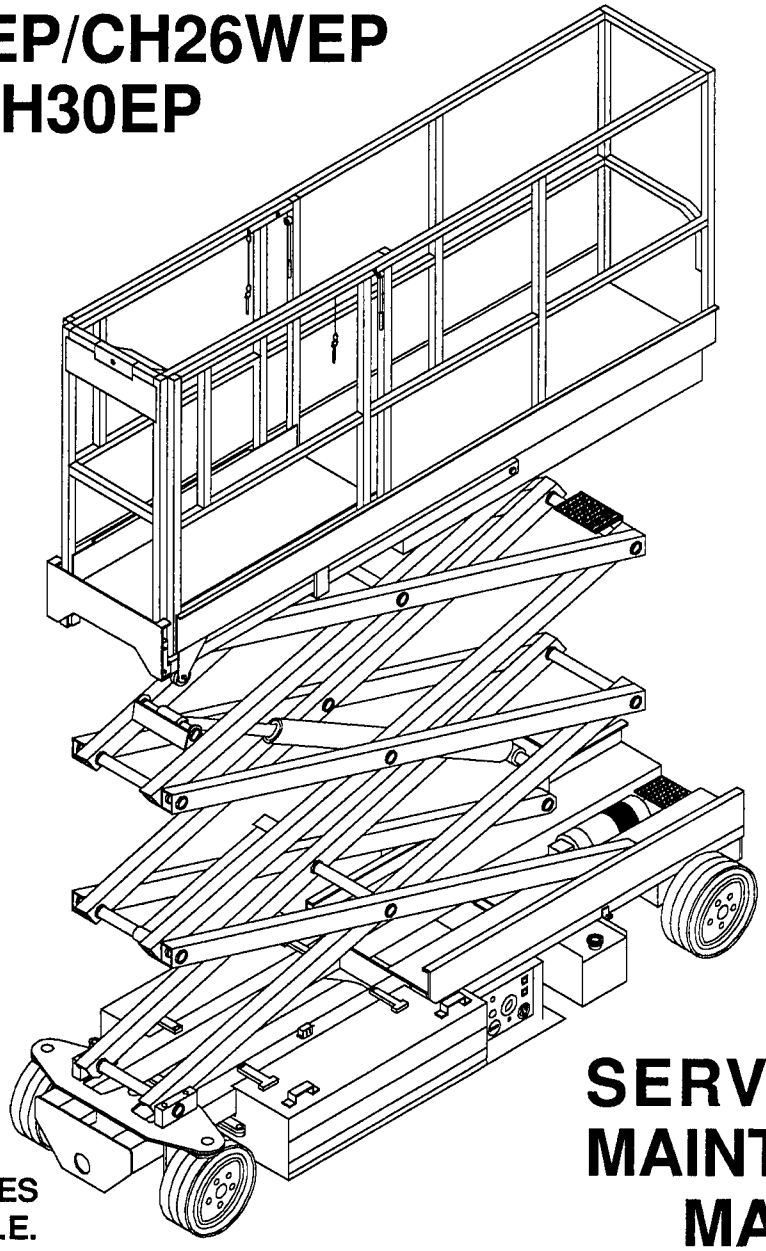
Mark Industries

SCISSOR LIFT MODELS:

J14EP
CH20NEP/CH20WEP
CH26NEP/CH26WEP
CH30EP



SERVICE AND MAINTENANCE MANUAL

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Issued: xx xxx xx
P/N 17236

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IF OPERATION OF THIS MACHINE IS REQUIRED TO PERFORM SERVICE OR MAINTENANCE, THEN THE OPERATOR MUST FIRST READ AND UNDERSTAND ALL THE INSTRUCTIONS IN THE OPERATOR'S MANUAL BEFORE OPERATING THE AERIAL LIFT.

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INTRODUCTION

Owners, Users, and Operators:

Mark Industries appreciates your choice of our machine for your application. Our number one priority is user safety which is best achieved by our joint efforts. We feel that you can make a major contribution to safety if you as the equipment users and operators:

1. **Comply** with OSHA, Federal, State, and Local Regulations.
2. **Read, Understand, and Follow** the instructions in this and other manuals supplied with this machine.
3. **Use Good, Safe Work Practices** in a common sense way.
4. **Only have trained operators** — directed by informed and knowledgeable supervision — running the machine.
5. **Only have qualified aerial lift mechanics** perform the service and maintenance procedures provided in the "Service and Maintenance Manual".

The information, specifications, vendor information, and illustrations in this publication are based on the information available at the time of approval for printing. Do to on-going changes and revisions by our many suppliers, it is often impossible to show all changes or variations. We reserve the right to make changes at any time without obligation.

If there is anything in this manual that is not clear or which you believe should be added, please send your comments to Manager of Publications, Mark Industries, 106 12th Street, S.E., Waverly, Iowa 50677; or contact us by telephone at (319) 352-3920.

Thank you!



**THIS SYMBOL MEANS YOUR SAFETY IS INVOLVED!
READ, UNDERSTAND, AND FOLLOW ALL
DANGER, WARNING, AND CAUTION DECALS
ON YOUR MACHINE.**

INTRODUCTION

Aerial lift longevity and low-cost performance depend on Periodic Maintenance, Troubleshooting and proper Service and Adjustment procedures.

It is responsibility of the owner, user, and operator to detect any unusual, sounds, odors, or other signs of abnormal performance that could indicate trouble ahead.

By detecting any problems in their early stages, you can save yourself unnecessary downtime and your employer a lot of money! Therefore, it is also your responsibility to use good judgment in detecting failures in quickly and repairing them. If you don't, one failure can lead to another.

NOTE: THE SERVICE AND MAINTENANCE PROCEDURES PROVIDED IN THIS MANUAL SHOULD ONLY BE PERFORMED BY A QUALIFIED AERIAL LIFT MECHANIC.

Before attempting to make an adjustment yourself, ask yourself if you have the RIGHT TOOLS, IF you have the PROPER TEST EQUIPMENT and IF you can accurately DIAGNOSE the cause of the problem.

If you can't answer YES to all three questions, rely on your Distributor Serviceman. He has the right tools, testing equipment and service knowledge to pin-point the problem in minutes instead of the hours consumed in hit-or-miss methods. TIME IS MONEY! He will save it for you.

If you decide to attempt an adjustment yourself, follow a logical TROUBLE SHOOTING PROCEDURE. Don't simply replace parts until the trouble is found.

Once the cause of problem or malfunction has been diagnosed, take the corrective action specified in this manual. Follow the procedures given for the specific problem. If the difficulty is not covered, consult your Mark Distributor, or the Mark Industries Product Support Department.

GENERAL INFORMATION

SECTION 2

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GENERAL INFORMATION

GENERAL SERVICE INFORMATION

Keep parts in order when large components are disassembled, particularly so when it has a great number of similar parts. Loosely reassemble assemblies whenever possible to prevent small parts from being lost. Keep sub-assembly parts together, but be careful not to get right and left hand parts mixed up.

When an assembly is removed to correct only one difficulty, it is good practice to recondition the whole assembly at that time to avoid repetition of work at a later date.

Bolts and nuts should be placed into their respective holes when removing guards, cases, etc. so that the proper bolts will be on hand for reassembling.

Safety should always be the first consideration when performing maintenance or service to equipment.

Always be conscious of a component's weight. Never attempt to move a heavy part without a proper lifting device. Ensure that adequate support is provided and that objects are set in a stable position.

Any hydraulic component disassembly or reassembly must be done in a clean, enclosed environment by personnel familiar with hydraulic systems and cleanliness procedures.

GENERAL INFORMATION

RECEIVING A NEW MACHINE

Before removing a new machine from the delivery vehicle:

1. Check and follow the Operation & Maintenance Manual for unloading procedure.
2. Check battery/batteries for cracks and for proper water level (if applicable).
3. Check for bent, broken or otherwise damaged functional components
4. Check for sufficient oil levels, both hydraulic and engine (if applicable).
5. Check for fluid leaks in hydraulic or fuel delivery systems.
6. Check lug nuts for looseness.

Upon receipt of a new machine the customer must:

1. Remove all packing materials and inspect for any damage incurred during transport.
2. Complete the NEW EQUIPMENT CONDITION REPORT
3. Complete the WARRANTY REGISTRATION.
4. If your machine is an export model, the export preservative must be removed.

EXPORT PRESERVATIVE REMOVAL

Before an export machine leaves the factory the exterior surfaces are given a coating designed to protect the paint from the environment encountered when shipping items overseas or for great distances. This coating can be removed using **warm soapy water**.

Do not use a steam cleaner to clean or wash this machine.

Do not spray water directly on **any** control panels or electrical compartments.

This preservative is applied to **export machines only.**

GENERAL INFORMATION

MACHINE STORAGE

Machines being placed in storage must be adequately protected from deterioration during the period of idleness. This will ensure that they can be restored to active service with a minimum effort.

Before removing this aerial lift from service for extended periods, it should be prepared for storage as prescribed in the following paragraphs. The specific procedure to be followed depends upon the expected period of storage.

SHORT TERM STORAGE - 30 DAYS OR LESS

Short term storage requires minimal preparation.

The **AERIAL LIFT** should be thoroughly cleaned, lubricated in accordance with Section 3, and painted surfaces retouched where the paint has deteriorated. Exposed portions of all hydraulic cylinders should be coated with multipurpose grease. Coat unpainted metal surfaces with multipurpose grease after removing any rust accumulations.

LONG TERM STORAGE - 30 DAYS OR MORE

Long term storage requires greater preparation than short term storage and must be undertaken with greater care.

The **MACHINE** should be prepared as follows:

1. Perform the short term machine storage preparation, making certain that All points with grease fittings are liberally lubricated.

2. Drain and refill the hydraulic reservoir. Refer to Section 3 when servicing the reservoir.

3. Distribute the new hydraulic fluid to all parts of the system by operating all functions.

4. The battery charger may be left connected to the batteries and should be turned on for a full charge period once a month. In extremely cold conditions it may be necessary to charge more frequently. After each charge cycle the charger should be checked to insure that it has turned off. Severe overcharging and possible damage to the batteries could result if the charger remains on for prolonged periods of time.

5. If the batteries are to be removed for storage, disconnect the charger from the batteries and clean and tape the battery cables.

6. Fill the hydraulic reservoir to the top *AFTER THE MACHINE IS PARKED IN ITS STORAGE SPOT.*

8. Coat exposed cylinder rods with grease.

RESTORING AERIAL LIFT TO SERVICE

Remove the **AERIAL LIFT** from storage via the following procedure:

1. Remove preservative lubricants from all surfaces.

2. Check all fluid levels, adding or draining as required.

3. If the batteries have been removed for storage, then install the batteries and reconnect the battery charger.

4. Perform all maintenance and lubrication of the aerial lift in accordance with the maintenance chart on pages 3 - 2 and 3 - 3.

GENERAL CLEANING, INSPECTION AND PREPARATION FOR MAJOR COMPONENT OVERHAUL

A. Clean parts having ground and polished surfaces, such as gears, bearings, and shafts with solvent type cleaners such as emulsion cleaners, or petroleum solvents excluding gasoline. Do not clean these parts in a hot tank solution or sodium hydroxide, orthosillcates or phosphates. When cleaning, remember to clean and/or replace breathers if applicable.



Exercise extreme care to avoid skin rashes, fire hazards and inhalation of vapors when using solvent-type cleaners.

B. Rough parts such as gear case housings may be cleaned hot solution tanks with mild alkali solutions providing these parts are not ground and polished. The parts should remain in the tank long enough to be thoroughly cleaned and heated through. This will aid and speed up the evaporation of the cleaning solution and the rinse water.



Exercise care to avoid skin rashes and inhalation of vapors when using alkali cleaners.

Parts cleaned in solution tanks or with alkali cleaners should be thoroughly rinsed after cleaning to remove all traces of alkali.

C. Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lint-free absorbent paper towels or wiping rags free of abrasive material such as lapping compound, metal filings or contaminated oil. Bearings should never be dried by spinning with compressed air.

D. To prevent corrosion, parts that have been cleaned and dried, then inspected, should be reassembled immediately and coated with a light film of oil.

E. It is impossible to overstress the importance of careful and thorough *inspection* of component parts prior to reassembly. Thorough visual inspection for indications of wear or stress, and the replacement of such parts as are necessary will eliminate costly and avoidable unit failure.

1. Inspect all bearings and replace any that are worn, pitted or damaged in any way. Remove parts needing replacement with a suitable puller or in a press with sleeves. Avoid the use of drifts and hammers, as they may easily mutilate or severely distort component parts.

2. Inspect all gears for wear or damage. Gears which are scored, pitted, ridged or worn should be replaced.

F. If repair is evident, replace all worn or damaged parts. Hex nuts with rounded corners, all lock washers, oil seals, o-rings and gaskets should all be replaced at the time of overhaul.

WELDING INSTRUCTIONS

CAUTION

When doing repair welding on your aerial lift take precaution attaching your ground to the component being repaired. This will eliminate the chance of arcing through a bearing, cylinder, etc., damaging the component. Paint should be removed from the surface to be used as the "ground" (earth).

CAUTION

Use necessary precaution when welding around fuel tanks, oil reservoir, batteries, tubing and pressure systems.

CAUTION

When welding close to glass, cylinder rods, or any polished surface, provide adequate protection from splatter.

CAUTION

Always disconnect the battery cables and applicable grounds before welding. If equipped with an engine, never weld when the engine is running.

CAUTION

Do not weld on wet surfaces since this will cause hydrogen embrittlement of the weld.

CAUTION

Always have a fire extinguisher on hand in case of fire. Adequate ventilation and dry area are necessary. Protective clothing should be used and all persons in the welding area should have protection for their eyes.

AWS CLASS E7018 Low hydrogen rod for normal repairs on low allow to medium carbon steel. All position welding, good penetration and crack resisting up to 80,000 yield. Also suitable for repair of previous intershield welds.

AWS CLASS E11018G Low hydrogen rod for repair on high strength allow steel such as T-1, 80,000 to 100,000 yield. All position welding, good penetration and high tensile strength up to 110,000.

NOTE: Low hydrogen rod E7018 must be used within four (4) hours upon removal from a freshly opened container or from a storage oven.

Low hydrogen rod E11018G must be used within 1/2 hour upon removal from its container or from a storage oven.

SPECIFICATIONS & RANGE DIAGRAMS

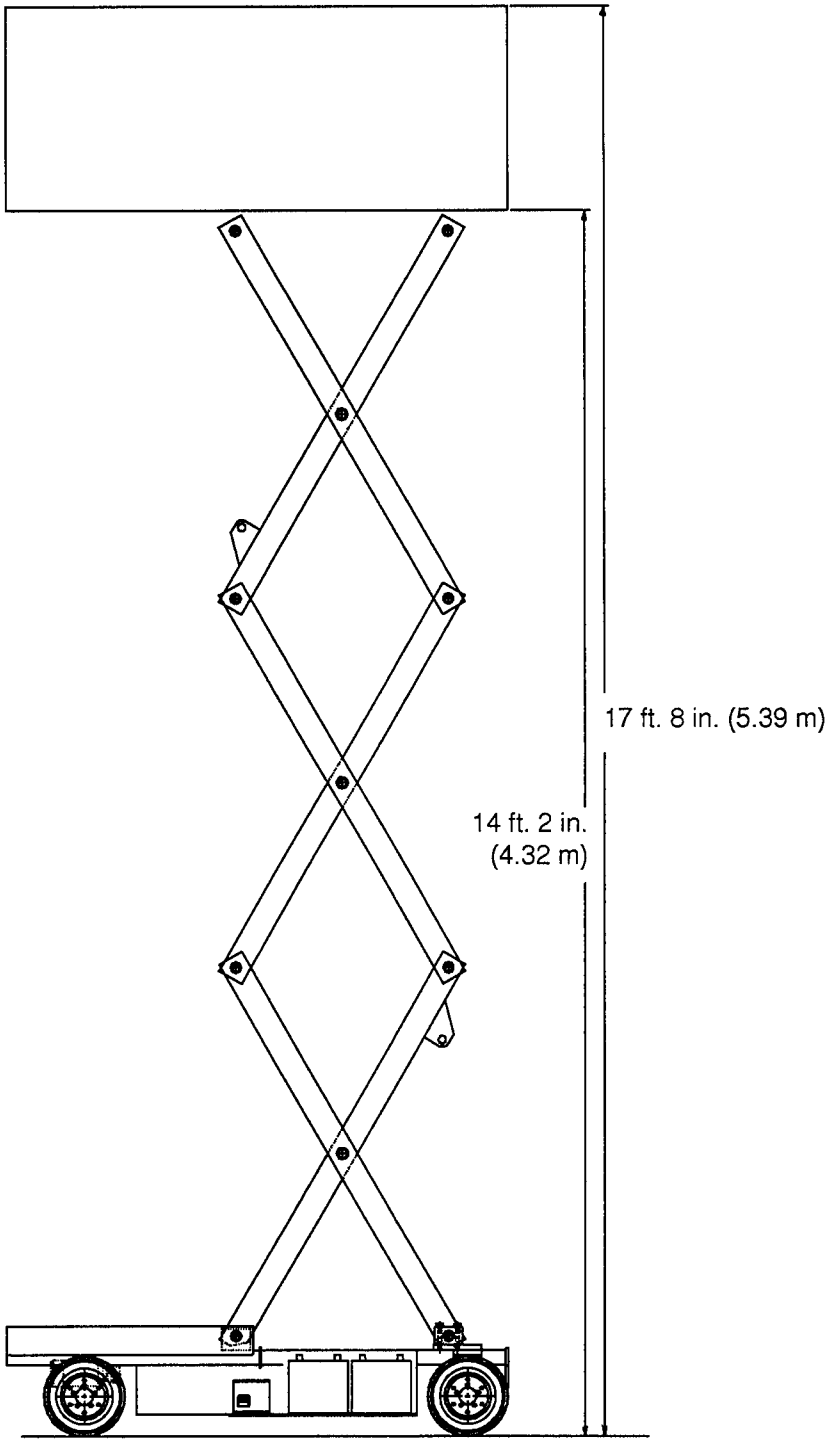
MODEL	PAGE
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CH20NEP/CH20WEP	2-7-4
CH26NEP/CH26WEP	2-7-7
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SPECIFICATIONS - J14EP

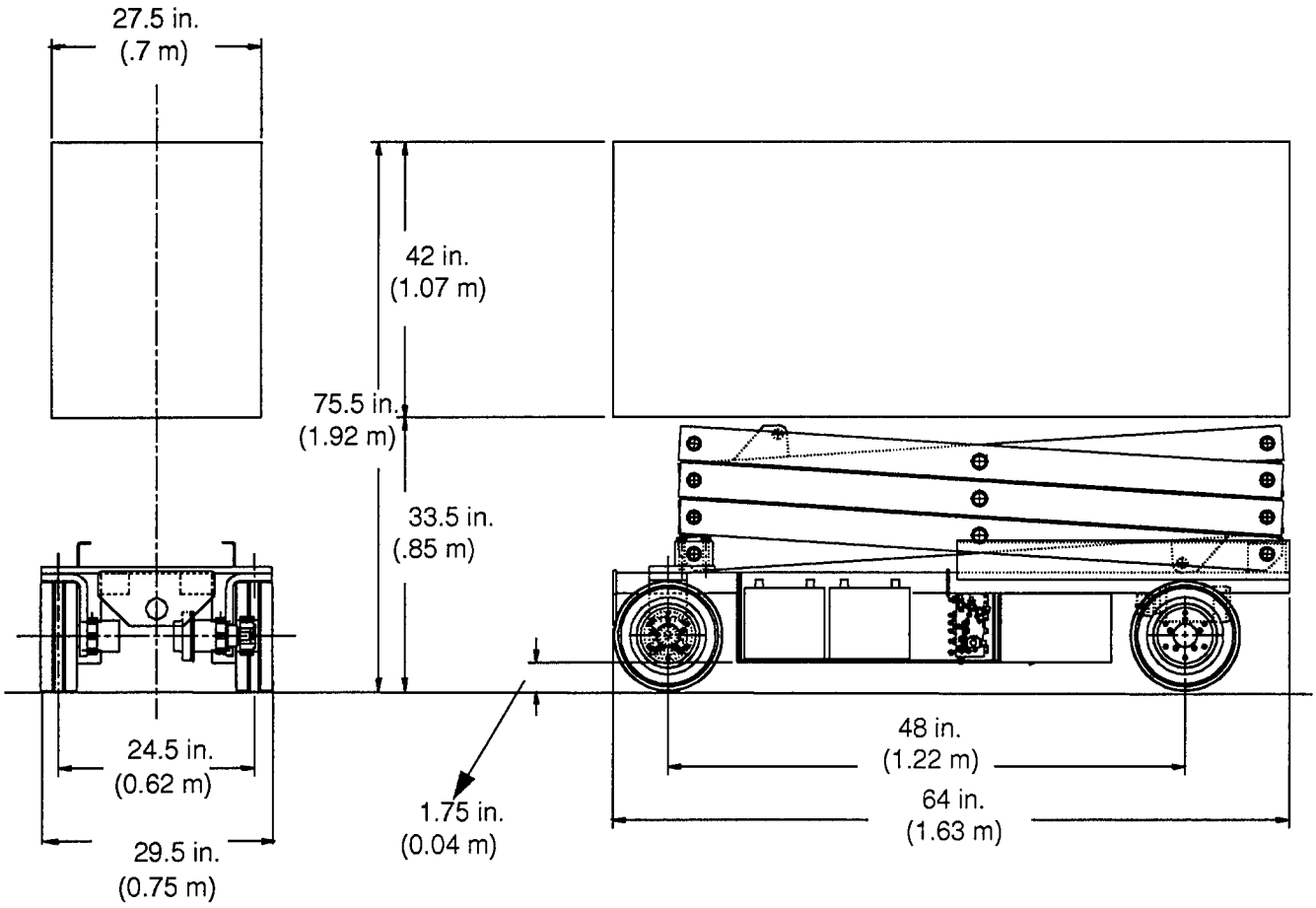
*Working Height (maximum)	20 ft. 2 in. (6.15 m)
Platform Height (maximum)	14 ft. 2 in. (4.32 m)
Platform (minimum - ground to platform)	33.5 in. (.85 m)
Stowed Height	75.5 in. (1.92 m)
Length (overall)	64 in. (1.63 m)
Width (overall)	29.5 in. (.75 m)
— Dimensions (inside) — Guard rails (non-removable) — Toe plate — Extendable platform (EP)	27.5 in. x 60 in. (.70 m x 1.52 m) 42 in. (1.07 m) 6 in. (.15 m) 24 in. (.61 m) forward
Load Capacity (maximum weight)	500 lbs. (226.8 kg) Incl. Occupants
Rated Number of Occupants	3 Occupants
Load Allowed on EP Deck (maximum)	250 lbs. (113 kg) Incl. Occupants
Wheelbase	48 in. (1.22 m)
Wheel Track	24.5 in. (.62 m)
Floor Loading Pressure (concentrated)	82.02 psi (5.75 kg/cm^2)
Wheel Load (maximum)	1070 lbs. (486 kg)
Turning Radius (inside curb)	56 in. (1.42 m)
— Low — High — Gradeability	1.0 m.p.h. (1.61 km/h) 2.4 m.p.h. (3.86 km/h) 10%
Lift/Lower Time (maximum load)	20/22 sec.
— Battery Voltage — Battery Capacity — Battery Weight	4 @ 6 VDC (series) 250 amp/hr (4) 78 lbs. (35.41 kg) - per battery
Hydraulic Tank Capacity	4.5 gal. (17.03 l)
Battery Charger	24 VDC 30 amp
Tire Size	5.30 x 6.00 monofilled
Hydraulic Working Pressure (maximum)	2500 psi (172 bar)
Ground Clearance	1.75 in. (.04 m)
Approximate Shipping Weight (with EP)	1865 lbs. (847 kg)

*** Clearance must be allowed for body parts for this and other work heights**

SPECIFICATIONS - J14EP



SPECIFICATIONS - J14EP



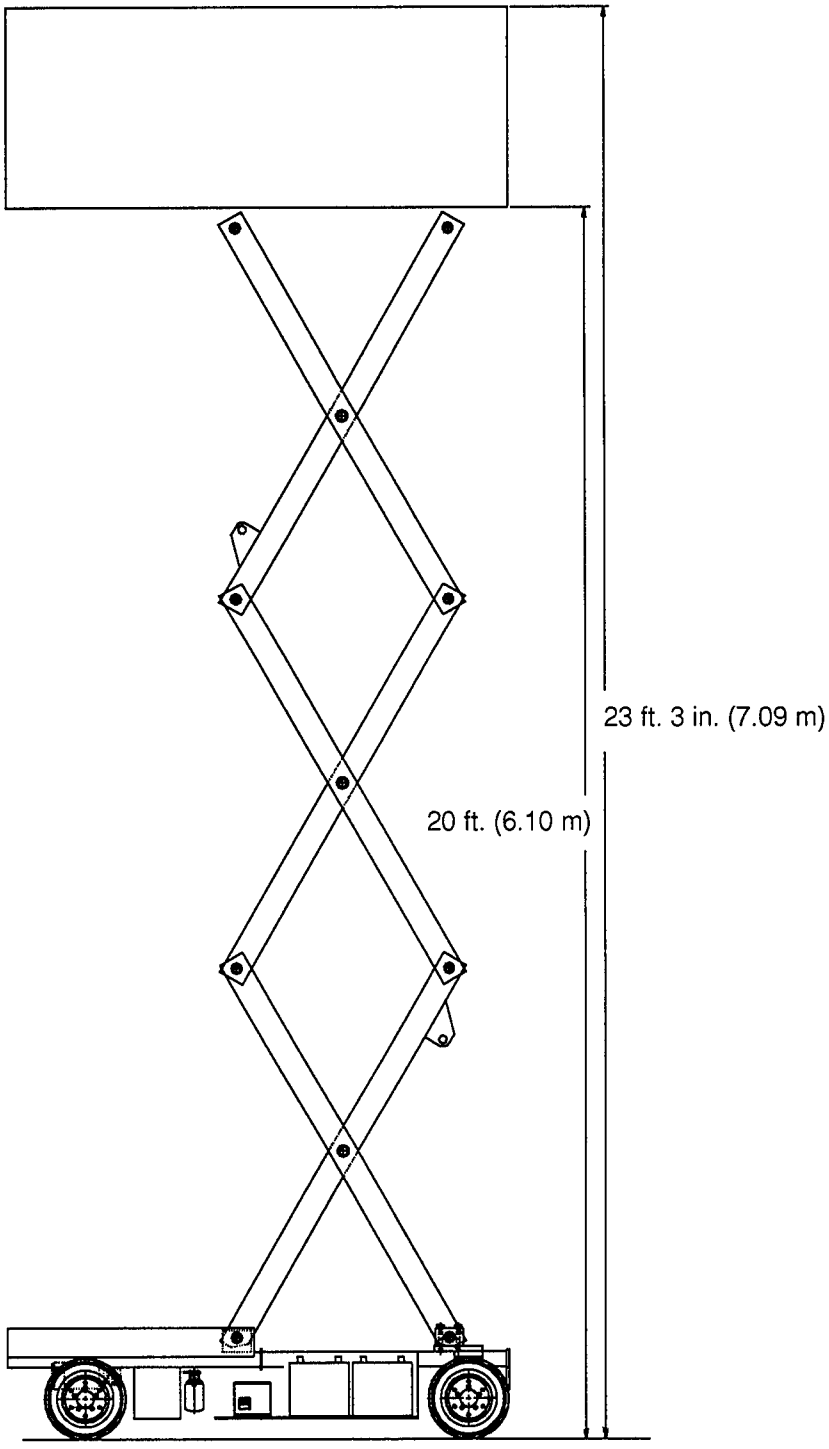
NOTES

SPECIFICATIONS - CH20NEP/CH20WEP

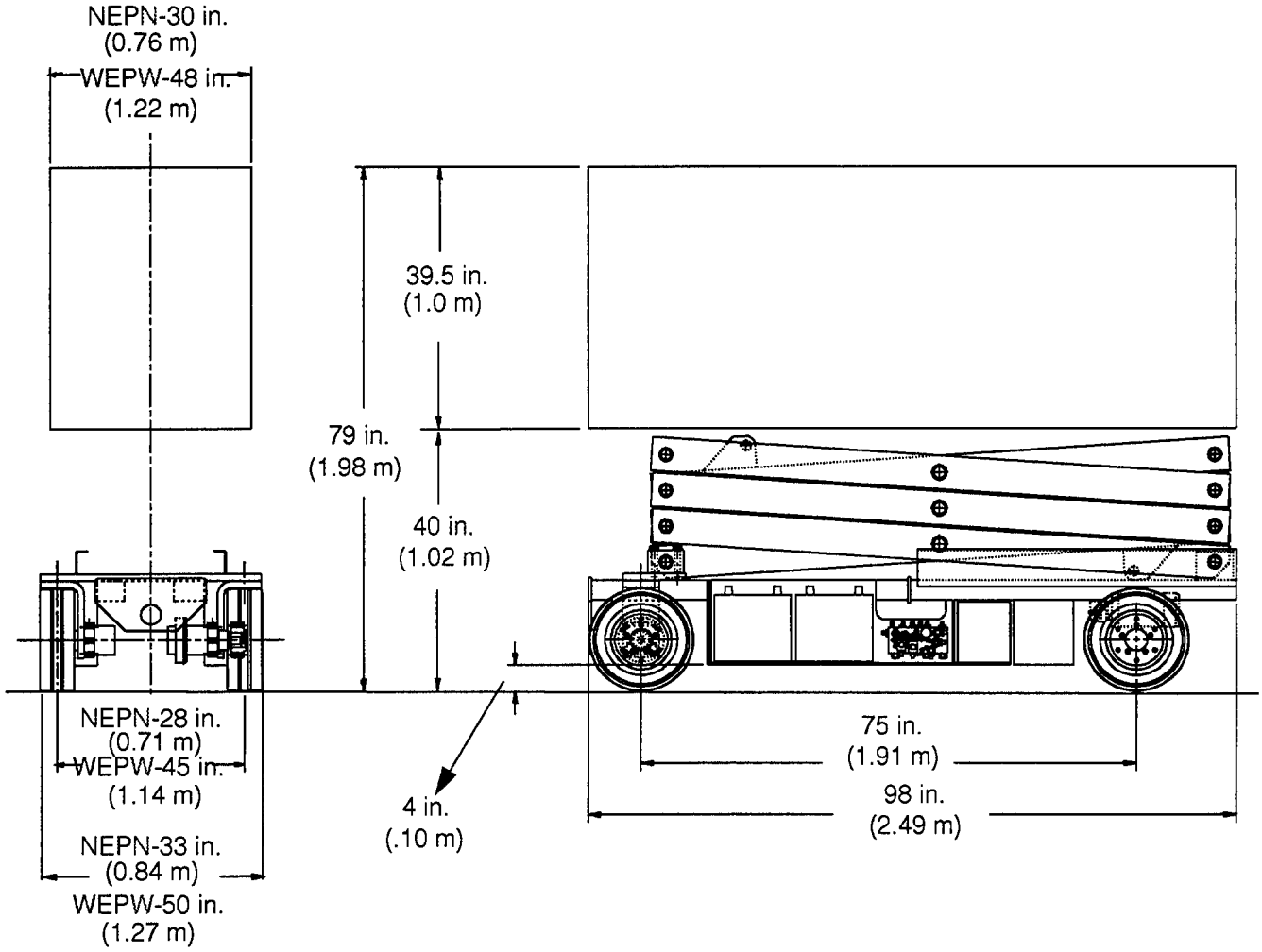
DESCRIPTION	CH20NEP	CH20WEP
*Working Height (maximum)	26 ft. (7.92 m)	26 ft. (7.92 m)
Platform Height (maximum)	20 ft. (6.10 m)	20 ft. (6.10 m)
Platform (minimum - ground to platform)	40 in. (1.02 m)	40 in. (1.02 m)
Stowed Height	79 in. (1.98 m)	84 in. (2.13 m)
Length (overall)	98 in. (2.49 m)	98 in. (2.49 m)
Width (overall)	33 in. (0.84 m)	50 in. (1.27 m)
Platform — Dimensions (outside) — Guard rails (non-removable) — Guard rails (folded down) — Toe plate — Extendable platform	 30 in. x 98 in. (0.76 x 2.49 m) 39.5 in. (1.0 m) Not Available 6 in. (.15 m) 36 in. (.91 m) forward	 48 in. x 98 in. (1.22 x 2.49 m) 39.5 in. (1.0 m) Optional 6 in. (.15 m) 36 in. (.91 m) forward
Load Capacity (maximum weight)	800 lbs. (363 kg) Incl. Occupants	1000 lbs. (453.6 kg) Incl. Occupants
Rated Number of Occupants	3 Occupants	3 Occupants
Load Allowed on EP Deck (maximum)	300 lbs (136.1 kg)	300 lbs (136.1 kg)
Wheelbase	75 in. (1.91 m)	75 in. (1.91 m)
Wheel Track	28 in. (0.71 m)	45 in. (1.14 m)
Floor Loading Pressure (Concentrated)	120 psi (8.43 kg/sq-m)	Not Available this Printing
Wheel Load (maximum)	2230 lbs. (1013 kg)	Not Available this Printing
Turning Radius (inside curb)	5 ft. 4 in. (1.63 m)	5 ft. 4 in. (1.63 m)
— Low — High — Gradeability	1.0 m.p.h. (1.61 km/h) 2.0 m.p.h. (3.22 km/h) 10%	1.0 m.p.h. (1.61 km/h) 2.0 m.p.h. (3.22 km/h) 25%
Lift/lower Speed (maximum load)	37/30 sec.	37/30 sec.
— Battery Voltage — Battery Capacity — Battery Weight	4 @ 6 VDC 220 amp/hr (4) 65 lbs. (29.51 kg)	4 @ 6 VDC 220 amp/hr (4) 65 lbs. (29.51 kg)
Hydraulic Tank Capacity	12 gal. (45.4 l)	12 gal. (45.4 l)
Battery Charger	24 VDC 40 amp	24 VDC 40 amp
Tire Size	4.00 x 8.00 solid tire	4.00 x 8.00 solid tire
Hydraulic Working Pressure (maximum)	2500 psi (173 bar)	2500 psi (173 bar)
Ground Clearance	4 in. (.10 m)	4 in. (.10 m)
Approximate Shipping Weight (with EP)	3300 lbs. (1497 kg)	3600 lbs. (1633 kg)

* **Clearance must be allowed for body parts for this and other work heights**

SPECIFICATIONS - CH20NEP/CH20WEP



SPECIFICATIONS - CH20NEP/CH20WEP



GENERAL INFORMATION

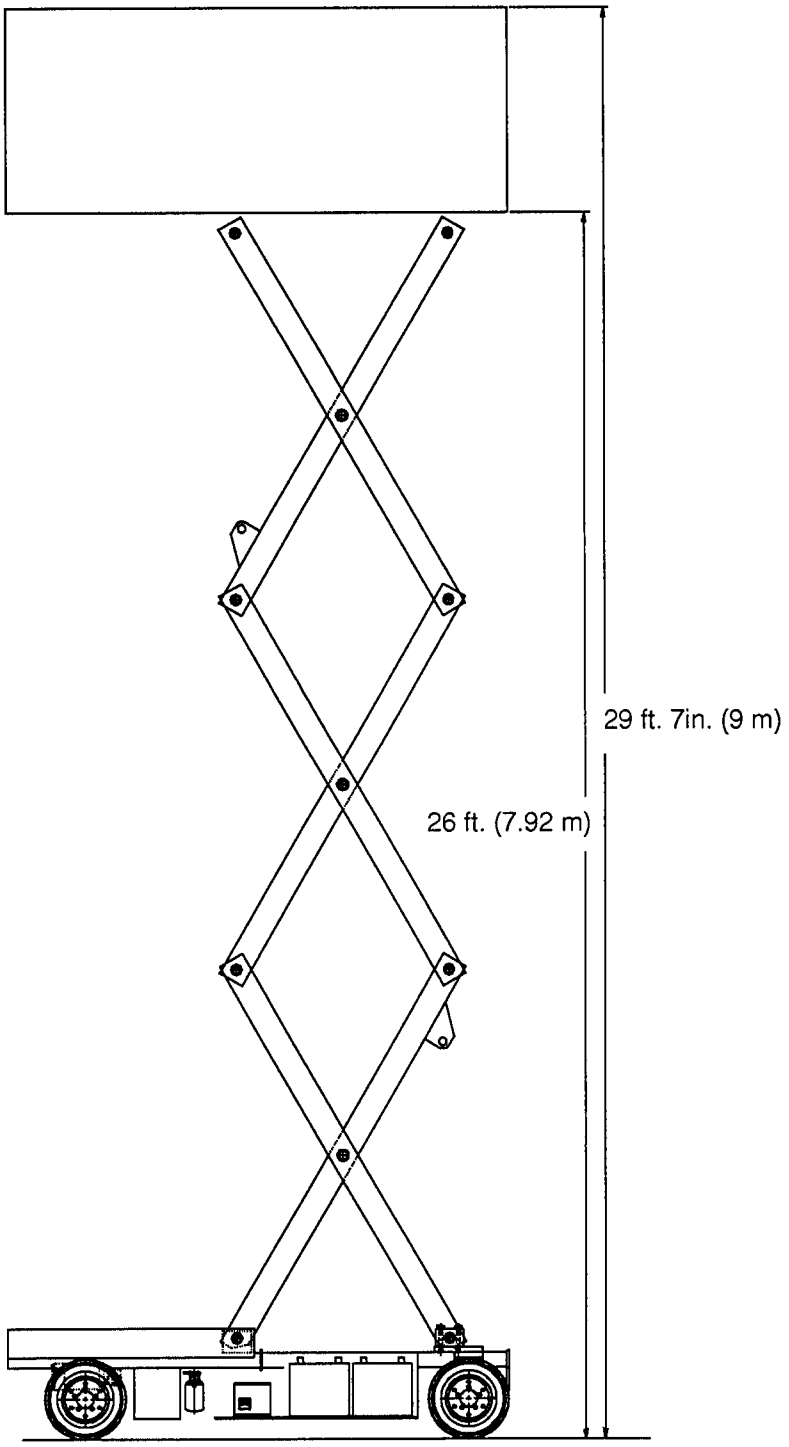
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SPECIFICATIONS - CH26NEP/CH26WEP

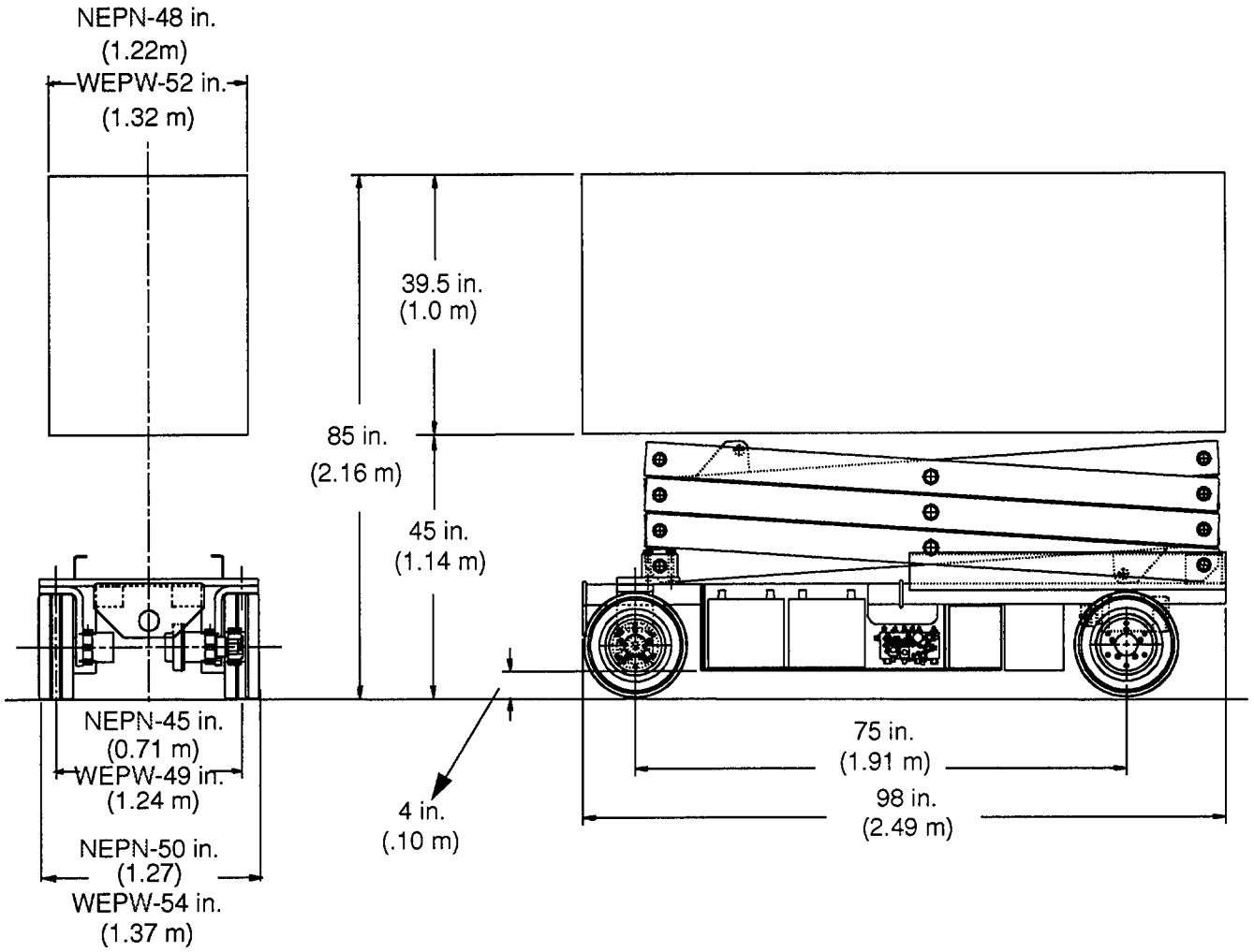
DESCRIPTION	CH26NEP	CH26WEP
*Working Height (maximum)	32 ft. (9.75 m)	32 ft. (9.75 m)
Platform Height (maximum)	26 ft. (7.92 m)	26 ft. (7.92 m)
Platform (minimum - ground to platform)	45 in. (1.14 m)	45 in. (1.14 m)
Stowed Height	85 in. (2.16 m)	85 in. (2.16 m)
Length (overall)	98 in. (2.49 m)	98 in. (2.49 m)
Width (overall)	50 in. (1.27 m)	54 in. (1.37 m)
Platform — Dimensions (outside) — Guard rails (non-removable) — Guard rails (folded down) — Toe plate — Extendable platform	 48 in. x 98 in. (1.22 x 2.49 m) 39.5 in. (1.0 m) Optional 6 in. (.15 m) 36 in. (.91 m) forward	 52 in. x 98 in. (1.32 x 2.49 m) 39.5 in. (1.0 m) Optional 6 in. (.15 m) 36 in. (.91 m) forward
Load Capacity (maximum weight)	1000 lbs. (453.6 kg) Incl. Occupants	1300 lbs. (589.7 kg) Incl. Occupants
Rated Number of Occupants	3 Occupants	3 Occupants
Load Allowed on EP Deck (maximum)	300 lbs (136.1 kg)	300 lbs (136.1 kg)
Wheelbase	75 in. (1.91 m)	75 in. (1.91 m)
Wheel Track	45 in. (1.14 m)	49 in. (1.24 m)
Floor Loading Pressure (Concentrated)	135 psi (9.50 kg/sq-m)	Not Available this Printing
Wheel Load (maximum)	2630 lbs. (1193 kg)	Not Available this Printing
Turning Radius (inside curb)	4 ft. 7in. (1.40 m)	4 ft. 5in. (1.35 m)
Drive Speed (No Load) — Low — High — Gradeability	1.0 m.p.h. (1.61 km/h) 2.0 m.p.h. (3.22 km/h) 25%	1.0 m.p.h. (1.61 km/h) 2.0 m.p.h. (3.22 km/h) 25%
Lift/lower Speed (maximum load)	38 sec.	38 sec.
Power system (24 VDC) — Battery Voltage — Battery Capacity — Battery Weight	4 @ 6 VDC 220 amp/hr (4) 65 lbs. (29.51 kg)	4 @ 6 VDC 220 amp/hr (4) 65 lbs. (29.51 kg)
Hydraulic Tank Capacity	12 gal. (45.4 l)	12 gal. (45.4 l)
Battery Charger	24 VDC 40 amp	24 VDC 40 amp
Tire Size	4.00 x 8.00 solid tire	4.00 x 8.00 solid tire
Hydraulic Working Pressure (maximum)	2500 psi (173 bar)	2500 psi (173 bar)
Ground Clearance	4 in. (.10 m)	4 in. (.10 m)
Approximate Shipping Weight (with EP)	4200 lbs. (1905 kg)	4400 lbs. (1996 kg)

* **Clearance must be allowed for body parts for this and other work heights**

SPECIFICATIONS - CH26NEP/CH26WEP



SPECIFICATIONS - CH26NEP/CH26WEP



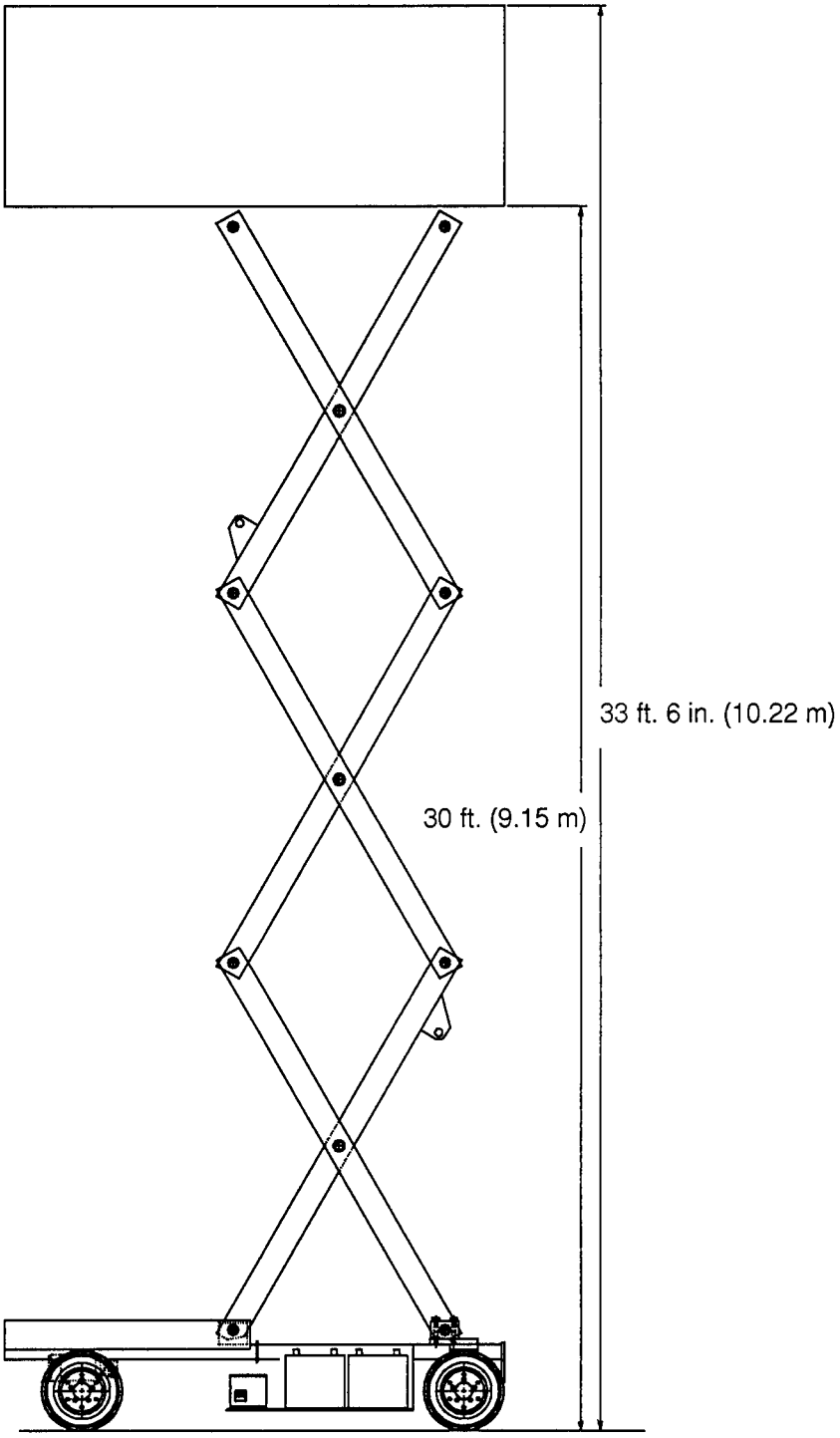
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SPECIFICATIONS - CH30EP

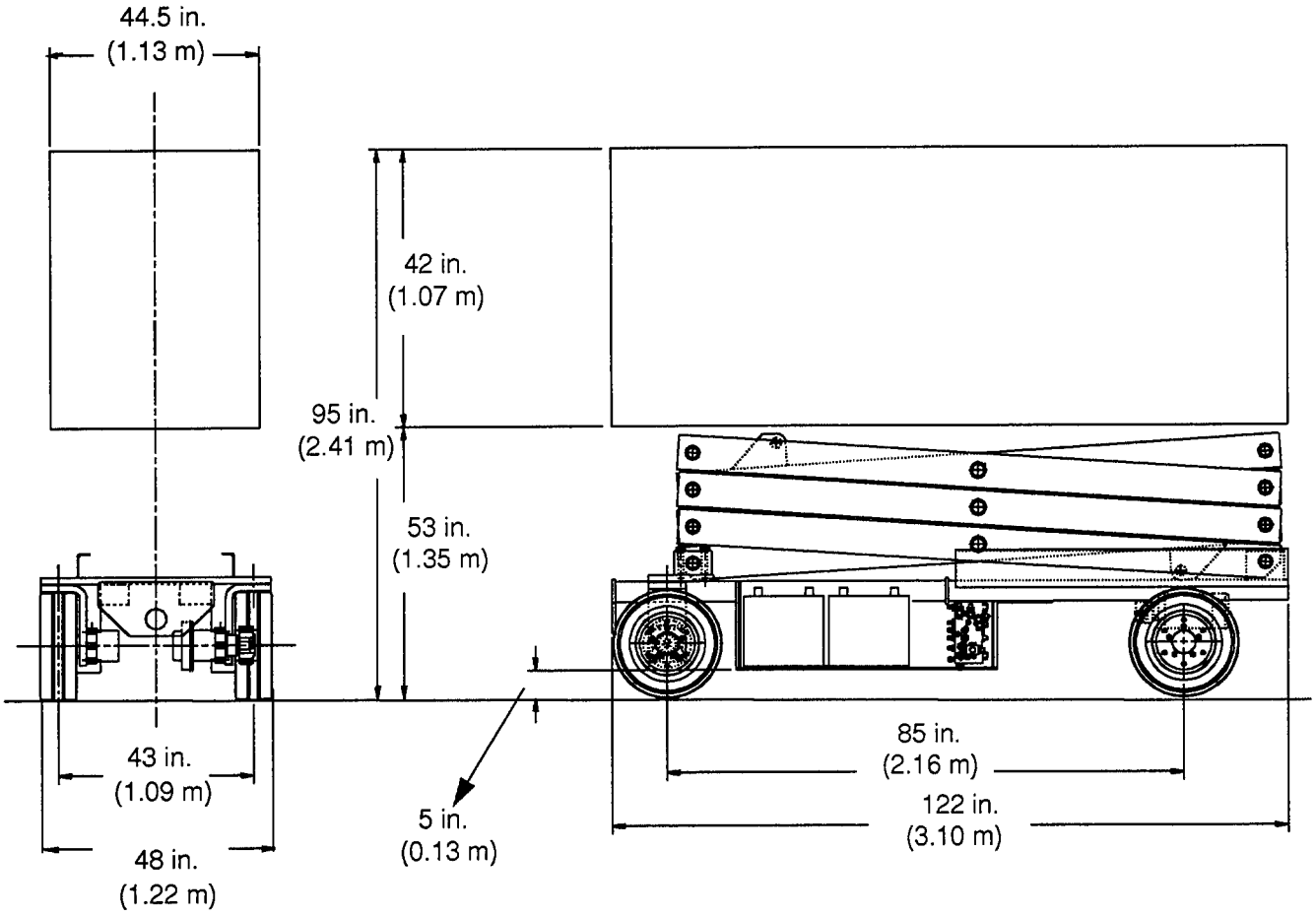
	W/1000 lbs. Capacity, 18' Drive Cutout	W/700 lbs. Capacity, Full Elev. Drive
*Working Height (maximum)	36 ft. (10.98 m)	36 ft. (10.98 m)
Platform Height (maximum)	30 ft. (9.15 m)	30 ft. (9.15 m)
Platform (minimum - ground to platform)	53 in. (1.35 m)	53 in. (1.35 m)
Stowed Height	95 in. (2.41 m)	95 in. (2.41 m)
Length (overall)	122 in. (3.10 m)	122 in. (3.10 m)
Width (overall)	48 in. (1.22 m)	48 in. (1.22 m)
Platform — Dimensions (inside) — Guard rails (non-removable) — Guard rails (folded down) — Toe plate — Extendable platform (EP)	44.5 in. x 112.5 in. (1.13 x 2.86 m) 42 in. (1.07 m) Optional - 76in. (1.93m) 6 in. (.15 m) 36 in. (.91 m) forward	44.5 in. x 112.5 in. (1.13 x 2.86 m) 42 in. (1.07 m) Optional - 76in. (1.93m) 6 in. (.15 m) 36 in. (.91 m) forward
Load Capacity (maximum weight)	1000 lbs. (454 kg) Incl. Occupants	700 lbs. (317 kg) Incl. Occupants
Rated Number of Occupants	3 Occupants	3 Occupants
Load Allowed on EP Deck (maximum)	1000 lbs. (454 kg) Incl. Occupants	300 lbs. (136 kg) Incl. Occupants
Wheelbase	85 in. (2.16 m)	85 in. (2.16 m)
Wheel Track	43 in. (1.09 m)	43 in. (1.09 m)
Floor Loading Pressure (Concentrated)	155 psi (10.9 kg/cm^2)	155 psi (10.9 kg/cm^2)
Wheel Load (maximum)	3250 lbs. (1474 kg)	3250 lbs. (1474 kg)
Turning Radius (inside curb)	34 in. (.86 m)	34 in. (.86 m)
Drive Speed (MAX)— Low (No Load) — High — Gradeability	0 - 1.1 m.p.h. (1.77 km/h) 0 - 2.9 m.p.h. (4.67 km/h) 25%	0 - 1.1 m.p.h. (1.77 km/h) 0 - 2.9 m.p.h. (4.67 km/h) 20%
Maximum Travel Height	18 ft. (5.49 m)	Maximum Height
Lift/lower Time (maximum load)	71/53 sec.	71/53 sec.
Power system — Battery Voltage (24 VDC) — Battery Capacity — Battery Weight	4 @ 6 VDC 250 amp/hr (4) 78 lbs. (35.41 kg) - per battery	4 @ 6 VDC 250 amp/hr (4) 78 lbs. (35.41 kg) - per battery
Hydraulic Tank Capacity	16 gal. (60.64 l)	16 gal. (60.64 l)
Battery Charger	110 VAC/24 VDC/40 amp	110 VAC/24 VDC/40 amp
Tire Size	4.00 x 8.00 solid tire	4.00 x 8.00 solid tire
Hydraulic Working Pressure (maximum)	2500 psi (173 bar)	2500 psi (173 bar)
Ground Clearance	5 in. (.13 m)	5 in. (.13 m)
Approximate Shipping Weight (with EP)	4510 lbs. (2048 kg)	4740 lbs. (2150 kg)

*** Clearance must be allowed for body parts for this and other work heights**

SPECIFICATIONS - CH30EP



SPECIFICATIONS - CH30EP



TORQUE RATINGS

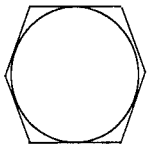
ES - 100.0
TORQUE RATINGS
FOR
DRY - UNCOATED FASTENERS

TORQUE VALUES TO BE WITHIN 5%
ALL FIGURES IN FOOT POUND

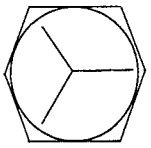
THIS TABLE DOES NOT APPLY TO HYDRAULIC CONNECTIONS. WHEN TORQUING HYDRAULIC CONNECTIONS REFER TO ES-100.1

NOM. DIA. IN.	GRADE 2	GRADE 5	GRADE 8
1/4	6 - * 4	8	12
5/16	12 - * 7	20	25
3/8	20 - * 12	30	45
7/16	35 - * 20	50	75
1/2	50 - * 30	80	110
9/16	75 - * 45	115	160
5/8	100 - * 60	160	225
3/4	180 - * 110	280	400
7/8	175	450	640
1	265	680	970
1-1/8	375	840	1,380
1-1/4	530	1,200	1,930
1-3/8	700	1,570	2,540
1-1/2	930	2,080	3,380
1-3/4	1,460	2,090	5,300
2	2,200	3,200	7,990
2-1/4	3,200	5,350	11,690
2-1/2	4,400	7,300	15,990

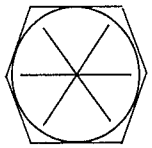
BOLT HEAD MARKING



GRADE 2



GRADE 5



GRADE 8

The above information was compiled for U.N.C. Threaded Fasteners.

NOTE: If threads are not lubricated prior to assembly or are not plated use Torque Spec. ES-100.0

** = Torque Values for Bolts and Screws longer than 6"*

Fasteners as supplied by the vendor are considered not lubricated.

TORQUE RATINGS

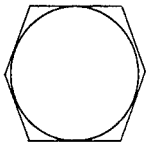
ES - 100.1
TORQUE RATINGS
FOR
LUBRICATED OR PLATED FASTENERS

TORQUE VALUES TO BE WITHIN 5%
ALL FIGURES IN FOOT POUND

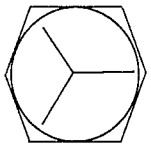
REFER TO THIS TABLE WHEN TORQUING HYDRAULIC CONNECTIONS (Piping & Cylinders).

NOM. DIA. IN.	GRADE 2	GRADE 5	GRADE 8
1/4	5 - * 3	7	10
5/16	9 - * 5	14	20
3/8	16 - * 9	25	35
7/16	25 - * 15	40	55
1/2	40 - * 20	60	85
9/16	55 - * 30	85	120
5/8	75 - * 45	120	170
3/4	135 - * 80	210	300
7/8	130	340	485
1	200	515	720
1-1/8	280	635	1,030
1-1/4	400	890	1,450
1-3/8	520	1,175	1,900
1-1/2	695	1,560	2,530
1-3/4	1,100	1,825	3,980
2	1,650	2,750	6,000
2-1/4	2,400	4,000	8,760
2-1/2	3,300	5,500	12,000

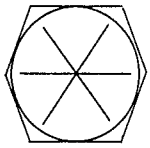
BOLT HEAD MARKING



GRADE 2



GRADE 5



GRADE 8

The above information was compiled for U.N.C. Threaded Fasteners.

NOTE: If threads are not lubricated prior to assembly or are not plated use Torque Spec. ES-100.0

** = Torque Values for Bolts and Screws longer than 6"*

Fasteners as supplied by the vendor are considered not lubricated.

TORQUE CHART

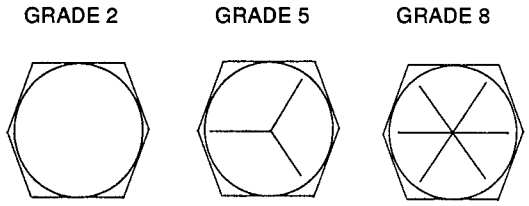
The following table contains many of the more common torques used when perfoming service or maintenance on the machine, and may be used as a quick reference

Table 1:

AREA	TORQUE
WHEEL NUTS (ALL WHEELS)	90 - 95 ft. lbs. (122-128 N•m) Dry
DRIVE MOTOR CASTLE NUTS	240-280 ft. lbs. (back off to 1st available hole)
BRAKE HOUSING BOLTS	55 - 60 ft. lbs. (75-82 N•m) Lubed
STEERING CYLINDER PISTON NUT	75 - 85 ft. lbs. (102-115 N•m) Lubed
LIFT CYLINDER PISTON NUT	650 ft. lbs. (889 N•m) Lubed

NOTE: CAPSCREW OR BOLT REPLACEMENT: Any bolt or capscrew replacement should be of the same grade or greater than the original. Grade markings are shown below:

BOLT HEAD MARKING



GENERAL INFORMATION

NOTES

SUGGESTED SPARE PARTS LIST: MARKLIFT SCISSOR LIFTS

J14EP/CH20NEP/CH20WEP/CH26NEP/CH26WEP/CH30EP

NOTE: 1 THE KINDS OF PARTS LISTED REFLECT ITEMS WHICH IT MAY BE DESIROUS TO HAVE ON HAND TO ENABLE RAPID REPAIR OF YOUR MARKLIFT SCISSOR LIFT DURING THE COURSE OF A NORMAL SERVICE LIFE. IT IS NOT INTENDED TO BE ALL INCLUSIVE, OTHER PARTS MAY BE REQUIRED DUE TO UNFORSEEN CIRCUMSTANCES, PART NUMBERS ARE SUBJECT TO CHANGE AS A CONSEQUENCE OF THE CONTINUED DEVELOPMENT OF THIS PRODUCT.

NOTE: 2 PARTS LISTED MAY HAVE MULTIPLE APPLICATIONS, SEE NOTES IN REMARKS COLUMN

Ref.	Part No.	Description	Qty	Remarks
1	181111	DECAL, FRONT OF EXTENDABLE DECK	1	
2	181312	DECAL, RATED WORK LOAD	3	3 REQUIRED
3	181313	DECAL, SERVICE STAND	3	3 REQUIRED
4	183402	DECAL, HYDRAULIC-SYSTEM FLUID	1	
5	130949	DECAL, TIRE REPLACEMENT	4	4 REQUIRED
6	181112	DECAL, BATTERY BOX	2	2 REQUIRED
7	181824	DECAL, FORKLIFT BOOT	2	2 REQUIRED
8	160137	TAPE, YELLOW W/BLACK STRIPE	2	2 FEET REQUIRED
9	182815	DECAL, AERIAL-CONTROL BOX	1	
10	181825	DECAL, EMERGENCY-LOWERING VALVE	1	
11	182778	DECAL, GROUND-CONTROL PANEL	1	
12	20481	TOGGLE SWITCH, LIFT/LOWER	2	2 REQUIRED
13	20482	TOGGLE SWITCH, DRIVE-SPEED SELECT	1	
14	70646	SWITCH, EMERGENCY-STOP "CONTACTS"	1	
15	70645	BUTTON, EMERGENCY-STOP "ACTUATOR"	1	
16	70780	SWITCH, CONTROLS-ENABLE "CONTACTS"	1	
17	70645	BUTTON, CONTROLS-ENABLE "ACTUATOR"	1	
18	69443	SWITCH, DRIVE/STEER OPER.	2	P/N 70778 CONTROLLER
19	69944	BOOT, DRIVE/STEER CONTROLLER	1	P/N 70778
20	70781	INDICATOR LAMP, UNSTABLE-CONDITION WARNING	1	
21	70259	ALARM, BUZZER, UNSTABLE CONDITION WARNING	1	
22	4011	PUSH-BUTTON SWITCH, DESCENT OVERRIDE	1	
23	70373	BOOT, DESCENT-OVERRIDE SWITCH	1	FOR P/N 4011

RECOMMENDED SPARE PARTS LIST

Ref.	Part No.	Description	Qty	Remarks
24	441 6834	PROXIMITY SWITCH, SPEED/LOWERING	1	
25	441 6835	CABLE, PROXIMITY SWITCH	1	
26	65124	PIN, "BALL-LOK DETENT" (SECURE CONTROL BOX)	1	
27	65669	LANYARD ASSEMBLY	1	FOR USE WITH P/N 65124
28	372 3041	LATCH, BATTERY/COMPONENT BOX COVER	2	
29	69734	KIT, ELECTRONIC TIMER	1	P/N 70789 CHARGER
30	600270	RELAY, TIMER KIT	1	FOR P/N 69734
31	66726	FUSE ASSEMBLY	1	P/N 70789
32	69733	DIODE ASSEMBLY, WITH HEAT SINK	1	P/N 70789
33	69748	FILTER ELEMENT, HYDRAULIC-FLUID RETURN	5	
34	70362	RELAY, PUMP-MOTOR OPERATION	1	
35	2717	KEY SWITCH	1	
36	66961	KEY, "SPARE"	1	FOR P/N 70610
37	70785	BOOT, CIRCUIT BREAKER	1	P/N 20562
38	70606	RELAY, DRIVE/LIFT/LOWER/HIGH SPEED ENABLE	2	
39	70593	RELAY BASE	1	FOR P/N 70590
40	70784	RELAY HOLD-DOWN SPRING	1	FOR P/N 70590
41	31074	SLOPE SENSOR	1	
42	68164	BRUSH SET, PUMP MOTOR	1	P/N 67836 (2 REQ.)
43	68518	SEAL KIT, HYDRAULIC PUMP	1	P/N 67835
44	69442	SEAL KIT, CONTROL VALVE	1	
45	69229	SOLENOID VALVE, PLATFORM LIFT/DRIVE SPEED/ETC.	1	
46	69339	COIL, SOLENOID VALVE, STEER/LIFT ETC.	1	
47	69339	COIL, SOLENOID VALVE, DRIVE	1	
48	135231	SOLENOID VALVE, PLATFORM LOWERING (IN LIFT CYLINDER)	1	
49	69945	COIL, SOLENOID VALVE	1	P/N 135231

RECOMMENDED SPARE PARTS LIST

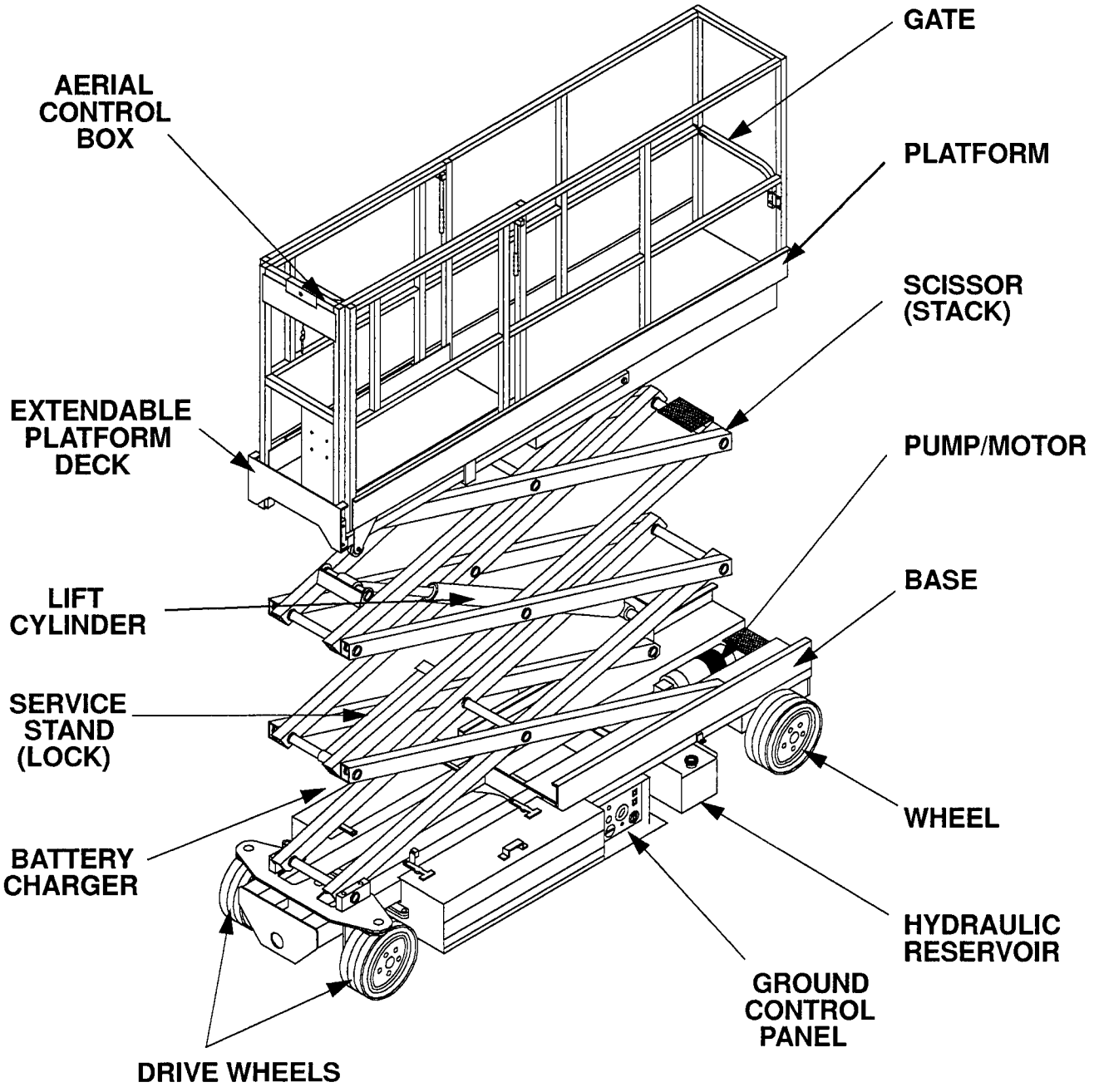
Ref.	Part No.	Description	Qty	Remarks
50	69753	SEAL KIT, DRIVE MOTOR, LEFT HAND	1	P/N 135144
51	69752	SEAL KIT, DRIVE MOTOR, RIGHT HAND	1	P/N 135143
52	600533	SEAL KIT, BRAKE	1	P/N 135204
53	69735	SEAL KIT, STEERING CYLINDER	1	P/N 135246
54	61316	LUG NUT	5	20 REQUIRED
55	69809	SEAL KIT, LIFT CYLINDER	1	P/N 135096-1
56	160311	"GRIP," PLATFORM-EXTENSION HANDLE	1	
57	20562	CIRCUIT BREAKER (20 AMP)	1	
58	3900-115	PAINT, SPRAY, WHITE	2	
59	3900-131	PAINT, SPRAY, BLUE	1	

GENERAL INFORMATION

NOTES

GENERAL INFORMATION

MAJOR COMPONENT IDENTIFICATION



ABBREVIATIONS

AC	ALTERNATING CURRENT
ADPTR	ADAPTER
AMP	AMPERE
APPROX	APPROXIMATELY
AR	AS REQUIRED
ASSY	ASSEMBLY
AVAIL	AVAILABLE
BRG	BEARING
BRKT	BRACKET
CCW	COUNTER CLOCKWISE
CFM	CUBIC FEET PER MINUTE
CHRG	CHARGING
CTSK	COUNTERSUNK
CVR	COVER
CW	CLOCKWISE
CYL	CYLINDER
°	DEGREE
DC	DIRECT CURRENT
DIA	DIAMETER
DRV	DRIVE
ENG	ENGINE
EXH	EXHAUST
EXT	EXTERNAL
FT	FEET
GAL	GALLON
GR	GRADE
GSK	GASKET
HD	HEAD
HEX	HEXAGON
HP	HORSEPOWER
HSG	HOUSING
HT	HEAT TREATED
HYD	HYDRAULIC
HZ	HERTZ
ID	INSIDE DIAMETER
INCL	INCLUDES
"	INCHES
INT	INTERNAL
INV	INVERTED
LG	LENGTH
LH	LEFT HAND
MAX	MAXIMUM
MIN	MINIMUM
MM	MILLIMETER
MTG	MOUNTING
P/N	PART NUMBER
NO	NUMBER
NSS	NOT SOLD SEPARATELY
OD	OUTSIDE DIAMETER
PTO	POWER TAKE-OFF
#	POUND
QTY	QUANTITY
RD	ROUND
REF	REFERENCE
RH	RIGHT HAND
ROT	ROTATION
RPM	REVOLUTIONS PER MINUTE
SL	SLOTTED
SM	SMALL
SPD	SPEED
STD	STANDARD
T	TOOTH
THK	THICK
THRU	THROUGH
TEMP	TEMPERATURE
V	VOLT
VAC	VOLTS ALTERNATING CUR-RENT
VARI	VARIABLE
VS	VARIABLE SPEED
W/	WITH
W/0	WITHOUT

MAINTENANCE & LUBRICATION

SECTION 3

DESCRIPTION	PAGE NO.
INTRODUCTION.	3 - 1
RECCOMENDED INSPECTION & MAINTENANCE SCHEDULE	3 - 2
OWNER'S INSPECTION RECORD	3 - 4
RECOMMENDED LUBRICANTS	3 - 5
MAINTENANCE PROCEDURES.	3 - 6
BATTERY WATER LEVEL	3 - 6
BATTERY CHARGING.	3 - 8
HYDRAULIC SYSTEM.	3 - 12
HYDRAULIC RESERVOIR & FILTER	3 - 12
HYDRAULIC CYLINDERS	3 - 12

MAINTENANCE & LUBRICATION

INTRODUCTION

In addition to the "Before Operation Checks" described in the "Operator's Manual" a regular program of periodic preventive maintenance is essential to prolong aerial lift life, maximize efficient service and minimize downtime. This section details a series of checks and procedures which are to be performed at daily, weekly, monthly and semi-annual intervals.

Even if the operator is not directly responsible for the maintenance of the aerial lift, the operator should perform daily, all of the inspections listed in the "Before Operation Check", Section 5 of the "Operator's Manual".

NOTE: Replace all worn or damaged parts, or decals discovered during the "Before Operation Check". The operator should be assured that the aerial lift has been properly maintained and inspected before operating it.

MAINTENANCE SCHEDULE

The checks prescribed for longer intervals include all the checks required for the shorter intervals. Thus, the weekly check includes all items in the daily check, the monthly check includes weekly and daily checks, and so on through the semi-annual check, which includes the quarterly, monthly, weekly and daily checks.

This maintenance schedule is a guide which ensures that basic preventive maintenance requirements will be met under average operating conditions. Conditions which impose greater wear, loads or strain on the aerial lift may dictate reduced check intervals. Before altering the maintenance schedule, reevaluate aerial lift operation and review the owner's inspection records. Consider all factors involved and develop a revised schedule adequate to meet routine maintenance requirements.

OWNER'S INSPECTION RECORD

Periodic maintenance of the aerial lift is the responsibility of the owner. The "Aerial Lift Inspection Report" shown on page 3-3 is to be used for recording the date of each inspection, person(s) performing the inspection, any deficiencies found, and corrective action.

This record also serves as a tool detecting problem areas and reanalyzing maintenance requirements.

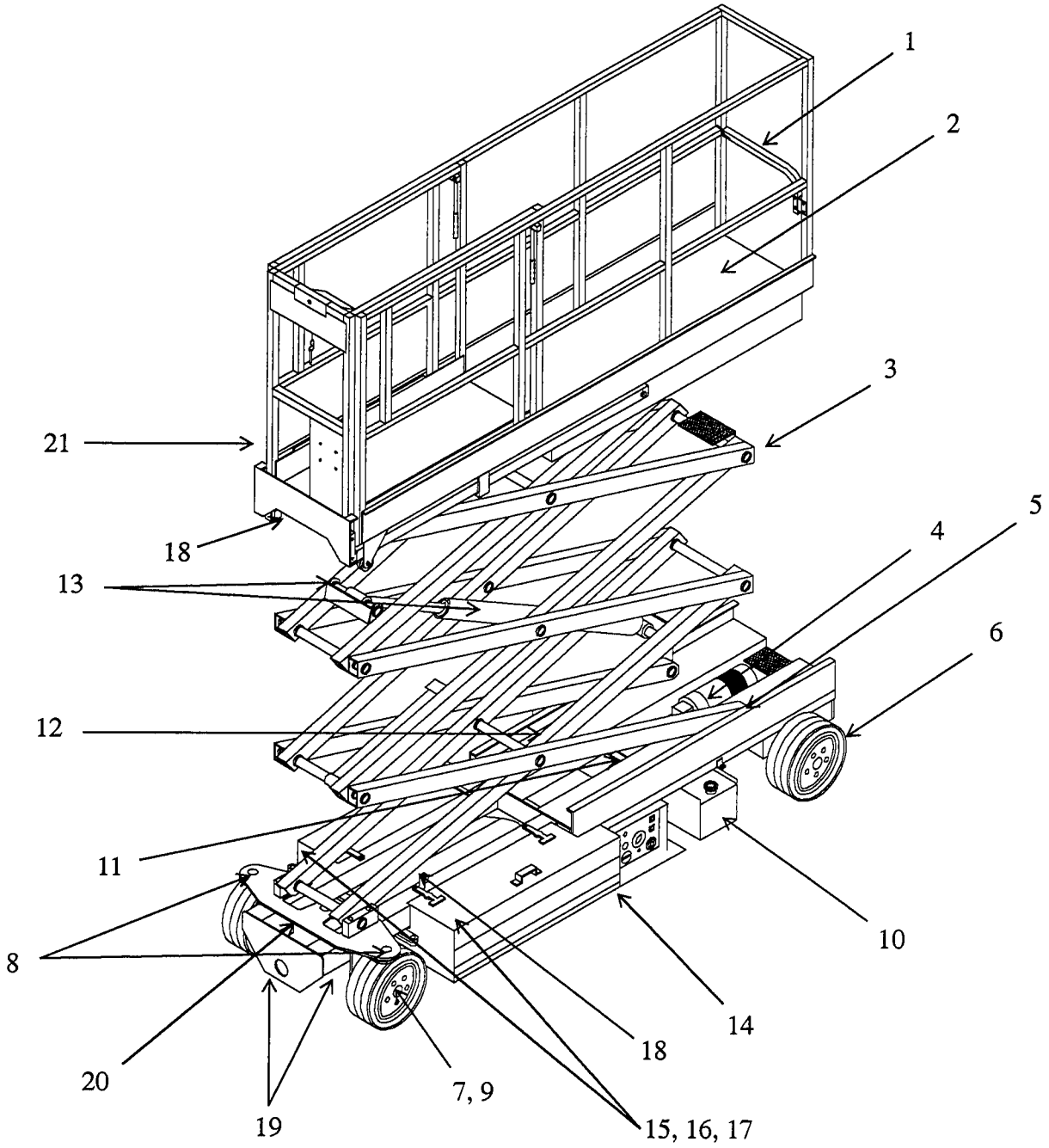
⚠ WARNING

DO NOT REACH THROUGH SCISSORS OR WORK BENEATH THE PLATFORM WITH OUT THE SERVICE STAND PROPERLY POSITIONED AND MECHANICALLY LOCKED. FAILURE TO DO THIS MAY RESULT IN DEATH OR SERIOUS INJURY.

REFER TO PAGE 4 - 0 - 1 FOR PROCEDURE.

MAINTENANCE & LUBRICATION

RECOMMENDED INSPECTION AND MAINTENANCE SCHEDULE



MAINTENANCE & LUBRICATION

Table 1: **RECOMMENDED INSPECTION AND MAINTENANCE SCHEDULE**

ITEM #	ITEM DESCRIPTION	SERVICE FREQUENCY
1	Platform Gate	Inspect Daily
2	Platform Deck	Inspect Daily
3	Collars on Scissor-pivot Pins	Inspect Daily
4	Hydraulic Pump	Inspect Daily
5	Wear (Slide) Pads	Inspect Daily
6	Tires and Wheels	Inspect Daily
7	Wheel Bearings	Lubricate Every 12 Months
8	Wheel Kingpins	Lubricate Every 12 Months
9	Wheel Lug Nuts	Inspect Daily Check Torque After First 40 Hours Check Torque Every 6 Months
10	Hydraulic Reservoir Fluid	Check Daily / Change Yearly
11	Hydraulic-fluid Inlet Strainer	Inspect and Clean Yearly
12	Hydraulic-fluid Return Filter	Change Every 100 Hours or Quarterly
13	Lift Cylinder and Pins	Inspect Daily
14	Hydraulic Valve	Inspect Daily
15	Batteries	Inspect Water Level Daily
16	Battery Housings	Inspect Daily
17	Battery Tops, Terminals, and Cables	Inspect Daily
18	Limit Switches (Proximity)	Inspect Daily
19	Drive Motors	Inspect Daily
20	Steering Cylinder and Pins	Inspect Daily
21	Extendable Platform Deck (Slide, Roller, and Handle Assemblies)	Inspect Daily

Check each of the above items for secure fasteners, leaks, missing or damaged hardware, or evidence of cracks. **Check** all visible electric wiring and hydraulic hoses for cracking, loose connections, or excessive wear. If a problem is found with any of the following items, **do not operate** the aerial lift until a qualified aerial-lift mechanic makes the necessary repairs.

Mark Industries

Return To: **Mark Industries**
106 12th Street S.E.
Waverly, IA 50677-9466

AERIAL LIFT INSPECTION REPORT

PRE-DELIVERY ❑ DELIVERY ❑ 30-DAY INSPECTION ❑ YEARLY INSPECTION ❑

MACHINE: SCISSOR LIFT ❑ BOOM LIFT ❑ KNUCKLE BOOM ❑

DEMO ❑ RENTAL ❑ OWNED ❑

DISTRIBUTOR _____ ENGINE S/N _____

ADDRESS _____ MODEL _____ SERIAL NO. _____

CUSTOMER _____ HOUR METER _____

MACHINE LOCATION _____ DATE DELIVERED _____

Scissors - Inspections		OK	NOT OK	N/A
1.	Platform Gate Latch	❑	❑	❑
2.	Platform Gate	❑	❑	❑
3.	Platform Deck	❑	❑	❑
4.	Collars on Scissor-pivot Pins	❑	❑	❑
5.	Hydraulic Pump	❑	❑	❑
6.	Wear (Slide) Pads	❑	❑	❑
7.	Tires and Wheels	❑	❑	❑
8.	Wheel Bearings	❑	❑	❑
9.	Wheel KIngpins	❑	❑	❑
10.	Wheel Lug Nuts	❑	❑	❑
11.	Hydraulic Reservoir Fluid	❑	❑	❑
12.	Hydraulic-fluid Inlet Strainer	❑	❑	❑
13.	Hydraulic-fluid Return Filter	❑	❑	❑
14.	Lift Cylinder and Pins	❑	❑	❑
15.	Hydraulic Valve	❑	❑	❑
16.	Batteries	❑	❑	❑
17.	Battery Housings	❑	❑	❑
18.	Battery Tops, Terminals, and Cables	❑	❑	❑
19.	Limit Switches (Proximity)	❑	❑	❑
20.	Drive Motors	❑	❑	❑
21.	Steering Cylinder and Pins	❑	❑	❑
22.	Extendable Platform Deck (Slide, Roller, and Handle Assemblies)	❑	❑	❑
23.	Hoses	❑	❑	❑
24.	Electrical Wiring	❑	❑	❑
35.	Decals	❑	❑	❑
26.	Operation and Maintenance Manual in Platform	❑	❑	❑

Booms - Inspections		OK	NOT OK	N/A
1.	Platform Gate Latch	❑	❑	❑
2.	Platform Gate	❑	❑	❑
3.	Platform Deck	❑	❑	❑
4.	Boom Pivot Pin	❑	❑	❑
5.	Air Filter	❑	❑	❑
6.	Engine Oil	❑	❑	❑
7.	Torque Hub	❑	❑	❑
8.	Torque Ring-gear Bolts	❑	❑	❑
9.	Boom	❑	❑	❑
10.	Platform Rotator	❑	❑	❑
11.	Tie Rod Pin	❑	❑	❑
12.	Steering-yoke King Pins	❑	❑	❑
13.	Steering Cylinder	❑	❑	❑
14.	Fuel Tank	❑	❑	❑
15.	Return-line filter	❑	❑	❑
16.	Hydraulic Reservoir Fluid	❑	❑	❑
17.	Hydraulic Pump	❑	❑	❑
18.	Hydraulic Valve	❑	❑	❑
19.	Wheel Lug Nuts	❑	❑	❑
20.	Extend-cable Equalizer Bracket	❑	❑	❑
21.	Extend Cable	❑	❑	❑
22.	Limit Switches (Proximity)	❑	❑	❑
23.	Boom-lift Cylinder Pins	❑	❑	❑
24.	Boom-lift cylinder	❑	❑	❑
25.	Rotation Gear Box	❑	❑	❑
26.	Power Track	❑	❑	❑
27.	Operation and Maintenance Manual in Platform	❑	❑	❑
28.	Guard Rail	❑	❑	❑
29.	Toe Plate Mesh	❑	❑	❑
30.	Tires	❑	❑	❑
31.	Decals	❑	❑	❑
32.	Electrical Wiring	❑	❑	❑

INSPECTED BY: _____ DATE: _____ TITLE: _____

Explain any deficiencies found, corrective action taken, and identification of the person(s) performing the repair: _____

_____

_____

_____

RECOMMENDED LUBRICATION TYPES

ITEM	ITEM DESCRIPTION	LUBRICANT TYPE
1	Hydraulic Oil	Dexron II (or equivalent)
2	Wheel Bearings	General (Multi) Purpose EP2 Grease —High-pressure Injection
3	Wheel Kingpin	General (Multi) Purpose EP2 Grease —High-pressure Injection

MIXING

Various companies use different additives which, when mixed together, may cause problems in a hydraulic system. This type of problem is rare but can cause sludge which can plug the oil filters or acid which will etch the pump. Any of the above conditions can result in the warranty being voided. If, knowing all this, you still choose to add oil different from the initial fill, stay with a single brand as this will minimize the likelihood of problems occurring. Then at the first complete oil change, you may switch to the brand you prefer to use.

If hydraulic oil needs to be added, the aerial lift owner must be contacted to find out what brand and viscosity of oil is being used. Use the same brand and viscosity of oil that is current in the aerial lift when adding additional oil.

HYDRAULIC OIL

Check the hydraulic oil level on a daily basis. The oil level is checked using the dipstick which is attached to the filler cap located on top of the hydraulic tank The oil level must be between the "FULL" and "LOW" marks on the dipstick. Add oil as needed in the filler cap opening of the hydraulic tank. The hydraulic system was filled at the factory with Nortran automatic transmission fluid (equivalent to Dexron II). Any oil used in this aerial lift's hydraulic system must meet the specifications of Dexron II.

MAINTENANCE & LUBRICATION

BATTERY-WATER LEVEL



⚠ WARNING

TO AVOID SERIOUS BURNS, EXTREME CARE SHOULD BE USED WHEN HANDLING OR WORKING NEAR BATTTERIES.

Avoid Battery Hazards!

- **Batteries produce flammable and explosive gasses. Keep** electric arcs, sparks, flames, and lit cigarettes (pipes, cigars, etc.) away from batteries.
- **Battery acid will damage eyes or skin on contact**. **Always** wear a face shield during battery maintenance to avoid getting acid in eyes. **Always** wear rubber gloves and protective clothing to keep acid off skin.
- **Never** check the battery by placing a metal object across the posts. Serious burns or an explosion can result.

Water or Acid Loss to Batteries

Water loss from the battery is mainly due to evaporation brought on by temperature rises during heavy charging cycles. A very small amount of water is lost due to hydrogen and oxygen formed during charging. Acid is lost if the case becomes cracked or if the battery is allowed to tip over. Therefore, acid is seldom needed.

Checking the Water level

When checking the water level, don't allow dirt to enter into the battery cells once the caps have been removed. Take particular care to avoid setting the battery-cell caps down on a dirty surface. Replace the caps immediately after checking the water level.

BATTERY-WATER LEVEL

Battery Fill Instructions

MATERIALS AND EQUIPMENT REQUIRED

1. Battery Filler Bottle

2. Distilled Water

3. Hydrometer

FILLING THE BATTERY

Use a hydrometer to see how much charge the battery has. A reading of 1.260 or more in all cells indicates a fully-charged condition. (See chart on following page.) If the battery is fully charged, add water up to the level indicator.

If the battery's water level is below the lead plates, add only enough water to barely cover the plates.

Note: Either excessive overcharge or moderate undercharge can shorten battery life. With proper attention to water level, charging time, and hydrometer readings, the batteries should have a long, useful life.

Note: Cold temperatures have a numbing effect on the electrical action of the battery, greatly reducing its capacity. Therefore, it is highly recommended that the battery be kept fully charged during cold weather.

CHARGING BATTERIES

CHARGING BATTERIES

1. Lower platform completely.
2. Remove battery covers.
3. Check battery "water" (electrolyte) level. Ensure that plates are covered to a minimum depth of 1/2 inch. DO NOT add additional water if plates are covered!
4. Reinstall battery caps before charging!
5. Plug charger into 120 VAC, 60 Hz power source. Charger will turn off automatically when batteries are fully charged.
6. Unplug charger and allow battery temperature to stabilize.
7. Recheck battery "water" level. Fill to indicator ring or approximately 1/2 in depth over top of separator plates and reinstall caps.

CHARGING NOTES:

1. Temperature does effect the power reserve in a battery.

   A. A battery that is 100% charged at 80°F:
   - drops to 65% at 32°F.
   - drops to 40% at 0°F.

   B. A battery that is 46% charged at 80°F:
   - drops to 32% at 31°F.
   - drops to 21% at 0°F.

2. When battery temperature reaches 125°F, battery should be taken off charge and cooled to room temperature or the charging rate should be lowered.
3. Batteries should be brought to full charge as soon as possible after use
4. Do not allow plates in batteries to become exposed to air. Lead plates in discharged batteries become hardened and sulfated. The battery eventually will not deliver its rated capacity or come up to a full change.

CHARGING BATTERIES

NORMAL OPERATION

1. Ensure that that there is adequate ventilation for both batteries and charger. The convection-cooled charger design requires an unobstructed flow of cooling air for proper operation.

2. Connect charger AC input cord to appropriate power supply.

3. Charger will turn "on" automatically and charge rate will adjust automatically according to battery power level. Charger shuts off automatically once batteries have been fully charged.

The state of discharge of the batteries will be slightly different each time they are put on charge, but the charger varies automatically the initial charge rate, and taper of charge rate over the charge period. For well discharged batteries the charge rate at the start of the charge period should correspond to the "DC AMPS" rating on the charger nameplate. The rate should then taper gradually down to a lower finish rate. Normal charging at the low finish rate during the last 1-3 hours is necessary to achieve equalization of all battery cells. This equalization period allows the specific gravity of the battery electrolyte solution to rise to its full charge value. Since the taper of the charging rate (in amps. as indicated by the ammeter needle) is controlled by the rising voltage of the batteries being charged, proper performance of the charger and resulting good battery life is dependent upon the following factors:

A. An adequate AC line to handle the power required. Request your electrician or power company to survey your installation.

B. All cells of the batteries must be good, rising to approximately 2.5 DC volts per cell while still on charge or near the end of a charging period. When in doubt, check each cell with a single cell voltmeter while still on charge. If a low reading is obtained, check the low cells with a temperature corrected hydrometer. NOTE: Hydrometer float must be thoroughly clean to obtain accurate specific gravity readings.

C. Connections on the battery terminals and connector wiring must be clean and tight.

The necessity of adding water more frequently than two of three weeks, and/or hot battery cases at the end of the charging cycle, indicates the finish rate is too high, due to one or both of the following:

A. One or more bad cells in the batteries.

B. Batteries are starting to age to the point where hours of charge should be reduced gradually to obtain prolonged battery life.

4. State of charge at start of day's use can be approximated by plugging charger "in" and monitoring the charge rate. Drop of ammeter needle to a low finish rate of less than 6 to 7 amps within approximately 15 minutes indicates that batteries are near full capacity of charge.

CHARGING BATTERIES

CARE OF MOTIVE POWER BATTERIES

1. New batteries should be given a full charge before their first use because it is difficult to know how long the batteries have been in storage without a charge.

2. Limit use of new batteries between charges for the first 5 cycles, New batteries and older batteries which have been in storage are not capable of their rated output until they have been discharged and charged a number of times.

3. During the first month of use, particularly when temperatures are below 60°F, new batteries should be given an extra full charge once a week. The ampere-hours of energy that batteries can deliver and their charge acceptance varies directly with battery temperature.

4. As long as the charger tapers down to the specified finish charge rate near the end of the charge cycle, the batteries should be given a full charge. All cells in a set of batteries do not react identically to the same discharge, and charge current. In a normal charge, the last 1 to 3 hours at the low finish charge rate equalize the cells for better battery life.

5. When batteries age to the point where the charge rate will no longer taper into the low finish rate area, reduce the hours of charge progressively. Reducing the charge period will prevent excessive battery heating and the resultant high water use rate.

6. Prior to each day's use, turn the charger on and check to see if charger ammeter needle jumps smartly upward and then tapers down to the finish rate area within 15 minutes. This will provide a very simple means of verifying that the batteries were charged.

7. Add water carefully to the proper level in cells as required after they have been fully charged. Do not fill them so high that they bubble over while charging. New batteries require very little addition of water, whereas very old batteries may need additional water two or three times a week. Water (electrolyte) level in the cells settles when batteries are discharged and rises during charge. The probability of overfilling can be reduced by adding water when batteries are fully charged.

8. When the temperature falls below 65°F, batteries should be placed on charge as soon after use as possible. In these low temperatures a 4 hour equalizing charge once a week will improve state of charge and battery life.

9. Keep tops of batteries and battery hold-downs clean and dry at all times. This will reduce the amount of current leakage between batteries and the frame.

CHARGING BATTERIES

Temperature/Specific Gravity Correction Table For Batteries
Actual Hydrometer Reading At Actual Temperature°
Table 1:

80°F (27°C)	0°F (-18°C)	-10°F (-23°C)	-20°F (-29°C)	-30°F (-34°C)	-45°F (-43°C)	-65° (-54°C)	Approx. State of Charge —%
1.280	1.312	1.316	1.320	1.324	1.330	1.338	100
1.250	1.282	1.286	1.290	1.294	1.300	1.308	75
1.220	1.252	1.256	1.260	1.264	1.270	1.278	50
1.190	1.222	1.226	1.230	1.234	1.240	1.248	25
1.160	1.192	1.192	1.200	1.204	1.210	1.218	0

Table 2: Specific Gravity

Corrected to 80°F (17°C)	Freezing Temperatures
1.280	-90°F (-68°C)
1.250	-62°F (-52°C)
1.200	-16°F (-27°C)
1.150	+05°F (-15°C)
1.000	+19°F (-07°C)

HYDRAULIC SYSTEM

HYDRAULIC RESERVOIR CHECK & FILL

1. Lower platform completely.
2. Remove filler cap and check fluid in reservoir. The oil level is checked using the dipstick attached to the filler cap. The oil level must be between the "FULL" and "LOW" marks on the dipstick. Refer to page 3-5 for oil specifications.
3. Fill to proper level.
4. Replace cap.

HYDRAULIC SYSTEM FILTER

The spin-on oil filter in the hydraulic system should be changed a minimum of every 100 hours or quarterly.

HYDRAULIC SYSTEM BLEEDING

The hydraulic system is self-bleeding. After the hydraulic system has been drained, such as during the replacement of a hydraulic system component, raise and lower the platform at least three complete cycles. Recheck the oil level and fill as required.

HYDRAULIC CYLINDER INSPECTION

Wash the cylinder bore and all the components with solvent and make the following inspections:

CYLINDER BORE: Check for signs of scoring and deep scratches. In the event of any defects, reassemble the entire cylinder and contact your distributor.

CYLINDER SHAFT/ROD: Check for dents, deep scratches, or damaged chrome plating. File any sharp edges on ends of shaft to protect the seals upon reassembly. Always protect the shaft finish when clamping in a vice or when welding against weld splatter.

PISTON RINGS (if applicable): Check for cracks or other damage. Particularly check the interlocking ends that they are not missing or broken.

PISTON SEALS: Check for signs of severe damage. Do not remove unless replacement is necessary.

PISTON & HEAD GLAND: Check for cracks or other damage. It is not necessary, normally, to replace the piston, piston rings, or head gland.

NOTES

SERVICE & ADJUSTMENTS

SECTION 4

DESCRIPTION	PAGE NO.
INTRODUCTION.	4 - 1
SERVICE STAND "LOCK"	4 - 2
"IDLER" HUB & WHEEL ASSEMBLY	4 - 4
"IDLER" HUB ASSEMBLY	4 - 5
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DRIVE MOTOR (J14EP/CH20NEP)	4 - 9
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STEERING CYLINDER.	4 - 19
PUMP/MOTOR ASSEMBLY	4 -
PUMP	4 -
HYDRAULIC ASSEMBLY	4 -
CONTROL VALVE - J14EP	4 -
CONTROL VALVE - CH20NEP/CH30EP (w/o Proportional Drive)	4 -
CONTROL VALVE - (Proportional Drive Machines)	4 -
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SERVICE & ADJUSTMENTS

INTRODUCTION

This section contains service and adjustment information and procedures.

SERVICE describes items that require repair or replacement

ADJUSTMENTS describes any adjustments necessary to ensure proper operation of the aerial lift and adjustments required after the replacement or repair of components.

NOTE: THE SERVICE AND ADJUSTMENT PROCEDURES PROVIDED IN THIS MANUAL SHOULD ONLY BE PERFORMED BY A QUALIFIED AERIAL LIFT MECHANIC.

Before attempting to make an adjustment yourself, ask yourself if you have the RIGHT TOOLS, IF you have the PROPER TEST EQUIPMENT and IF you can accurately DIAGNOSE the cause of the problem.

If you can't answer YES to all three questions, rely on your Distributor Serviceman. He has the right tools, testing equipment and service knowledge to pin-point the problem in minutes instead of the hours consumed in hit-or-miss methods. TIME IS MONEY! He will save it for you.

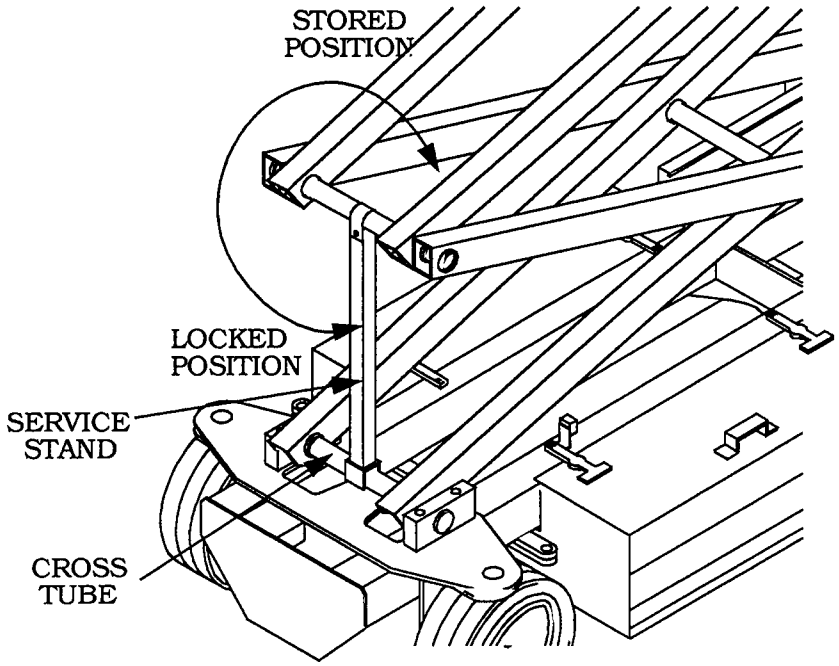
If you decide to attempt an adjustment yourself, follow a logical TROUBLE SHOOTING PROCEDURE. Don't simply replace parts until the trouble is found. Refer to Section 5 Troubleshooting for general and specific troubleshooting information.

Once the cause of problem or malfunction has been diagnosed, take the corrective action specified in this manual. Follow the procedures given for the specific problem. If the difficulty is not covered, consult your Mark Distributor, or the Mark Industries Product Support Department.

SERVICE & ADJUSTMENTS

⚠ WARNING

DO NOT SERVICE A RAISED OR PARTIALLY RAISED AERIAL LIFT UNTIL THE BELOW PROCEDURE HAS BEEN FOLLOWED.



LOCK THE SERVICE STAND BY USING THE FOLLOWING PROCEDURE:

1. Remove any load from the platform and the extendable platform deck.

2. Raise the platform as high as necessary to engage the lock.

3. Lift the service stand from the support and rotate to a vertical position directly over the cross tube.

4. Lower the platform until clevis rests on the cross tube.

TO DISENGAGE THE SERVICE STAND:

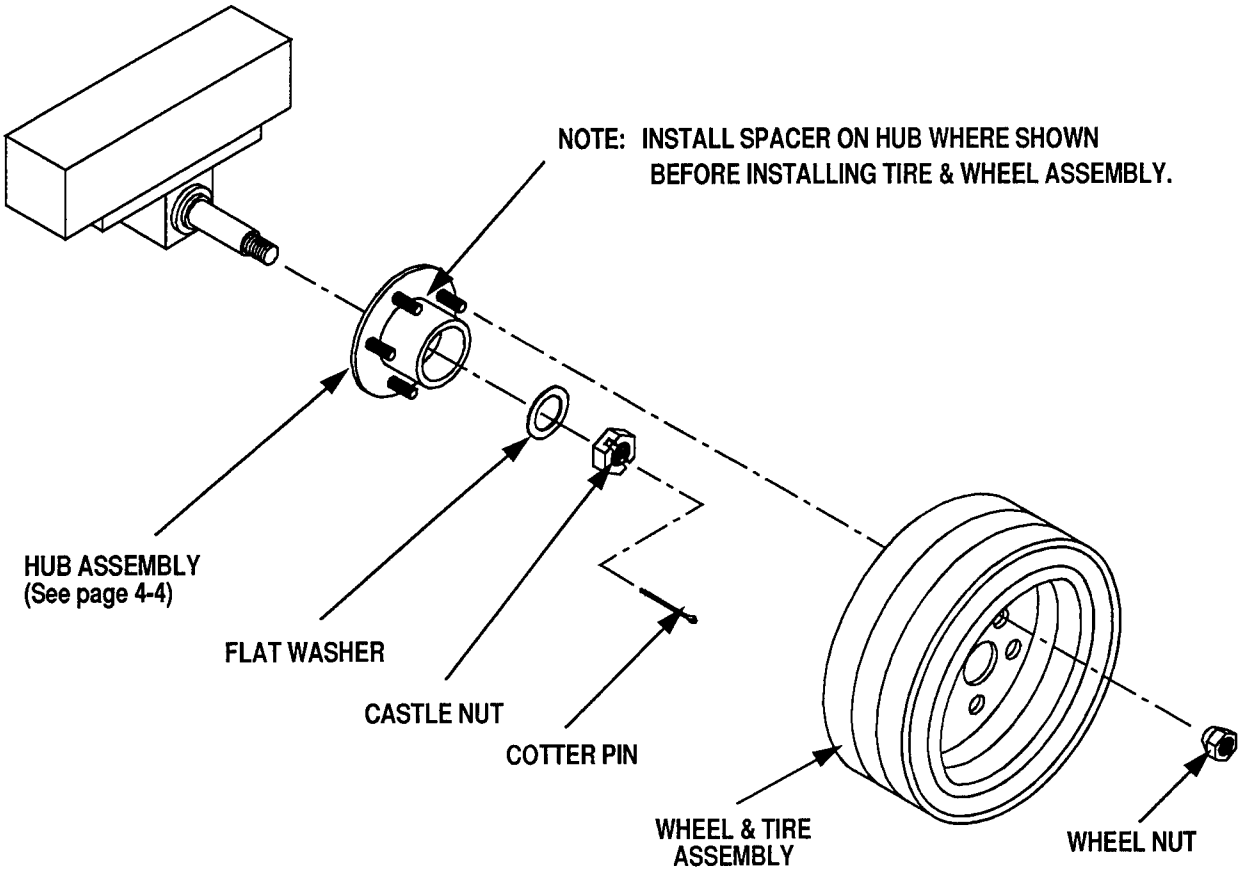
1. Raise the platform until the weight of the platform is no longer resting on the stand, and the stand can be removed from the cross tube.

2. Rotate the stand until it is resting in the service stand support.

NOTES

SERVICE & ADJUSTMENTS

"IDLER" HUB & WHEEL ASSEMBLY



MAINTENANCE CHECK As a part of the recommended inspection and maintenance schedule, inspect the tires for damage.

Check for loose or missing wheel (lug) nuts. Wheel nut torque should be checked after first 40 hours and then every six months. Wheel nuts should be torqued to 90-95 ft. lbs. (122-128 N•m) dry.

Installing Castle/Wheel Retaining Nut

The castle nut is installed as follows:

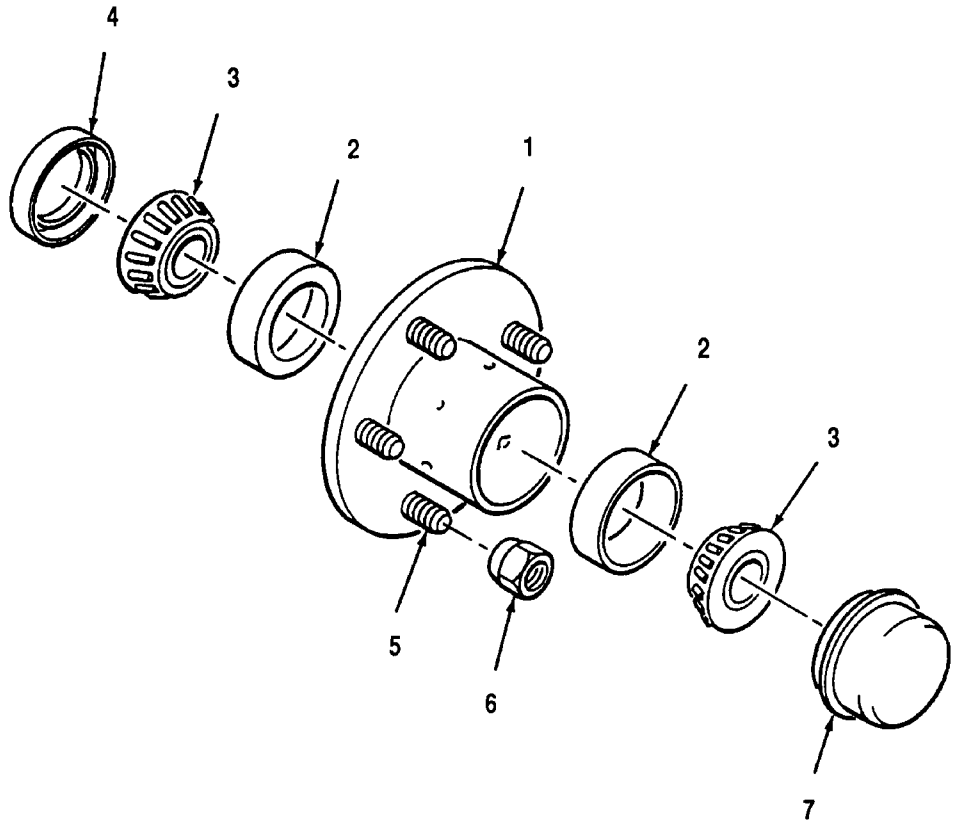
1. Install the castle nut and tighten to approximately 12 ft. lbs (16 N•m) to preload the bearing.

2. Then back off the castle nut to the next slot in the castle nut (approximately 1/4 turn).

3. Secure with a new cotter pin.

SERVICE & ADJUSTMENTS

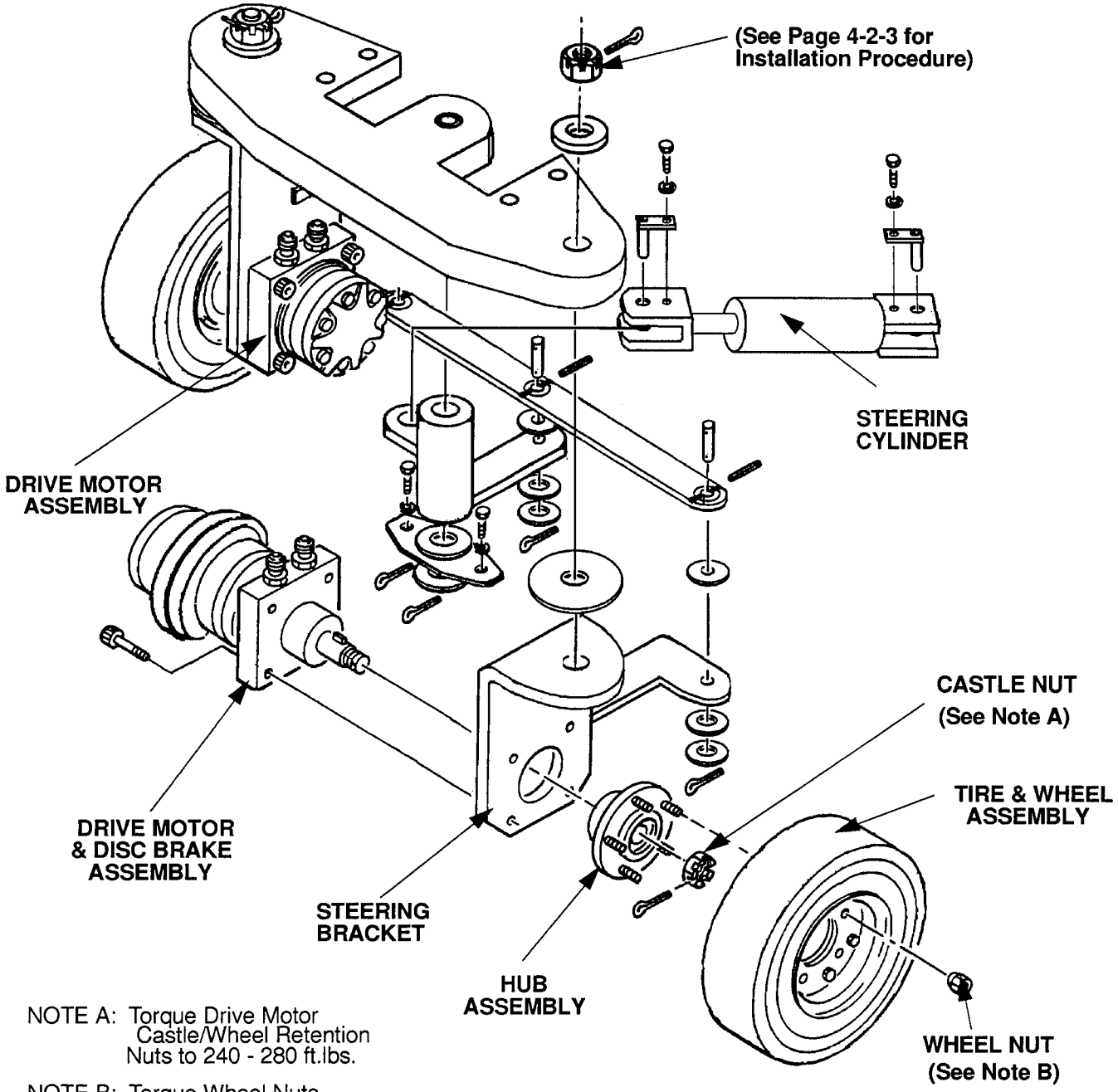
"IDLER" HUB ASSEMBLY



1. Hub
2. Race, Bearing
3. Bearing
4. Seal, Grease
5. Studs, Wheel
6. Nut, Wheel Lug
7. Dust Cap

SERVICE & ADJUSTMENTS

STEERING & DRIVE ASSEMBLY



NOTE A: Torque Drive Motor Castle/Wheel Retention Nuts to 240 - 280 ft.lbs.

NOTE B: Torque Wheel Nuts to 90-95 ft.lbs. Dry

STEERING & DRIVE ASSEMBLY

Steering Bracket Castle Nut Installation & Tightening Procedure

The castle nuts located on top of the base which secure the steering brackets should be installed and tightened as follows:

1. Install the castle nut as shown and torque to approximately 30 to 35 ft. lbs.

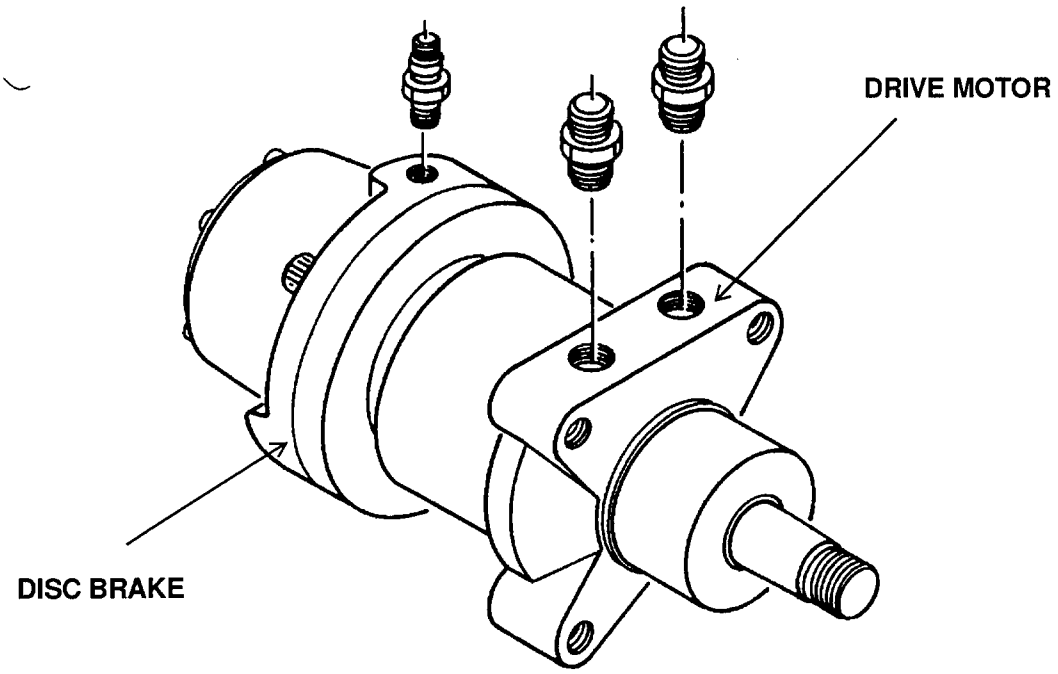
2. Back off the castle nut to the next slot in the nut (approximately 1/4 turn).

3. Secure castle nut with new cotterpin.

SERVICE & ADJUSTMENTS

NOTES

DRIVE MOTOR & BRAKE ASSEMBLY: J14EP/CH20NEP



Drive Motor/Drive Motor & Brake Assembly

The R.H. drive motor and the L.H. drive motor & disc brake assembly may be removed or installed as follows:

Drive Motor Assembly Removal

1. Clean outside of the drive motor assembly and wipe of all hydraulic fittings.
2. Remove the hydraulic fittings and hoses, noting location of each.
3. Remove the four retaining capscrews and lockwashers. Remove the drive motor from the steering arm. Refer to page 4-2-2 for location of drive motors.

Drive Motor Assembly Installation

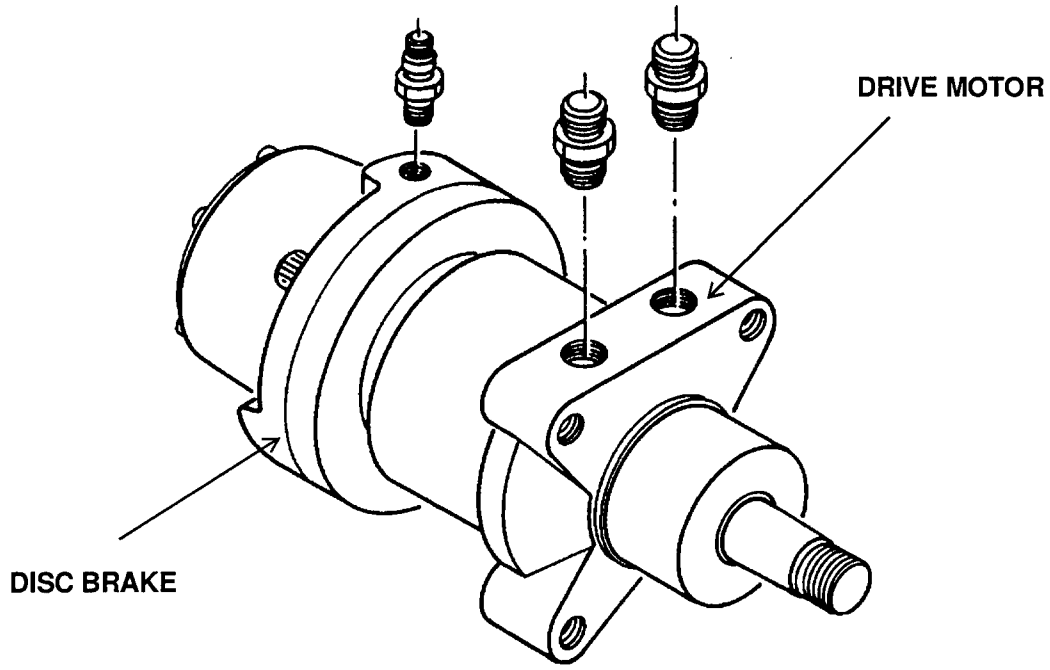
1. Install the drive motor and secure to the steering arm with the four capscrews and lockwashers.
2. Install the hydraulic fittings and hoses.

Disc Brake Assembly

The disc brake is secured to the left hand drive motor with two capscrews and lock washers.

SERVICE & ADJUSTMENTS

DRIVE MOTOR & BRAKE ASSEMBLY: J14EP/CH20NEP



Drive Motor/Drive Motor & Brake Assembly

The R.H. drive motor and the L.H. drive motor & disc brake assembly may be removed or installed as follows:

Drive Motor Assembly Removal

1. Clean outside of the drive motor assembly and wipe of all hydraulic fittings.

2. Remove the hydraulic fittings and hoses, noting location of each.

3. Remove the four retaining capscrews and lockwashers. Remove the drive motor from the steering arm. Refer to page 4-2-2 for location of drive motors.

Drive Motor Assembly Installation

1. Install the drive motor and secure to the steering arm with the four capscrews and lockwashers.

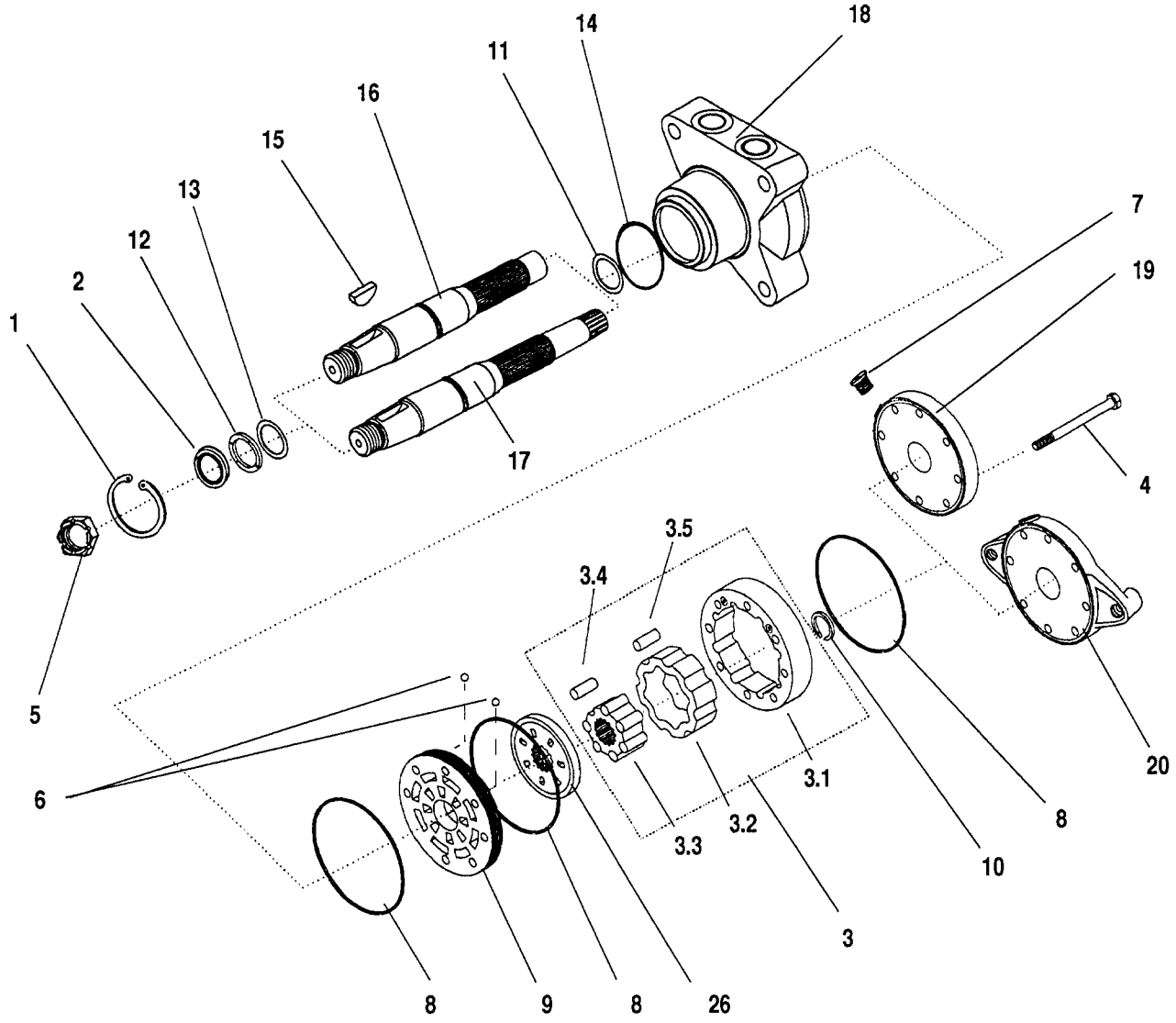
2. Install the hydraulic fittings and hoses.

Disc Brake Assembly

The disc brake is secured to the left hand drive motor with two capscrews and lock washers.

SERVICE & ADJUSTMENTS

DRIVE MOTOR ASSEMBLY: J14EP/CH20NEP



1. Snap Ring
2. Assembly, Seal/Retainer
3. Assembly, IGR
4. Bolt, Hex 5/16-24
5. Nut, Slotted 1-20
6. Check Valve Ball
7. Plug, Vent w/O-ring
8. Square Ring Seal
9. Commuator Plate
10. Snap Ring
11. Washer, Thrust
12. Washer, Thrust
13. Washer, Thrust
14. O-ring
15. Key, Woodruff
16. Shaft, 1.25" J501 Taper
17. Shaft, 1.25 J501 Taper Thru
18. Body
19. Cover/Bearing Assembly
20. Cover/Bearing Assembly (thru Shaft)
26. Rotary Valve

SERVICE & ADJUSTMENTS

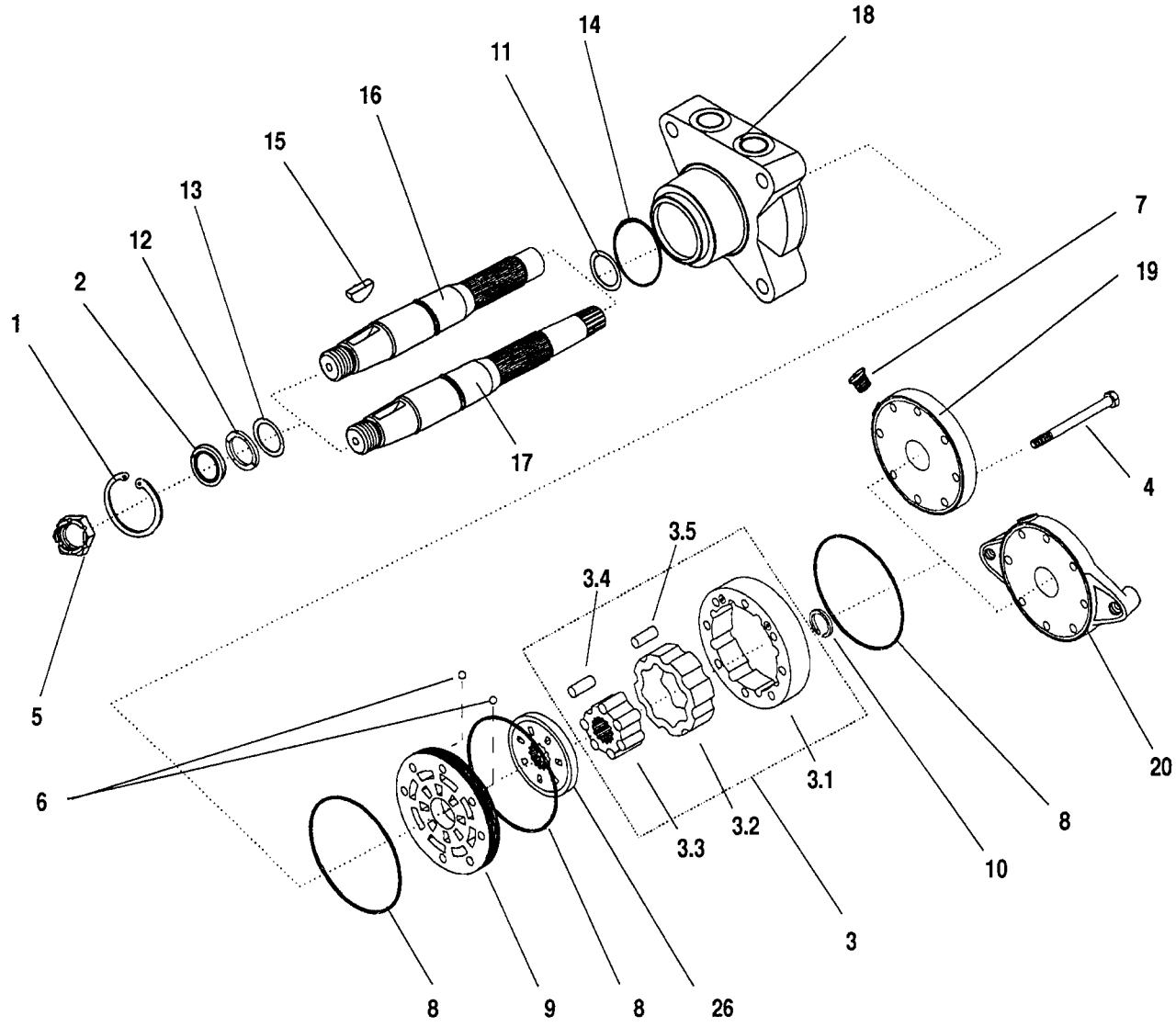
DRIVE MOTOR ASSEMBLY: J14EP/CH20NEP

Motor Disassembly

1. Remove the key (15) and Castle nut (5) from the shaft if either is on the shaft.
2. Mount the motor in a vice or other holding device with the shaft facing down.
3. Using a 1/2" socket remove the eight 5/16-24 bolts (4).
4. Remove the cover/bearing assembly (19 or 20) and the square ring (8). Discard the square ring.
5. Remove the locating ring (3.1) and [8] eight rollers (3.5).
6. Remove the two check balls (6). **Note:** The check balls frequently fall into the bolt holes disassembly. Be sure that the check balls are removed and accounted for.
7. Next remove the outer rotor (3.2) and the [7] seven sealing rolls (3.4).
8. The inner rotor (3.3) of the IGR™ set and rotary valve (26) are retained on the shaft by snap ring (10). Remove this snap ring with snap ring pliers. **Do Not Discard.** This snap ring will be reinstalled later.
9. Lift the inner rotor (3.3), rotary valve (26) and commutator plate (9) off the shaft and body bearing assembly.
10. The body bearing assembly (18) with shaft may now be removed from the holding device, after removing and discarding the square ring (8).
11. Place the body bearing assembly (18) on a clean, soft surface with the output end of the shaft facing up, if possible. Clean the front end of the body bearing assembly to avoid contaminating the lube system during the following steps.
12. Remove the snap ring (1) using snap ring pliers. (For 1-1/4" straight keyed shaft model remove outer snap ring first).
13. Pull the shaft (16 or 17) out vertically through the front of body bearing assembly (18). Removing the shaft in this manner will also remove the seal retainer, thrust washer (13) and thrust washer DU (12).
14. With the seal retainer assembly (2) and shaft (16 or 17) removed, use a small screwdriver to dislodge the O-ring (14) from its groove in the body bore.
15. Thrust washer (11) can be removed by hand. It will be laying on the shaft bearing in the body bearing assembly (18).
16. Remove all parts from the shaft. Inspect the shaft and all parts of the seal retainer assembly (2) and all components of the thrust system (11, 12, 13). Replace any worn or damaged parts. *Always replace the seal retainer assembly (2).* The shaft should have smooth polished surfaces in the bearing and seal areas. If the shaft is lightly scratched in these areas, polish with fine emery paper in a circumferential direction. However, if the shaft has pitting or deep scratches, the entire motor should be inspected for scratches, galling and contamination. Replacement of parts may be required.

SERVICE & ADJUSTMENTS

DRIVE MOTOR ASSEMBLY: J14EP/CH20NEP



1. Snap Ring
2. Assembly, Seal/Retainer
3. Assembly, IGR
4. Bolt, Hex 5/16-24
5. Nut, Slotted 1-20
6. Check Valve Ball
7. Plug, Vent w/O-ring
8. Square Ring Seal
9. Commuator Plate
10. Snap Ring
11. Washer, Thrust
12. Washer, Thrust
13. Washer, Thrust
14. O-ring
15. Key, Woodruff
16. Shaft, 1.25" J501 Taper
17. Shaft, 1.25 J501 Taper Thru
18. Body
19. Cover/Bearing Assembly
20. Cover/Bearing Assembly (thru Shaft)
26. Rotary Valve

SERVICE & ADJUSTMENTS

DRIVE MOTOR ASSEMBLY: J14EP/CH20NEP

Motor Assembly

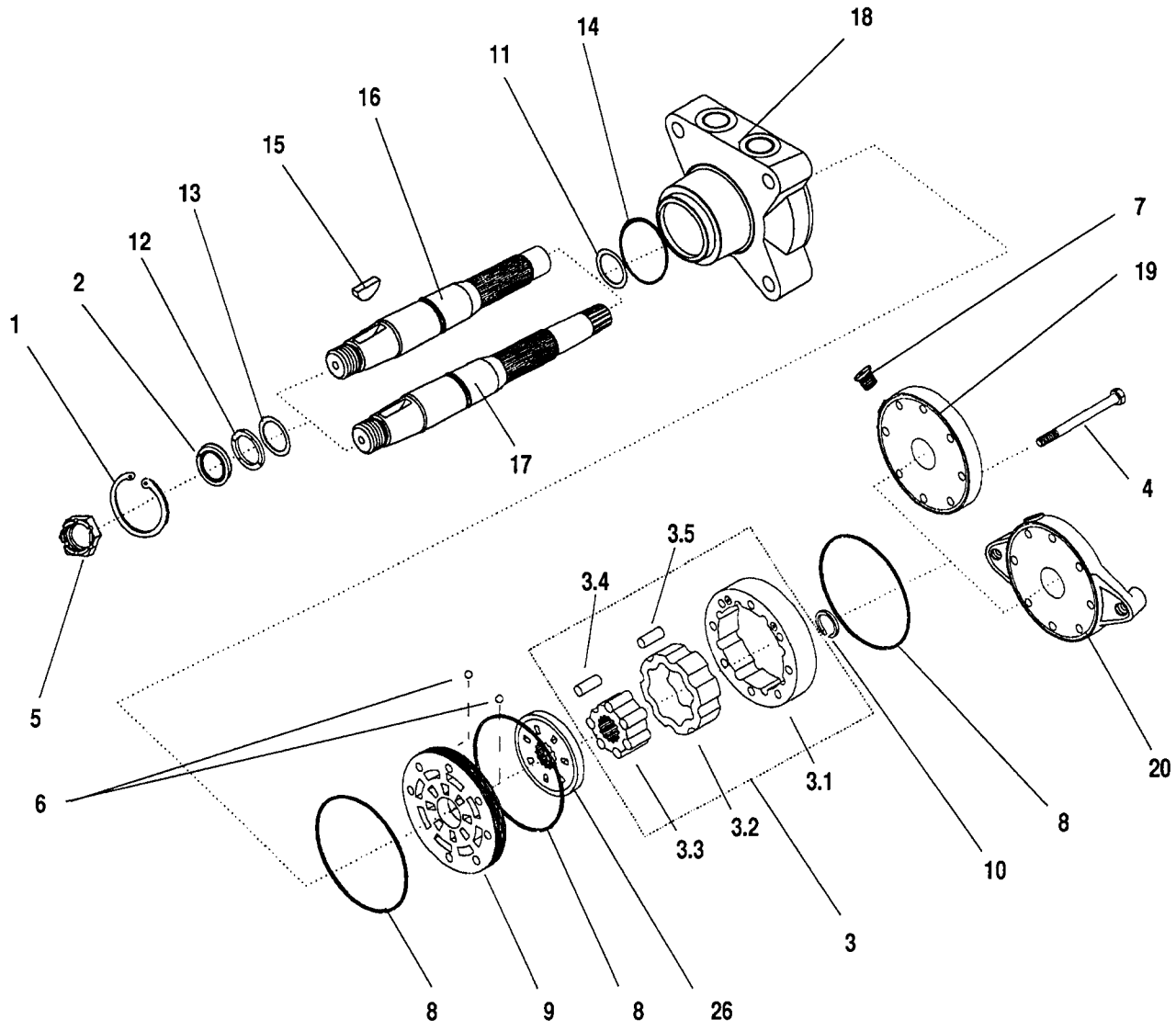
1. Prior to assembly, all parts must be cleaned with a suitable solvent and free of nicks and burrs.
2. Mount the body bearing assembly (18) with the pilot and bearing facing up, in holding device.
3. Place the thrust washer (11) on the shaft bearing in the body bearing assembly (18).
4. Place the lightly oiled O-ring (14) into the innermost groove in the body bore.
5. Lower the spline end of the shaft (16 or 17) into the body bearing assembly.
6. Place the hardened thrust washer (13) on the shaft. Next slide DU thrust washer (12) on the shaft, copper and grooved side up.
7. Gently slide the oiled seal retainer assembly (2) over the shaft, chamfered side first, and press into the body bore. When fully in place, the body snap ring groove will be visible.
8. Install the snap ring (1) into its body groove with the snap ring's sharp edges facing outward and the retainer pin between the snap ring lugs. Be sure the snap ring is completely seated in the groove. (For 1 1/4" straight keyed shaft model, replace shaft snap ring.)
9. Remount the body bearing assembly (18) with the pilot and shaft facing down in holding device.
10. Inspect all components of the IGR™ assembly (3), if any of these are damaged the *entire* IGR™ assembly must be replaced.
11. Lightly oil the square ring seal (8) and place in the body groove.
12. Place the commutator plate (9) over the body, with the square ring groove facing up. Align the eight bolt holes in the plate with the eight bolt holes in the body. (The holes will align in only one position). **Note:Be sure not to dislodge the body square ring seal while positioning the commutator plate (9).**
13. Place the rotary valve (26) on the shaft spline with the "T" shaped slots facing the body bearing assembly.
14. Next, place the IGR™ inner member on the shaft spline with the semicircular roll pockets **between** the rotary valve ports.
15. Reinstall shaft snap ring (10) behind the IGR™ inner.
16. Place the outer rotor member of the IGR™ over the inner and insert seven rolls into the inner pockets. (The difference between rolls and rollers is distinquishable by eye. Rolls have square ends and rollers have domed ends).
17. Lightly oil the square ring seal (8) and place in the commutator plate (9) groove.
18. Place the check balls (6) over the two 1/8" diameter holes in the commutator plate. Be sure the check balls do not fall into the bolt holes.
19. Place the locating ring section (3.1) of the IGR™ (3) onto the commutator plate (9) with the check ball holes facing downward over the balls. Align the eight bolt holes in the locating ring with the eight holes in the body. The holes align in only one position **NOTE: Be sure not to dislodge the commutator plate square ring seal while positioning the locating ring.**
20. Install the eight locating ring rollers (domed end (3.5)) into their pockets and oil lightly.
21. Place the other lightly oiled square ring seal (8) into the groove in the cover and place the cover over the shaft end and align the bolt holes.
22. Install the eight bolts with lightly oiled thread ends into the bolt holes. Tighten diagonally to 15 ft. lb. Now, turn the shaft by hand through several revolutions.

A. In a diagonal pattern, increase the torque of each bolt by 5 ft. lb. Turn the shaft by hand through several revolutions.

B. Repeat step A until the torque of each bolt has reached 30 ft. lb.

SERVICE & ADJUSTMENTS

DRIVE MOTOR ASSEMBLY: J14EP/CH20NEP



1. Snap Ring
2. Assembly, Seal/Retainer
3. Assembly, IGR
4. Bolt, Hex 5/16-24
5. Nut, Slotted 1-20
6. Check Valve Ball
7. Plug, Vent w/O-ring
8. Square Ring Seal
9. Commuator Plate
10. Snap Ring
11. Washer, Thrust
12. Washer, Thrust
13. Washer, Thrust
14. O-ring
15. Key, Woodruff
16. Shaft, 1.25" J501 Taper
17. Shaft, 1.25 J501 Taper Thru
18. Body
19. Cover/Bearing Assembly
20. Cover/Bearing Assembly (thru Shaft)
26. Rotary Valve

SERVICE & ADJUSTMENTS

DRIVE MOTOR ASSEMBLY: J14EP/CH20NEP

NOTE: Prior to any motor disassembly, plug all open ports and clean all dirt from the outside of the motor. Prior to assembly, lightly oil all seals, rolls and threaded bolt ends.

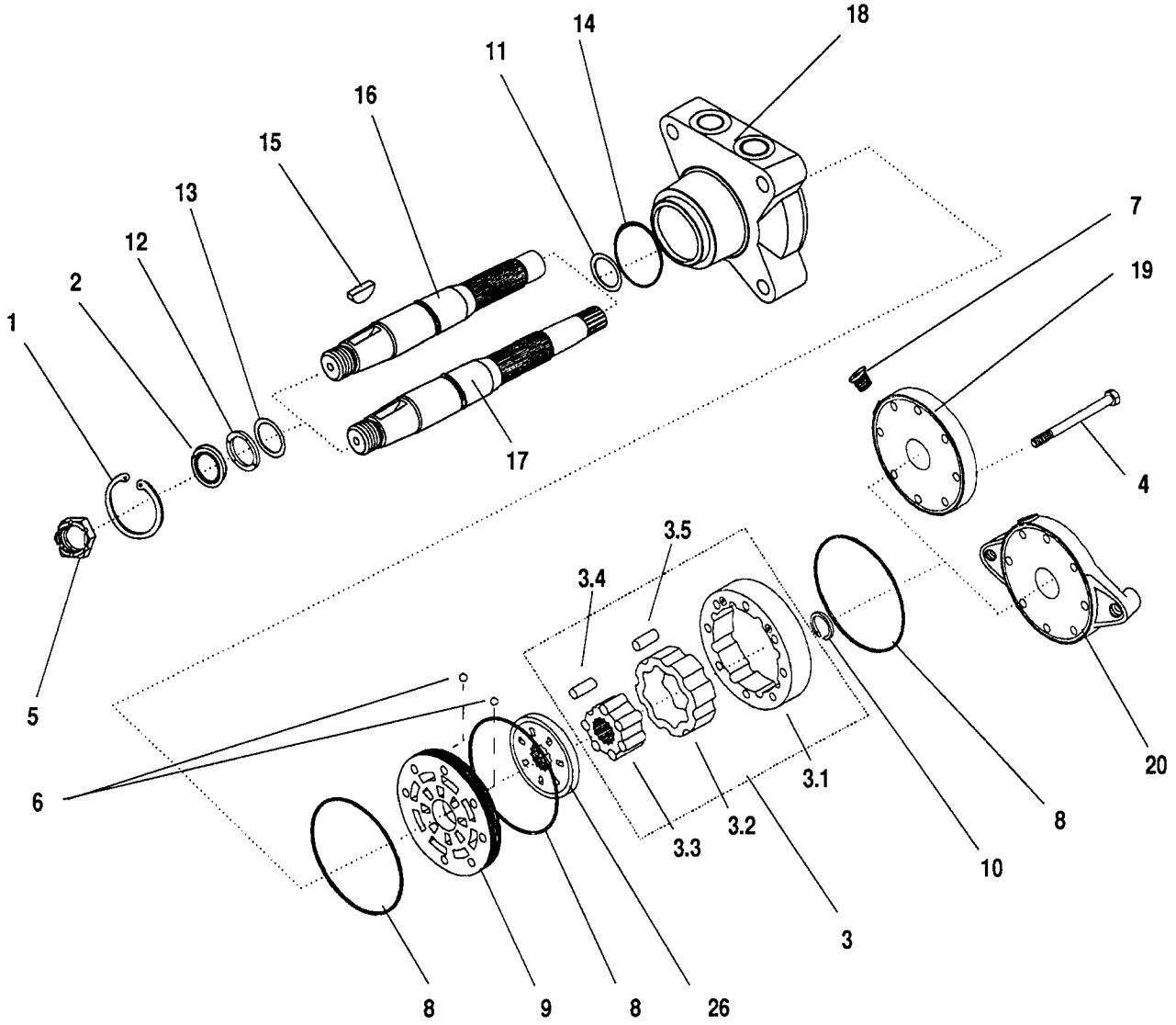
Replacement of Front Seal Assembly and / or Shaft

A.Disassembly

1. Remove the key (15) and Castle nut (5) from the shaft if either is on the shaft.
2. Mount the motor in a vice or other holding device with the shaft facing down.
3. With the 1/2" socket remove the [8] eight 5/16-24 bolts (4). If there are bolt washers under these bolts, remove and discard them.
4. Remove the cover/bearing assembly (19 or 20) and the square ring (8).
5. Remove snap ring (10) using snap ring pliers. **DO NOT DISCARD.** This snap ring will be reinstalled later.
6. Remove square ring (8) from cover/bearing assembly (19 or 20) and discard. Replace the cover on the motor and align the bolt holes. Install the eight bolts (4) into the bolt holes. **FINGER TIGHTEN ONLY.**
7. Remove the motor from the vice or holding device place the motor on a clean flat surface with the shaft facing up.
8. Clean the front end of the motor to avoid contaminating the lube system during the procedure.
9. Remove the snap ring (1) using snap ring pliers. (For 11/4" straight keyed shaft model, remove outer snap ring first.)
10. Pull the shaft (16 or 17) out vertically through the front of body bearing assembly (18). Removing the shaft in this manner will also remove the seal retainer assembly, thrust washer (13) and thrust washer DU (12). **CAUTION:** When pulling the shaft out, do not rotate the shaft or move the motor as this alters internal timing.
11. With the seal retainer assembly (2) and shaft (16 or 17) removed, use a small screwdriver to dislodge the O-ring (14) from its groove in the body bore.
12. Thrust washer (11) can be removed by hand. It will be laying on the shaft bearing in the body bearing assembly (18).
13. Remove all the parts from the shaft and inspect the various parts of the seal retainer assembly (2) shaft (16 or 17) and thrust assembly (11,12,13). Replace any worn or damaged parts. Always replace the seal retainer assembly (2). The shaft should have smooth polished surfaces in the bearing and seal areas. If the shaft is lightly scratched in these areas, polish with fine emery paper in a circumferential direction. However, if the shaft has any pitting or deep scratches, the entire motor should be disassembled for inspection according to Section I.

SERVICE & ADJUSTMENTS

DRIVE MOTOR ASSEMBLY: J14EP/CH20NEP



1. Snap Ring
2. Assembly, Seal/Retainer
3. Assembly, IGR
4. Bolt, Hex 5/16-24
5. Nut, Slotted 1-20
6. Check Valve Ball
7. Plug, Vent w/O-ring
8. Square Ring Seal
9. Commuator Plate
10. Snap Ring
11. Washer, Thrust
12. Washer, Thrust
13. Washer, Thrust
14. O-ring
15. Key, Woodruff
16. Shaft, 1.25" J501 Taper
17. Shaft, 1.25 J501 Taper Thru
18. Body
19. Cover/Bearing Assembly
20. Cover/Bearing Assembly (thru Shaft)
26. Rotary Valve

DRIVE MOTOR ASSEMBLY: J14EP/CH20NEP

B. Assembly

1. Prior to assembly, all parts must be cleaned with a suitable solvent and free of nicks and burrs.
2. Mount the body bearing assembly (18) with the pilot and bearing facing up, in a vise or other holding device.
3. Place the thrust washer (11) on the shaft bearing in the body bearing assembly (18).
4. Place the lightly oiled O-ring (14) into the groove in the body bore.
5. Slowly lower the spline end of the shaft assembly (16 or 17) into the motor body using caution not to rotate the internal parts once the shaft spline starts to engage.
6. Place the hardened thrust washer (13) on the shaft. Next slide DU thrust washer (12) on the shaft, copper and grooved side up.
7. Gently slide the oiled seal retainer assembly (2) over the shaft, chamfered side first, and press into the body bore. When fully in place, the body snap ring groove will be visible.
8. Install the snap ring (1) into its body groove with the snap ring's sharp edges facing outward and the retainer pin between the snap ring lugs. Be sure the snap ring is completely seated in the groove. (For 11/4" straight keyed shaft model, replace shaft snap ring.)
9. Remount the motor in other holding device with the shaft facing down.
10. Remove the eight 5/16 - 24 bolts (4) that you finger tightened previously. (Section III, A, Step 6)
11. Remove the cover/bearing assembly (19 or 20).
12. Install snap ring (10) onto the shaft in the snap ring groove directly behind the IGR™ assembly.
10. Place the lightly oiled square ring (8) into the cover groove. Place the cover over the shaft end and align the bolt holes. Note: Be sure not to dislodge the square ring while installing the cover.
11. Install the eight bolts with lightly oiled thread ends into the bolt holes. Tighten diagonally to 15 ft. lb. Now turn the shaft by hand through several revolutions.

A. In a diagonal pattern, increase the torque of each bolt by 5 ft. lb. Turn the shaft by hand through several revolutions.

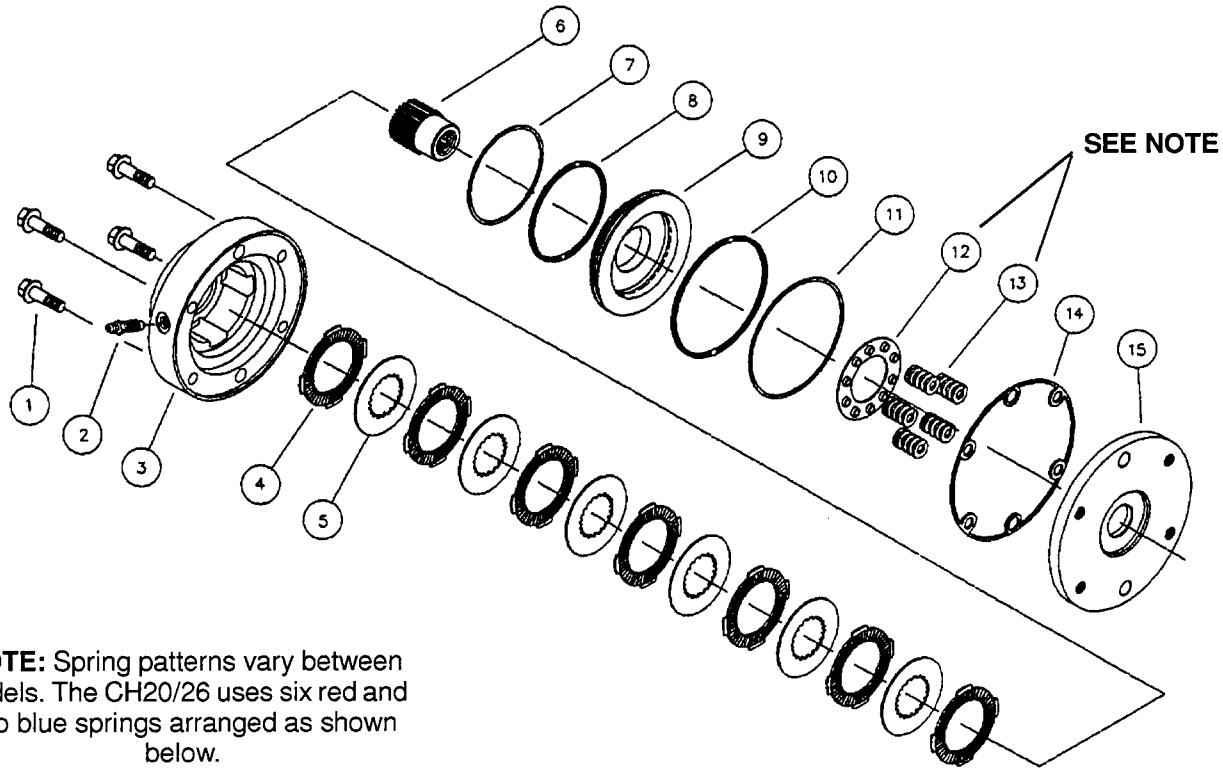
B. Repeat step A until the torque of each bolt has reached 30 ft. lb.

Thru Cover Shaft Seal Replacement
(DRIVE MOTOR W/DISC BRAKE)

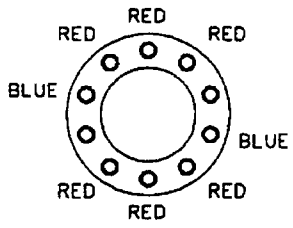
1. Place the motor in a vise or other holding device with the output shaft facing downward. Clean the rear cover area of the motor to avoid contaminating the lube system during this procedure.
2. Remove the eight 5/16-24 bolts.
3. Remove and discard the cover and square ring seal.
4. Place a lightly oiled square ring into the groove in the new cover and place the new cover over the shaft end. Align the bolts holed but use extreme caution not to dislocate the square ring seal.
5. Install the eight bolts, with lightly oiled threaded ends into the bolts holes.
   A. Tighten diagonally to 15 ft. lbs.
   B. Turn the shaft by hand through several rotations.
   C. Increase the torque of each bolt by 5 ft. lbs. in a diagonal pattern.
   D. Turn the shaft by hand through several rotations.
   E. Repeat this procedure until the torque of each bolt has reached 27 1 ft. lbs.

SERVICE & ADJUSTMENTS

BRAKE ASSEMBLY: J14EP/CH20NEP



NOTE: Spring patterns vary between models. The CH20/26 uses six red and two blue springs arranged as shown below.



INSTALLATION NOTE:
Pressurizing brake may be required to properly align shafts and pilots when mounting brake to motor.

1. Washer Head Bolts
2. Bleeder Screw
3. Housing
4. Friction Plates
5. Rotating Plates
6. Shaft
7. Back-up Rings
8. O-ring
9. Piston
10. O-ring
11. Back-up Rings
12. Retainer
13. Springs
14. Case Seal
15. Housing Cover

SERVICE & ADJUSTMENTS

DISC BRAKE ASSEMBLY: J14EP/CH20NEP

DISASSEMBLY

1. Remove bleeder screws (2) and any other plugs or fittings from pressure ports in housing (3). Drain oil from brake as thoroughly as possible.

2. Remove four washer head bolts (1) which retain cover (15) to housing (3).

⚠ CAUTION

Since cover is under spring tension of approximately 1500 lbs., the four bolts should be loosened evenly to relieve this force. If a hydraulic press is available (5000 lbs. max.), the cover can be held in position while removing the bolts.

3. Remove case seal (14) from cover (15).

4. Before removing springs (13) and retainer (12) from piston (9) be sure to note pattern and color for reassembly purposes.

5. Remove piston (9) from housing (3) by plugging one pressure port and slowly pressurizing other port with air.

6. Remove o-rings (8 & 10) and back-up rings (7 & 11) from piston (9). **NOTE: Be careful to avoid contaminating friction surfaces with oil as this is a dry design brake.**

7. Remove Shaft (6) from housing (3).

8. Remove plate stack assembly consisting of rotating plates (5) and friction plates (4) from housing (3). **NOTE: Be careful to avoid contaminating friction surfaces with oil as this is a dry design brake.**

ASSEMBLY

LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Clean all parts thoroughly before assembly.

2. Starting with one of the friction plates (4) and alternating with rotating plates (5) assemble stack in housing (3).

3. Insert shaft (6) thru rotating plater (5) until stack is aligned and shaft bottoms in housing (3).

4. Install o-rings (8 & 10) and back-up rings (7 & 11) on piston (9). **NOTE: Care must be taken so as not to scratch or mar piston.**

5. Carefully push piston (9) into bore of housing (3) until piston bottoms on top of lining stack.

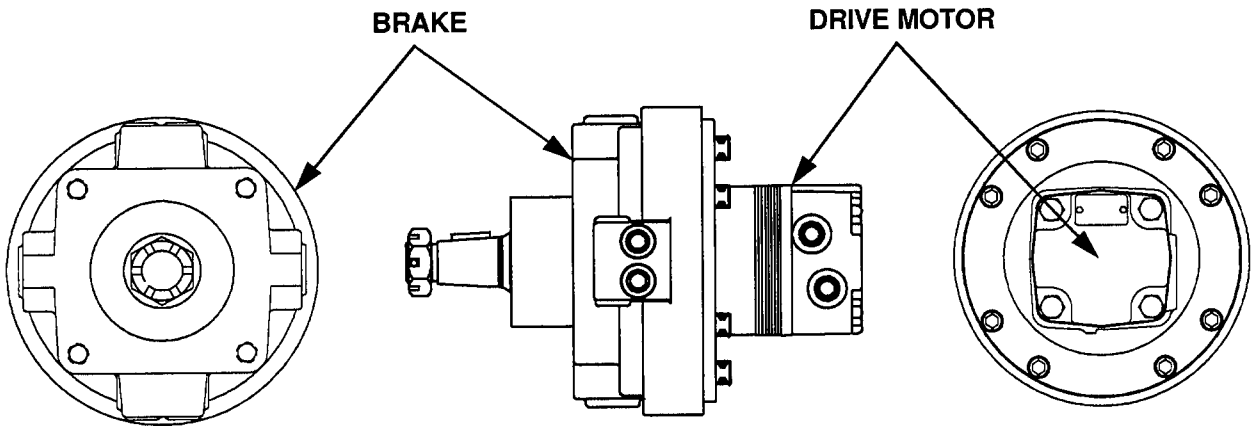
6. Install retainer (12) and springs (13) in piston (9). Be careful to install springs according to pattern and color noted during disassembly.

7. Affix case seal (14) on cover (15).

8. Position cover (15) on top of springs (13). Insert washer head bolts (1) thru housing (3) and into cover (15). NOTE: Bolts should have one or two drops of Loctite #242 applied to threads. Tighten bolts evenly to draw cover (15) to housing (3). Torque bolts (1) to 55 - 60 ft. lbs. **NOTE: If available, a hydraulic press will simplify installation of cover on housing. Clamp cover in position while tightening bolts.**

9. Install bleeder screw (2) into housing (3).

DRIVE MOTOR & BRAKE ASSEMBLY: CH20WEP/CH26NEP/CH26WEP/CH30EP



Drive Motor/Brake Assembly Removal

1. Clean the outside of the drive motor/brake assembly, wipe of all hydraulic fittings. Refer to page 4-2-2 for location.
2. Remove the hydraulic hoses, note thier location for reinstalation later.
3. Remove the self locking nuts from the cap-screws securing the assembly to the steering bracket and slide motor/brake assembly out of bracket.

Drive Motor Removal

1. Throroughly clean outside of drive motor/brake.
2. Remove the hydraulic fittings.
3. Remove the four hex head capscrews secruring the motor to the brake.

Drive Motor Installation

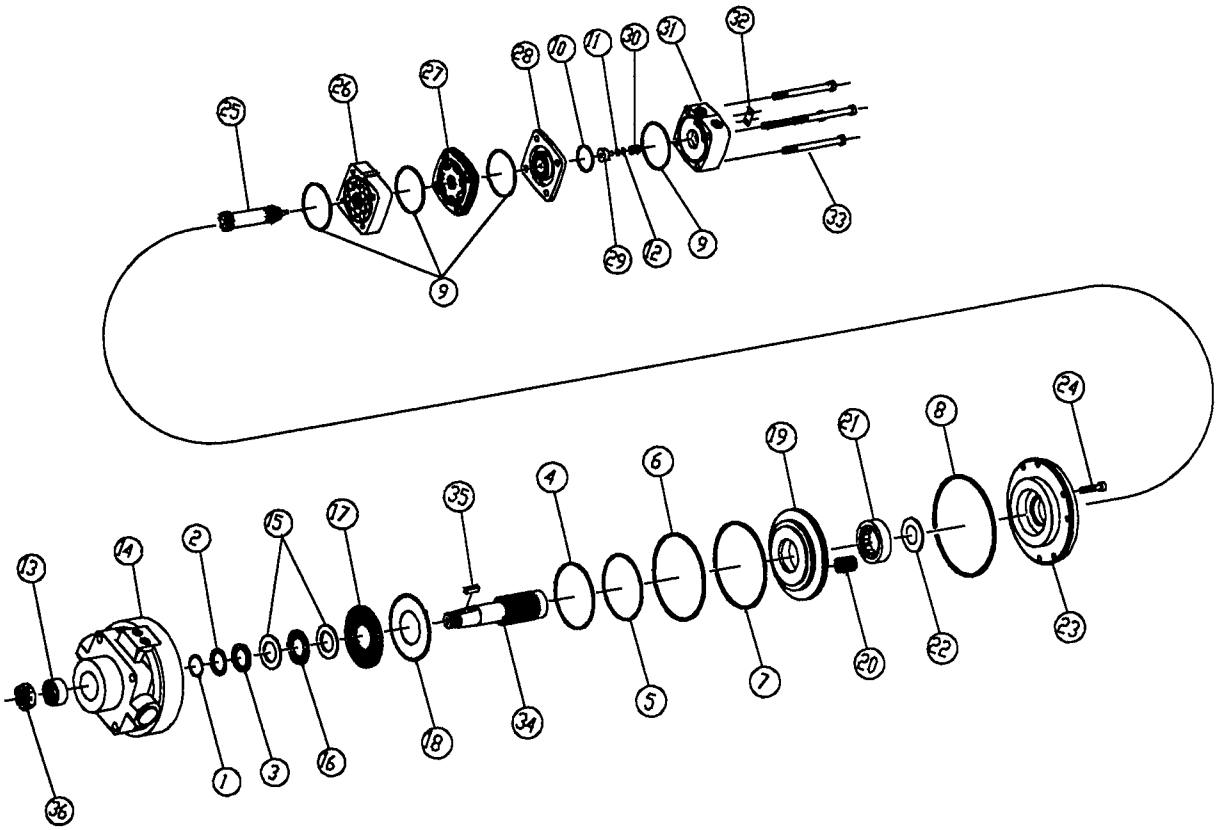
1. Refer to motor overhaul procedure (page 4-20) for installation procedure.

Drive Motor/Brake Assembly Installation

1. Fit the motor & brake assembly into the steering bracket with the motor ports pointed "up".
2. Install the four cap screws through the motor brake assembly and steering bracket.
3. Install the four sel-locking nuts and torque to 53 ft. lbs..
4. Install the hydraulic fittings and hoses.

SERVICE & ADJUSTMENTS

DRIVE MOTOR & BRAKE ASSEMBLY: CH20WEP/CH26NEP/CH26WEP/CH30EP



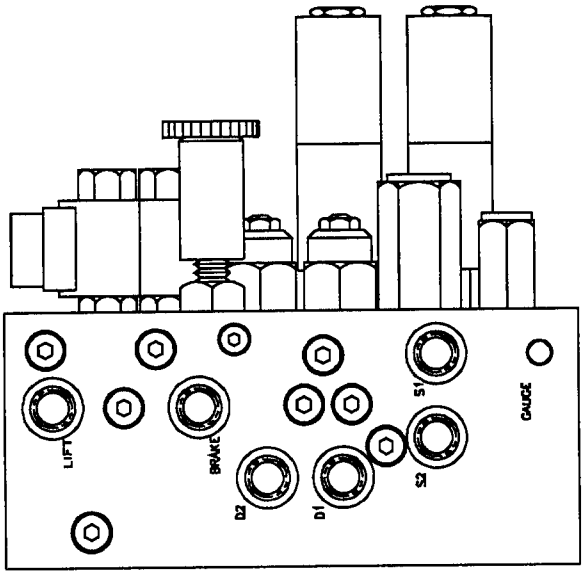
1. METAL BACK-UP RING
2. TEFLON BACK-UP SEAL
3. SHAFT SEAL
4. SMALL O-RING SEAL
5. SMALL TEFLON SEAL
6. LARGE O-RING SEAL
7. LARGE TEFLON SEAL
8. O-RING SEAL
9. BODY SEALS (4)
10. COMMUTATOR SEAL
11. PISTON O-RING SEAL
12. PISTON TEFLON SEAL
13. FRONT SHAFT BEARING
14. FRONT HOUSING
15. THRUST WASHERS (2)
16. THRUST BEARING
17. FRICTION DISKS (4)
18. DISK STAMPINGS (4)
19. PISTON
20. SPRINGS (25)
21. REAR SHAFT BEARING
22. SPACER SHIMS
23. REAR HOUSING
24. CAP SCREWS (25)
25. DRIVE LINK
26. ROTOR ASSEMBLY
27. MANIFOLD
28. COMMUTATOR ASSEMBLY
29. PISTON
30. PISTON SPRING
31. END COVER
32. I.D. TAG
33. ASSEMBLY BOLTS (4)
34. SHAFT
35. KEY
36. CASTELATED NUT

DRIVE MOTOR & BRAKE ASSEMBLY: CH20WEP/CH26NEP/CH26WEP/CH30EP

SERVICE & ADJUSTMENTS

P/N 81381 FUNCTIONS VALVE

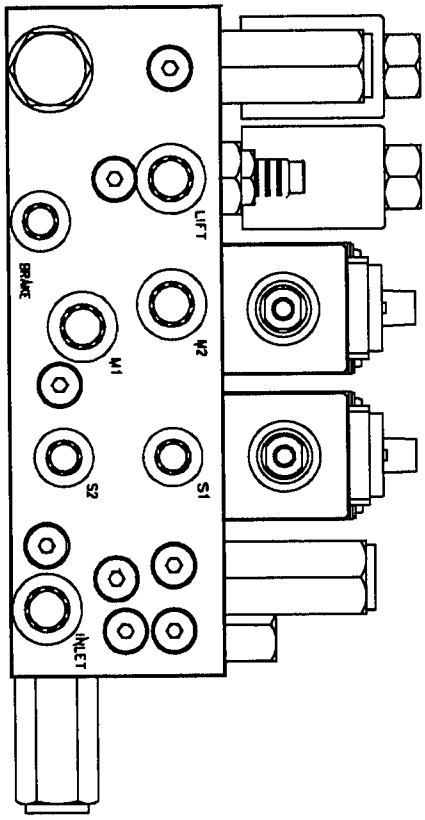
(SEE PAGE 4-13-13)



(TYP. CH20NEP/CH30EP W/NON-PROPORTIONAL DRIVE)

P/N 81288 FUNCTIONS VALVE

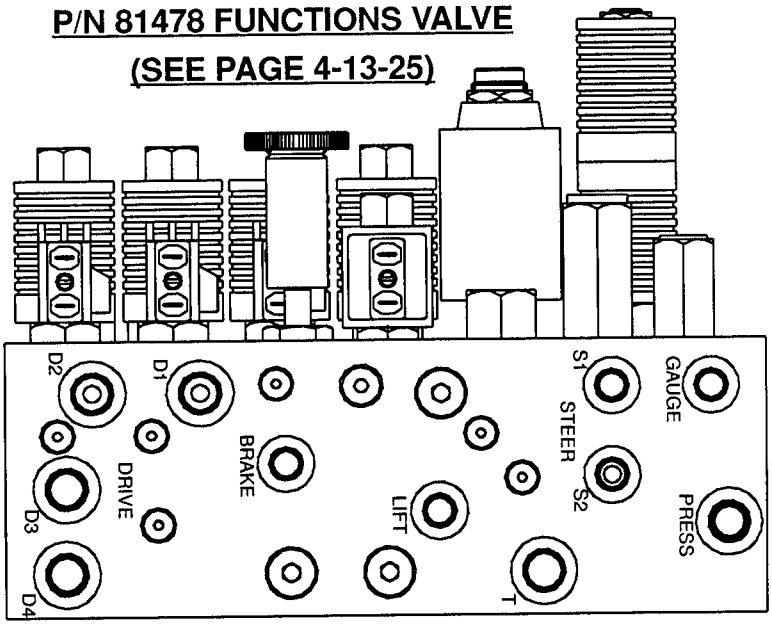
(SEE PAGE 4-13-1)



(TYP. J14EP)

P/N 81478 FUNCTIONS VALVE

(SEE PAGE 4-13-25)

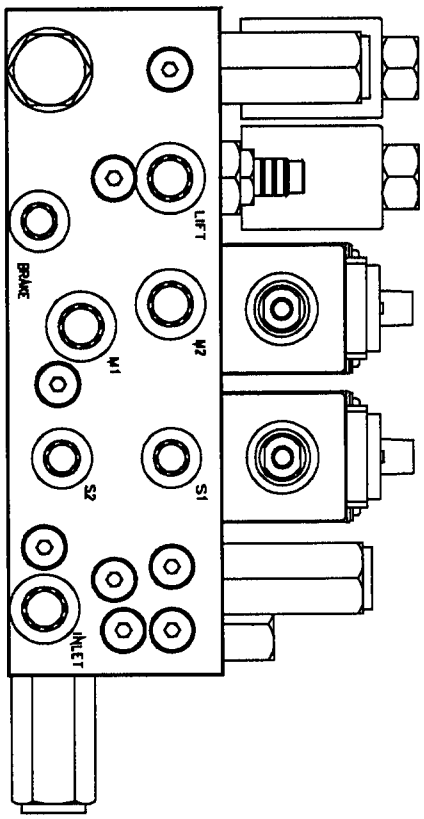


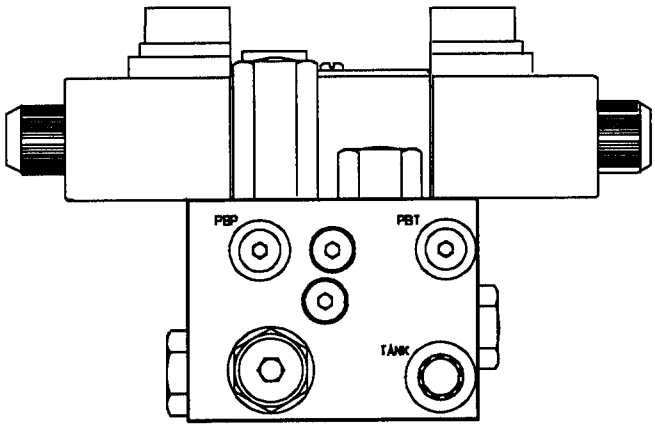
(TYP. ALL CH MODELS W/PROPORTIONAL DRIVE)

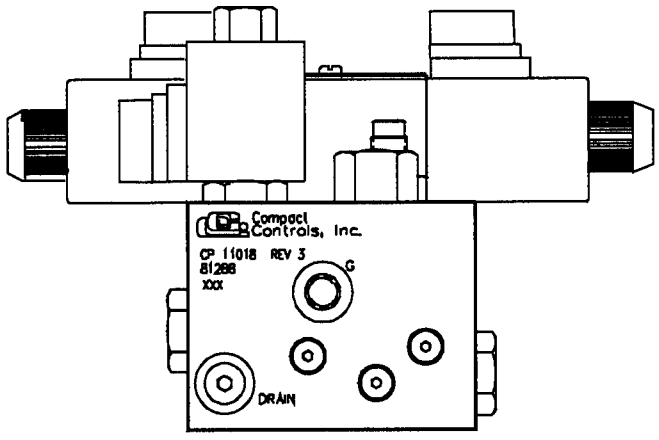
SERVICE & ADJUSTMENTS

P/N 81288 FUNCTIONS VALVE

(USED ON MODEL J14EP EXCLUSIVELY)

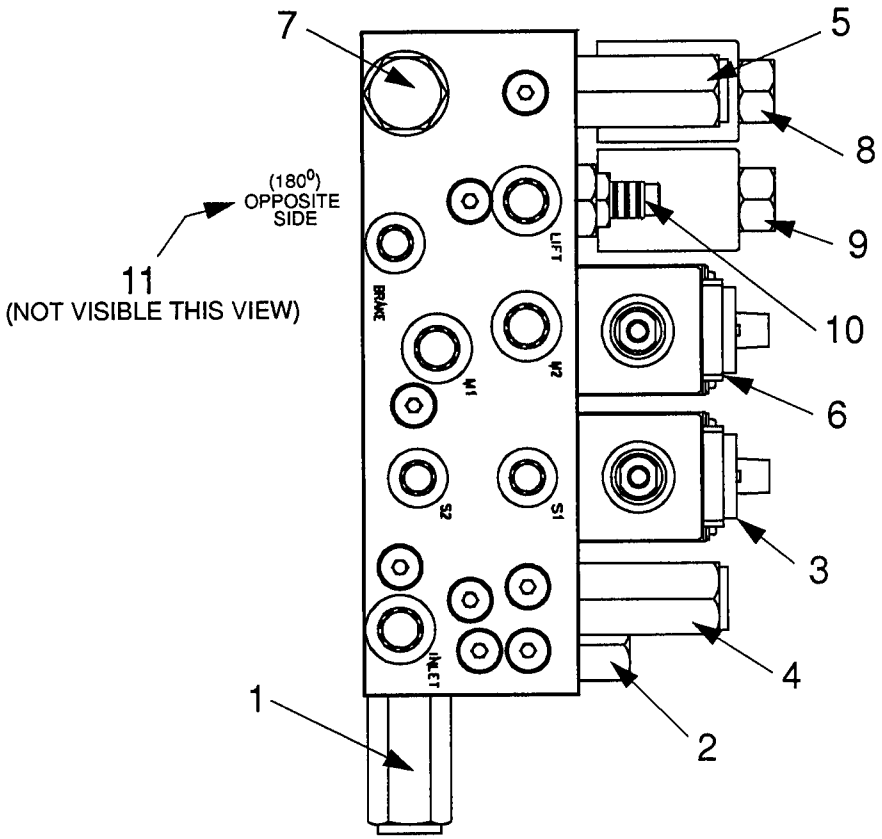






SERVICE & ADJUSTMENTS

P/N 81288 FUNCTIONS VALVE

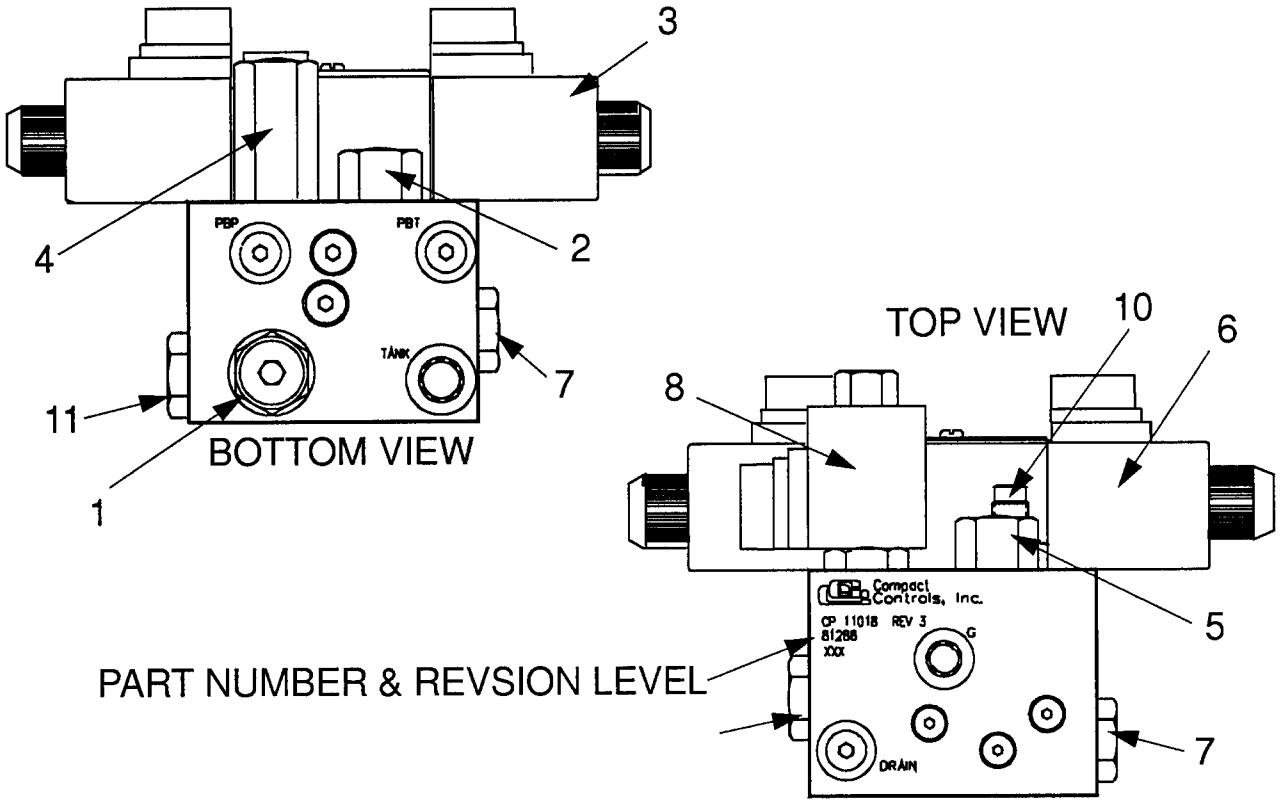


LEGEND: COMPONENT IDENTIFICATION

1. .....SYSTEM RELIEF VALVE
2. .....STEERING FLOW REGULATOR
3. .....STEERING DIRECTIONAL CONTROL VALVE
4. .....STEERING "CROSS-PORT" RELIEF VALVE
5. .....LOW SPEED TRAVEL FLOW REGULATOR
6. .....DRIVE DIRECTIONAL CONTROL VALVE
7. .....PARKING BRAKE RELEASE SHUTTLE VALVE
8. .....HIGH SPEED DRIVE SOLENOID VALVE
9. .....PLATFORM LIFT SOLENOID VALVE
10. .....PLATFORM LOWERING SPEED FLOW REGULATOR
11. .....PARKING BRAKE CIRCUIT UNLOADING CHECK VALVE

SERVICE & ADJUSTMENTS

P/N 81288 FUNCTIONS VALVE

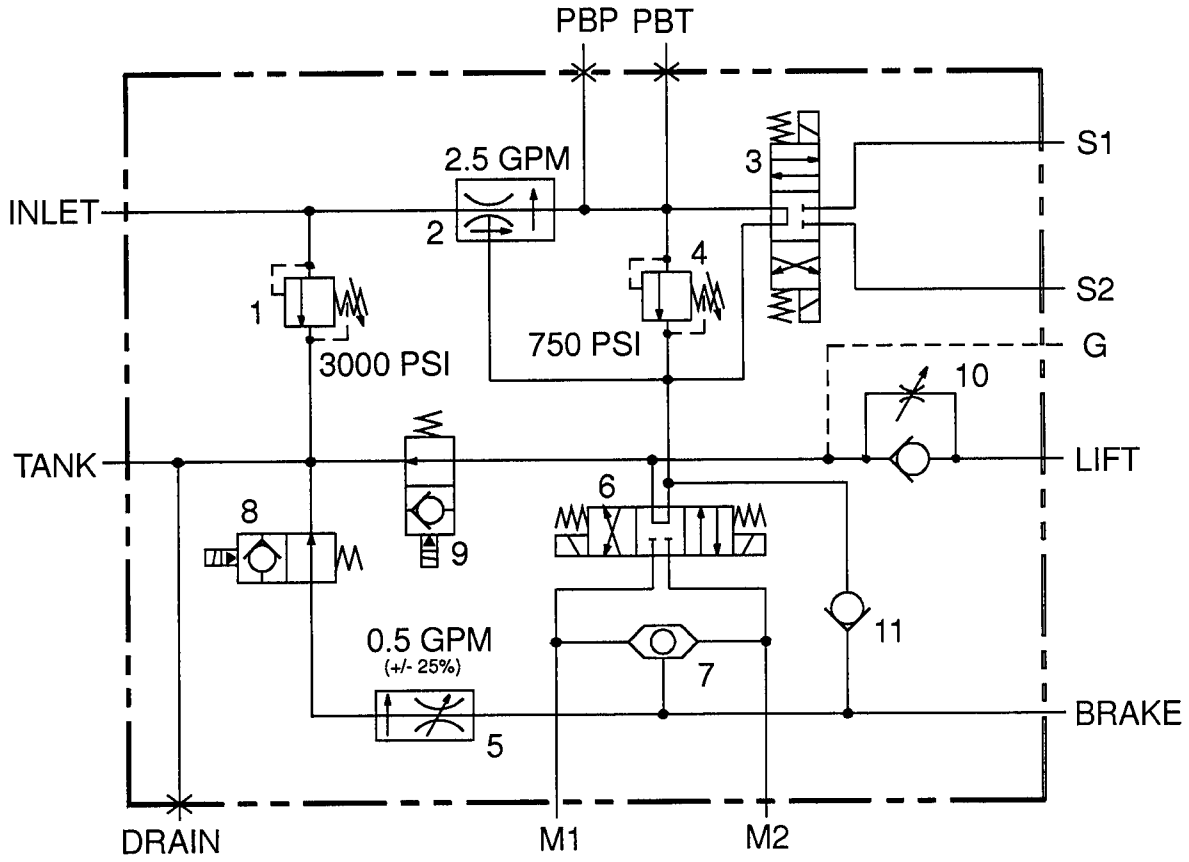


LEGEND: COMPONENT IDENTIFICATION

1. .....SYSTEM RELIEF VALVE
2. .....STEERING FLOW REGULATOR
3. .....STEERING DIRECTIONAL CONTROL VALVE
4. .....STEERING "CROSS-PORT" RELIEF VALVE
5. .....LOW SPEED TRAVEL FLOW REGULATOR
6. .....DRIVE DIRECTIONAL CONTROL VALVE
7. .....PARKING BRAKE RELEASE SHUTTLE VALVE
8. .....HIGH SPEED DRIVE SOLENOID VALVE
9. .....PLATFORM LIFT SOLENOID VALVE
10. .....PLATFORM LOWERING SPEED FLOW REGULATOR
11. .....PARKING BRAKE CIRCUIT UNLOADING CHECK VALVE

SERVICE & ADJUSTMENTS

HYDRAULIC SCHEMATIC (P/N 81288)



KEY TO PORT IDENTIFICATION

1. BRAKE.....PARKING BRAKE RELEASE
2. DRAIN.....N/A (BLOCKED)
3. G.....PRESSURE TEST PORT
4. INLET.....PUMP INLET
5. LIFT.....PLATFORM LIFT
6. M1.....FORWARD DRIVE
7. M2.....REVERSE DRIVE
8. PBP....."POWER BEYOND PRESSURE" NOT USED (BLOCKED)
9. PBT....."POWER BEYOND TANK" NOT USED (BLOCKED)
10. S1.....STEER RIGHT
11. S2.....STEER LEFT
12. TANK.....TANK RETURN

P/N 81288 FUNCTIONS VALVE

LEGEND: COMPONENT IDENTIFICATION

1. .....SYSTEM RELIEF VALVE
2. .....STEERING FLOW REGULATOR
3. .....STEERING DIRECTIONAL CONTROL VALVE
4. .....STEERING "CROSS-PORT" RELIEF VALVE
5. .....LOW SPEED TRAVEL FLOW REGULATOR
6. .....DRIVE DIRECTIONAL CONTROL VALVE
7. .....PARKING BRAKE RELEASE SHUTTLE VALVE
8. .....HIGH SPEED DRIVE SOLENOID VALVE
9. .....PLATFORM LIFT SOLENOID VALVE
10. .....PLATFORM LOWERING SPEED FLOW REGULATOR
11. .....PARKING BRAKE CIRCUIT UNLOADING CHECK VALVE

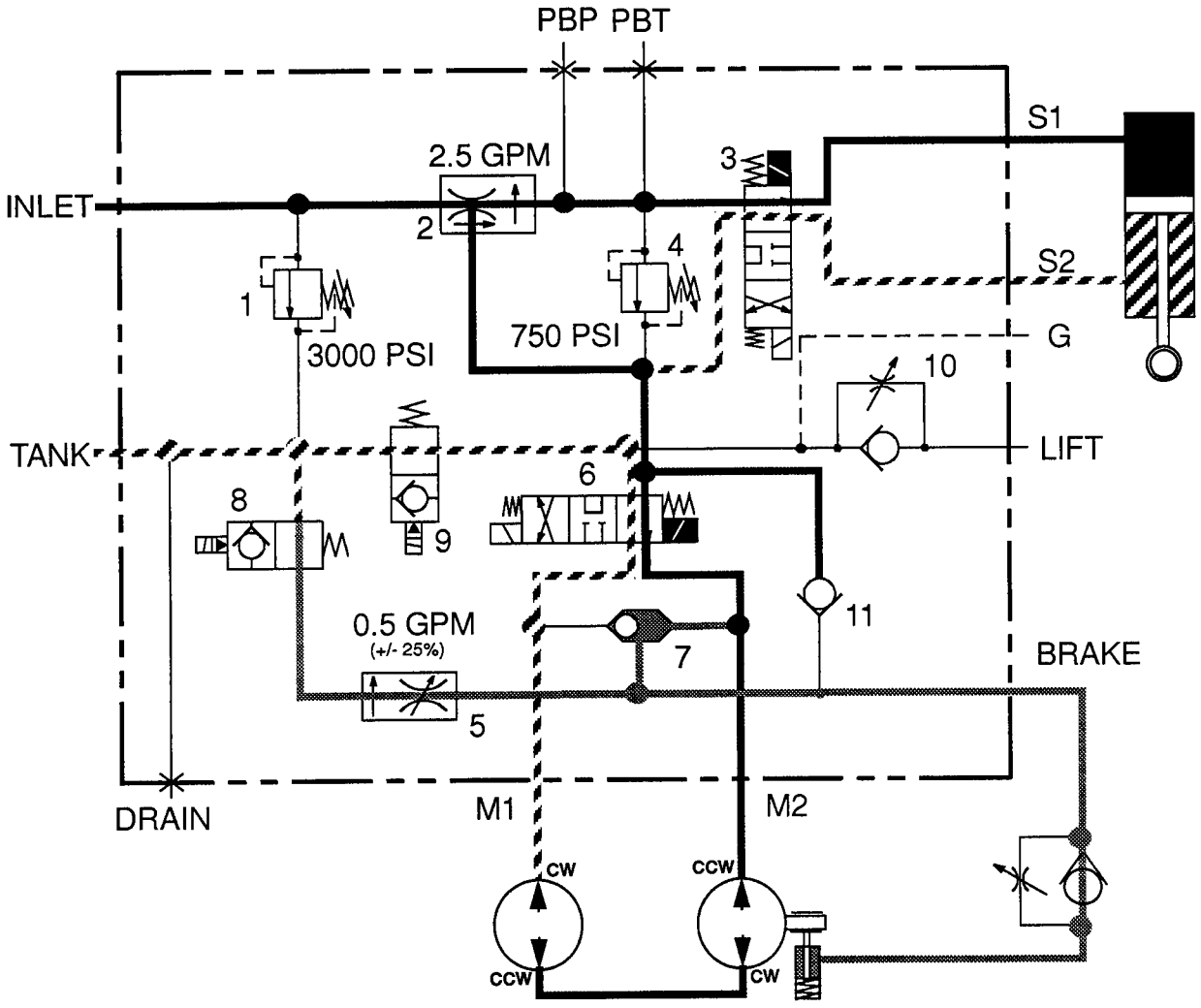
SERVICE & ADJUSTMENTS

FLOW DIAGRAM

P/N 81288

"LOW SPEED" TRAVEL FORWARD & STEER RIGHT

INLET/PUMP FLOW
RETURN/TANK FLOW
PILOT/CONTROL FLOW



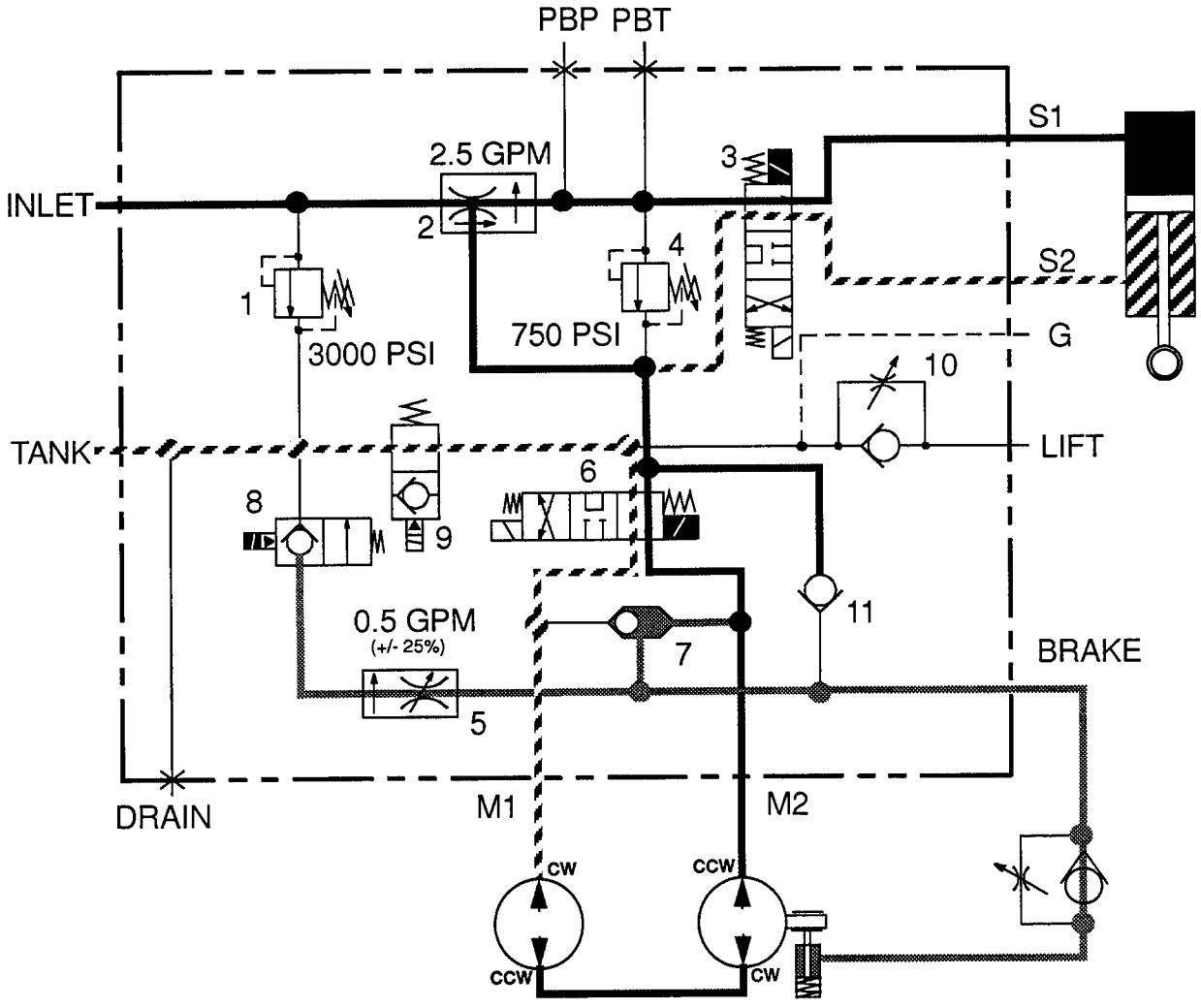
SERVICE & ADJUSTMENTS

FLOW DIAGRAM

P/N 81288

"HIGH SPEED" TRAVEL FORWARD & STEER RIGHT

INLET/PUMP FLOW
RETURN/TANK FLOW
PILOT/CONTROL FLOW

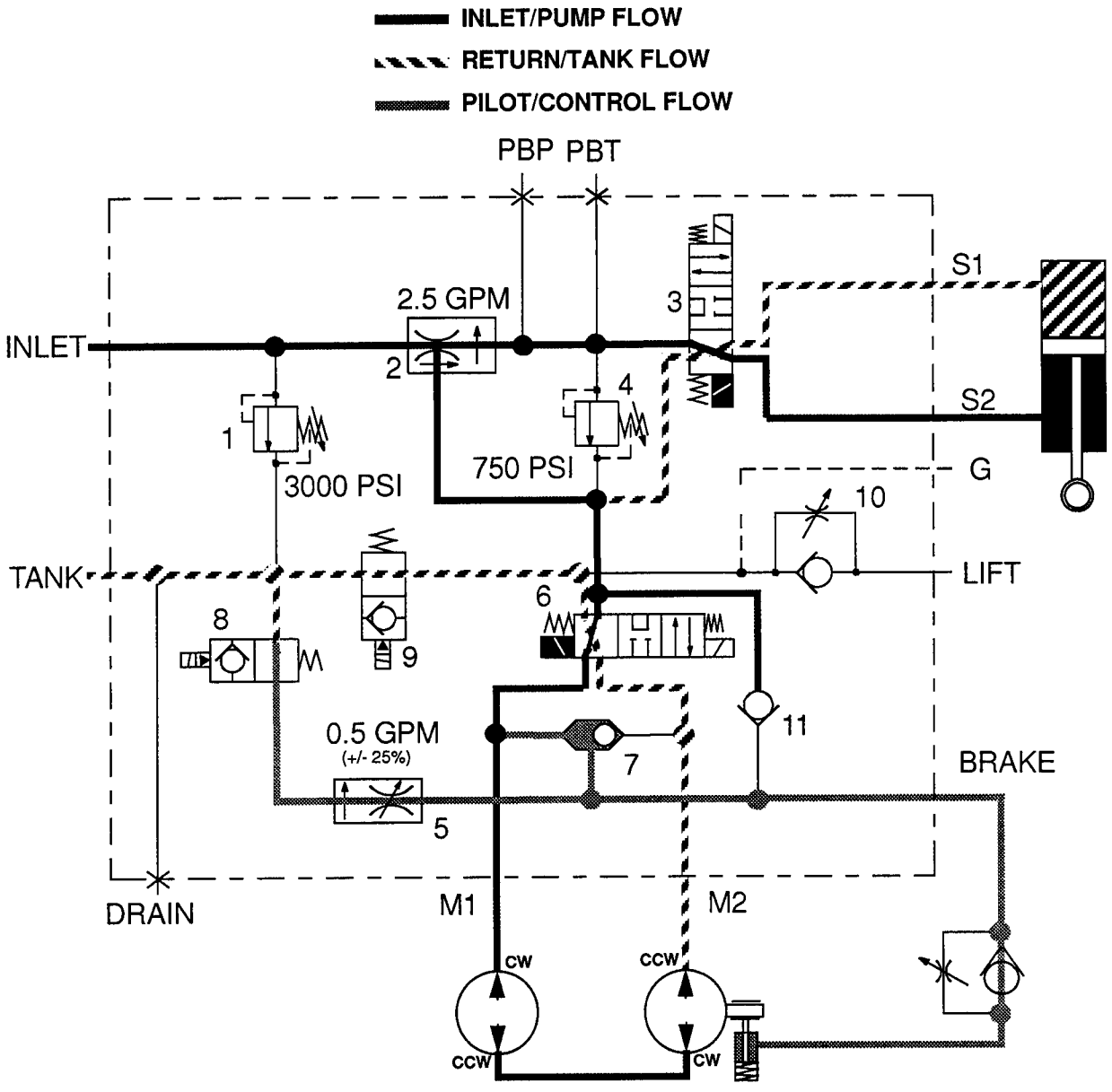


SERVICE & ADJUSTMENTS

FLOW DIAGRAM

P/N 81288

"LOW SPEED" TRAVEL REVERSE & STEER LEFT

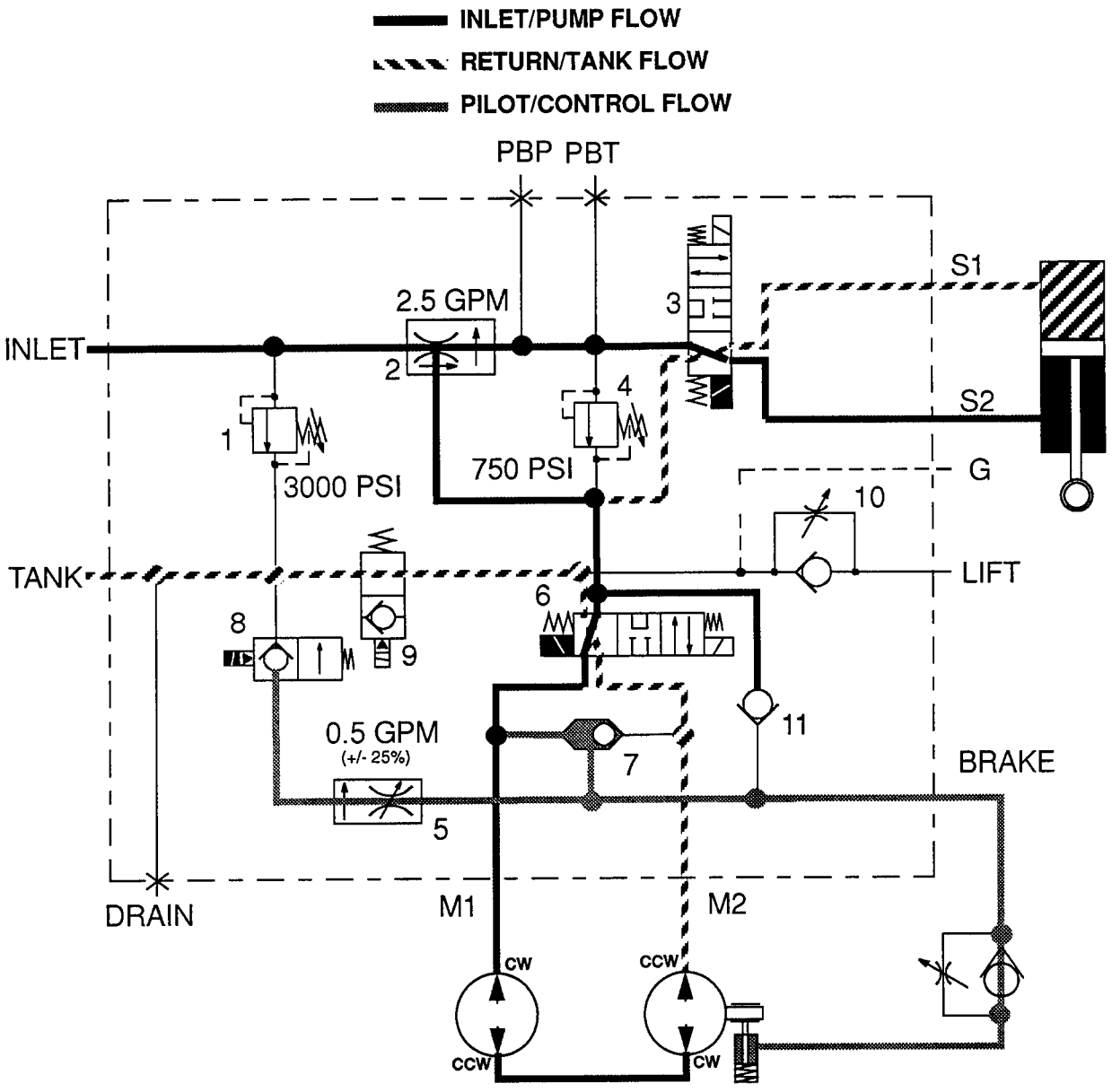


SERVICE & ADJUSTMENTS

FLOW DIAGRAM

P/N 81288

"HIGH SPEED" TRAVEL REVERSE & STEER LEFT



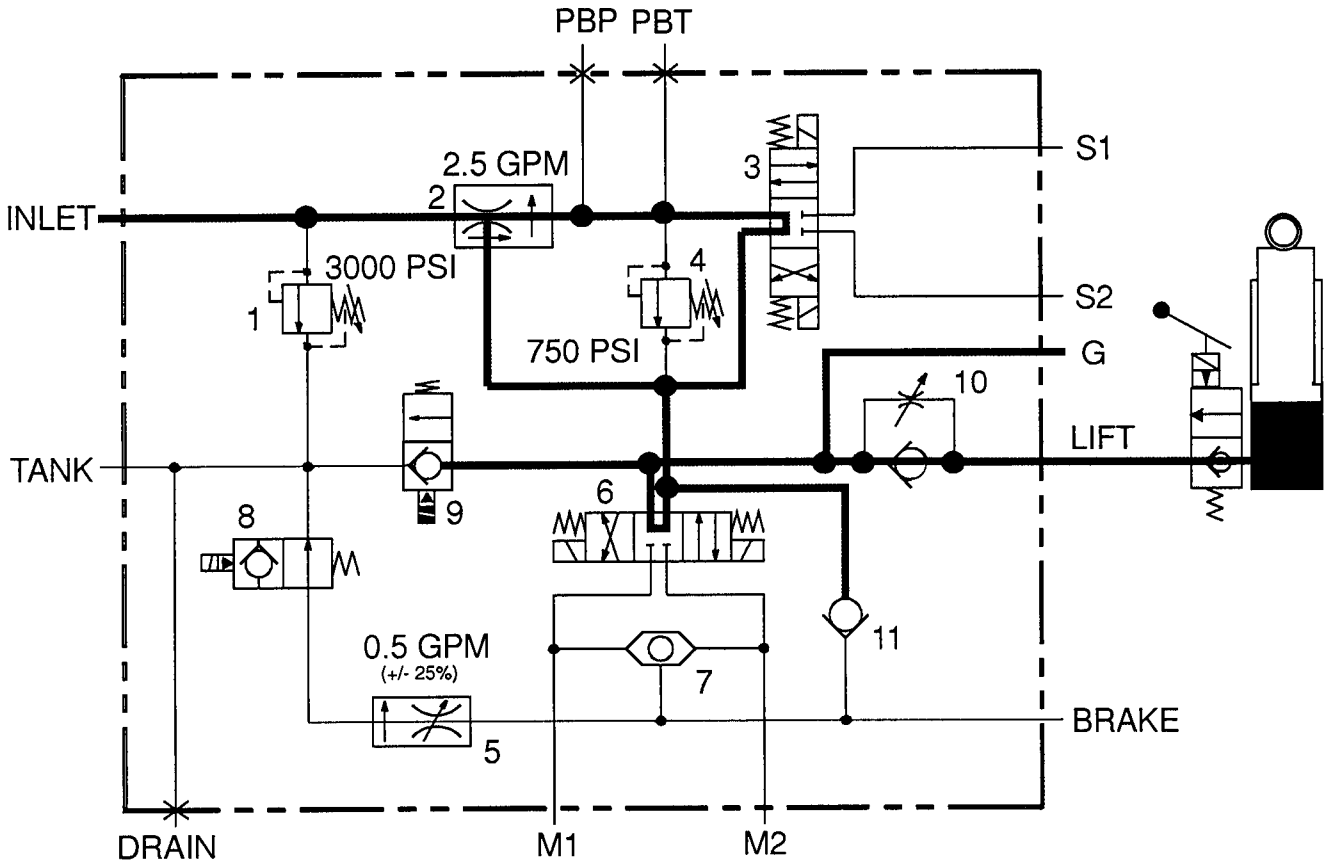
SERVICE & ADJUSTMENTS

FLOW DIAGRAM

P/N 81288

PLATFORM LIFT

INLET/PUMP FLOW
RETURN/TANK FLOW
PILOT/CONTROL FLOW

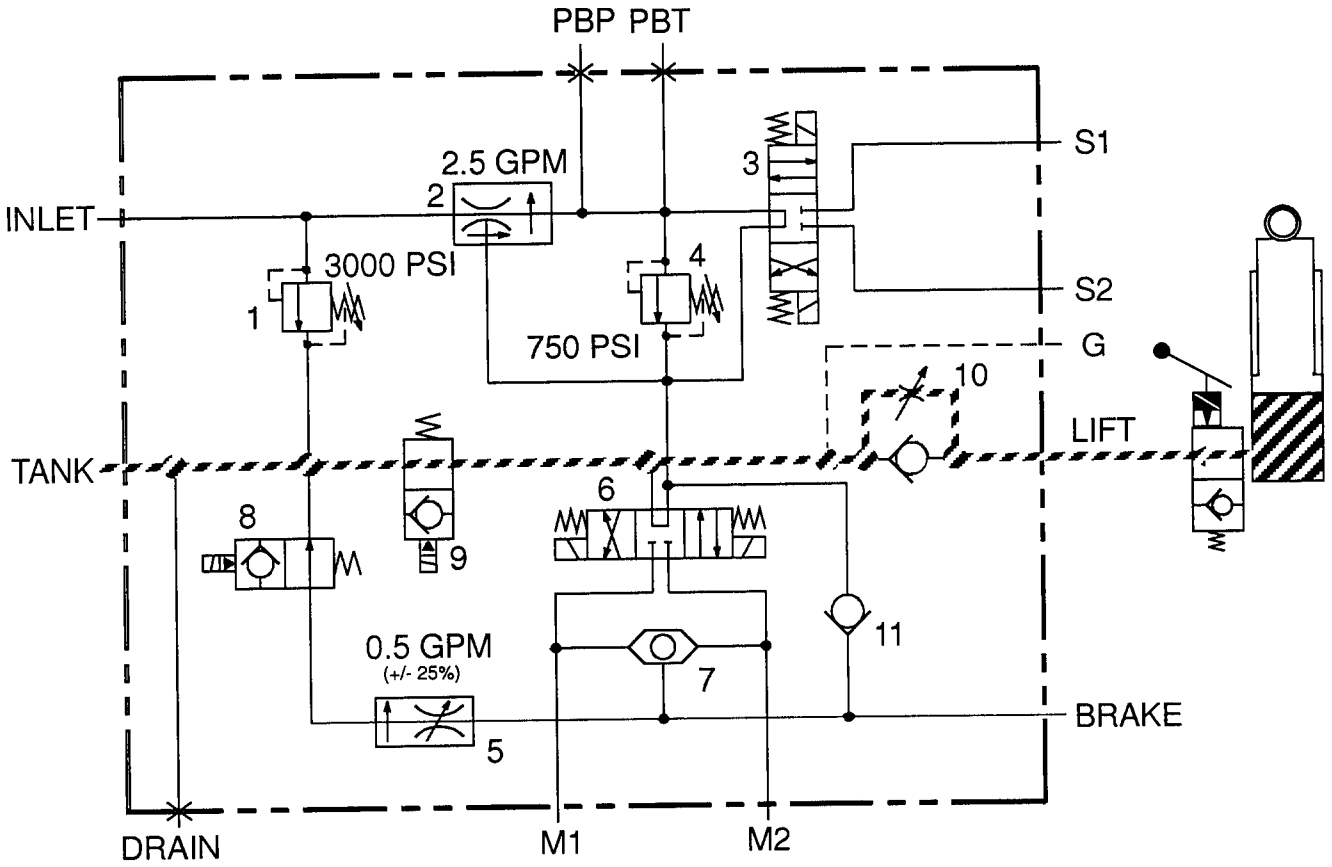


FLOW DIAGRAM

P/N 81288

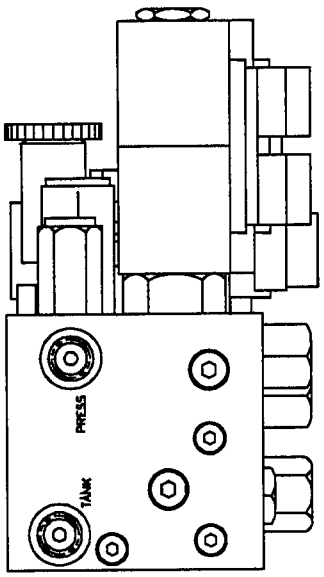
PLATFORM LOWER

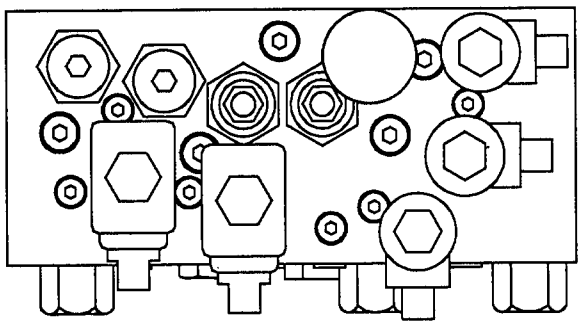
INLET/PUMP FLOW
RETURN/TANK FLOW
PILOT/CONTROL FLOW

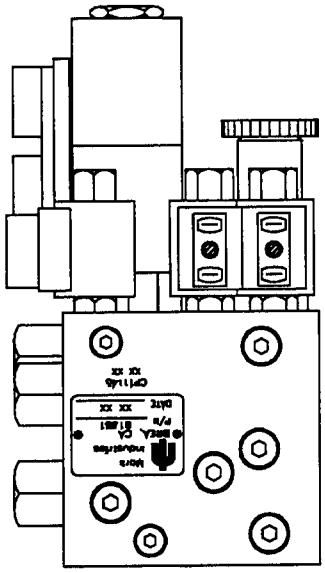


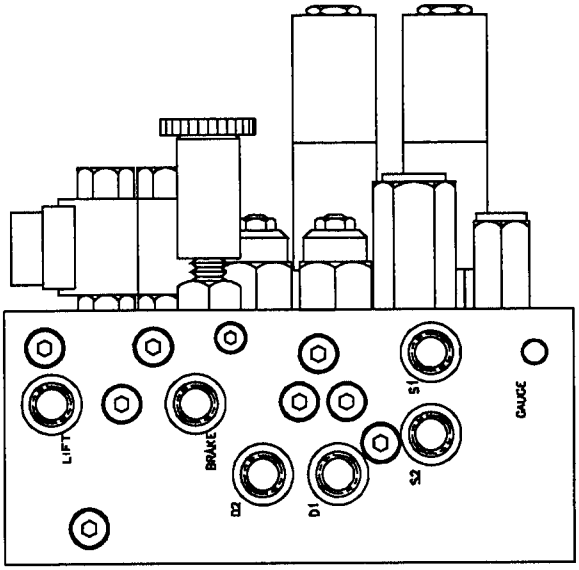
P/N 81381 FUNCTIONS VALVE

(CH20NEP/CH30EP W/NON-PROPORTIONAL DRIVE)



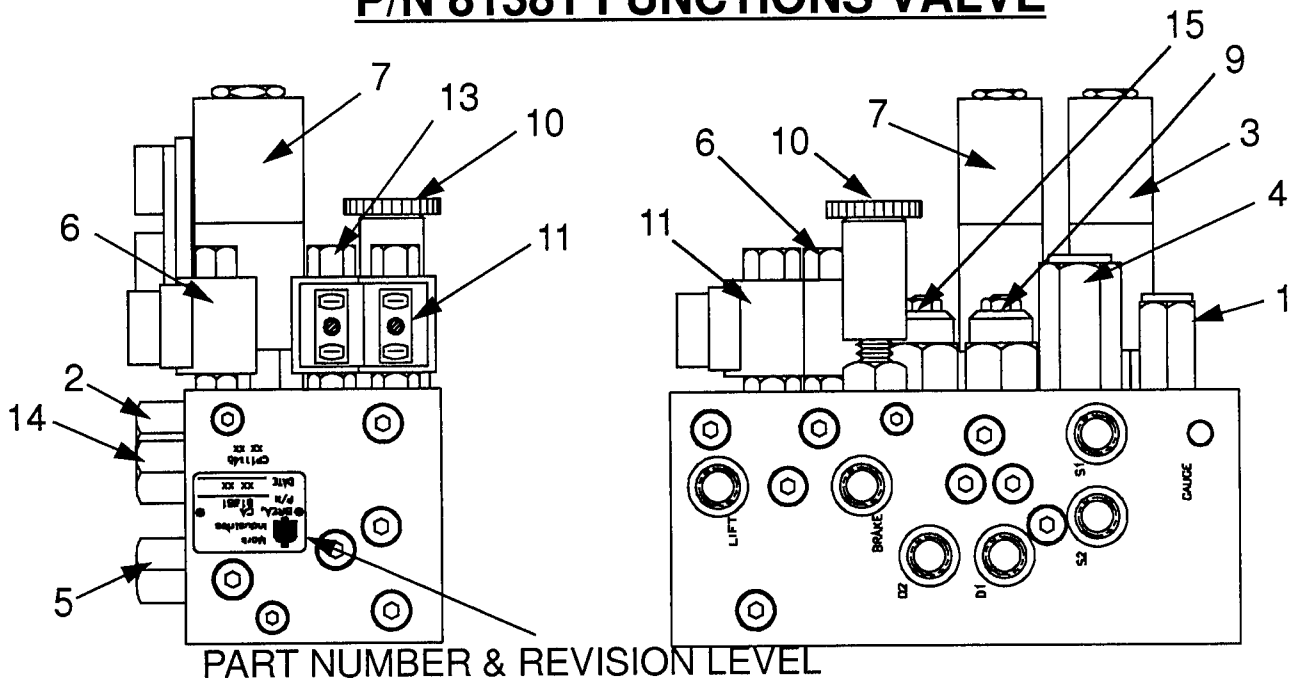






SERVICE & ADJUSTMENTS

P/N 81381 FUNCTIONS VALVE



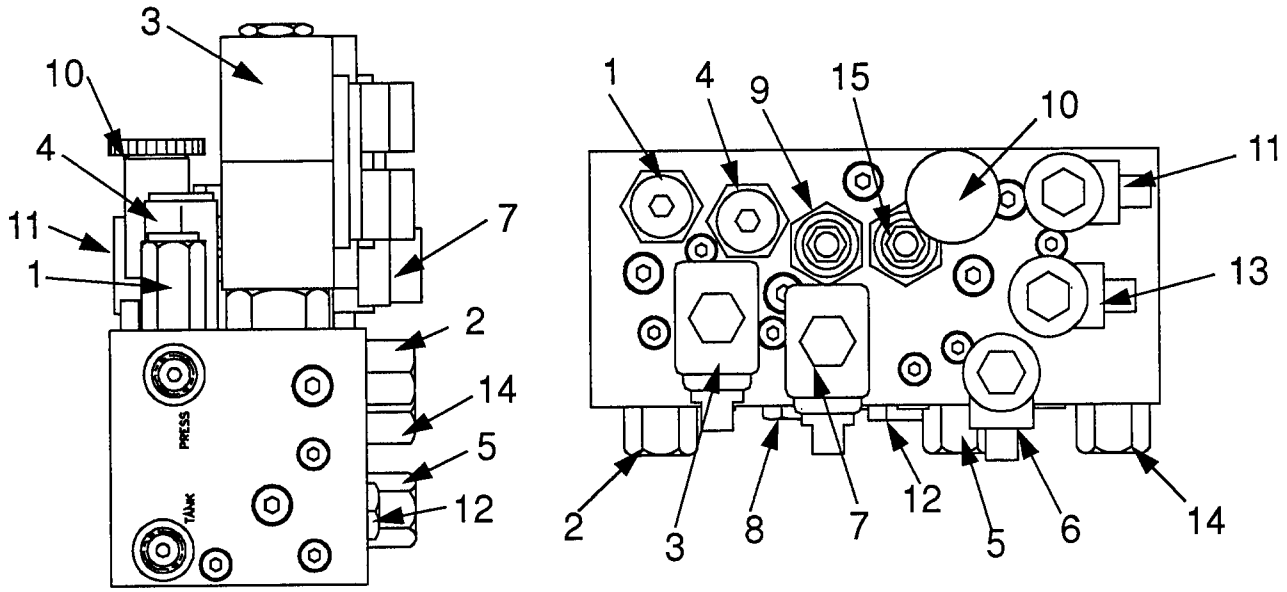
PART NUMBER & REVISION LEVEL

LEGEND: COMPONENT IDENTIFICATION

1. .....SYSTEM RELIEF VALVE
2. .....STEERING FLOW REGULATOR
3. .....STEERING DIRECTIONAL CONTROL VALVE
4. .....STEERING "CROSS-PORT" RELIEF VALVE
5. .....LOW SPEED TRAVEL FLOW REGULATOR
6. .....DRIVE "ENABLE" SOLENOID VALVE
7. .....DRIVE DIRECTIONAL CONTROL VALVE
8. .....PARKING BRAKE RELEASE SHUTTLE VALVE
9. .....DYNAMIC BRAKING COUNTERBALANCE VALVE (FORWARD)
10. .....PARKING BRAKE APPLICATION/"FREE-WHEELING VALVE
11. .....HIGH SPEED DRIVE SOLENOID VALVE
12. .....LOW SPEED FLOW REGULATOR BY-PASS CHECK VALVE
13. .....PLATFORM LIFT SOLENOID VALVE
14. .....PLATFORM LOWERING SPEED FLOW REGULATOR
15. .....DYNAMICBRAKING COUNTERBALANCE VALVE ((REVERSE)

SERVICE & ADJUSTMENTS

P/N 81381 FUNCTIONS VALVE

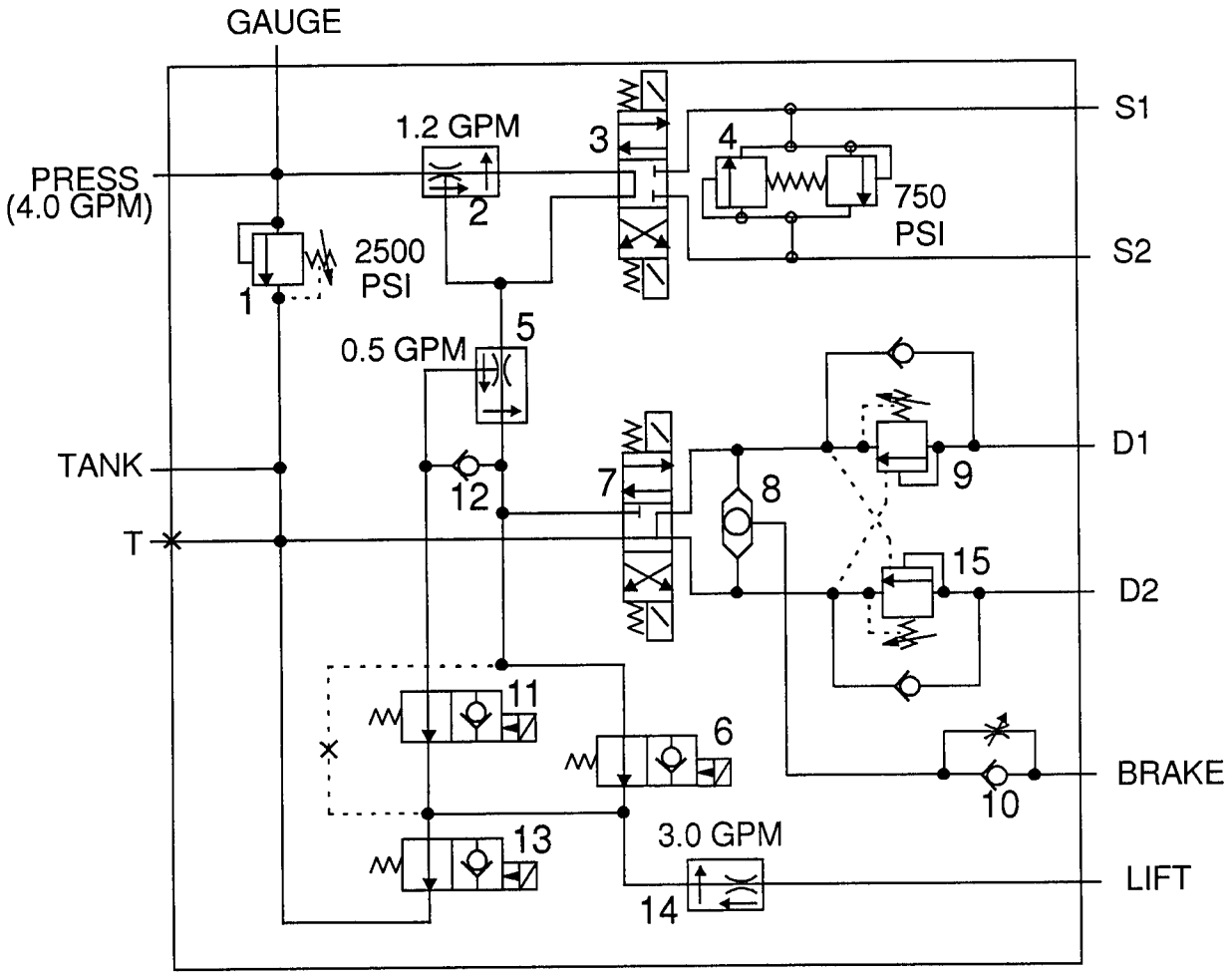


LEGEND: COMPONENT IDENTIFICATION

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7. .....DRIVE DIRECTIONAL CONTROL VALVE
8. .....PARKING BRAKE RELEASE SHUTTLE VALVE
9. .....DYNAMIC BRAKING COUNTERBALANCE VALVE (FORWARD)
10. .....PARKING BRAKE APPLICATION/"FREE-WHEELING VALVE
11. .....HIGH SPEED DRIVE SOLENOID VALVE
12. .....LOW SPEED FLOW REGULATOR BY-PASS CHECK VALVE
13. .....PLATFORM LIFT SOLENOID VALVE
14. .....PLATFORM LOWERING SPEED FLOW REGULATOR
15. .....DYNAMICBRAKING COUNTERBALANCE VALVE ((REVERSE)

SERVICE & ADJUSTMENTS

HYDRAULIC SCHEMATIC (P/N 81381)



KEY TO PORT IDENTIFICATION

BRAKE.....PARKING BRAKE RELEASE
D1.....FORWARD DRIVE
D2.....REVERSE DRIVE
GAUGE.....PRESSURE TEST
LIFT.....PLATFORM LIFT
PRESS.....PUMP INLET
S1.....STEER RIGHT
S2.....STEER LEFT
T.....N/A (BLOCKED)
TANK.....TANK RETURN

P/N 81381 FUNCTIONS VALVE

LEGEND: COMPONENT IDENTIFICATION

1. .....SYSTEM RELIEF VALVE
2. .....STEERING FLOW REGULATOR
3. .....STEERING DIRECTIONAL CONTROL VALVE
4. .....STEERING "CROSS-PORT" RELIEF VALVE
5. .....LOW SPEED TRAVEL FLOW REGULATOR
6. .....DRIVE "ENABLE" SOLENOID VALVE
7. .....DRIVE DIRECTIONAL CONTROL VALVE
8. .....PARKING BRAKE RELEASE SHUTTLE VALVE
9. .....DYNAMIC BRAKING COUNTERBALANCE VALVE (FORWARD)
10. .....PARKING BRAKE APPLICATION/"FREE-WHEELING VALVE
11. .....HIGH SPEED DRIVE SOLENOID VALVE
12. .....LOW SPEED FLOW REGULATOR BY-PASS CHECK VALVE
13. .....PLATFORM LIFT SOLENOID VALVE
14. .....PLATFORM LOWERING SPEED FLOW REGULATOR
15. .....DYNAMICBRAKING COUNTERBALANCE VALVE ((REVERSE)

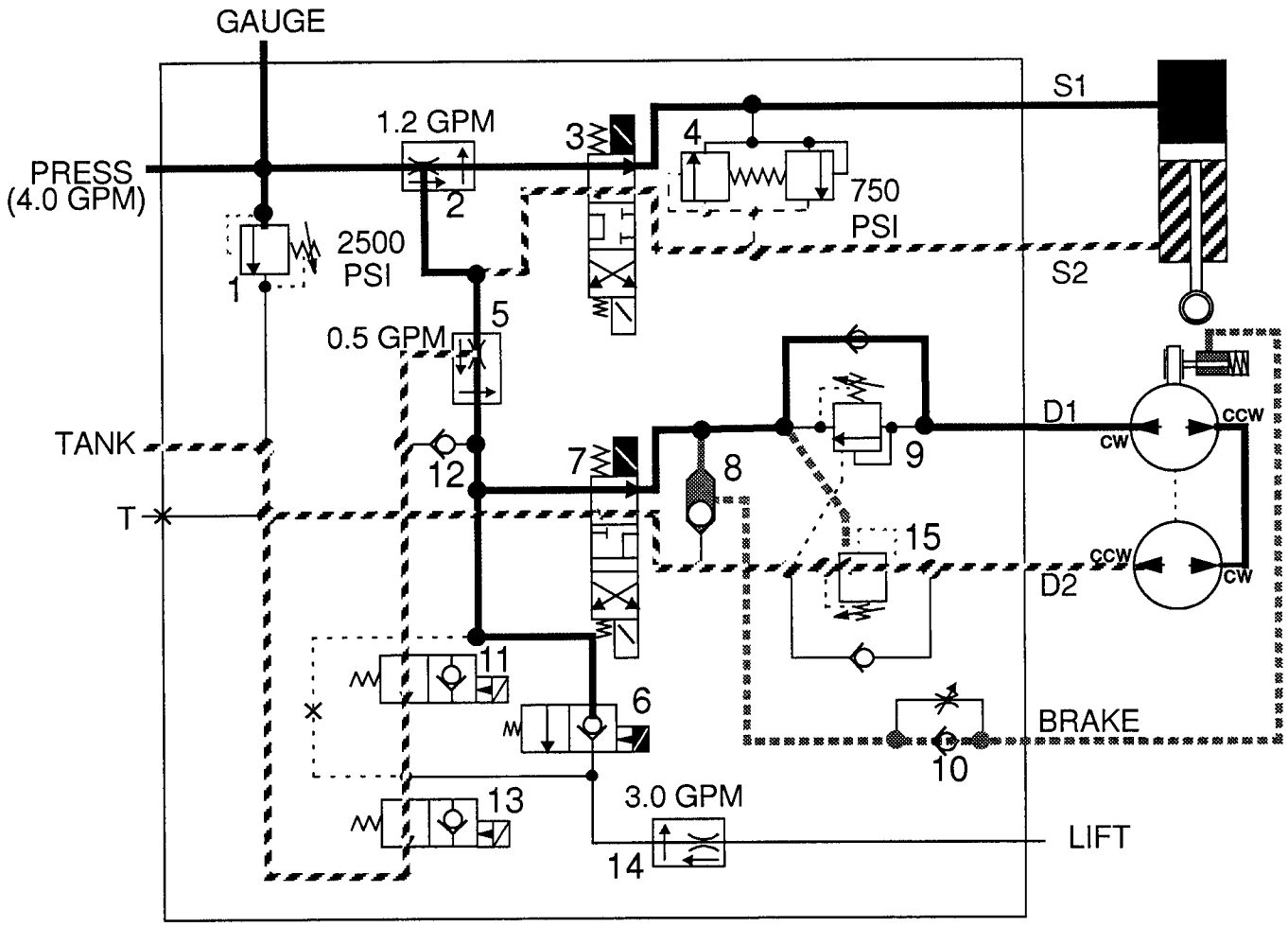
SERVICE & ADJUSTMENTS

FLOW DIAGRAM

P/N 81381

"LOW SPEED" TRAVEL FORWARD & STEER RIGHT

INLET/PUMP FLOW
RETURN/TANK FLOW
PILOT/CONTROL FLOW



FLOW DIAGRAM

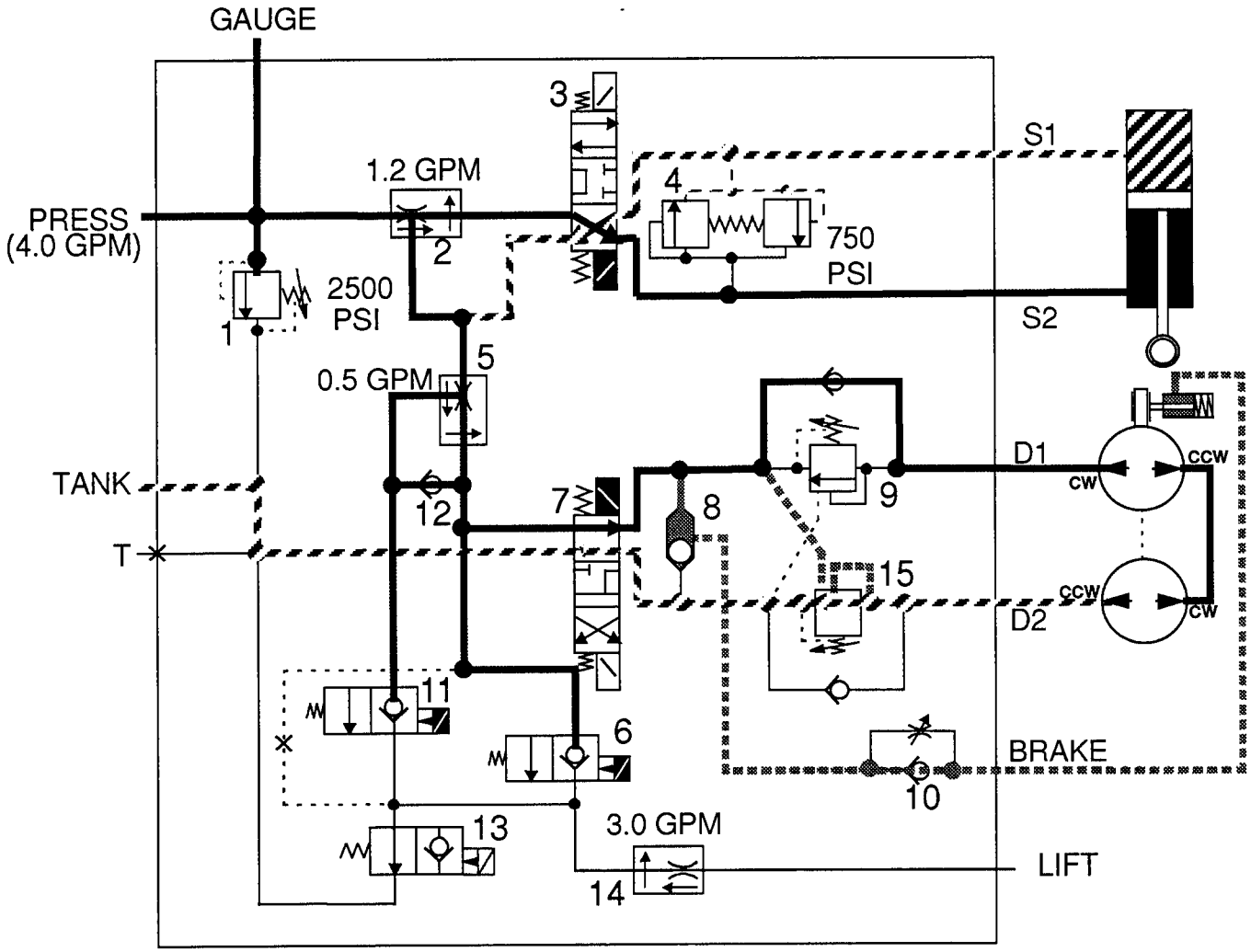
P/N 81381

"HIGH SPEED" TRAVEL FORWARD & STEER LEFT

INLET/PUMP FLOW

RETURN/TANK FLOW

PILOT/CONTROL FLOW



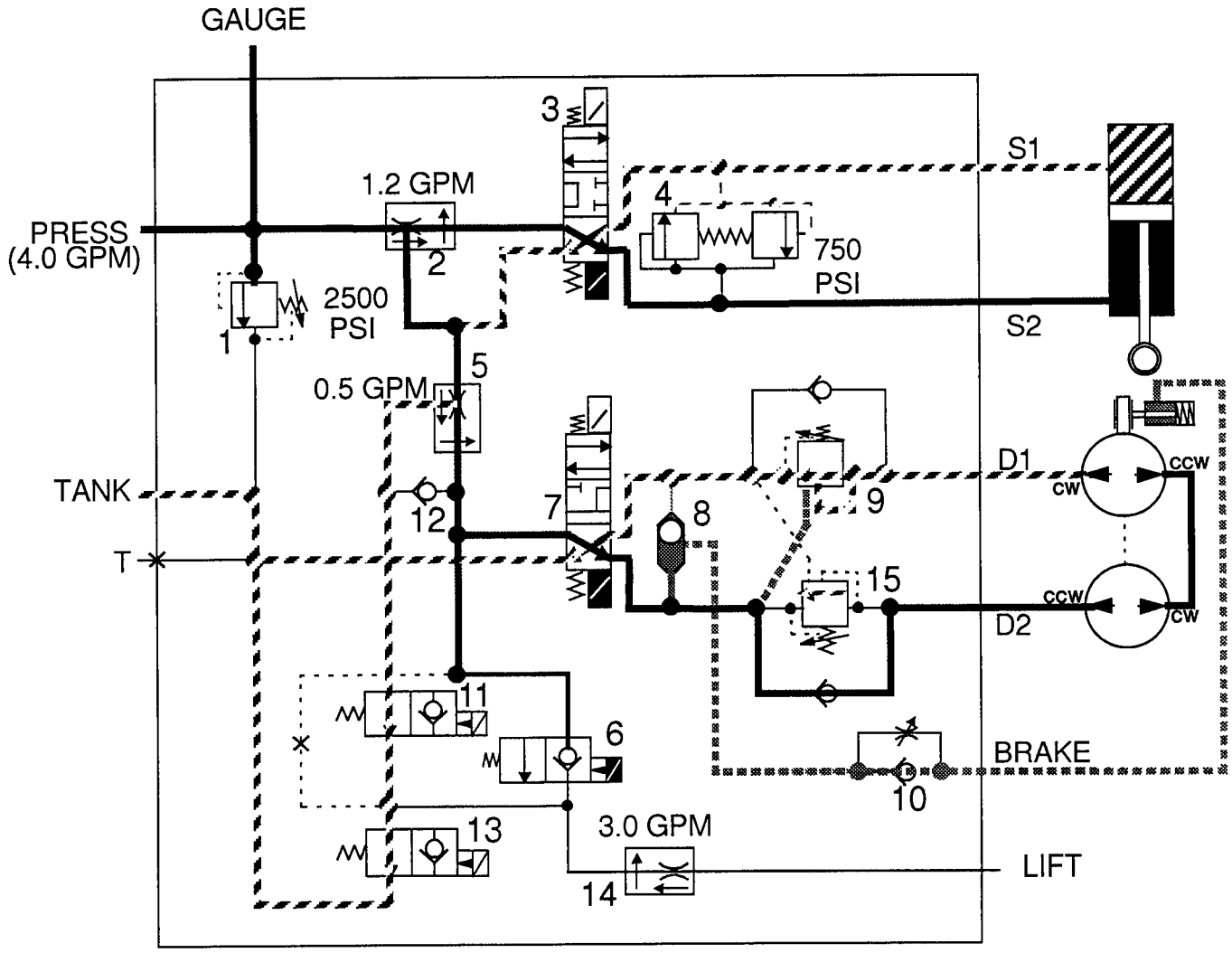
SERVICE & ADJUSTMENTS

FLOW DIAGRAM

P/N 81381

"LOW SPEED" TRAVEL REVERSE & STEER LEFT

INLET/PUMP FLOW
RETURN/TANK FLOW
PILOT/CONTROL FLOW

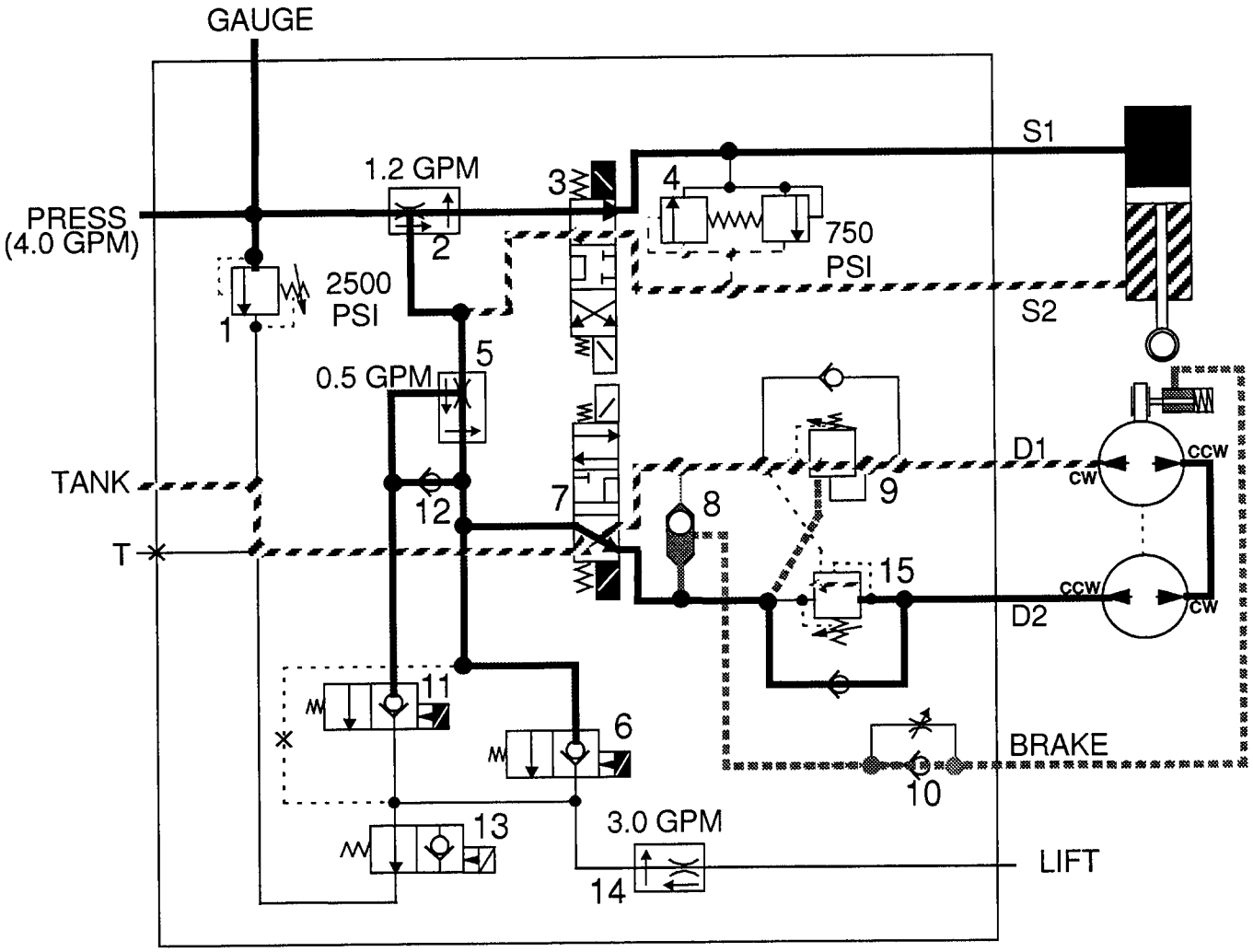


FLOW DIAGRAM

P/N 81381

"HIGH SPEED" TRAVEL REVERSE & STEER LEFT

INLET/PUMP FLOW
RETURN/TANK FLOW
PILOT/CONTROL FLOW



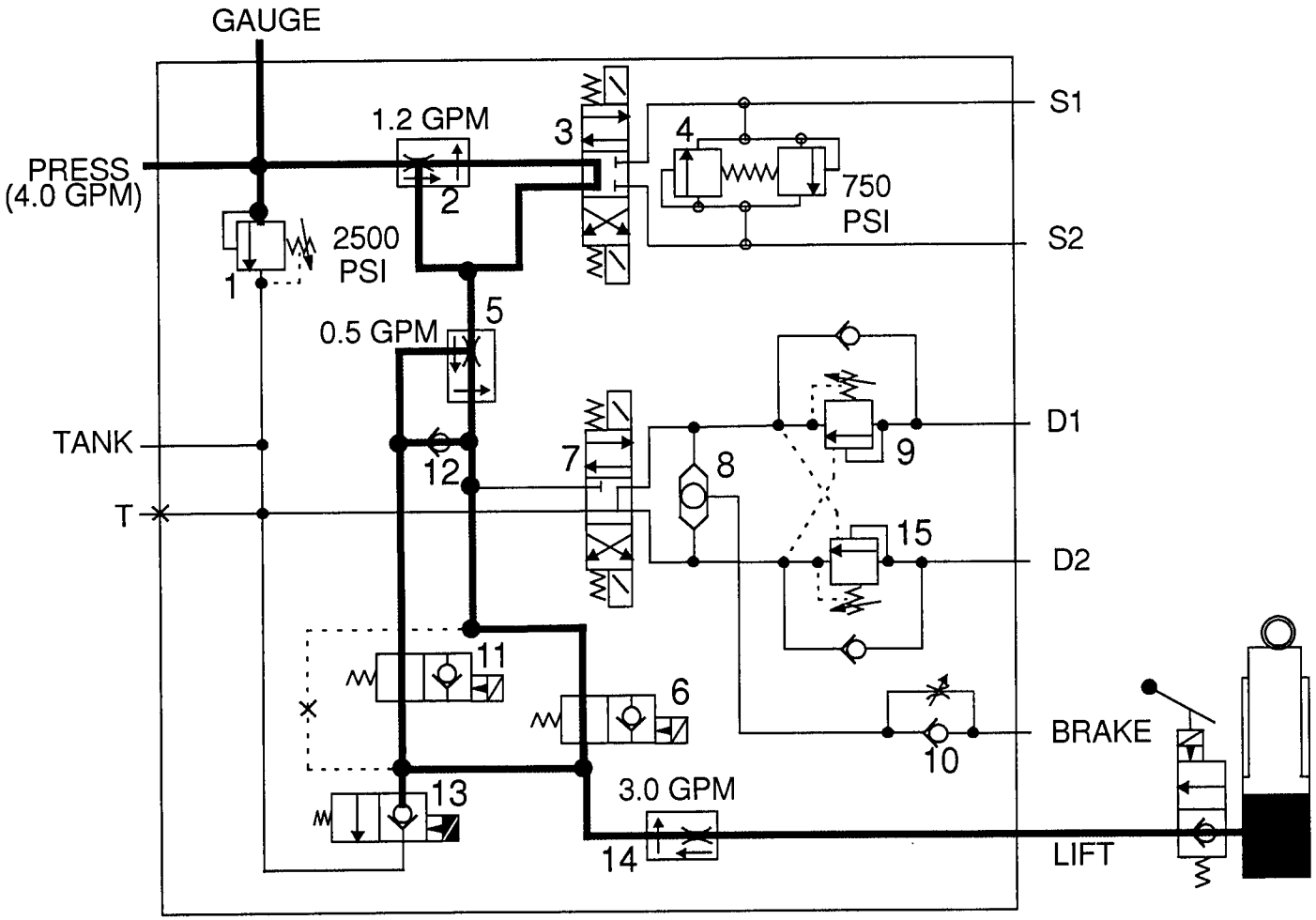
SERVICE & ADJUSTMENTS

FLOW DIAGRAM

P/N 81381

PLATFORM LIFT

INLET/PUMP FLOW
RETURN/TANK FLOW
PILOT/CONTROL FLOW



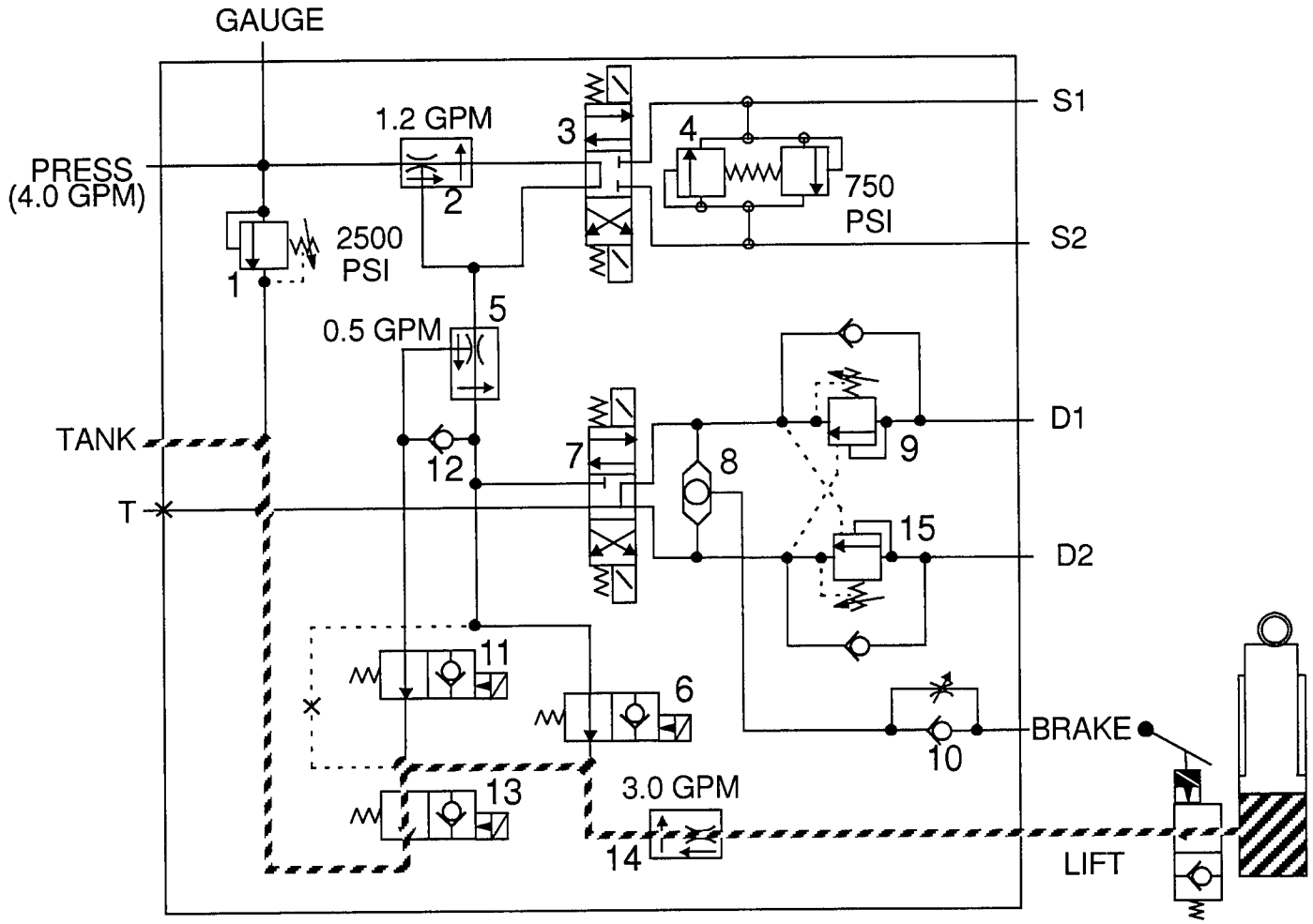
SERVICE & ADJUSTMENTS

FLOW DIAGRAM

P/N 81381

PLATFORM LOWER

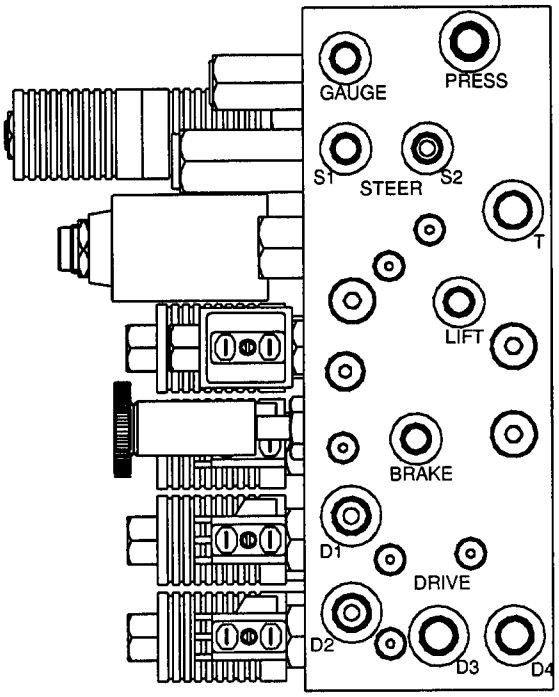
INLET/PUMP FLOW
RETURN/TANK FLOW
PILOT/CONTROL FLOW

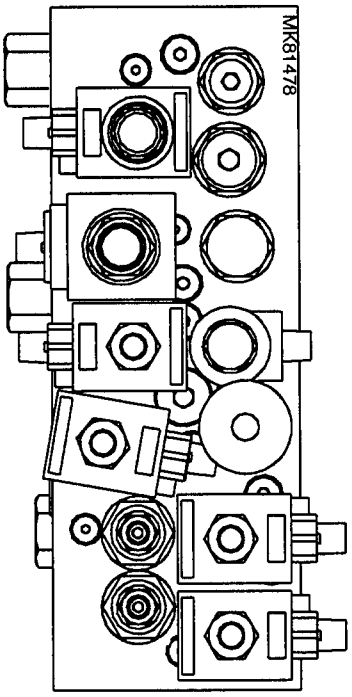


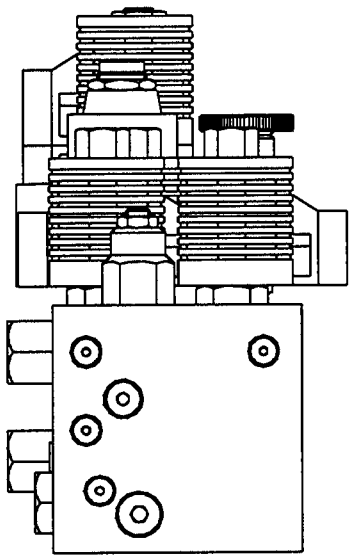
SERVICE & ADJUSTMENTS

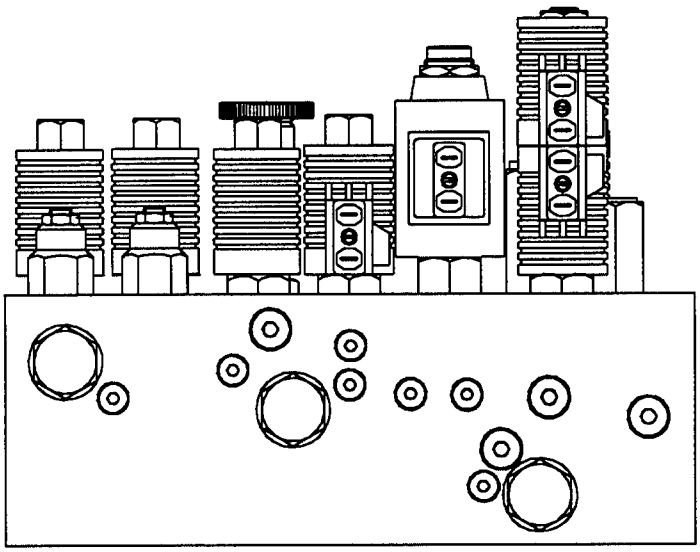
P/N 81478 FUNCTIONS VALVE

(USED ON ALL CH MODELS W/PROPORTIONAL DRIVE)



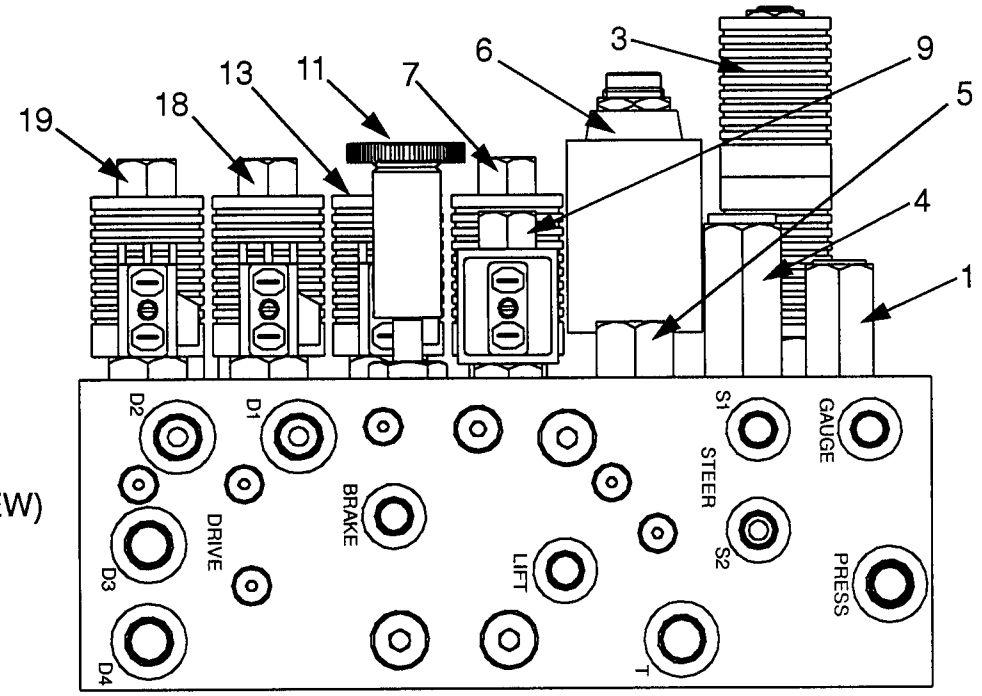






SERVICE & ADJUSTMENTS

P/N 81478 FUNCTIONS VALVE



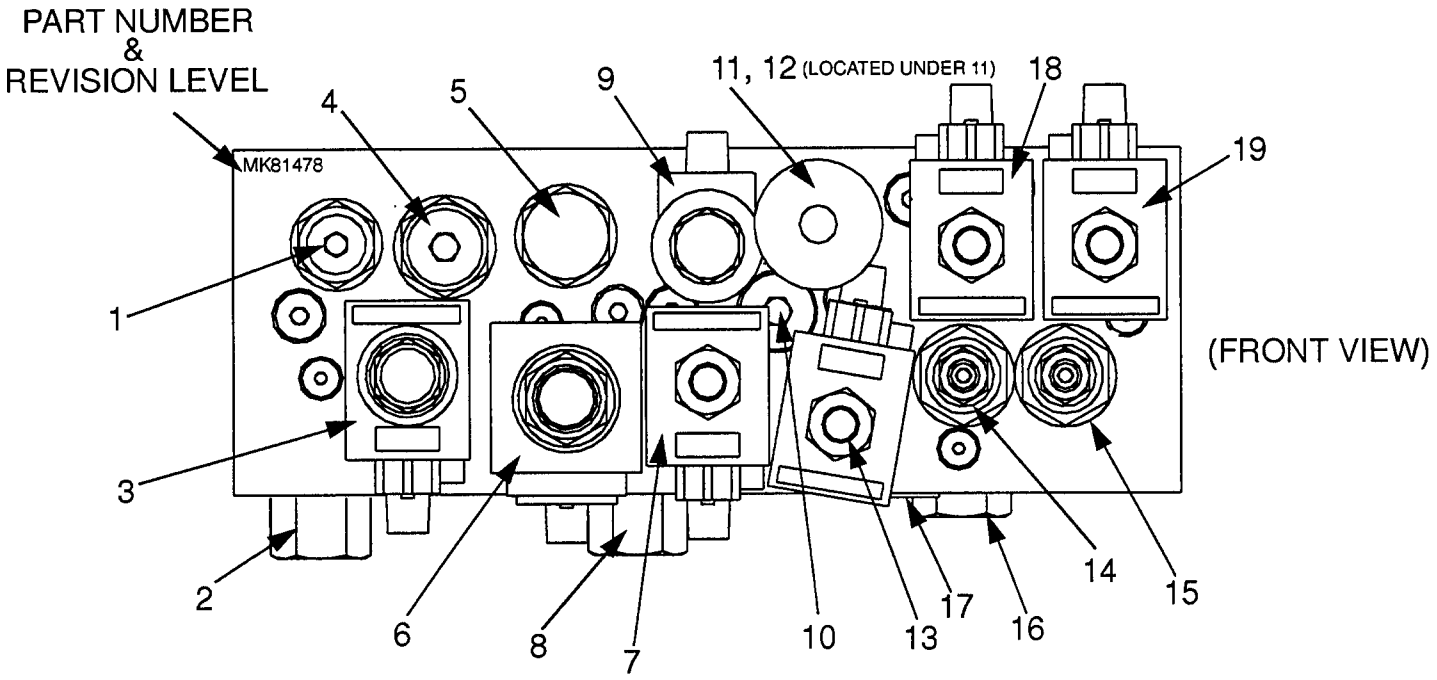
(TOP VIEW)

LEGEND: COMPONENT IDENTIFICATION

1. .....SYSTEM RELIEF VALVE
2. .....STEERING FLOW REGULATOR
3. .....STEERING DIRECTIONAL CONTROL VALVE
4. .....STEERING RELIEF VALVE
5. .....DIFFERRENTIAL PRESSURE SENSING VALVE
6. .....PROPORTIONAL SOLENOID VALVE
7. .....PLATFORM LIFT SOLENOID VALVE
8. .....PLATFROM LOWERING SPEED FLOW REGULATOR
9. .....DRIVE ENABLE SOLENOID VALVE
10. .....PARKING BRAKE RELEASE CHECK VALVE
11. .....PARKING BRAKE APPLICATION ORIFICE PLUG
12. .....PARKING BRAKE "FREE-WHEELING" VALVE
13. .....DRIVE DIRECTIONAL CONTROL SOLENOID VALVE
14. .....COUNTERBALANCE VALVE "DYNAMIC BRAKING" FWD
15. .....COUNTERBALANCE VALVE "DYNAMIC BRAKING" REV
16. .....FLOW DIVIDER/COMBINER VALVE
17. .....ORIFICE PLUG FLOW DIVIDER/COMBINER "BYPASS"
18. .....HIGH SPEED DRIVE -"SERIES/PARALLEL" VALVE
19. .....HIGH SPEED DRIVE -"SERIES/PARALLEL" VALVE

SERVICE & ADJUSTMENTS

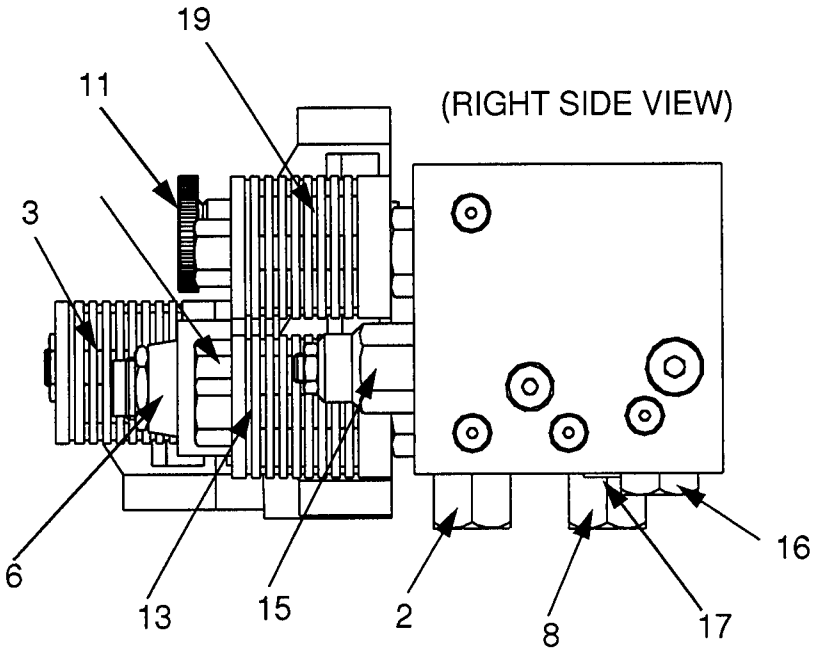
P/N 81478 FUNCTIONS VALVE



LEGEND: COMPONENT IDENTIFICATION

1. .....SYSTEM RELIEF VALVE
2. .....STEERING FLOW REGULATOR
3. .....STEERING DIRECTIONAL CONTROL VALVE
4. .....STEERING RELIEF VALVE
5. .....DIFFERRENTIAL PRESSURE SENSING VALVE
6. .....PROPORTIONAL SOLENOID VALVE
7. .....PLATFORM LIFT SOLENOID VALVE
8. .....PLATFROM LOWERING SPEED FLOW REGULATOR
9. .....DRIVE ENABLE SOLENOID VALVE
10. .....PARKING BRAKE RELEASE CHECK VALVE
11. .....PARKING BRAKE APPLICATION ORIFICE PLUG
12. .....PARKING BRAKE "FREE-WHEELING" VALVE
13. .....DRIVE DIRECTIONAL CONTROL SOLENOID VALVE
14. .....COUNTERBALANCE VALVE "DYNAMIC BRAKING" FWD
15. .....COUNTERBALANCE VALVE "DYNAMIC BRAKING" REV
16. .....FLOW DIVIDER/COMBINER VALVE
17. .....ORIFICE PLUG FLOW DIVIDER/COMBINER "BYPASS"
18. .....HIGH SPEED DRIVE -"SERIES/PARALLEL" VALVE
19. .....HIGH SPEED DRIVE -"SERIES/PARALLEL" VALVE

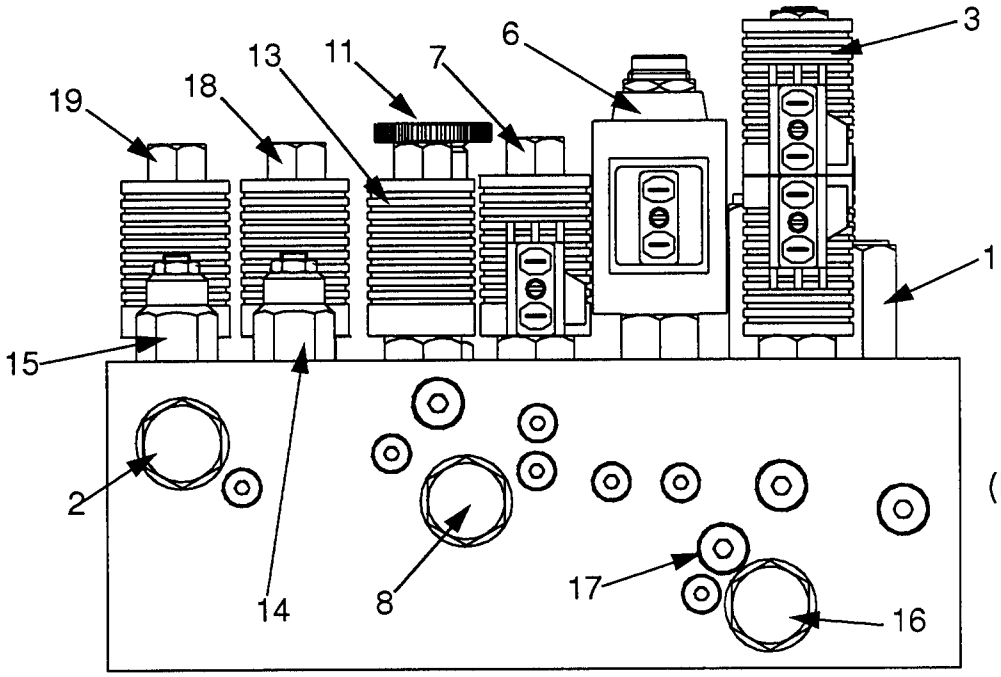
P/N 81478 FUNCTIONS VALVE



LEGEND: COMPONENT IDENTIFICATION

1. .....SYSTEM RELIEF VALVE
2. .....STEERING FLOW REGULATOR
3. .....STEERING DIRECTIONAL CONTROL VALVE
4. .....STEERING RELIEF VALVE
5. .....DIFFERRENTIAL PRESSURE SENSING VALVE
6. .....PROPORTIONAL SOLENOID VALVE
7. .....PLATFORM LIFT SOLENOID VALVE
8. .....PLATFROM LOWERING SPEED FLOW REGULATOR
9. .....DRIVE ENABLE SOLENOID VALVE
10. .....PARKING BRAKE RELEASE CHECK VALVE
11. .....PARKING BRAKE APPLICATION ORIFICE PLUG
12. .....PARKING BRAKE "FREE-WHEELING" VALVE
13. .....DRIVE DIRECTIONAL CONTROL SOLENOID VALVE
14. .....COUNTERBALANCE VALVE "DYNAMIC BRAKING" FWD
15. .....COUNTERBALANCE VALVE "DYNAMIC BRAKING" REV
16. .....FLOW DIVIDER/COMBINER VALVE
17. .....ORIFICE PLUG FLOW DIVIDER/COMBINER "BYPASS"
18. .....HIGH SPEED DRIVE -"SERIES/PARALLEL" VALVE
19. .....HIGH SPEED DRIVE -"SERIES/PARALLEL" VALVE

P/N 81478 FUNCTIONS VALVE

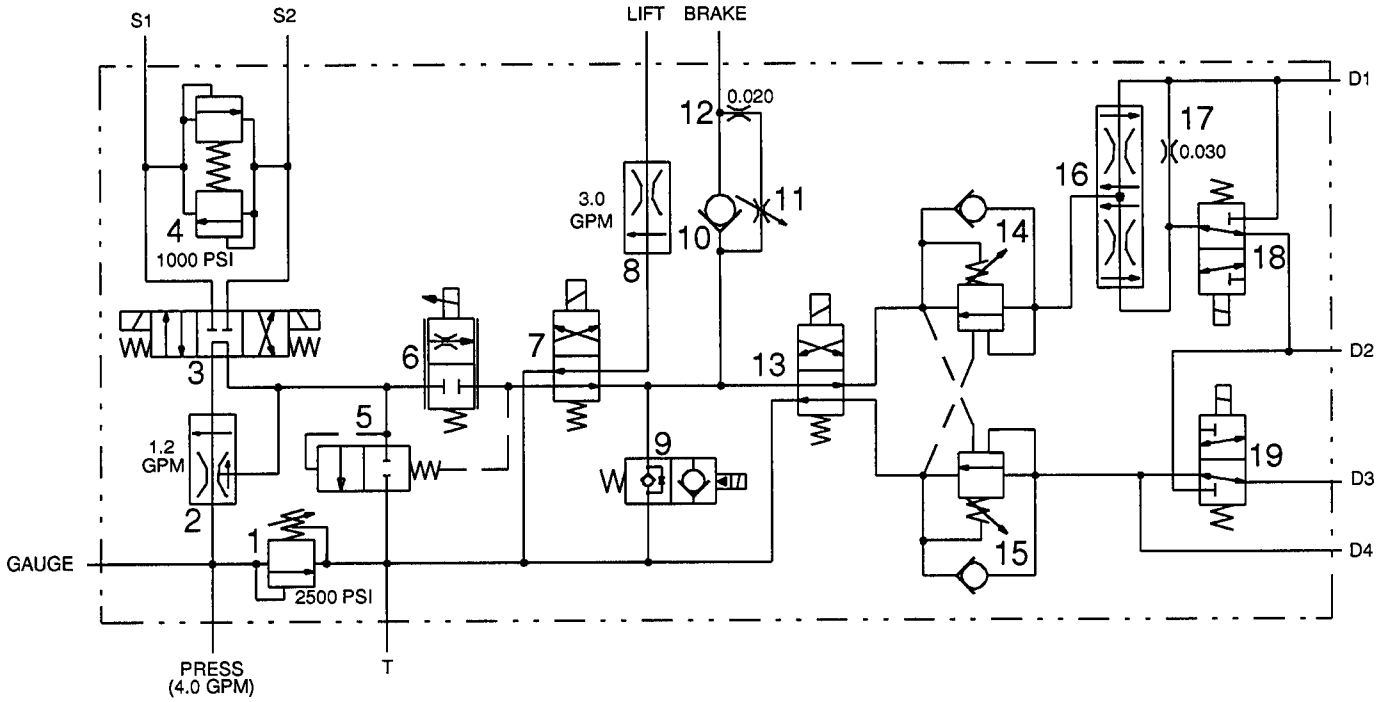


(BOTTOM VIEW)

LEGEND: COMPONENT IDENTIFICATION

1. .....SYSTEM RELIEF VALVE
2. .....STEERING FLOW REGULATOR
3. .....STEERING DIRECTIONAL CONTROL VALVE
4. .....STEERING RELIEF VALVE
5. .....DIFFERRENTIAL PRESSURE SENSING VALVE
6. .....PROPORTIONAL SOLENOID VALVE
7. .....PLATFORM LIFT SOLENOID VALVE
8. .....PLATFROM LOWERING SPEED FLOW REGULATOR
9. .....DRIVE ENABLE SOLENOID VALVE
10. .....PARKING BRAKE RELEASE CHECK VALVE
11. .....PARKING BRAKE APPLICATION ORIFICE PLUG
12. .....PARKING BRAKE "FREE-WHEELING" VALVE
13. .....DRIVE DIRECTIONAL CONTROL SOLENOID VALVE
14. .....COUNTERBALANCE VALVE "DYNAMIC BRAKING" FWD
15. .....COUNTERBALANCE VALVE "DYNAMIC BRAKING" REV
16. .....FLOW DIVIDER/COMBINER VALVE
17. .....ORIFICE PLUG FLOW DIVIDER/COMBINER "BYPASS"
18. .....HIGH SPEED DRIVE -"SERIES/PARALLEL" VALVE
19. .....HIGH SPEED DRIVE -"SERIES/PARALLEL" VALVE

P/N 81478 FUNCTIONS VALVE



KEY TO PORT IDENTIFICATION

BRAKE.....PARKING BRAKE RELEASE
D1.....FORWARD DRIVE
D2.....FORWARD DRIVE
D3.....REVERSE DRIVE
D4.....REVERSE DRIVE
GAUGE.....PRESSURE TEST
LIFT.....PLATFORM LIFT
PRESS.....PUMP INLET
S1.....STEER RIGHT
S2.....STEER LEFT
T.....TANK RETURN

P/N 81478 FUNCTIONS VALVE

LEGEND: COMPONENT IDENTIFICATION

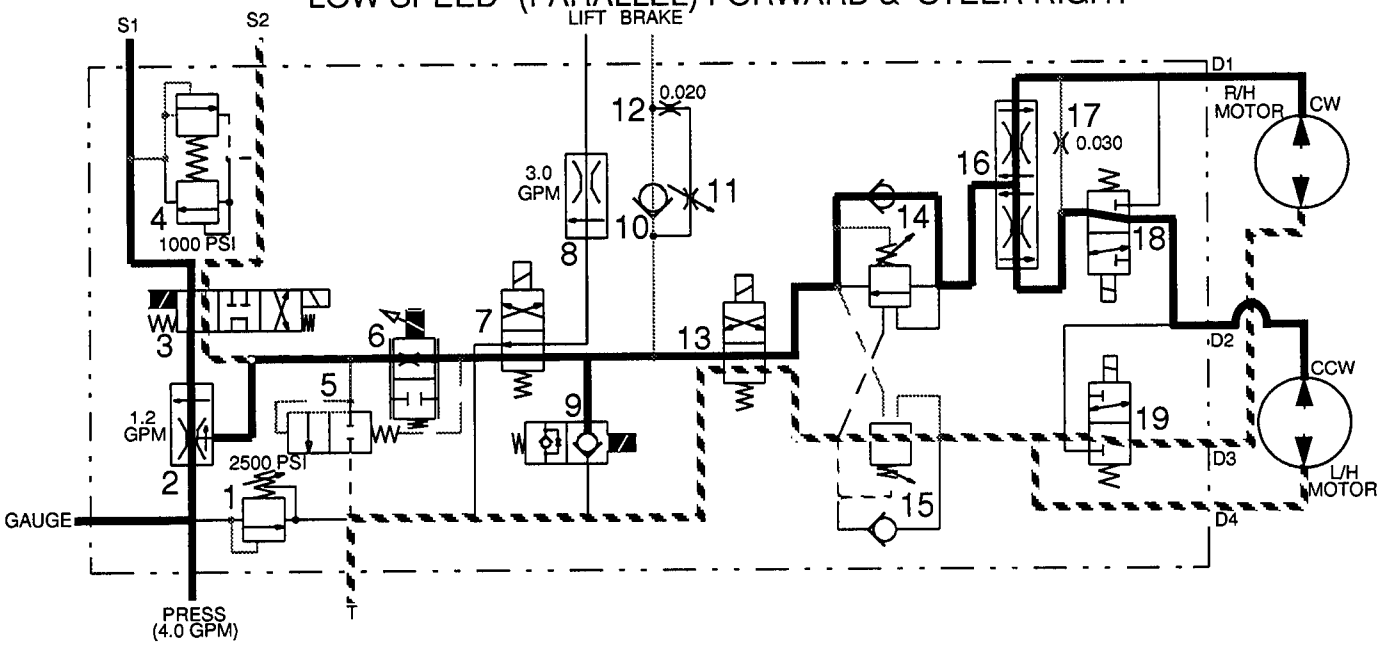
1. .....SYSTEM RELIEF VALVE
2. .....STEERING FLOW REGULATOR
3. .....STEERING DIRECTIONAL CONTROL VALVE
4. .....STEERING RELIEF VALVE
5. .....DIFFERRENTIAL PRESSURE SENSING VALVE
6. .....PROPORTIONAL SOLENOID VALVE
7. .....PLATFORM LIFT SOLENOID VALVE
8. .....PLATFROM LOWERING SPEED FLOW REGULATOR
9. .....DRIVE ENABLE SOLENOID VALVE
10. .....PARKING BRAKE RELEASE CHECK VALVE
11. .....PARKING BRAKE APPLICATION ORIFICE PLUG
12. .....PARKING BRAKE "FREE-WHEELING" VALVE
13. .....DRIVE DIRECTIONAL CONTROL SOLENOID VALVE
14. .....COUNTERBALANCE VALVE "DYNAMIC BRAKING" FWD
15. .....COUNTERBALANCE VALVE "DYNAMIC BRAKING" REV
16. .....FLOW DIVIDER/COMBINER VALVE
17. .....ORIFICE PLUG FLOW DIVIDER/COMBINER "BYPASS"
18. .....HIGH SPEED DRIVE -"SERIES/PARALLEL" VALVE
19. .....HIGH SPEED DRIVE -"SERIES/PARALLEL" VALVE

SERVICE & ADJUSTMENTS

FLOW DIAGRAM

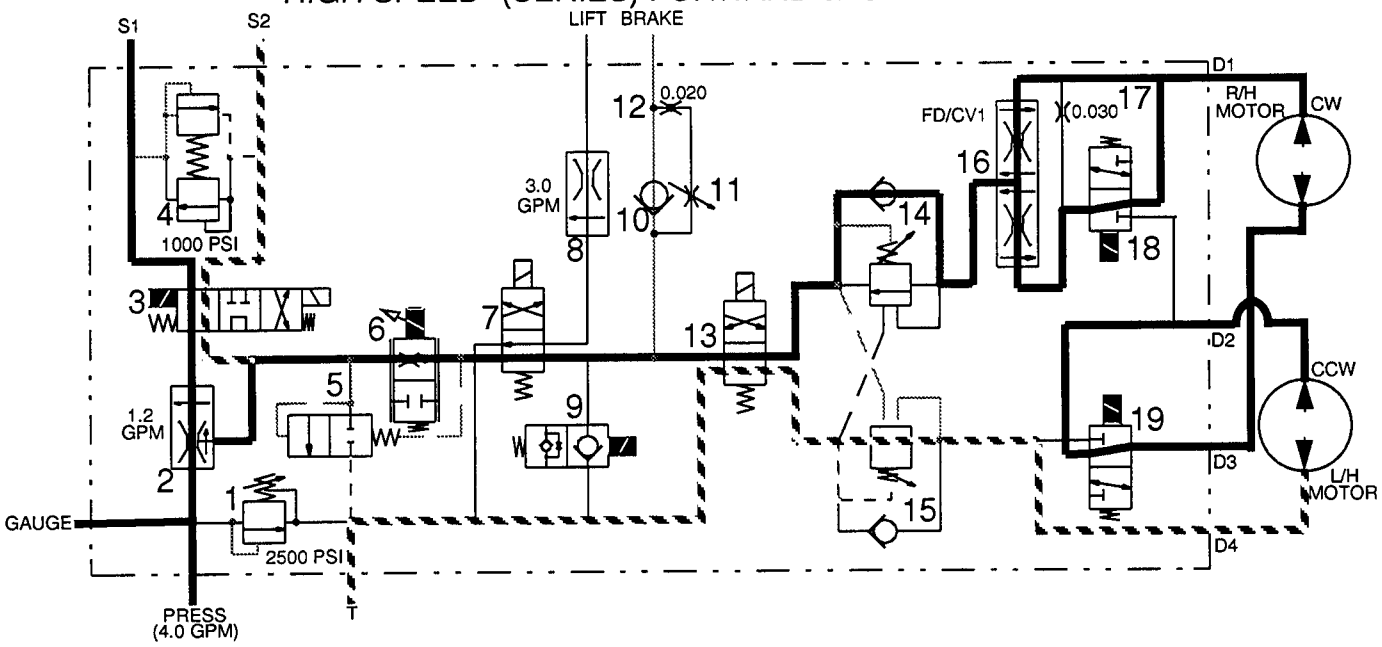
P/N 81478

"LOW SPEED" (PARALLEL) FORWARD & STEER RIGHT



INLET/PUMP FLOW **RETURN/TANK FLOW** **PILOT/CONTROL FLOW**

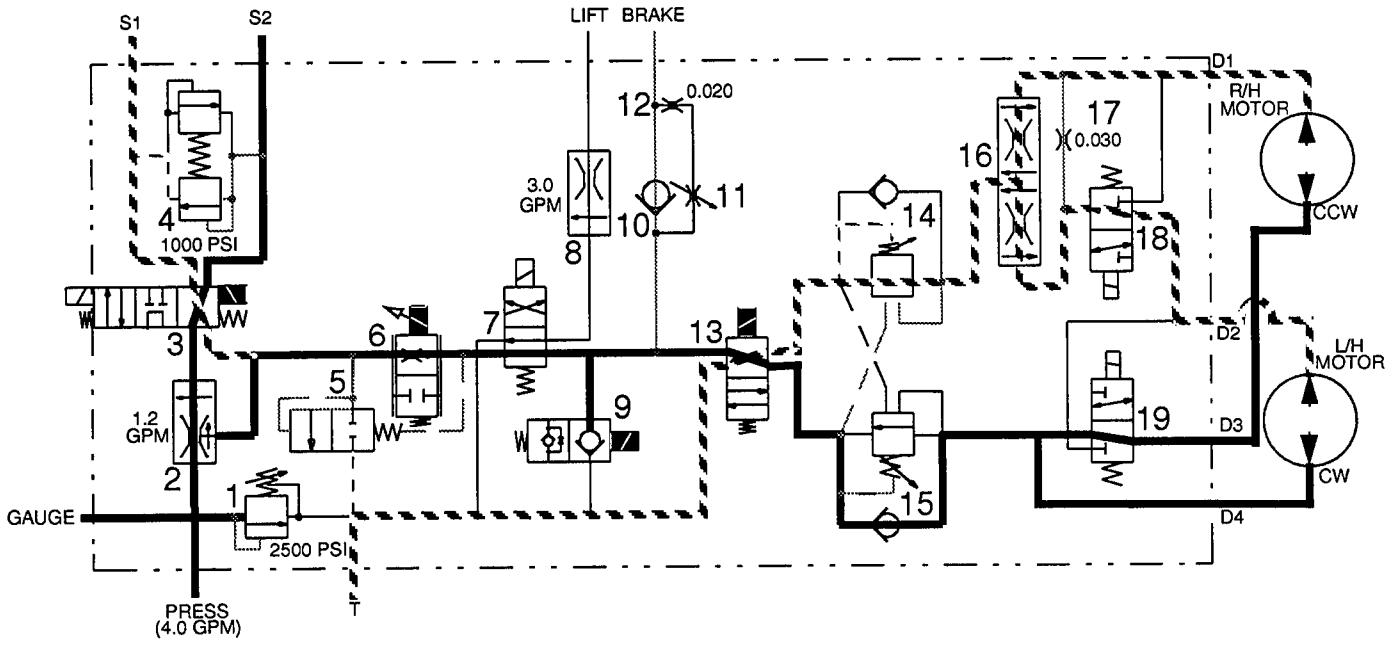
"HIGH SPEED" (SERIES) FORWARD & STEER RIGHT



FLOW DIAGRAM

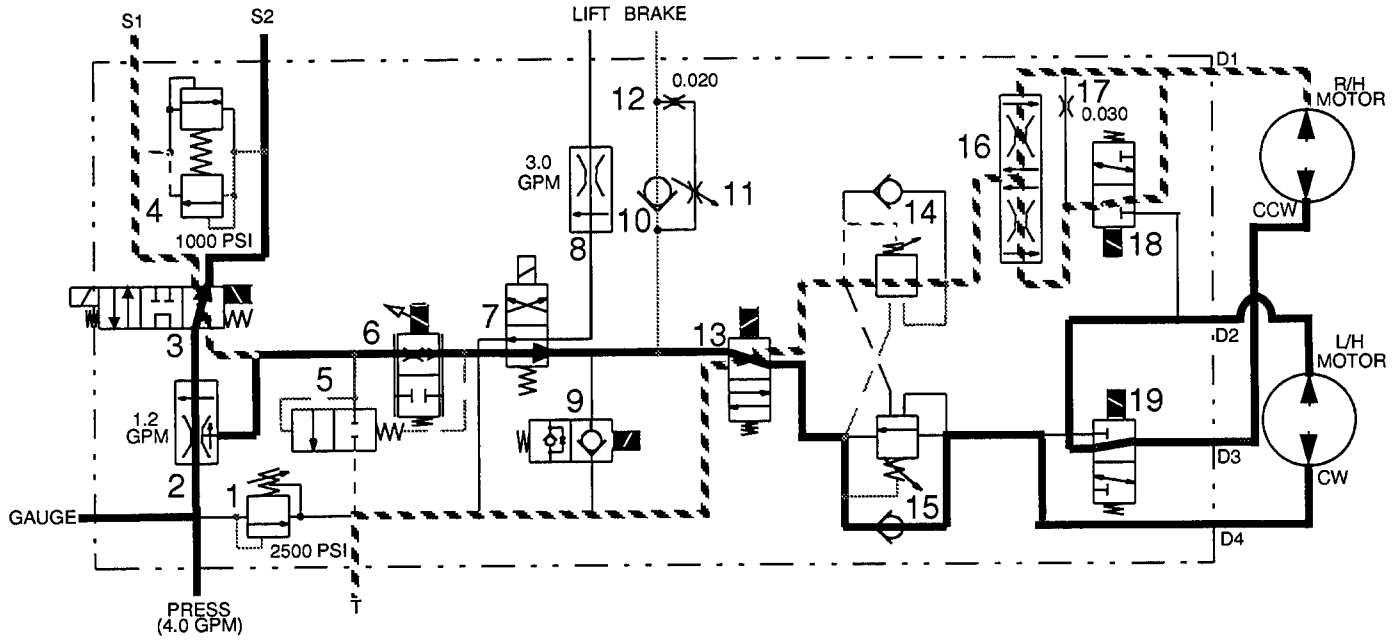
P/N 81478

"LOW SPEED" (PARALLEL) REVERSE & STEER LEFT



INLET/PUMP FLOW **RETURN/TANK FLOW** **PILOT/CONTROL FLOW**

"HIGH SPEED" (SERIES) REVERSE & STEER LEFT



FLOW DIAGRAM

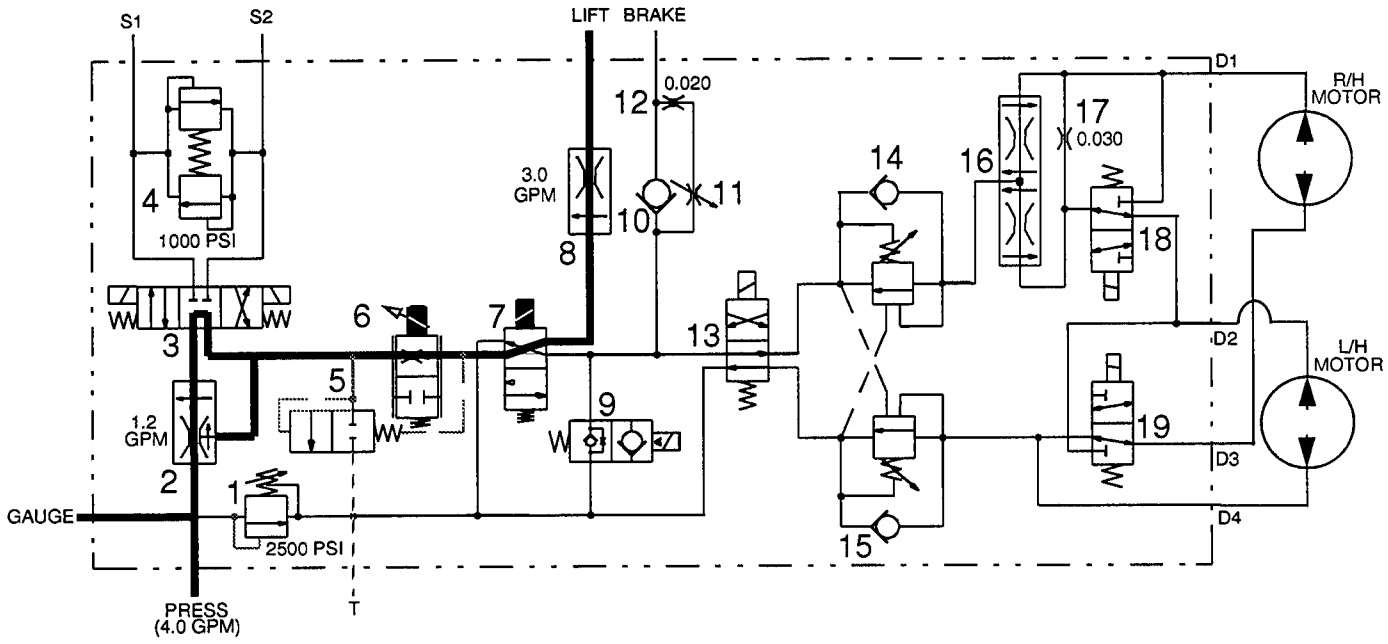
P/N 81478

PLATFORM LIFT

INLET/PUMP FLOW

RETURN/TANK FLOW

PILOT/CONTROL FLOW



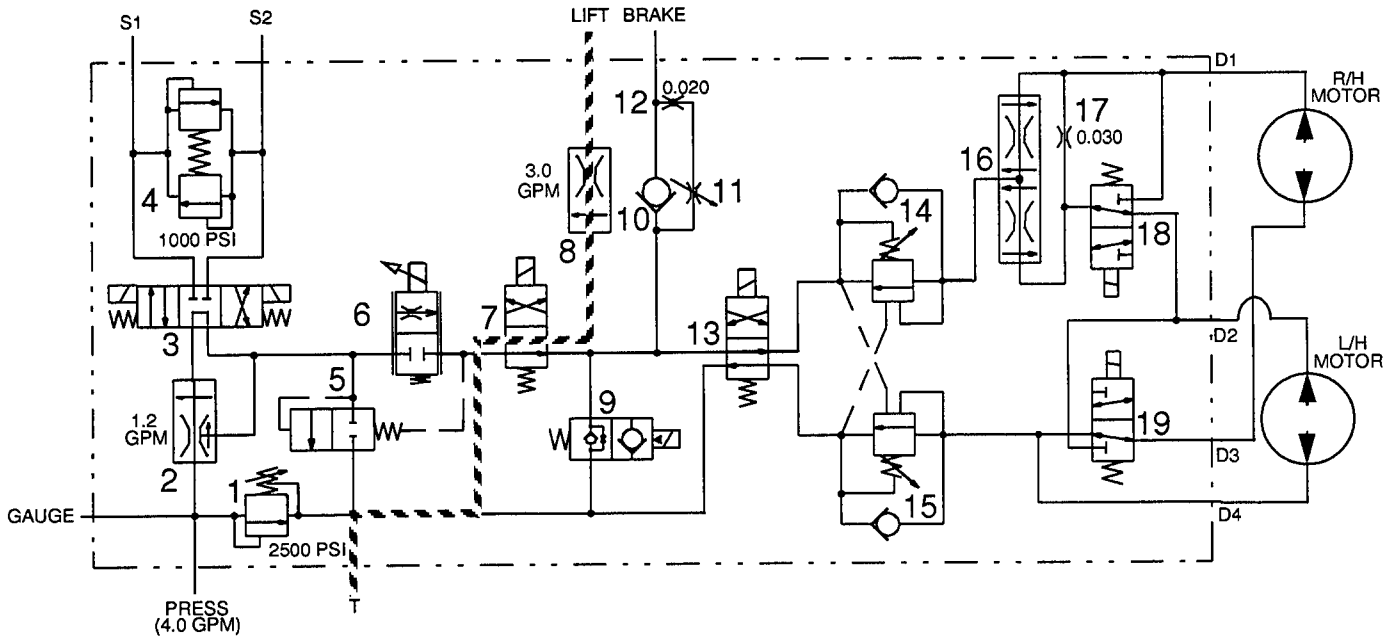
SERVICE & ADJUSTMENTS

FLOW DIAGRAM

P/N 81478

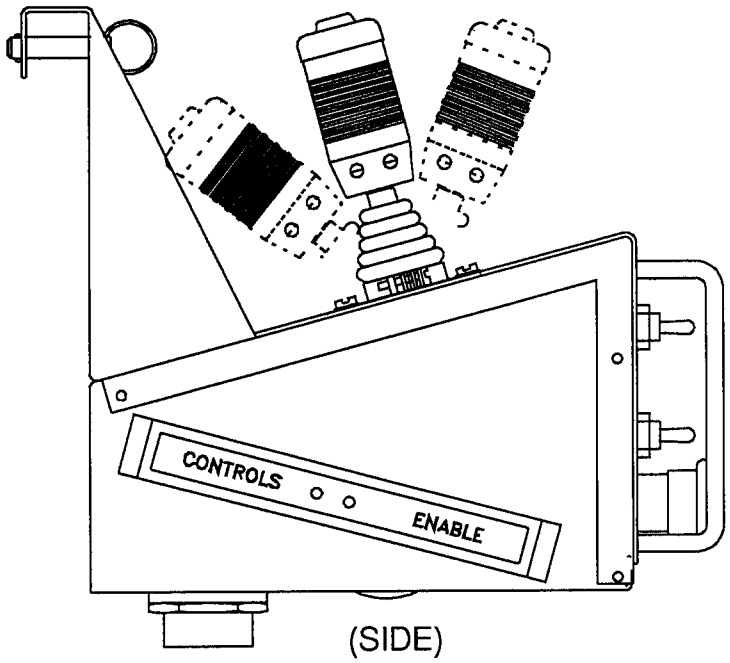
PLATFORM LOWER

INLET/PUMP FLOW
RETURN/TANK FLOW
PILOT/CONTROL FLOW



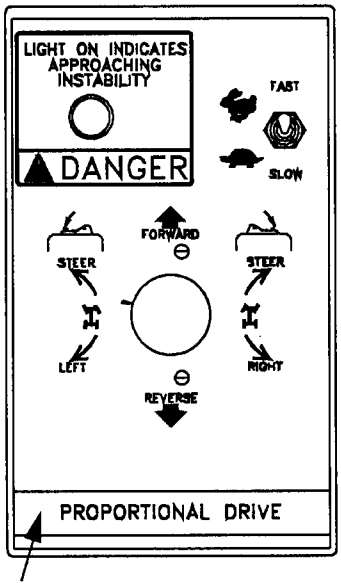
GENERAL INFORMATION

AERIAL CONTROL BOX
P/N 135765/135763
("single axis" drive/steer control lever)

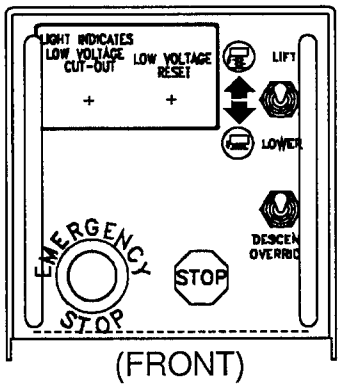


(SIDE)

(TOP)



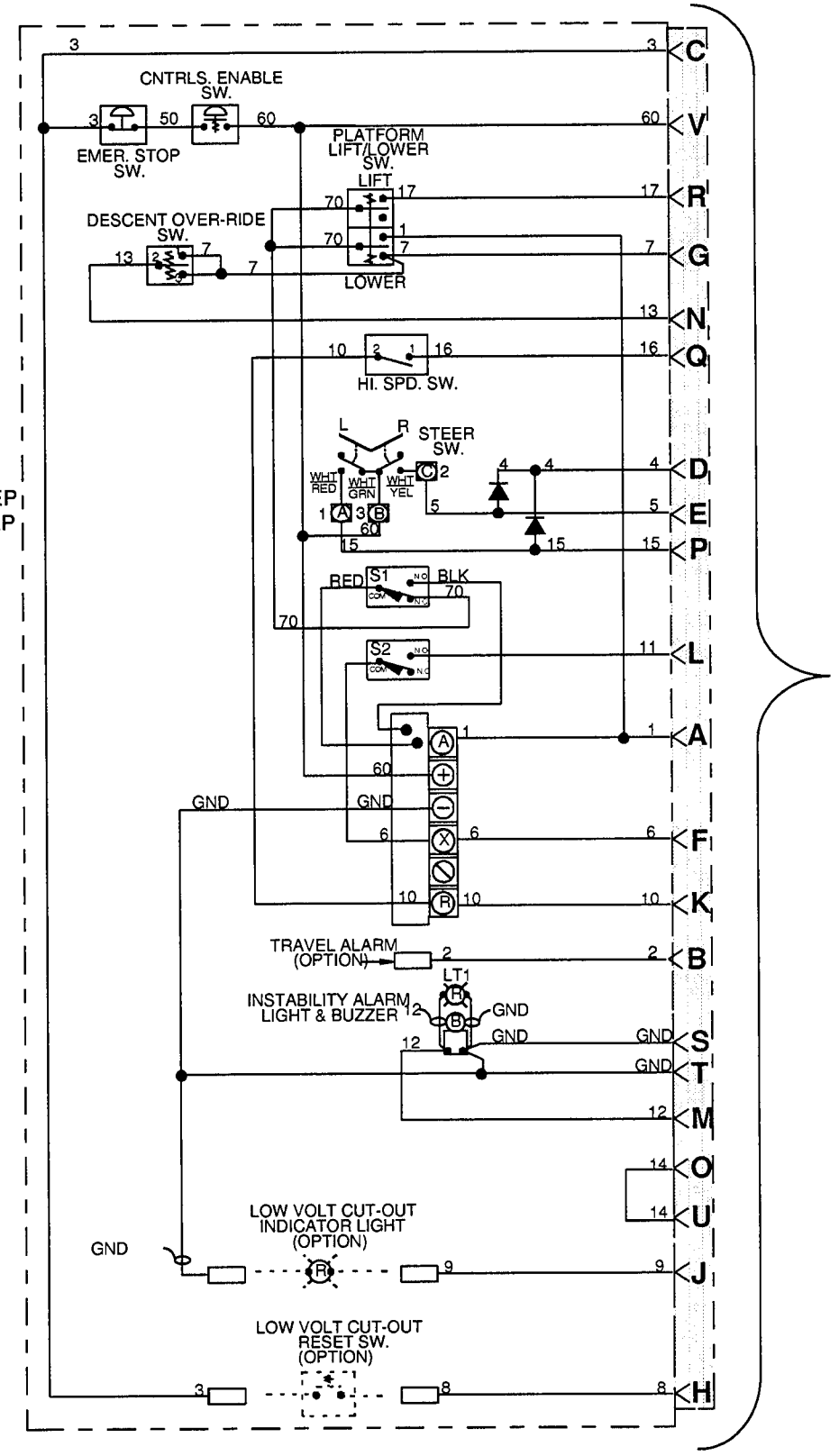
(DECAL: PROPORTIONAL DRIVE ONLY)



(FRONT)

P/N 135765

(PROPORTIONAL DRIVE)
STANDARD ON ALL MODEL
CH20WEP/CH26NEP/CH26WEP
INCORPORATED ON CH20NEP
CH30EP APPROXIMATELY
APRIL 95



LEGEND: AERIAL CONTROL BOX (P/N 135765 proportional drive)

PIN LETTER - WIRE NUMBER - FUNCTION/PURPOSE

A - 1 - OUTPUT, VARIABLE SIGNAL TO PROP. SOL. VALVE
B - 2 - (OPTION) OUTPUT TO TRAVEL ALARM
C - 3 - INPUT, 24 V.D.C. TO AERIAL CONTROL BOX (FROM KEY SW.)
D - 4 - OUTPUT, 24 V.D.C. TO TERMINAL 4 OF RELAY CARD (PUMP MOTOR "ON" STEER)
E - 5 - OUTPUT, 24 V.D.C. TO STEER RIGHT SOL. VALVE
F - 6 - OUTPUT, 24 V.D.C. FROM DRIVE CONTROL (PUMP MOTOR & HI. SPD. PROX. SW. "ON")
G - 7 - OUTPUT, 24 V.D.C. FROM PLAT. LIFT/LOWER SW. ("PLAT. LOWER")
H - 8 - (OPTION) OUTPUT TO LOW VOLTAGE CUT-OUT (RESET SWITCH)
J - 9 - (OPTION) OUTPUT TO LOW VOLTAGE CUT-OUT (INDICATOR LIGHT)
K - 10 - INPUT, 24 V.D.C. FROM HI SPEED PROX. SW. MOUNTED ON BASE
L - 11 - OUTPUT, 24 V.D.C. TO REVERSE DRIVE SOL. VALVE
M - 12 - INPUT, 24 V.D.C. FROM RELAY K2 (SLOPE SENSOR ALARM "ON")
N - 13 - OUTPUT, 24 V.D.C. TO PLAT. LOWER SOL. VALVE FROM DESCENT OVERIDE SW.
O - 14 - INPUT, 24 V.D.C FROM PLAT. EXTEND PROX. SW. (BENEATH DECK)
P - 15 - OUTPUT, 24 V.D.C. TO STEER LEFT SOL. VALVE
Q - 16 - OUTPUT, 24 V.D.C. TO RELAY K5 (HI SPEED OR SERIES/PARALLELSOL. VALVES)
R - 17 - OUTPUT, 24 V.D.C. TO TERMINAL 17A OF RELAY CARD (RELAY K4 "PLAT. LIFT ENABLE")
S - YEL/GRN - "GROUND"/BATTERY NEGATIVE (-)
T - YEL/GRN - "GROUND"/BATTERY NEGATIVE (-)
U - 14 - OUTPUT TO TERMINAL 14 OF RELAY CARD (RELAY K4 "PLAT. LOWER ENABLE")
V - 60 - OUTPUT, 24 V.D.C. TO PLAT. EXTEND PROX. SW. (BENEATH DECK)
W - x - NOT USED, NO PIN INSTALLED
X - x - NOT USED, NO PIN INSTALLED

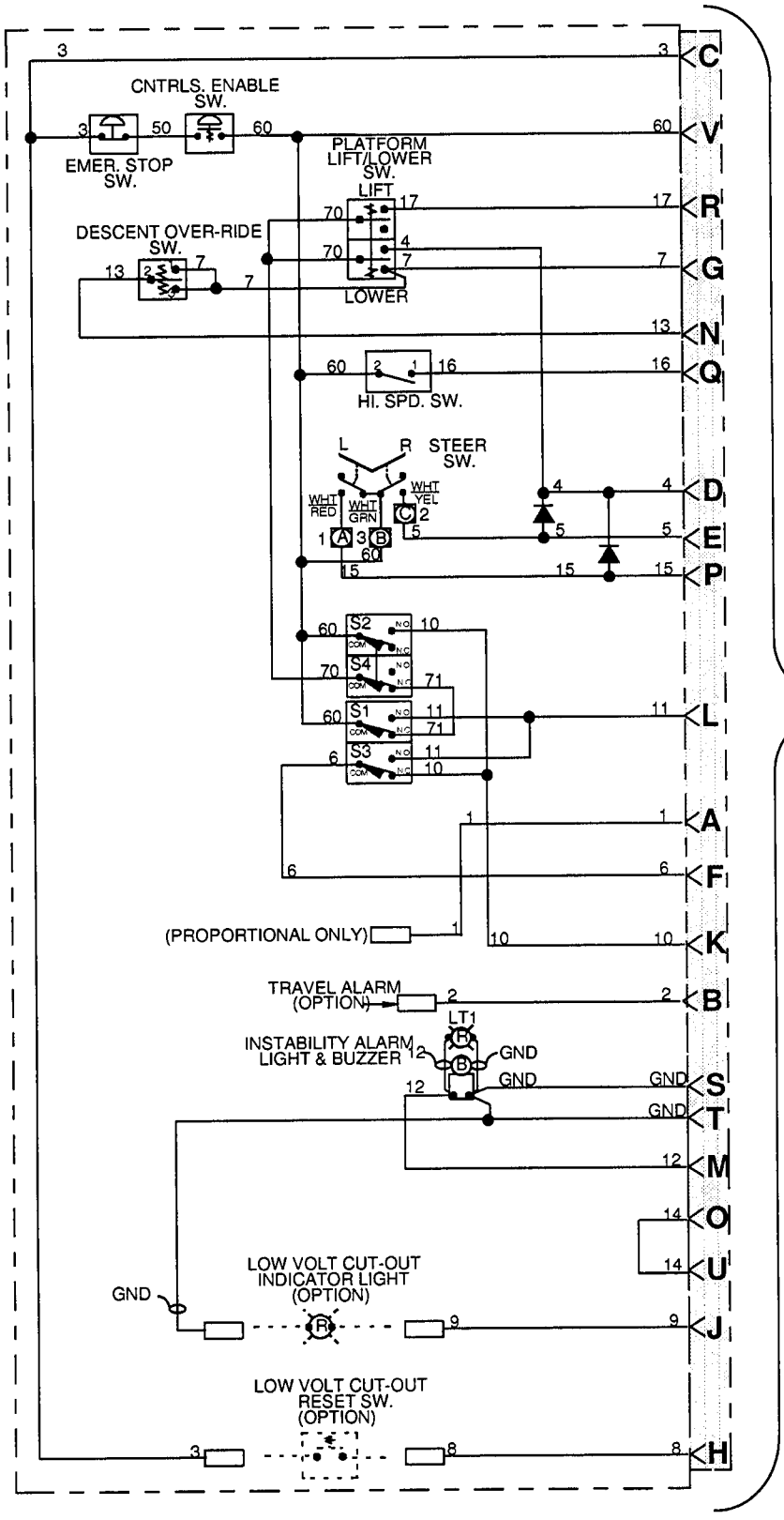
P/N 135763

(NON-PROPORTIONAL DRIVE)

STANDARD ON ALL MODEL CH20NEP SCISSORLIFTS PRIOR TO APRIL 95

NOTE:

REPLACES P/N 135021 "AERIAL CONTROL BOX W/"JOYSTICK" DRIVE LEVER ON MODEL J14EP



LEGEND: AERIAL CONTROL BOX (P/N 135763 non-proportional drive)

PIN LETTER - WIRE NUMBER - FUNCTION/PURPOSE

A - 1 - NOT USED, PROPORTIONAL DRIVE ONLY (RE: P/N 135765)
B - 2 - (OPTION) OUTPUT TO TRAVEL ALARM
C - 3 - INPUT, 24 V.D.C. TO AERIAL CONTROL BOX (FROM KEY SW.)
D - 4 - OUTPUT, 24 V.D.C. TO TERMINAL 4 OF RELAY CARD (PUMP MOTOR "ON" STEER/LIFT)
E - 5 - OUTPUT, 24 V.D.C. TO STEER RIGHT SOL. VALVE
F - 6 - OUTPUT, 24 V.D.C. DRIVE ENABLE SOL. VALVE & PUMP MOTOR "ON"
G - 7 - OUTPUT, 24 V.D.C. FROM PLAT. LIFT/LOWER SW. ("PLAT. LOWER")
H - 8 - (OPTION) OUTPUT TO LOW VOLTAGE CUT-OUT (RESET SWITCH)
J - 9 - (OPTION) OUTPUT TO LOW VOLTAGE CUT-OUT (INDICATOR LIGHT)
K - 10 - OUTPUT, 24 V.D.C. TO DRIVE FOWARD SOL VALVE
L - 11 - OUTPUT, 24 V.D.C. TO DRIVE REVERSE SOL. VALVE
M - 12 - INPUT, 24 V.D.C. FROM RELAY K2 (SLOPE SENSOR ALARM "ON")
N - 13 - OUTPUT, 24 V.D.C. TO PLAT. LOWER SOL. VALVE FROM DESCENT OVERIDE SW.
O - 14 - INPUT, 24 V.D.C FROM PLAT. EXTEND PROX. SW. (BENEATH DECK)
P - 15 - OUTPUT, 24 V.D.C. TO STEER LEFT SOL. VALVE
Q - 16 - OUTPUT, 24 V.D.C. TO RELAY K5 (HI SPEED OR SERIES/PARALLELSOL. VALVES)
R - 17 - OUTPUT, 24 V.D.C. TO TERMINAL 17A OF RELAY CARD (RELAY K4 "PLAT. LIFT ENABLE")
S - YEL/GRN - "GROUND"/BATTERY NEGATIVE (-)
T - YEL/GRN - "GROUND"/BATTERY NEGATIVE (-)
U - 14 - OUTPUT TO TERMINAL 14 OF RELAY CARD (RELAY K4 "PLAT. LOWER ENABLE")
V - 60 - OUTPUT, 24 V.D.C. TO PLAT. EXTEND PROX. SW. (BENEATH DECK)
W - x - NOT USED, NO PIN INSTALLED
X - x - NOT USED, NO PIN INSTALLED

SECTION 5

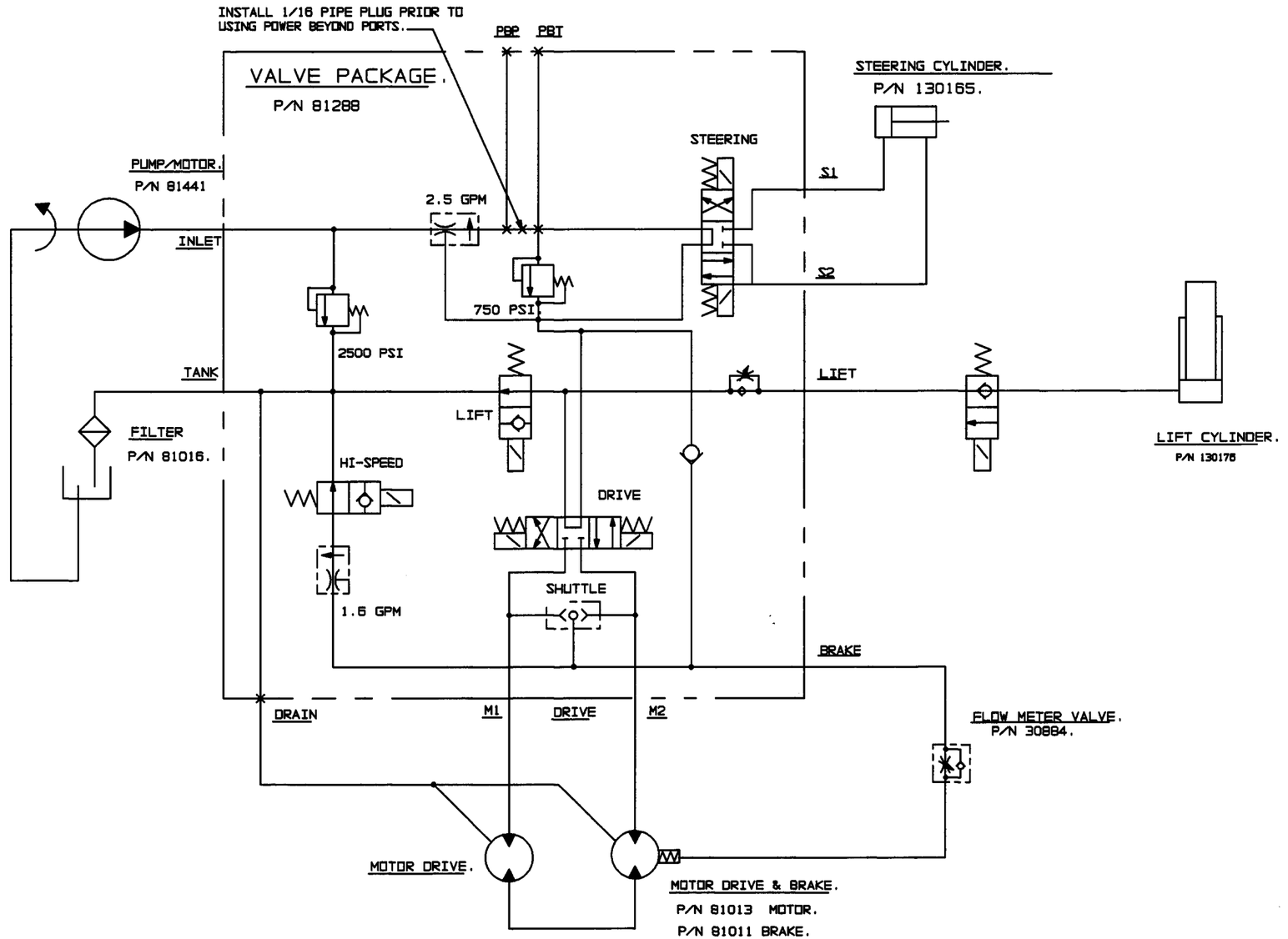
NOT AVAILABLE AT THIS TIME

SECTION 6

SCHEMATICS

Drawing	Description	Pages	
134864	Hydraulic Schematic	1	
135623	System Wiring	4	Page 1&2
135624	Hydraulic Schematic	1	
135703	Hydraulic Schematic	1	
135783	Hydraulic Schematic	1	
E103-6447-72	System Wiring	2	
E103-7421-00	Wiring Diagram	1	

Item	Part No.	Description	Qty.	Wt.



REF. LET.			
—	7-1-92	PRODUCTION RELEASE	U917
L.E.N.	DATE	CHANGE ALL CHANGES MUST BE MADE ON AUTOCAD.	E.C.N.

Inch [mm]

MARK INDUSTRIES INCORPORATED
Waverly, Iowa 50677

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Concentricity of Cylindrical Machined Surfaces to be kept to within .005 T.I.R. and Perpendicular or Angularity between Machined Surfaces and/or Drilling or Boring Center Lines to be kept within 0° - 7' (.035 per in.) unless otherwise specified.

All Dimensions In Inches. Tolerances-Unless Noted: .X = ±.03, .XX = ±.015, .XXX = ±.030

Spec. 2800 Tolerancing | Spec. 2117 Welding

Remove Objectionable Weld Splatter, Burrs & Sharp Edges

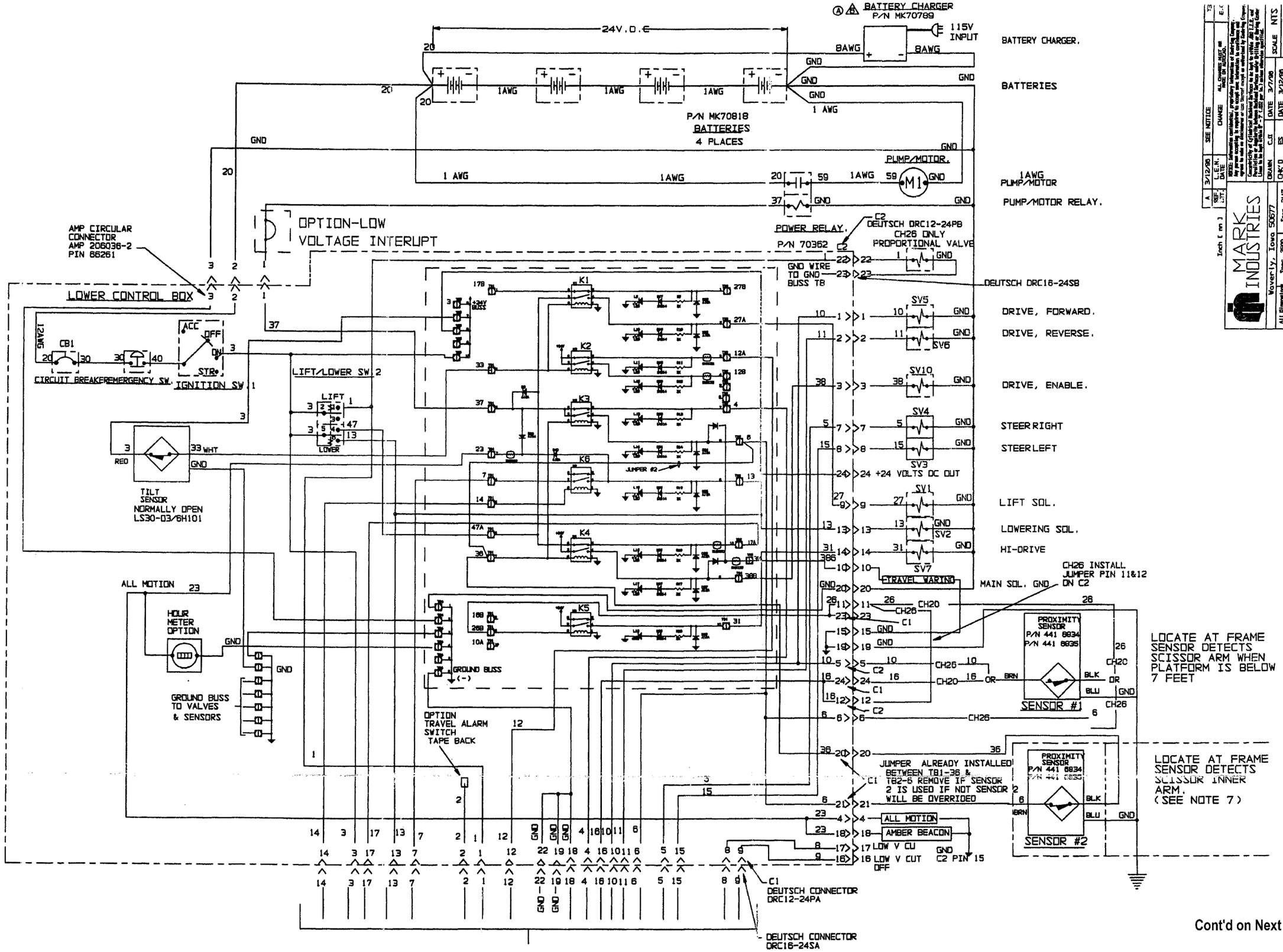
Model J14EP

DRAWN MD	DATE 7-1-92	SCALE N/A
CHK'D ES	DATE 8-10-92	WT.
APP'D	DATE	
MATERIAL		

Do Not Scale Print

TITLE: SCHEMATIC HYD 24V

NUMBER: MK134864



Cont'd on Next Page

MARK INDUSTRIES
Waverly, Iowa 50677

TITLE SYSTEM WIRING DIAGRAM SN1 142 & SN1 151 FOR NORMALLY CLOSED TILT SENSOR

NUMBER MK135623

SCALE NTS

MODEL 20/26/30

MATERIAL NA

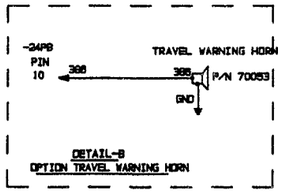
DRAWN C.R. DATE 3/7/98

CK'D ES DATE 3/12/98

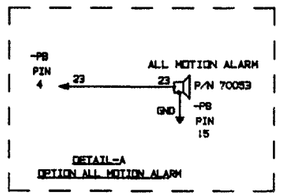
APP'D DATE

Do Not Scale Print

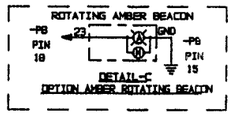
REF. LET.	DATE	CHANGE
A	3/12/98	SEE NOTICE



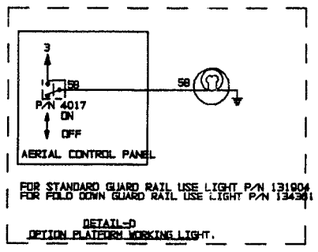
DETAIL-B
OPTION TRAVEL WARNING HORN



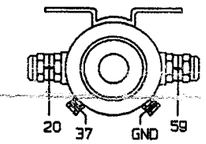
DETAIL-A
OPTION ALL MOTION ALARM



DETAIL-C
OPTION AMBER ROTATING BEACON



DETAIL-D
OPTION PLATFORM WORKING LIGHT.



POWER RELAY 1
P/N 70362.



LEGEND FOR LIMIT SWITCHES.

Cont'd from
Previous Page

	A	3/12/98	SEE NOTICE	T3
Inch [mm]	REF. LET.	L.E.N. DATE	CHANGE ALL CHANGES MUST BE MADE ON AUTOCAD.	E.C

MARK INDUSTRIES
Waverly, Iowa 50677

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DRAWN C.H	DATE 3/7/98	SCALE NTS	
CHK'D ES	DATE 3/12/98	WT.	
APP'D	DATE		

All Dimensions In Inches. Tolerancing Unless Noted: .X = ±.12, .XX = ±.05, .XXX = ±.020
Spec. 2500 Tolerancing | Spec. 2117 Welding
Remove Objectionable Weld Splatter, Burrs & Sharp Edges

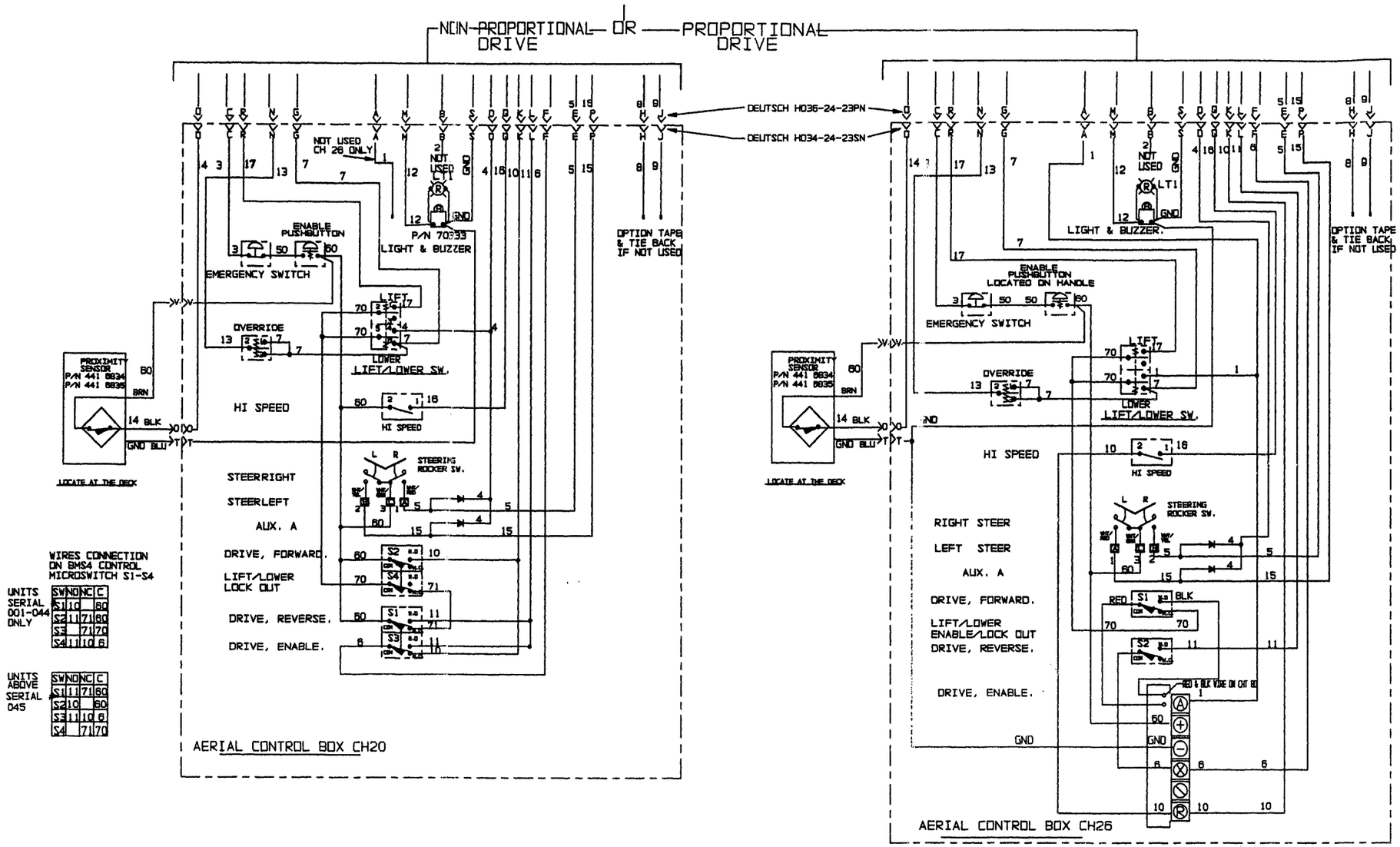
MATERIAL NA

Model EH20/26/30

Do Not Scale Print

TITLE SYSTEM WIRING DIAGRAM SN1 142 & SN1 151 FOR NORMALLY CLOSED TILT SENSOR

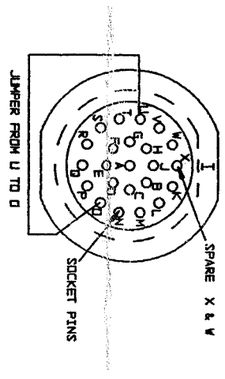
NUMBER MK135623



WIRES CONNECTION ON BMS4 CONTROL MICROSWITCH S1-S4

UNITS SERIAL 001-044 ONLY	SW	NO	NC	C
	S1	11	10	60
	S2	11	71	60
	S3		71	70
	S4	11	10	6

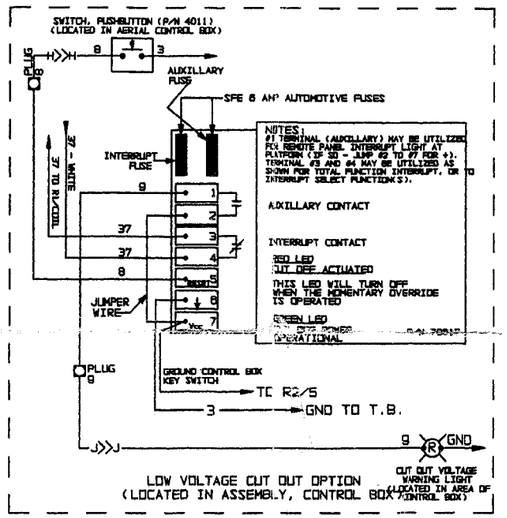
UNITS ABOVE SERIAL 045	SW	NO	NC	C
	S1	11	71	60
	S2	10		60
	S3	11	10	6
	S4	71	70	



DEUTSCH HD34-24-23SN

CH 20

PLUG #	WIRE #	LOCATION
A	1	PROPORTIONAL OUTPUT (NOT USED)
B	2	TRAVEL ALARM WIRE
C	3	EMERGENCY STOP - SW
D	4	LIFT/LOWER SW & STEER SW. TB (A & B) DIODES
E	5	STEER SW. TB (A)
F	6	V3L TYPE SW. S4/COM
G	7	DESCENT OVERRIDE
H	8	LOW VOLTAGE RESET
J	9	LOW VOLTAGE LIGHT
K	10	V3L TYPE SW. S1/NO & S4/NC
L	11	V3L TYPE SW. S2/NO & S4/NO
M	12	BUZZER
N	13	DESCENT OVERRIDE
O	14	JUMPER TO
P	15	STEER SW. TB (B)
Q	16	FAST/SLOW TOGGLE SW
R	17	LIFT/LOWER TOGGLE SW
S	GND	BUZZER
T	GND	BUZZER, LIGHT WARNING INDICATOR & PROX SENSOR
U	14	JUMPER FROM O
V	60	FAST/SLOW SW, S1/COM & S2/COM, ENABLE SW. STEER TB (C)
W	---	---
X	---	---



CH 26

PLUG #	WIRE #	LOCATION
A	1	PROPORTIONAL OUTPUT PCB BD A & LIFT/LOWER SW.
B	2	TRAVEL ALARM WIRE
C	3	EMERGENCY STOP - SW
D	4	STEER SW. TB (A & B) DIODES
E	5	STEER SW. TB (A)
F	6	V3L TYPE SW. S2/COM & PROPORTIONAL BD (X)
G	7	DESCENT OVERRIDE
H	8	LOW VOLTAGE RESET
J	9	LOW VOLTAGE LIGHT
K	10	FAST/SLOW SW & PROPORTIONAL PCB BD (R)
L	11	EMS4 PCB X & V3L TYPE SW. S2/NO
M	12	BUZZER
N	13	DESCENT OVERRIDE
O	14	JUMPER TO U
P	15	STEER SW. TB (B)
Q	16	FAST/SLOW TOGGLE SW
R	17	LIFT/LOWER TOGGLE SW
S	GND	BUZZER & EMS4 PCB TERMINAL (-)
T	GND	BUZZER, LIGHT WARNING INDICATOR & PROX SENSOR
U	14	JUMPER FROM O
V	60	ENABLE SW. STEER SW. TB (C), PROPORTIONAL BD. (+)
W	---	---
X	---	---

A	3/12/08	SEE NOTICE
REF LET:	L.E.N. DATE	CHANGE

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Compatibility of Lifting Machines Service to be safe to within .25" (6.35 mm) Lines to be kept within 0" - 1" (.002 per in.) unless otherwise specified.

Inch [mm]

DRAWN CJI DATE 3/1/06
CHK'D ES DATE 3/12/08
APP'D DATE
MATERIAL NA
SCALE NTS
WT.

MARK INDUSTRIES

Waverly, Iowa 50677

All Dimensions are in Inches Tolerances Unless Noted: .x = ±.12 .xx = ±.030 .xxx = ±.010

Spec. 2500 Paint Spec. 2117 Welding

Do Not Scale Print

Model 20/26/30

TITLE SYSTEM WIRING DIAGRAM SN1 142 & SN1 151 FOR NORMALLY CLOSED TILT SENSOR

NUMBER MK135623

Cont'd on Next Page

CONNECTORS C1 & C2
PIN NUMBERS SHOWN
FROM THE BACK SIDE



DEUTSCH PINS
460-202-16141

C1 DEUTSCH DRC12-24 PA		C2 DEUTSCH DRC12-24 PB	
PIN#	WIRE#	PIN#	WIRE#
1	1	1	10
2	2	2	11
3	3	3	38
4	4	4	23
5	5	5	10
6	6	6	6
7	7	7	5
8	8	8	15
9	9	9	27
10	10	10	388
11	11	11	28
12	12	12	16
13	13	13	13
14	14	14	31
15	15	15	GND
16	16	16	9
17	17	17	8
18	GND	18	23
19	GND	19	GND
20	36	20	GND
21	6	21	9
22	GND	22	1
23	26	23	GND
24	16	24	3

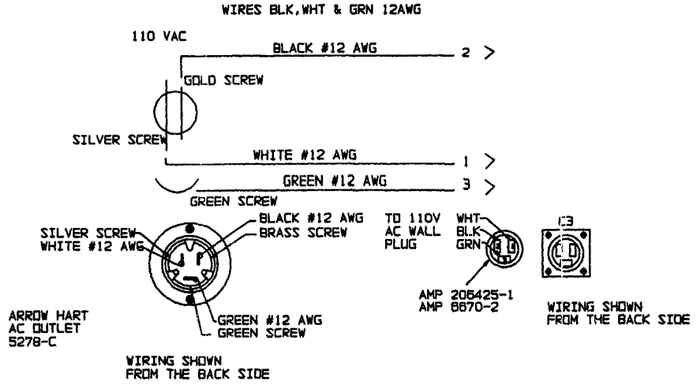
24VDC



WIRING SHOWN
FROM THE BACK SIDE

WIRES BLK,WHT & GRN 12AWG

WIRES BLK,WHT & GRN 12AWG



WIRING SHOWN
FROM THE BACK SIDE

WIRING SHOWN
FROM THE BACK SIDE

Cont'd from
Previous Page

A	3/12/98	SEE NOTICE	
REF. LET.	L.E.N. DATE	CHANGE	ALL CHANGES MUST BE MADE ON AUTOCAD.

Inch [mm]

MARK INDUSTRIES

Waverly, Iowa 50677

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Concentricity of Cylindrical Machined Surfaces to be kept to within .000 T.I.R. ma
Parallelism or Angularity between Machined Surfaces and/or Drilling or Boring Center
Lines to be kept within 0° - 7' (.002 per in.) unless otherwise specified

DRAWN	C.H	DATE 3/7/98	SCALE NTS
CHK'D	ES	DATE 3/12/98	WT.
APP'D		DATE	

All Dimensions In Inches, Tolerance-Unless Marked: .X = ±.12, .XX = ±.03, .XXX = ±.000

Spec. 2500 Tolerancing | Spec. 2117 Welding

Remove Objectionable Weld Spatter, Burrs & Sharp Edges

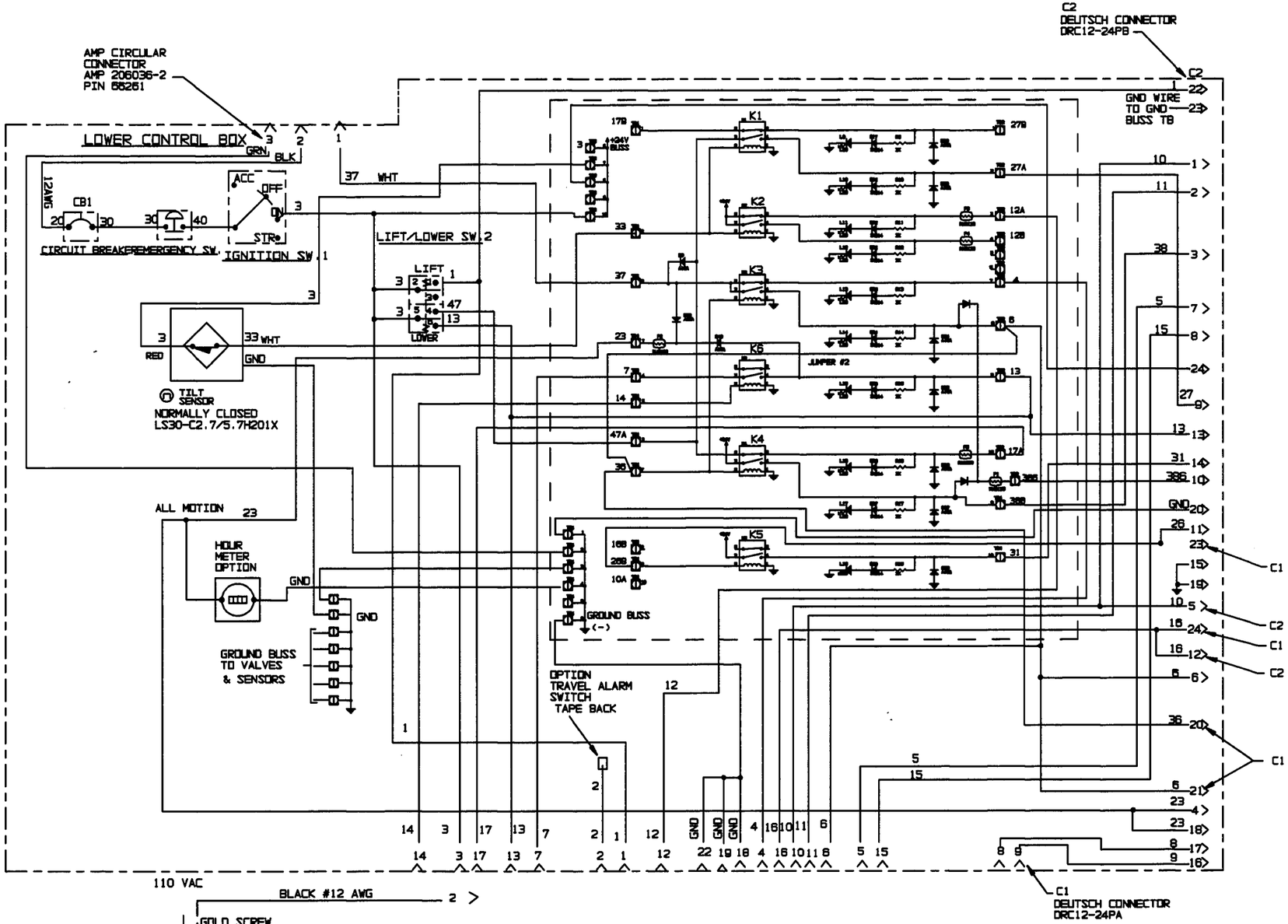
MATERIAL NA

Model CH20/26/30

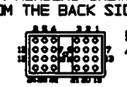
Do Not Scale Print

TITLE SYSTEM WIRING DIAGRAM SN1 142 & SN1 151 FOR NORMALLY CLOSED TILT SENSOR

NUMBER MK135623

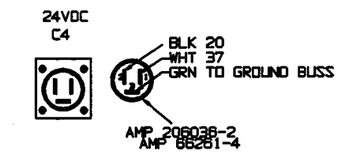


CONNECTORS C1 & C2
PIN NUMBERS SHOWN
FROM THE BACK SIDE



DEUTSCH PINS
460-202-16141

C1 DEUTSCH DRC12-24 PA		C2 DEUTSCH DRC12-24 PB	
PIN#	WIRE#	PIN#	WIRE#
1	1	1	10
2	2	2	11
3	3	3	38
4	4	4	23
5	5	5	10
6	6	6	6
7	7	7	5
8	8	8	15
9	9	9	27
10	10	10	386
11	11	11	26
12	12	12	16
13	13	13	13
14	14	14	31
15	15	15	GND
16	16	16	9
17	17	17	8
18	GND	18	23
19	GND	19	GND
20	36	20	GND
21	6	21	6
22	GND	22	1
23	26	23	GND
24	16	24	3



REF. LET.	DATE	CHANGE	E.C.N.
A	3/12/96	SEE NOTICE	T32

Inch [mm]

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Waverly, Iowa 50677

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DRAWN	CJI	DATE 3/7/96	SCALE NTS
CHK'D	ES	DATE 3/12/96	WT.
APP'D		DATE	

All Dimensions In Inches. Tolerances Unless Noted: .x = ±.12 .xx = ±.05 .xxx = ±.020

Spec. 2500 Tolerancing | Spec. 2117 Welding

Remove Objectionable Weld Splatter, Burrs & Sharp Edges

Model CH20/26/30

MATERIAL LISTED

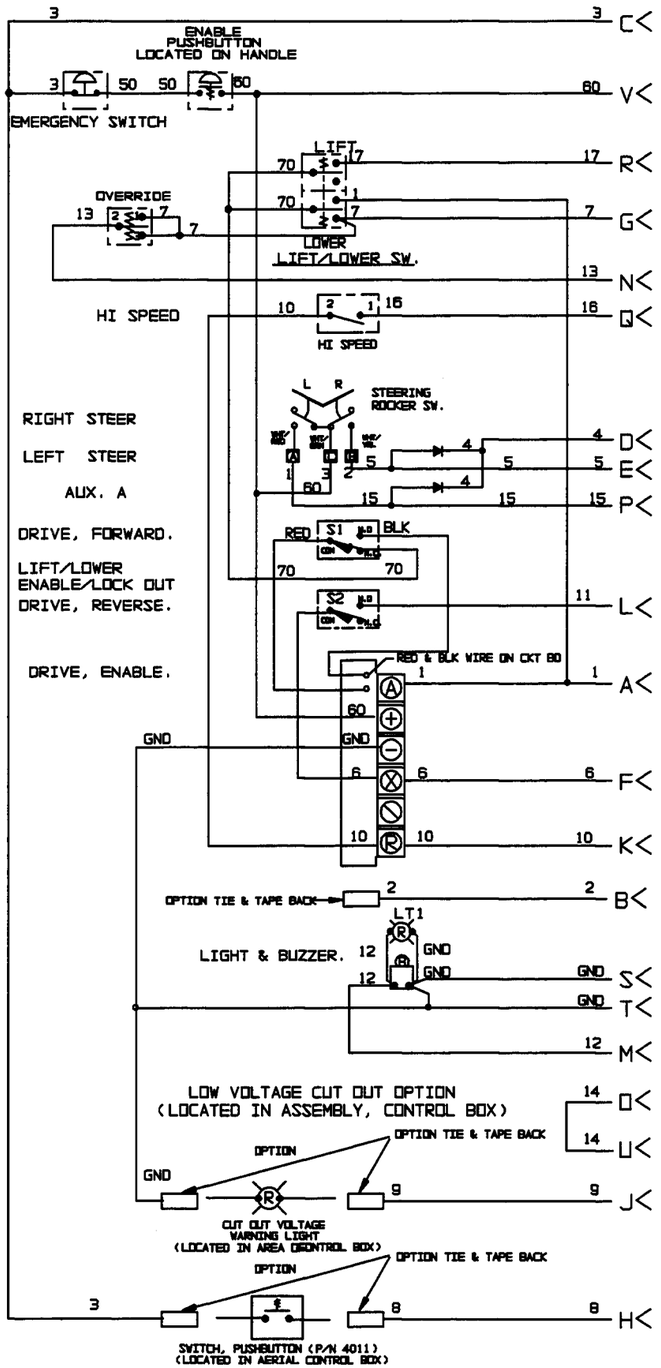
Do Not Scale Print

TITLE WIRING DIAGRAM SN1142-1GC
GROUND CONTROL
(NORMALLY CLOSED SLOPE SENSOR)

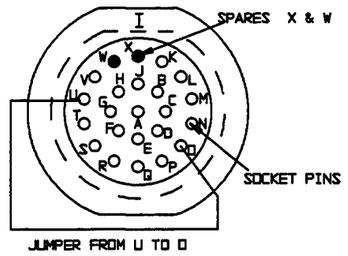
NUMBER MK135623

2/3

AERIAL CONTROL BOX
PROPORTIONAL DRIVE



DEUTSCH HD34-24-23SN



CH 26

PLUG #	WIRE #	LOCATION
A	1	PROPORTIONAL OUTPUT PCB BD A & LIFT/LOWER SW.
B	2	TRAVEL ALARM WIRE
C	3	EMERGENCY STOP - SW
D	4	ROCKER SW. TB DIODES
E	5	ROCKER SW TB A
F	6	V3L TYPE SW. S2/COM
G	7	DESCENT OVERRIDE
H	8	LOW VOLTAGE RESET
J	9	LOW VOLTAGE LIGHT
K	10	FAST/SLOW SW & PROPORTIONAL PCB BD R
L	11	EMS4 PCB X & MICROSW. S2/NO
M	12	BUZZER
N	13	DESCENT OVERRIDE
O	14	JUMPER TO U
P	15	ROCKET SW TB B
Q	16	FAST/SLOW TOGGLE SW
R	17	LIFT/LOWER TOGGLE SW
S	GND	BUZZER & EMS4 PCB TERMINAL (-)
T	GND	BUZZER & 2 WARNING INDICATORS
U	14	JUMPER FROM O-14
V	60	V3L TYPE SW S1/COM
W	---	---
X	---	---

REF. LET.	DATE	CHANGE	E.C.N.
A	3/12/96	SEE NOTICE	T32

Inch [mm]

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All Dimensions In Inches. Tolerance-Unless Noted: .x = ±.12 .xx = ±.08 .xxx = ±.020

Spec. 2500 Tolerancing | Spec. 2117 Welding

Remove Objectionable Weld Splatter, Burrs & Sharp Edges

Model CH20/26/30

DRAWN	CJI	DATE 3/7/96	SCALE NTS
CHK'D	ES	DATE 3/12/96	WT.
APP'D		DATE	

MATERIAL LISTED

Do Not Scale Print

TITLE WIRING DIAGRAM SN1151-1AC AERIAL CONTROL

NUMBER MK135623 3/3

MARK INDUSTRIES

Waverly, Iowa 50677

TITLE: SCHEMATIC, HYDRAULIC CH20WEP/CH26NEP/CH26WEP

NUMBER: MK135624

Spec. 2117 Welding	Spec. 2500 Tolerancing	Do Not Scale Print

All Dimensions In Inches. Tolerance -Unless Noted: .X = ±.12 .XX = ±.06 .XXX = ±.020

Renove Objectionable Weld Splatter Burrs & Sharp Edges

DRAWN SJR	DATE 3/18/96	SCALE
CHK'D DLW	DATE 3/18/96	
APP'D	DATE	WT.

Model CH20NEP | MATERIAL

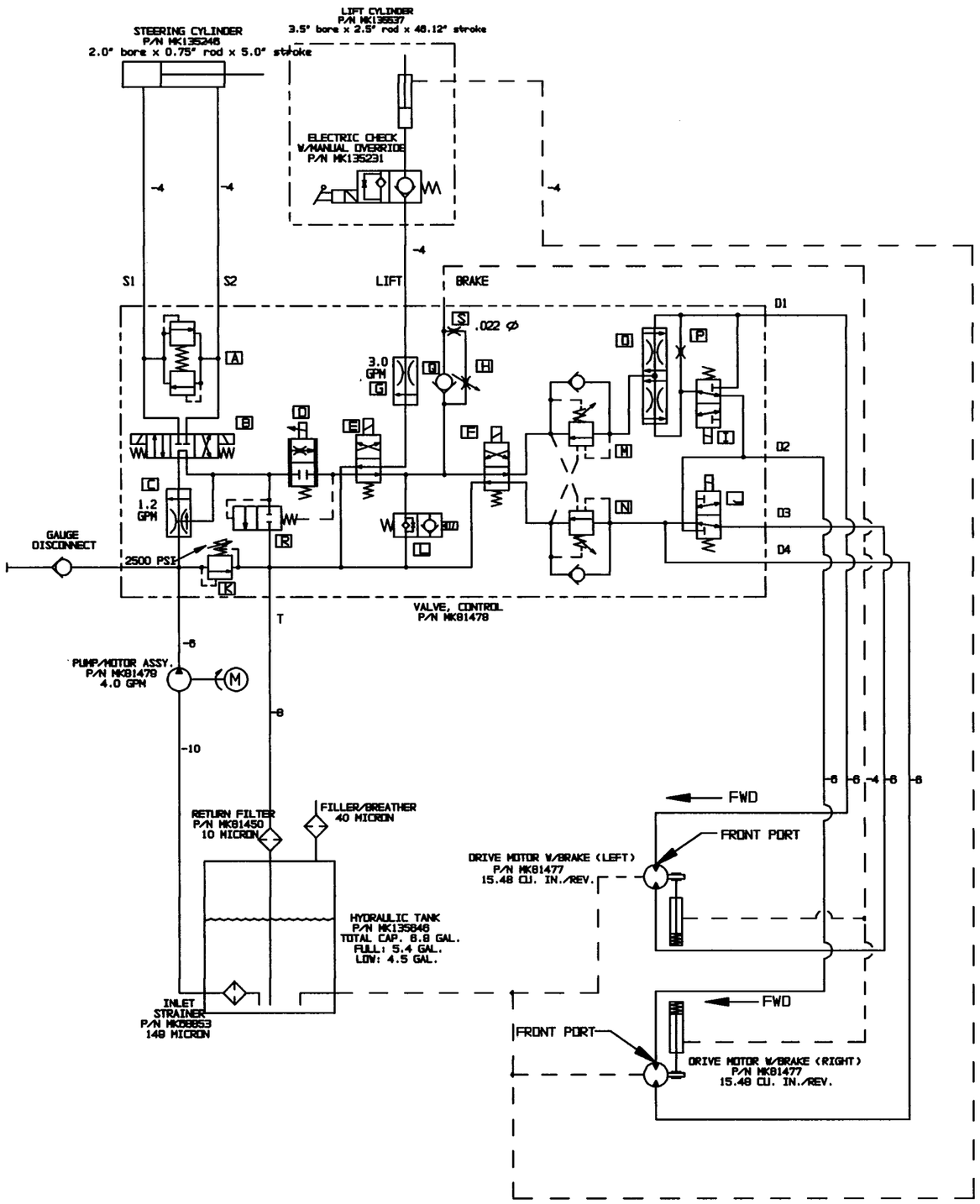
REF. LET.	L.E.N.	DATE	CHANGE	E.C.N.
--	3/20/96		PRODUCTION RELEASE	T13

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Inch [mm]



Item	Part No.	Description	Qty.	Wt.

MARK INDUSTRIES

Waverly, Iowa 50677

TITLE	NUMBER
SCHEMATIC, HYDRAULIC CH20NEP W/PROP. DRIVE	MK135703

Spec. 2117 Welding	Spec. 2500 Tolerancing	Do Not Scale Print

All Dimensions In Inches. Tolerance -Unless Noted: .X = ±.12 .XX = ±.06 .XXX = ±.020

Renove Objectionable Weld Splatter Burrs & Sharp Edges

DRAWN SJR	DATE 3/18/96	SCALE
CHK'D DLW	DATE 3/18/96	
APP'D	DATE	WT.

Mode ICH20NEP | MATERIAL

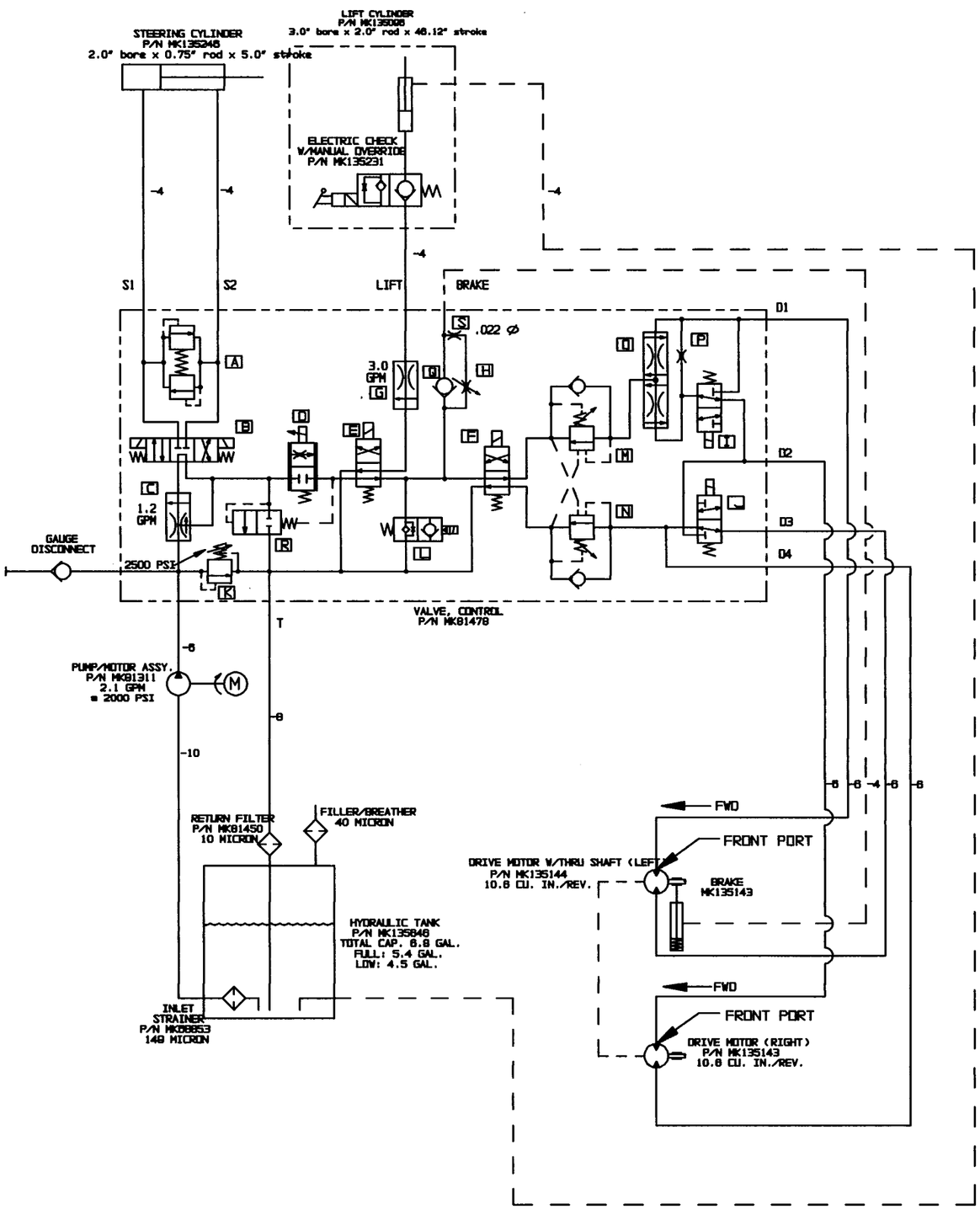
REF. LET.	L.E.N. DATE	CHANGE	E.C.N.
--	3/20/96	PRODUCTION RELEASE	T13

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Concentricity of Cylindrical Machined Surfaces to be kept to within .010 T.I.R. and Parallelism or Angularity between Machined Surfaces and/or Drilling or Boring Center Lines to be kept within 0°-7' (.002 per in.) unless otherwise specified.

Inch [mm]



Item	Part No.	Description	Qty.	Wt.

MARK INDUSTRIES

Waverly, Iowa 50677

Spec. 2117 Welding	Spec. 2500 Tolerancing	Do Not Scale Print

TITLE: SCHEMATIC, HYDRAULIC CH30EP

NUMBER: MK135783

All Dimensions In Inches. Tolerance -Unless Noted: .X = ±.12 .XX = ±.06 .XXX = ±.020

Remove Objectionable Weld Splatter Burrs & Sharp Edges

DRAWN SJR	DATE 3/18/96	SCALE
CHK'D DLW	DATE 3/18/96	
APP'D	DATE	WT.

Model CH20NEP | MATERIAL

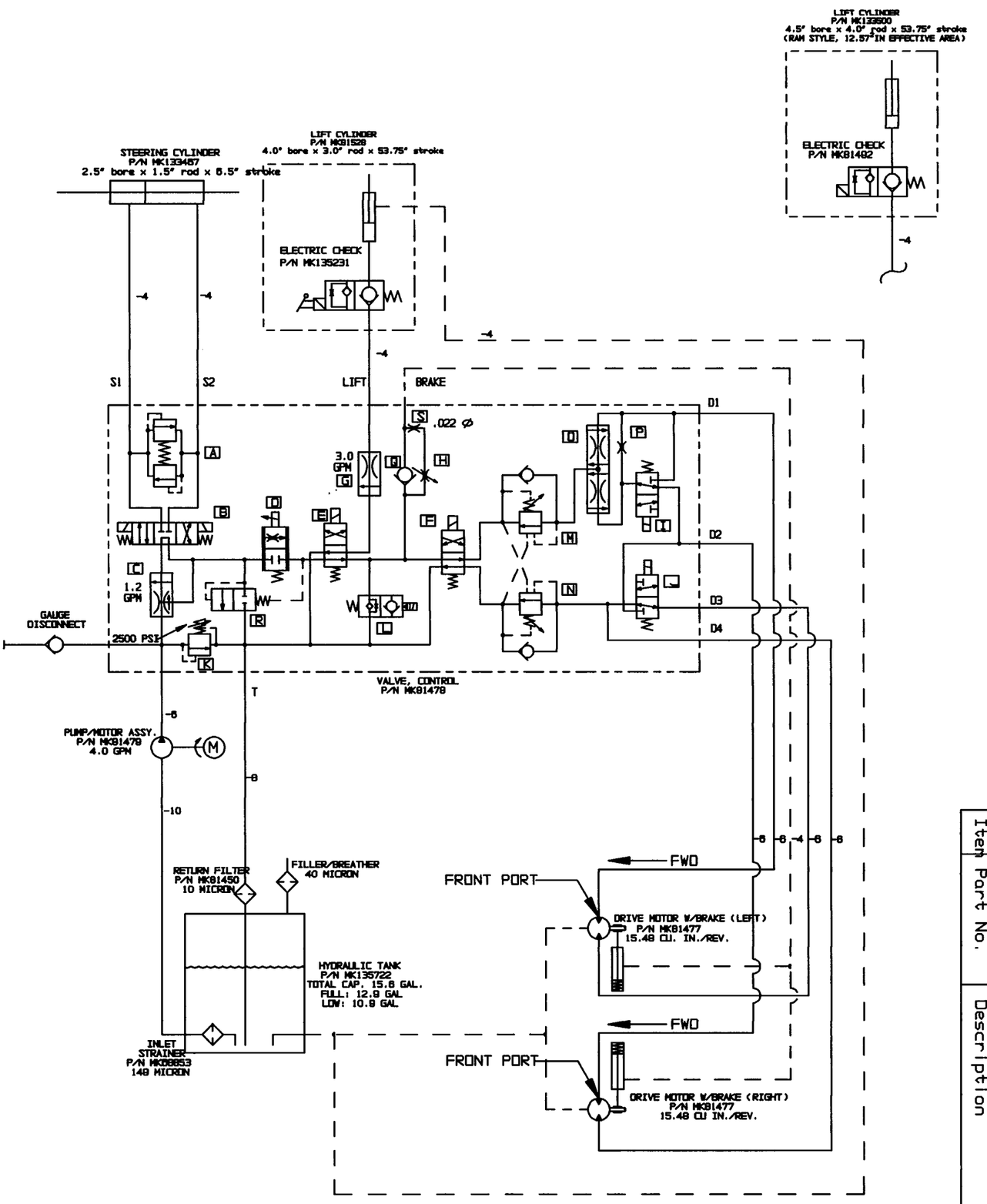
NOTICE: Information confidential, proprietary information of Koehring Company. Any person accepting is required to accept same information in confidence and agrees to make no disclosures or use thereof except as authorized by Koehring Company.

Concentricity of Cylindrical Machined Surfaces to be kept to within .010 T.I.R. and Parallelism or Angularity between Machined Surfaces and/or Drilling or Boring Center Lines to be kept within 0°-7' (.002 per in.) unless otherwise specified.

REF. LET.	L.E.N. DATE	CHANGE — ALL CHANGES MUST BE MADE ON AUTOCAD.	E.C.N.
--	3/20/96	PRODUCTION RELEASE	T13
A	5/8/96	LIFT CYL WAS MK133500	S946

Inch [mm]

PRIOR TO MAY '96



Item	Part No.	Description	Qty.	Wt.

CONNECTORS C1 & C2
PIN NUMBERS SHOWN
FROM THE BACK SIDE



DEUTSCH PINS
#80-202-16141

C1 DEUTSCH DRC12-24 PA		C2 DEUTSCH DRC12-24 PB	
PIN#	WIRE#	PIN#	WIRE#
1	1	1	10
2	2	2	11
3	3	3	28
4	4	4	23
5	5	5	10
6	6	6	6
7	7	7	5
8	8	8	15
9	9	9	27
10	10	10	36
11	11	11	28
12	12	12	16
13	13	13	13
14	14	14	31
15	15	15	GND
16	16	16	9
17	17	17	8
18	GND	18	23
19	GND	19	GND
20	36	20	GND
21	9	21	9
XX	---	XX	---
23	25	23	GND
24	15	24	3

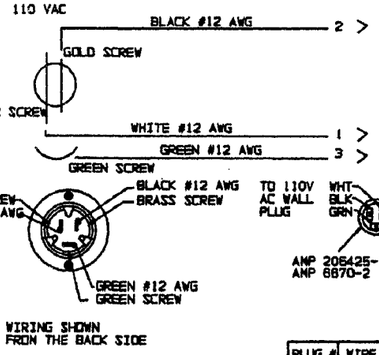
24VDC
C4



WIRING SHOWN
FROM THE BACK SIDE

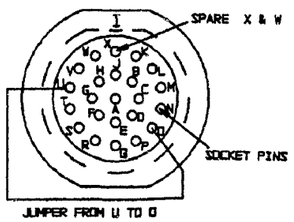
WIRES BLK, WHT & GRN 12AWG

WIRES BLK, WHT & GRN 12AWG

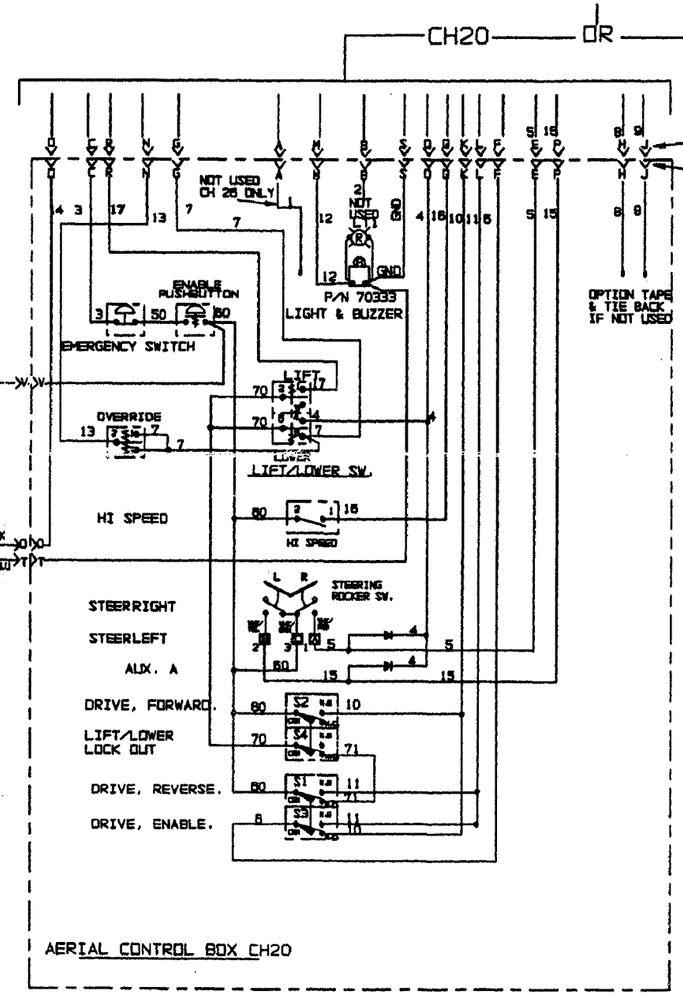


WIRING SHOWN
FROM THE BACK SIDE

DEUTSCH HD34-24-23SN



JUMPER FROM U TO O



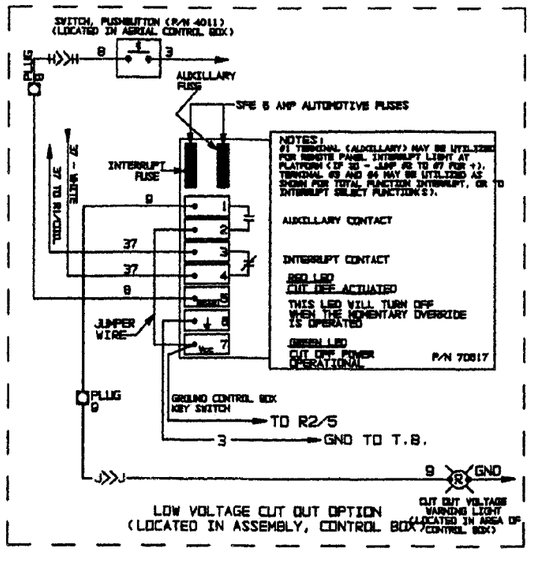
WIRES CONNECTION
ON BMS4 CONTROL
MICROSWITCH S1-S4

UNITS SERIAL 001-044 ONLY	SW	NO	NC	C
	S1	11		60
	S2	10	71	60
	S3		71	70
	S4	11	10	6

UNITS ABOVE SERIAL 045	SW	NO	NC	C
	S1	11	71	60
	S2	10		60
	S3	11	10	6
	S4		71	70

CH 20

PLUG #	WIRE #	LOCATION
A	1	PROPORTIONAL OUTPUT (NOT USED)
B	2	TRAVEL ALARM WIRE
C	3	EMERGENCY STOP - SW
D	4	LIFT/LOWER SW & STEER SW. TB (A & B) DIODES
E	5	STEER SW. TB (A)
F	6	V3L TYPE SW. S4/COM
G	7	DESCENT OVERRIDE
H	8	LOW VOLTAGE RESET
J	9	LOW VOLTAGE LIGHT
K	10	V3L TYPE SW. S1/NO & S4/NC
L	11	V3L TYPE SW. S2/NO & S4/NO
M	12	BUZZER
N	13	DESCENT OVERRIDE
O	14	JUMPER TO U
P	15	STEER SW. TB (B)
Q	16	FAST/SLOW TOGGLE SW
R	17	LIFT/LOWER TOGGLE SW
S	GND	BUZZER
T	GND	BUZZER, LIGHT WARNING INDICATOR & PROX SENSOR
U	14	JUMPER FROM O
V	60	FAST/SLOW SW, S1/COM & S2/CON, ENABLE SW. STEER TB (C)
W	---	---
X	---	---



LOW VOLTAGE CUT OUT OPTION
(LOCATED IN ASSEMBLY, CONTROL BOX)

CH 26

PLUG #	WIRE #	LOCATION
A	1	PROPORTIONAL OUTPUT PCB 80 A & LIFT/LOWER SW.
B	2	TRAVEL ALARM WIRE
C	3	EMERGENCY STOP - SW
D	4	STEER SW. TB (A & B) DIODES
E	5	STEER SW. TB (A)
F	6	V3L TYPE SW. S2/COM & PROPORTIONAL 80 (X)
G	7	DESCENT OVERRIDE
H	8	LOW VOLTAGE RESET
J	9	LOW VOLTAGE LIGHT
K	10	FAST/SLOW SW & PROPORTIONAL PCB 80 (R)
L	11	EMS4 PCB X & V3L TYPE SW. S2/NO
M	12	BUZZER
N	13	DESCENT OVERRIDE
O	14	JUMPER TO U
P	15	STEER SW. TB (B)
Q	16	FAST/SLOW TOGGLE SW
R	17	LIFT/LOWER TOGGLE SW
S	GND	BUZZER & EMS4 PCB TERMINAL (-)
T	GND	BUZZER, LIGHT WARNING INDICATOR & PROX SENSOR
U	14	JUMPER FROM O
V	80	ENABLE SW. STEER SW. TB (C), PROPORTIONAL 80. (+)
W	---	---
X	---	---

NORMALLY CLOSE TILT SENSOR STARTING WITH SERIAL #185 1/27/05

NO.	BY	DATE	DESCRIPTION	ENGINEERING NO.	MANUFACTURING NO.	SERVICE NO.

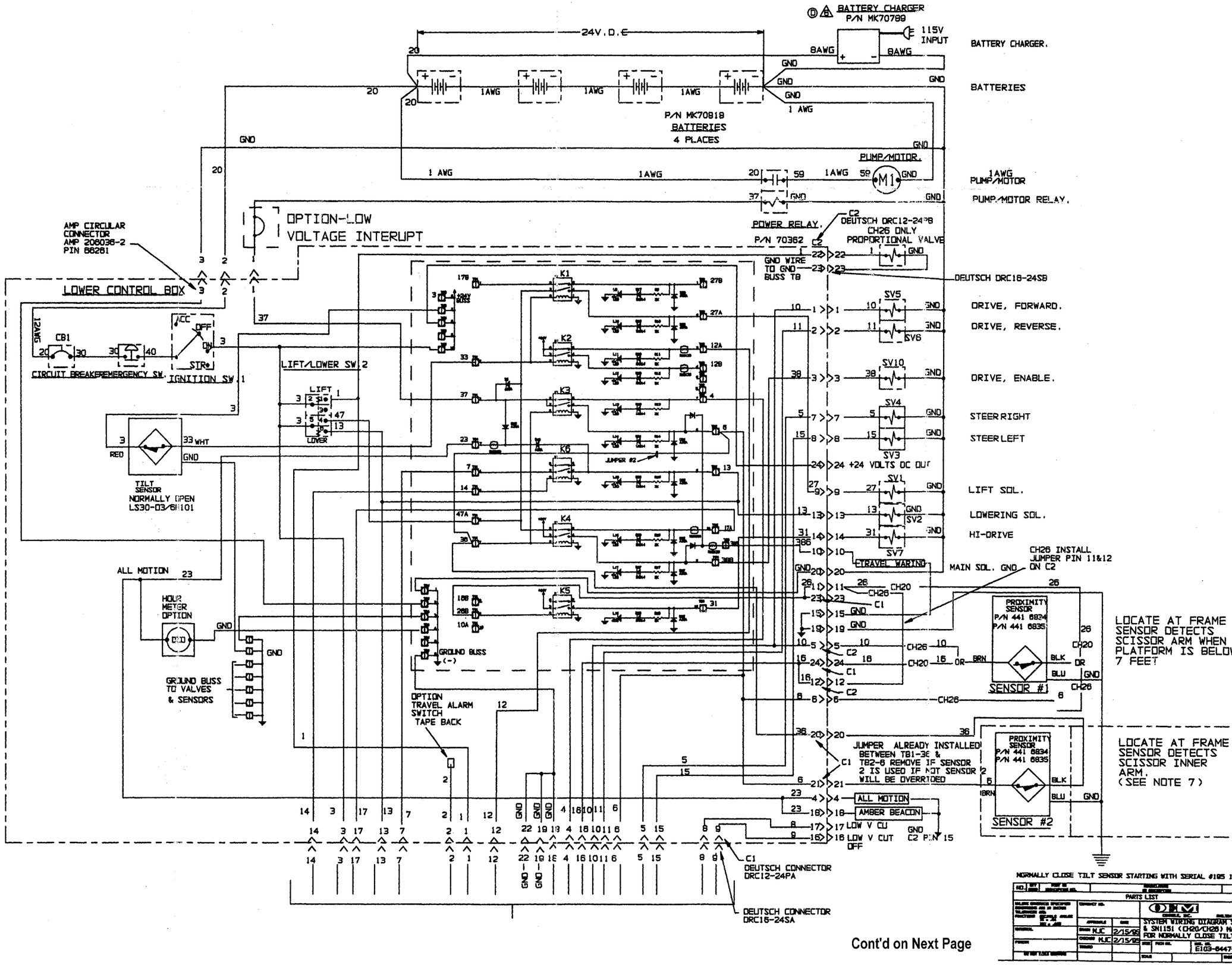
PARTS LIST

CONTRACT NO.	OHM
APPROVALS	DATE
DRAWN MJC	2/15/05
CHECKED MJC	2/15/05
ENGINEER	

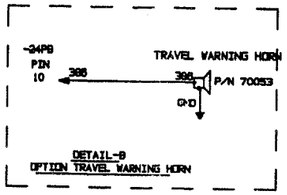
SYSTEM WIRING DIAGRAM SN1145 & SN1151 (CH20/CH26) MARK IND. FOR NORMALLY CLOSE TILT SENSOR

DWG. NO. E103-8447-72 REV. D

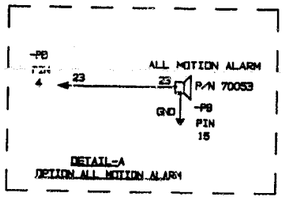
SCALE SHEET



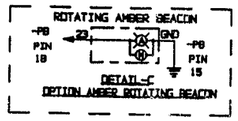
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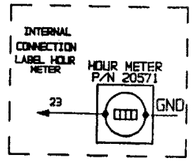
DETAIL-B
OPTION TRAVEL WARNING HORN

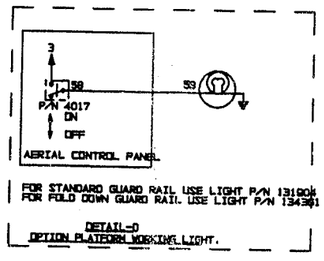


DETAIL-A
OPTION ALL MOTION ALARM

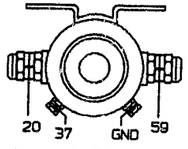


DETAIL-C
OPTION AMBER ROTATING BEACON





DETAIL-D
OPTION PLATFORM WORKING LIGHT.



POWER RELAY 1
P/N 70362.



LEGEND FOR LIMIT SWITCHES.

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Previous Page

NORMALLY CLOSE TILT SENSOR STARTING WITH SERIAL #185 1/27/05

PARTS LIST

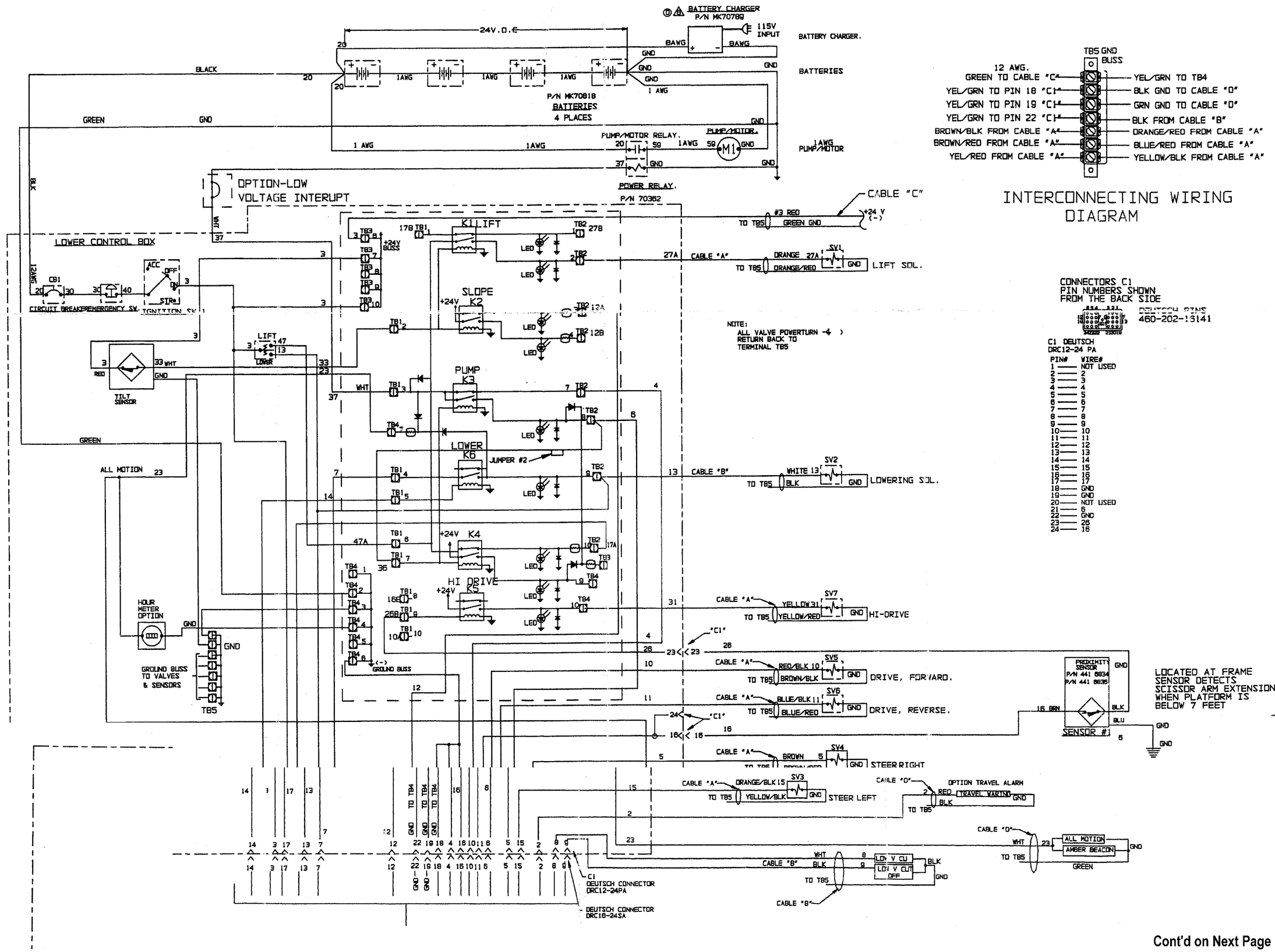
OEM
OSHKOSH, WI.

SYSTEM WIRING DIAGRAM SN1142 & SN1151 (CH20/CH25) MARK IND. FOR NORMALLY CLOSE TILT SENSOR

DRAWN	M.JC	2/15/05
CHECKED	M.JC	2/15/05

SIZE: E | DWG. NO.: E103-8447-72 | REV.: 0

INTERCONNECTING WIRING DIAGRAM



CONNECTORS C1
PIN NUMBERS SHOWN
FROM THE BACK SIDE

DEUTSCH PINS
460-202-16141

C1 DEUTSCH
DRC12-24 PA

PIN#	WIRE#
1	NOT USED
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	GND
19	GND
20	NOT USED
21	6
22	GND
23	26
24	16

LOCATED AT FRAME SENSOR DETECTS SCISSOR ARM EXTENSION WHEN PLATFORM IS BELOW 7 FEET

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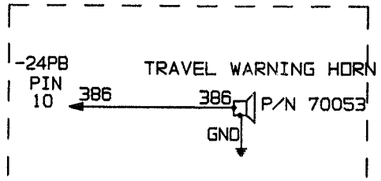
MK135828-1

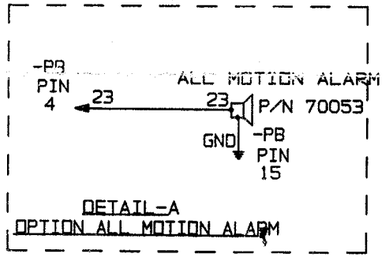
REV B: DELETED SHEET 2 OF 2 6/26/98 DG
REV A: CHANGED FROM SN1136 TO SN1140-IGC (J-14EP) 6/26/98 DG

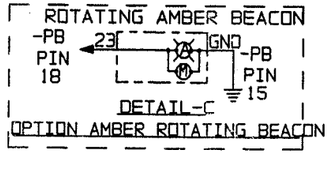
PARTS LIST

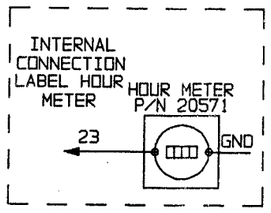
WIRING DIAGRAM FOR SN1140-IGC (J-14EP) #MK135828-1

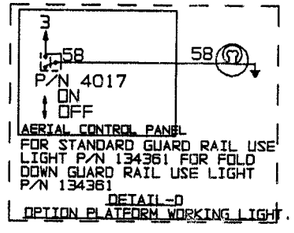
DRAWN AJS 06/27/96

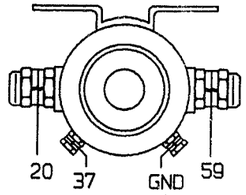












POWER RELAY 1
P/N 70362.

Cont'd from
Previous Page

MK135828-1

REV B: DELETED SHEET 2 OF 2		8/9/98 DD
REV A: CHANGED FROM SN1139 TO SN1140-1GC (J-14EP) ADDED #MK135828		8/28/98 DD
NO. / REV / ISSUE	PART NO. / DESCRIPTION NO.	REFERENCE SPECIFICATION

PARTS LIST

CONTRACT NO.	OEM CONTROLS, INC. SHELTON CONNECTICUT 06484	
APPROVALS / DATE	WIRING DIAGRAM FOR SN1140-1GC (J-14EP) #MK135828-1	
DRAWN AJS 08/27/98		
CHECKED	SIZE / FSCM NO. / DWG. NO. E103-7421-00	REV. B
ISSUED	SCALE	SHEET

MATERIAL

FINISH

DO NOT SCALE DRAWING