump shaft with general purpose grease and attach the motor with the capscrews.
2. Using a crisscross pattern, torque each capscrew a little at a time until all capscrews are torqued to 27 N-m (20 ft./lbs.).

Pump and Motor Assembly to Control Module

3. Position the motor and vibration mounts into the control module.
4. Put a drop of Loctite® 242 thread lock on each capscrew as you install the capscrew and lock washer through the bottom of the control module.
5. Tighten the motor mount nuts to 24 N-m (18 ft./lbs.).
6. Unplug and connect the hydraulic hoses.
7. Connect the power supply to the motor.
8. Connect the battery negative (–) lead.
9. Connect the battery pack connector.
10. Check the fluid level in the hydraulic reservoir before operating the machine.

HYDRAULIC MANIFOLD

It is not necessary to remove the manifold to perform all maintenance procedures (i.e. replacing a single valve). Determine whether or not the manifold should be removed before maintenance begins.

Refer to *Section 3 - Schematics* for the hydraulic schematic and hose routing diagram.

REMOVAL AND INSTALLATION

! WARNING !

Before disconnecting the battery negative (–) lead, make sure all switches are OFF. If ON, a spark will occur at the ground terminal which could cause an explosion if hydrogen gas or fuel vapors are present.

1. Disconnect the battery pack connector and the battery negative (–) lead.
2. Tag and disconnect the solenoid valve leads.
3. Tag, disconnect, and plug hydraulic hoses.
4. Remove the bolts that hold the manifold to the mounting bracket.
5. Remove the manifold block.

Installation is reverse of removal.

Torque mounting capscrews to 11 N-m (8 ft./lbs.).

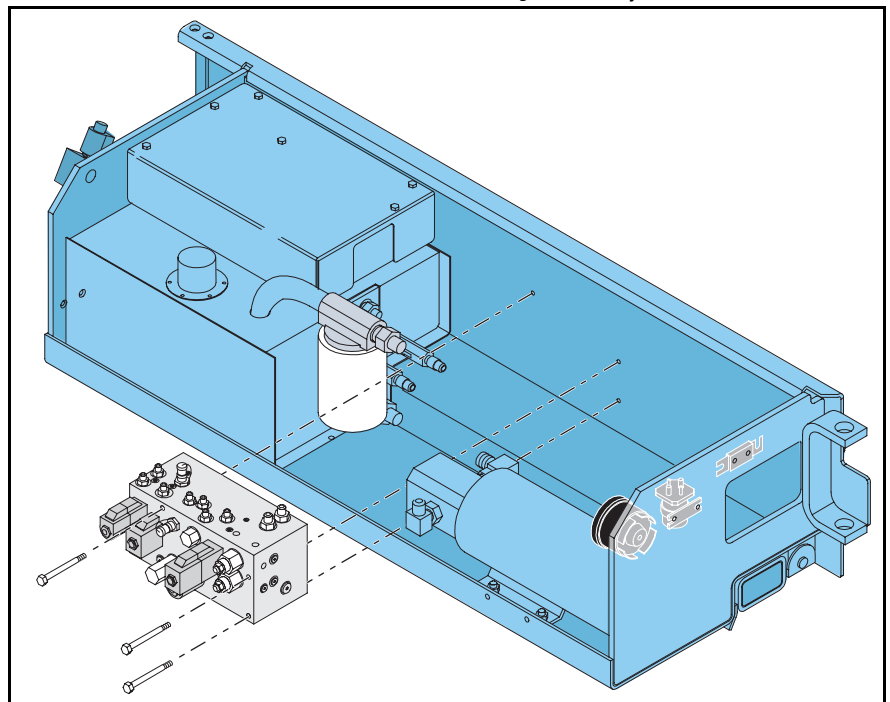


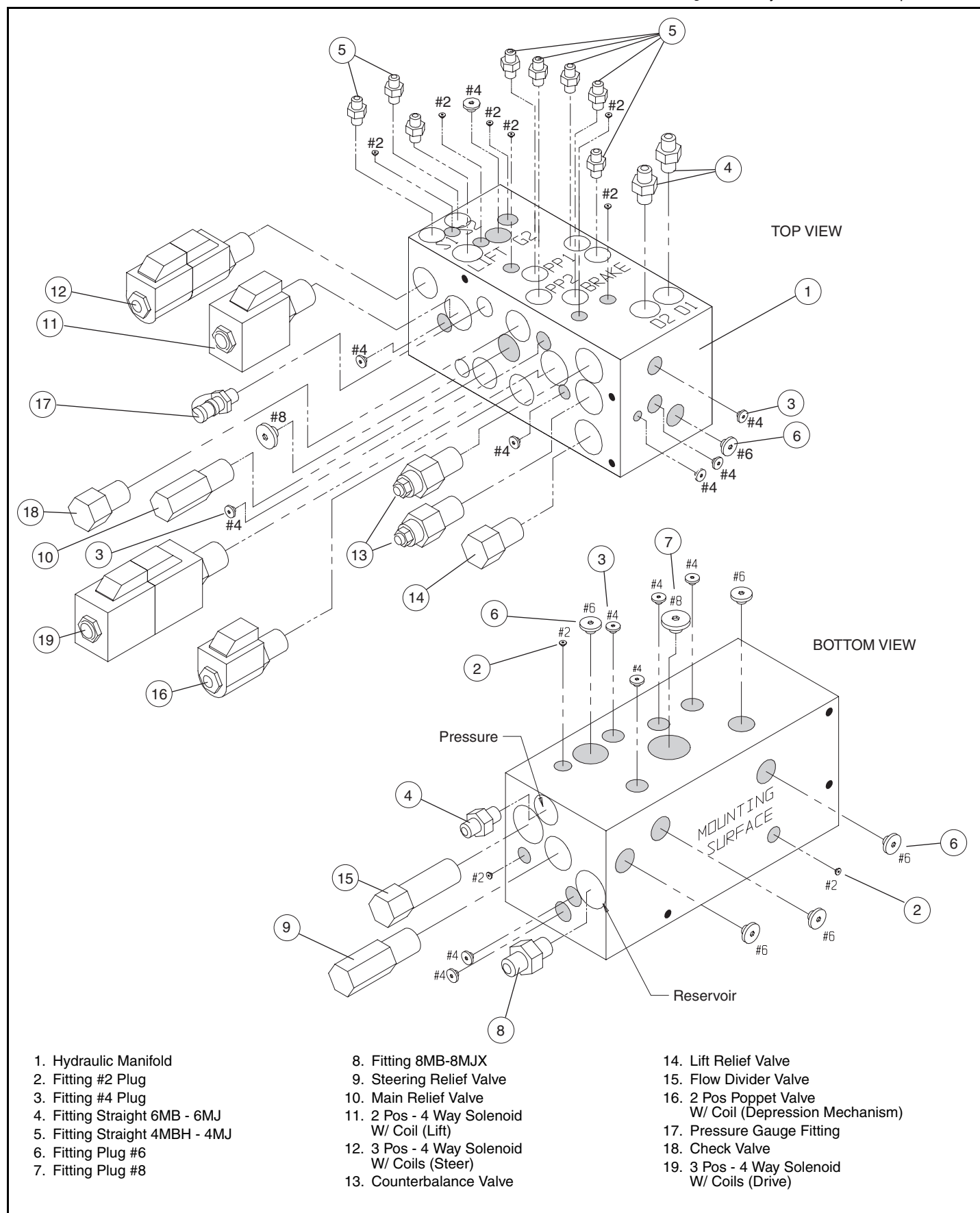
Figure 2-16: Hydraulic Manifold Location

REPAIR

Refer to *Section 1 - General Information* for repair instructions.

Refer to Figure 2-17: “Hydraulic Manifold Exploded View,” on page 2-24.

Figure 2-17: Hydraulic Manifold Exploded View



SETTING HYDRAULIC MANIFOLD PRESSURES

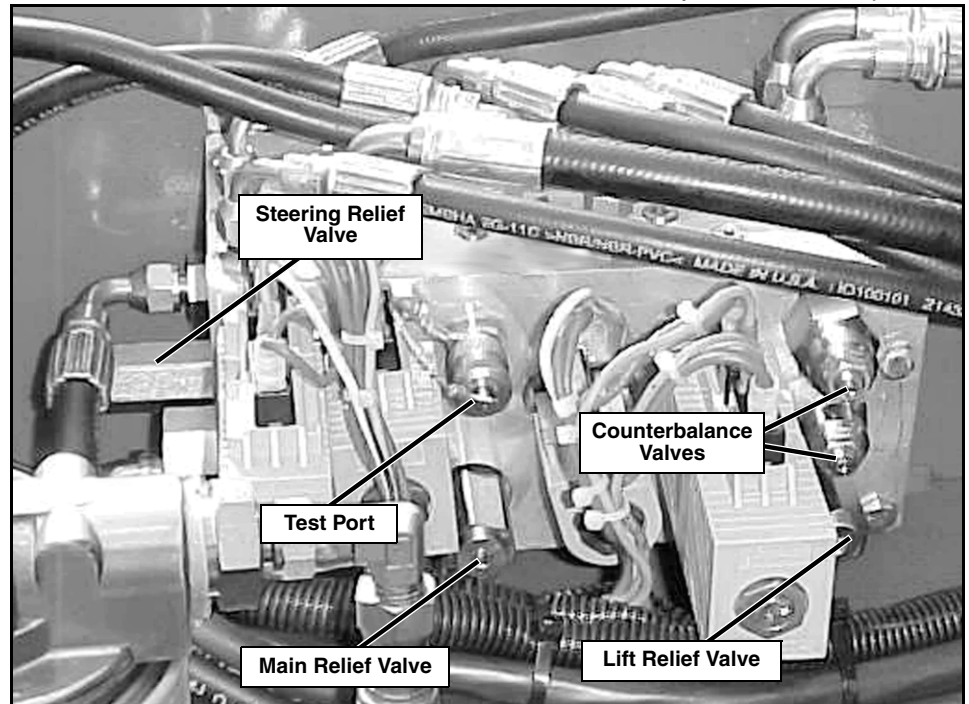
Check the hydraulic pressures whenever the pump, manifold, or relief valves have been serviced or replaced.

! WARNING !

The hydraulic fluid may be of sufficient temperature to cause burns. Wear safety gloves and safety glasses when handling hot fluid.

The fluid in the hydraulic system is under very high pressure which can easily cause severe cuts. Obtain medical assistance immediately if cut by hydraulic fluid.

Figure 2-18: Hydraulic Manifold Adjustment



MAIN RELIEF VALVE

1. Operate the hydraulic system 10-15 minutes to warm the fluid.
2. Slowly drive the machine to within 8 cm (**3 in.**) of a solid, immovable brick wall. Ease the machine forward until the front of the chassis is in solid contact with the wall.
3. Insert a 0-207 bar (**0-3000 psi**) pressure gauge into the test port.
4. Remove the protective end-cap on the Main Relief Valve and turn the adjusting screw counterclockwise two full turns.
5. Unhook the Platform Controls from the guardrail so that the machine may be operated from the ground. Slowly push the Control Handle in the direction of the wall.
6. Slowly turn the Main Relief Valve adjusting screw clockwise to increase the pressure until the gauge reads 200 bar (**2800 psi**).
7. Replace the protective end-cap on the Main Relief Valve.

STEERING RELIEF VALVE

1. Operate the machine for 10-15 minutes to bring the hydraulic fluid up to normal operating temperature.
2. Remove the gauge port cap and install the pressure gauge assembly.
3. Remove the protective end-cap on the Steering Relief Valve and turn the adjusting screw counterclockwise two full turns.
4. While one person holds the Steering Switch to steer to the right or left, slowly turn the Steering Relief Valve adjusting screw clockwise to increase the pressure until the gauge reads 103 bar (**1500 psi**).
5. Replace the protective end-cap on the Steering Relief Valve cover.
6. Remove the gauge and replace the cap.

LIFT RELIEF VALVE

1. Operate the hydraulic system 10-15 minutes to warm the fluid.
2. Remove the protective end-cap on the Lift Relief Valve and turn the adjusting screw counterclockwise two full turns.
3. Place the maximum rated load on the platform (see the Specifications Table in the *Operator Manual*).
4. Turn and hold the Chassis Key Switch to CHASSIS. Push the Chassis Lift Switch to the UP position and hold it there.
5. Slowly turn the Lift Relief Valve adjusting screw clockwise to increase the pressure until the platform just begins to rise.
6. Release the Chassis Lift Switch. Replace the protective end-cap on the Lift Relief Valve.

COUNTERBALANCE VALVES

1. Operate the machine for 10-15 minutes to bring the hydraulic fluid up to normal operating temperature.
2. Remove the gauge port cap and install the pressure gauge assembly.
3. Lift the machine and support the chassis with jackstands so that the drive wheels are off the ground.
4. Loosen the locknuts on Counterbalance Valves.
5. With the Chassis Key Switch on DECK and the Drive/Lift Switch in DRIVE depress the Interlock Lever and slowly pull the Control Handle to REVERSE to drive the wheels.
6. Adjust the Forward Counterbalance Valve by turning the adjustment screw until the pressure gauge indicates 76 bar (**1100 psi**).
7. Slowly push the Control Handle to FORWARD to drive the wheels.
8. Adjust the Reverse Counterbalance Valve by turning the adjustment screw until the pressure gauge indicates 76 bar (**1100 psi**).
9. Check the settings by slowly moving the Control Handle FORWARD, then REVERSE, checking the gauge to ensure that the pressures are properly set. Readjust as needed.
10. Tighten the locknuts on the valves to 8 N-m (**6 ft./lbs.**). Remove the blocks and lower the machine to the ground.

SERIES PARALLEL MANIFOLD

X20W, X26N, X26UN, X31N

NOTE: The X20N does not have a series parallel manifold.

It is not necessary to remove the manifold to perform all maintenance procedures (i.e. replacing a single valve).

Refer to *Section 3 - Schematics* for the hydraulic schematic and hose routing diagram.

REMOVAL AND INSTALLATION

1. Turn the wheels straight, then open both module doors to gain access to the manifold.

⚠ WARNING ⚠

Before disconnecting the battery negative (–) lead, make sure all switches are OFF. If ON, a spark will occur at the ground terminal which could cause an explosion if hydrogen gas or fuel vapors are present.

Figure 2-19: Series Parallel Manifold Location

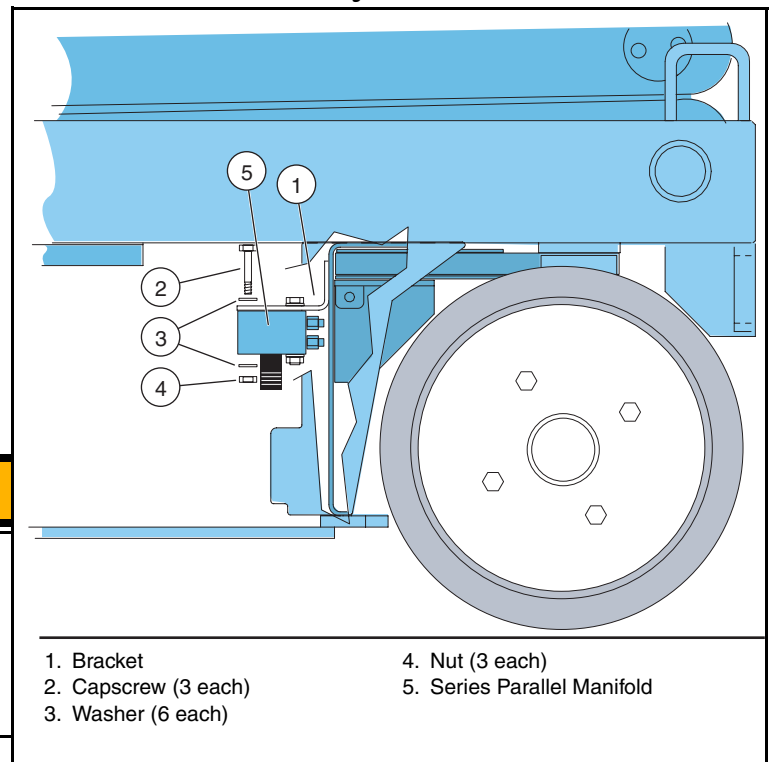
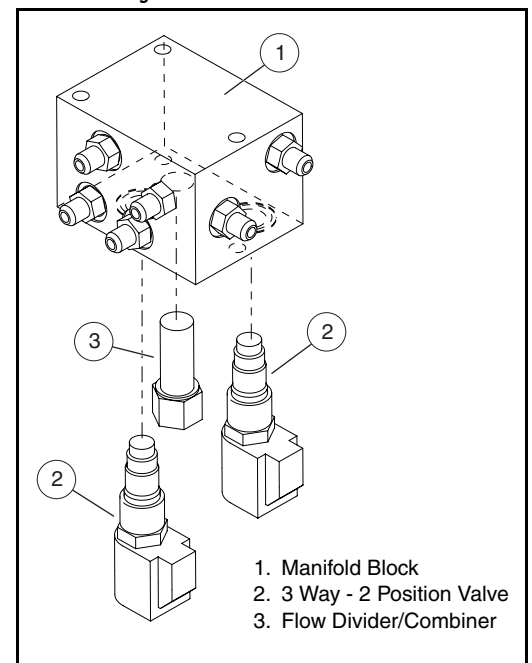


Figure 2-20: Series Parallel Valve Manifold

2. Disconnect the battery pack connector and the battery negative (–) lead.
3. From the control module side;
 - tag and disconnect wires.
 - tag, disconnect and plug the side hoses.
4. From the front, tag, disconnect and plug the front hoses.
5. Remove the three capscrews and nuts while supporting the manifold.
6. Remove the manifold.

Installation is reverse of removal. Torque mounting capscrews to 24 N-m (18 ft./lbs.).



EMERGENCY LOWERING VALVE

MANUAL OPERATION - X20N, X20W, X26N, X26UN

! WARNING !

*Never perform service while the platform is elevated without first blocking the elevating assembly.
DO NOT stand in the elevating assembly area while deploying or storing the maintenance brace.*

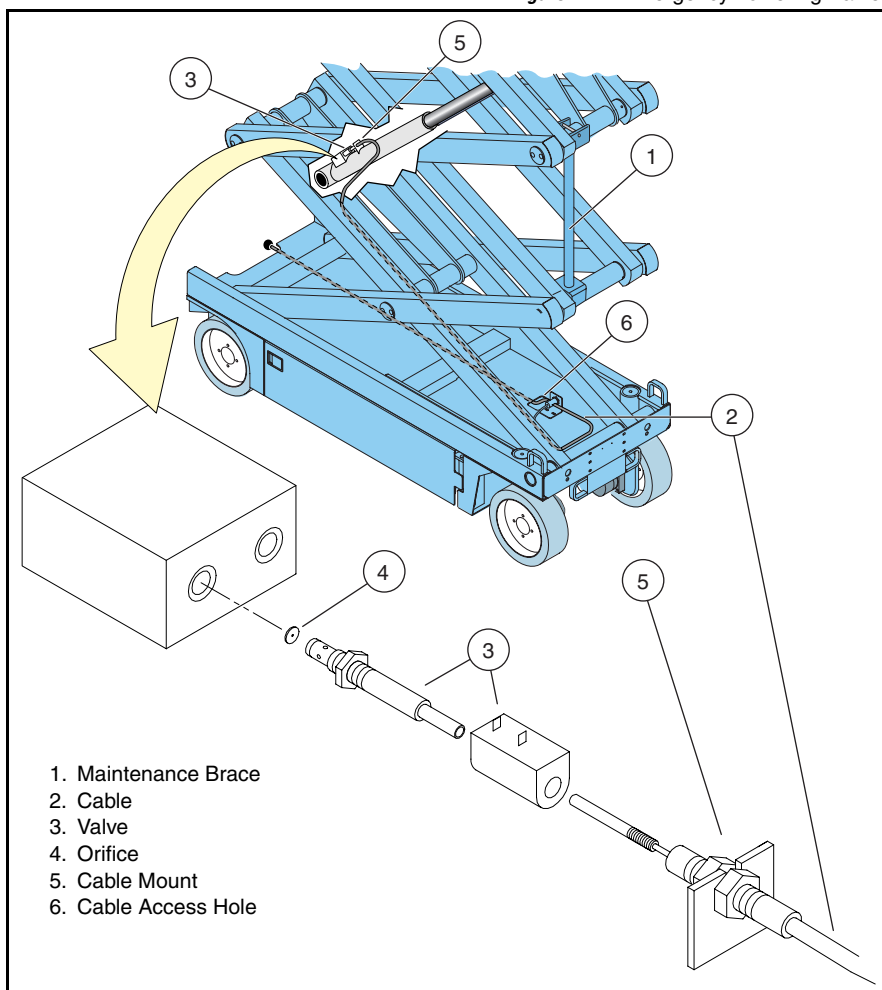
The Emergency Lowering Valve is mounted on the base of the lift cylinder. The cable is routed;

- from the valve,
- along the elevating assembly tube to the front of the machine,
- through the cable access hole to the rear of the machine.

REPAIR

1. Deploy the maintenance brace (see "Blocking the Elevating Assembly" on page 2-8).
2. Inspect the cable. Replace if damaged.
3. Inspect the valve. Replace if damaged.
4. Check for and clear any blockage in the orifice. Install the orifice with the beveled side toward the cylinder block.
5. Adjust the valve.
 - At the cable mount, adjust the cable cover to stop the inner cable when the valve is fully open.
6. Store the maintenance brace and lower the platform.

Figure 2-21: Emergency Lowering Valve



ELECTRIC OPERATION - X31N**⚠ WARNING ⚠**

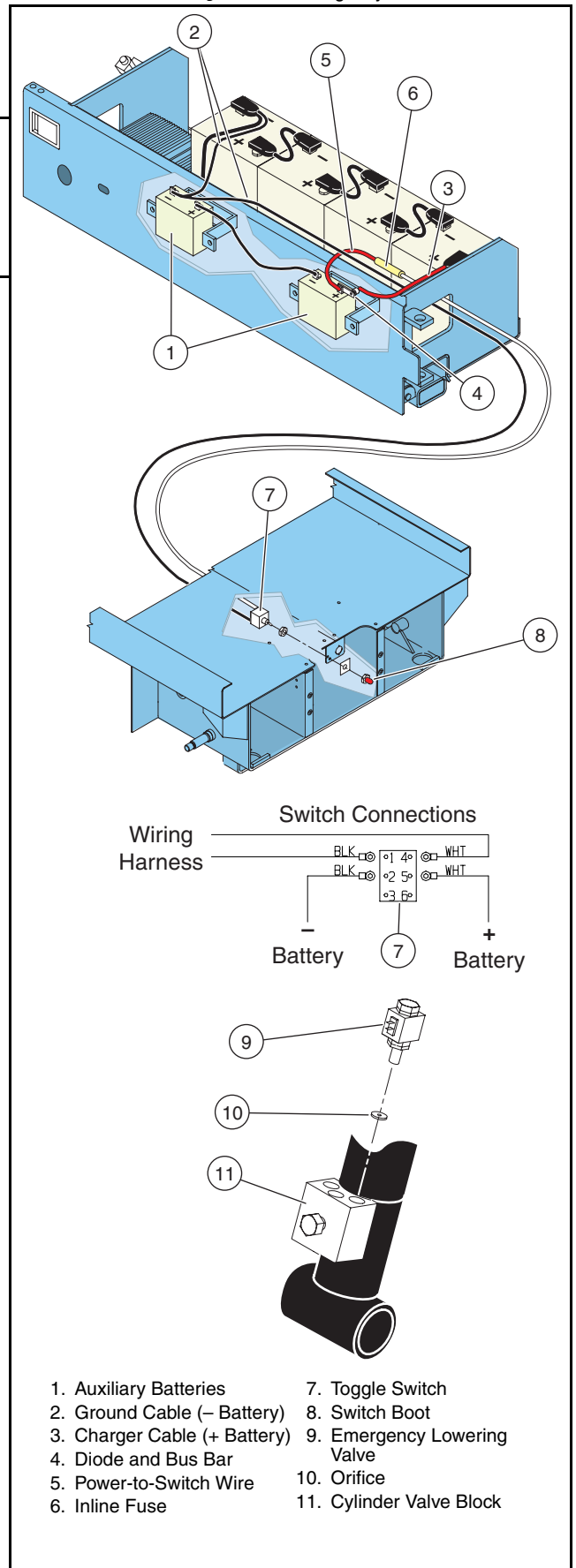
Never perform service while the platform is elevated without first blocking the elevating assembly.

DO NOT stand in the elevating assembly area while deploying or storing the maintenance brace.

The Emergency Lowering Valves are mounted on the base of the lift cylinders and are activated electrically. Power is supplied by two auxiliary batteries mounted in the power module.

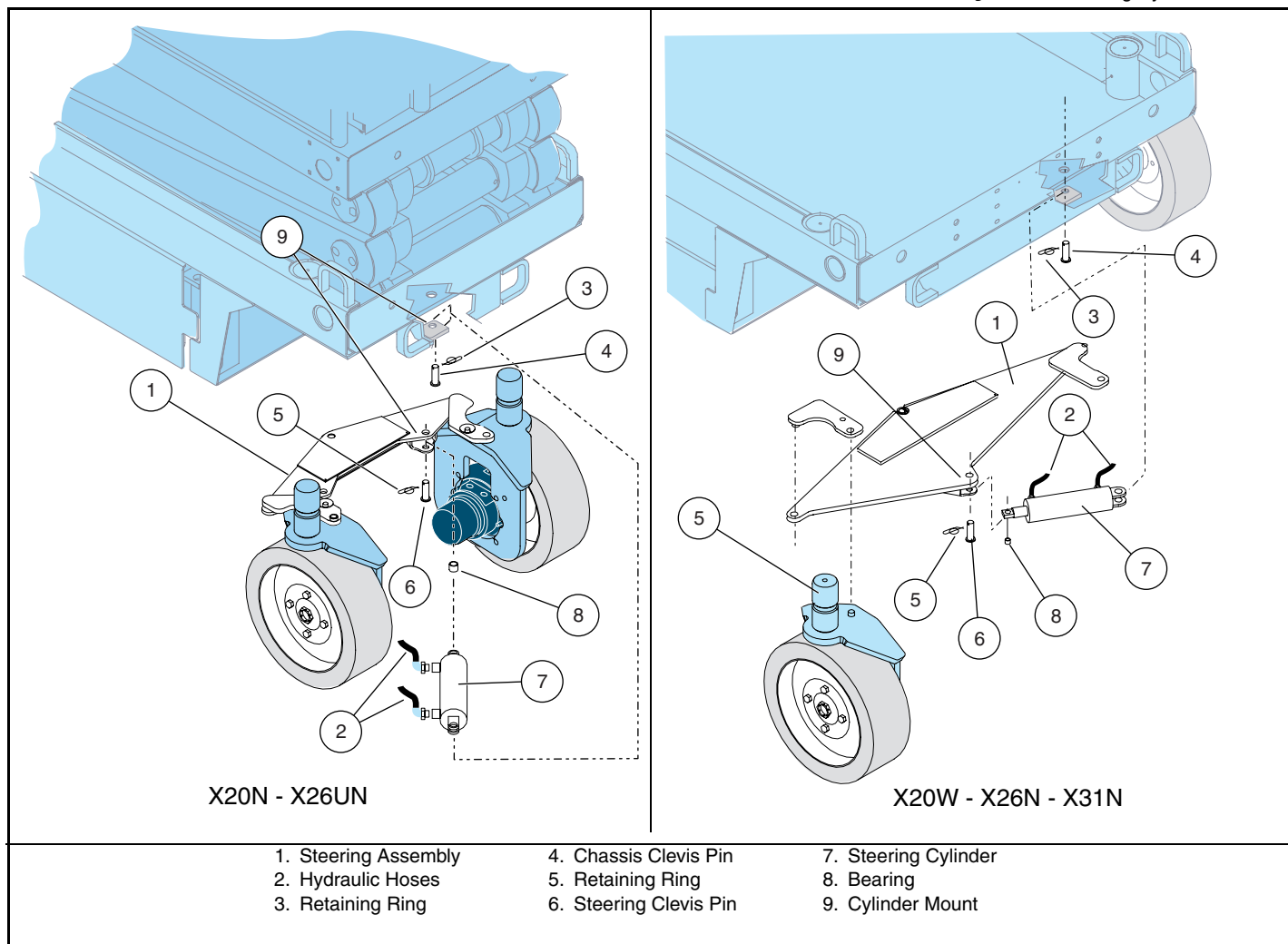
REPAIR

1. Deploy the maintenance brace (see "Blocking the Elevating Assembly" on page 2-8).
2. Inspect the power supply;
 - a. check the auxiliary batteries (Refer to *Section 1: General Information* for complete battery maintenance instructions).
 - If the batteries fail to charge, check the diode and bus bar.
 - b. examine all cables and connections.
 - c. check the inline fuse.
3. Inspect the electrical connection at the switch. Repair if damaged.
4. Inspect the electrical connection at each valve. Repair if damaged.
5. Inspect the valve. Replace if damaged.
6. Check for and clear any blockage in the orifice. Install the orifice with the beveled side toward the cylinder block.
7. Store the maintenance brace and lower the platform.

Figure 2-22: Emergency Down Switch - X31N

STEERING CYLINDER

Figure 2-23: Steering Cylinder Location



REMOVAL

1. Turn the wheels to the straight position.

IMPORTANT: Before disconnecting any hoses, thoroughly clean off all the outside dirt around the fittings.
IMMEDIATELY plug the holes after disconnecting the hoses and before removing the cylinder from the machine.

2. Tag and disconnect the hose assemblies from the cylinder fittings and immediately cap the openings to prevent foreign material from entering.
3. Remove the retaining ring from the chassis clevis pin.
4. Remove the upper clevis pin straight down.
5. Remove the retaining ring from the steering clevis pin.
6. While supporting the cylinder, remove the lower clevis pin straight down through the steering assembly.
7. Remove the cylinder.
8. Remove the bearing from the steering assembly end of the cylinder.

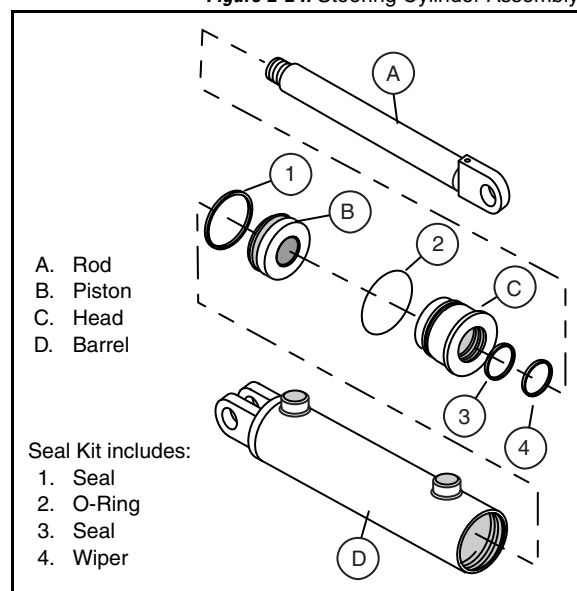
REPAIR

Refer to *Section 1 - General Information* for disassembly, cleaning and inspection, and assembly instructions.

INSTALLATION

1. Apply Neverseize® or equivalent to the clevis pins.
2. Insert the bearing into the cylinder rod eye.
3. Position the cylinder into the mounting points.
4. Insert the clevis pins and secure with retaining rings.
5. Unplug and connect the hose assemblies to the cylinder fittings.
6. Check the fluid level in the hydraulic reservoir before operating the machine.
7. Operate the steering circuit several times throughout its entire range of travel to expel trapped air and check for leaks.

Figure 2-24: Steering Cylinder Assembly



DEPRESSION MECHANISM CYLINDER

The depression mechanism cylinders are located at the end of the power module and the control module.

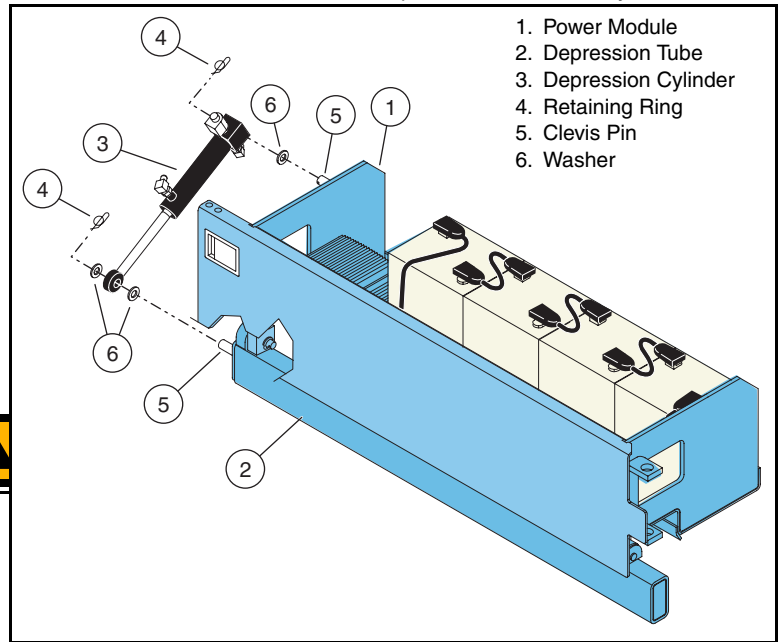
REMOVAL

1. Open the module door to reach the desired depression mechanism cylinder.
2. Support the depression tube from underneath.

WARNING

Before disconnecting the battery negative (–) lead, make sure all switches are OFF. If ON, a spark will occur at the ground terminal which could cause an explosion if hydrogen gas or fuel vapors are present.

Figure 2-25: Depression Mechanism Cylinder Location



3. Disconnect the battery pack connector and the battery negative (–) lead.
4. Tag and disconnect the electrical connections from the solenoid.
5. Tag and disconnect the hoses from the cylinder fittings and immediately cap the openings to prevent foreign material from entering.
6. Remove the retaining rings from the depression cylinder clevis pins
7. Pull the cylinder off the pins.

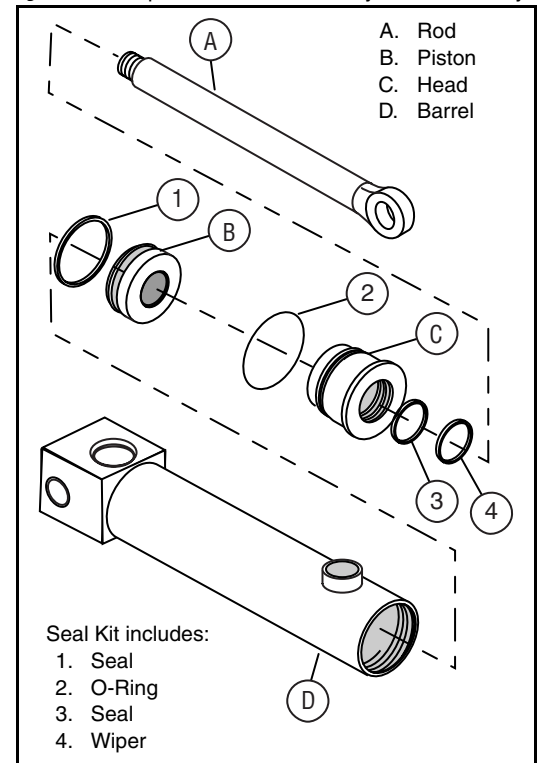
REPAIR

Refer to *Section 1 - General Information* for disassembly, cleaning and inspection, and assembly instructions.

INSTALLATION

1. Place a washer on both clevis pins.
2. Apply Neverseize® or equivalent to the clevis pins.
3. Place the cylinder, piston end down, onto the clevis pins.
4. Place a second washer on the lower clevis pin (located on the depression tube).
5. Install a retaining ring on each clevis pin.
6. Unplug and connect the hoses to the fittings.
7. Connect the electrical connections to the solenoid.
8. Connect the battery negative (–) lead.
9. Connect the battery pack connector.
10. Check the fluid level in the hydraulic reservoir before operating the machine.
11. Lift the platform, then lower it and move the machine. Repeat this several times to check for proper operation.

Figure 2-26: Depression Mechanism Cylinder Assembly



2-9 LIFT CYLINDER

W A R N I N G

*Never perform service while the platform is elevated without first blocking the elevating assembly.
DO NOT stand in the elevating assembly area while deploying or storing the maintenance brace.*

REMOVAL

Refer to Figure 2-27.

1. Deploy the maintenance brace (see “Blocking the Elevating Assembly” on page 2-8).

W A R N I N G

Before disconnecting the battery negative (–) lead, make sure all switches are OFF. If ON, a spark will occur at the ground terminal which could cause an explosion if hydrogen gas or fuel vapors are present.

2. Disconnect the battery pack connector and the battery negative (–) lead.
3. Provide a suitable container to catch the hydraulic fluid, then disconnect the hydraulic hoses from the cylinder. Immediately plug hoses and fittings to prevent foreign material from entering.
4. Remove the cable and electrical connections from the Emergency Lowering Valve.
5. Remove the retaining rings securing the lift cylinder pins.
6. Remove lower lift cylinder pin by driving the pin towards the shaft locking pin side. Lower the cylinder to rest on the chassis.
7. Attach a suitable hoisting device and sling to the cylinder and remove the upper lift cylinder pin.
8. Carefully remove the cylinder.

REPAIR

Refer to *Section 1 - General Information* for disassembly, cleaning and inspection, and assembly instructions.

Figure 2-27: Lift Cylinder Remove and Replace

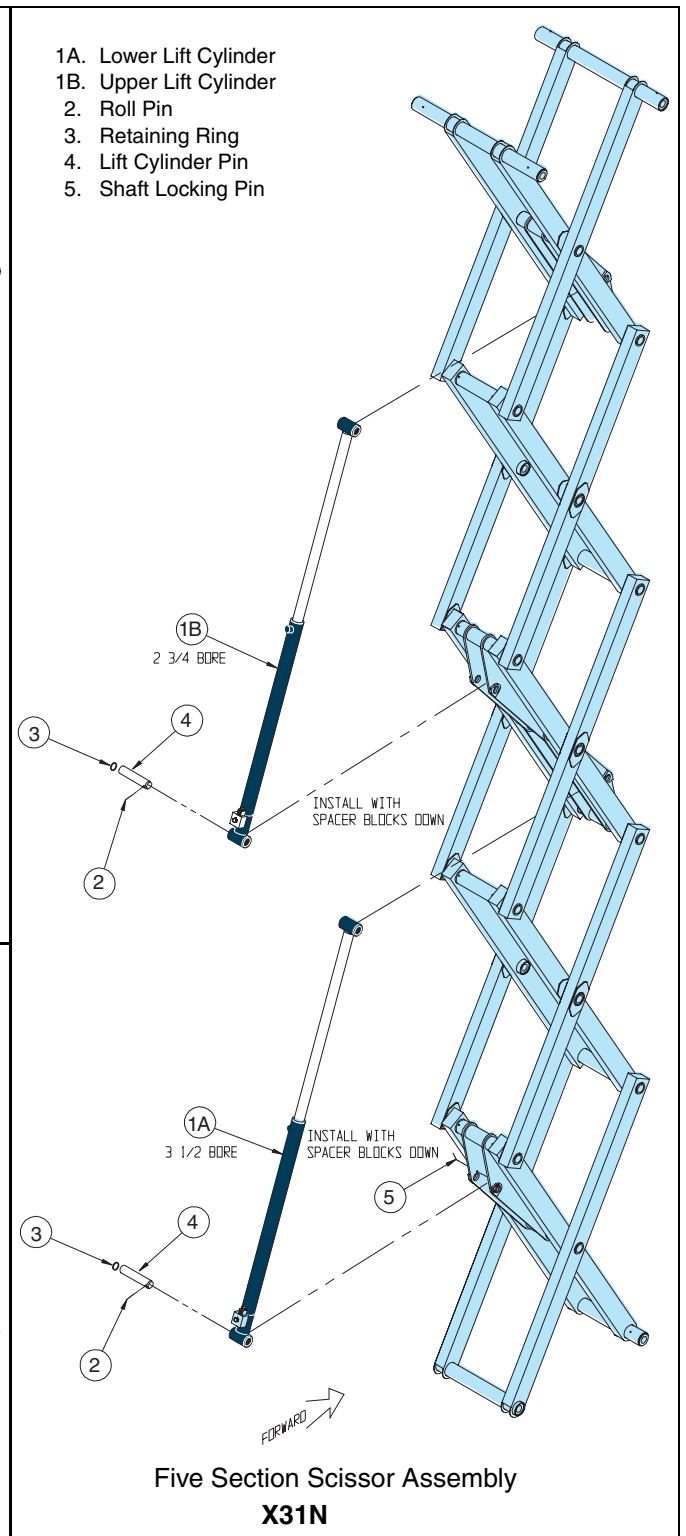
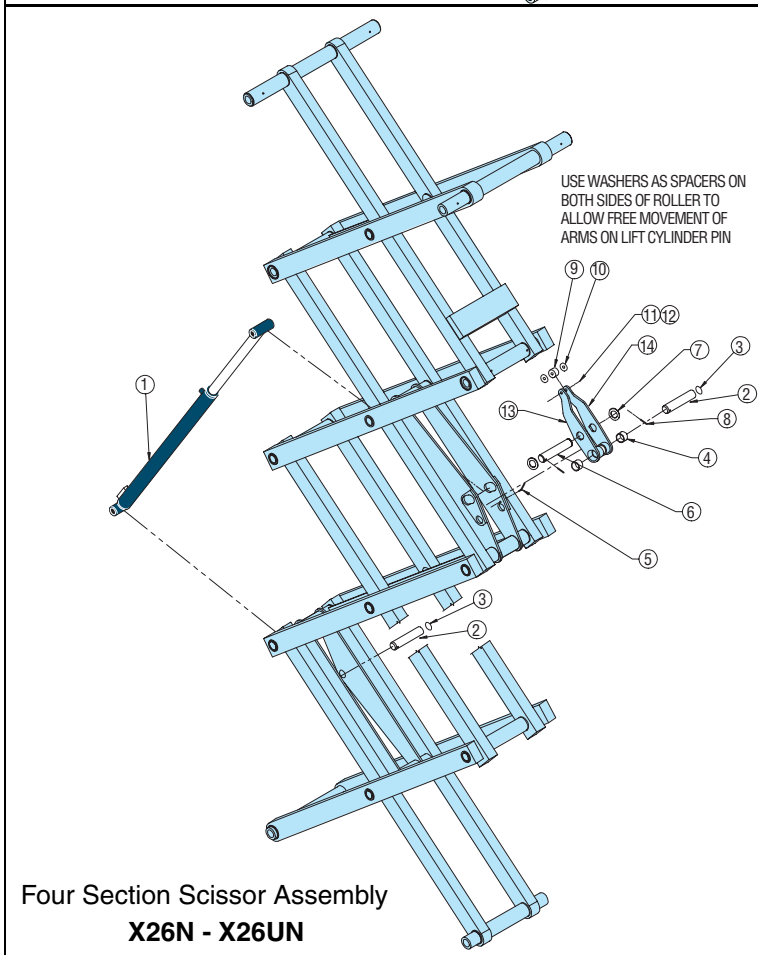
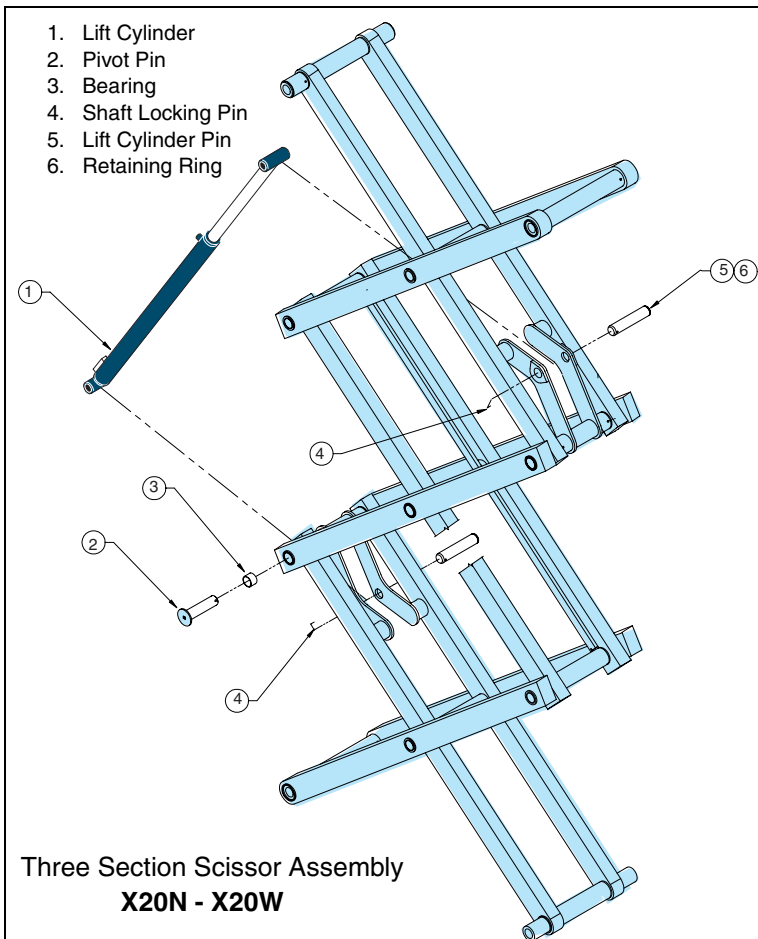
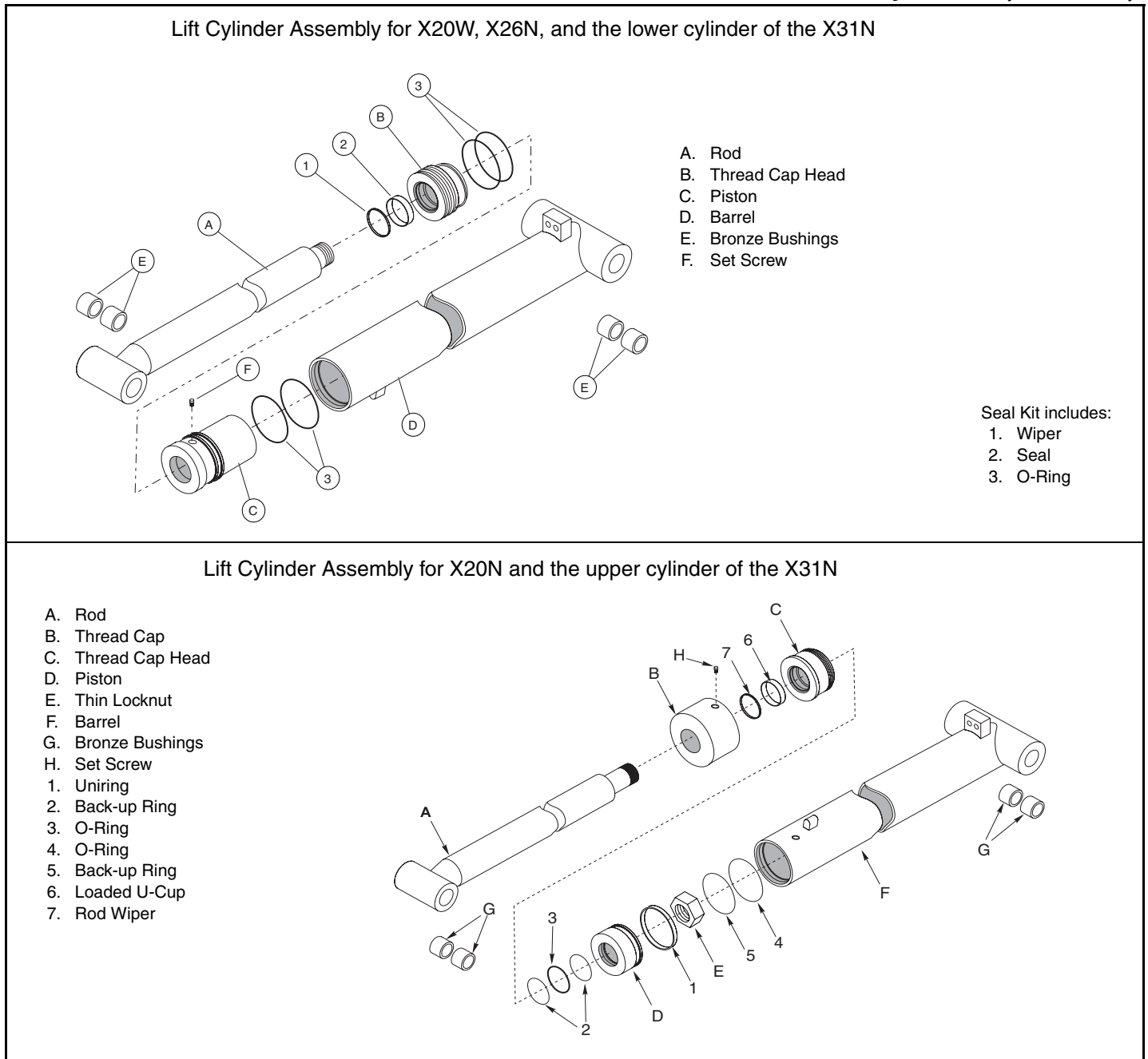


Figure 2-28: Lift Cylinder Assembly



INSTALLATION

1. Attach a suitable hoisting device and sling to the cylinder. Carefully position the cylinder into the elevating assembly and install the upper lift cylinder pin.
2. Install a new roll pin.
3. Carefully lift the cylinder and align the lower mount and install the lift cylinder pin. Make sure the locking pin is properly installed, then install the retaining ring.
4. Connect the Emergency Lowering Valve cable and electrical connections.
5. Unplug and attach the hydraulic hoses to the cylinder.
6. Connect the battery negative (–) lead.
7. Connect the battery pack connector.
8. Check the fluid level in the hydraulic reservoir before operating the machine.
9. Test with weight at rated platform load to check system operation. Check for leaks and level of fluid.

2-10 DRIVE MOTORS AND HUBS

DRIVE MOTORS

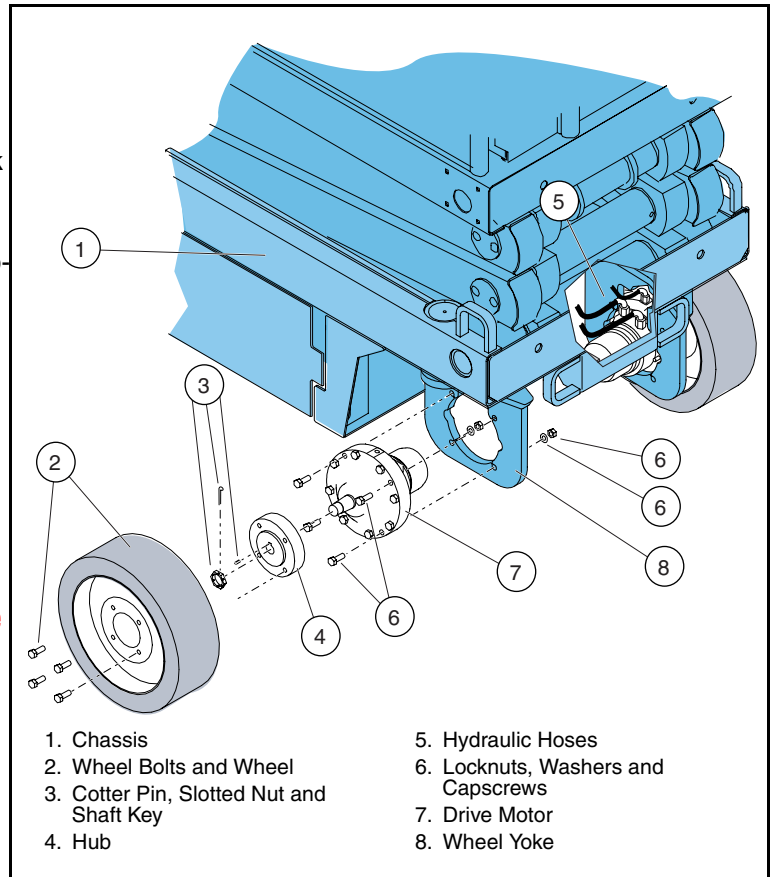
Figure 2-29: Drive Motor

REMOVAL

1. Chock the rear wheels to prevent the machine from rolling.
 - Use a 1000 Kg (1 ton) capacity jack to raise the front of the machine.
 - Place two 1000 Kg (1 ton) jackstands beneath the machine for support.
 - Remove the jack.
2. Remove the wheel bolts and wheel.
3. Remove the cotter pin, slotted nut, hub, and shaft key.
4. Remove the hub.

IMPORTANT: Before disconnecting any hoses, thoroughly clean off all the outside dirt around the fittings. IMMEDIATELY plug the holes after disconnecting the hoses and before removing the motor from the machine.

5. Tag, disconnect and plug the hose assemblies to prevent foreign material from entering.
6. Remove the locknuts, washers and capscrews.
7. Remove the drive motor.



INSTALLATION

1. Position the drive motor into the wheel yoke and secure it with capscrews and locknuts.
2. Torque the locknuts to 95 N-m (70 ft./lbs.).
3. Install the shaft key, hub, and slotted nut. Torque the slotted nut to 190-217 N-m (140-160 ft./lbs.).
4. Install a new cotter pin. DO NOT back-off the nut to install the cotter pin.
5. Remove the plugs from the hose assemblies and reconnect them to the drive motor.
6. Install the wheel and wheel bolts. Torque to 108 N-m (80 ft./lbs.).
7. Remove the jackstands and lower the machine to the ground.
8. Check the fluid level in the hydraulic reservoir before operating the machine.
9. Operate the drive system and check for leaks.

BRAKE SERVICE

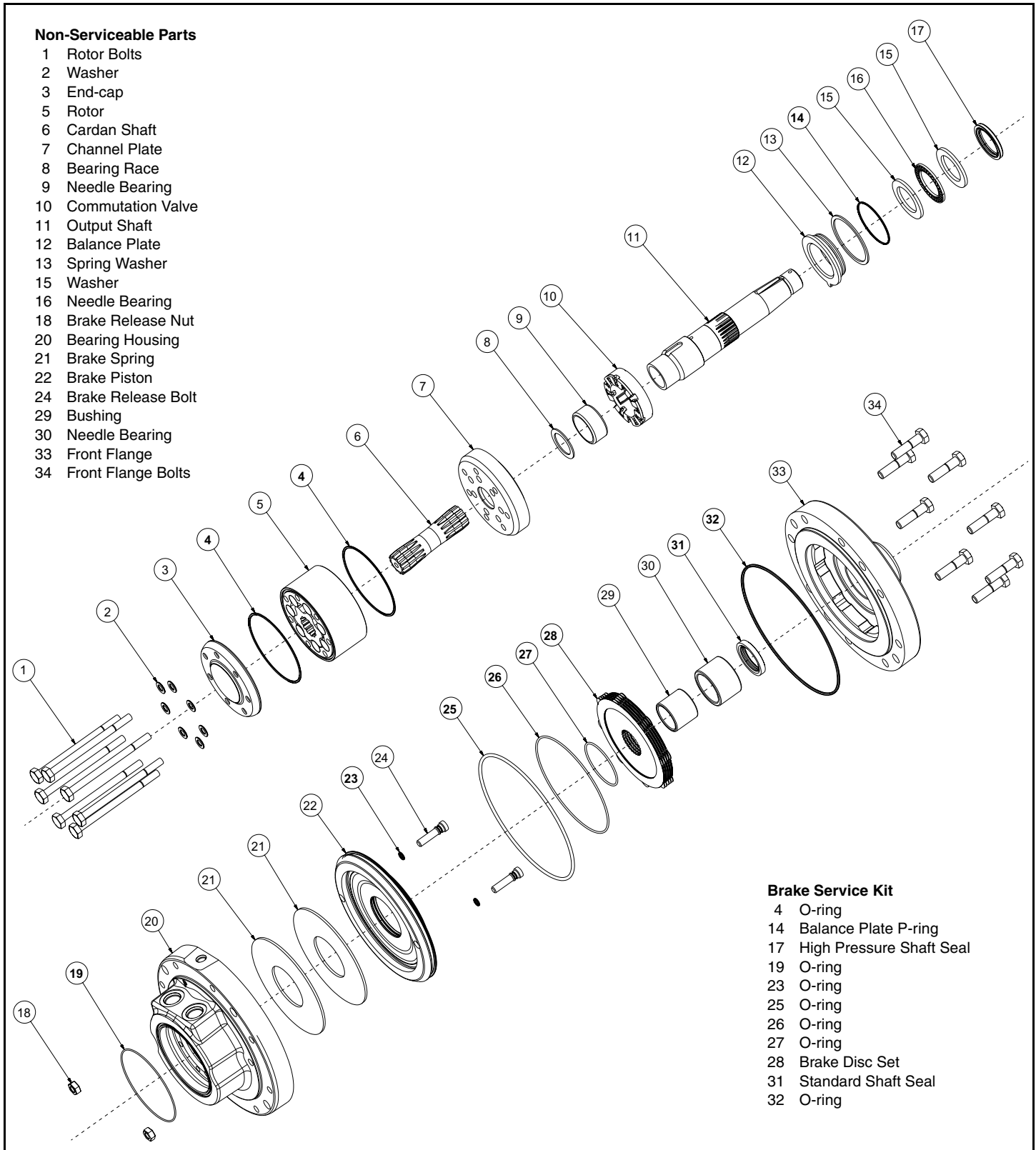
If brake service or repair is required, replace all serviceable parts. Refer to the *Parts Manual* for the brake service kit part number. Refer to Figure 2-30 when assembling the motor.

Torque the rotor bolts [1] and the front flange bolts [34] to 54 N-m (40 ft./lbs.).

Brake Adjustment

1. Using a 13 mm socket wrench, alternately turn the brake release nuts counter-clockwise in $\frac{1}{2}$ turn increments. Repeat until there is approximately 3.2 mm ($\frac{1}{8}$ in.) between the brake release nuts and the drive motor body.
2. After installing the motors, verify that the brakes have fully engaged before operating the machine. Refer to the *Operator Manual*.

Figure 2-30: Drive Motor Exploded View

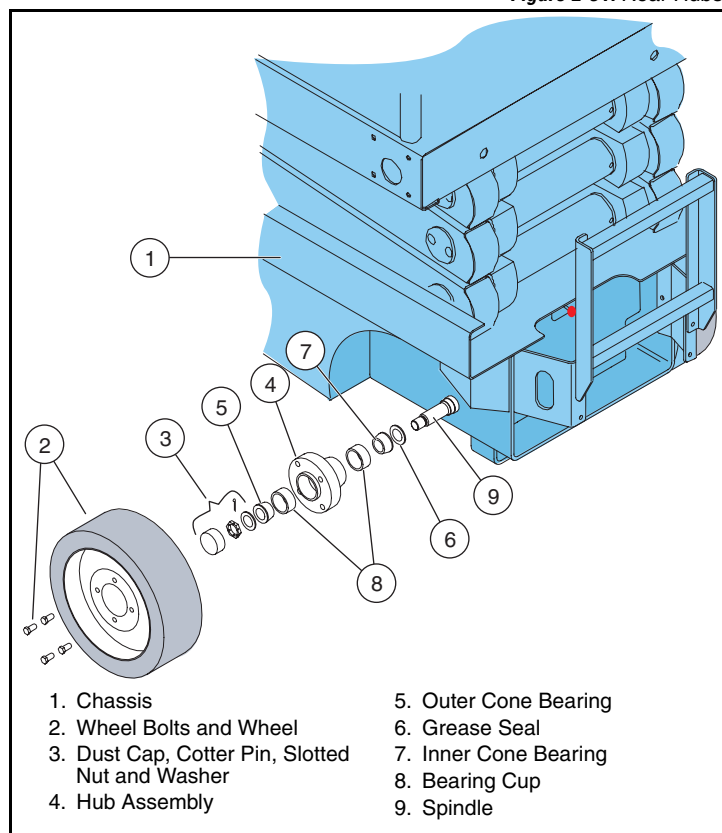


REAR WHEELS, HUBS AND BEARINGS

Figure 2-31: Rear Hubs

REMOVAL

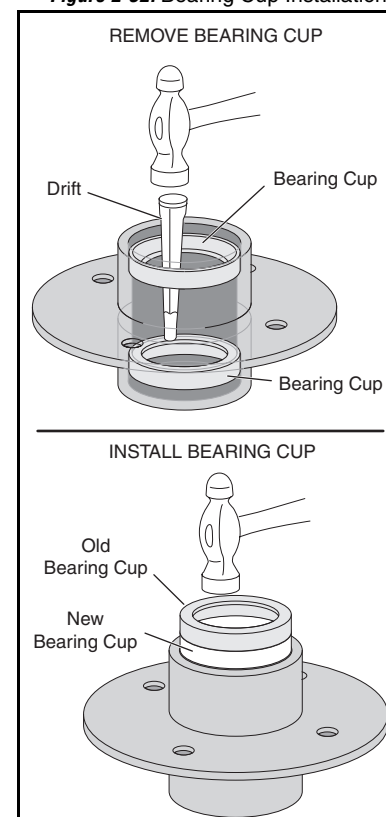
1. Chock the front wheels to prevent the machine from rolling.
 - Use a 1000 Kg (1 ton) capacity jack to raise the front of the machine.
 - Place two 1000 Kg (1 ton) jackstands beneath the machine for support.
 - Remove the jack.
2. Remove the wheel bolts and wheel.
3. Remove the dust cap, cotter pin, slotted nut, and washer.
4. Slide the entire hub assembly from the spindle.
5. Remove the outer cone bearing.
6. Remove the grease seal.
7. Remove the inner cone bearing.
8. Examine the bearing cups. If they are smooth, shiny and free of pits or any surface irregularities, **DO NOT** remove them.
 - If the cups need replacement, remove them by tapping around the circumference of the inside surface of the cups from the opposite side using a long drift.



INSTALLATION

1. Install the new bearing cups (refer to Figure 2-32):
 - Position the replacement bearing cup over the opening in the hub assembly.
 - Position the worn cup over the replacement so that the bearing surfaces face each other.
 - Use the old bearing cone as a drift to work the replacement into position by tapping evenly around the circumference.
2. Apply a liberal coating of multipurpose grease to the bearing surface of each cup.
3. Pack the inner bearing with multipurpose grease and position it into the inner bearing cup.
4. Press a new grease seal into the hub assembly.
5. Apply a thin coating of multipurpose grease to the spindle to protect the grease seal, then slide the hub assembly onto the spindle.
6. Pack the outer bearing with multipurpose grease and slide it onto the spindle until it seats in the outer bearing cup.
7. Install the washer and slotted nut.
8. While rotating the hub, tighten the slotted nut until the hub drags, then back the nut to the first slot that aligns with the cotter pin hole in the spindle.
9. Install a new cotter pin and bend the end up over the nut and spindle.
10. Install the dust cap
11. Install the wheel and wheel bolts. Torque to 108 N-m (80 ft./lbs.).

Figure 2-32: Bearing Cup Installation



TROUBLESHOOTING

This section contains troubleshooting Truth Tables.

Careful inspection and accurate analysis of the symptoms listed in the Troubleshooting Guide will localize the trouble more quickly than any other method. This manual cannot cover all possible problems that may occur. If a specific problem is not covered in this manual, call our toll free number for service assistance.

Referring to the Operator Manual and the Schematics section will aid in understanding the operation and function of the various components and systems of the machine and help in diagnosing and repair of the machine.

W A R N I N G

When troubleshooting, ensure that the machine is resting on a firm, level surface.

When performing any service which requires the platform to be raised, the Elevating Assembly must be blocked.

Disconnect the battery when replacing or testing the continuity of any electrical component.

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3-1 TECHNICAL SUPPORT

Technical Support is available by telephone or FAX.

**UPRIGHT
USA** Tel: 1-800-926-5438
FAX: 1-559-662-4785

**UPRIGHT
EUROPE** Tel: +353-1-620-9300
FAX: +353-1-620-9301

3-2 GENERAL PROCEDURE

Thoroughly study hydraulic and electric schematics in *Section 3 - Schematics*. Check for loose connections and short circuits. Check/repair/replace each component in the Truth Table which is listed under each machine function which does not operate properly.

Determine whether the problem is mechanical (interference), electrical or hydraulic. Some functions require power at more than one solenoid.

Use the charts on the following pages to help determine the cause of a fault in your UpRight Aerial Work Platform.

NOTE: Spike protection diodes at components have been left out of the charts to eliminate confusion.

3-3 TROUBLESHOOTING PROCEDURES

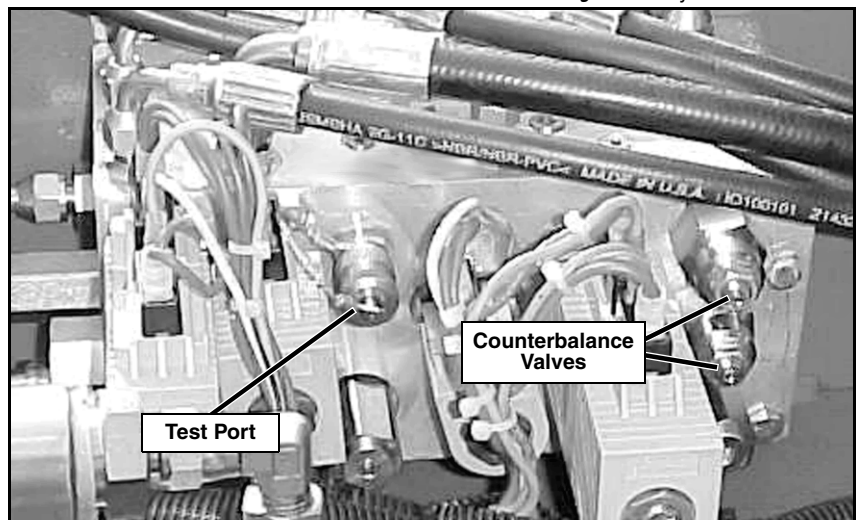
1. *Verify your problem.* Do a full function test from both platform controls and chassis controls and note all functions that are not operating correctly.
2. *Narrow the possible causes of the malfunction.* Use the troubleshooting guide to determine which components are common to all circuits that are not functioning correctly. To aid in troubleshooting, the letters following the component on the table are the same as the component's designation on the schematics.
3. *Identify the problem component.* Test components that are common to all circuits that are not functioning correctly. Remember to check wires and terminals between suspect components. Be sure to check connections to battery negative.
4. *Repair or replace component found to be faulty.*
5. *Verify that repair is complete.* Do a full function test from both the platform and chassis controls to verify that all functions are operating correctly and that the machine is performing according to specifications.

ADJUSTMENT PROCEDURES

- Hydraulic settings must be checked whenever a component is repaired or replaced.
- Remove counterbalance valves and "bench test" them if they are suspect.
- Connect a pressure gauge of appropriate range to the test port located on the hydraulic manifold.

NOTE: Correct pressure settings are listed in the hydraulic schematic.

Figure 3-1: Hydraulic Test Port



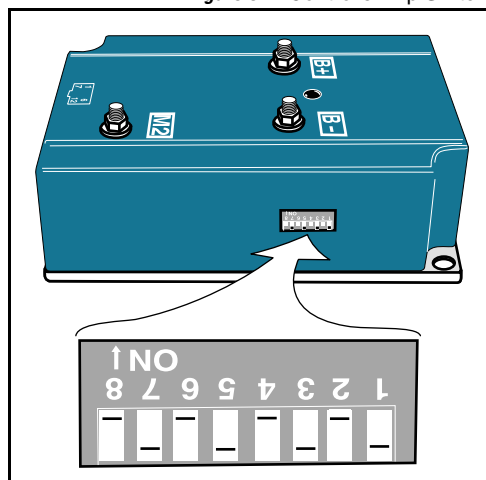
3-4 MOTOR CONTROLLER DIP SWITCH SETTINGS

DEFAULT DIP SWITCH SETTINGS

The table shows the default dip switch settings on the controller box when the machine leaves the factory.

	1	2	3	4	5	6	7	8
MX15/19	OFF	ON	OFF	ON	OFF	ON	OFF	ON
SL20	ON	OFF	OFF	ON	OFF	ON	OFF	ON
TM12	OFF	OFF	OFF	ON	OFF	ON	OFF	ON
X20N	ON	OFF	OFF	ON	OFF	ON	OFF	ON
X20W	ON	OFF	OFF	ON	OFF	ON	OFF	ON
X26UN	ON	ON	OFF	OFF	OFF	ON	OFF	ON
X26/32	ON	ON	OFF	ON	OFF	OFF	OFF	ON

Figure 3-2: Controller Dip Switch



ADJUSTED DIP SWITCH SETTINGS

The following adjustments may be made to the dip switch settings.

CREEP SPEED

Switches 3 & 4 determine the elevated “creep” speed. If the machine does not operate at the specified speed at the default settings, use the following table to adjust the dip switch settings.

	3	4
1 (slowest)	OFF	OFF
2	ON	OFF
3 (default)	OFF	ON
4 (fastest)	ON	ON

DECELERATION TIME

Switches 5 & 6 determine the deceleration time. Switch 5 is for the deceleration rate while the platform is lowered. Switch 6 is for the elevated rate.

DECEL	5	6
0.24 sec.	OFF	OFF
1.27 sec.	ON	ON

3-5 I/O BOARD DIP SWITCH SETTINGS

DEFAULT SETTINGS

The table shows the default dip switch settings on the I/O board when the machine leaves the factory.

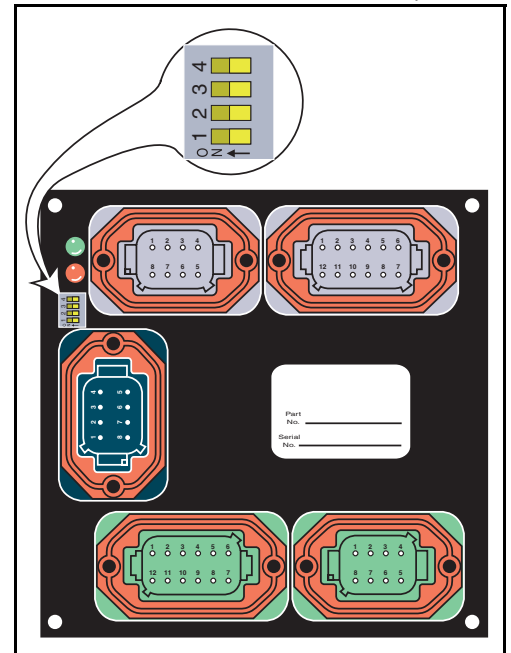
	1	2	3	4
MX15/19	OFF	OFF	OFF	OFF
SL20	OFF	OFF	OFF	OFF
TM12	OFF	OFF	OFF	OFF
X20N	OFF	OFF	OFF	OFF
X20W	OFF	OFF	OFF	OFF
X26UN	OFF	OFF	OFF	OFF
X26/32	OFF	OFF	OFF	OFF

OPTIONAL SETTINGS

Switches 3 & 4 work together to determine the optional alarm settings.

1	2	3	4	RESULT
ON				Two Speed Mode (not used)
OFF				Proportional Control
	ON			not used
	OFF			Depression Mechanism extends when platform is raised
		OFF	OFF	Down alarm only
		ON	OFF	Down and Reverse alarm
		OFF	ON	Drive and Down alarm
		ON	ON	All Motion alarm

Figure 3-3: I/O Board Dip Switch

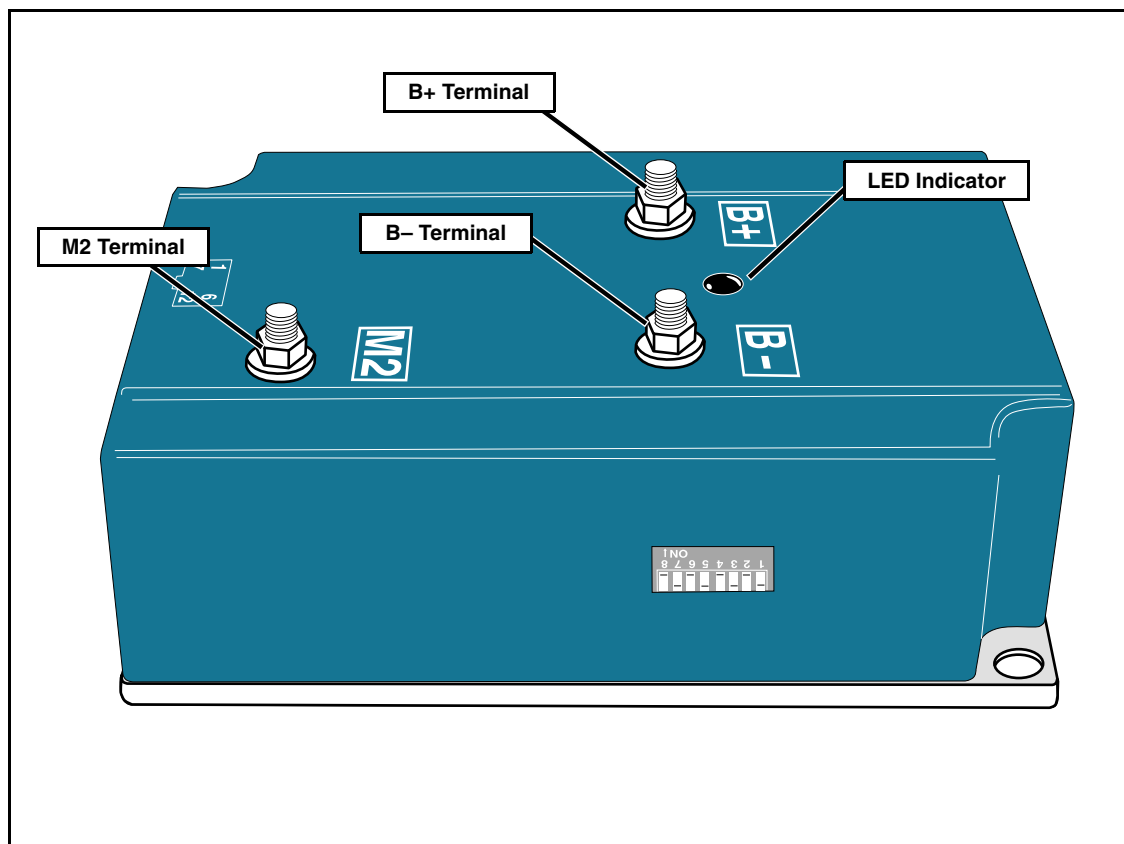


3-6 LED FAULT CODES

Batteries must be fully charged before troubleshooting.

Check/Repair all connections before replacing any components

Figure 3-4: Motor Controller Connections



NOTE: Before dip switch settings will take effect, power must be disconnected or Emergency Stop switches must be depressed.

Table 3-1: LED Fault Codes

Flash Code	Meaning	Status	Corrective Action
LED on	Power to the controller and the controller is operational.	System is functional	None.
LED off	No power to the controller, or internal fault in the controller.	Battery cables not connected properly; Failed controller	Check battery cable connections. Replace the controller.
2 Flash	Procedural fault.	Lift, drive, or steer switch is engaged at start-up; Drive/Lift switch rotated while operating	Cycle the Control Handle through neutral to clear fault.
3 Flash	Controller senses B- at the M2 terminal.	Short circuit at the motor; M2 cable in contact with B- cable; Short circuit within controller	Check cable routing and connections. Test terminals for source of B-. Replace the controller
4 Flash	Controller senses B+ at the M2 terminal before engaging the Motor Start relay.	B+ cable routed incorrectly; M2 cable making contact with B+ cable; Motor Start relay contacts welded closed.	Check cable routing and connections. Test terminals for source of B+. Replace the Motor Start relay.
5 Flash	Controller senses open circuit at M2 after engaging the Motor Start terminal.	Cables loose or not connected; Faulty Motor Start relay	Check the cable routing and connections. Check the signal from Motor Controller to relay. Check/replace the Motor Start relay.
6 Flash	Faulty signal from Control Handle or I/O board.	Faulty Control Handle; Wiring error	If Platform Controls are affected, check/replace the Control Handle. If Chassis Controls are affected, check/replace the I/O board.
7 Flash	Battery voltage below 12V or above 45V.	Dead batteries; Bad cable connections	Check batteries and cable connections.
8 Flash	Thermal cut-off.	Controller is overheated due to overuse or other failure	Allow system to cool. Locate and repair other source of overheat.

3-7 LEDs AT I/O BOARD

GREEN LED ON

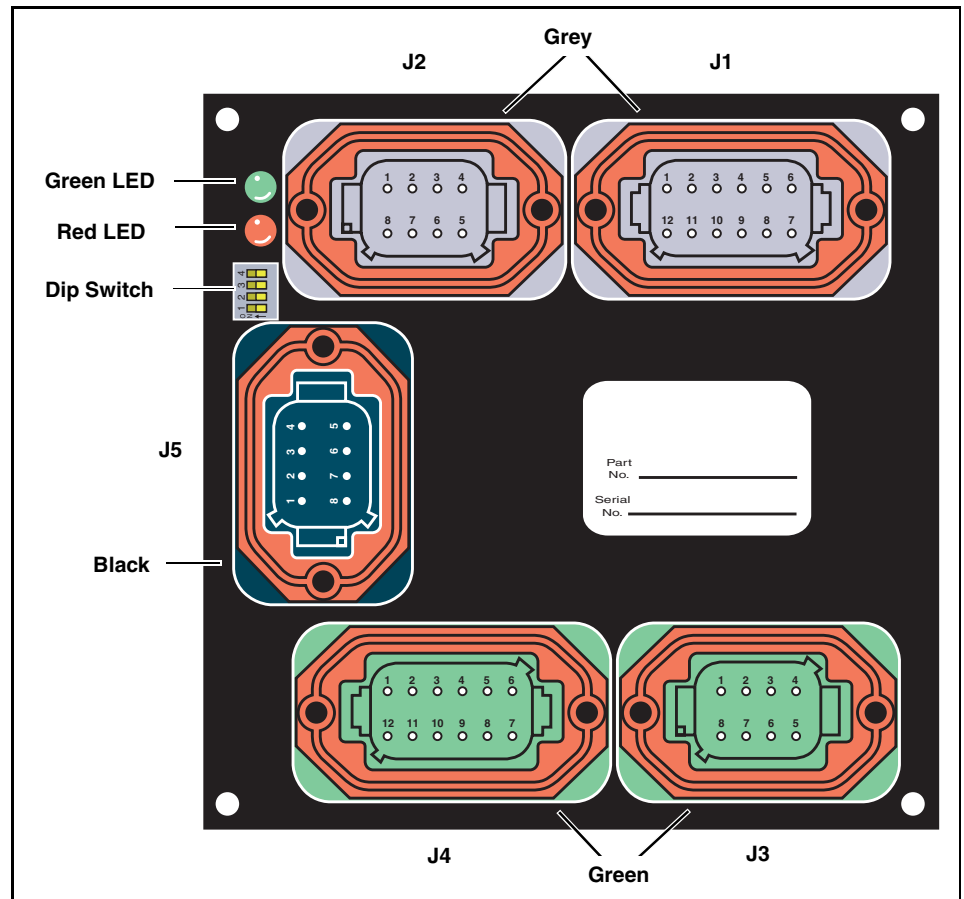
The Green LED indicates that power is present at the board.

RED LED ON

The Red LED indicates a short in the system. To locate the problem;

1. Push both E-Stop switches to the OFF position.
2. Turn the Keyswitch to the OFF position, then to either Platform or Chassis.
3. Pull both E-Stop switches to the ON position.
 - The Green LED should be ON.
 - The Red LED should be OFF.
4. Perform all machine functions until the Red LED is ON. Determine which function activated the Red LED and check all components that are active for that function.

Figure 3-5: I/O Board Connections



3-8 I/O BOARD INPUTS AND OUTPUTS

Refer to Figure Figure 3-5: "I/O Board Connections," on page 3-7.

PERFORM TESTS WITH FULLY CHARGED BATTERIES

Battery state of charge will affect readings.

BV = BATTERY VOLTAGE

Readings within a few volts of current battery state of charge will be called BV.

ØV

ØV is generally Ø up to 1 volt.

VOLTAGE READINGS FOR ELECTRONICS ARE RARELY EXACT

Many factors can affect readings, such as state of charge, voltage drops through switches (mechanical or electrical), and wires.

Be sure that both the Platform and Chassis Emergency Stop Switches are pulled out to the ON position.

All voltages are measured between the component and the B– terminal on the Motor Controller.

NOTE: For the I/O board to be powered up (Green LED illuminated), both E-Stops must be closed and either Platform Controls or Chassis Controls selected by the Keyswitch.

Table 3-2: Connector J1

PIN	PIN DESCRIPTION	CONDITION	VOLTAGE	CONTINUOUS TO PIN
J1-1	Lift input from Lift/Drive selector switch	Lift selected	BV	—
		Lift not selected	0V	
J1-2	Not Used	—	—	—
J1-3	Drive input from Lift/Drive selector switch	Drive selected	BV	—
		Drive not selected	0V	
J1-4	Lower E-Stop activation (output from I/O board when lower E-Stop is closed)	Lower E-Stop closed	BV	J4-9
		Lower E-Stop open	0V	
J1-5	Upper E-Stop activation (output to I/O board when upper E-Stop is closed)	Upper E-Stop closed	BV	J4-2
		Upper E-Stop open	0V	
J1-6	Power to Platform Controls when selected by Keyswitch	Platform Controls selected	BV	J4-10
		Platform Controls not selected	0V	
J1-7	Not Used	—	—	—
J1-8	Controller direction "A" (up/forward)	Control Handle pushed forward	20-22V	—
J1-9	Controller direction "B" (down/reverse)	Control Handle pushed forward	20-22V	—
J1-10	Speed signal from Control Handle	Signal starts high and drops proportionally as Control Handle is moved in either direction	4.3V dropping to 0.2V	—
J1-11	Steer Left input from Steering switch	Steer Left selected	23V	—
		Steer Left not selected	0V	
J1-12	Steer Right input from Steering switch	Steer Right selected	23V	—
		Steer Right not selected	0V	

Table 3-3: Connector J2

PIN	PIN DESCRIPTION	CONDITION	VOLTAGE	CONTINUOUS TO PIN
J2-1	Depression mechanism activation (extend)	Lift Up requested	0V	—
		Lift Up not requested	BV	
J2-2	Not Used	—	—	—
J2-3	24 Volt supply for solenoids	Upper & Lower E-Stops closed	BV	J4-5 & J3-3
		Upper or Lower E-Stop open	0V	
J2-4	Forward solenoid activation	Forward requested	0V	—
		Forward not requested	BV	
J2-5	Reverse solenoid activation	Reverse requested	0V	—
		Reverse not requested	BV	
J2-6	Up solenoid activation	Up requested	0V	—
		Up not requested	BV	
J2-7	Steer Left solenoid activation	Steer Left requested	0V	—
		Steer Left not requested	BV	
J2-8	Steer Right solenoid activation	Steer Right requested	0V	—
		Steer Right not requested	BV	

Table 3-4: Connector J3

PIN	PIN DESCRIPTION	CONDITION	VOLTAGE	CONTINUOUS TO PIN
J3-1	Alarm activation	Alarm sounding (out of level unit lowering, etc.)	†	—
† If the alarm is sounding because the unit is out of level, BV will drop to 0V as long as the alarm is sounding. If the alarm is sounding because the unit is lowering, there will be alternating high and low voltages (the voltages will vary).				
J3-2	Level Sensor output signal	Unit within Level Sensor angle	BV	—
		Unit outside Level Sensor angle	0V	
J3-3	24 Volt supply for Alarm, Level Sensor and solenoids,	Upper & Lower E-Stops closed	BV	J2-3 & J4-5
		Upper or Lower E-Stop open	0V	
J3-4	Input from platform down Proximity Switch	Above Proximity switch	0V	—
		Below Proximity switch	BV	
J3-5	Down solenoid activation	Down requested	0V	—
		Down not requested	BV	
J3-6	Depression mechanism activation (retract)	Drive requested	0V	—
		Drive not requested	BV	
J3-7	Not Used	—	—	—
J3-8	Battery negative supply for Level sensor and Proximity switch	—	B–	J4-11

Table 3-5: Connector J4

PIN	PIN DESCRIPTION	CONDITION	VOLTAGE	CONTINUOUS TO PIN
J4-1	Motor Start relay and Hourmeter activation	Drive, Lift or Steer requested	0V	—
		Drive, Lift or Steer not requested	BV	
J4-2	24 Volt supply to Keyswitch	Upper & Lower E-Stops closed	BV	—
		Upper or Lower E-Stop open	0V	
J4-3	Chassis Controls selected from Keyswitch	Chassis Controls selected	BV	—
		Chassis Controls not selected	0V	
J4-4	24 Volt supply to chassis Up/Down switch	—	‡	—
‡ Keyswitch must be held to Chassis Controls position to measure BV				
J4-5	24 Volt supply to Keyswitch	Upper & Lower E-Stops closed	BV	J2-3 & J3-3
		Upper or Lower E-Stop open	0V	
J4-6	Not Used	—	—	—
J4-7	Up signal from Chassis Controls	Up requested from Chassis Controls	BV	—
		Up not requested from Chassis Controls	0V	
J4-8	Down signal from Chassis Controls	Down requested from Chassis Controls	BV	—
		Down not requested from Chassis Controls	0V	
J4-9	Lower E-Stop activation (input to I/O board when E-Stop is closed)	Lower E-Stop closed	BV	J1-4
		Lower E-Stop open	0V	
J4-10	Power output to Platform Controls	Platform selected at Keyswitch	BV	J1-6
		Platform not selected at Keyswitch	0V	
J4-11	Battery negative supply to I/O Board	—	B–	—
J4-12	24 Volt supply to Hourmeter and Line Contactor coil	Upper & Lower E-Stops closed and Platform Controls or Chassis Controls selected	BV	—

Table 3-6: Connector J5

PIN	PIN DESCRIPTION	CONDITION	VOLTAGE	CONTINUOUS TO PIN
J5-1	24 Volt supply to EMC motor controller	Upper & Lower E-Stops closed and Platform Controls or Chassis Controls selected	BV	—
J5-2	Drive signal to EMC motor controller	Forward/Reverse requested	15V	—
		Forward/Reverse not requested	0V	
J5-3	Steer signal to EMC motor controller	Steer Right/Steer Left requested	15V	—
		Steer Right/Steer Left not requested	0V	
J5-4	Up signal to EMC motor controller	Up requested	15V	—
		Up not requested	0V	
J5-5	Speed Reduction signal to EMC motor controller	Below Proximity switch	15V - 17V	—
		Above Proximity switch	0V	
J5-6	Line Contactor activation signal	Drive, Lift or Steer requested	0V	—
		Drive, Lift or Steer not requested	BV	
J5-7	Direction enable	Forward/Reverse requested	0V	—
		Forward/Reverse not requested	4.0V - 4.3V	
J5-8	Speed signal to EMC motor controller	Signal starts high and drops proportionally as Control Handle is moved in either direction	4.3V dropping to 0.2V	—

3-9 ELECTRIC

Table 3-7: Electrical Troubleshooting Table

Component		Function	Lower Controls	Upper Controls	Drive Forward	Drive Reverse	High Speed/Creep	Raise Platform	Lower Platform	Steer Left	Steer Right	Depression Mechanism Extend	Depression Mechanism Retract	Brakes	Level Alarm	Down Alarm	Battery Charge
ALM	Alarm														X	X	
BAT	Batteries		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CHG	Battery Charger																X
F1	5 AMP Circuit Breaker		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
F2	175 AMP Fuse		X	X	X	X	X	X	X	X	X	X	X	X			
HM	Hour Meter/low Voltage Indicator																
I/O	I/O Board		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
MC	Motor Control		X	X	X	X	X	X	X	X	X	X	X	X			
MOT	Motor				X	X	X	X	X	X	X	X	X	X			
R1	Motor Relay				X	X	X	X	X	X	X	X	X	X			
R2	Series Parallel Relay				X	X	X										
S1	Chassis Emergency Stop Switch		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
S2	Chassis Lift Switch							X	X								
S3	Chassis Key Switch		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
S4	Proximity Switch						X										
S5	Height Limit Switch							X	X								
S6	Platform Emergency Stop Switch		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
S7	Lift/Drive Selector Switch			X	X	X		X	X								
S8	Interlock Switch			X	X	X	X	X	X	X	X						
S9	Control Handle			X	X	X		X	X								
S10	Platform Steering Switch									X	X						
SNSR	Level Sensor		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
SOL1A	Steering Solenoid (right)										X						
SOL1B	Steering Solenoid (left)									X							
SOL2A	Platform Lift Solenoid							X									
SOL2B	Down Solenoid (Emergency Lowering)								X								
SOL3A	Depression Mechanism Extension Solenoid											X					
SOL3B	Depression Mechanism Retraction Solenoid (2)												X				
SOL4A	Reverse Solenoid					X											
SOL4B	Forward Solenoid				X												
SOL5	Series Parallel Solenoid (2)				X	X	X										

3-10 HYDRAULIC

Table 3-8: Hydraulic Troubleshooting Table

Component		Function	Lift Platform	Lower Platform	Steer Right	Steer Left	Drive Forward	Drive Reverse	Creep	Depression Mechanism Extend	Depression Mechanism Retract	Brakes
CV	Check Valve									X	X	
CYL1	Steering Cylinder				X	X						
CYL2	Lift Cylinder		X									
CYL3	Depression Mechanism Cylinder (2)									X	X	
DVR1	Priority Flow Divider		X		X	X	X	X	X	X	X	X
DVR2	Series Parallel Flow Divider						X	X	X			
FL1	Suction Strainer		X		X	X	X	X	X	X	X	
FL2	Return Filter		X		X	X	X	X	X	X	X	
MOT	Drive Motors (2)						X	X				X
OR	Orifice		X	X								
PMP	Pump		X		X	X	X	X	X	X	X	
RES	Reservoir		X	X	X	X	X	X	X	X	X	X
RV1	Steering Relief Valve				X	X						
RV2	Lift Relief Valve		X									
RV3	Main Relief Valve		X				X	X	X	X	X	X
V1	Steering Right/Left Valve				X	X						
V2A	Lift Valve		X									
V2B	Down/Emergency Lowering Valve			X								
V3A	Depression Mechanism Extend Valve									X		
V3B	Depression Mechanism Retract Valve (2)										X	
V4	Forward/Reverse Valve						X	X				
V5	Series Parallel Valve (2)						X	X	X			
V6	Counterbalance Valve (2)						X	X	X			X

SCHEMATICS

This section contains electrical and hydraulic power schematics and associated information for maintenance purposes.

The diagrams are to be used in conjunction with the **Troubleshooting Truth Tables** in **Section 3**. They allow understanding of the makeup and functions of the systems for checking, tracing, and faultfinding during troubleshooting analysis.

The components that comprise the electrical and hydraulic systems are given a reference designation and are explained as to function and location in the following tables.

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4-1 ELECTRIC SCHEMATICS

Legend: 065616-024 Electric Schematic, X20N

Reference Number	Name	Function	Location
ALM1	Alarm	Provides warning sound	Control Module
ALM2	Horn (option)	Provides warning sound	Power Module
BAT	Battery Pack	Power source for the machine	Power Module
CHG	Battery Charger	Charges the battery pack	Power Module
F1	5 AMP Circuit Breaker	Electrical overload protection	Chassis Controls
F2	175 AMP Fuse	Overload protection for the electric motor	Control Module
HM	Hour Meter	Shows how many hours the machine has been in use	Chassis Controls
I/O	I/O Board (Circuit Board)	Connection point for machine function wiring	Control Module
MC	Motor Control	Controls the speed of the electric motor	Control Module
MOT	Motor	Provides power to the hydraulic pump	Control Module
R1	Motor Relay	Controls the speed of the electric motor	Control Module
S1	Chassis Emergency Stop Switch	Shuts down all machine functions	Chassis Controls
S2	Chassis Lift Switch	Elevates platform	Chassis Controls
S3	Chassis Key Switch	Allows some machine functions to be initiated from ground level	Chassis Controls
S4	Lift/Drive Selector Switch	Activates lift or drive functions, and high and low speed drive	Platform Controls
S5	Proximity Switch (Limit Switch)	Stops lift assembly at lower limit, cuts out high speed drive when platform is elevated	Chassis, Front
S7	Platform Emergency Stop Switch	Shuts down all machine functions	Platform Controls
S8	Interlock Switch (Trigger)	Safety mechanism for control handle	Platform Controls
S9	Control Handle	Proportionally controls the drive and lift functions	Platform Controls
S10	Platform Steering Switch	Control left and right steering solenoids	Platform Controls
S12	Horn Button (option)	Provides power to horn	Platform Controls
SNSR	Level Sensor	Activates level sensor alarm and disables all machine functions except platform lower when the machine is more than 2° out of level	Chassis, Front
SOL1A	Steering Solenoid (right)	Shifts steering valve to the left	Hydraulic Manifold
SOL1B	Steering Solenoid (left)	Shifts steering valve to the right	Hydraulic Manifold
SOL2A	Platform Lift Solenoid	Elevates platform	Hydraulic Manifold
SOL2B	Down Solenoid (Emergency Lower)	Lowers platform	Lift Cylinder
SOL3A	Depression Mechanism Extension Solenoid	Extends depression mechanism bars	Hydraulic Manifold
SOL3B	Depression Mechanism Retraction Solenoid (2)	Retracts depression mechanism bars	Depression Mechanism cylinders
SOL4A	Reverse Solenoid	Shifts forward/reverse valve to reverse	Hydraulic Manifold
SOL4B	Forward Solenoid	Shifts forward/reverse valve to forward	Hydraulic Manifold

Figure 4-1: Electric Components Locations, X20N-X20W

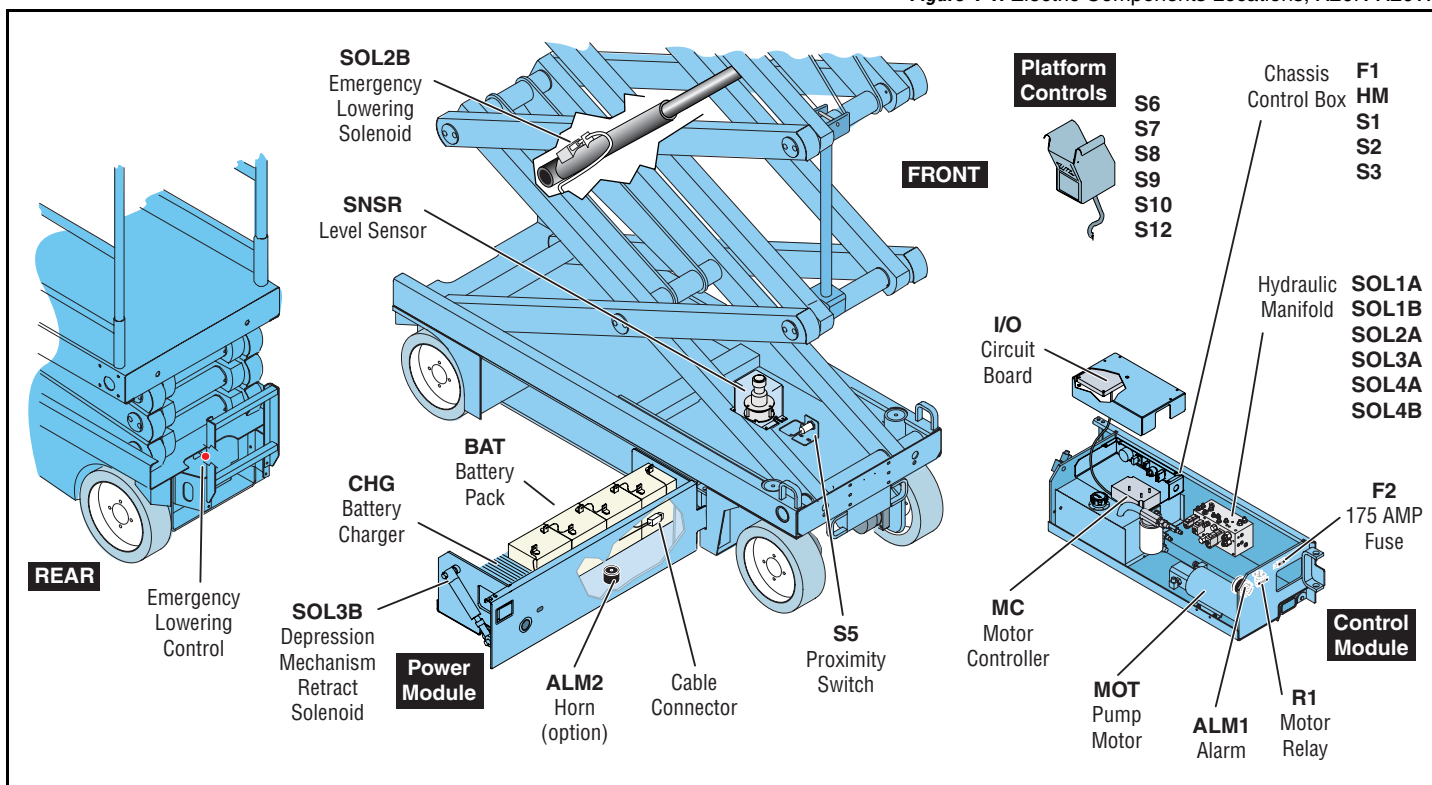
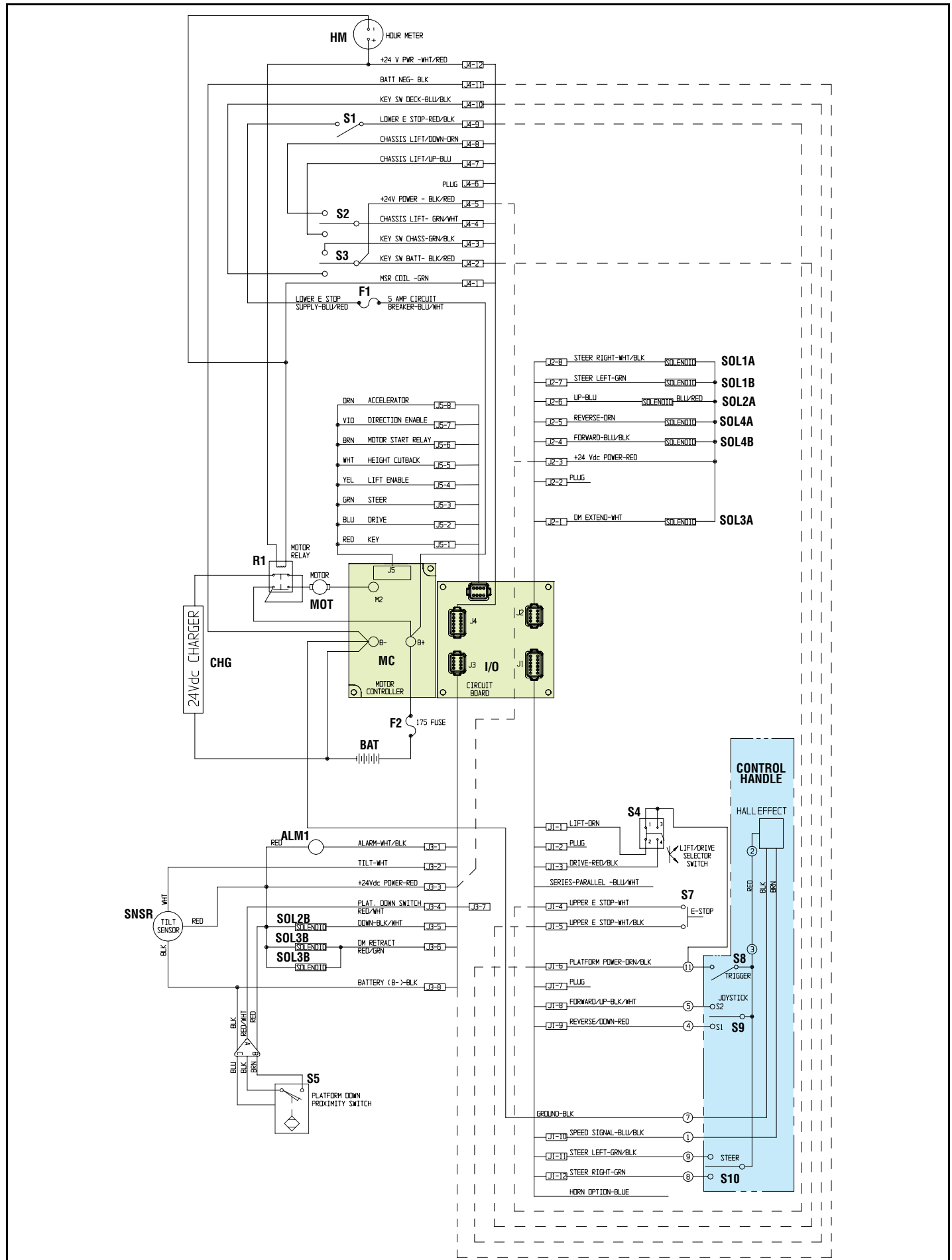


Figure 4-2: Electric Schematic, X20N



Legend: 066769-020 Electric Schematic, X20W-X26N-X26UN-X31N

Reference Number	Name	Function	Location
ALM1	Alarm	Provides warning sound	Control Module
ALM2	Horn (option)	Provides warning sound	Power Module
BAT	Battery Pack	Power source for the machine	Power Module
BAT2	Auxiliary Batteries [X31N only]	Power source for emergency lowering	Power Module
CHG	Battery Charger	Charges the battery pack	Power Module
D1	16 AMP Diode [X31N only]	Charging system protection	BAT2 - Power Module
F1	5 AMP Circuit Breaker	Electrical overload protection	Chassis Controls
F2	175 AMP Fuse	Overload protection for the electric motor	Control Module
F3	7.5 AMP Fuse [X31N only]	Overload protection for the Emergency Lowering circuit	Power Module
HM	Hour Meter	Shows how many hours the machine has been in use	Chassis Controls
I/O	I/O Board (Circuit Board)	Connection point for machine function wiring	Control Module
MC	Motor Control	Controls the speed of the electric motor	Control Module
MOT	Motor	Provides power to the hydraulic pump	Control Module
R1	Motor Relay	Controls the speed of the electric motor	Control Module
R2	Series/Parallel Relay	Activates Series/Parallel solenoids	Chassis Controls
S1	Chassis Emergency Stop Switch	Shuts down all machine functions	Chassis Controls
S2	Chassis Lift Switch	Elevates platform	Chassis Controls
S3	Chassis Key Switch	Allows some machine functions to be initiated from ground level	Chassis Controls
S4	Lift/Drive Selector Switch	Activates lift or drive functions, and high and low speed drive	Platform Controls
S5	Proximity Switch (Limit Switch)	Stops lift assembly at lower limit, cuts out high speed drive when platform is elevated	Chassis, Front
S6	Height Limit Switch [X26UN & X31N only]	Stops lift assembly at upper limit	Elevating Assembly, Front
S7	Platform Emergency Stop Switch	Shuts down all machine functions	Platform Controls
S8	Interlock Switch (Trigger)	Safety mechanism for control handle	Platform Controls
S9	Control Handle	Proportionally controls the drive and lift functions	Platform Controls
S10	Platform Steering Switch	Control left and right steering solenoids	Platform Controls
S11	Emergency Lowering Switch [X31N only]	Control emergency lowering solenoids	Chassis, Rear
S12	Horn Button (option)	Provides power to horn	Platform Controls
SNSR	Level Sensor	Activates level sensor alarm and disables all machine functions except platform lower when the machine is more than 2° out of level	Chassis, Front
SOL1A	Steering Solenoid (right)	Shifts steering valve to the left	Hydraulic Manifold
SOL1B	Steering Solenoid (left)	Shifts steering valve to the right	Hydraulic Manifold
SOL2A	Platform Lift Solenoid	Elevates platform	Hydraulic Manifold
SOL2B	Down Solenoid (Emergency Lower) [X31N = 2]	Lowers platform	Lift Cylinder
SOL3A	Depression Mechanism Extension Solenoid	Extends depression mechanism bars	Hydraulic Manifold
SOL3B	Depression Mechanism Retraction Solenoid (2)	Retracts depression mechanism bars	Depression Mechanism cylinders
SOL4A	Reverse Solenoid	Shifts forward/reverse valve to reverse	Hydraulic Manifold
SOL4B	Forward Solenoid	Shifts forward/reverse valve to forward	Hydraulic Manifold
SOL5	Series/Parallel Solenoids (2)	Shift between high and low speed drive	Series Parallel Manifold

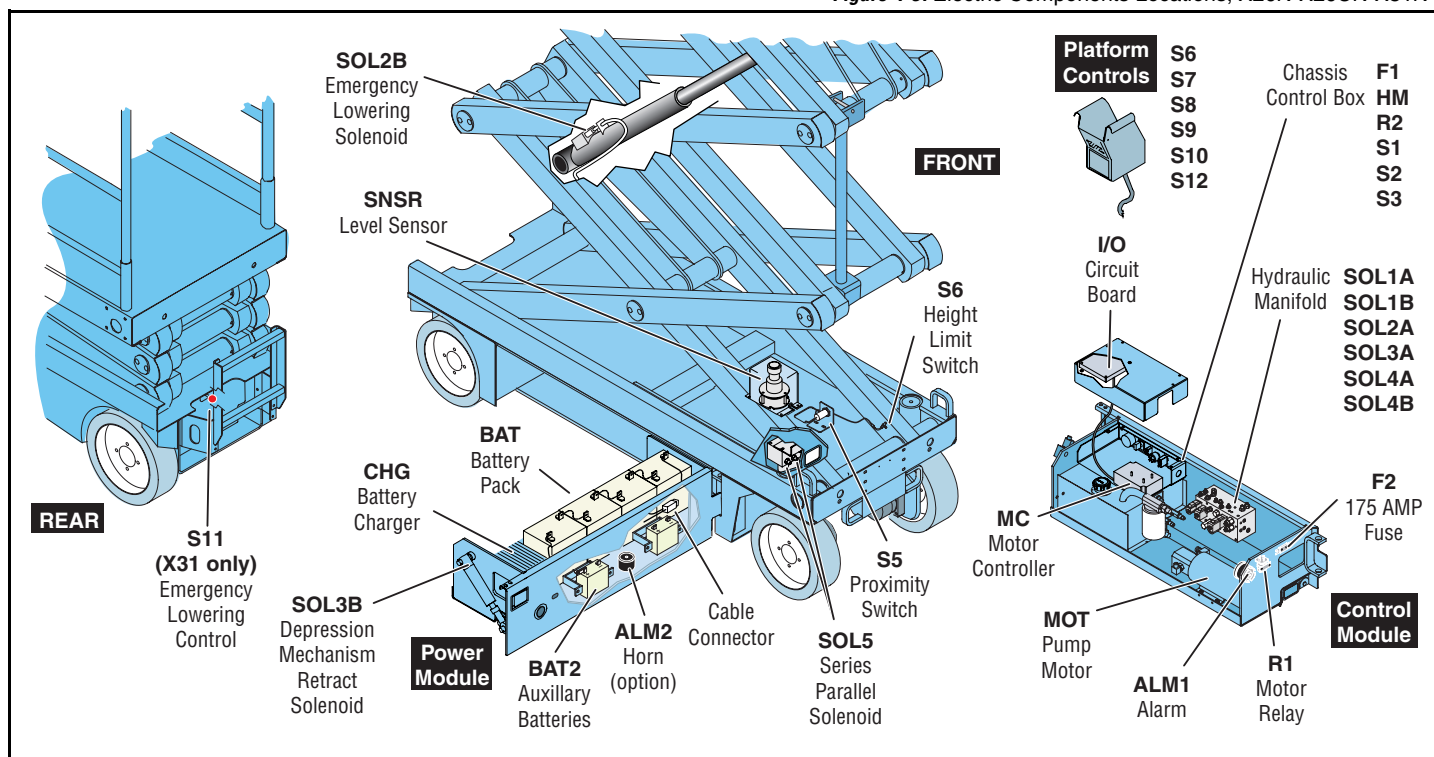
Figure 4-3: Electric Components Locations, X26N-X26UN-X31N

Figure 4-4: Electric Schematic, X20W-X26N-X26UN-X31N

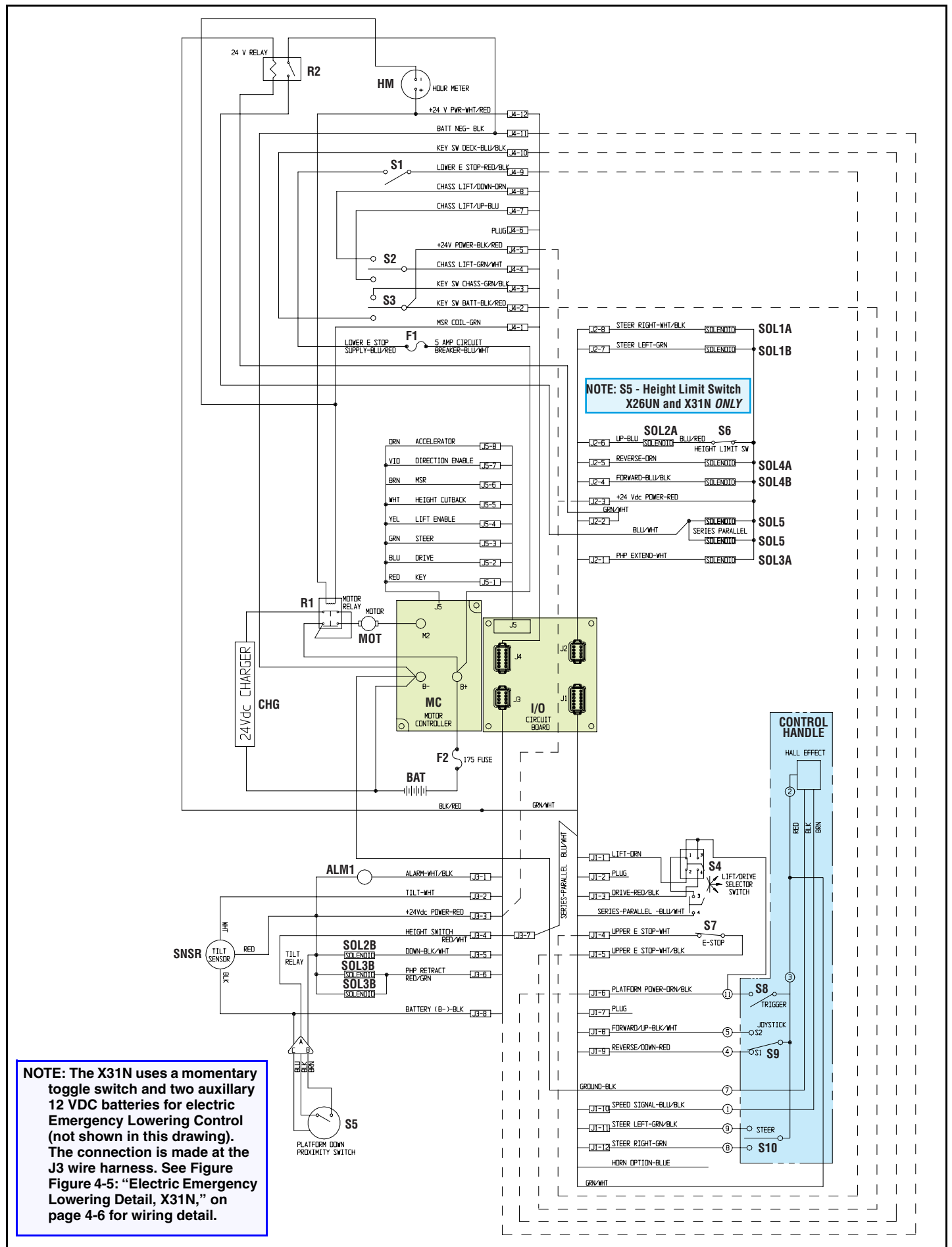
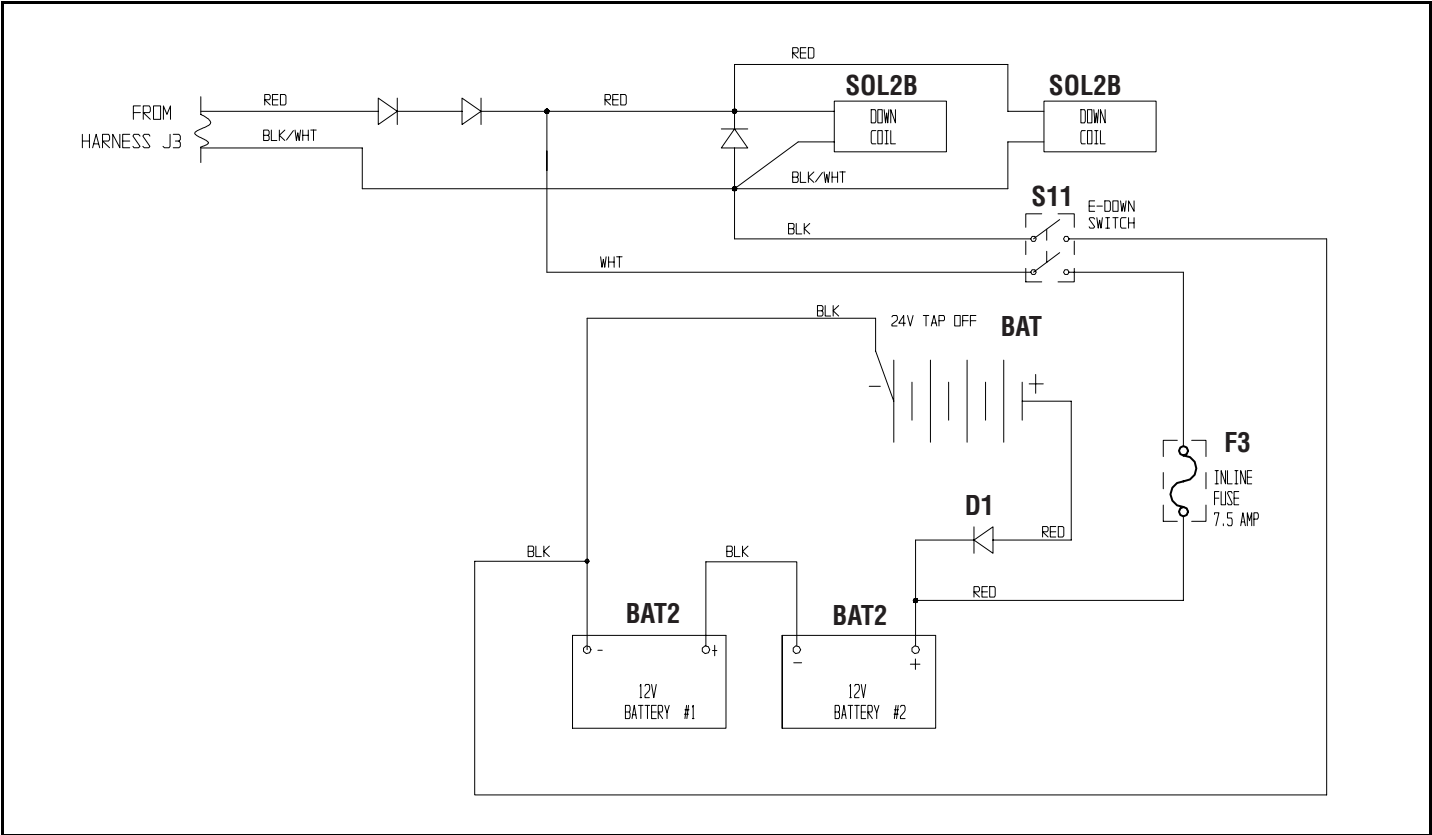
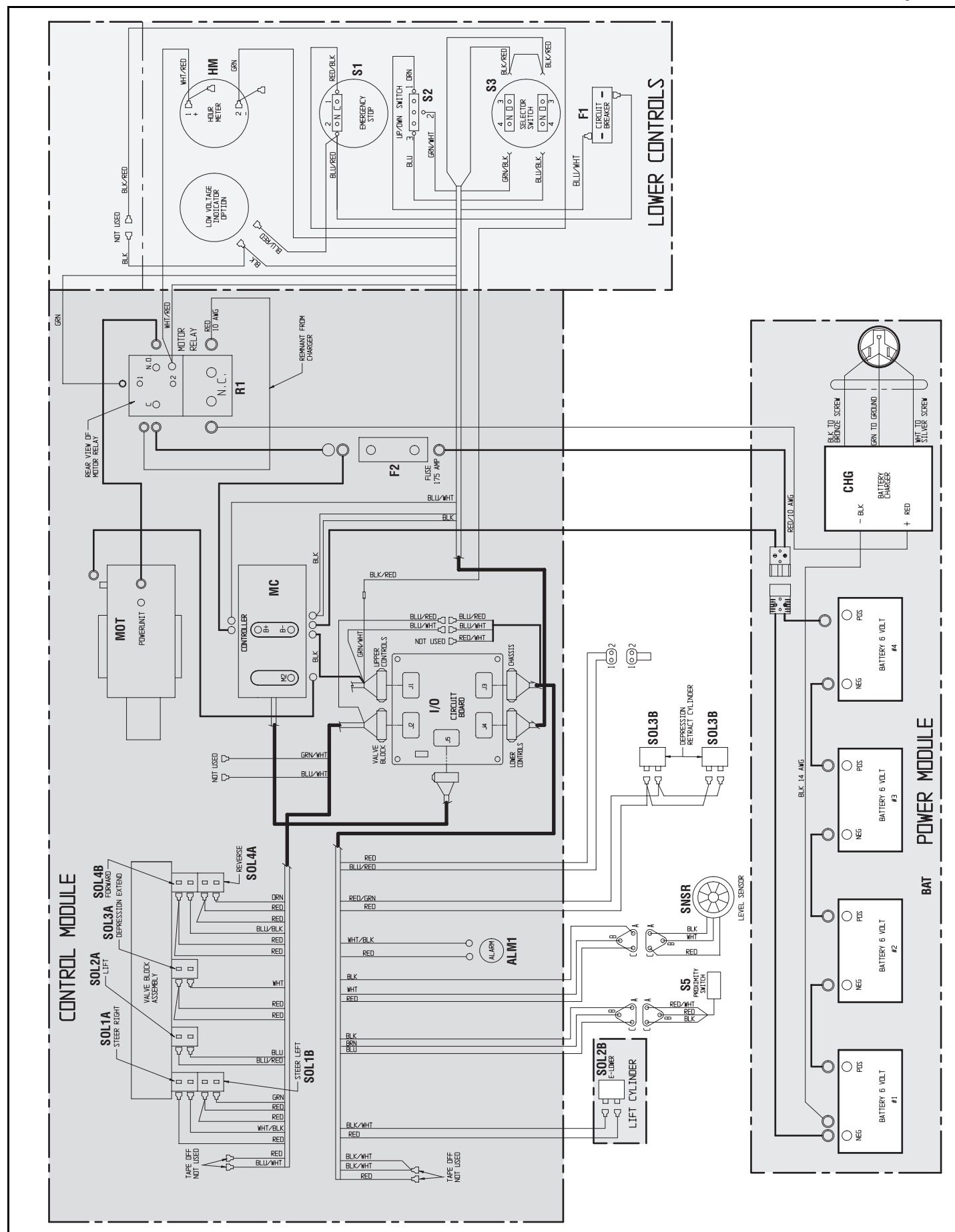


Figure 4-5: Electric Emergency Lowering Detail, X31N





[illegible]

Figure 4-8: Wire Routing, X26UN

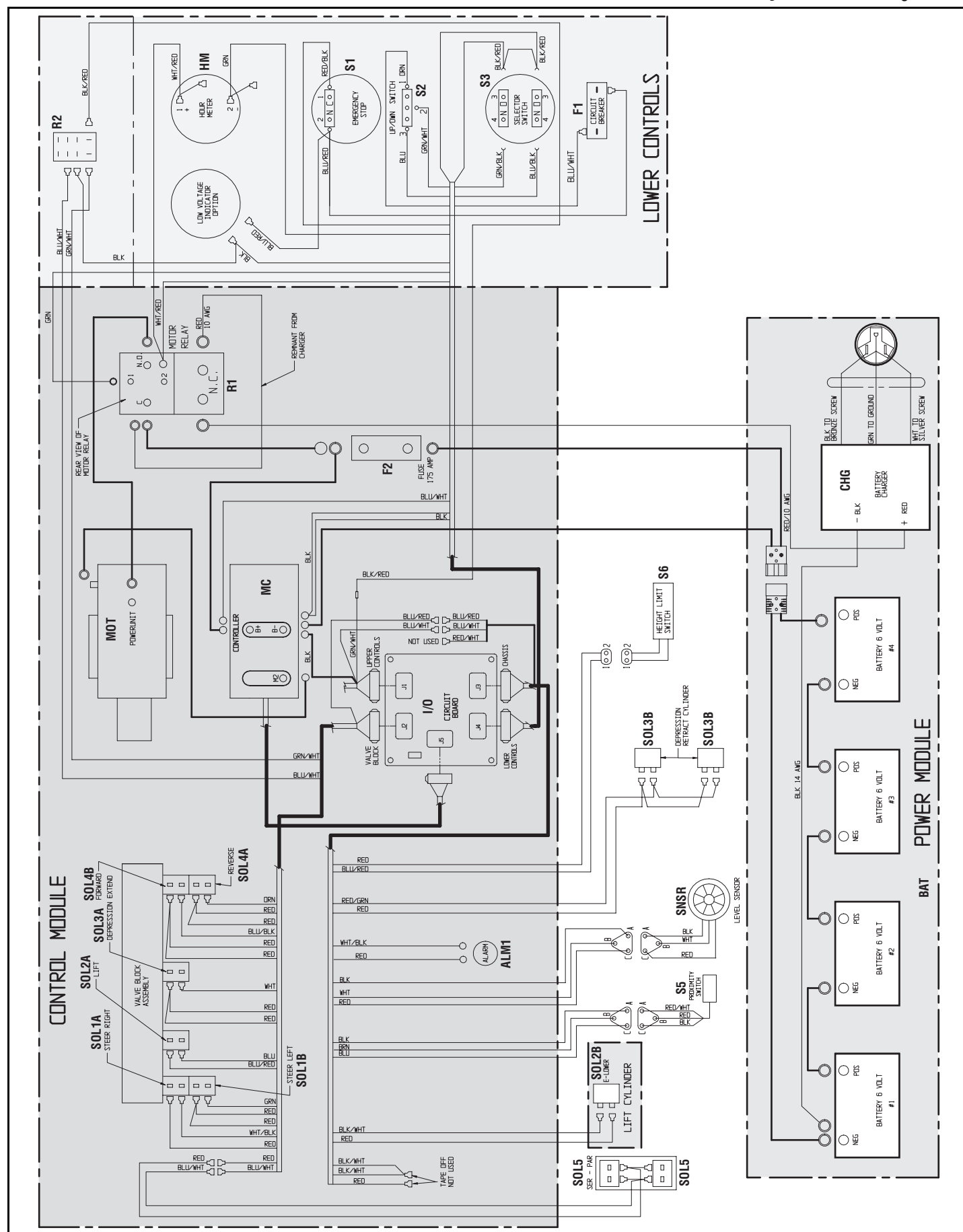
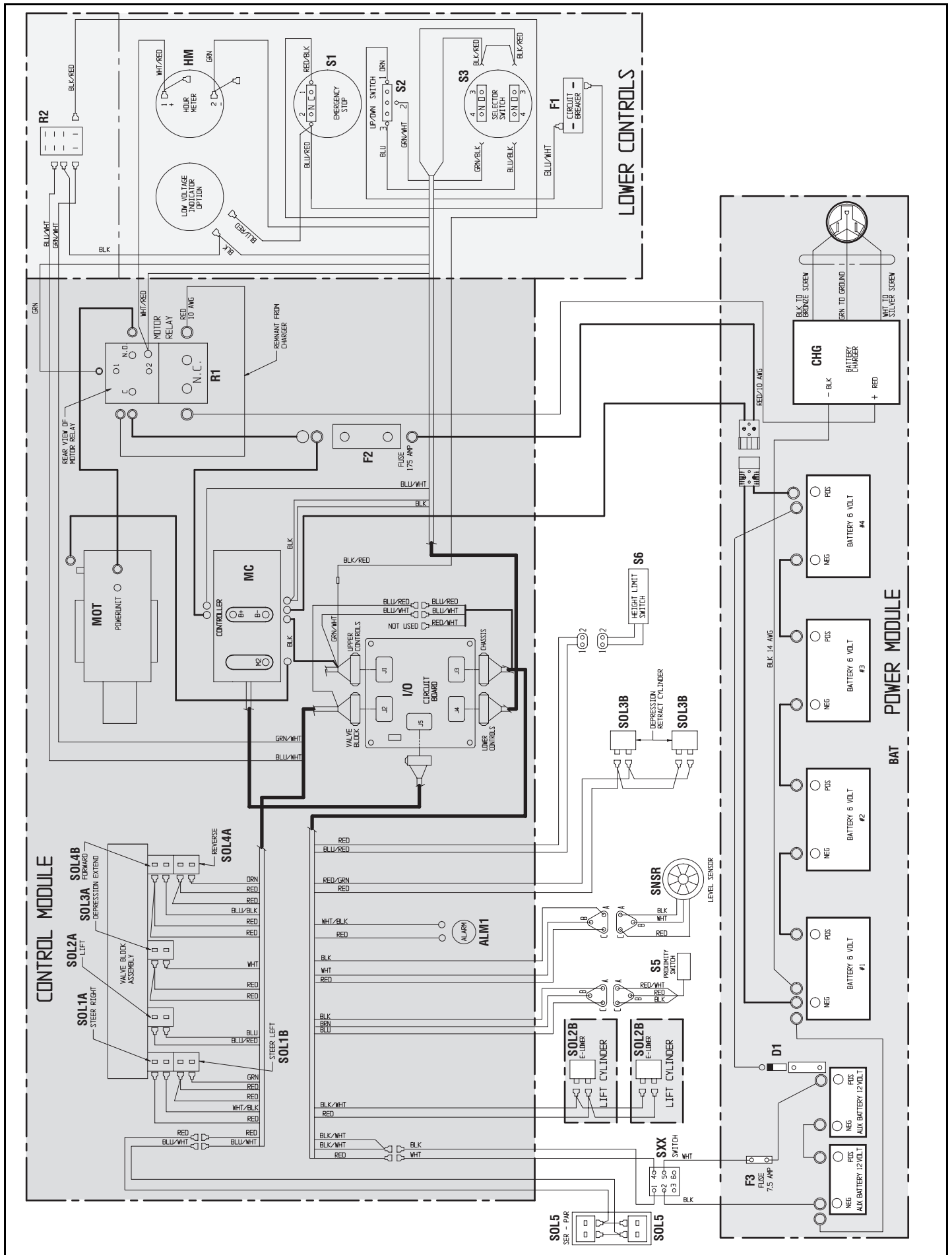


Figure 4-9: Wire Routing, X31N



ELECTRIC COMPONENTS

Figure 4-10: Chassis Controls Components Location

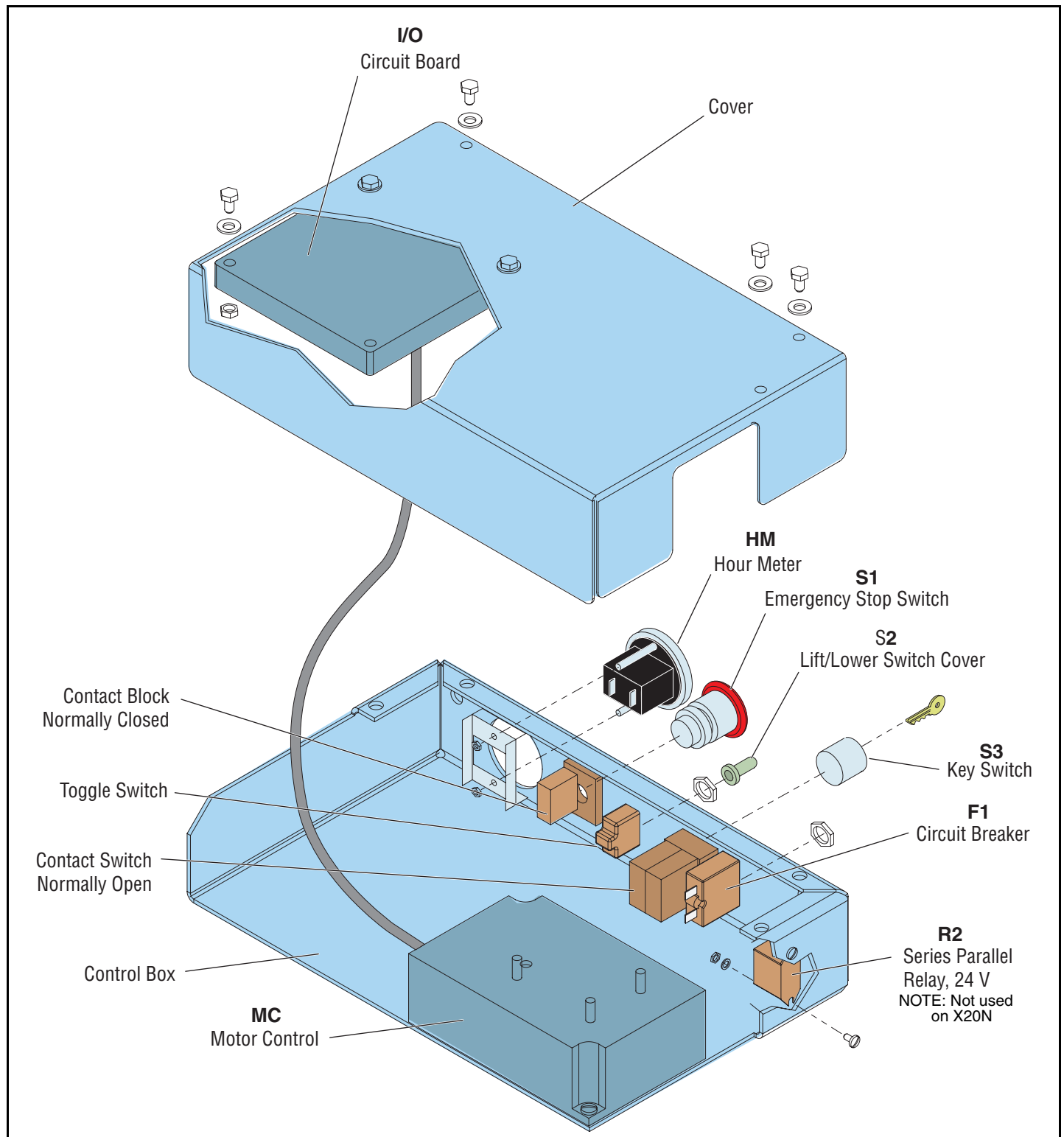


Figure 4-11: Platform Controls Components Location

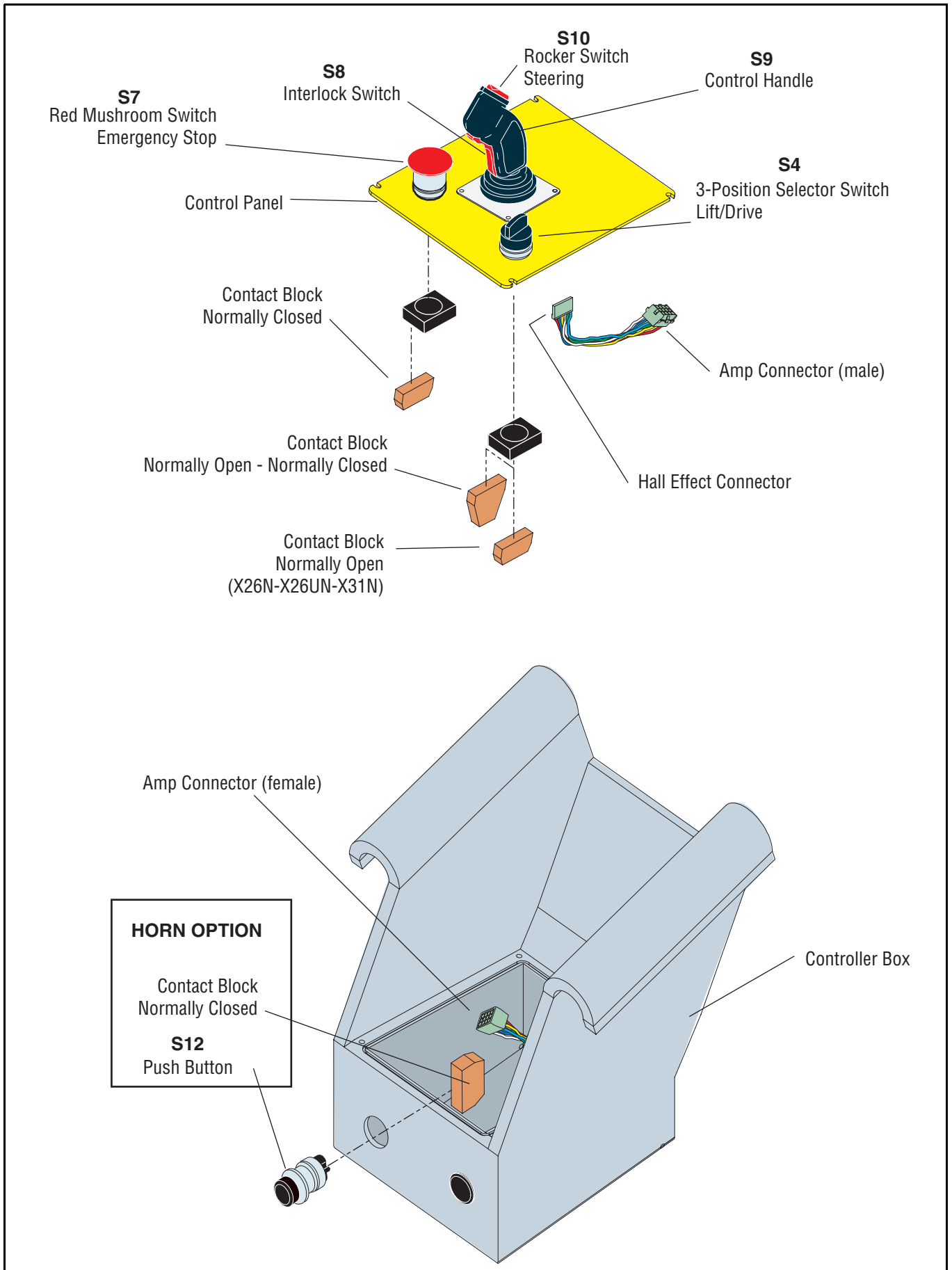


Figure 4-12: Platform Controls Wiring, X20N

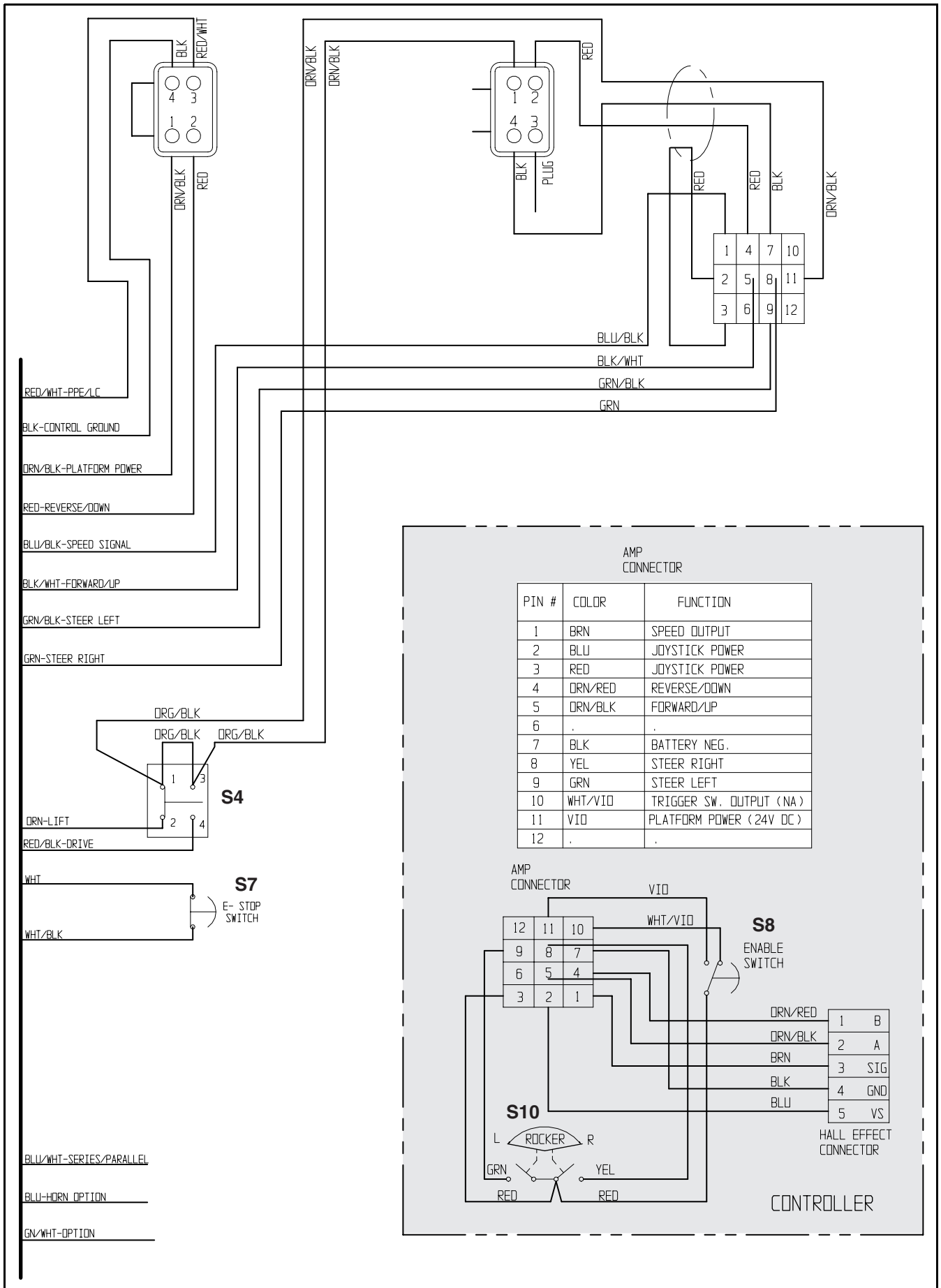


Figure 4-13: Platform Controls Wiring, X20W-X26N-X26UN-X31N

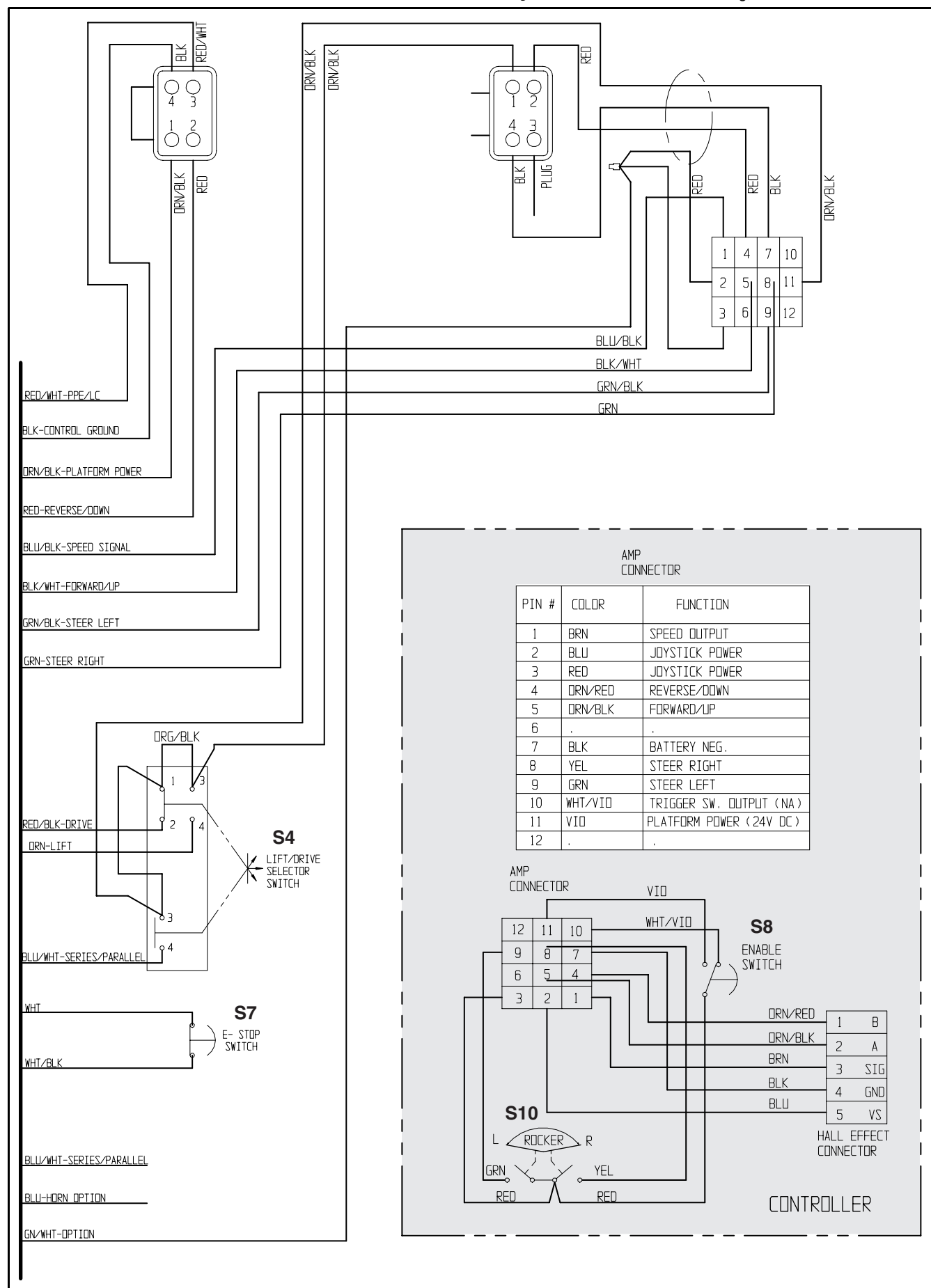
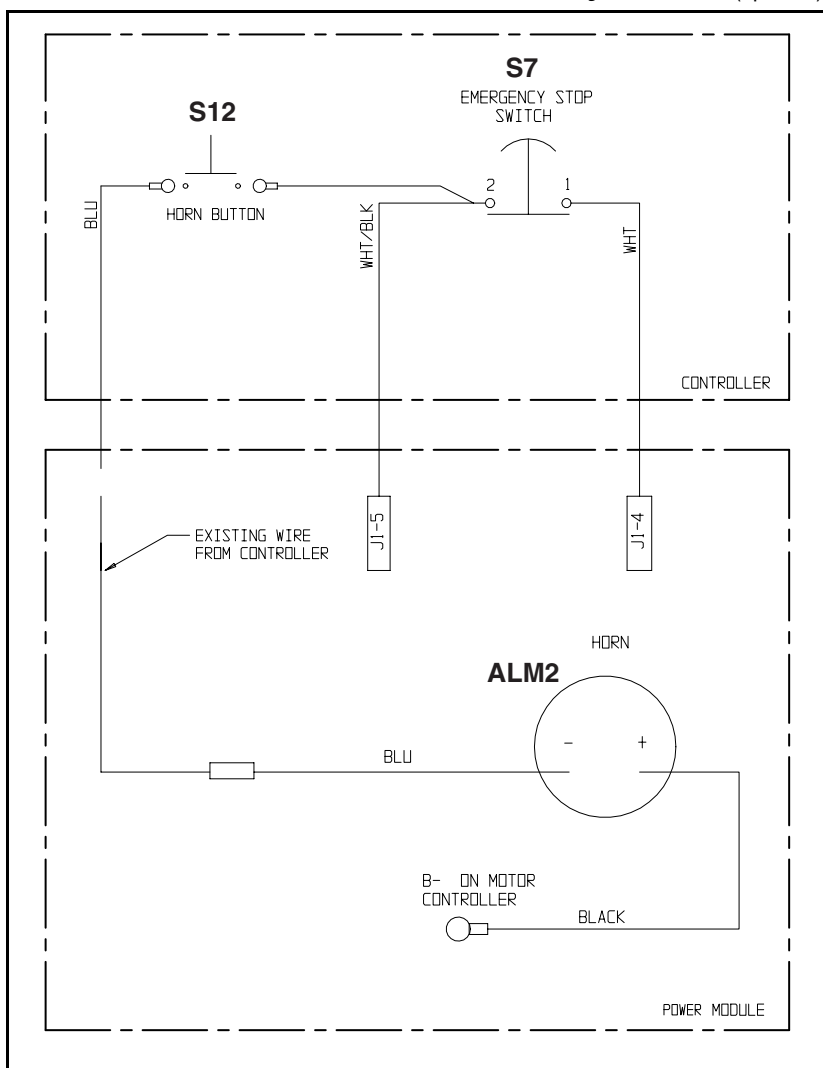


Figure 4-14: Horn (optional)



4-2 HYDRAULICS

Legend: 065615-023 Hydraulic Schematic, X20N

Reference number	Name	Function	Location
CV	Check Valve	Allows depression mechanism to retract in drive mode	Hydraulic Manifold
CYL1	Steering Cylinder	Provides force to turn front wheels	Front of Chassis above Drive Motors
CYL2	Lift Cylinder	Provides force to lift platform	Elevating Assembly
CYL3	Depression Mechanism Cylinder (2)	Extends or retracts depression mechanism bar	Control Module and Power Module
DVR1	Priority Flow Divider	Provides priority fluid flow to steering	Hydraulic Manifold
FL1	Suction Strainer (Filter)	Traps particles in hydraulic reservoir	Inside Hydraulic Reservoir at outlet
FL2	Return Filter	Filters fluid returning to reservoir	Control Module
MAN	Hydraulic Manifold	Provides fluid distribution to cylinders, brakes, and series parallel reservoir	Control Module
MOT	Drive Motors (2)	Provides tractive effort to move machine	Front Wheels
OR	Orifice	Restricts fluid return from emergency lowering valve	Lift Cylinder
PB	Parking Brake (2)	Stops machine from moving while parked	Internal to Drive Motors
PMP	Pump	Provides hydraulic pressure for all functions	Control Module
RV1	Steering Relief	Provides pressure protection to pump and steering components when steering	Hydraulic Manifold
RV2	Lift Relief Valve	Provides pressure protection to lift system	Hydraulic Manifold
RV3	Main Relief Valve	Provides pressure protection to hydraulic system	Hydraulic Manifold
RES	Reservoir	Holds hydraulic fluid	Control Module
V1	Steering Right/Left Valve	Provides directional control for steering	Hydraulic Manifold
V2A	Lift Valve	Provides fluid control for drive or lift functions	Hydraulic Manifold
V2B	Down/Emergency Lowering Valve	Allows fluid to return to reservoir; manually operated for emergency lowering	Lift Cylinder
V3A	Depression Mechanism Extend Valve	Provides fluid control for depression mechanism bar	Hydraulic Manifold
V3B	Depression Mechanism Retract Valve (2)	Provides fluid control for depression mechanism bar	Depression Mechanism Cylinders
V4	Forward/Reverse Valve	Provides fluid control for drive or lift functions	Hydraulic Manifold
V6	Counterbalance Valve (2)	Provides dynamic braking	Hydraulic Manifold

Figure 4-15: Hydraulic Components Location, X20N

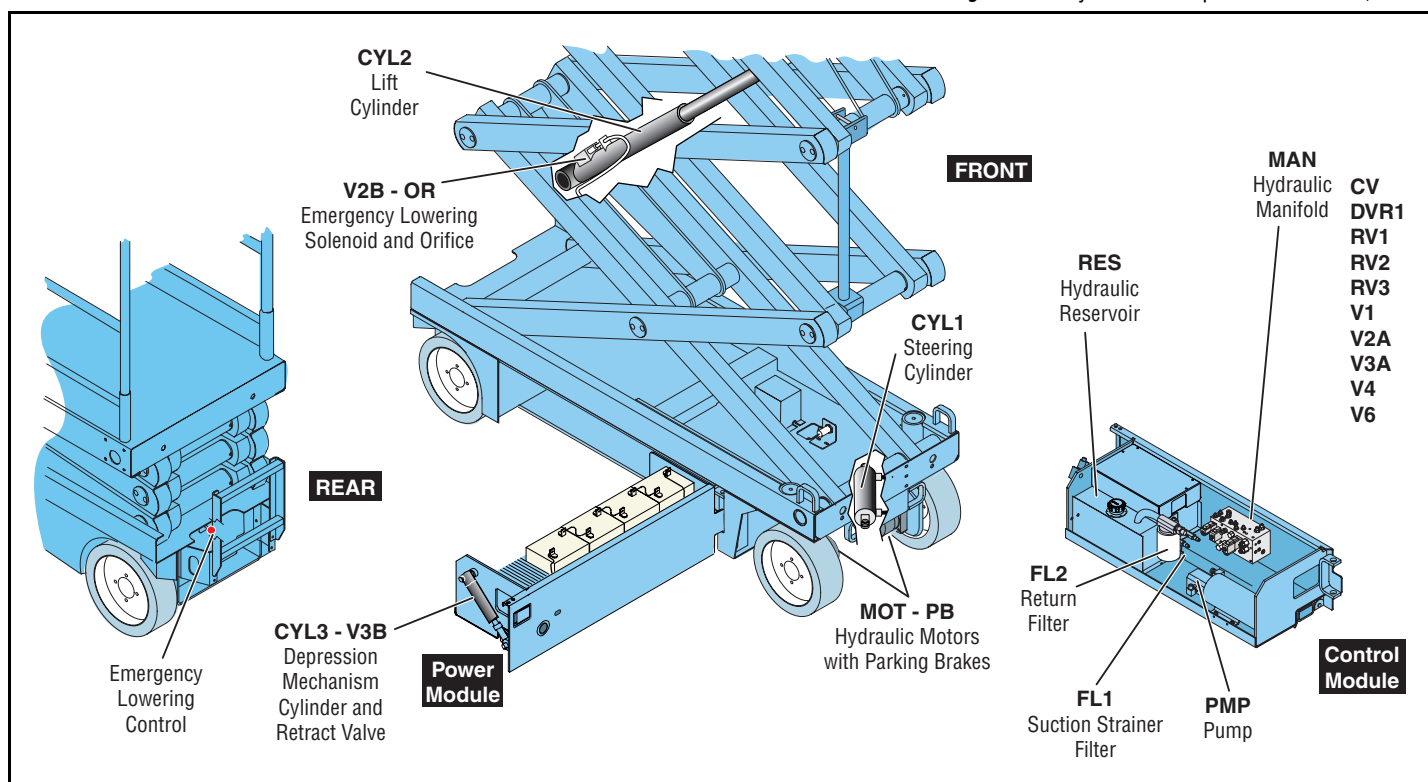
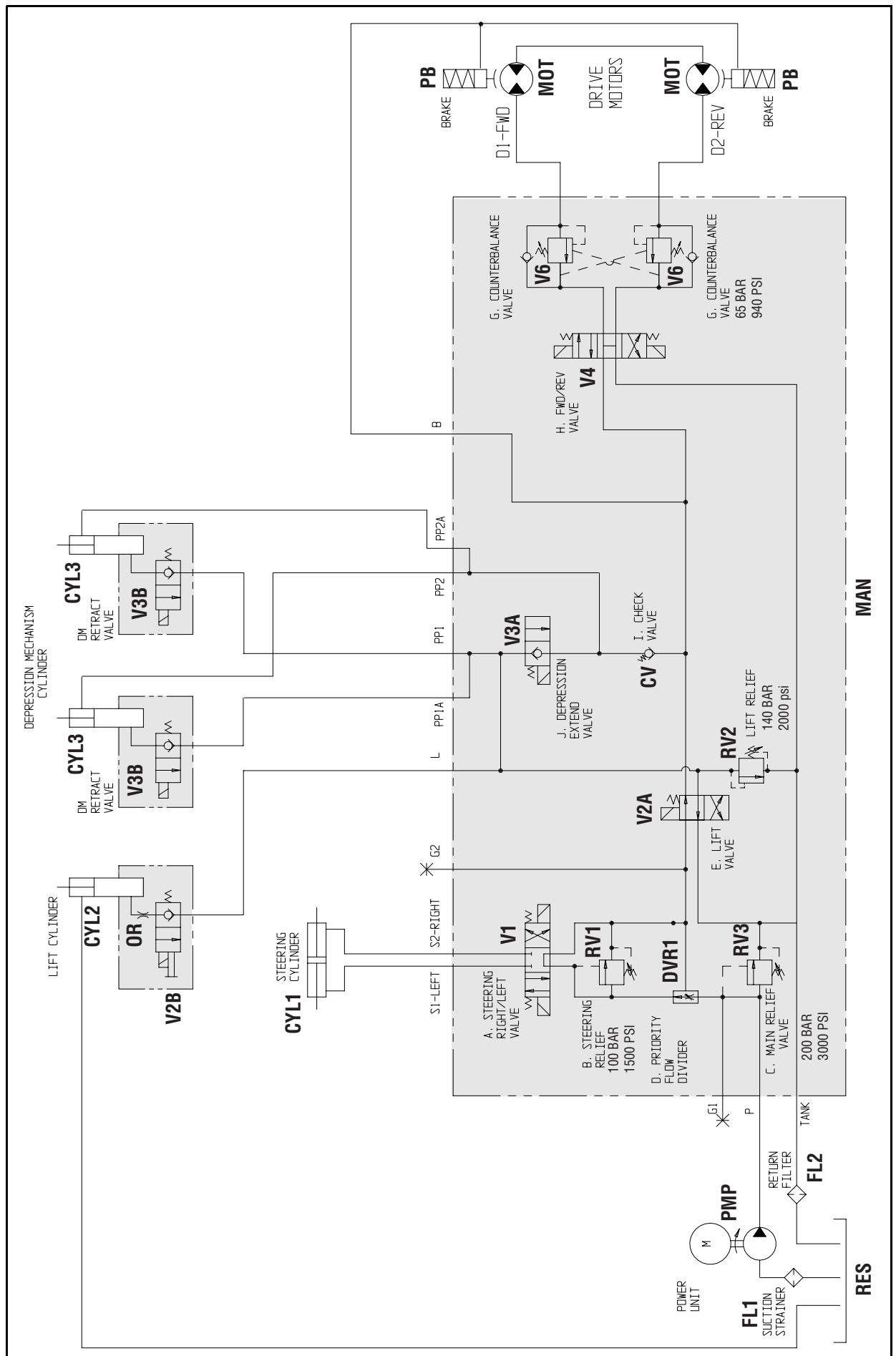


Figure 4-16: Hydraulic Schematic, X20N



Legend: 066781-020 Hydraulic Schematic, X20W-X26N-X26UN

Reference number	Name	Function	Location
CV	Check Valve	Allows depression mechanism to retract in drive mode	Hydraulic Manifold
CYL1	Steering Cylinder	Provides force to turn front wheels	Front of Chassis above Drive Motors
CYL2	Lift Cylinder	Provides force to lift platform	Elevating Assembly
CYL3	Depression Mechanism Cylinder (2)	Extends or retracts depression mechanism bar	Control Module and Power Module
DVR1	Priority Flow Divider	Provides priority fluid flow to steering	Hydraulic Manifold
DVR2	Flow Divider	Divides fluid to drive motors in parallel drive mode	Series/Parallel Manifold
FL1	Suction Strainer (Filter)	Traps particles in hydraulic reservoir	Inside Hydraulic Reservoir at outlet
FL2	Return Filter	Filters fluid returning to reservoir	Control Module
MAN	Hydraulic Manifold	Provides fluid distribution to cylinders, brakes, and series parallel reservoir	Control Module
MOT	Drive Motors (2)	Provides tractive effort to move machine	Front Wheels
OR	Orifice	Restricts fluid return from emergency lowering valve	Lift Cylinder
PB	Parking Brake (2)	Stops machine from moving while parked	Internal to Drive Motors
PMP	Pump	Provides hydraulic pressure for all functions	Control Module
RV1	Steering Relief	Provides pressure protection to pump and steering components when steering	Hydraulic Manifold
RV2	Lift Relief Valve	Provides pressure protection to lift system	Hydraulic Manifold
RV3	Main Relief Valve	Provides pressure protection to hydraulic system	Hydraulic Manifold
RES	Reservoir	Holds hydraulic fluid	Control Module
SP	Series Parallel Valve Manifold	Provides fluid distribution to drive motors	Chassis, between Modules
V1	Steering Right/Left Valve	Provides directional control for steering	Hydraulic Manifold
V2A	Lift Valve	Provides fluid control for drive or lift functions	Hydraulic Manifold
V2B	Down/Emergency Lowering Valve	Allows fluid to return to reservoir; manually operated for emergency lowering	Lift Cylinder
V3A	Depression Mechanism Extend Valve	Provides fluid control for depression mechanism bar	Hydraulic Manifold
V3B	Depression Mechanism Retract Valve (2)	Provides fluid control for depression mechanism bar	Depression Mechanism Cylinders
V4	Forward/Reverse Valve	Provides fluid control for drive or lift functions	Hydraulic Manifold
V5	Series/Parallel Valve (2)	Controls drive speed	Series/Parallel Manifold
V6	Counterbalance Valve (2)	Provides dynamic braking	Hydraulic Manifold

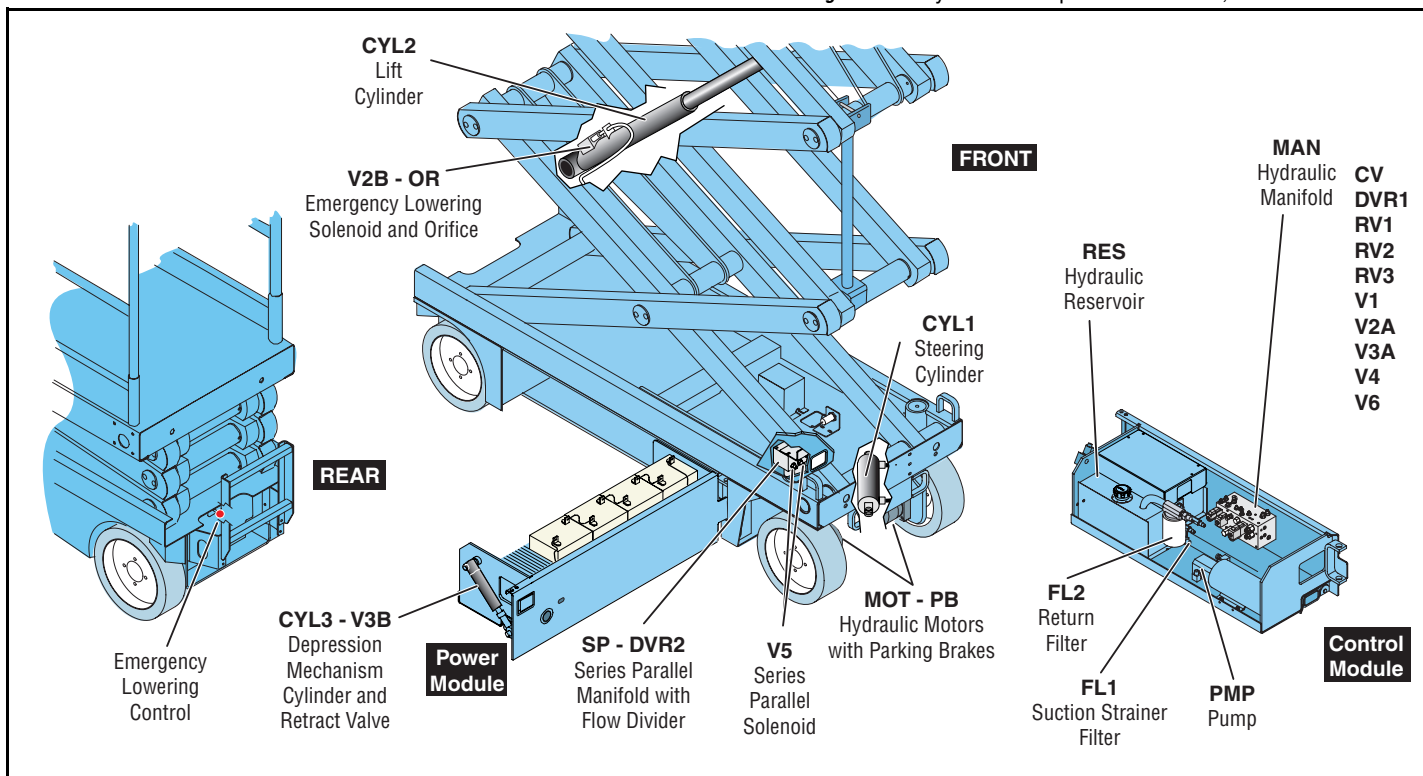
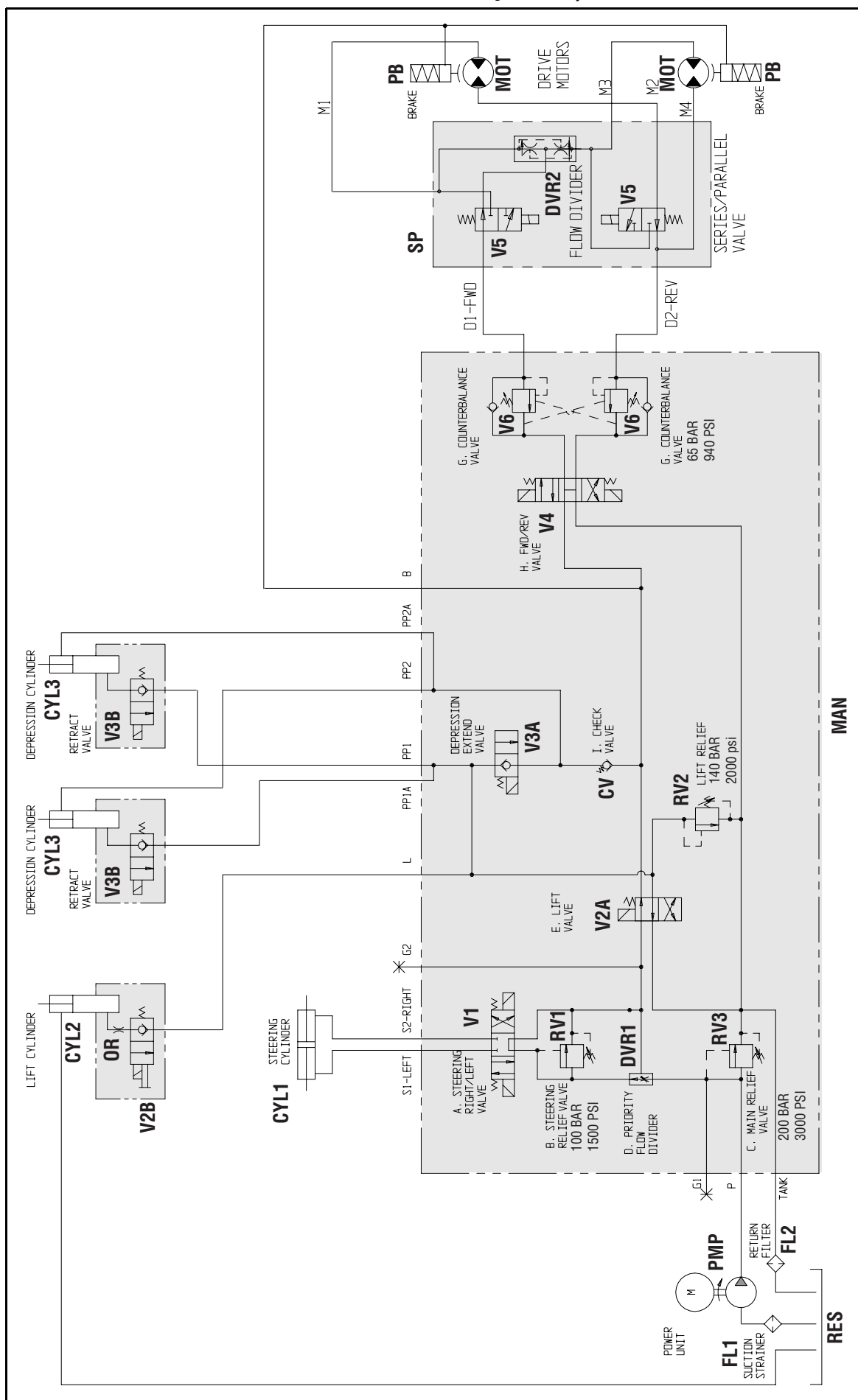
Figure 4-17: Hydraulic Components Location, X20W-X26N-X26UN

Figure 4-18: Hydraulic Schematic, X20W-X26N-X26UN



Legend: 066781-021 Hydraulic Schematic, X31N

Reference number	Name	Function	Location
CV	Check Valve	Allows depression mechanism to retract in drive mode	Hydraulic Manifold
CYL1	Steering Cylinder (2)	Provides force to turn front wheels	Front of Chassis above Drive Motors
CYL2	Lower Lift Cylinder	Provides force to lift platform	Elevating Assembly
CYL3	Depression Mechanism Cylinder (2)	Extends or retracts depression mechanism bar	Control Module and Power Module
CYL4	Upper Lift Cylinder	Provides force to lift platform	Elevating Assembly
DVR1	Priority Flow Divider	Provides priority fluid flow to steering	Hydraulic Manifold
DVR2	Flow Divider	Divides fluid to drive motors in parallel drive mode	Series/Parallel Manifold
FL1	Suction Strainer (Filter)	Traps particles in hydraulic reservoir	Inside Hydraulic Reservoir at outlet
FL2	Return Filter	Filters fluid returning to reservoir	Control Module
MAN	Hydraulic Manifold	Provides fluid distribution to cylinders, brakes, and series parallel reservoir	Control Module
MOT	Drive Motors (2)	Provides tractive effort to move machine	Front Wheels
OR	Orifice (2)	Restricts fluid return from emergency lowering valve	Lift Cylinder
PB	Parking Brake (2)	Stops machine from moving while parked	Internal to Drive Motors
PMP	Pump	Provides hydraulic pressure for all functions	Control Module
RV1	Steering Relief	Provides pressure protection to pump and steering components when steering	Hydraulic Manifold
RV2	Lift Relief Valve	Provides pressure protection to lift system	Hydraulic Manifold
RV3	Main Relief Valve	Provides pressure protection to hydraulic system	Hydraulic Manifold
RES	Reservoir	Holds hydraulic fluid	Control Module
SP	Series Parallel Valve Manifold	Provides fluid distribution to drive motors	Chassis, between Modules
V1	Steering Right/Left Valve	Provides directional control for steering	Hydraulic Manifold
V2A	Lift Valve	Provides fluid control for drive or lift functions	Hydraulic Manifold
V2B	Down/Emergency Lowering Valve	Allows fluid to return to reservoir; manually operated for emergency lowering	Lift Cylinder
V3A	Depression Mechanism Extend Valve	Provides fluid control for depression mechanism bar	Hydraulic Manifold
V3B	Depression Mechanism Retract Valve (2)	Provides fluid control for depression mechanism bar	Depression Mechanism Cylinders
V4	Forward/Reverse Valve	Provides fluid control for drive or lift functions	Hydraulic Manifold
V5	Series/Parallel Valve (2)	Controls drive speed	Series/Parallel Manifold
V6	Counterbalance Valve (2)	Provides dynamic braking	Hydraulic Manifold

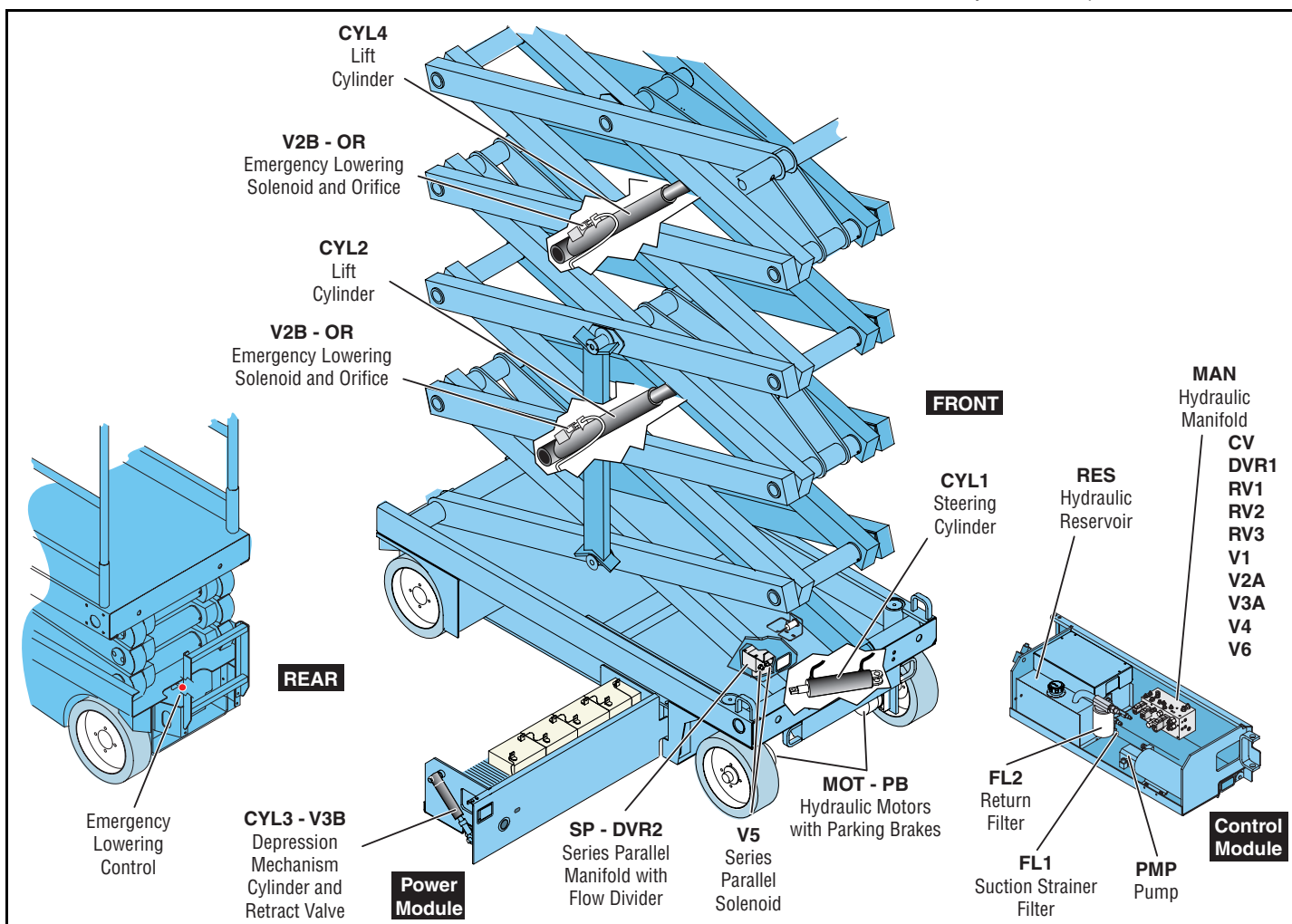
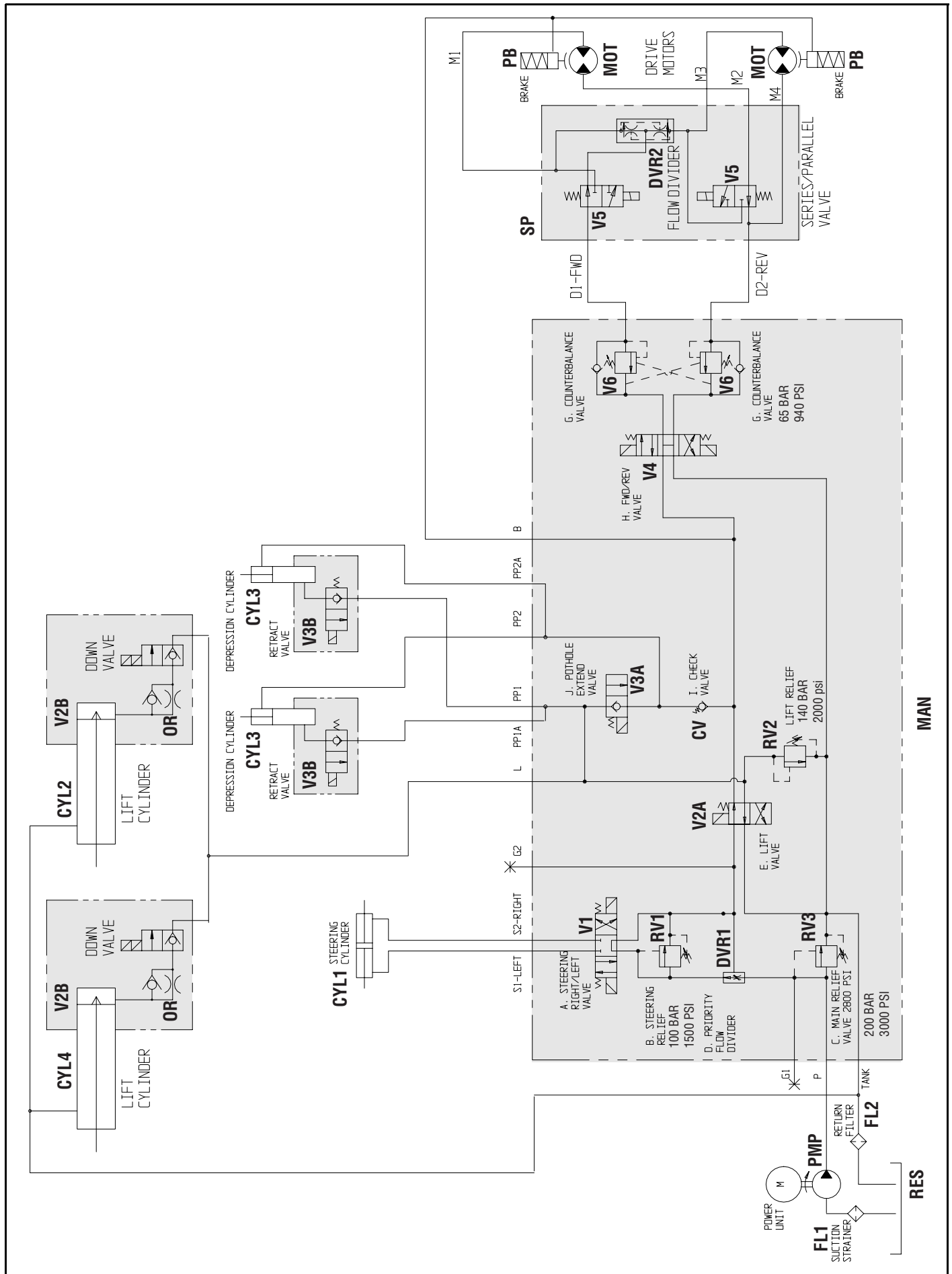
Figure 4-19: Hydraulic Components Location, X31N

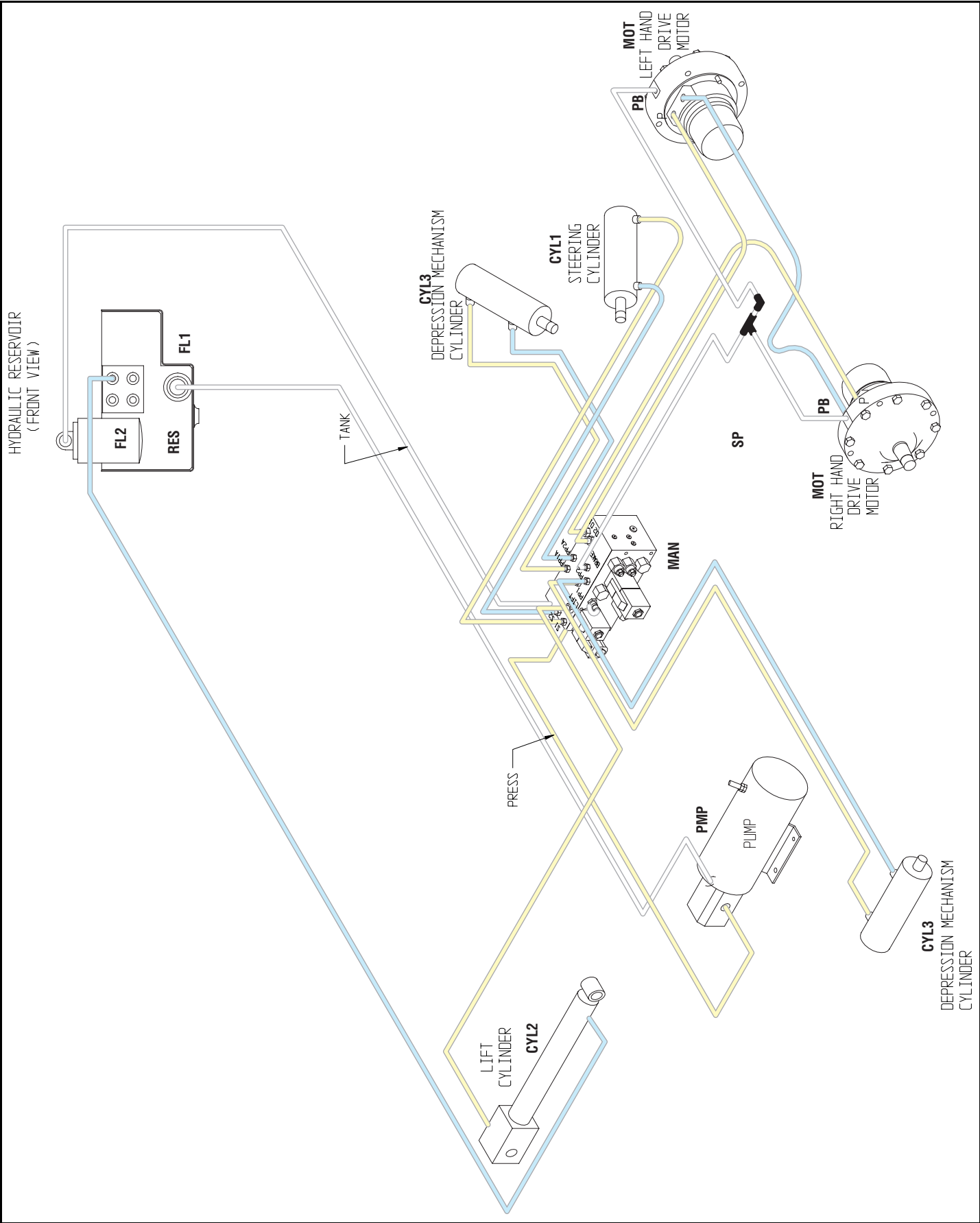
Figure 4-20: Hydraulic Schematic, X31N

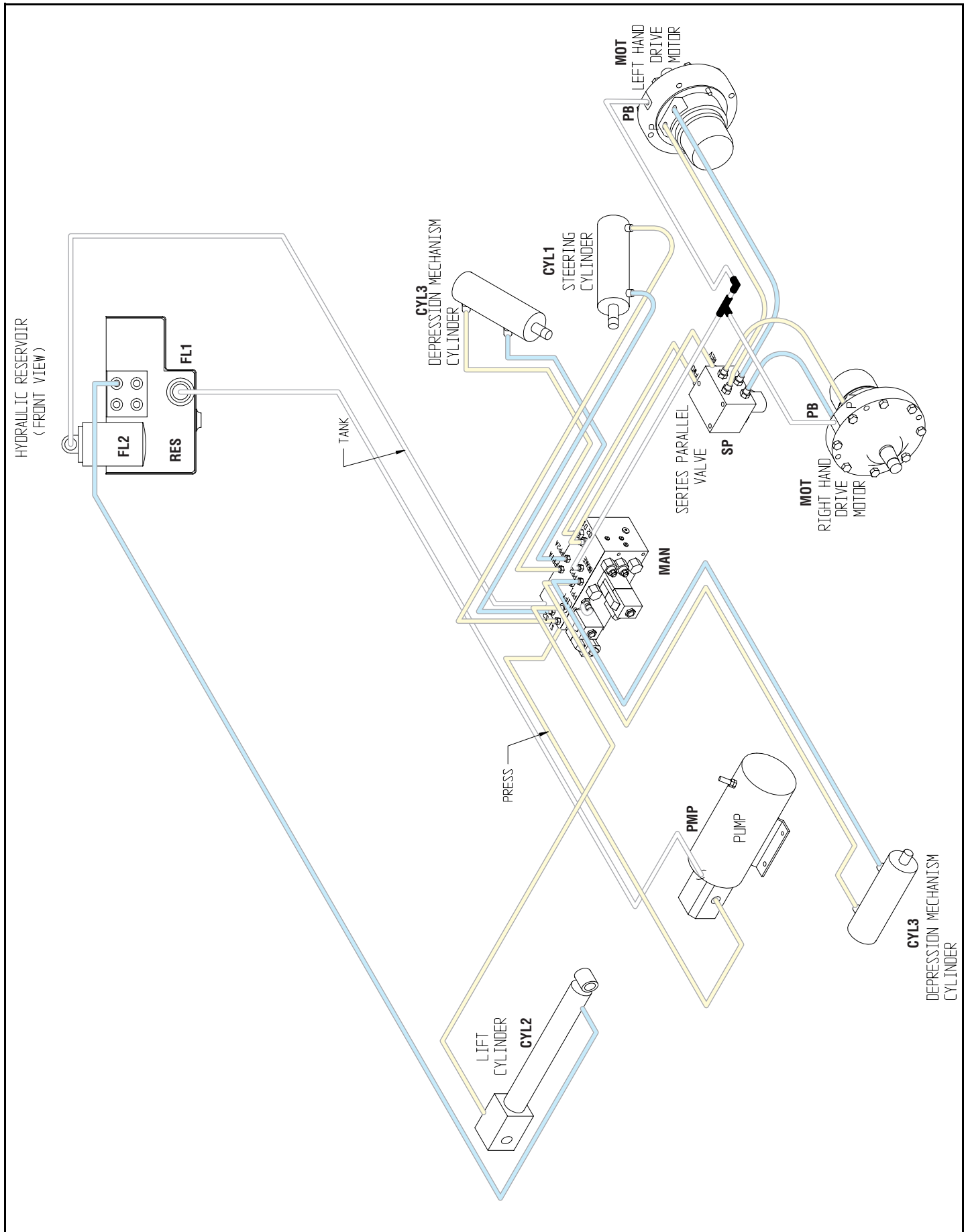


HOSE ROUTING

X20N - 114006-000

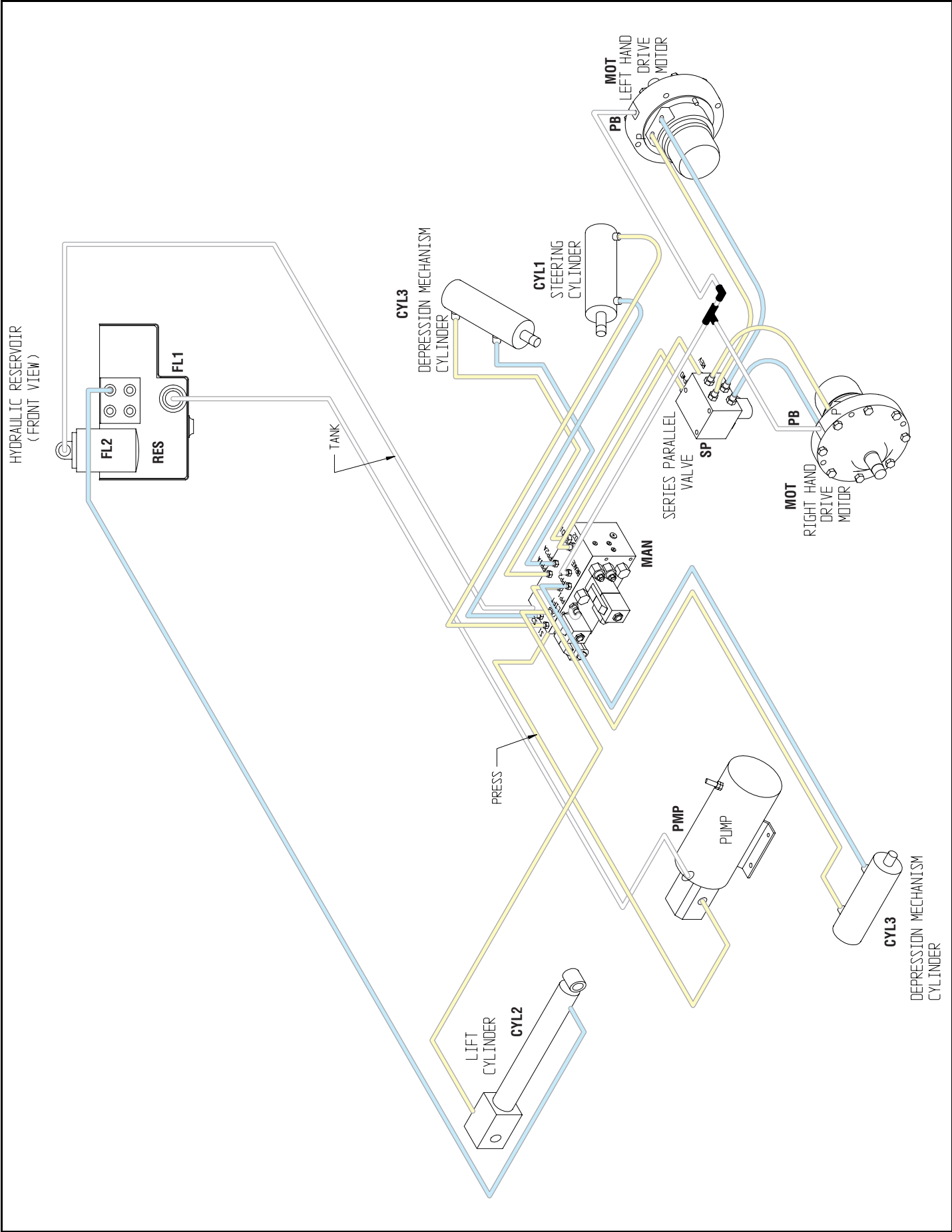
Figure 4-21: Hose Routing, X20N

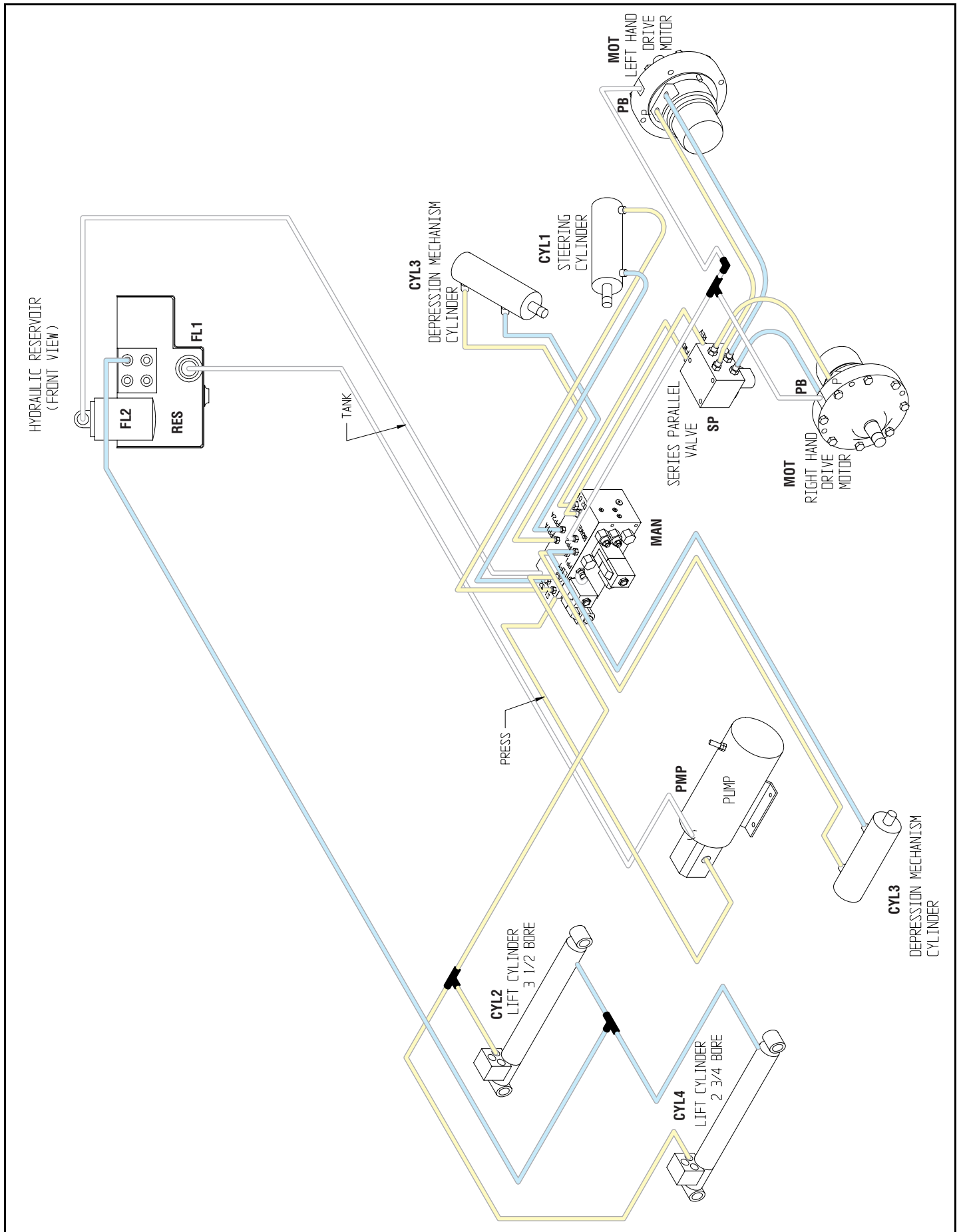


X20W-X26N - 114016-000**Figure 4-22: Hose Routing, X20W-X26N**

X26UN - 066061-026

Figure 4-23: Hose Routing, X26UN



X31N - 114046-000**Figure 4-24: Hose Routing, X31N**

HYDRAULIC COMPONENTS

Figure 4-25: Hydraulic Manifold Components

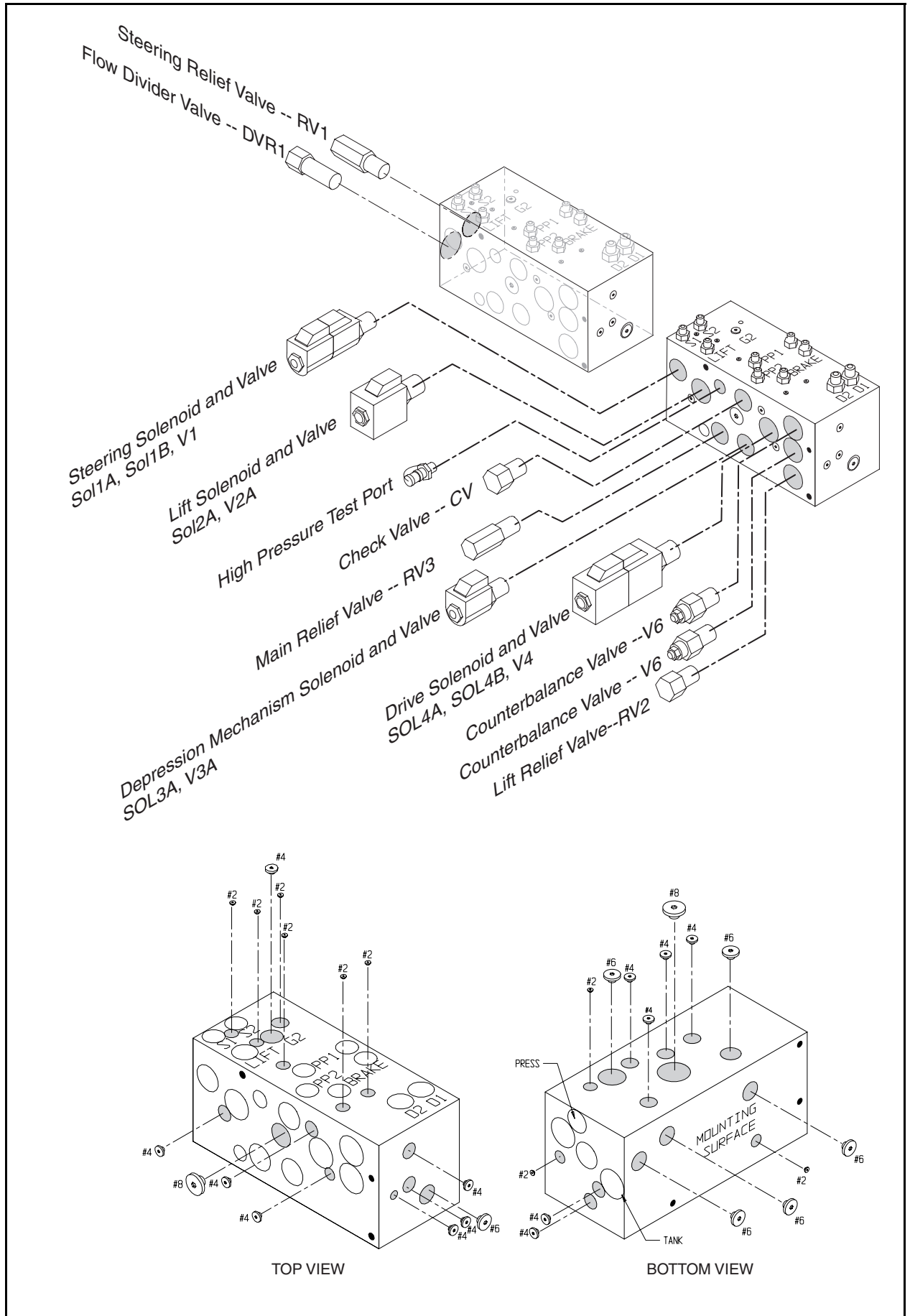


Figure 4-26: Cylinders

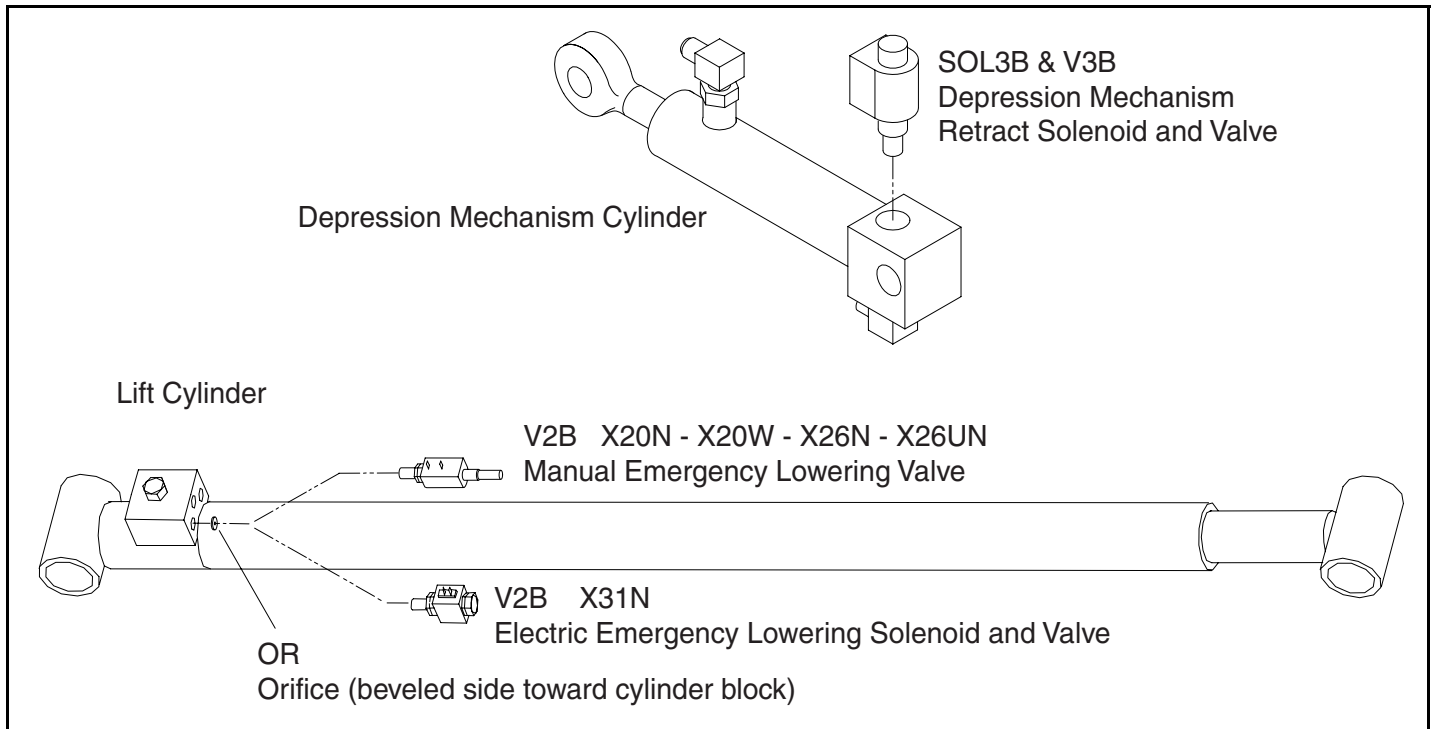
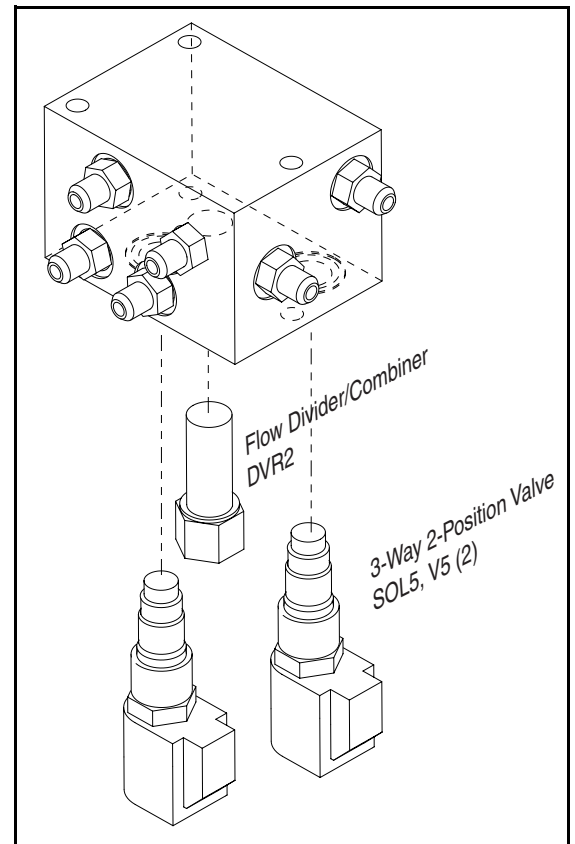


Figure 4-27: Series/Parallel Drive Manifold



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