



INDUSTRIAL TRUCK DIVISION



OPERATORS MANUAL

C500-E685SG "B"-1-2140 thru 73-2190

EC 60 B SG

EC 70 B SG

EC 80 B SG

BOOK No. 0-223-2

CLARK EQUIPMENT COMPANY

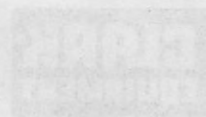
PUBLISHED BY

TECHNICAL SERVICE DEPARTMENT,
BATTLE CREEK, MICHIGAN, U.S.A.

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INDUSTRIAL TRUCK DIVISION



OPERATORS MANUAL

CS00-56922C *R-1-2140 TRUCK 73-1130

EC 20 P. 20

EC 20 P. 20

EC 20 P. 20

BOOK NO. 0-523-2

CLARK EQUIPMENT COMPANY

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TECHNICAL SERVICE DEPARTMENT
BATTLE CREEK MICHIGAN U.S.A.



INDUSTRIAL TRUCK DIVISION



P L E A S E N O T E

I N S T R U C T I O N S O N U S E O F M A N U A L

This Operator's Manual is published as a service reference guide and includes Specifications, Operating Instructions, Lubrication and Preventive Maintenance Instructions, and Trouble Shooting Guide.

The TABLE OF CONTENTS for this manual is printed on green paper and is placed at the front for easy reference. A separate INDEX (also printed on green paper) is placed in front of the Lubrication and Preventive Maintenance Section.

Lubrication and Preventive Maintenance Instructions are listed under the TIME INTERVALS that they should be performed.

The TIME INTERVAL is part of the page number and code number.

Example: 8H 002-0; 8H is the TIME INTERVAL (8 operating hours), 002 is the PAGE NUMBER, and -0 is a CODE NUMBER that you as a customer should disregard. The dash number or code number is for the benefit of the publisher only.

The INDEX is set up under the TIME INTERVALS that the Lubrication and Preventive Maintenance should be performed.

Example:	(8 Hours)	Time Interval (H=Hours)	&	Page Number (000-)
		8H		503
		8H		373

The above states to check the sump tank fluid level every 8 operating hours and refer to page 503 for fluid recommendations etc. Also, to check brake pedal free travel at this interval and turn to page 373 for instructions.

Turn to the eight (8) hour section (8H) and then to the page listed — 503 or 373 etc. The instructions covered therein will pertain only to the checks or adjustments that should be performed at this TIME INTERVAL.

If, for instance, the Brake Pedal Free Travel is incorrect, you would then refer to the INDEX for "Brake Pedal Free Travel, adjust" which would be listed in the TIME INTERVALS following the 8 hour section.

Example:	(100 Hours)	Time Interval (H=Hours)	&	Page Number (000-)
		100H		302

Turn to the one hundred hour section (100H) and then to



INDUSTRIAL TRUCK DIVISION



(continued)

INSTRUCTIONS ON USE OF MANUAL

page 302. Complete instructions as to the importance of pedal free travel, the method to check and adjust for correct free travel with illustrations are included therein.

NOTE

YOU WILL NOTE THAT AT THE BEGINNING OF EVERY SECTION A LUBRICATION AND PREVENTIVE MAINTENANCE ILLUSTRATION IS SHOWN GIVING THE LOCATION OF THE COMPONENTS TO BE SERVICED.

It is impossible to cover all types of machine operations in one manual. Operating conditions should determine the lubrication and maintenance intervals. Common sense and a close observance can best determine the frequency with which you should service your machine.

The care you give your machine will greatly determine the satisfaction and service life that you will obtain from it. A definite maintenance program should be set up and followed. Haphazard maintenance will only lead to faulty performance and short life.



INDUSTRIAL TRUCK DIVISION



TABLE OF CONTENTS

<u>Page</u>	<u>Description</u>
A001	Instructions on use of manual.
A073	Table of Contents.
B071	Illustration of machine.
B073	Specifications.

OPERATIONS

C072	Overall controls.
C073	Battery charge indicator; hour meter.
C173	To operate machine.
C303	To move a load; safety and operating instructions
C511-C531	Preventive maintenance and battery maintenance

LUBRICATION AND PREVENTIVE MAINTENANCE

Time Interval & Number (H-Hours)	Page Number (0000-)	<u>Description</u>
H	071	Index
8H	072	<u>8 Hour Lubrication & Preventive Maintenance Illustration</u>
8H	073	Horn, Lights (Machines so equipped); Control Circuit Fuse
8H	273	Battery charge indicator, hour meter.
8H	373	Brake pedal free travel, check; parking brake, check.
8H	374	Parking Brake
8H	473	Battery, inspect.
8H	474	Battery, inspect.
8H	475	Battery, inspect.
8H	476	Battery, inspect.
8H	477	Battery, inspect.
8H	503	Hydraulic sump tank, level check; operation check; hydraulic controls, check.
8H	603	Tires, inspect.
100H	070	100 Hour Lubrication & Preventive Maintenance Illustration
100H	073	Axle adapter, lubricant level check.
100H	273	Parking brake power cut-off switch, check and adjust; Service brake power cut-off switch, check and adjust.
100H	302	Brake pedal free travel, check and adjust.
100H	303	Brake system, inspect.
100H	403	Lubricate machine; hydraulic control valve and lines, inspect. lift cylinder and tilt cylinder, inspect; lift chains, check and adjust.
100H	473	Pump control switches (lift and tilt); check and adjust.
100H	475	Master (speed control) cylinder, check and adjust; 1MS and 2MS switches (accelerator pedal), check and adjust.
100H	476	Solid State Control, test and adjust.
100H	476-2	Solid State Control, Test and adjust. (GE)
100H	503	Hydraulic sump tank breather, inspect.
100H	603	Steering gear, lubricant level check.
100H	673	Forward, reverse, 1A contactors, inspect and adjust.
100H	674	Switchette, adjust.
100H	772	Lubrication Chart
100H	773	Lubrication Chart
500H	072	<u>500 Hour Lubrication & Preventive Maintenance Illustration</u>
500H	173	Hydraulic sump tank, drain and refill.
500H	174	Hydraulic sump tank filter, change.
500H	202	Steering gear, check and adjust.
500H	302	Typical steer linkage adjustment.
1000H	069	<u>1000 Hour Lubrication & Preventive Maintenance Illustration</u>
1000H	671	Typical drive motor assembly.
1000H	672	Typical drive motor assembly (disassembled view).



INDUSTRIAL TRUCK DIVISION



TABLE OF CONTENTS

<u>Time Interval (H-Hours)</u>	<u>Page & Number (0000-)</u>	<u>Description</u>
1000H	673	Drive and pump motor, inspect; brush spring tension, check brushes, inspect.
1000H	803	Steering wheel bearings, clean, repack and adjust.
1000H	805	Axle ends, clean and repack.
1000H	912	Brake system, illustration.
1000H	913	Brake system, bleed.
1000H	1003	Service wheel brake assembly.
1000H	1172	Seat safety brake (parking brake), check and adjust.
1000H	1173	Seat linkage disconnect pin.
1000H	1303	Axle adapter, drain and refill.
1000H	1507	System pressure checks.
1000H	1803	Lift carriage and upright rollers, check and adjust.

TROUBLE SHOOTING GUIDE

TS 483	Drive Axle
TS 521	Steering Axle
TS 541	Brakes
TS 542	Brakes
TS 653	Hydraulic System
TS 654	Hydraulic System
TS(SG)819	Solid State Control, test & adjust

FOLDOUT: IN-15938 (change letter E)

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ILLUSTRATION OF MACHINE



EC60B EC70B ECS80B

B 071-7

MAY 70

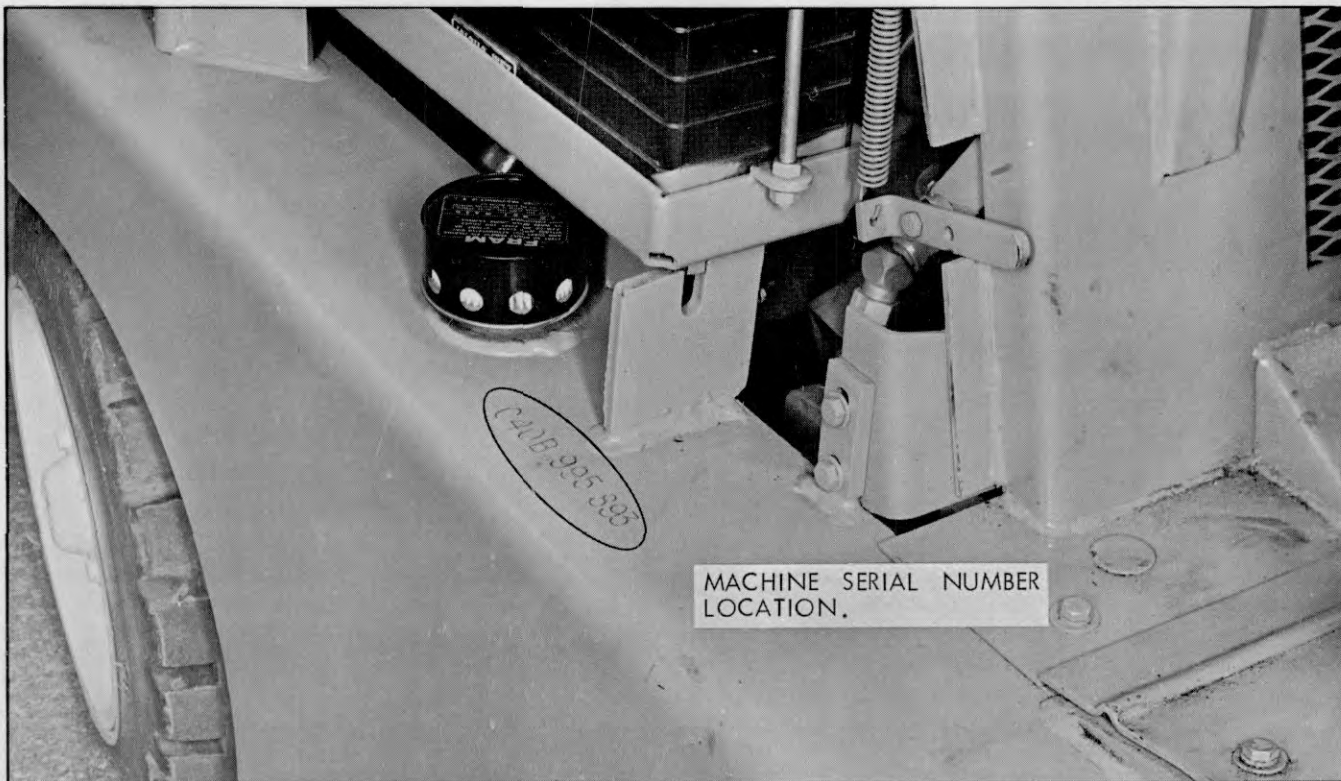


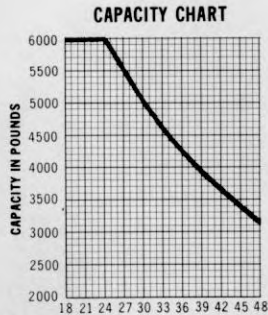
Plate 9474. Machine Serial No. Location



Plate 9475. Upright Serial (Deck) No. Location

EC-60-B 36 VOLT CLARKLIFT® ELECTRIC

6,000 pound capacity at 24 inch load center



Load center in inches from front face of forks — Rated capacities shown above are computed with uprights in vertical position. Lifts above 154" maximum fork height, contact factory. Specific capacities will be shown on truck nameplate.

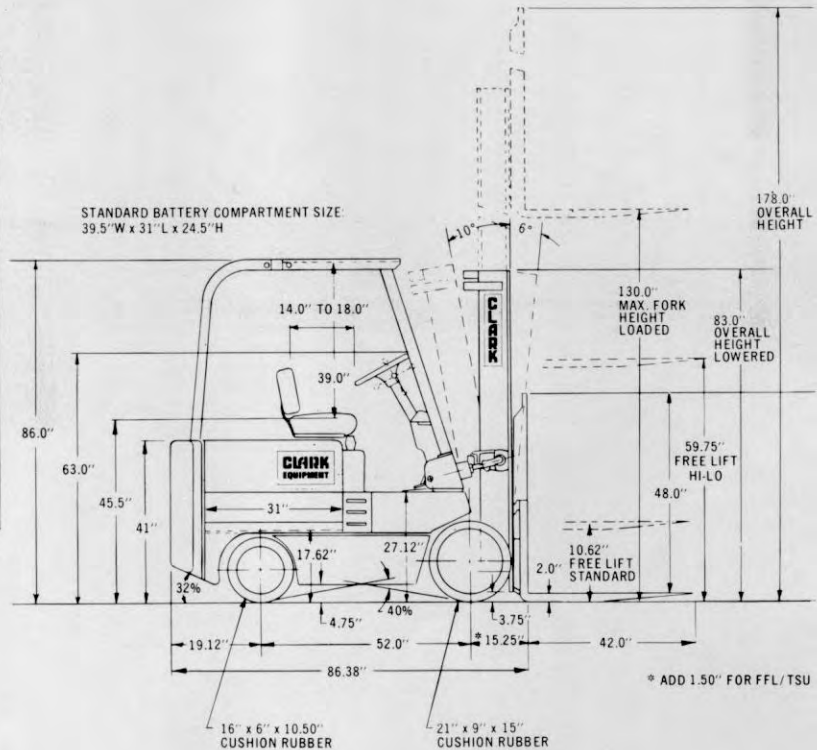
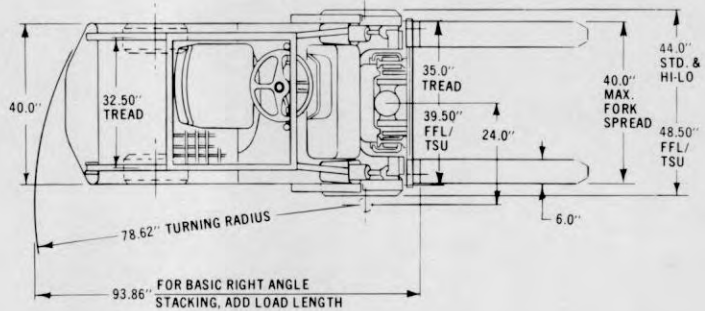
UPRIGHT DIMENSION TABLE

Max. Fork Ht. Std. & Hi-Lo	FFL/TSU	Overall Height Lowered	Free Lift	
			Std.	FFL/TSU & Hi-Lo
76	—	56	10.625	32.75
82	—	59	10.625	35.75
88	—	62	10.625	38.75
94	126	65	10.625	41.75
100	135	68	10.625	44.75
106	*144	71	10.625	47.75
112	153	74	10.625	50.75
118	162	77	10.625	53.75
124	171	80	10.625	56.75
*130	*180	83	10.625	59.75
136	—	86	10.625	62.75
—	189	88	10.625	64.75
142	—	89	10.625	65.75
—	198	91	10.625	67.75
148	—	92	10.625	68.75
*154	—	95	10.625	71.75
—	207	96	10.625	72.75
160	*216	99	10.625	75.75
—	225	104	10.625	80.75
172	—	106	10.625	82.75
—	234	107	10.625	83.75
*178	—	109	10.625	85.75
184	243	112	10.625	88.75
—	252	115	10.625	91.75
190	—	116	10.625	92.75
196	—	119	10.625	95.75
202	—	124	10.625	100.75
208	—	127	10.625	103.75

* Preferred standard heights. For overall height raised, add 49" to maximum fork height.



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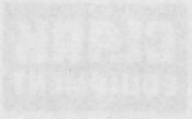


CLARK
EQUIPMENT Industrial Truck Division
Battle Creek, Michigan

GAS/DIESEL/ELECTRIC FORK LIFTS
ELECTRIC NARROW AISLE TRUCKS
ELECTRIC HAND TRUCKS/STRADDLE CARRIERS
TOWING TRACTORS/COMPLETE LINE OF HANDLING DEVICES

SS 2286 470 15ME

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INDUSTRIAL TRUCK DIVISION

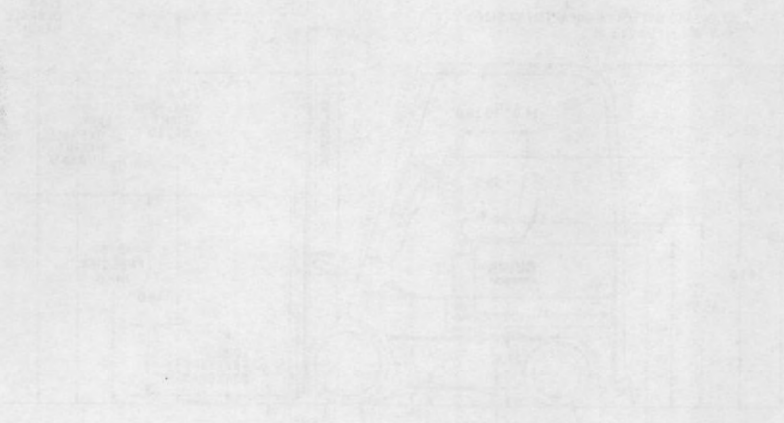


ST. LOUIS, MISSOURI

36 VOLT CLARKLIFT ELECTRIC

EG-80-B

6,000 pound capacity at 24 inch fork center



TABLE

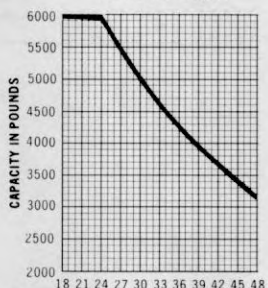
Capacity (lb)	Speed (ft/min)	Motor (hp)	Motor (kw)
0	100	1.5	1.1
1000	80	1.5	1.1
2000	60	1.5	1.1
3000	45	1.5	1.1
4000	35	1.5	1.1
5000	25	1.5	1.1
6000	15	1.5	1.1

INDUSTRIAL TRUCK DIVISION
 FACOM
 ST. LOUIS, MISSOURI

EC-60-B 48 VOLT CLARKLIFT® ELECTRIC

6,000 pound capacity at 24 inch load center

CAPACITY CHART



Load center in inches from front face of forks — Rated capacities shown above are computed with uprights in vertical position. Lifts above 154" maximum fork height, contact factory. Specific capacities will be shown on truck nameplate.

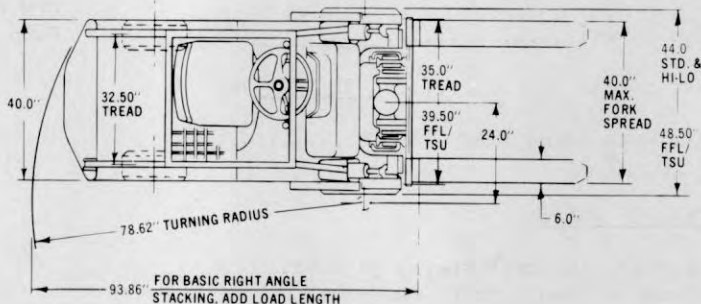
UPRIGHT DIMENSION TABLE

Max. Fork Ht. Std. & Hi-Lo	FFL / TSU	Overall Height Lowered	Free Lift	
			Std.	FFL / TSU & Hi-Lo
76	—	56	10.625	32.75
82	—	59	10.625	35.75
88	—	62	10.625	38.75
94	126	65	10.625	41.75
100	135	68	10.625	44.75
106	*144	71	10.625	47.75
112	153	74	10.625	50.75
118	162	77	10.625	53.75
124	171	80	10.625	56.75
*130	*180	83	10.625	59.75
136	—	86	10.625	62.75
—	189	88	10.625	64.75
142	—	89	10.625	65.75
—	198	91	10.625	67.75
148	—	92	10.625	68.75
*154	—	95	10.625	71.75
—	207	96	10.625	72.75
160	*216	99	10.625	75.75
—	225	104	10.625	80.75
172	—	106	10.625	82.75
—	234	107	10.625	83.75
*178	—	109	10.625	85.75
184	243	112	10.625	88.75
—	252	115	10.625	91.75
190	—	116	10.625	92.75
196	—	119	10.625	95.75
202	—	124	10.625	100.75
208	—	127	10.625	103.75

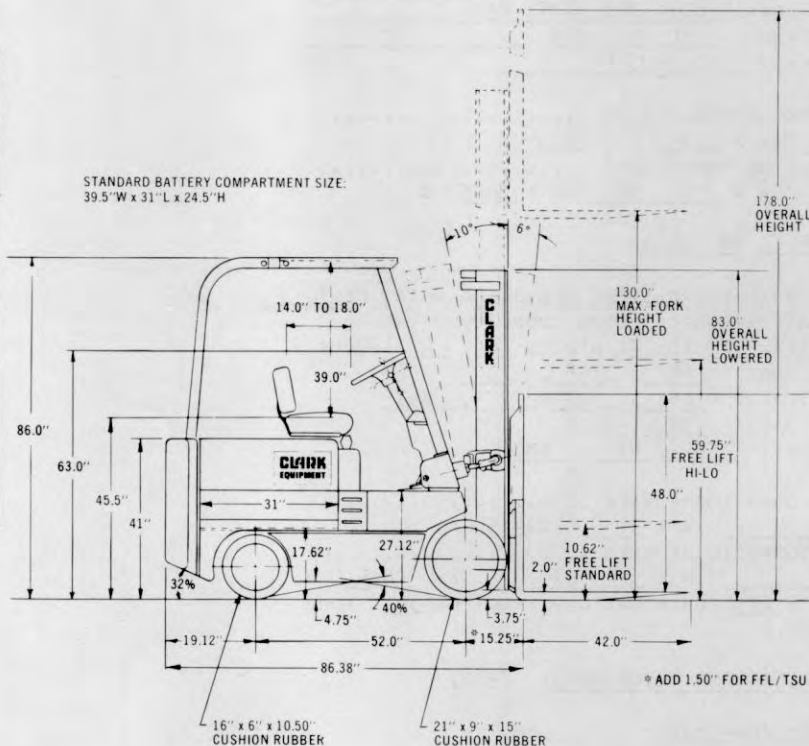
* Preferred standard heights. For overall height raised, add 49" to maximum fork height.



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STANDARD BATTERY COMPARTMENT SIZE:
39.5" W x 31" L x 24.5" H



* ADD 1.50" FOR FFL/TSU

CLARK
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Battle Creek, Michigan

GAS DIESEL ELECTRIC FORK LIFTS
ELECTRIC NARROW AISLE TRUCKS
ELECTRIC HAND TRUCKS STRADDLE CARRIERS
TOWING TRACTORS COMPLETE LINE OF HANDLING DEVICES

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INDUSTRIAL TRUCK DIVISION



SPECIFICATIONS FOR EC60B

GENERAL:

Type of vehicle Electric Clarklift

WHEELS AND TIRES:

Front (size) 21x9x15

Rear (size) 16x6x10.5

Single Drive:

Tread (drive tires) 35 in.

Tread (steer tires) 32 1/2 in.

Gradeability with rated load @ 1 MPH
..... 36 %

POWER SUPPLY, 36 Volts:

Lead-acid battery in steel trays, 36 volt, having adequate kilowatt hours capacity.

18 cells, 25 to 27 plate, 3 x 6 layout

Exide Types: TSC, TGP, TG

Gould Types: 60X, 72X, 72T, 85T

C & D Types: HYL, HC, CDS

K-W Types: HT, FH, FM

Standard compartment size
39.5 " W x 31 " L x 24.5" H

Optional compartment size
39.5 " W x 37 " L x 24.5" H

POWER SUPPLY, 48 Volts:

Lead-acid battery in steel trays, 48 volt, having adequate kilowatt hours capacity.

24 cells, 19 to 21 plate, 6 x 4 layout

Exide Types: TG, TGP, TSC

Gould Types: 60X, 72X, 72T, 85T

C & D Types: HYL, HC

K-W Types: FH, HT, FM

Standard compartment size
39.5 " W x 31 " L x 24.5" H

Optional compartment size
39.5 " W x 37" L x 24.5 " H

(24 cell - 21 plate battery requires 34" long compartment.)

LIFTING SPEEDS AND MOTOR AMPS: (36V)

STD Upright (no-load):

Line amps 155
FPM lift 58.2
FPM lower 84
Pump press. 240

STD Upright (capacity):

Line amps 315
FPM lift 38.7
FPM lower 75
Pump press. 1160

LIFTING SPEEDS AND MOTOR AMPS: (48V)

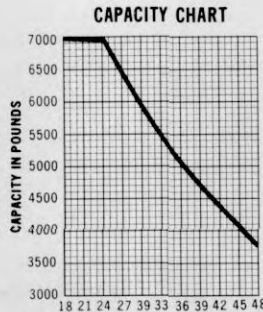
STD Upright (no-load):

Line amps 170
FPM lift 78.8
FPM lower 84
Pump press. 250

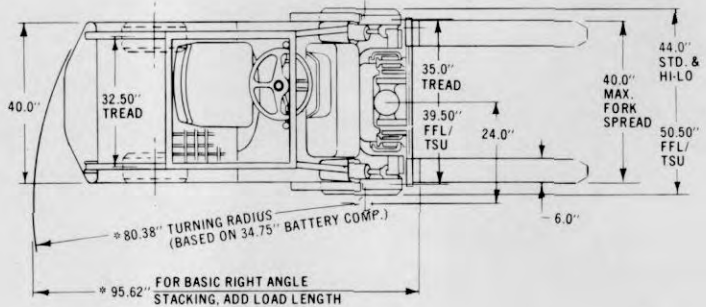
STD Upright (capacity):

Line amps 320
FPM lift 54.3
FPM lower 75
Pump press. 1200

EC-70-B 36 VOLT CLARKLIFT® ELECTRIC
7,000 pound capacity at 24 inch load center



Load center in inches from front face of forks — Rated capacities shown above are computed with uprights in vertical position. Lifts above 154" maximum fork height, contact factory. Specific capacities will be shown on truck nameplate.



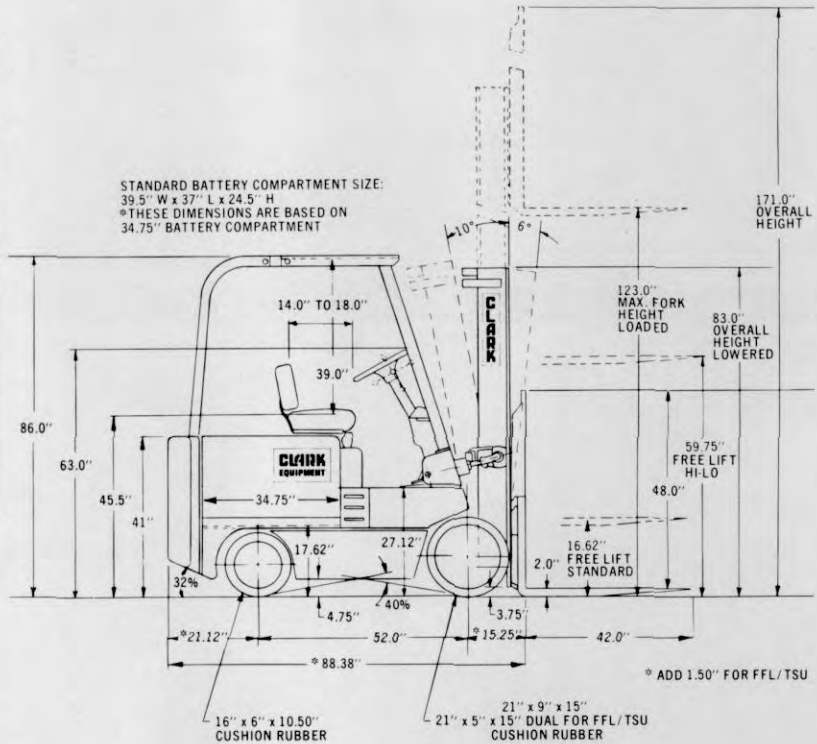
UPRIGHT DIMENSION TABLE

Max. Fork Ht. Std. & Hi-Lo	FFL/TSU	Overall Height Lowered	Free Lift		
			Std.	FFL/TSU & Hi-Lo	
75	—	59	16.625	35.75	
81	—	62	16.625	38.75	
87	—	65	16.625	41.75	
93	126	68	16.625	44.75	
* 99	135	71	16.625	47.75	
105	* 144	74	16.625	50.75	
111	153	77	16.625	53.75	
117	162	80	16.625	56.75	
* 123	171	83	16.625	59.75	
129	—	86	16.625	62.75	
—	* 180	88	16.625	64.75	
135	—	89	16.625	65.75	
—	189	91	16.625	67.75	
* 141	—	92	16.625	68.75	
—	198	95	16.625	71.75	
153	207	99	16.625	72.75	
159	—	102	16.625	78.75	
—	* 216	104	16.625	80.75	
165	—	106	16.625	82.75	
—	225	107	16.625	83.75	
* 171	—	109	16.625	85.75	
177	234	112	16.625	88.75	
183	—	243	115	16.625	91.75
189	—	119	16.625	95.75	
195	—	124	16.625	100.75	
201	—	127	16.625	103.75	

* Preferred standard heights. For overall height raised, add 49" to maximum fork height.



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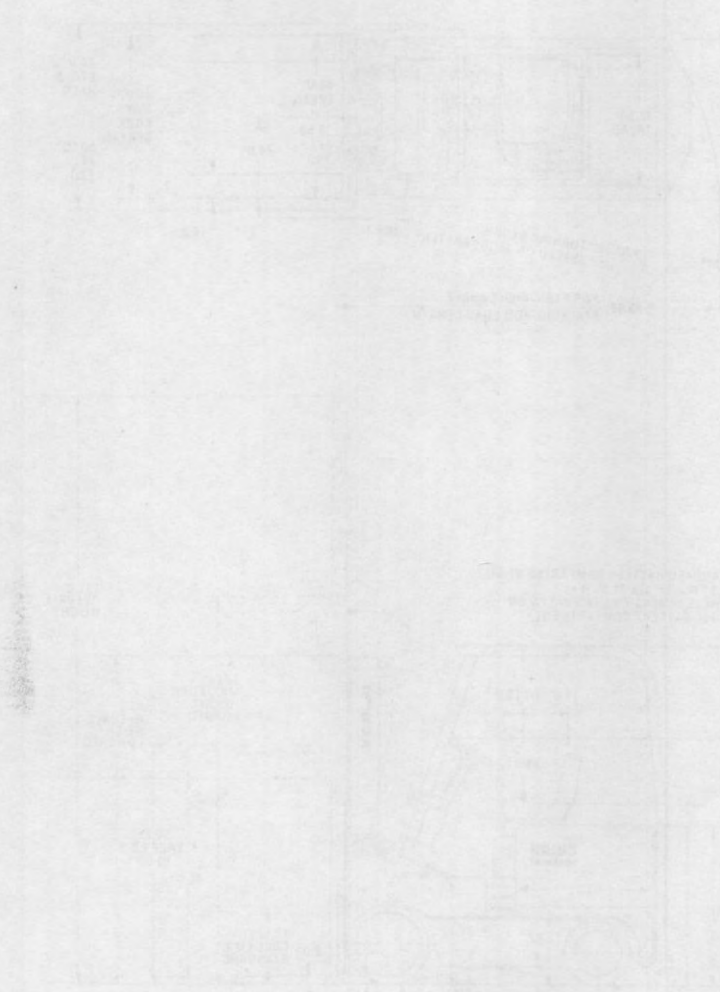
CLARK
EQUIPMENT Industrial Truck Division
Battle Creek, Michigan

GAS/DIESEL/ELECTRIC FORK LIFTS
ELECTRIC NARROW AISLE TRUCKS
ELECTRIC HAND TRUCKS/STRADDLE CARRIERS
TOWING TRACTORS/COMPLETE LINE OF HANDLING DEVICES

38 VOLT CLARKLIFT ELECTRIC

EC-70-B

7,000 pound capacity at 24 inch load center



WEIGHT DISTRIBUTION TABLE

LOADING CAPACITY (LBS)	FRONT AXLE (LBS)	REAR AXLE (LBS)
7,000	3,500	3,500
8,000	4,000	4,000
9,000	4,500	4,500
10,000	5,000	5,000
11,000	5,500	5,500
12,000	6,000	6,000
13,000	6,500	6,500
14,000	7,000	7,000
15,000	7,500	7,500
16,000	8,000	8,000
17,000	8,500	8,500
18,000	9,000	9,000
19,000	9,500	9,500
20,000	10,000	10,000



WEIGHT DISTRIBUTION TABLE

LOADING CAPACITY (LBS)	FRONT AXLE (LBS)	REAR AXLE (LBS)
7,000	3,500	3,500
8,000	4,000	4,000
9,000	4,500	4,500
10,000	5,000	5,000
11,000	5,500	5,500
12,000	6,000	6,000
13,000	6,500	6,500
14,000	7,000	7,000
15,000	7,500	7,500
16,000	8,000	8,000
17,000	8,500	8,500
18,000	9,000	9,000
19,000	9,500	9,500
20,000	10,000	10,000



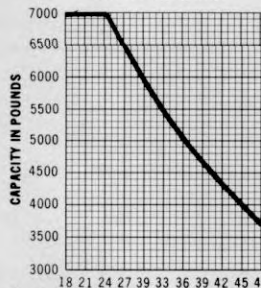
INDUSTRIAL TRUCK DIVISION



SPECIFICATIONS FOR EC70B

EC-70-B 48 VOLT CLARKLIFT® ELECTRIC 7,000 pound capacity at 24 inch load center

CAPACITY CHART



Load center in inches from front face of forks —
Rated capacities shown above are computed with
uprights in vertical position. Lifts above 154"
maximum fork height, contact factory. Specific
capacities will be shown on truck nameplate.

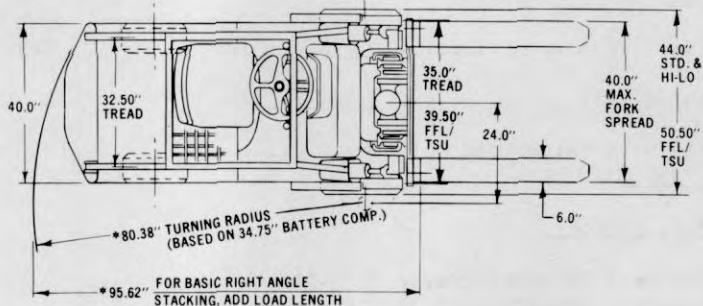
UPRIGHT DIMENSION TABLE

Max. Fork Ht. Std. & Hi-Lo	FFL/ TSU	Overall Height Lowered	Free Lift	
			Std.	FFL/TSU & Hi-Lo
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81	—	62	16.625	38.75
87	—	65	16.625	41.75
93	126	68	16.625	44.75
* 99	135	71	16.625	47.75
105	*144	74	16.625	50.75
111	153	77	16.625	53.75
117	162	80	16.625	56.75
*123	171	83	16.625	59.75
129	—	86	16.625	62.75
—	*180	88	16.625	64.75
135	—	89	16.625	65.75
—	189	91	16.625	67.75
141	—	92	16.625	68.75
*147	—	95	16.625	71.75
—	198	96	16.625	72.75
153	207	99	16.625	75.75
159	—	102	16.625	78.75
—	*216	104	16.625	80.75
165	—	106	16.625	82.75
—	225	107	16.625	83.75
*171	—	109	16.625	85.75
177	234	112	16.625	88.75
—	243	115	16.625	91.75
183	—	116	16.625	92.75
189	—	119	16.625	95.75
195	—	124	16.625	100.75
201	—	127	16.625	103.75

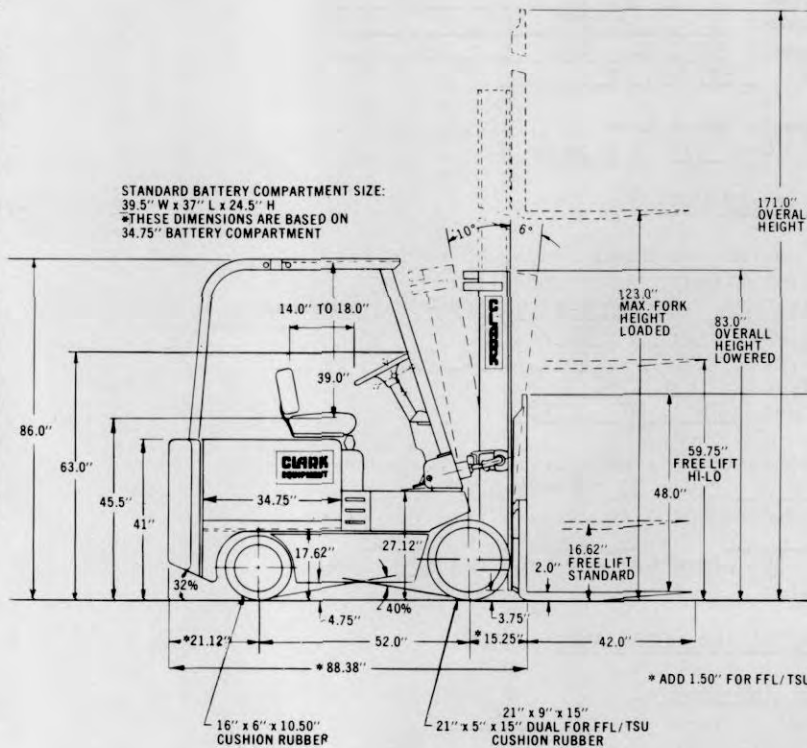
*Preferred standard heights.
For overall height raised, add 49" to maximum
fork height.



Clark products and specifications are
subject to improvements and changes
without notice.



STANDARD BATTERY COMPARTMENT SIZE:
39.5" W x 37" L x 24.5" H
*THESE DIMENSIONS ARE BASED ON
34.75" BATTERY COMPARTMENT



GAS/DIESEL/ELECTRIC FORK LIFTS
ELECTRIC NARROW AISLE TRUCKS
ELECTRIC HAND TRUCKS/STRADDLE CARRIERS
TOWING TRACTORS/COMPLETE LINE OF HANDLING DEVICES

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INDUSTRIAL TRUCK DIVISION



SPECIFICATIONS FOR EC708

GENERAL:

Type of vehicle Electric Clarklift

WHEELS AND TIRES:

Front (size) 21x9x15

Rear (size) 16x6x10.5

Single Drive:

Tread (drive tires) 35 in.

Tread (steer tires) 32 1/2 in.

Gradeability with rated load @ 1 MPH
..... 33 %

POWER SUPPLY, 36 Volts:

Lead-acid battery in steel trays, 36 volt,
having adequate kilowatt hours capacity.

18 cells, 31 plate, 3 x 6 layout

Exide Types: TSC, TGP, TG

Gould Types: 60X, 72X, 72T, 85T

C & D Types: HYL, HC, CDS

K-W Types: HT, FH, FM

Standard compartment size
39.5 " W x 37 " L x 24.5 " H

POWER SUPPLY, 48 Volts:

Lead-acid battery in steel trays, 48 volt, hav-
ing adequate kilowatt hours capacity.

24 cells, 23 plate, 6 x 4 layout

Exide Types: TG, TGP, TSC

Gould Types: 60X, 72X, 72T, 85T

C & D Types: HYL, HC

K-W Types: FH, HT, FM

Standard compartment size
39.5 " W x 37 " L x 24.5 " H

Optional compartment size
39.5 " W x 40 " L x 24.5 " H

(24 cell -25 plate battery requires 40 " long
compartment.)

LIFTING SPEEDS AND MOTOR AMPS: (36V)

STD Upright (no-load):

Line amps 155

FPM lift 58.2

FPM lower 84

Pump press. 240

STD Upright (capacity):

Line amps 340

FPM lift 36.3

FPM lower 70

Pump press. 1300

LIFTING SPEEDS AND MOTOR AMPS: (48V)

STD Upright (no-load):

Line amps 170

FPM lift 78.8

FPM lower 84

Pump press. 250

STD Upright (capacity):

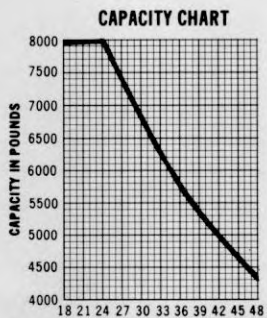
Line amps 350

FPM lift 52.5

FPM lower 70

Pump press. 1350

EC-80-B 36 VOLT CLARKLIFT® ELECTRIC
8,000 pound capacity at 24 inch load center



Load center in inches from front face of forks — Rated capacities shown above are computed with uprights in vertical position. Lifts above 154" maximum fork height, contact factory. Specific capacities will be shown on truck nameplate.

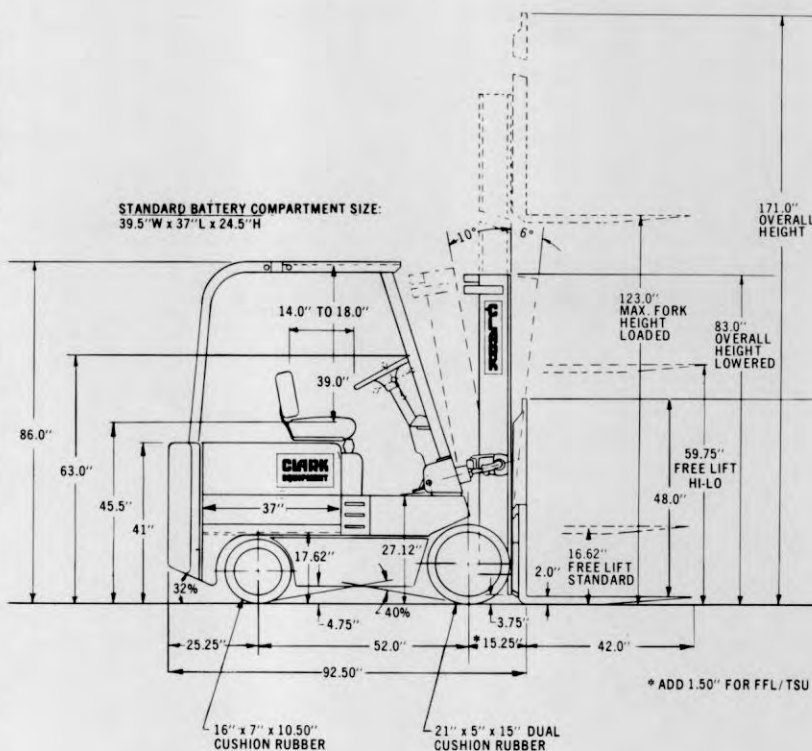
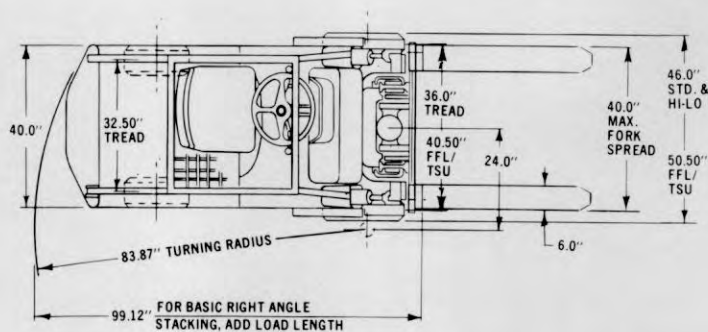
UPRIGHT DIMENSION TABLE

Max. Fork Ht. Std. & Hi-Lo	FFL/TSU	Overall Height Lowered	Free Lift	
			Std.	FFL/TSU & Hi-Lo
75	—	59	16.625	35.75
81	—	62	16.625	38.75
87	—	65	16.625	41.75
93	126	68	16.625	44.75
* 99	135	71	16.625	47.75
105	*144	74	16.625	50.75
111	153	77	16.625	53.75
* 117	162	80	16.625	56.75
* 123	171	83	16.625	59.75
129	—	86	16.625	62.75
—	*180	88	16.625	64.75
—	135	89	16.625	65.75
—	189	91	16.625	67.75
141	—	92	16.625	68.75
* 147	—	95	16.625	71.75
—	198	96	16.625	72.75
153	207	99	16.625	75.75
159	—	102	16.625	78.75
—	*216	104	16.625	80.75
165	—	106	16.625	82.75
—	225	107	16.625	83.75
* 171	—	109	16.625	85.75
177	234	112	16.625	88.75
—	243	115	16.625	91.75
183	—	116	16.625	92.75
189	—	119	16.625	95.75
195	—	124	16.625	100.75
201	—	127	16.625	103.75

* Preferred standard heights. For overall height raised, add 49" to maximum fork height.



Clark products and specifications are subject to improvements and changes without notice.



CLARK
EQUIPMENT Industrial Truck Division
Battle Creek, Michigan

GAS/DIESEL/ELECTRIC FORK LIFTS
ELECTRIC NARROW AISLE TRUCKS
ELECTRIC HAND TRUCKS/STRADDLE CARRIERS
TOWING TRACTORS/COMPLETE LINE OF HANDLING DEVICES

SS 2292 470 15ME

PRINTED IN U.S.A.

38 VOLT CLARKIFIT ELECTRIC

EC-80-B

3,000 pound capacity at 24 inch load center

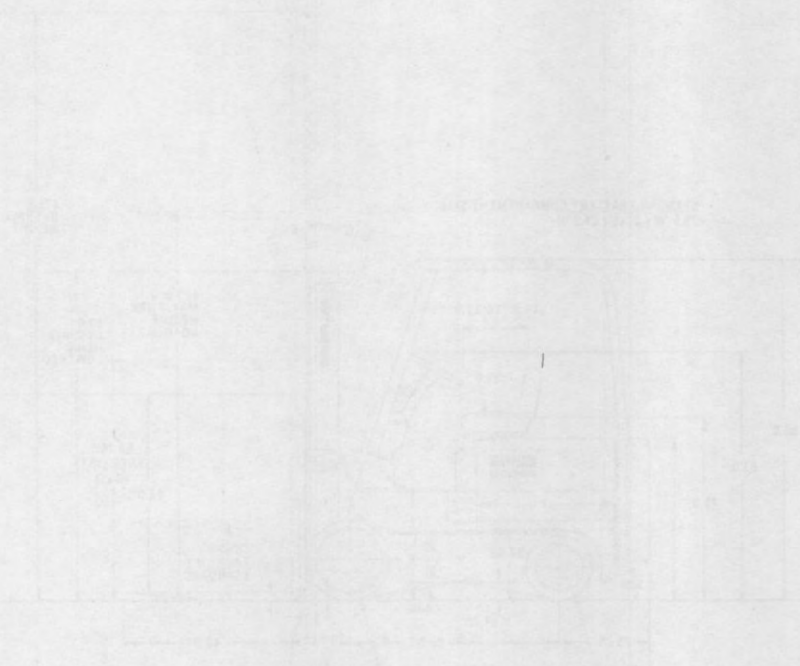


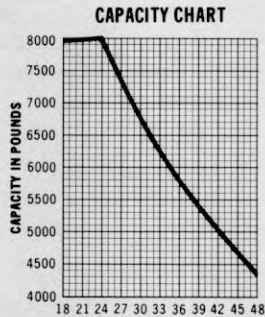
Table with 4 columns: RPM, Torque (ft-lb), Horsepower, and Efficiency. The table lists performance data at various RPM levels from 1000 to 2000.

Technical specifications and notes regarding the motor's operating conditions and safety warnings.

Additional technical details, possibly related to the motor's electrical characteristics or maintenance requirements.

EC-80-B 48 VOLT CLARKLIFT® ELECTRIC

8,000 pound capacity at 24 inch load center



Load center in inches from front face of forks — Rated capacities shown above are computed with uprights in vertical position. Lifts above 154" maximum fork height, contact factory. Specific capacities will be shown on truck nameplate.

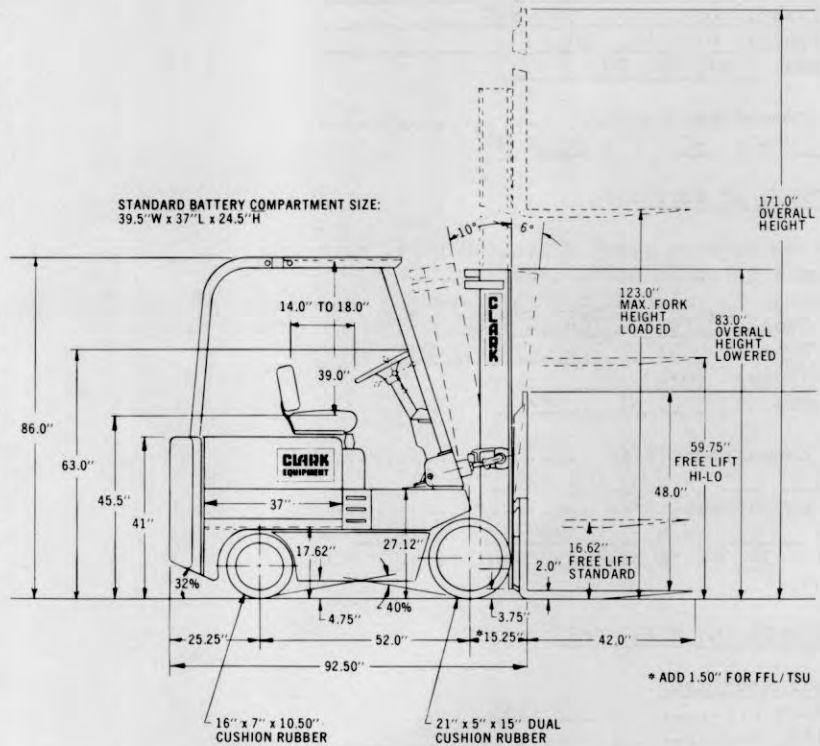
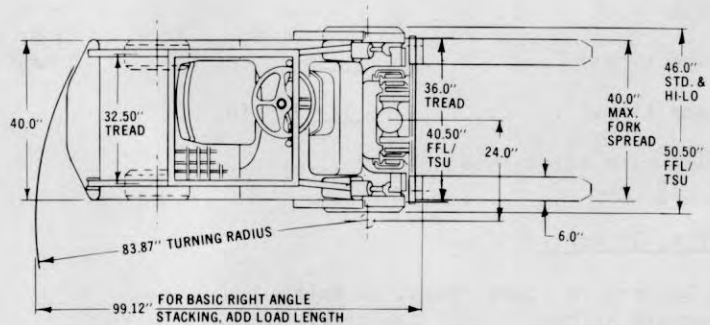
UPRIGHT DIMENSION TABLE

Max. Fork Ht. Std. & Hi-Lo	FFL/TSU	Overall Height Lowered	Free Lift	
			Std.	FFL/TSU & Hi-Lo
75	—	59	16.625	35.75
81	—	62	16.625	38.75
87	—	65	16.625	41.75
93	—	68	16.625	44.75
*99	126	71	16.625	47.75
105	*144	74	16.625	50.75
111	153	77	16.625	53.75
117	162	80	16.625	56.75
*123	171	83	16.625	59.75
129	—	86	16.625	62.75
—	*180	88	16.625	64.75
135	—	89	16.625	65.75
—	189	91	16.625	67.75
141	—	92	16.625	68.75
*147	—	95	16.625	71.75
—	198	96	16.625	72.75
153	207	99	16.625	75.75
159	—	102	16.625	78.75
—	*216	104	16.625	80.75
165	—	106	16.625	82.75
—	225	107	16.625	83.75
*171	—	109	16.625	85.75
177	234	112	16.625	88.75
183	243	115	16.625	91.75
189	—	116	16.625	92.75
189	—	119	16.625	95.75
195	—	124	16.625	100.75
201	—	127	16.625	103.75

*Preferred standard heights. For overall height raised, add 49" to maximum fork height.



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CLARK
EQUIPMENT Industrial Truck Division
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GAS/DIESEL/ELECTRIC FORK LIFTS
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TOWING TRACTORS/COMPLETE LINE OF HANDLING DEVICES

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INDUSTRIAL TRUCK DIVISION



SPECIFICATIONS FOR EC80B

GENERAL:

Type of vehicle Electric Clarklift

WHEELS AND TIRES:

Front (size) 21x5x15

Rear (size) 16x7x10.5

Single Drive:

Tread (drive tires) 36 in.

Tread (steer tires) 32 1/2 in.

Gradeability with rated load @ 1 MPH
..... 32 %

POWER SUPPLY, 36 Volts:

Lead-acid battery in steel trays, 36 volt, having adequate kilowatt hours capacity.

18 cells, 31 plate, 3 x 6 layout

Exide Types: TSC, TGP, TG

Gould Types: 60X, 72X, 72T, 85T

C & D Types: HYL, HC, CDS

K-W Types: HT, FH, FM

Standard compartment size
39.5 " W x 37 " L x 24.5 " H

POWER SUPPLY, 48 Volts:

Lead-acid battery in steel trays, 48 volt, having adequate kilowatt hours capacity.

24 cells, 23 plate, 6 x 4 layout

Exide Types: TG, TGP, TSC

Gould Types: 60X, 72X, 72T, 85T

C & D Types: HYL, HC

K-W Types: FH, HT, FM

Standard compartment size
39.5 " W x 37 " L x 24.5 " H

Optional compartment size
39.5 " W x 40 " L x 24.5 " H

(24 cell - 25 plate battery requires 40 " long compartment.)

LIFTING SPEEDS AND MOTOR AMPS: (36V)

STD Upright (no-load):

Line amps 155

FPM lift 58.2

FPM lower 84

Pump press. 240

STD Upright (capacity):

Line amps 360

FPM lift 34.6

FPM lower 65

Pump press. 1500

LIFTING SPEEDS AND MOTOR AMPS: (48V)

STD Upright (no-load):

Line amps 170

FPM lift 78.8

FPM lower 84

Pump press. 250

STD Upright (capacity):

Line amps 370

FPM lift 49.2

FPM lower 65

Pump press. 1500



INDUSTRIAL TRUCK DIVISION



SPECIFICATIONS FOR EC60,70,80B

GENERAL:

Type of vehicleElectric Clarklifts

DRAW BAR PULL:

Draw bar pull loaded W/IA:

36 Volt, 7500 lbs at 13 " coupler height
48 Volt, 8800 lbs at 13 " coupler height

Draw bar pull empty (SCR):

36 Volt, 2500 lbs at 13 " coupler height
48 Volt, 3200 lbs at 13 " coupler height

HYDRAULIC SYSTEM:

Relief setting (PSI) 1900

Hydraulic Pump (Type: Gear)

Max. pressure (PSI)..... 2000

Sump filter (Return Line):

Micron size 25

Capacity (GPM) 30

By-pass relief (PSI) 25

Sump Tank Capacity 9.5 gal.

Sump Tank Breather 5 micron

Sump Tank Strainer 100 mesh

STEERING SYSTEM:

Relief setting (PSI) 550 (Location: Pump)

Steering wheel turning diameter: 17"

MAJOR BOLT TORQUE (lbs/ft., dry thread):

1. Steer wheel 115-150

2. Drive wheel;

a. Wide drive axle ends 275-350

b. All others 275-350

3. Axle Mounting Ring Bolts:

Body Fit 950-1000

Tapered Head 650-700

4. Counterweight bolt 1720-1820

5. Pitman arm locknut..... 320-400

6. Outboard Pitman shaft support bolts
..... 60-70

7. Tilt cylinder yoke clamp bolt
..... 80-90

8. Hand wheel to steer gear shaft nut
..... 35-40 lbs ft

9. Pump motor mounting nuts 218 lbs ft

10. Counterweight to spacer mounting bolts.....
..... 1720-1820 lbs ft

11. Axle end to adaptor bolt
..... 200-250 lbs ft

12. Axle end to adaptor Stud
..... 180-200 lbs ft

13. Axle end to adaptor stud nut
..... 180-200 lbs ft

14. Steer axle mounting bolts - silent block
to axle 145-180 lbs ft

15. Motor mounting bracket to motor clamp.....
..... 210-260 lbs ft

16. Steer sector mounting bolts
torque 60-75

RIGHT FOOT BRAKE PEDAL:

Free play 3/8-1/2 in.

Up height 3 1/2 in.

Parking Brake Effectiveness:

Brake must be capable of holding a truck with
fully rated load on a maximum grade of up to
..... 15 %

PUMP MOTOR:

Brush Spring Tension:

Initial 36 oz.

Final 16 oz.

STEER PUMP MOTOR:

Brush Spring Tension:

Initial 33-38 oz.

Final 16 oz.

Battery Connector:

Std. - Type SB-350 AMP

Opt. - Type EC



INDUSTRIAL TRUCK DIVISION



SPECIFICATIONS FOR EC60,70,80B

Forward Contactor (with new tips):

1. Nominally rated at: 200 Amps
2. Normally open contact gap: 3/8-13/32
3. Normally closed contact gap: 3/32-1/8
4. Normally open contact pressure: 46-56 oz.
5. Normally closed contact pressure: 32-38
6. Electrical interlock adjustment:

(a) With .035 shim between armature and core. Snapping noise indicates interlock has operated. This adjustment is preset at the factory. If adjustment is reqd. bend interlock bracket.

7. Contactor tip fastening nut tightening torque 80-100 lbs/in.

Pump Contactor (with new tips):

1. Nominally rated at: 200
2. Normally open contact gap: 3/16-7/32
3. Normally open contact pressure: 60-68 oz.
4. Contactor tip fastening nut tightening torque: 80-100 in. lbs.

Reverse Contactor (with new tips):

1. Nominally rated at: 200
2. Normally open contact gap: 3/8-13/32
3. Normally closed contact gap: 3/32-1/8
4. Normally open contact pressure: 46-56 oz.
5. Normally closed contact pressure: 32-38
6. Electrical interlock adjustment:

(a) With .035 shim between amature and core. Snapping noise indicates interlock has operated. This adjustment is preset at factory. If adjustment is reqd. bend interlock bracket.

7. Contactor tip fastening nut tightening torque: 80-100 in/lbs

1A Contactor (with new tips):

1. Nominally rated at: 200
2. Normally open contact gap: 3/16-7/32
3. Normally open contact pressure: 60-68 oz.
4. Electrical interlock adjustment:

(a) With .015 shim between amature and core. Snapping noise indicates interlock operated, same as F & R.

5. Contactor tip fastening nut tightening torque: 80/100

N O T E

All contactors for 36 and 48 volt systems.

SAFETY INSTRUCTIONS FOR MAINTAINING INDUSTRIAL TRUCKS

Powered industrial trucks may become hazardous if adequate maintenance is neglected. Therefore, adequate maintenance facilities, personnel and procedures should be provided.

Maintenance and inspection of all powered industrial trucks should be performed in conformance with the recommendation in this manual and the following practices.

1. A scheduled preventive maintenance, lubrication, and inspection system should be followed.
2. Only qualified and authorized personnel should be permitted to maintain, repair, adjust, and inspect industrial trucks.
3. Before Leaving The Truck:

- A. Stop truck.
- B. Fully lower the load engaging means.
- C. Place directional controls in neutral.
- D. Apply the parking brake.
- E. Stop the engine or turn off power.
- F. Lock the control or ignition circuit.
- G. Block the wheels if truck is on a ramp, or being worked on.

4. Before Working On Truck:

- A. Raise wheels free of floor or disconnect power source.
- B. Use chocks or other positive truck positioning devices.
- C. Block load engaging means, innermast(s), or chassis before working under them.

Before working on engine fuel system of gasoline powered trucks with gravity feed fuel systems, be sure fuel shutoff valve is closed.

Before working on engine fuel system of LP gas powered trucks, close LP gas cylinder valve and run engine until fuel in system is depleted and engine stops running.

Operation to check performance of the truck or attachments should be conducted in an authorized, safe clearance area.

5. Before Starting To Operate The Truck:

- A. Be in operating position.
- B. Depress clutch (or brake pedal on automatic transmission and electric trucks).
- C. Place directional controls in neutral.
- D. Start engine or turn on power.
- E. Before operating truck, check functioning of lift and tilt systems, directional and speed controls, steering, warning devices, brakes, and any attachment. (If used)
- F. Release parking brake.

- continued -

SAFETY INSTRUCTIONS FOR MAINTAINING INDUSTRIAL TRUCKS

6. Avoid fire hazards and have fire protection equipment present. Do not use an open flame to check level, or for leakage, of fuel, electrolyte or coolant. Do not use open pans of fuel or flammable cleaning fluids for cleaning parts.
7. Properly ventilate work area, vent exhaust fumes and keep shop clean and floor dry.
8. Handle LP gas cylinders with care. Do not drop, dent, or damage in any way.
9. Brakes, steering mechanisms, control mechanisms, warning devices, lights, governors, lift overload devices, guards and safety devices should be inspected regularly and maintained in a safe operating condition.
10. All parts of lift and tilt mechanisms and frame members should be carefully and regularly inspected and maintained in a safe operating condition.
11. Special trucks or devices designed and approved for hazardous area operation should receive special attention to ensure that maintenance preserves the original, approved safe operating features.
12. Fuel systems should be checked for leaks and condition of parts. Extra special consideration should be given in the case of a leak in the fuel system. Action should be taken to prevent the use of the truck until the leak has been corrected.
13. All hydraulic systems should be regularly inspected and maintained in conformance with good practice. Tilt cylinders, valves, and other similar parts should be checked to assure that "drift" has not developed to the extent that it would create a hazard.
14. Capacity, operation and maintenance instructions plates, tags, or decals should be maintained in legible condition.
15. Batteries, motors, controllers, limit switches, protective devices, electrical conductors and connections should be inspected and maintained in conformance with good practice. Special attention should be paid to the condition of electrical insulation.
16. Industrial trucks should be kept in a clean condition to minimize fire hazards and facilitate detection of loose or defective parts.
17. Modifications and additions which affect capacity and safe truck operation should not be performed by the customer or user without manufacturers prior written approval. Capacity, operation and maintenance instruction plates, tags or decals should be changed accordingly.
18. Care should be taken to assure that all replacement parts are interchangeable with the original parts and of a quality equal to that provided in the original equipment.



INDUSTRIAL TRUCK DIVISION



WORK SAFELY

DRIVE SAFELY

BE CAREFUL

ALWAYS

**GIVE MACHINE SERIAL NUMBER
WHEN ORDERING PARTS**

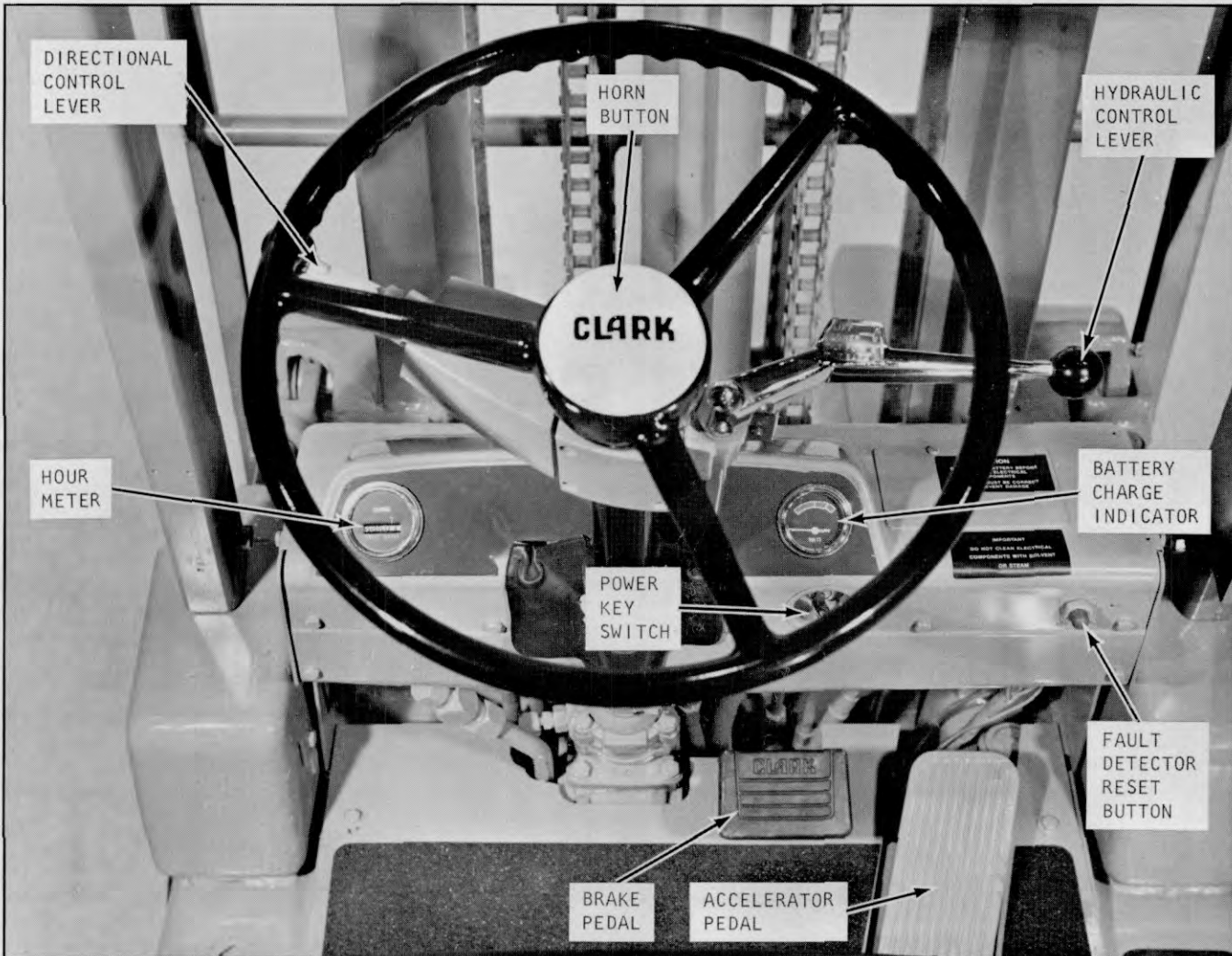


Plate 10623. Typical Overall Controls

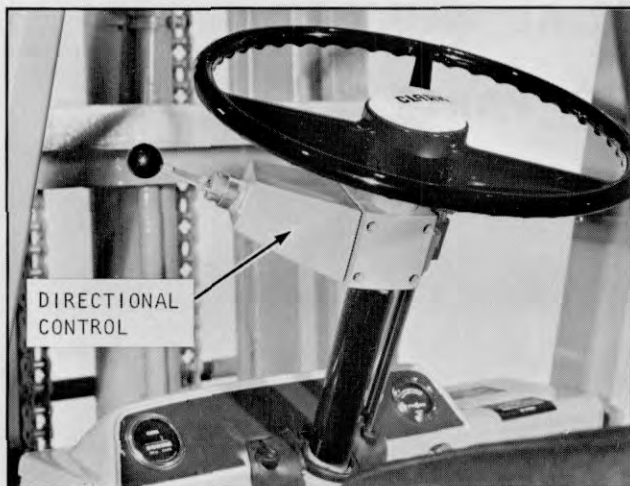


Plate 10624. Typical Directional Control Lever

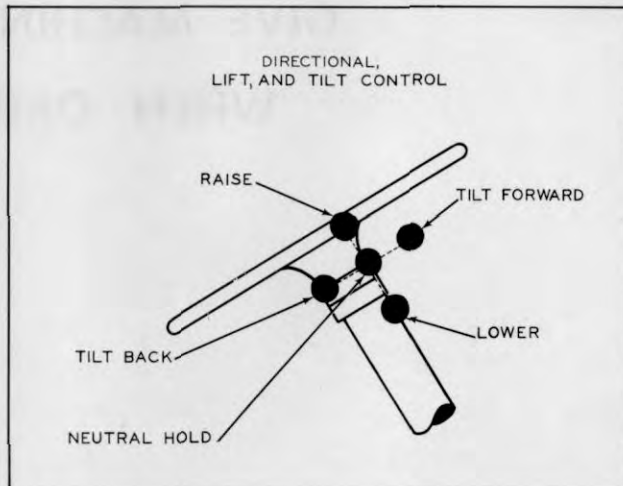


Plate 4448. Typical Hydraulic Control Lever



Plate 7388. Battery Charge Indicator

With the key switch in the "on" position the battery charge indicator will show the available battery voltage. When the indicator needle registers in the red portion of the indicator scale the battery should be recharged. It is recommended that at this time a specific gravity test be taken with a hydrometer to more accurately determine battery condition.



Plate 7162. Hour Meter

The hour meter accurately records the actual hours of machine operation. This will serve as an aid in determining the time intervals for lubrication and preventative maintenance services.

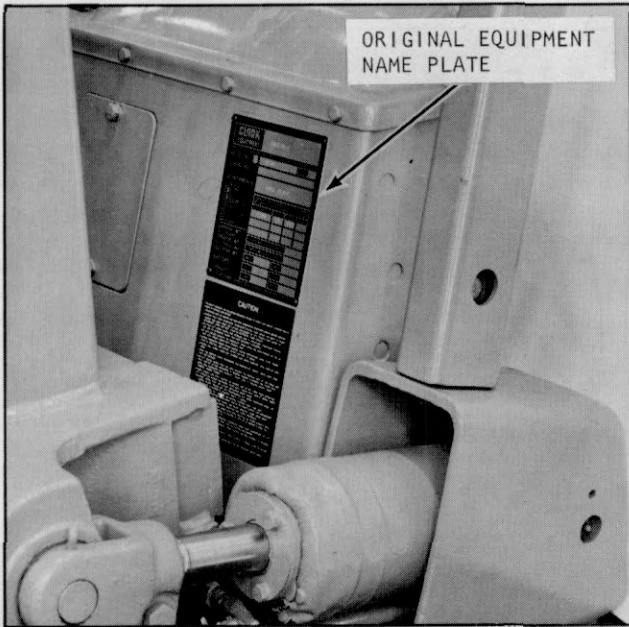


Plate 10635. Typical Name Plate

ORIGINAL EQUIPMENT NAME PLATE:

The above picture shows the location of the original equipment name plate.

TO OPERATE MACHINE:

1. When the driver's seat is occupied, the seat safety brake (deadman brake) will be released.
2. Place directional control lever in neutral position.
3. Turn switch key to the "on" position while allowing accelerator pedal and brake pedal to assume their free or undepressed position.
4. Move the directional lever in position for the desired direction of travel.
5. Depress accelerator pedal as required for the speed desired.

TO STOP MACHINE:

Remove foot from accelerator pedal and depress brake pedal sufficiently to allow a safe, smooth stop. If the machine is to be parked, turn switch key to "off" and place directional control lever in neutral (centered) position. When the driver's seat is unoccupied, the (deadman brake) parking brake is applied.

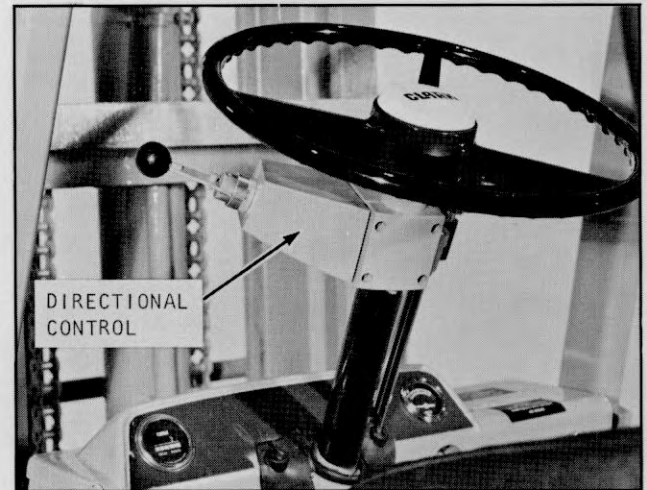


Plate 10624. Typical Directional Control Lever

INDUSTRIAL TRUCK DIVISION



Plate 10023 - Upper Steering Knuckle

DESCRIPTION:
This drawing shows the upper steering knuckle assembly for the Industrial Truck Division. The assembly consists of the upper control arm, lower control arm, ball joints, and the steering knuckle. The upper control arm is attached to the chassis and the lower control arm is attached to the steering knuckle. The ball joints connect the control arms to the steering knuckle. The steering knuckle is the part of the suspension that holds the wheels in place and allows them to turn.

NOTES:
1. This drawing is for the upper steering knuckle assembly. The lower steering knuckle assembly is shown in drawing 10024.
2. The upper control arm is shown in drawing 10025.
3. The lower control arm is shown in drawing 10026.
4. The ball joints are shown in drawing 10027.
5. The steering knuckle is shown in drawing 10028.

10023



INDUSTRIAL TRUCK DIVISION



OPERATIONS

To Move A Load.

The forks should be adjusted sidewise on the fork bars to obtain firm support and maximum balance of the load. Raise or lower the forks to the proper level and engage the load by driving forward. Tilt the upright backward sufficiently to adequately cradle the load, and raise load sufficiently to clear obstructions. Back away from stack.

The operator should have clear vision ahead when moving in a forward direction. When this is not possible, the operator should drive in reverse and turn in his seat to obtain clear vision backward.

When the load is to be deposited, enter the area squarely, especially when placing one load on top of another, in order that all piles will be square and secure. Place load directly over desired area and slowly lower into position. Disengage forks from the load by using necessary lift-tilt and then back away.

Loads will vary in size, shape, method of packaging, stacking procedures, etc. The best way to handle a load will depend on these factors. If in doubt, consult with your supervisor.

I M P O R T A N T

EVERY 8 OPERATING HOURS (OR EVERY SHIFT) ELEVATE UPRIGHT TO THE UPPER LIMIT. THIS WILL PROVIDE LUBRICATION TO THE TOP PORTION OF THE LIFT CYLINDER. CHECK FOR NORMAL SEQUENCE OF OPERATION.

OPERATING SAFETY RULES AND PRACTICES.

1. Operators of powered industrial trucks should be physically qualified. An examination should be made on an annual basis and include such things as field of vision, hearing, depth perception and reaction timing.

2. Only trained and authorized operators should be permitted to operate a powered industrial truck. Methods should be devised to train operators in the safe operation of powered industrial trucks. It is recommended that badges or other visual indication of the operator's authorization should be displayed at all times during work period.

GENERAL.

1. Safeguard the pedestrians at all times. Do not drive a truck up to anyone standing in front of a bench or other fixed object.

2. Do not allow anyone to stand or pass under the elevated portion of any truck, whether loaded or empty.

3. Unauthorized personnel should not be permitted to ride on powered industrial trucks. A safe place to ride should be provided where riding of trucks is authorized.

4. Do not put arms or legs between the uprights of the mast or outside the running lines of the truck.

5. When leaving a powered industrial truck unattended, load engaging means should be fully lowered, controls should be neutralized, power shut off, brakes set, key or connector plug removed. Block wheels if truck is parked on an incline.

6. Maintain a safe distance from the edge of ramps or platforms and do not, while on any elevated dock or platform, push freight cars. Do not use trucks for opening or closing freight doors.

7. Have brakes set and wheel blocks in place to prevent movement of trucks, trailers, or railroad cars while loading or unloading. Fixed jacks may be necessary to support a semi-trailer during loading or unloading when the trailer is not coupled to a tractor. Check the flooring of trucks, trailers, and railroad cars for breaks and weakness before driving onto them.

8. Be sure of sufficient headroom under overhead installations, lights, pipes, sprinkler system, etc.

9. Use an Overhead Guard and Load Backrest Extension unless conditions prevent their use.

```

x x x x x x x x x x x x x x x x x x x x x x x
x
x           W A R N I N G           x
x
x AN OVERHEAD GUARD IS INTENDED TO OFFER  x
x PROTECTION FROM THE IMPACT OF SMALL    x
x PACKAGES, BOXES, BAGGED MATERIAL, ETC., x
x REPRESENTATIVE OF THE JOB APPLICATION, x
x BUT NOT TO WITHSTAND THE IMPACT OF A    x
x FALLING CAPACITY LOAD.                  x
x
x x x x x x x x x x x x x x x x x x x x x x x

```

10. Use only approved industrial trucks in hazardous locations.



INDUSTRIAL TRUCK DIVISION



OPERATIONS

11. Elevate personnel only on an approved safety platform firmly secured to the lifting carriage and/or forks.
12. Report all accidents involving personnel, building structures, and equipment.
13. Fire aisles, access to stairways, and fire equipment should be kept clear.

TRAVELING.

1. Observe all traffic regulations including authorized plant speed limits. Under normal traffic conditions, keep to the right. Maintain a safe distance, approximately three truck lengths from the truck ahead, and keep the truck under control at all times. Use of truck on public roads should conform to local traffic regulations.
2. Yield the right of way to ambulances, fire trucks, or other vehicles in emergency situations.
3. Do not pass another truck traveling in the same direction at intersections, blind spots, or at other dangerous locations.
4. Slow down and sound horn at cross aisles and other locations where vision is obstructed. If the load being carried obstructs forward view travel with the load trailing.
5. Cross railroad tracks diagonally wherever possible. Do not park closer than 8 feet from center of railroad tracks.
6. Look in the direction of, and keep a clear view of the path of travel.
7. Ascend or descend grades slowly.

When ascending or descending grades in excess of 10%, loaded trucks should be driven with the load up grade.

Unloaded trucks should be operated on all grades with the load engaging means downgrade.

On all grades the load and load engaging means should be tilted back if applicable, and raised only as far as necessary to clear the road surface.

8. Under all travel conditions the truck should be operated at a speed that will permit it to be brought to a stop in a safe manner.
9. Travel with load engaging means or load low and, where possible, tilted back. Do not elevate the load except during stacking.
10. Make starts, stops, turns or direction reversals in a smooth manner so as not to shift load and/or overturn the truck.

11. Stunt driving and horseplay should not be permitted.
12. Slow down for wet and slippery floors.
13. Before driving over a dockboard or bridgeplate, be sure that it is properly secured. Drive carefully and slowly across the dockboard or bridgeplate and never exceed its rated capacity.
14. Do not run vehicles onto any elevator unless specifically authorized to do so. Approach elevators slowly, and then enter squarely after the elevator car is properly leveled. Once on the elevator, neutralize the controls, shut off power, and set brakes. It is advisable that all personnel leave the elevator before a truck is allowed to enter or leave.
15. Avoid running over loose objects on the roadway surface.

LOADING.

1. Handle only stable or safely arranged loads. When handling off-center loads which cannot be centered, operate with caution.
2. Handle only loads within the rated capacity of the truck.
3. Adjust for long or high (including multiple tiered) loads which may affect capacity.
4. When attachments are used, particular care should be taken in securing, manipulating, positioning, and transporting the load. Operate trucks equipped with attachments as partially loaded trucks when not handling a load.
5. Place load engaging means under the load as far as possible and carefully tilt the mast backward to stabilize the load. Caution should be used in tilting backward with high or segmented loads.
6. Use extreme care when tilting load forward or backward particularly when high tiering. Do not tilt forward with load engaging means elevated except to pick up a load. Do not tilt an elevated load forward except when the load is in a deposit position over a rack or stack. When stacking or tiering use only enough backward tilt to stabilize the load.

OPERATOR CARE OF THE TRUCK.

1. Give special consideration to the proper functioning of tires, horn, lights, battery, controller, lift system (including load engaging means, chains, cable, and limit switches), brakes and steering mechanism. If at any time



INDUSTRIAL TRUCK DIVISION



OPERATIONS

OPERATOR CARE OF THE TRUCK (CONT.)

a powered industrial truck is found to be in need of repair, defective, or in any way unsafe, the matter should be reported immediately to the designated authority, and the truck should be taken out of service until it has been restored to safe operating condition.

2. Do not make repairs or adjustments unless specifically authorized to do so.
3. Do not use open flames for checking electrolyte level in storage batteries.

NOTE

The preceding is reproduced from:

American National Standard ... Safety Standard
for Powered Industrial Trucks. B56.1 - 1969



INDUSTRIAL TRUCK DIVISION



OPERATIONS

OPERATOR CARE OF THE TRUCK (CONT.)

1. If a powered industrial truck is found to be in need of repair, adjustment, or in any way unsafe, the operator should be tagged immediately to indicate the location of the defect, and the truck should be taken out of service until it has been returned to safe operating condition.

2. Do not make repairs or adjustments unless specifically authorized to do so.

3. Report the open items for checking after 15 days have elapsed in working condition.

NOTE

The preceding is reproduced from:

American National Standards ... Safety Standards
for Powered Industrial Trucks - 1957

10-1
10-2
10-3
10-4
10-5

PREVENTIVE MAINTENANCE:

1. Arrange for systematic inspection and lubrication. See that the truck is properly lubricated and in good repair at all times. Refer to pertinent lubrication chart for lubrication instructions.
2. Avoid overloading the truck, as a safety measure against possible injury to the driver and fellow workmen. Overloading also shortens the life of the truck and increases maintenance. Refer to Name (Serial No.) Plate.
3. Take proper care of the battery. Check height of electrolyte solution daily. Never allow the water level to be below the top of the plates. When replacing evaporation, fill cells to proper level only -- overfilling causes loss of acid and reduces capacity. Use only water approved for battery use. Keep top of battery clean and dry at all times. A light coating of vaseline or a light cup grease on the battery terminals will help prevent corrosion. If terminals become corroded, wash off corrosion with a soda and water solution and rise thoroughly. See that the battery is properly charged after each day or shift.
4. Wiring should be checked periodically to make certain all connections are tight and intact.
5. The hydraulic system should be checked periodically for worn hoses, loose fillings and/or leaks, and security of mountings.
6. A periodic check of the brake system should be made for lining wear. Proper brake adjustment should be maintained at all times.
7. Charging equipment should be carefully maintained. Maintenance, operation, and service of charging equipment should be carried out in accordance with the battery manufacturers instructions.



INDUSTRIAL TRUCK DIVISION



OPERATIONS

CHANGING AND CHARGING STORAGE BATTERIES:

N O T E

The two types of batteries in common use are (1) lead and (2) nickel-iron. They contain corrosive chemical solutions, either acid or alkali, and therefore present a chemical hazard. On charge, they give off hydrogen and oxygen which, when mixed with air in certain concentrations, may be explosive. They are of relatively small bulk and great weight making handling a special consideration.

1. Battery charging installations should be located in areas designated for that purpose. Facilities should be provided for flushing and neutralizing spilled electrolyte, for fire protection, for protecting charging apparatus from damage by trucks, and for adequate ventilation for dispersal of fumes from gassing batteries.

2. When racks are used for support of batteries, they should be made of materials not conducive to spark generation or be coated or covered to achieve this objective.

Handling Batteries:

1. A conveyor, overhead hoist, or equivalent material handling equipment should be provided for handling batteries.

2. Chain hoists should be equipped with load-chain containers. When hand hoist is used, uncovered batteries should be covered with a sheet of plywood or other non-conducting material to prevent the hand chain from shorting on cell connectors or terminals. A properly insulated spreader bar should be used with any overhead hoist.

3. Reinstalled batteries should be properly positioned and secured in the truck.

4. A carboy tilter or siphon should be provided for handling electrolyte. Always pour acid into water; not water into acid. Personnel maintaining batteries should wear protective clothing such as face shield, long sleeves and gauntlet gloves.

5. Electrical installations should conform to the National Electrical Code (NEPA No. 70; USA Standard C1-1965) and any local ordinances.

6. Trained and authorized personnel should change or charge batteries.

7. Trucks should be properly positioned and brake applied before attempting to change or charge batteries.

8. When charging batteries, the vent caps

should be kept in place to avoid electrolyte spray. Care should be taken to assure that vent caps are functioning. The battery (or compartment) cover (s) should be open to dissipate heat.

9. Smoking should be prohibited in the charging area.

10. Precautions should be taken to prevent open flames, sparks, or electric arcs in battery charging areas.

11. Tools and other metallic objects should be kept away from the top of uncovered batteries.

SERVICE RECORDER:

The service recorder records number of productive lifts in addition to busy and idle time of each truck. The records are made on a 6-inch diameter chart, revolving once. This model records the raising or lowering of a predetermined load. The limits generally are between 5% of the truck's capacity and a full load. Minimums may be established, and the chart will show only those lifts of the minimum weight or greater. Selective load records are made by using an adjustable pressure switch. This switch fits into the hydraulic system between the lift control and the cylinder. It is sensitive to system pressure changes but insensitive to surges or vibration. Switch setting can be adjusted externally and then sealed. The load recording stylus is always in contact with the chart. When the predetermined load or more is lifted, an electrical circuit is closed and this stylus is lifted up, making a record. A surge dampener is recommended particularly when lift trucks are in service where rough or uneven floors occur.

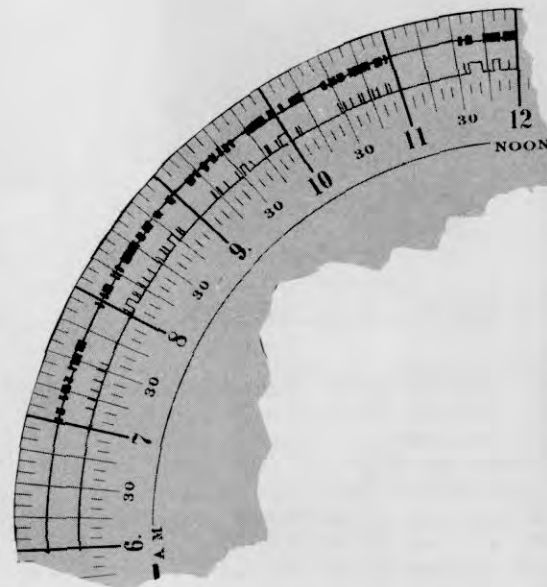


Plate 10161. Service Recorder Chart

HOW TO OPERATE SERVICE RECORDERS

Wind the Clock Movement: No key is needed. Turn the star-shaped winding disc clockwise until the movement is wound fairly tight. Do not over-wind. It is a good practice to wind the clock each time a chart is changed even if it is not run down.



Plate 10164

Place Chart in the Recorder: Snap up the two finger-like clamps. Slip the chart down over the now vertical clamps to the face of the winding disc.

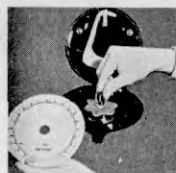


Plate 10165

To Set the Chart: Before clamping it down, turn the chart so that the place on it that corresponds to the present time of the day is at the little white spot on rim of Recorder case. If this is not done correctly, the recorder will be "that much off" all day.

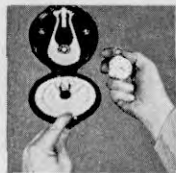


Plate 10166

Fasten the Chart in Place By snapping down the two clamping fingers. Now close and lock the Recorder and it is ready to operate for its full cycle, the length of time depending on the model and clock speed.



Plate 10167

HOW TO READ THE CHART:

This section of chart shows a typical record. The wide marks in the outer record band show when the truck was in motion. The fine line shows down time.

Inner record band shows lifts. Load recording stylus normally rests at lower or inner position. When activated by pressure switch, it is moved outward to record each lift.

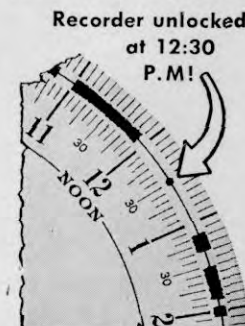


Plate 10162. Service Recorder Chart

When the key is turned to lock or unlock the Recorder, the stylus makes a round dot at the exact time of locking or unlocking. The mark appears on the face of the chart, and it's also embossed on the back. It is unmistakable.

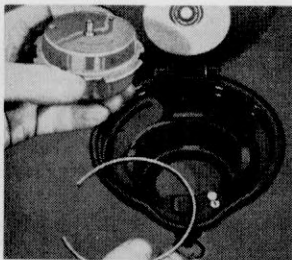


Plate 10163. Clock Exchange

HOW TO EXCHANGE CLOCK MOVEMENTS:

A clock movement is inherently a delicate mechanism that should receive reasonably good care. We have tried to make the clocks in Servis Recorders as rugged as possible to withstand the rough use they sometimes get. If the clock should fail, it can be easily lifted out and mailed in for repair or replacement. Merely unscrew the winding disc by turning it counter-clockwise and pry out wire retaining ring.

To replace the clock movement, first notice that one of the four retaining lugs in the Recorder case is wider than the rest. Match this wide space in movement top and settle movement into place. Then force wire retaining ring into place securely under lugs.

It is a good policy to have a spare clock movement in stock to insure uninterrupted service. Extra clocks are inexpensive.

SAFETY INSTRUCTIONS For Maintaining Electrical Industrial Trucks:

Powered industrial trucks may become hazardous if adequate maintenance is neglected. Therefore, adequate maintenance facilities, personnel and procedures should be provided.

Maintenance and inspection of all powered industrial trucks should be performed in conformance with the recommendation in this manual and the following practices.

1. A scheduled preventive maintenance, lubrication, and inspection system should be followed.

2. Only qualified and authorized personnel should be permitted to maintain, repair, adjust, and inspect industrial trucks.

3. Before Leaving The Truck:

- A. Stop truck.
- B. Fully lower the load engaging means.
- C. Place directional controls in neutral.
- D. Apply the parking brake.
- E. Turn off the power.
- F. Lock the control circuit.
- G. Block the wheels if truck is on a ramp, or being worked on.

4. Before Working On Truck:

- A. Raise wheels free of floor or disconnect power source.
- B. Use chocks or other positive truck positioning devices.
- C. Block load engaging means, innermast (s), or chassis before working under them.

An operation to check performance of the truck or attachments should be conducted in an authorized, safe clearance area.

5. Before Starting To Operate The Truck:

- A. Be in operating position.
- B. Depress brake pedal.
- C. Place directional controls in neutral.
- D. Turn on power.
- E. Before operating truck, check functioning of lift and tilt systems, directional and speed controls, steering, warning devices, brakes, and

any attachment.

F. Release parking brake.

6. Avoid fire hazards and have fire protection equipment present. Do not use an open flame to check level, or for leakage. Do not use open pans of flammable cleaning fluids for cleaning parts.

7. Properly ventilate work area, keep shop clean and floor dry.

8. Brakes, steering mechanisms, control mechanisms, warning devices, lights, lift overload devices, guards and safety devices should be inspected regularly and maintained in a safe operating condition.

9. All parts of lift and tilt mechanisms and frame members should be carefully and regularly inspected and maintained in a safe operating condition.

10. Special trucks or devices designed and approved for hazardous area operation should receive special attention to ensure that maintenance preserves the original, approved safe operating features.

11. All hydraulic systems should be regularly inspected and maintained in conformance with good practice. Tilt cylinders, valves, and other similar parts should be checked to assure that "drift" has not developed to the extent that it would create a hazard.

12. Capacity, operation and maintenance instructions plates, tags, or decals should be maintained in legible condition.

13. Batteries, motors, controllers, limit switches, protective devices, electrical conductors and connections should be inspected and maintained in conformance with good practice. Special attention should be paid to the condition of electrical insulation.

14. Industrial trucks should be kept in a clean condition to minimize fire hazards and facilitate detection of loose or defective parts.

15. Modifications and additions which affect capacity and safe truck operation should not be performed by the customer or user without manufacturers prior written approval. Capacity, operation and maintenance instruction plates, tags or decals should be changed accordingly.

16. Care should be taken to assure that all replacement parts are interchangeable with the original parts and of a quality equal to that provided in the original equipment.



INDUSTRIAL TRUCK DIVISION



IMPORTANT

SUBJECT: CAUTIONS CONNECTED WITH
THE OPERATION AND MAINTENANCE OF
SOLID STATE CONTROLLED TRUCKS.

C A U T I O N

WELDING ON SCR TRUCKS:

1. MAKE SURE TRUCK HAS NO GROUNDS.
2. DISCONNECT BATTERY.
3. PROTECT ELECTRICAL WIRING AND COMPONENTS FROM WELD SPLATTER WITH A SHIELD.

IF THE ABOVE IS NOT FOLLOWED.....
DAMAGE CAN RESULT TO WIRING AND
ELECTRICAL COMPONENTS ON A SOLID
STATE CONTROLLED TRUCK.

C A U T I O N

DO NOT STEAM CLEAN A SOLID STATE
CONTROLLED TRUCK AS EXCESSIVE MOIS-
TURE WILL INTERFERE WITH PROPER
OPERATION OF THE SOLID STATE COMPON-
ENTS.

C A U T I O N

BATTERY POLARITY MUST BE CORRECT OR
ELECTRICAL SYSTEM WILL BE DAMAGED.

C A U T I O N

DO NOT USE A MOTOR GENERATOR UNIT
SUCH AS READY POWER TO MOVE AND/OR
CHECK THIS MACHINE AS SERIOUS DAM-
AGE MAY OCCUR.

OVERHEAD GUARD ADJUSTMENT:

GENERAL: Proper adjustment of the retractable overhead guard linkage is extremely important in maintaining this feature of the vehicle in proper operating condition. Failure to perform and maintain the proper adjustment on the guard linkage and components can result in severe distortion or damage to the guard linkage, rendering the guard inoperable. The adjustment procedure set forth below should be followed each time the guard is reinstalled, after any minor repair to components of the guard, or if the guard is not operating properly.

ADJUSTMENT PROCEDURE:

Refer to #11451, and proceed as follows:

1. With guard retracted check front stationary legs for dimensions "A", "B" and "C". See specs for all dimensions.

STATIONARY LEG DIMENSIONS:

2. Use flat washers or shim stock under the front leg attaching bolts to obtain the required dimensions. Shim equally on each side.

3. Raise guard to the fully closed position and loosen bolts holding the rear support legs to the counterweight. This will remove any strain from the linkage.

4. Clamp a straightedge to the fixed portion of the rear leg as shown in the illustration. Check to see that the upper (movable) section of the rear leg is in exact alignment with the lower section.

5. If the upper portion of the rear leg does not line up with the fixed leg, adjust the cylinder yoke and/or the rod yokes to bring sections into perfect alignment. Adjust dimensions D, E and F.

N O T E

To insure proper operation, the retracting linkage must have equal adjustment on both sides. The retracting cylinder piston rod travel and the tie rod length must be the same on both sides. In addition, the rear legs must be perpendicular and square to the top retracting section and the leg mounting bolts must be kept tight, and frequently checked, during operation.

REAR LEG AND LINKAGE DIMENSIONS:

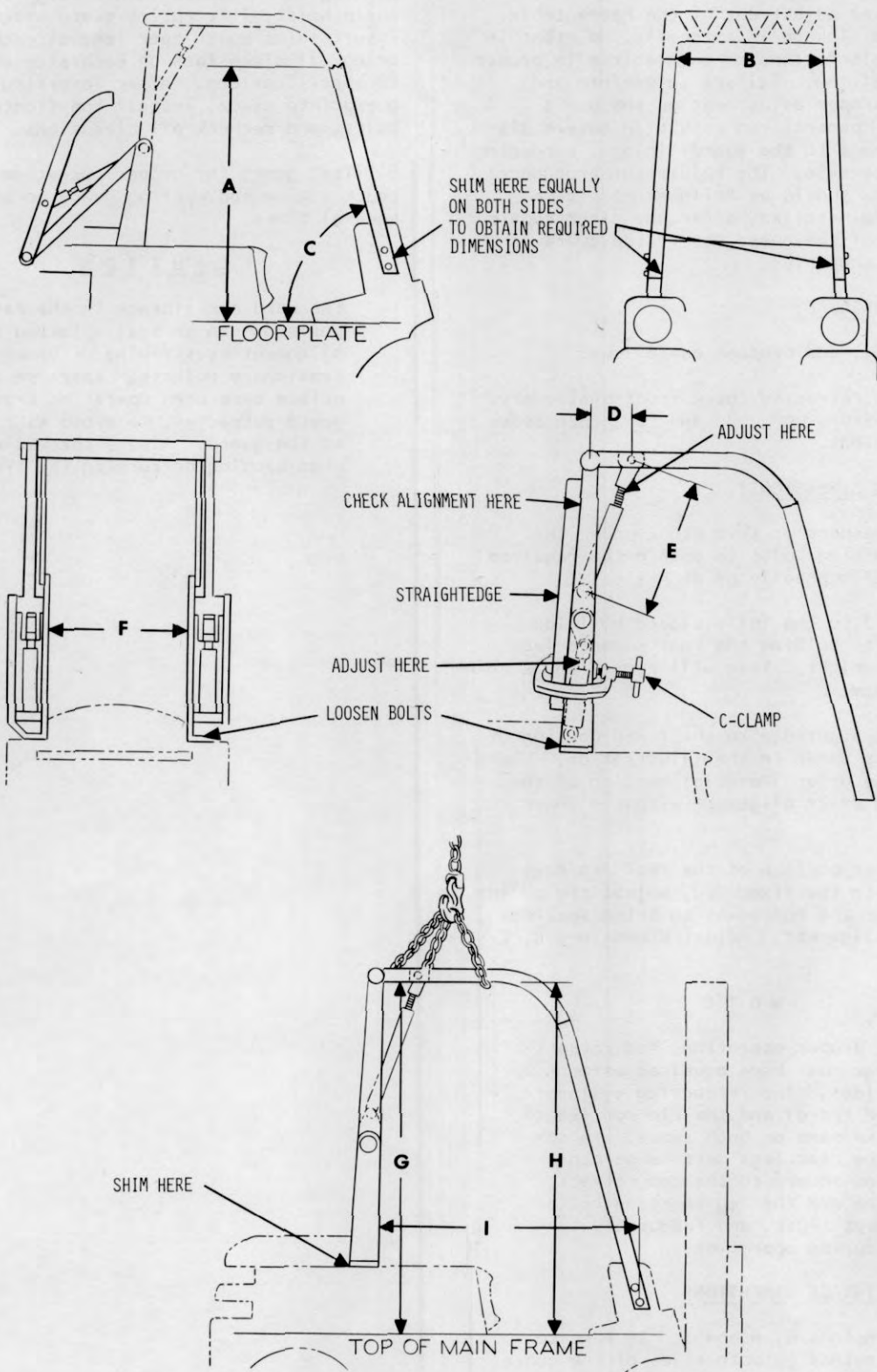
6. Check dimensions G, H and I. Be sure to check the dimensions on both sides of the guard.

7. If adjustment is required, remove bolts holding rear legs to counterweight. Using a chain hoist, lift entire guard assembly, and insert shims under rear legs as required to bring all dimensions on each side of the guard to specifications. After inserting shims, lower guard into place, install and tighten mounting bolts, and recheck all dimensions.

8. Test guard for proper operation by starting truck engine and cycling guard up and down several times.

C A U T I O N

The guard and linkage in the retracted position can be easily jarred out of alignment by striking or backing into stationary objects. Exercise appropriate care when operating truck with guard retracted, to avoid such damage to the guard. Always check clearance when backing or turning the truck.



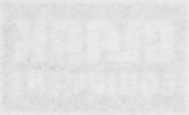
FIRE EXTINGUISHERS AND SCR EQUIPMENT:Fire Extinguishers Recommended

The two types of fire extinguishers recommended for use on SCR equipment are dry chemical (for B and C applications) and the CO₂ (carbon dioxide) which is more suitable for electrical type fires. The reason being that cleaning (after the use of carbon dioxide) is not necessary. Carbon dioxide simply replaces the oxygen in the area of the fire and extinguishes the flames. The only danger when using this type is in small areas where a great deal of carbon dioxide could replace so much oxygen that the persons in this area could collapse from the lack of oxygen themselves.

The chemical used in the dry type extinguishers is either sodium or potassium bicarbonate which has been treated for water repellency. After using, the control must be thoroughly cleaned and dried. When water is used to rinse down the control, it forms a CONDUCTIVE solution 'with' the sodium or potassium. Therefore, the battery MUST be disconnected before cleaning and must not be reconnected until after the control has been thoroughly dried. General Electric recommends the Ansul brand of dry type fire extinguisher.

Fire Extinguisher Not Recommended

Pyrene fire extinguishers are not recommended for use on SCR equipment. General Electric has reported that the chemical agents in pyrene extinguishers destroys the Flamenol insulation on the cables and has an adverse effect on Lexan used on SCR controls.



INDUSTRIAL TRUCK DIVISION



FIELD INVESTIGATION AND RECOMMENDATION

Case Description

The case involves a...
 The investigation was conducted...
 The results of the investigation...
 It is recommended that...
 The following actions should be taken...

The field investigation...
 The investigation was conducted...
 The results of the investigation...
 It is recommended that...
 The following actions should be taken...

Investigation and Recommendation

The investigation was conducted...
 The results of the investigation...
 It is recommended that...
 The following actions should be taken...

BATTERY MUST COMPLY WITH THE FOLLOWING PARAGRAPHS FROM U/L 583 STANDARD
FOR ELECTRIC BATTERY POWERED INDUSTRIAL TRUCKS, COVERING BATTERY CONSTRUCTION

PARAGRAPHS:

43. The battery shall be provided with support and protection by means of a noncombustible enclosure which, if of metal, shall be no less than 0.053-inch thick (no. 16 msg) and shall be flanged not less than 1/2 inch on all sides or be provided with a construction that gives equivalent strength. A cover shall remain closed by the force of gravity or shall be provided with a fastener.

44. A metal cover shall have such strength and rigidity that, in conjunction with an air spacing provided between it and the battery terminals, the battery terminals will not be short-circuited when a 250-pound force is applied to any one square foot area of the cover. In lieu of the spacing, insulation designed to prevent short-circuiting of the battery terminals shall be secured to the inner surface of a metal battery-compartment cover.

45. A battery furnished with a noncombustible tray and cover intended to form the ultimate enclosure for the battery shall comply with the requirements of paragraphs 43 and 44.

46. The battery enclosure shall be provided with means for ventilation that will minimize the possibility of accumulation of explosive hydrogen-air mixtures above the battery.

48. Cells employing metal containers (such as alkaline batteries) shall be insulated from one another and from a metal tray or metal battery compartment. Insulation of wood or other material shall be (1) treated or painted to minimize deterioration by the battery electrolyte, and (2) constructed to minimize the risk of damage to the insulation in the normal operation and maintenance of the truck.

49. The connections shall be such that the potential between any two adjacent cells will be not more than 24 volts (nominal).

51. Battery leads shall be of a size and current-carrying capacity adequate for the application. They shall be neoprene insulated or insulated with an equivalent material, resistant to acids and/or alkalis, and able to withstand flexing, handling, and impact at temperatures between 54 deg. C (130 deg. F) and minus 29 deg. C (minus 20 deg. F). The insulation thickness shall be no less than 1/16 inch for a no. 8-2 AWG wire and no less than 5/64 inch for a no. 1-4/0 AWG wire.

53. One part of the connector shall be permanently mounted to either the truck or the battery enclosure. The length of the cable attached to the free part of the connector shall be as short as practicable, without interfering with the disconnecting operation and without placing stress on terminals.

54. The live parts shall be recessed from the face of the connector to minimize the possibility of shorting.

55. A battery connector shall have the proper rating for use in its particular application.

56. The removal portion of the connector shall be provided with means for being grasped to permit removal.

For EE Construction Batteries Must Comply With The Following Additional Paragraphs:

123. The battery enclosure shall be provided with a cover with means for locking it in the closed position to deter opening by unauthorized persons. Insulation designed to prevent shorting of the terminals shall be secured to the inner surface of a metal enclosure, over the terminals.

124. All upper openings shall be covered with a heavy-gauge wire mesh, expanded metal, or a perforated cover. The size and shape of the opening shall not permit passage of a rod having a diameter greater than 1/2 inch. If the distance between an uninsulated live part and the opening is greater than 4 inches. The opening may be larger than that previously mentioned, provided no opening will permit passage of a rod having a diameter greater than 3/4 inch. The diameter of the wires of a screen shall be no less than 0.051 inch if the screen openings are 1/2 square inch or less in area, and shall be no less than 0.081 inch for larger screen openings. Perforated sheet steel and sheet steel employed for expanded-metal mesh shall be no less than 0.042 inch in thickness if uncoated (no. 18 MSG) and no less than 0.046 inch if zinc-coated (no. 18 GSG) for mesh openings or perforations 1/2 square inch or less in area. They shall not be less than 0.080 inch in thickness if uncoated (no. 13 MSG) and no less than 0.084 inch if zinc-coated (no. 13 GSG) for larger openings.



INDUSTRIAL TRUCK DIVISION



LUBRICATION AND PREVENTIVE MAINTENANCE INDEX

(8 HOURS)	Time Interval (H-Hours) &	Page Number (0000-)	(100 HOURS cont'd)	Time Interval (H-Hours) &	Page Number (0000-)
Battery charge indicator	8H	273	Lift chains, check and adjust	100H	403
Battery, inspect	8H	473	Lubrication chart	100H	772
Brake interlock switch, check	8H	374	Lubricate machine	100H	403
Brake pedal free travel check	8H	373	Master (speed control cyl.)	100H	475
Control circuit fuse, check	8H	073	Parking brake power cut-off switch, check/adjust	100H	273
Horn lights (machines so equipped), check	8H	073	Pump control switches, (lift/tilt) check/adjust	100H	473
Hour meter, check	8H	273	Solid State Control, adjust (Acc. Pedal/1MS & 2MS)	100H	476
Hydraulic controls, check	8H	503	Speed control cylinder fluid level check,	100H	173
Hydraulic sump tank, level check	8H	503	Steering gear lubricant level check.	100H	603
Operation (controls), check	8H	503	Switchette, adjust	100H	674
Parking brake linkage, inspect/check	8H	373	<u>(500 HOUR)</u>		
Seat safety (deadman) switch, check	8H	374	Hydraulic sump tank, drain and refill	500H	173
Tires, inspect	8H	603	Hydraulic sump tank filter, change	500H	174
<u>(100 HOURS)</u>			Steer linkage adjustments	500H	302
Axle adaptor, lubricant level check	100H	073	Steering gear, check and adjust	500H	202
Axle adaptor vent, check	100H	073	<u>(1000 HOURS)</u>		
Brake pedal free travel, check/adjust	100H	302	Accumulator, creep speed and actuator, adjust	1000H	174
Brake system, inspect	100H	303	Axle adapter, drain and refill	1000H	1308
Contactors, inspect	100H	673	Axle ends, clean & repack	1000H	805
Forward, reverse, 1A contactors, inspect/adjust	100H	672	Brake system, bleed.....	1000H	913
Hydraulic control valve and lines, inspect	100H	403	Brushes (motor), inspect	1000H	673
Hydraulic sump tank breather, inspect	100H	503	Brush spring tension, inspect.....	1000H	673
Lift and Tilt Cylinders	100H	403			



INDUSTRIAL TRUCK DIVISION



LUBRICATION AND PREVENTIVE MAINTENANCE INDEX

(100 HOURS cont'd)

	Time Interval (H-HOURS & (0000-)	Page Number
Lift carriage and upright rollers, check/adjust	1000H	1803
Drive and pump motor, inspect		673
Seat linkage disconnect	1000H	1173
Seat safety brake (parking brake), check/adjust	1000H	1172
Service wheel brake assy.	1000H	1003
Steering wheel bearings, clean/repack & adjust	1000H	803
System pressure checks	1000H	1507

LUBRICATION AND PREVENTIVE MAINTENANCE ILLUSTRATIONS:

<u>Description</u>	<u>Page</u>
8 Hour	8H 072
100 Hour	100H 072
500 Hour	500H 072
1000 Hour	1000H 069
Lubrication Chart	100H 772

Trouble Shooting:

Solid State Control	TS(SG)819
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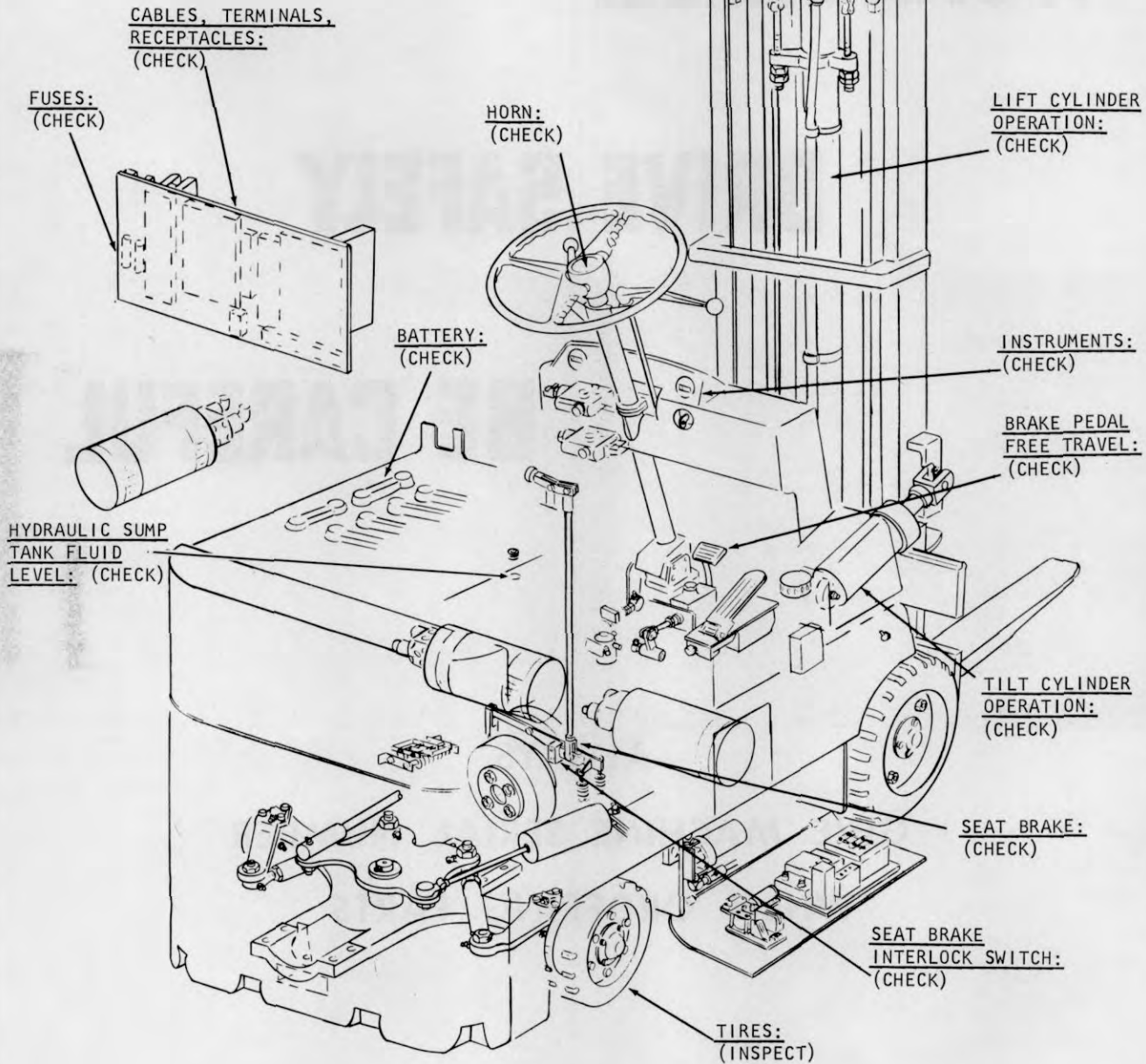
WORK SAFELY

DRIVE SAFELY

BE CAREFUL

ALWAYS
GIVE MACHINE SERIAL NUMBER
WHEN ORDERING PARTS

8 HOURS



NOTE

AFTER EACH 8 HOURS OF OPERATION,
PERFORM THE ABOVE SERVICES.

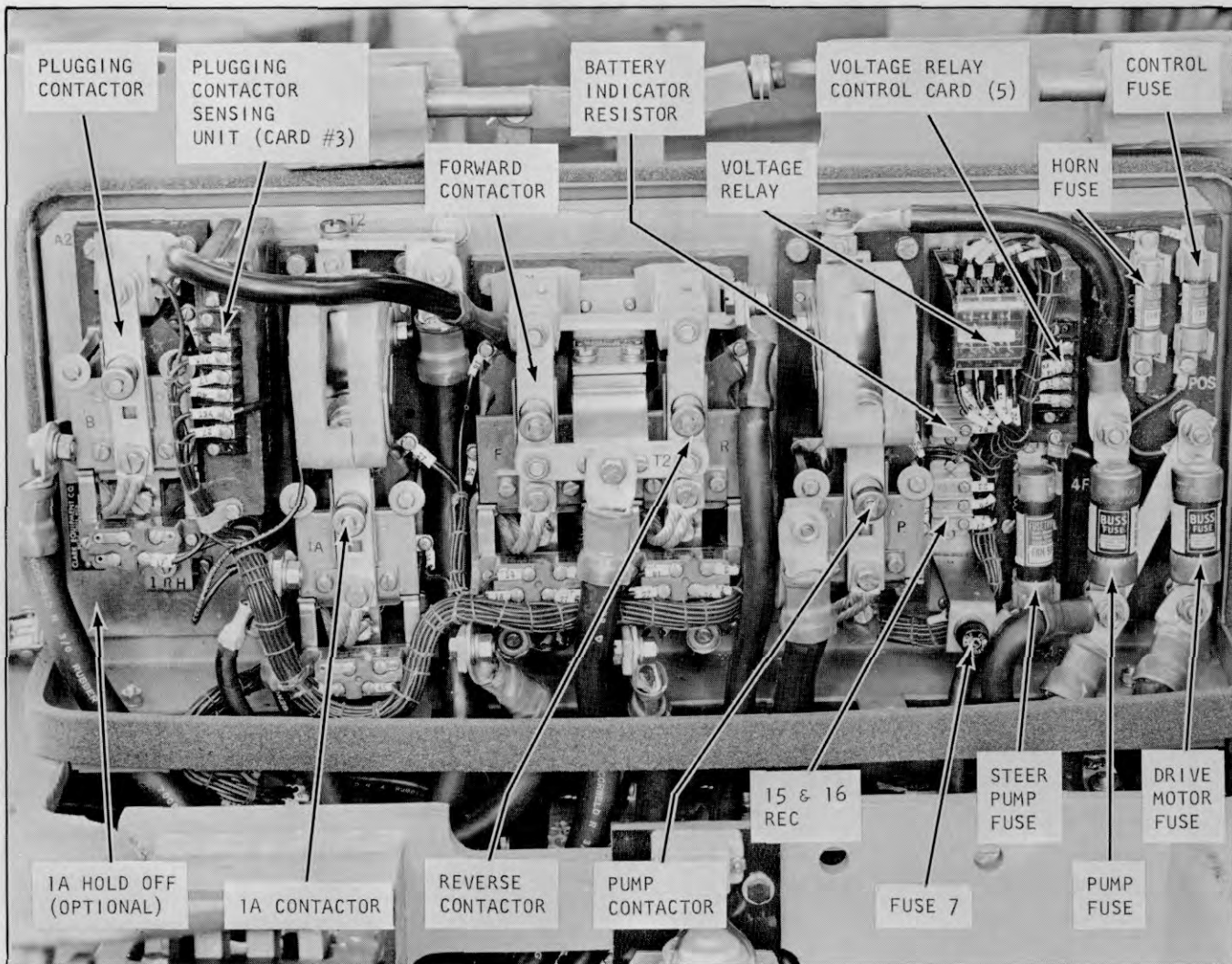


Plate 10619. Typical System Fuses

HORN:

Check to be sure the horn is working properly.

LIGHTS (Optional):

Check all lights to see if they are functioning properly.

SYSTEM FUSES:

- Steer pump; 60 Amp
- Hydraulic pump; 400 Amp
- Drive motor; 500 Amp
- Control fuse; 15 Amp
- Horn fuse; 10 Amp

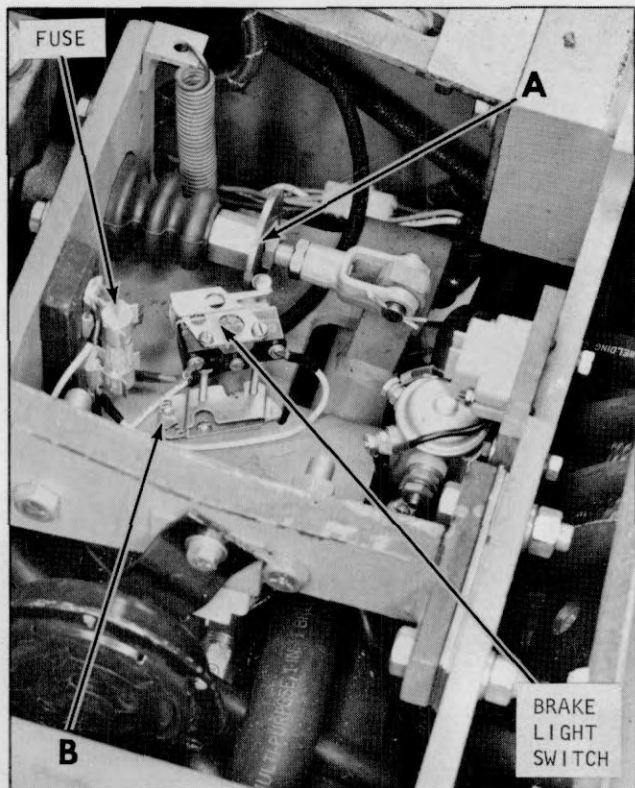


Plate 10636. Typical Brake Light Switch

BRAKE LIGHT SWITCH:

Adjust in the following manner:

1. Loosen screw (A).
2. Move switch roller toward plate (B) until switch clicks.
3. Tighten screw (A) to secure adjustment.

Before starting to charge, see that the solution is at the proper level. If the solution is low, bring it to the proper level by adding pure distilled water as instructed under watering. If the battery is in a compartment, open the cover before starting a charge. **DO NOT** charge in a hot place or allow the temperature of the solution to exceed 115° Fahrenheit on charge.

CHARGE TEST FORK

The charge test fork was developed to provide an easy means of determining the state of charge of an alkaline battery.



Plate 4008. Charge Test Fork Check

This is done by obtaining a key voltage reading which, on reference to the charts supplied for use with instrument, will indicate the amount of charge necessary to restore the battery to a fully charged condition.

ELECTROLYTE

The specific gravity of the electrolyte in fully charged alkaline cells has a normal operating range of between 1.215 and 1.160, with electrolyte at the proper level and corrected for temperature.

The specific gravity reading of the electrolyte (of an alkaline cell) has no value in determining its state of charge, as the specific gravity does not change during the charging or discharging periods

to any marked extent. It, therefore, is only necessary to take infrequent readings, to determine if the specific gravity has dropped to the point where a change of electrolyte is desirable.

There are two kinds of alkaline potash electrolyte which are normally used when a "change" of solution is found necessary. Renewal solution, which has a specific gravity of approximately 1.250; is normally used to replace old electrolyte, the gravity of which has dropped to the low limit ranging between 1.160 and 1.170. Refill solution has a specific gravity of approximately 1.215 and is used to replace spillage. **DO NOT** use any potash solution other than alkaline electrolyte, as the presence of impurities or improper compounding of such solution may permanently injure your battery.

WATERING CELLS

Before putting a new electric filler into service; see that the tank is washed thoroughly to remove any foreign matter and then rinse tank, hose and filler thoroughly by running distilled water through them. Then fill the tank with distilled water and mount in a convenient place at least four or five feet above the cells to be watered.

To operate, insert the nozzle into the filler opening in the top of the cell. If the solution is already at the proper height, the bell signal will ring. If bell does not ring, start flow of water by opening valve by pushing down lever on filler handle. When the bell rings, remove the nozzle from the cell, close cell filler cap and proceed to next cell.

LAYING UP BATTERY

If battery is to be laid up for any length of time (in excess of one year) be sure that the plates are covered to the proper height with solution and that the battery is discharged and short circuited. The battery should be stored in a cool dry place.

Alkaline batteries are easy to lay up. Merely discharge to zero voltage and short circuit. They may be left standing idle indefinitely, without injury, if stored in this short circuited condition. The battery may be stored for 6 months to a year without discharging and short circuiting.



INDUSTRIAL TRUCK DIVISION



LUBRICATION AND PREVENTIVE MAINTENANCE

CAUTIONS

NEVER put lead battery acid into an alkaline battery or use utensils that have been used with acid; you may ruin the battery.

NEVER bring a "lighted match" other "open flame" near a battery.

NEVER lay a "tool" or any piece of "metal" on a battery. Always keep the filler caps closed except when necessary to have them open for filling as provided for in these instructions.

ALWAYS keep batteries clean and dry externally.

ALKALINE ELECTROLYTE is injurious to the skin or clothing and must be handled carefully. Solution spilled on the person should be immediately washed away with plenty of water.

DO NOT use the electric filler, or fill cells while a battery is on charge.

USE ONLY pure distilled water for watering the battery.

WEAR GOGGLES when cleaning or changing solution.

CABLES, TERMINALS AND BATTERY RECEPTACLE.

Check cables, terminals and receptacle for condition and security of mounting. Correct as necessary.



Plate 10617. Typical Hydraulic Fill

HYDRAULIC SUMP TANK:

Check the hydraulic sump tank fluid level in the following manner:

1. Lower upright to the floor.
2. Turn switch key to off position.
3. Remove sump fill plug. Fluid level should be up to the top of the tank.

If necessary, fill sump tank using MS 68 Hydraulic Fluid. Move valve control levers with hydraulic pump operating to allow any air in the lines to escape, then recheck sump tank fluid level and fill as required before putting machine in operation.

HYDRAULIC CONTROL LEVERS:

I M P O R T A N T

EVERY 8 OPERATING HOURS (OR EVERY SHIFT)

ELEVATE UPRIGHT TO THE UPPER LIMIT. THIS WILL PROVIDE LUBRICATION TO THE TOP PORTION OF THE LIFT CYLINDER.

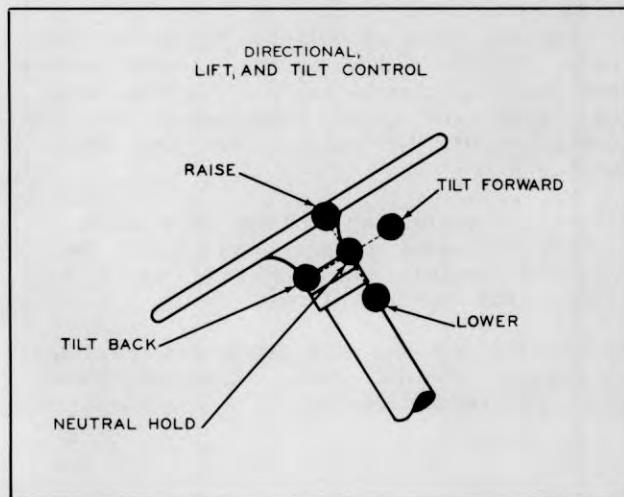


Plate 4448. Lift and Tilt Lever

Check lift and tilt operation. The lift and tilt cylinders should actuate when lift or tilt levers are moved either way from neutral position.

When load is elevated and control lever returned to neutral position, load should remain in elevated position with no noticeable downward drift. If load drifts downward excessively, this may indicate lift cylinder U-Cup or seal damage. Report to designated person in authority.

With tilt lever in neutral position, upright should remain steady with no noticeable backward or forward drift. If upright drifts excessively either way, this may indicate tilt cylinder seal or U-Cup damage. Report to designated person in authority.

C A U T I O N

NEVER ALLOW LOADED OR UNLOADED LIFT CARRIAGE TO REMAIN IN AN ELEVATED POSITION FOR ANY PROLONGED PERIODS. LIFT CARRIAGE SHOULD BE LOWERED WHEN NOT IN USE. DO NOT HOLD CONTROL LEVERS IN EXTREME POSITIONS AFTER A LOAD HAS REACHED ITS LIMITS. TO DO SO WILL CAUSE HIGH OIL PRESSURE THAT MAY RESULT IN HEATING OF THE HYDRAULIC OIL.



INDUSTRIAL TRUCK DIVISION



LUBRICATION AND PREVENTIVE MAINTENANCE

TIRE AND RIM MAINTENANCE

1. Inspect tires regularly - remove all sharp objects picked up by treads before they have a chance to cut further into the rubber and cause chipping or possible separation of the rubber from the base metal.

2. Avoid overloading and do not allow vehicle to stand under heavy loads for prolonged periods as this will cause a "flat" spot on the tires.

3. Check steering axle alignment regularly to protect against fast, irregular tread wear and separation.

4. If rubber tires come in contact with oils, grease, and gasoline they should be wiped off without delay.

5. Regular lubrication of all wheel bearings will assure free-rolling and elimination of tire drag when stopping or starting.

1. NEVER ATTEMPT TO WELD ON AN INFLATED TIRE/RIM ASSEMBLY.
 2. ALWAYS EXHAUST ALL AIR FROM A SINGLE TIRE AND FROM BOTH TIRES OF A DUAL ASSEMBLY PRIOR TO REMOVING ANY RIM COMPONENTS, OR ANY WHEEL COMPONENTS, SUCH AS NUTS AND RIM CLAMPS.

MAKE SURE TO REMOVE THE VALVE CORE AND EXHAUST ALL AIR FROM THE TIRE.

REMOVE THE VALVE CORES FROM BOTH TIRES OF A DUAL ASSEMBLY.

CHECK THE VALVE STEM BY RUNNING A PIECE OF WIRE THROUGH THE STEM TO MAKE SURE IT IS NOT PLUGGED.
 3. CHECK RIM COMPONENTS PERIODICALLY FOR FATIGUE CRACKS. REPLACE ALL CRACKED, BADLY WORN, DAMAGED AND SEVERELY RUSTED COMPONENTS.
 4. CLEAN RIMS AND REPAINT TO STOP DETRIMENTAL EFFECTS OF CORROSION. BE VERY CAREFUL TO CLEAN ALL DIRT AND RUST FROM THE LOCK RING GUTTER.

THIS IS IMPORTANT TO SECURE THE LOCK RING IN ITS PROPER POSITION.

A FILTER ON THE AIR INFLATION EQUIPMENT TO REMOVE THE MOISTURE FROM THE AIR LINE PREVENTS A LOT OF CORROSION. THE FILTER SHOULD BE CHECKED PERIODICALLY TO SEE THAT IT IS WORKING PROPERLY.
 5. MAKE SURE CORRECT PARTS ARE BEING ASSEMBLED. CHECK YOUR DISTRIBUTOR OR THE MANUFACTURER IF YOU HAVE ANY DOUBTS.
 6. DOUBLE CHECK TO MAKE SURE ALL COMPONENTS ARE PROPERLY SEATED PRIOR TO INFLATION.
 7. MIXING PARTS OF ONE MANUFACTURER'S RIMS WITH THOSE OF ANOTHER IS POTENTIALLY DANGEROUS. ALWAYS CHECK MANUFACTURER FOR APPROVAL.
 8. DON'T OVERLOAD OR OVER-INFLATE RIMS. CHECK YOUR RIM MANUFACTURER IF SPECIAL OPERATING CONDITIONS ARE REQUIRED.
 9. DON'T REINFLATE A TIRE THAT HAS BEEN RUN FLAT WITHOUT FIRST INSPECTING THE TIRE, RIM, AND WHEEL ASSEMBLY.

DOUBLE CHECK THE LOCK RING FOR DAMAGE...MAKE SURE THAT IT IS SECURE IN THE GUTTER BEFORE INFLATION.

S A F E T Y T I P S
- continued -

10. NEVER RUN A VEHICLE ON ONE TIRE OF A DUAL ASSEMBLY. THE CARRYING CAPACITY OF THE SINGLE TIRE AND RIM IS DANGEROUSLY EXCEEDED, AND OPERATING A VEHICLE IN THIS MANNER CAN RESULT IN DAMAGE TO THE RIM.
11. DON'T BE CARELESS OR TAKE CHANCES. IF YOU ARE NOT SURE ABOUT THE PROPER MATING OF RIM AND WHEEL PARTS, CONSULT A WHEEL AND RIM EXPERT. THIS MAY BE THE TIRE MAN WHO IS SERVICING YOUR FLEET, THE RIM AND WHEEL DISTRIBUTOR IN YOUR AREA, OR THE CLARK DEALER.
12. DON'T USE UNDERSIZED RIMS. USE THE RIGHT RIMS FOR THE JOB.
13. DON'T SEAT RINGS BY HAMMERING WHILE THE TIRE IS INFLATED.

DON'T HAMMER ON AN INFLATED OR PARTIALLY INFLATED TIRE/RIM ASSEMBLY.
14. DON'T LET ANYONE MOUNT OR DEMOUNT TIRES WITHOUT PROPER TRAINING.
15. NEVER SIT ON OR STAND IN FRONT OF A TIRE AND RIM ASSEMBLY THAT IS BEING INFLATED. USE A CLIP-ON CHUCK AND MAKE SURE INFLATION HOSE IS LONG ENOUGH TO PERMIT THE PERSON INFLATING THE TIRE TO STAND TO THE SIDE OF THE TIRE, NOT IN FRONT OR IN BACK OF THE TIRE ASSEMBLY.
16. DO NOT, UNDER ANY CIRCUMSTANCES, ATTEMPT TO REWORK, WELD HEAT, OR BRAZE ANY RIM COMPONENTS THAT ARE CRACKED, BROKEN OR DAMAGED. REPLACE WITH NEW PARTS OR PARTS THAT ARE NOT CRACKED, BROKEN, OR DAMAGED, WHICH ARE OF THE SAME SIZE, TYPE AND MAKE.
17. INFLATE IN A SAFETY CAGE OR USE SAFETY CHAINS DURING INFLATION.
18. REGARDLESS OF HOW HARD OR FIRM THE GROUND APPEARS, PUT HARDWOOD BLOCKS UNDER THE JACK.
19. BLOCK THE TIRE AND WHEEL ON THE OTHER SIDE OF THE VEHICLE, BEFORE YOU PLACE THE JACK IN POSITION...ALWAYS CRIB UP WITH BLOCKS JUST IN CASE THE JACK MAY SLIP.
20. REMOVE THE BEAD SEAT BAND SLOWLY TO PREVENT IT FROM DROPPING OFF AND CRUSHING YOUR TOES. SUPPORT THE BAND ON YOUR THIGH AND ROLL IT SLOWLY TO THE GROUND THIS WILL PROTECT YOUR BACK AND TOES.
21. BEAD BREAKERS AND RAMS APPLY PRESSURE TO BEAD FLANGES. KEEP YOUR FINGERS CLEAR. SLANT BEAD BREAKER ABOUT 10 DEGREES TO KEEP IT FIRMLY IN PLACE. IF...

...IT SLIPS OFF, IT CAN FLY WITH ENOUGH FORCE TO KILL.
ALWAYS STAND TO ONE SIDE WHEN YOU APPLY HYDRAULIC PRESSURE.
21. WHEN USING A CABLE OR CHAIN SLING, STAND CLEAR...IT MIGHT SNAP AND LASH OUT.

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CAUTION

WHEN OPERATING IN AN
ABRASIVE ATMOSPHERE, DO
NOT LUBRICATE LIFT CHAINS.

100 HOURS

LUBRICATE MACHINE

LIFT CHAINS:
(INSPECT/ADJUST/
LUBRICATE)

HYDRAULIC VALVE/
HOSES: (INSPECT)

LIFT CYLINDER:
(INSPECT)

LIFT & TILT
SWITCHES: (CHECK)

STEERING GEAR
LEVEL: (CHECK)

CONTACTORS,
SWITCHETTES:
(INSPECT/ADJUST)

AXLE ADAPTER
LEVEL: (CHECK)

AXLE ADAPTER
VENT: (INSPECT)

SUMP TANK
BREATHER:
(INSPECT)

BRAKE PEDAL
FREE TRAVEL:
(CHECK/ADJUST)

BRAKE SYSTEM:
(CHECK)

ACCELERATOR
OPERATION:
(CHECK)

SEAT BRAKE
INTERLOCK
SWITCH:
(CHECK/ADJUST)

SOLID STATE CONTROL:
(REFER TO TROUBLE
SHOOTING SECTION
IN THIS MANUAL.)

NOTE

AFTER EACH 100 HOURS OF OPERATION, PERFORM
THE ABOVE SERVICES IN ADDITION TO THE ONES
LISTED ON THE 8 HOUR LUBRICATION AND PRE-
VENTIVE MAINTENANCE ILLUSTRATION.

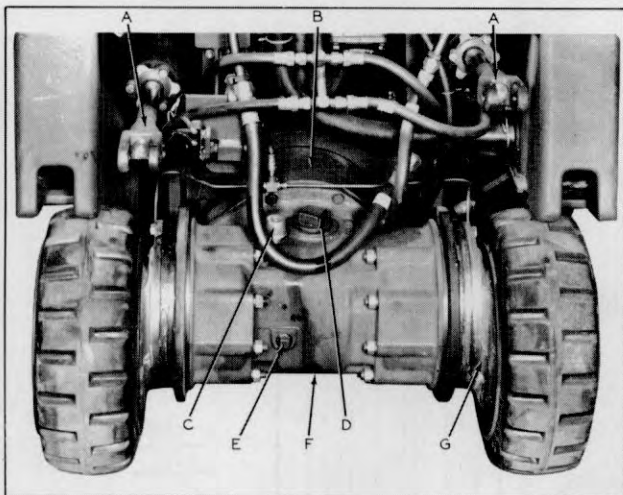


Plate 5988. Typical Axle Adapter

AXLE ADAPTER LUBRICANT LEVEL CHECK:

Check lubricant level (E) and fill if necessary. Use Type "A", Suffix "A", Automatic Transmission Fluid (fluid containers must display a qualification number prefixed by "AQ-ATF"...Clark Part Number 879803) or Dexron Automatic Transmission Fluid.

Clean dirt from around filler plug (D) and remove. Fill until fluid reaches the level of the level plug opening (E). DO NOT overfill, as the excess quantity will serve no useful purpose. If the fluid level is too high, it will cause excessive churning, high temperature and possible leakage.

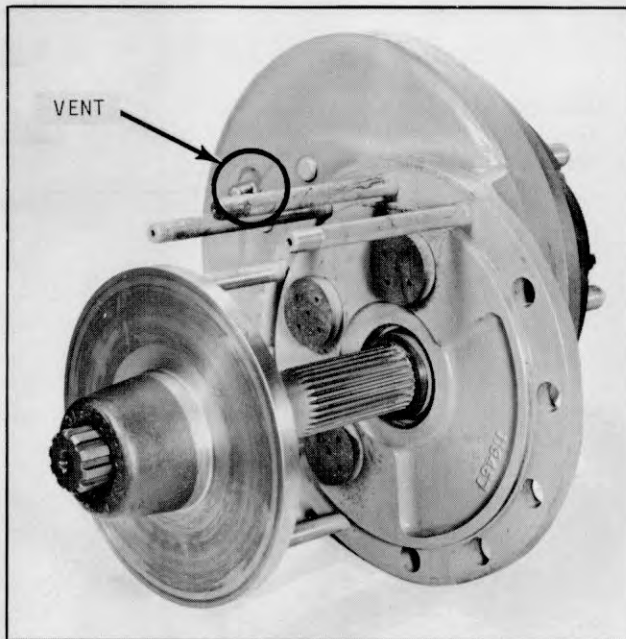


Plate 7550. Typical Axle End Vent

AXLE ADAPTER (C) AND AXLE END VENTS:

Inspect vents to be sure they are free of obstructions. If not, remove and clean in a Stoddard type cleaning solvent. Be sure they are completely dry before replacing.

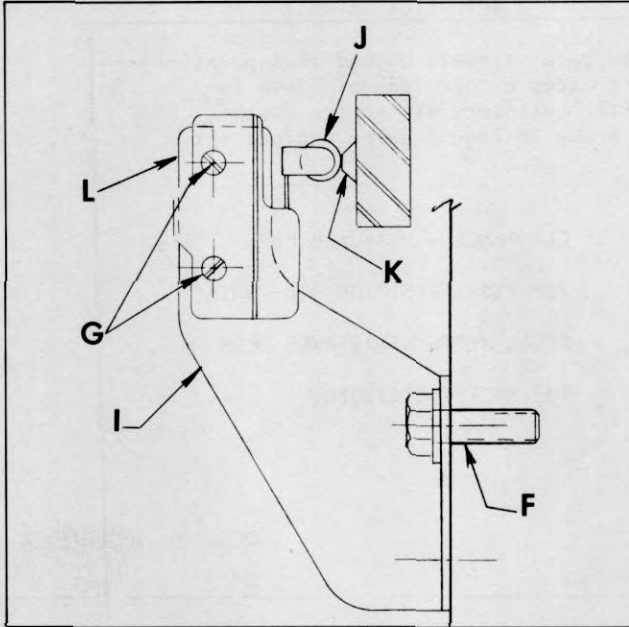


Plate 10625. Typical Brake Switch Adjustment

BRAKE SWITCH ADJUSTMENT:

With seat unoccupied, adjust switch so that it sits on the cam with switch open. Adjustment is made in the following manner:

1. Loosen nuts (F) and nuts (G).
2. Lift bracket (I) till roller (J) is parallel to the cam (K).
3. Tighten nuts (F).
4. Move switch (L) toward cam till it clicks open.
5. Tighten nuts (G).
6. Adjust brake rod so that bottom of seat is 15-20 deg. angle to the battery cover.

Test adjustment in the following manner;

1. Block seat in the up position.
2. Occupy seat and try to operate machine. If the switch has been adjusted properly, the machine will be inoperable.
3. Remove seat blocking, occupy seat and operate machine. If machine operates, the adjustment is correct.

BRAKE PEDAL FREE TRAVEL

Using a rule, measure pedal free travel at either of the two places shown below.

Depress brake pedal by hand. When pedal meets resistance from the master cylinder, the distance traveled should be 3/8 to 1/2 in. — if free travel is incorrect, adjust as follows:

1. Loosen lock nut, see Plate 7339.
2. Rotate adjuster to obtain specified pedal free travel.
3. Tighten lock nut to hold adjustment.

ACTUATION STROKE

If brake pedal travels beyond this point ----- this indicates either lack of fluid in the master cylinder; air in the system, or the brake linings require replacement.

CLEARANCE - measured here
TOP PEDAL POSITION -TO- WHERE
PEDAL MEETS RESISTANCE FROM
THE MASTER CYLINDER.

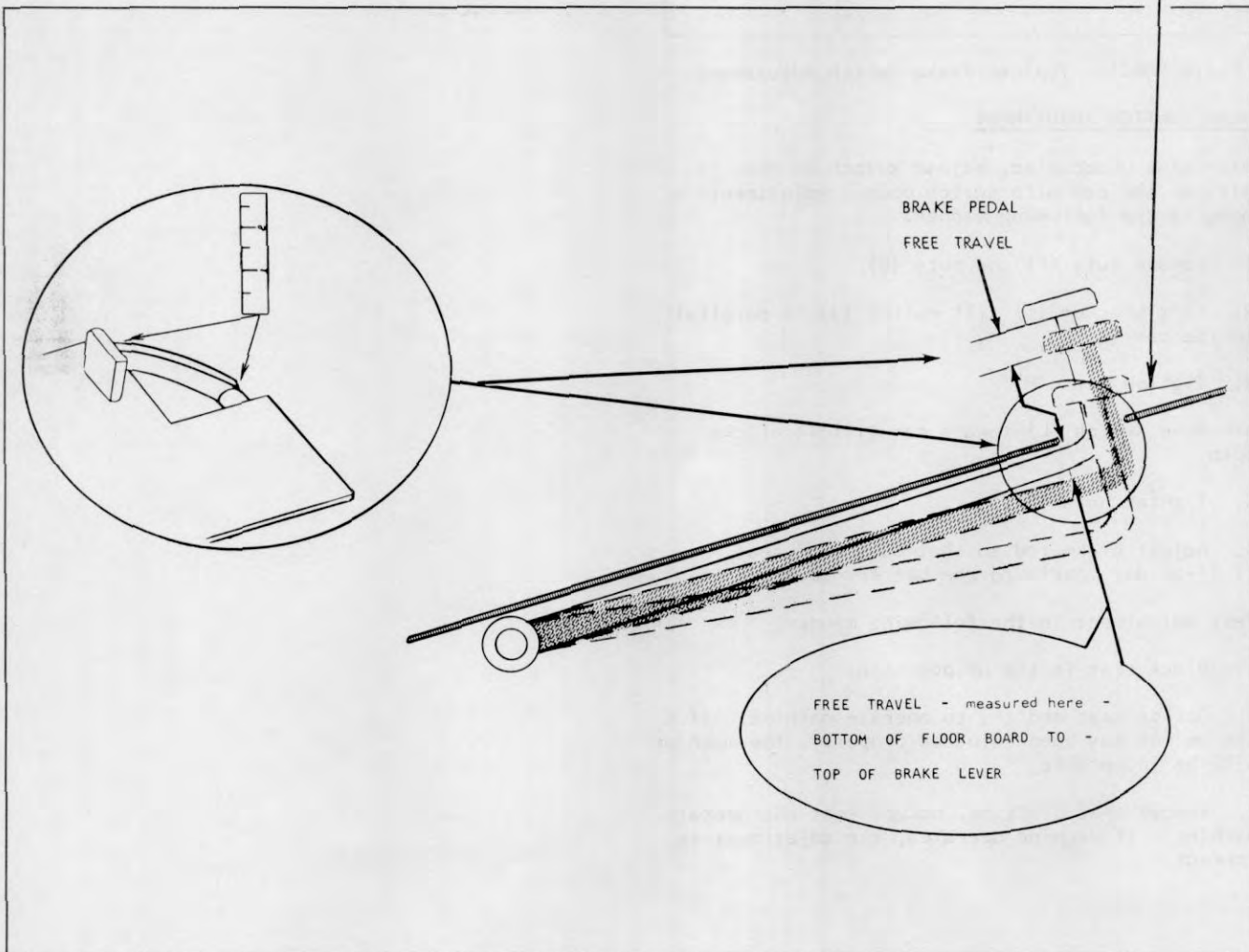


Plate 7042. Brake Pedal Check and Adjustment

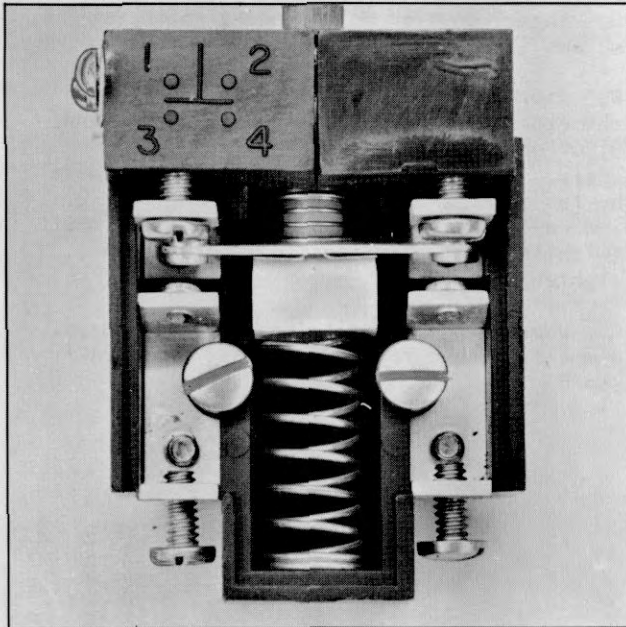


Plate 7443. Typical Pump Control Switch

PUMP CONTROL SWITCHES

The pump control switches are mounted at the valve spool end covers and are activated by movement of the valve spool.

SWITCH ADJUSTMENT

1. Loosen the two screws clamping switch to valve.

2. Position switch on spool end cover so that movable switch contacts are centered between stationary contacts. (Switch contacts are viewed thru clear plastic cover on switch.)

N O T E

ADJUSTMENT OF SWITCHES MUST BE MADE WITH VALVE SPOOL IN NEUTRAL POSITION.

3. After correct adjustment is obtained tighten switch clamping screws.



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

SOLID STATE CONTROL (EC60,70B/ECS80B):

ACCELERATOR ADJUSTMENT:

STEP #1:

- A. Disconnect ball joint (Item A), position pedal to 2-7/8" dimension, from machined surface of casting.
- B. Turn stop nut (Item B) to hold this position.

STEP #2:

- A. Loosen nuts (Item C) and back off (2) set screws (Item D) until flush with cast surface of spring actuator (Item E).
- B. Do not tighten set screws (Item F) in coupler at this time.

STEP #3:

- A. Adjust linkage rod (Item G) to 2-3/16" dimension.

STEP #4:

- A. Adjustment of 1MS switch with pedal in the up position: ...adjust 1MS switch (Item K) with set screw (Item D) by turning screw in against spring (Item L) until 1MS just actuates. Turn screw an additional 1/4 turn...tighten lock nut (Item C).
- B. Depress pedal several times to be certain 1MS is actuated each time. If not, unlock nut (Item C) and turn screw (Item D) in an additional 1/4 turn....lock nut and repeat above.

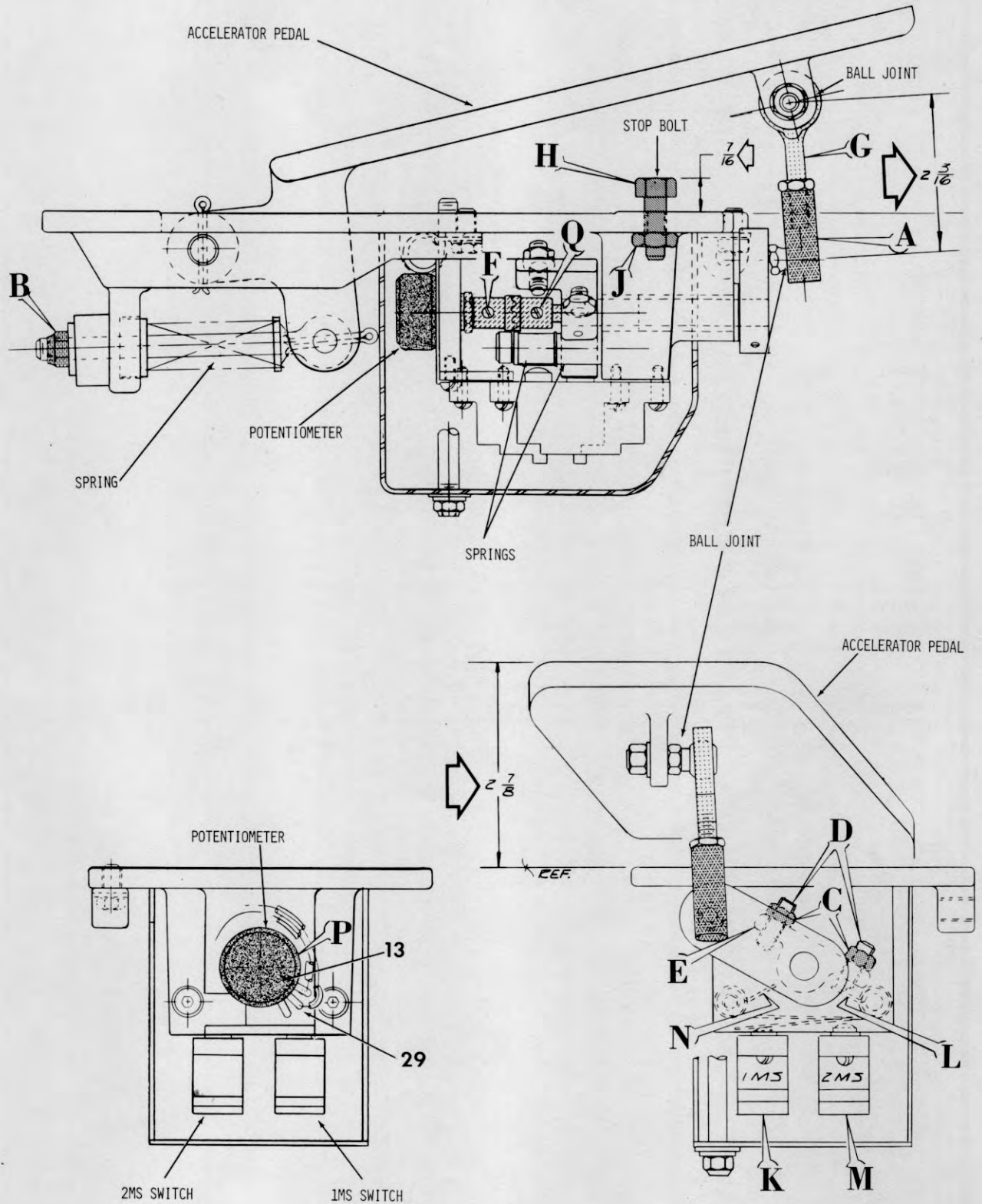
STEP #6:

- A. Adjustment of 2MS switch: ...with 1/8" spacer placed between pedal and stop bolt (Item H) ...and with pedal depressed...adjust 2MS switch (Item M) with set screw (Item D) (off-set tab of spring actuator) by turning screw in against spring (Item N) until 2MS actuates....tighten lock nut (Item C).
- B. Remove 1/8" spacer and depress pedal fully to be certain that 2MS switch actuates each time.

STEP #7:

- A. Adjustment of potentiometer (Item P) with set screw (Item F) tightened, and set screw (Item Q) loosened...disengage coupler halves.
- B. With ohmmeter connected between wires 13 and 29...RX100 scale...revolve coupler half and potentiometer until ohmmeter reads approximately 10,000 ohms.

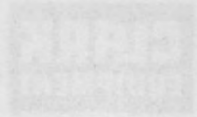
- C. Engage coupler halves and tighten set screws (Item Q).
- D. Depress pedal until 1MS actuates... ohmmeter should read between 8,500 ohms and 9,500 ohms...terminals 13 and 29...RX100 scale. If not, minor adjustment can be made by loosening the coupler set screw (Item Q) and revolving coupler and potentiometer shaft (with 1MS just actuated) to within range... tighten set screw.
- E. Depress pedal until 2MS just actuates... ohmmeter should read 300 or less ohms...RX1 scale.



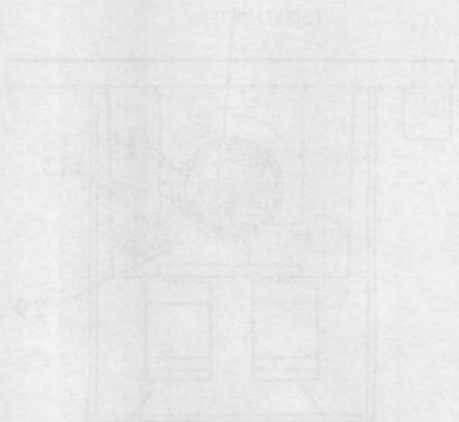
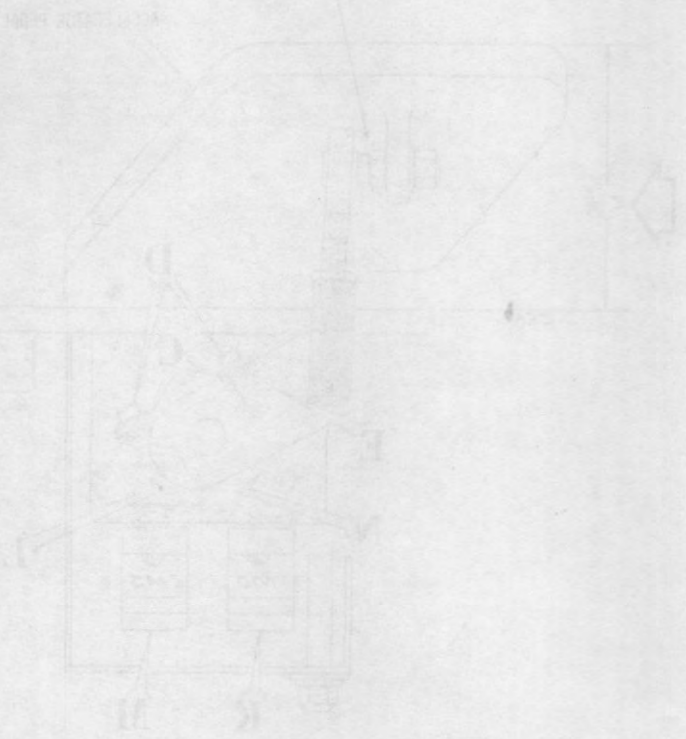
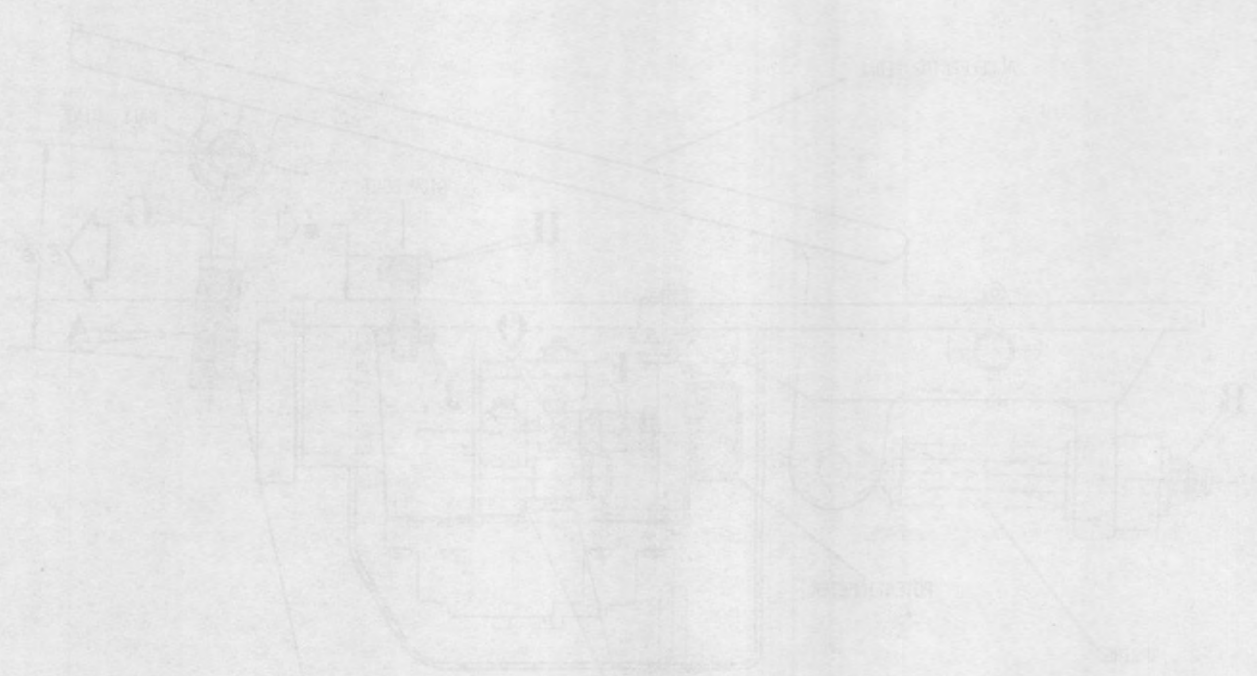
ACCELERATOR CONTROL ASSEMBLY ADJUSTMENT



INDUSTRIAL TRUCK DIVISION



TECHNICAL DRAWING



ACTUATOR CONTROL SYSTEM - ADJUSTMENT

FORM 10-64

REV. 10-64

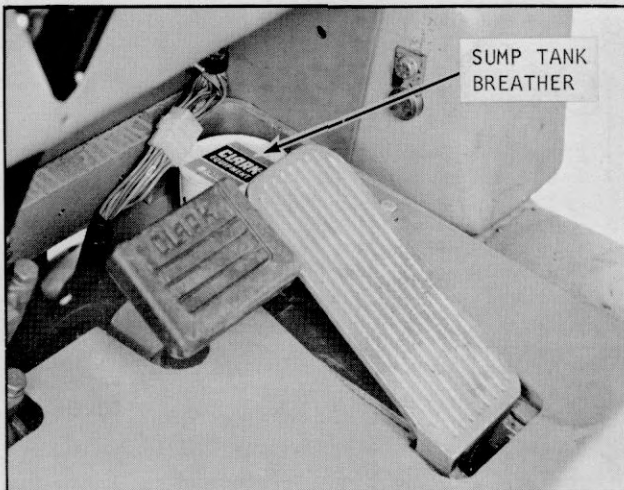


Plate 10620. Typical Sump Tank Breather

HYDRAULIC SUMP TANK BREATHER:

Wash breather in a Stoddard type cleaning solvent until free of all foreign matter. Use compressed air to dry breather before replacing it on the machine.

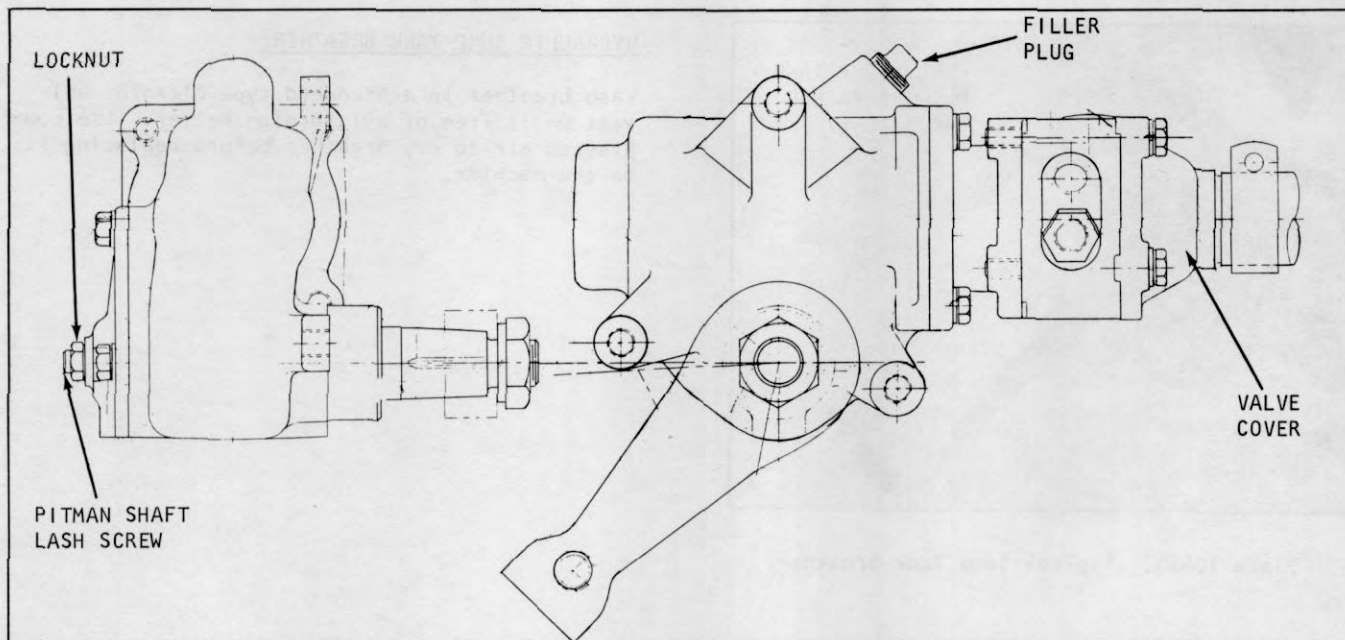


Plate 10172. Typical Steering Gear

STEERING GEAR:

Check lubricant level in steering gear housing.
If low, add enough lubricant to bring level up
to filler plug hole. (Use NLGI #1, Amolith
grease EP #1 or its equivalent.)

N O T E

Before removing fill/level plug, be sure to wipe
all dirt from around the plug and opening.



INDUSTRIAL TRUCK DIVISION



WORK SAFELY

DRIVE SAFELY

BE CAREFUL

ALWAYS

**GIVE MACHINE SERIAL NUMBER
WHEN ORDERING PARTS**



INDUSTRIAL TRUCK DIVISION



LUBRICATION AND PREVENTIVE MAINTENANCE

CONTACTOR ADJUSTMENTS:

Adjustment Of Wipe & Gap:

P & 1A Contactors:

Wipe (armature seated against core) adj. by adding or removing shims behind contact support (M).

Gap:

Adjust by adding or removing equal number of washers under armature stop posts (P).

F & R Contactor:

Wipe - adj. by same method as P & 1A cont.

Gaps:

N.O. Gap:

Loosen supp. brkt. screws (L) and supp. brkt. (K) in or out.

N.C. Gap:

If wipe and N.O. gap are correct, N.C. gap should be within limit.

ADJUSTMENT OF INTERLOCK (R):

The electrical interlock must operate with a (0.015 in P 1A or 0.035 in F & R) thick shim (F) between armature and core. Snapping noise indicates interlock (R) has operated. Also with a 0.15 in. thick shim (F2 all contactors) between interlock operator plunger. Plunger must not bottom with armature seated against core. All contactors to operate on 36 V.D.C. circuit, to pick up on 18 V.D.C., and drop out approx. 1 V.D.C. power fuse. Term. connectors marked F & R, 1A & P require 5/16 terminals on cable leads. A amp plug connector with female terminals is required for exterior control lead connections. (18 term. connector min.) Double shunts on P, 1A and F & R contactors. Panel to be imprinted with fuse size adjacent to fuse location.

COIL RESISTANCE: 30.5 Ohms +/- 10% @ 25 deg. C

*N O T E

Allow 2 ounces increased pressure if measuring device is installed between contactor tips.

CONTACTOR TIP STUD TORQUE

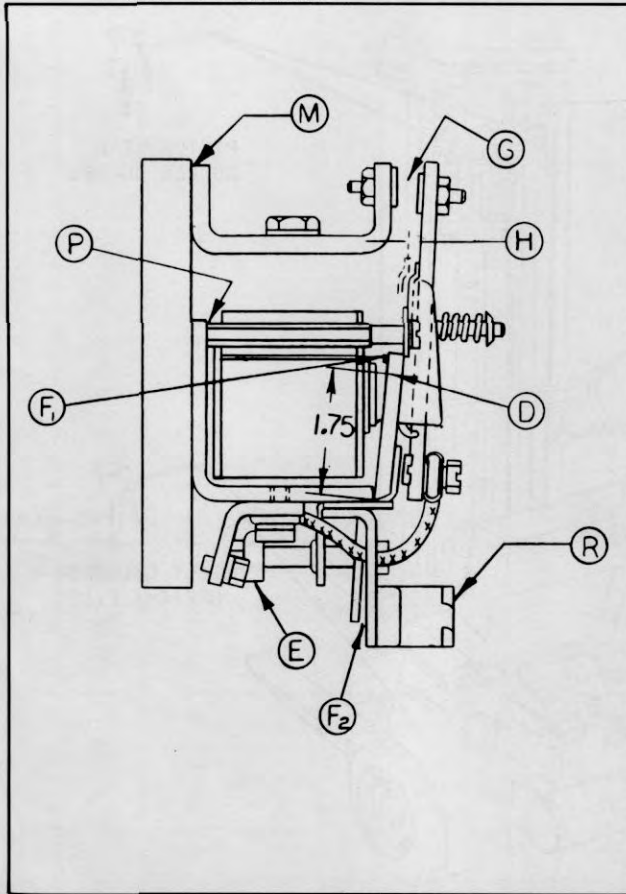
CONTACTOR	TORQUE (IN. LBS.)
F - R	80-100 (5/16 STUD)
P - 1A	80-100 (5/16 STUD)
P 1A	45-60 (1/4 STUD) (EARLY PRODUCTION)

STUD TO BE PEENED
AFTER TORQUING TO ABOVE
FIGURE OR LOCK-NUT - "GRIP
NUT CENTER LOCK " OR EQUAL
(INDENT ON SIDE TO LOCK THDS)

GAPS AND SPRING PRESSURES

POINT	RATING	F - R	FW	P - 1A
	AMPERAGE	200	100	200
	N.O. GAP	$\frac{3}{8} - \frac{13}{32}$	$\frac{1}{4} - \frac{5}{16}$	$\frac{3}{16} - \frac{7}{32}$
	N.C. GAP	$\frac{3}{32} - \frac{1}{8}$		
G*	N O FINAL PRESSURE IN OUNCES	46 - 56		60 TO 68
G	N O INITIAL PRESSURE IN OUNCES	40	48	56 TO 64
D	ARMATURE (N C) PRESSURE IN OUNCES	32 - 38		
H	WIPE	$\frac{3}{32}$ MIN		$\frac{3}{32} - \frac{1}{8}$

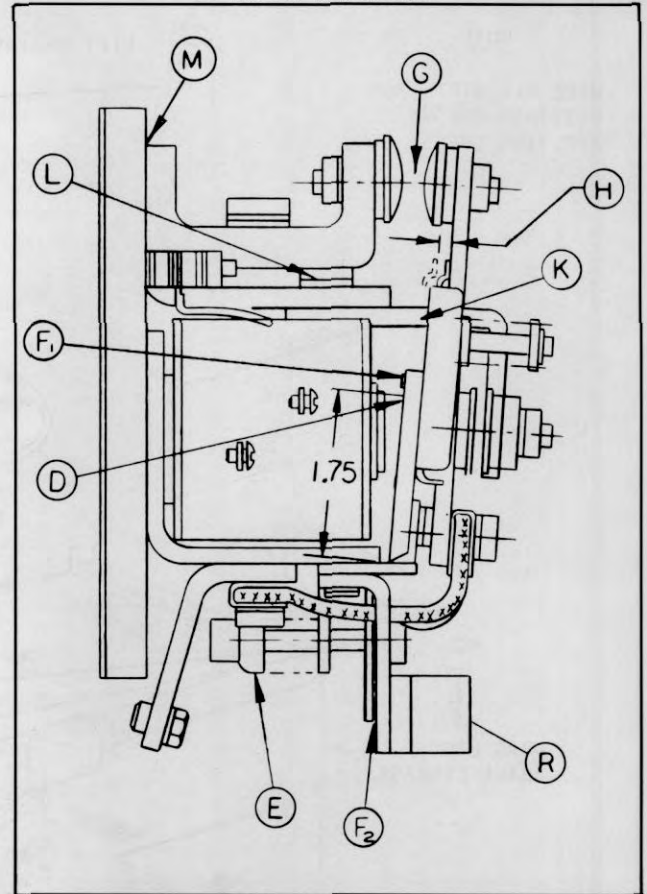
P and 1A CONTACTOR



ADJUSTMENT OF ARMATURE SPRING PRESSURE P & 1A CONTACTOR

Adjust nut (E) so that pressure at (D) requires amount of force noted in chart to move armature away from stop.

F and R CONTACTOR

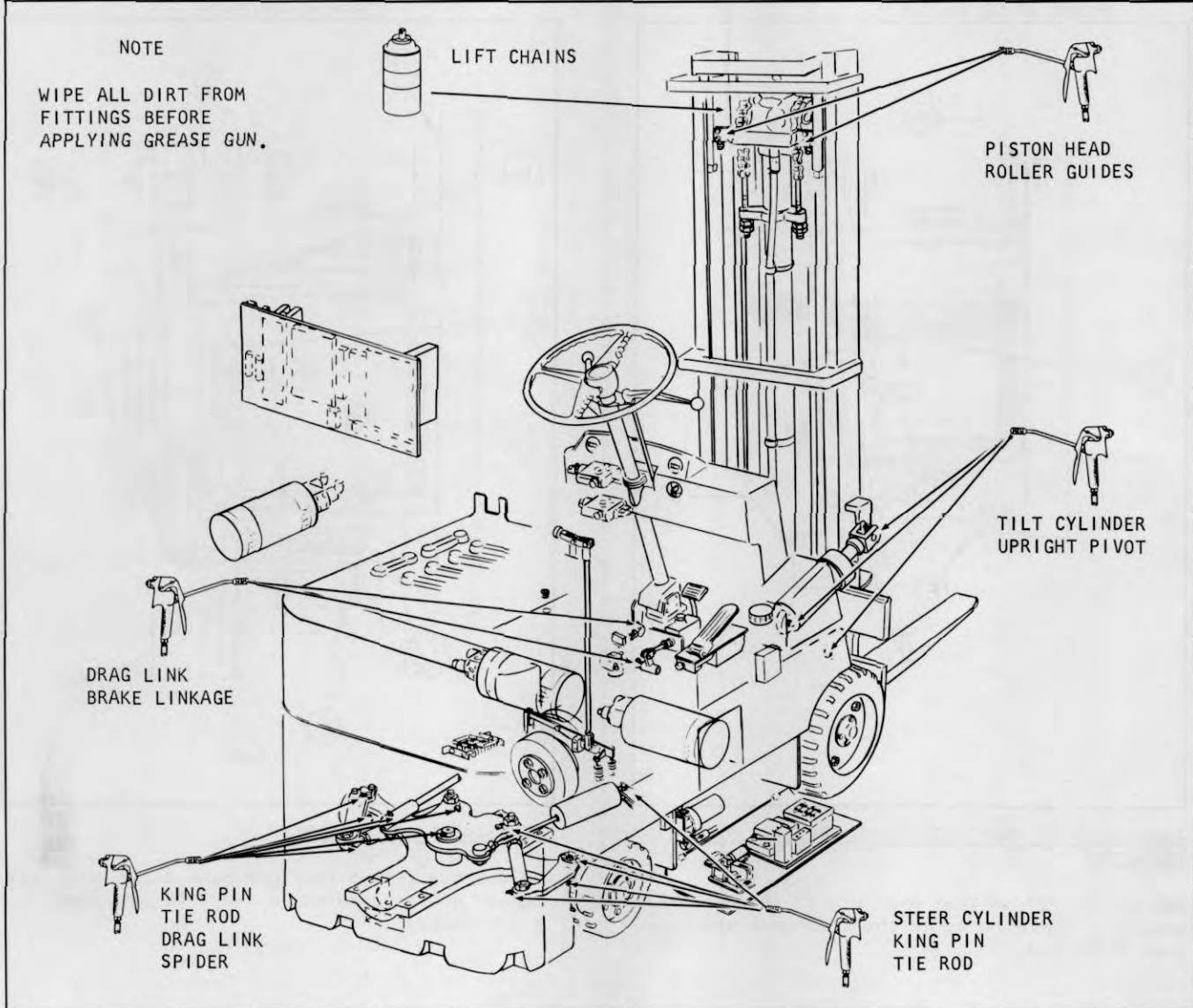


ADJUSTMENT OF ARMATURE

Adjust nut (E) so that pressure at (D) requires amount of force noted in chart to just open N C contacts.

NOTE

WIPE ALL DIRT FROM FITTINGS BEFORE APPLYING GREASE GUN.



NLGI #2 (AMOLITH GREASE EP #2 OR ITS EQUIVALENT)



ENGINE OIL: SAE 20



NLGI #1 OR #2 (AMOLITH GREASE EP #1 OR #2 OR ITS EQUIVALENT)



OIL FILTER CARTRIDGE KIT



1800200 HYDRAULIC BRAKE FLUID HEAVY DUTY SAE 70R3



CHAIN LUBE (886399)



REFER TO PAGES 100H 073 AND 1000H 1303



SLIDING TANDEM LUBE CLARK NUMBER 886396



NLGI #1 OR #2 (AMOLITH GREASE EP #1 OR #2 OR ITS EQUIVALENT)



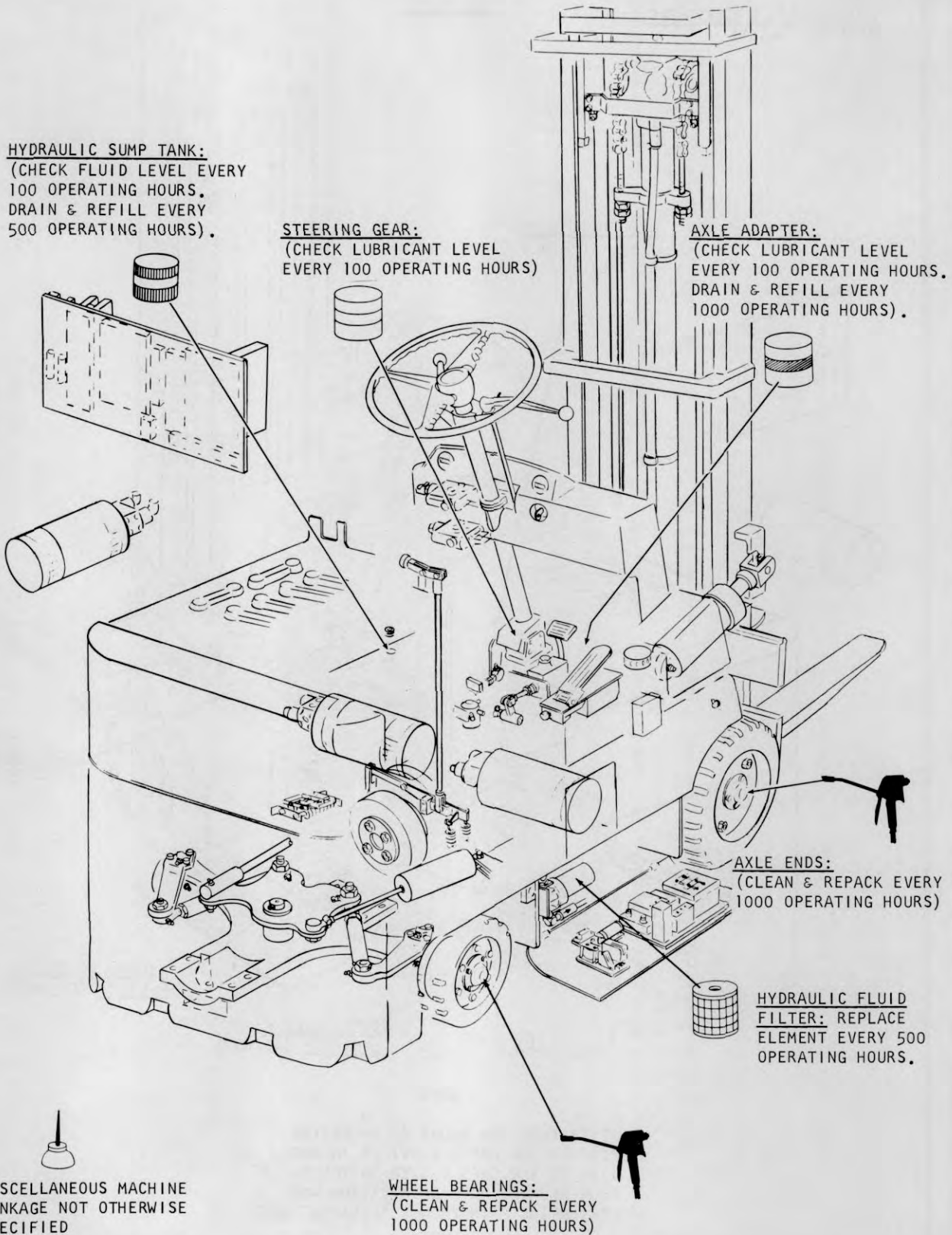
HYDRAULIC FLUID - CLARK SPEC. MS-68 (885385)



HYDRAULIC SUMP TANK:
(CHECK FLUID LEVEL EVERY
100 OPERATING HOURS.
DRAIN & REFILL EVERY
500 OPERATING HOURS).

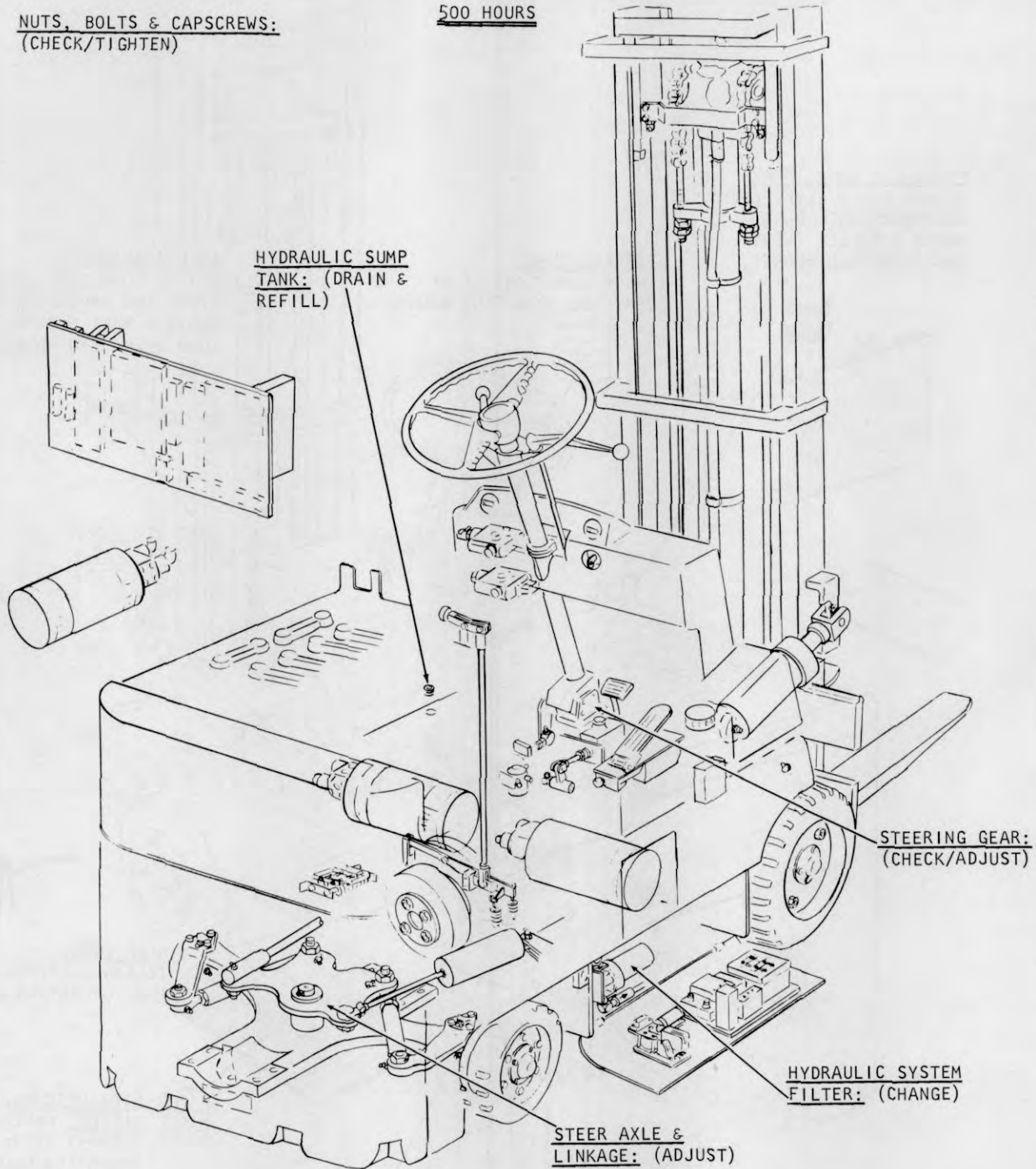
STEERING GEAR:
(CHECK LUBRICANT LEVEL
EVERY 100 OPERATING HOURS)

AXLE ADAPTER:
(CHECK LUBRICANT LEVEL
EVERY 100 OPERATING HOURS.
DRAIN & REFILL EVERY
1000 OPERATING HOURS).



NUTS, BOLTS & CAPSCREWS:
(CHECK/TIGHTEN)

500 HOURS



NOTE

AFTER EACH 500 HOURS OF OPERATION, PERFORM THE ABOVE SERVICES IN ADDITION TO THE ONES LISTED ON THE 8 HOUR AND 100 HOUR LUBRICATION AND PREVENTIVE MAINTENANCE ILLUSTRATIONS.



INDUSTRIAL TRUCK DIVISION



WORK SAFELY

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ALWAYS

GIVE MACHINE SERIAL NUMBER

WHEN ORDERING PARTS

SUMP TANK DRAIN:

1. Lower upright, turn power switch to the off position and open both L.H. and R.H. frame doors to allow access to the sump tank drain plugs and hydraulic filter.
2. Remove sump fill plug from L.H. tank and sump breather from R.H. tank. Using a hose attached to a funnel, place unattached end of hose in a large container and remove drain plugs.
3. Allow tanks to thoroughly drain and then flush each tank with at least two quarts of clean hydraulic fluid.

CAUTION

DO NOT OPERATE THE HYDRAULIC PUMP WHILE THE SUMP TANK IS EMPTY AS DAMAGE TO THE HYDRAULIC PUMP WILL RESULT.

4. Disconnect hose and remove hydraulic strainer retaining bolts and pull assembly out of the sump tank. REMOVE ANY REMAINING GASKET MATERIAL FROM MOUNTING FLANGES.

5. Clean out any residue left in the sump cavity.

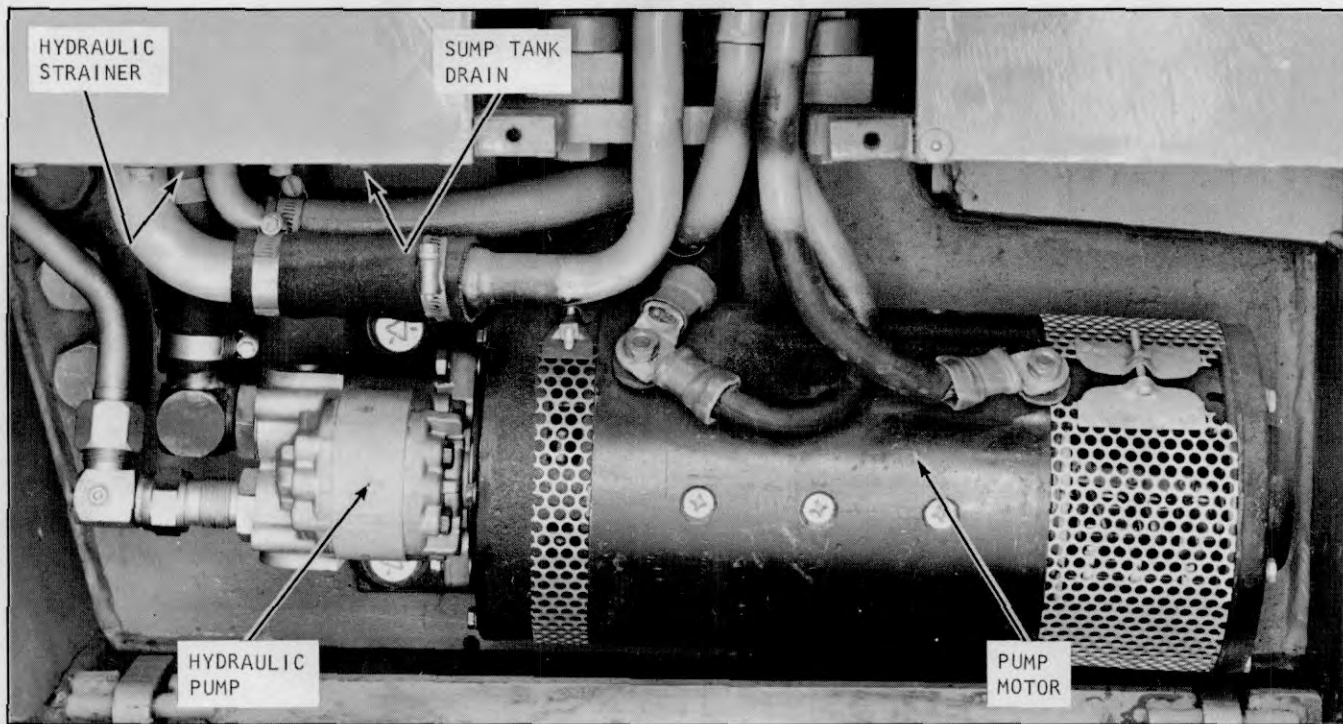


Plate 10621. Typical Sump Tank Drain

6. Clean strainer in a Stoddard type cleaning solvent, dry with compressed air, and reinstall in the sump tank.

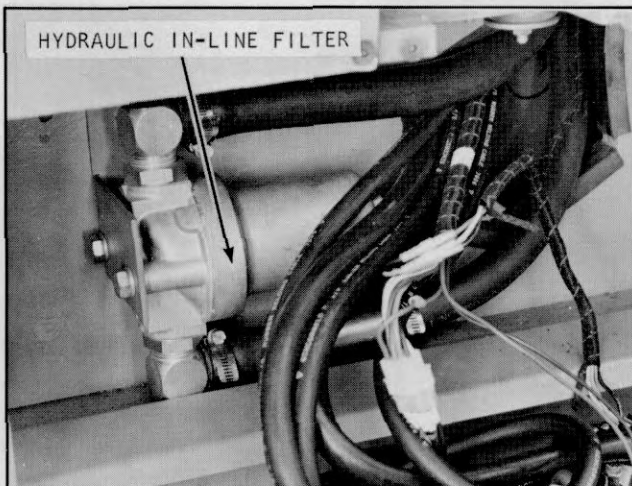


Plate 10622. Typical Hydraulic Filter

7. Remove sump tank "in line" filter and replace element.
8. Replace drain plugs and fill both sump tanks full. Use Clark Spec. MS-68 Hydraulic Fluid. Replace sump breather and fill plug. Close both access doors.

C A U T I O N

THE HYDRAULIC SYSTEM MUST BE KEPT CLEAN. IT MAY BE NECESSARY TO DRAIN, CLEAN AND REFILL THE SUMP TANK MORE OFTEN UNDER ADVERSE CONDITIONS. THIS IS BEST DETERMINED BY CHECKING HYDRAULIC FLUID FOR EVIDENCE OF DIRT, SLUDGE OR ANY FOREIGN MATTER AT PERIODIC INTERVALS. IF SUMP BREATHER BECOMES DIRTY, REPLACEMENT IS NECESSARY.

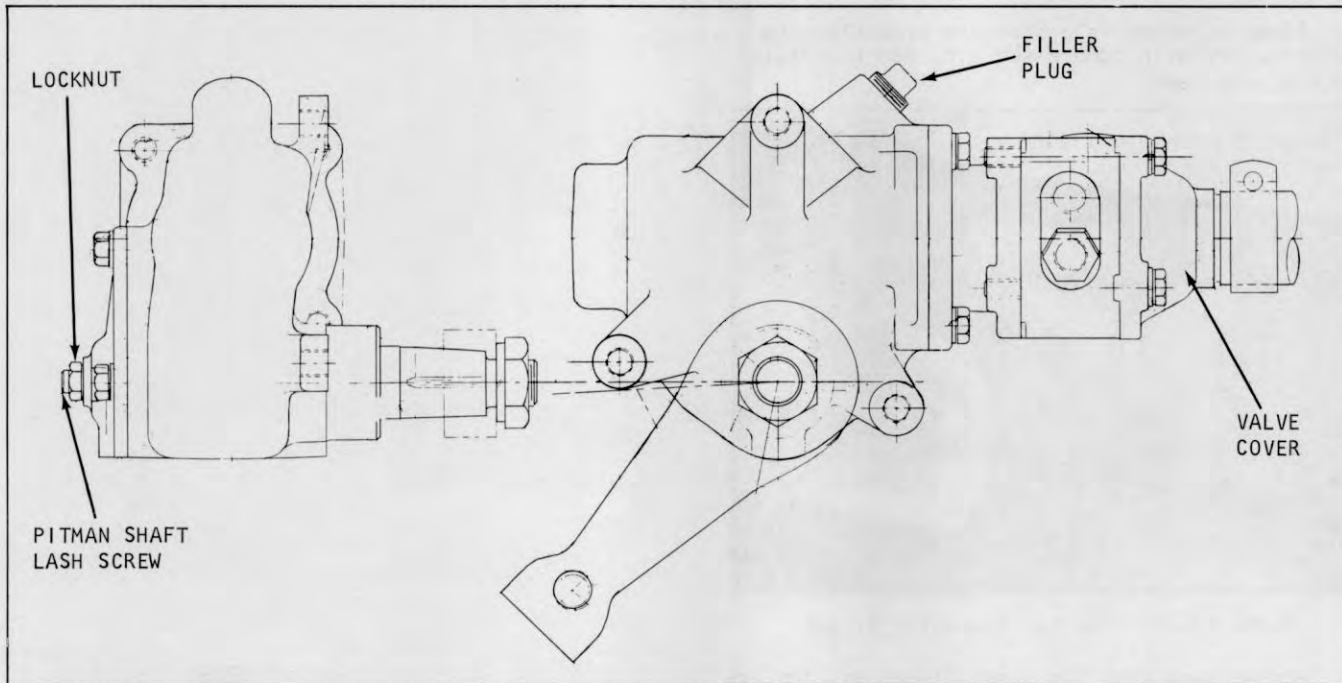


Plate 10172. Typical Steering Gear

STEERING GEAR:

Adjust steering gear as follows:

1. Disconnect drag link from pitman arm.
2. Check lubricant level in steering gear housing. If low, add enough lubricant to bring level up to filler plug hole. (Use NLGI #1, Amolith grease EP #1 or its equivalent.)
3. Tighten steering gear housing to frame side member bolts.
4. Determine straight ahead position of steering gear as follows:

CAUTION

APPROACH EXTREME ENDS CAUTIOUSLY. WORM BALL

NUT MUST NOT STRIKE END FORCEFULLY.

- a. Turn steering wheel to extreme right. Then turn to extreme left....counting the exact number of turns from right to full left. Then turn wheel back one-half the number of turns. Mark wheel with respect to steering column so center position may readily be found.

5. The overcenter (or pitman shaft) adjustment is as follows:

- a. With gear on center, adjust pitman shaft lash screw so that pull on the rim of an 18" wheel through a 3" arc (at the rim) is 1 1/4 to 1 1/2 pounds. Then tighten locknut. (Plate 10172)

6. As a recheck of total overcenter load; the pull on the rim of an 18" wheel through a 3" arc (at the rim) with gear overcenter, must be 1 1/8 to 2 pounds.

7. After adjustments are made, install drag link on pitman arm.

N O T E

If steering linkage adjustment is necessary do not install drag link to pitman arm.



INDUSTRIAL TRUCK DIVISION



WORK SAFELY

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ALWAYS

GIVE MACHINE SERIAL NUMBER

WHEN ORDERING PARTS

STEER LINKAGE ADJUSTMENT CHECKS:

Check the steer axle and linkage adjustment in the following manner:

1. Turn the hand wheel while watching a steer tire. The steer tire should start moving soon after you turn the hand wheel. If there seems to be too much play in the hand wheel, then the steering gear needs a lash adjustment.

Raise the steer tires off the floor for the remainder of the checks.

2. Turn the hand wheel full left and measure the left side tie rod. The length should be approximately 10 9/32 (Plate 10633). Then turn the hand wheel full right and check the right side tie rod (same dimension). If both dimensions are correct, then no adjustment is necessary.

3. Turn the hand wheel from full left to full right (without cramping after you hit the stop) and count the number of full turns and partial turn. Now...turn the hand wheel back half way. If the tires are straight, then the drag link and the pitman arm are adjusted correctly.

NOTE

It is hard to do this perfectly...if you are only off a little bit, this is alright, but check to be sure both steer tires are off the same amount. If they are, then for all practical purposes, your adjustment is still correct.

4. Turn the hand wheel all the way right and left to see if the linkage is hitting the stops. If so, then you know that the steering cylinder is not bottoming out.
5. Turn the hand wheel full left till you reach the stop. Now "cramp" the wheel hard left and release quickly. If the hand wheel snaps back, you know you have proper cushion on the left side. Do the same for the right side.

If during these steer linkage adjustment checks you find something wrong, then correct the condition according to the appropriate step in the following adjustment procedure.

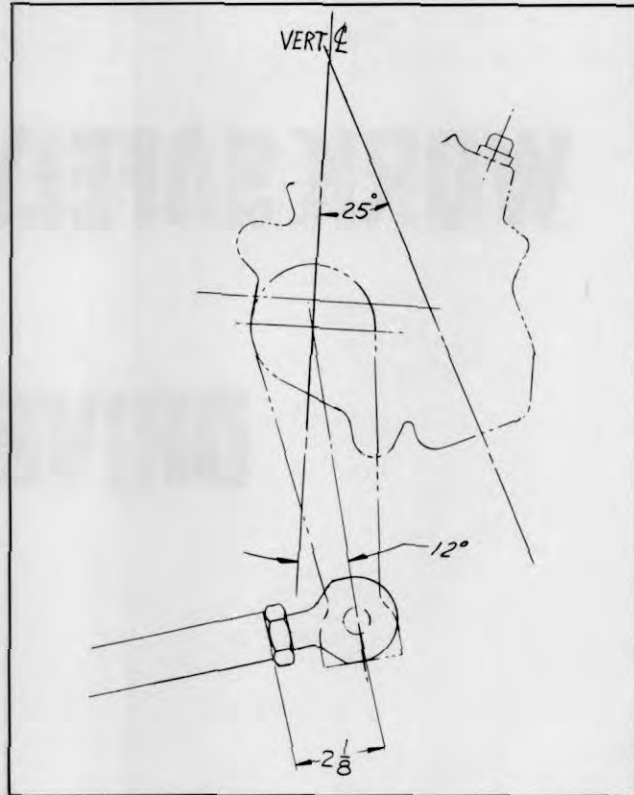


Plate 10631. Typical Pitman Arm Adjustment

STEER LINKAGE ADJUSTMENTS:

The following is a series of steps for the complete adjustment of the steer axle and linkage. You may find, in the foregoing adjustment checks, that you will need only part of these series of steps to correct your particular problem.

Before starting any of the following adjustments, torque the steering gear mounting bolts and the steering gear bracket bolts 60-75 lbs. ft. (Plate 10630).

Pitman Arm to Steering Gear Adjustment:

1. Disconnect the pitman arm from the steering gear and the drag link.
2. Center the steering gear by turning the hand wheel from full left to full right, counting the turns and then turn it back 1/2 way.
3. Now attach the pitman arm to the steering gear shaft so that the center line of the pitman arm is 12 degrees forward of the vertical line (Plate 10631). Torque the pitman arm to steering gear shaft nut 320-400 lbs. ft.

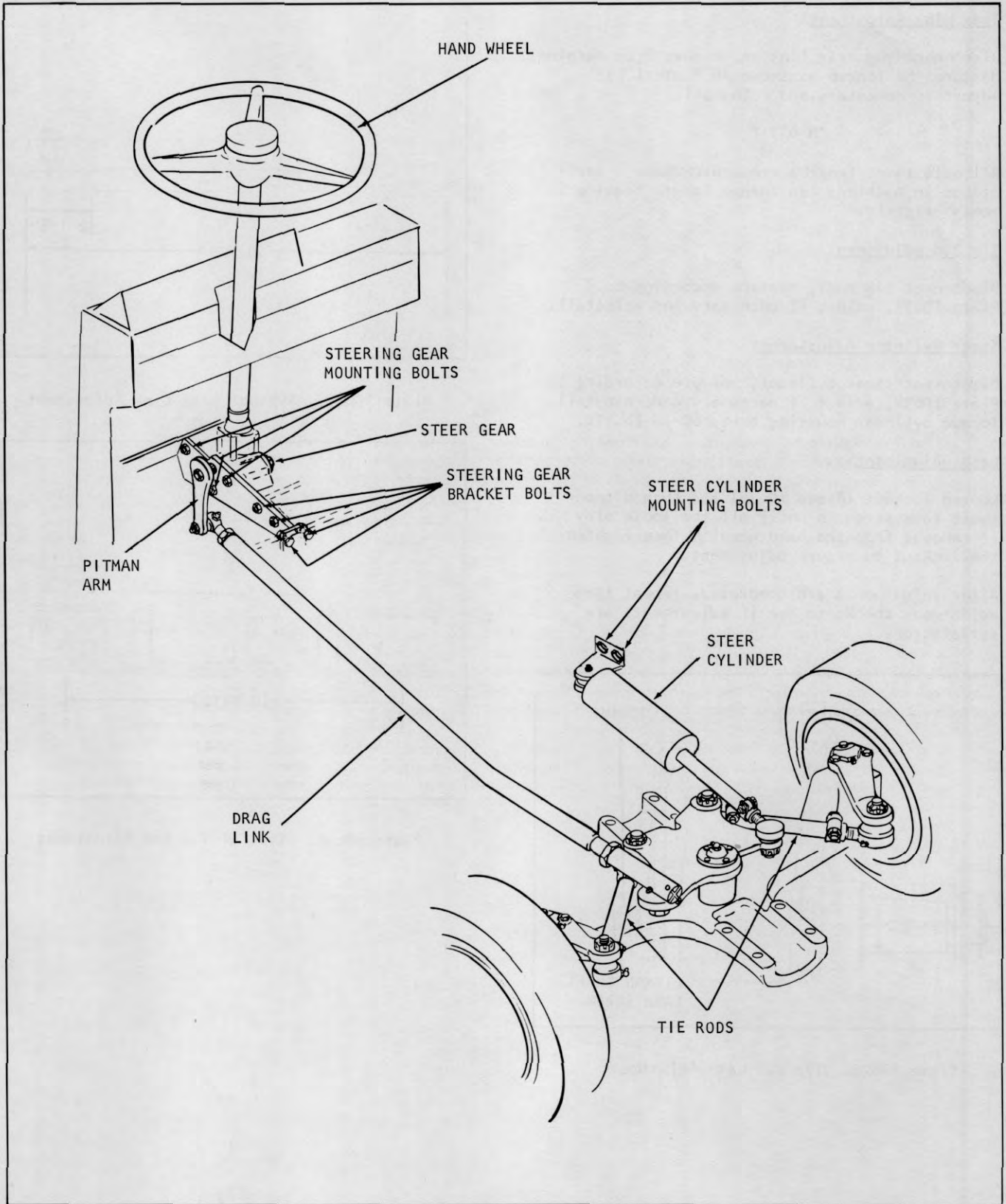


Plate 10630. Typical Steer Axle Adjustment

Drag Link Adjustment:

Disconnect the drag link and remove from machine. Measure the length as shown in Plate 10632. Adjust if necessary and reinstall.

N O T E

All adjustment lengths are approximate. Variations in machines can change length requirements slightly.

Tie Rod Adjustment:

Disconnect tie rods, measure according to Plate 10633, adjust if necessary and reinstall.

Steer Cylinder Adjustment:

Disconnect steer cylinder, measure according to Plate 10634, adjust if necessary and reinstall. Torque cylinder mounting bolts 60-75 lb. ft.

Lash Adjustment:

Loosen locknut (Plate 10629) and turn pitman shaft lash screw in until all the loose play is removed from the hand wheel. Then tighten the locknut to secure adjustment.

After adjustments are completed, repeat the adjustment checks to see if adjustments are satisfactory.

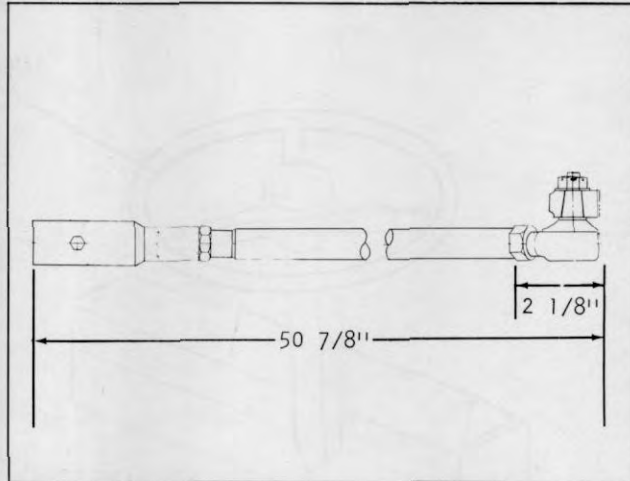


Plate 10632. Typical Drag Link Adjustment

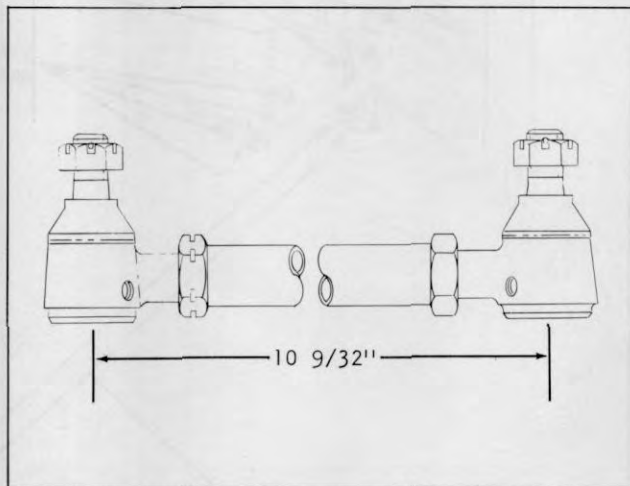


Plate 10633. Typical Tie Rod Adjustment

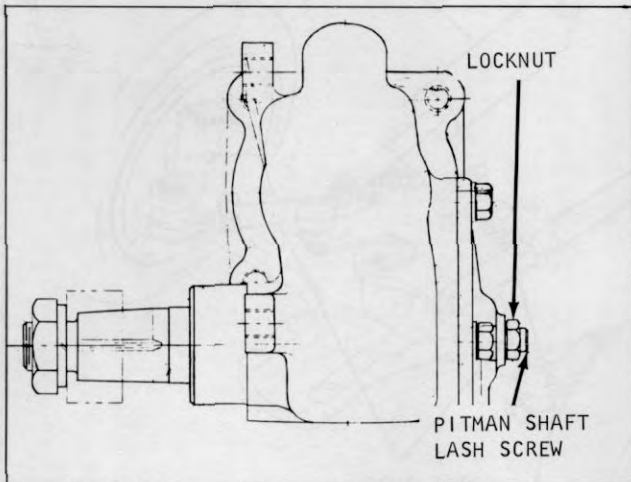


Plate 10629. Typical Lash Adjustment

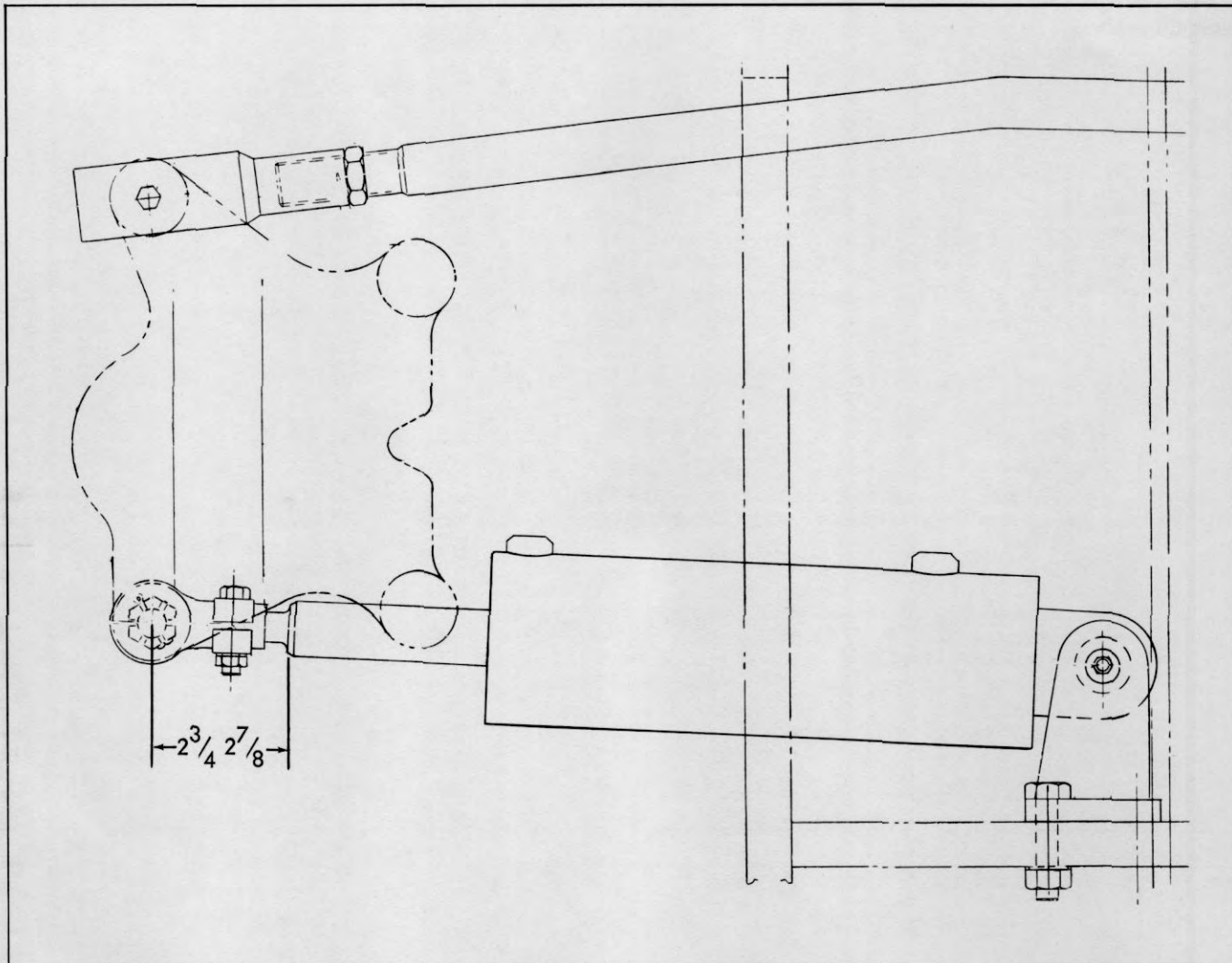


Plate 10634. Typical Steer Cylinder Adjustment

INDUSTRIAL TRUCK DIVISION

OPERATION AND MAINTENANCE

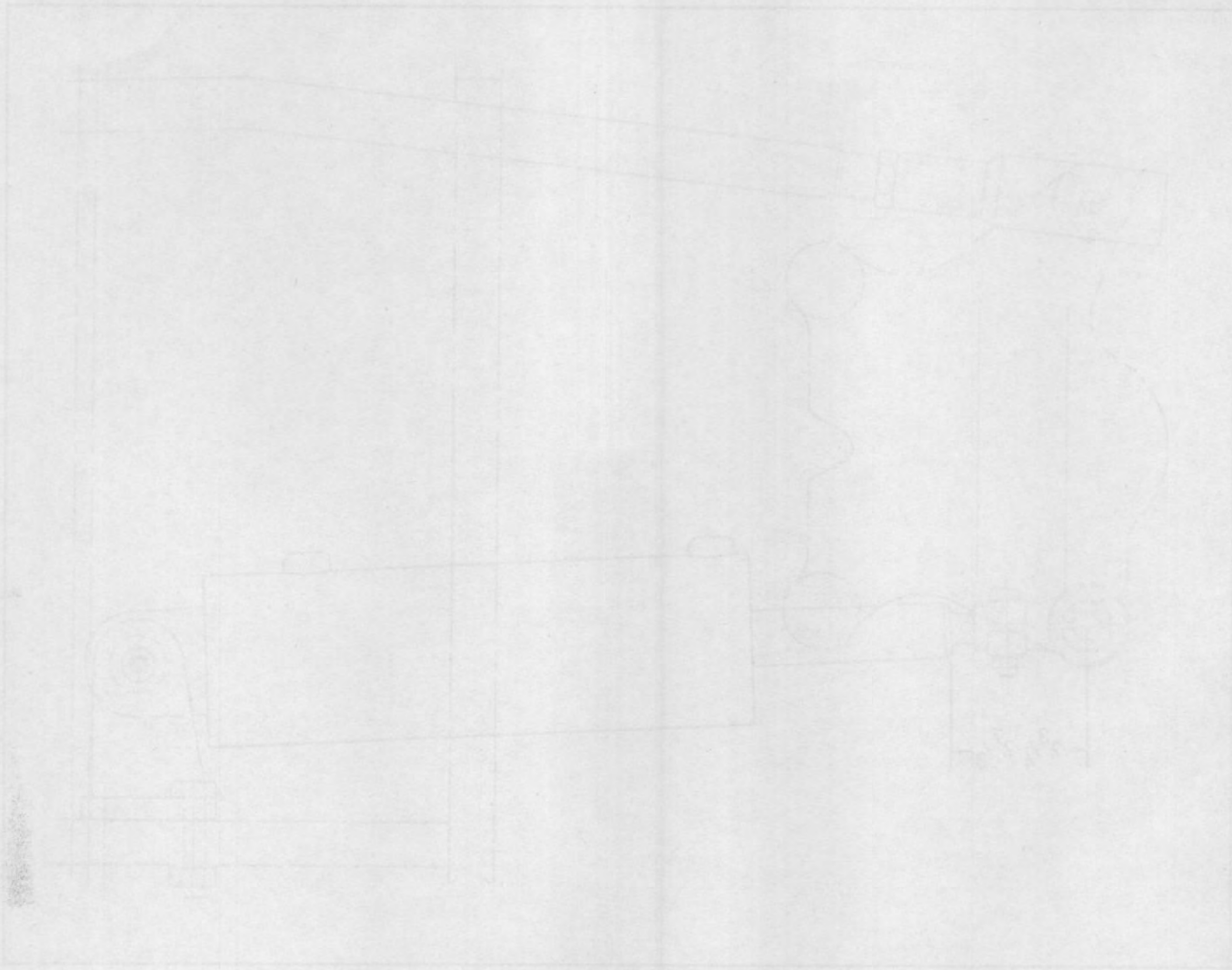
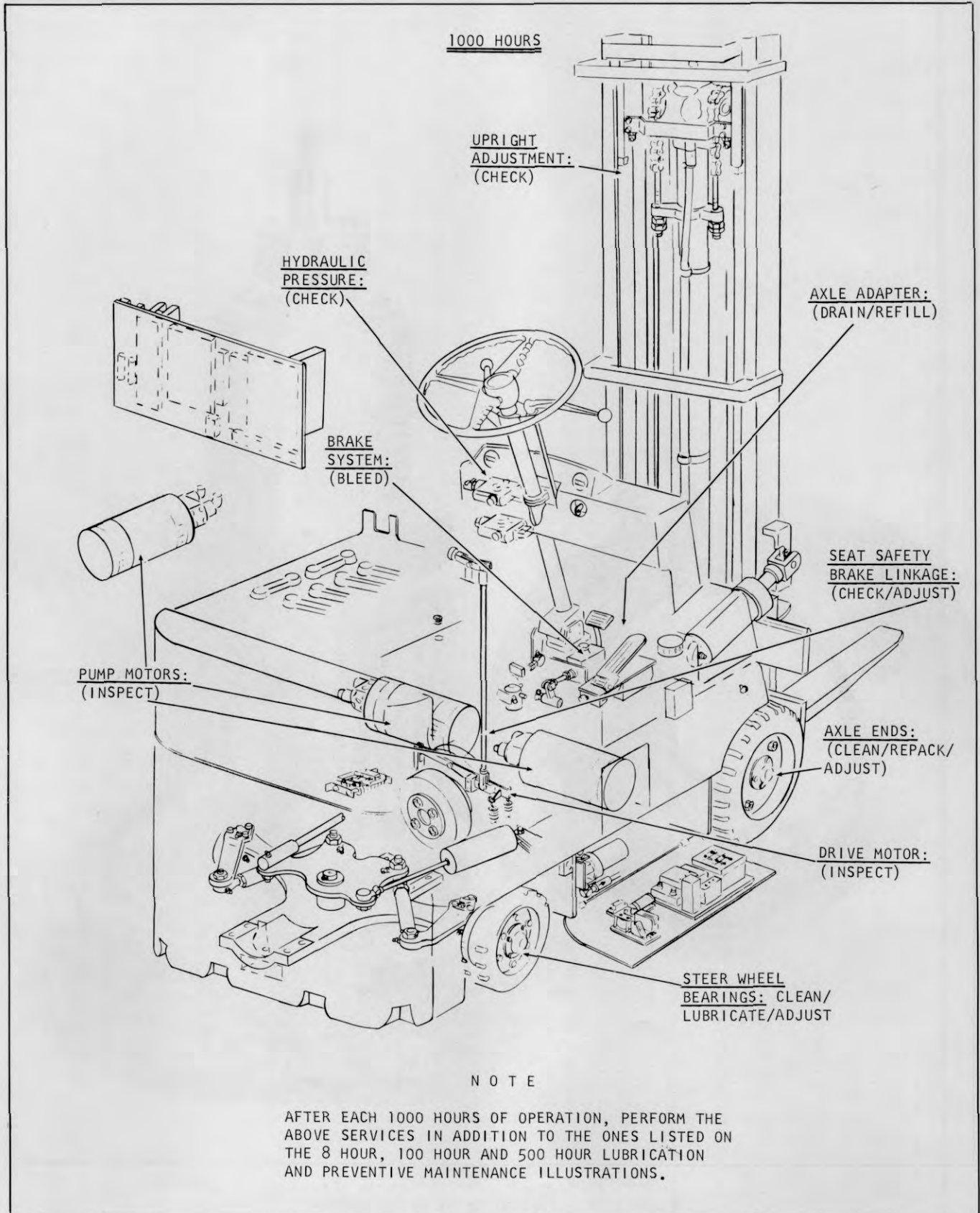


FIGURE 1. Typical Rear Cylinder Adjustment



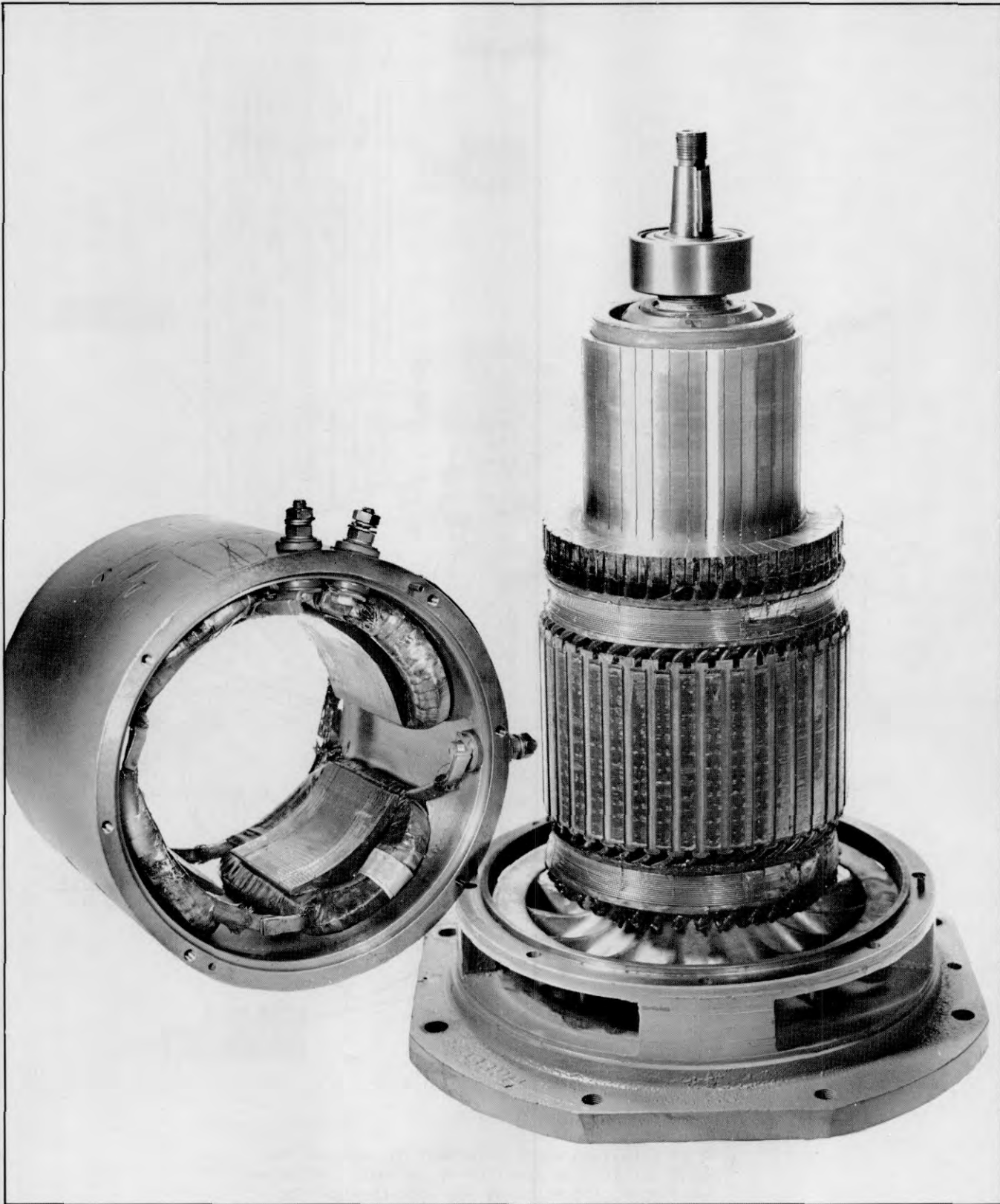


Plate 7562. Typical Drive Motor Assembly

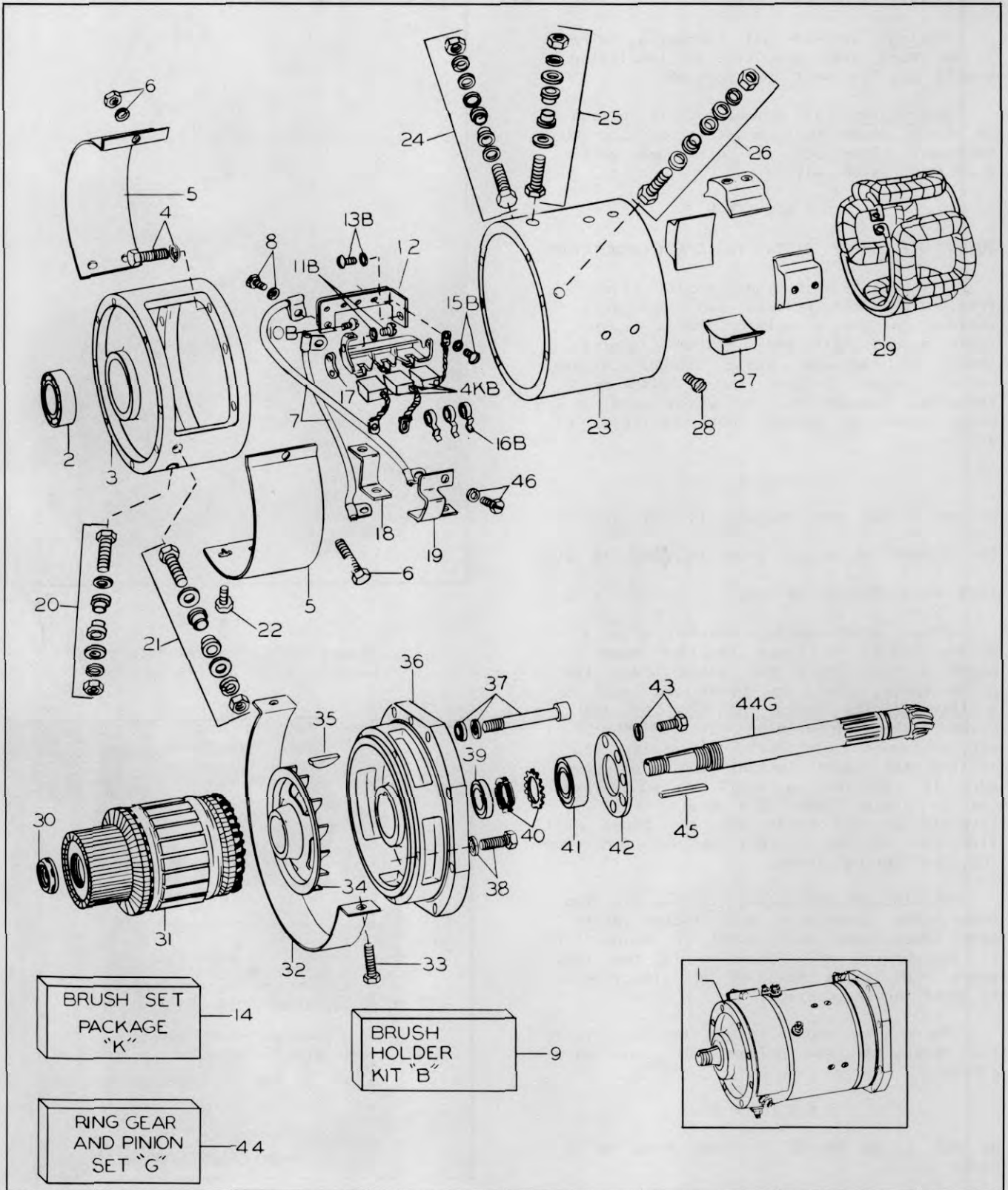


Plate 7565. Typical Drive Motor (Disassembled View)

MOTOR INSPECTION AND CHECKS

Wiring: Inspect all connecting wires to be sure they are secure. Insulation should not be worn or damaged.

Commutator: If commutator is glazed or dirty clean with a strip of No. 00 sandpaper. Blow out all dirt and grit with compressed air.

CAUTION

DO NOT USE EMERY CLOTH TO CLEAN COMMUTATOR.

Brushes: The brushes should slide freely in their holders and make full contact on the commutator. Worn brushes (worn beyond half the original length) should be replaced. Badly chipped, broken or oil soaked brushes should also be replaced. Brushes may be wiped with a dry clean cloth to remove loose particles of dirt.

NOTE

DO NOT CLEAN THE BRUSHES IN ANY KIND OF SOLVENT OR ALLOW THEM TO COME IN CONTACT WITH GREASE OR OIL.

Check brush spring tension with a spring scale. To check reaction type brush springs, hook the scale under the brush spring near the brush and pull on a line parallel with the side of the brush. Take the reading just as the spring leaves the brush. To assist in telling the exact instant that the pressure is relieved, a small strip of paper can be placed under the brush. Pull slightly on the paper and the paper will slip out at the correct instant for reading the spring scale.

If the brush spring tension is too great, the commutator and brushes will wear excessively and result in short life. If the brush spring tension is too low, there will be a loss of efficiency due to poor brush contact.

To change brush spring tension, twist the spring at the holder with long nose pliers.

CAUTION

DO NOT ALLOW SPRING TO SNAP DOWN ON A BRUSH.

Refer to Specifications for correct brush spring tension.

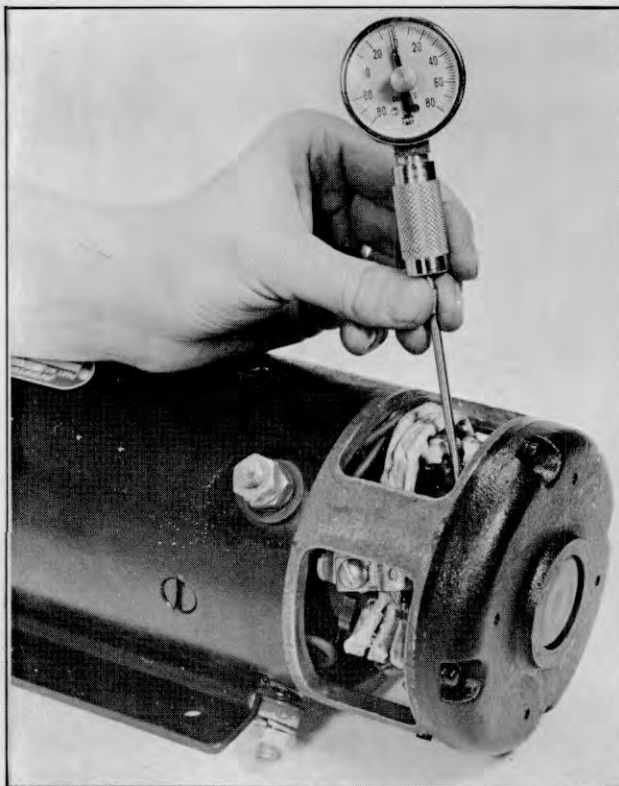


Plate 6560. Typical Method Checking Brush Spring Tension

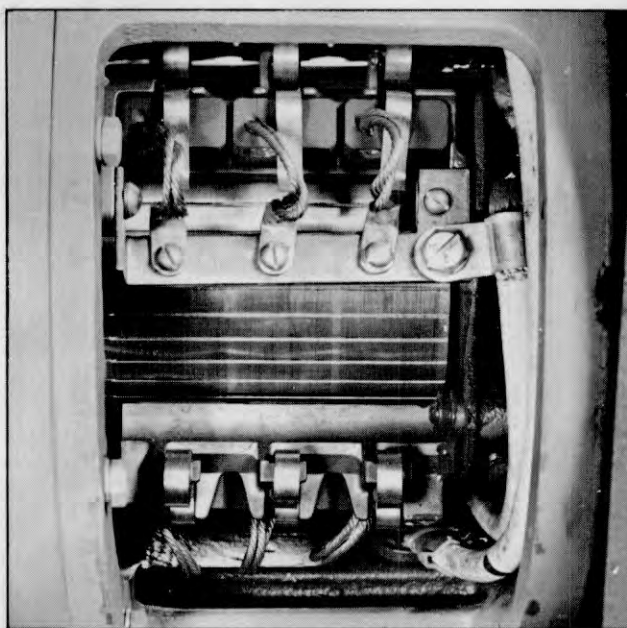


Plate 7564. Typical Motor Brushes

LUBRICATION AND PREVENTIVE MAINTENANCE

CLEAN AND REPACK AXLE ENDS

Every 1000 operating hours remove and repack the axle ends with NLGI #1 (Amolith grease #1 or its equivalent).

1. Tilt upright back. Place solid heavy blocks under each upright rail. Tilt upright forward until vertical to the floor. This should allow the drive wheels to clean the floor. Remove drive wheels.

2. Remove hub cap, cotter pin, washer, spindle nut and pull hub assembly from spindle.

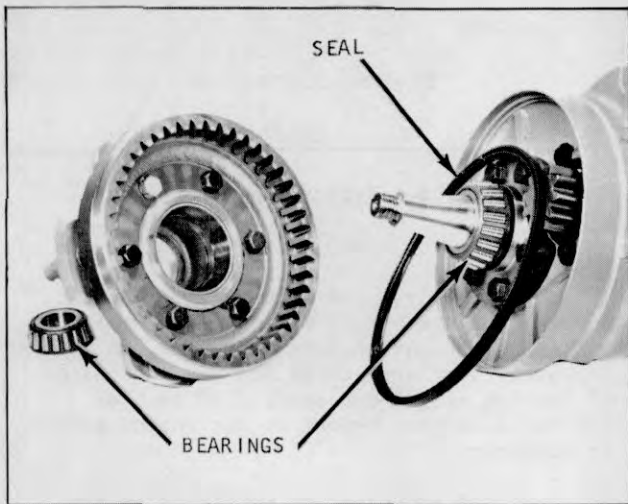


Plate 6892. Axle End Assembly

3. Remove bearings and clean in a Stoddard type cleaning solvent. Sloss bearings up and down in solvent. Remove and tap large side of bearing against a block of wood to dislodge solidified particles of lubricant. Repeat operation until bearings are thoroughly clean. Blow bearings dry with compressed air. Direct air stream across bearing to avoid spinning. Slowly rotate bearing by hand to facilitate drying. Dip bearings in gear oil and wrap in paper until they are to be reinstalled.

4. Clean ring gear, pinion drive shaft, hub assembly, spindle and spindle support.

5. Inspect seal for cuts, scratches and nicks. If is necessary to replace seal if such a condition is found.

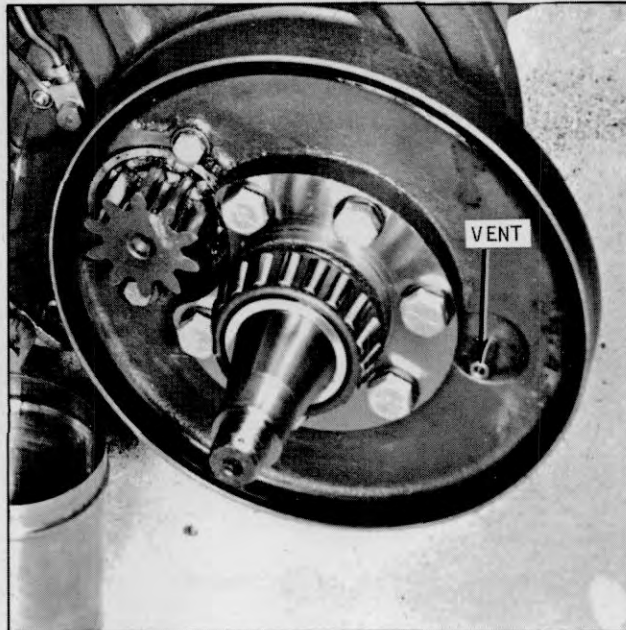


Plate 6893. Axle End Vent

6. Repack each axle end (bearings, spindle, ring gear and pinion) with one pound of NLGI #1 (Amolith grease #1 or its equivalent). Check the axle end vent for obstructions. the vent must be open.

7. Install bearings, seal and hub assembly.

8. Install washer, spindle nut and hub cap.

9. Tilt upright back and remove blocking.



INDUSTRIAL TRUCK DIVISION



WORK SAFELY

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WHEN ORDERING PARTS

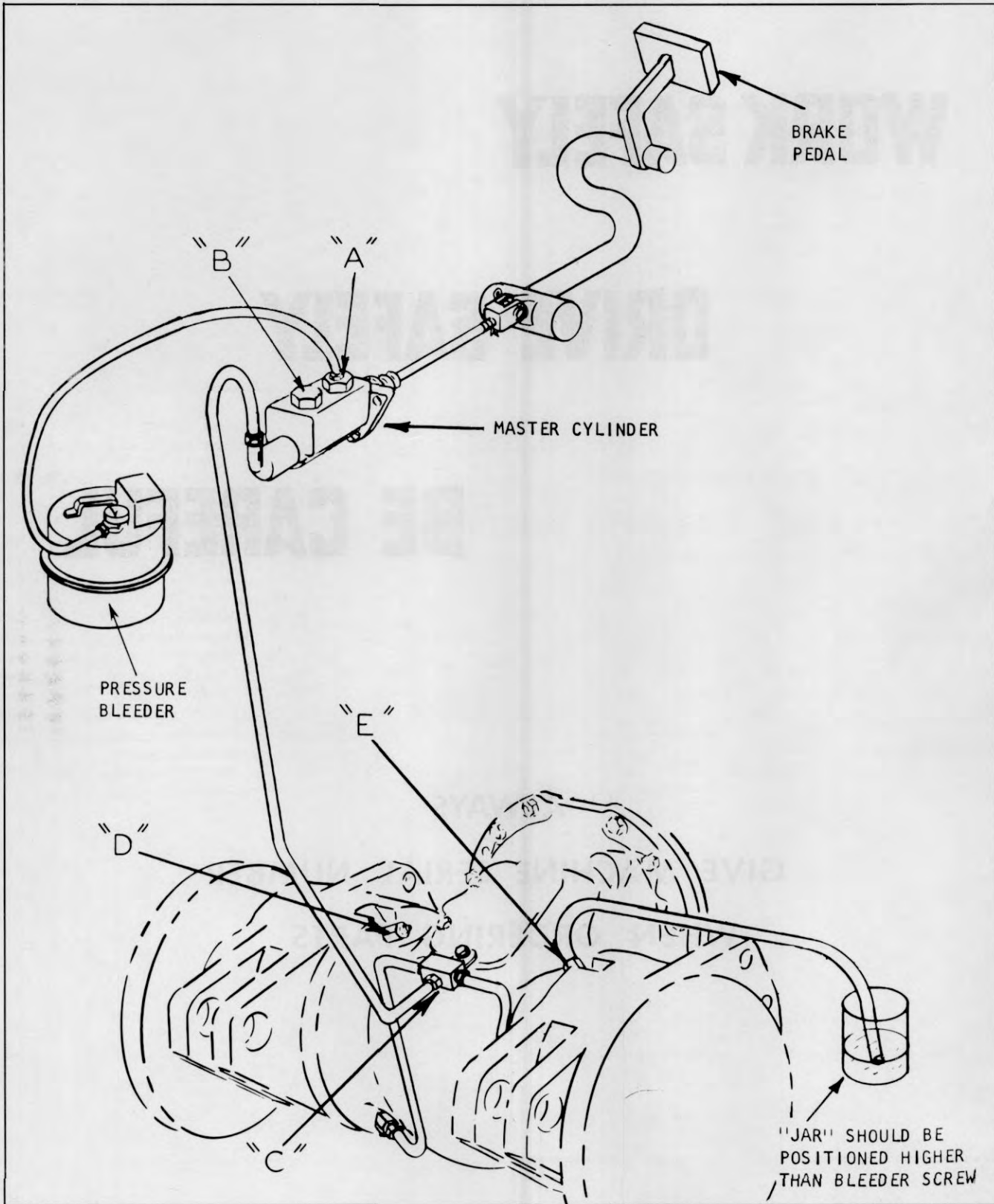


Plate 7566. Bleeding Brakes

BRAKE BLEEDING PROCEDURE

Proper operation of the hydraulic brake system requires a solid column of fluid without air bubbles at all points in the pressure system. Under certain conditions it becomes necessary to bleed fluid from the system in order to expel air bubbles which have become mixed with the fluid. The necessity of bleeding is indicated by a soft spongy pedal, or at any time a brake line is removed (or broken) the system must be bled.

Step 1. Tilt upright back. Place solid heavy blocks under each upright rail. Tilt upright forward until vertical to the floor. This should allow the drive wheels to clear the floor. If the bleeder screws are not accessible with the drive wheels on the machine, the wheels should be removed.

N O T E

MACHINES EQUIPPED WITH PNEUMATIC TIRES,
DEFLATE TIRES BEFORE REMOVING DRIVE WHEELS
FROM MACHINE.

Step 2. Check the brake pedal free travel (see Specifications). Clean dirt from around the vented filler cap of the master cylinder reservoir. Brake fluid should be within 1/4 of an inch from the top. With filler cap off the master cylinder, depress and release brake pedal. A small displacement of fluid should be noticed in the reservoir. If this happens, the brake pedal (upon being released) is returning the master cylinder piston to its normal position to open a cylinder port. This port must be open. If fluid does not return to the reservoir (when releasing brake pedal), this indicates improper pedal free travel and a pedal adjustment is required.

Step 3. To properly bleed the system it is recommended that a pressure bleeder filled with about two quarts of S.A.E. 70R-3 heavy duty brake fluid be connected to the master cylinder reservoir point "A". Pressure bleeder should then be pressurized to approximately 20 P.S.I.

Step 4. Loosen plug "B" to permit air to escape from reservoir. Tighten plug after oil appears around plug.

Step 5. Loosen tube nut "C" and allow all air to escape. Tighten tube nut.

Step 6. Install a bleeder hose on bleeder screw "D" and submerge the unattached end of the hose in a clean transparent jar containing several inches of brake fluid. NOTE: DURING BLEEDING OF THE WHEEL CYLINDERS, THE JAR SHOULD BE ELEVATED TO A POSITION HIGHER THAN THE BLEEDER SCREW MAKING SURE THAT THE END OF THE HOSE REMAINS SUBMERGED IN THE FLUID AT ALL TIMES. Loosen bleeder screw and slowly push brake pedal to the floorboard and hold pedal in this position until bleeder screw is retightened. Repeat this operation until all air bubbles disappear and clear fluid is being pumped into the jar.

Step 7. Install bleeder hose on the remaining bleeder screw "E" and proceed as in Step 6.

Step 8. After all bleeding has been completed close the pressure bleeder shut-off cock and loosen hose connection at master cylinder to allow pressure to escape. Replace master cylinder vented cap.

Step 9. If drive wheels were removed from the machine replace them. (Inflate tires if they are of the pneumatic type). Tilt upright back and remove blocking from under each upright rail.

If a pressure bleeder is unavailable, the system may be bled manually by following Steps 1, 2, 5, 6, 7 and 9. It must be remembered that the brake pedal should be depressed slowly and held to the floorboard until the line connections or bleeder screws are securely tightened. This prevents the possibility of air being drawn into the system during the bleeding operation. Check master cylinder reservoir level periodically during manual bleeding and fill to within 1/4 of an inch of the top as required.

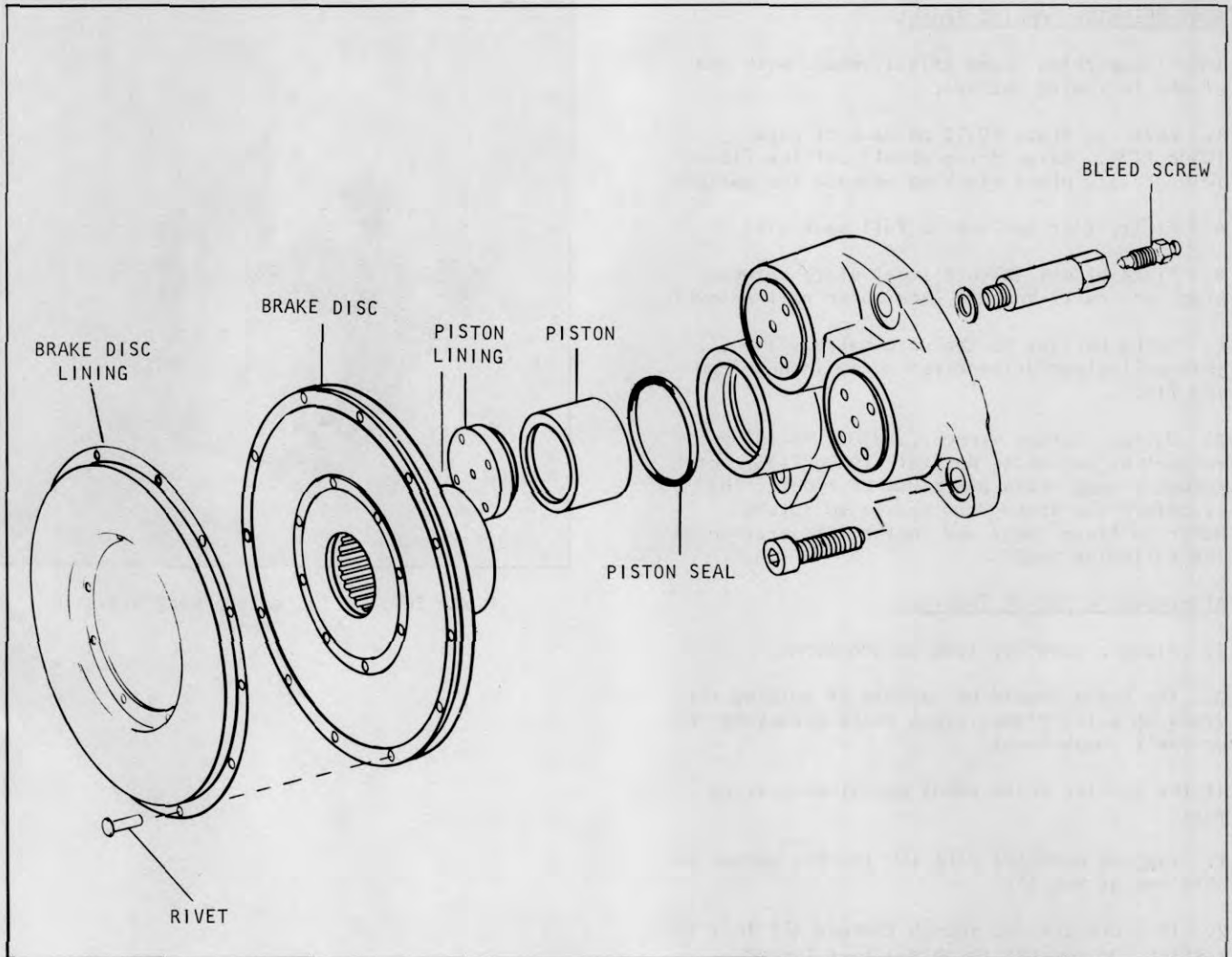


Plate 8261. Typical Wheel Brake Assembly

DESCRIPTION

When depressing the brake pedal, hydraulic pressure is applied to the brakes, the pistons move out and their linings force the brake disc and its lining against a member of the axle end producing braking action by friction.

INSPECTION

Operating conditions determine the inspection and service periods for the brake linings. If it is found that the brake effectiveness has dropped to a noticeable degree (and the system has been properly bled and pedal free travel is correctly adjusted) the axle ends should be removed so that linings may be inspected to determine their further serviceability.

The original thickness of the brake disc lining is 0.221 inch. The disc lining is effective until it is worn to 1/16 inch thickness. If after inspection it is found that the lining is worn to the extent that it will not be effective until the next inspection period, it should be replaced. The brake piston lining when new is 0.649 inch thick to the step on the lining. This lining should also be replaced if it is determined that it will be worn to within 1/16 inch of step before the next inspection period.

Before replacing axle ends, check the cylinders for leakage. The actual presence of fluid, other than mere dampness, indicates a fluid leak. Correct leaks as necessary by replacing the piston seals after cleaning the pistons and seal grooves thoroughly.

SEAT OPERATED PARKING BRAKE:

Test the parking brake effectiveness with one of the following methods:

1. Refer to Plate 10317 on back of page 1000H 1173. Raise drive wheels off the floor. To do this...place blocking beneath the upright.
 - A. First, tilt upright to full back tilt.
 - B. Place blocks (with a steel plate between block and rail) beneath each outer rail assembly.
 - C. Bring upright to the vertical position... this will clear drive tires a few inches from the floor.
2. Using a torque wrench...adjust 'holding torque' by adjusting Nut (A) (1000H 1173) until torque wrench reads a minimum of 150 ft. lbs. ...before the brake drum starts to rotate. Refer to Plate 10637 and to the illustration on the following page.

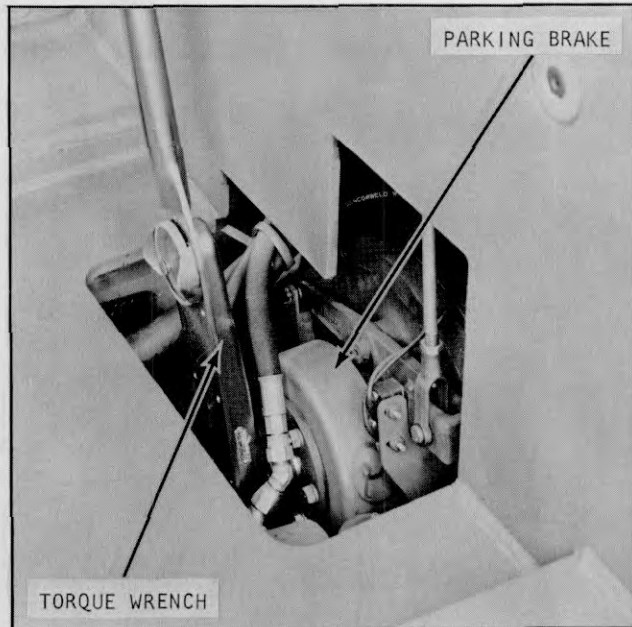


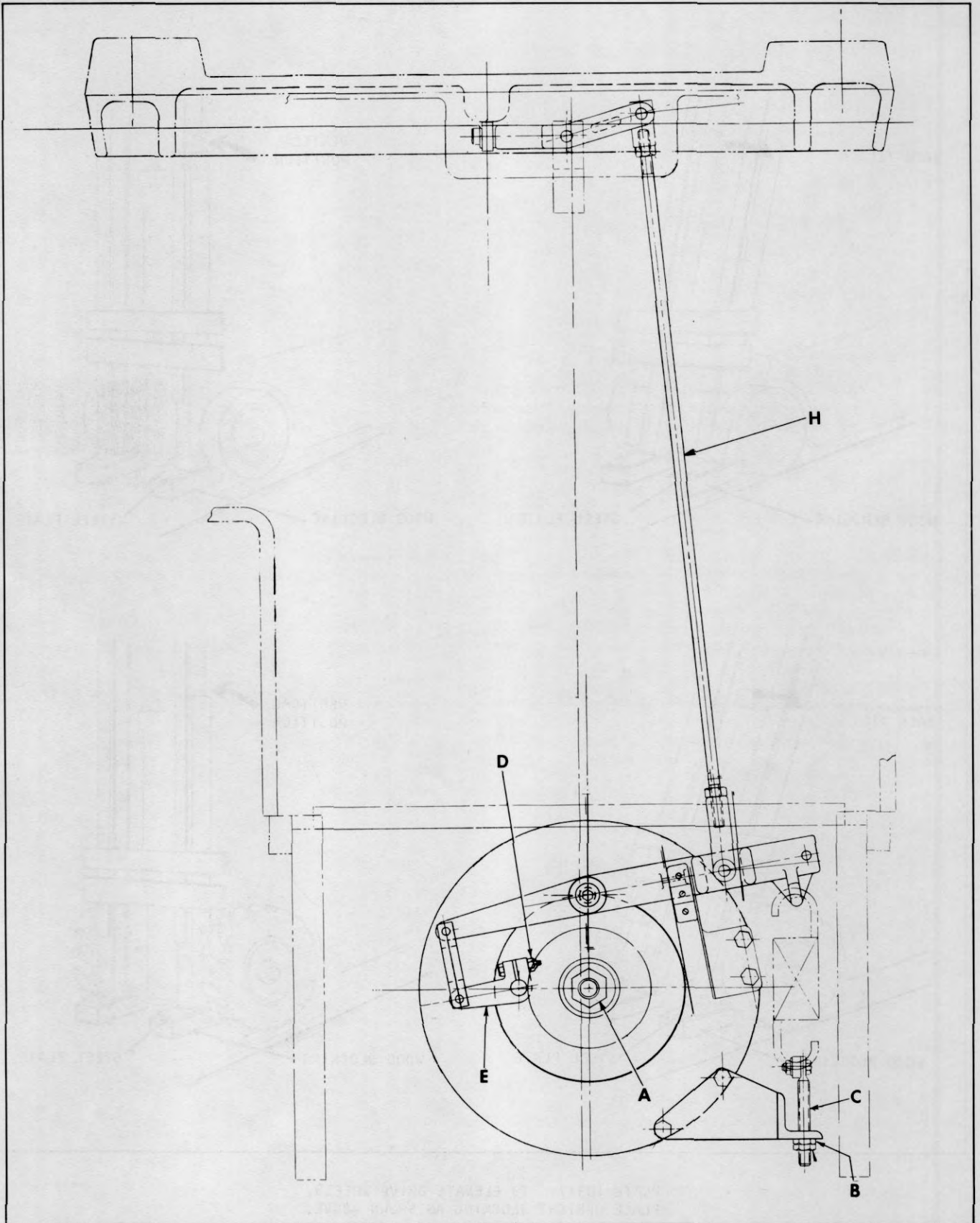
Plate 10637. Typical Parking Brake Adjustment

Alternate Method of Testing:

1. Place a capacity load on the forks.
2. The brake should be capable of holding the truck on a 15% grade...test while occupying the driver's compartment.

If the parking brake needs adjustment...you must:

1. Tighten Nuts (B) till 150 lb. ft. torque is obtained at Nut (A).
2. If there are not enough threads (C) left to tighten the springs to obtain this torque... loosen Nuts (B), loosen Nut (D), move Arm (E) counterclockwise 1 or 2 deg. Tighten Nut (D) and retighten Nuts (B) to obtain necessary torque.



TO ELEVATE DRIVE WHEELS

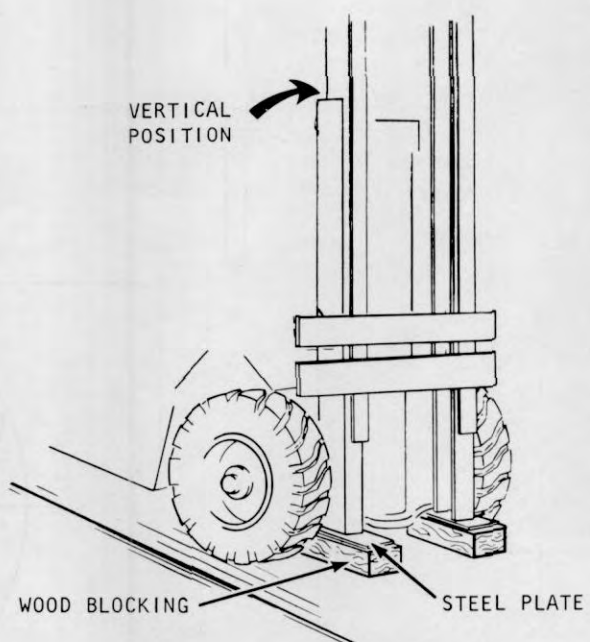
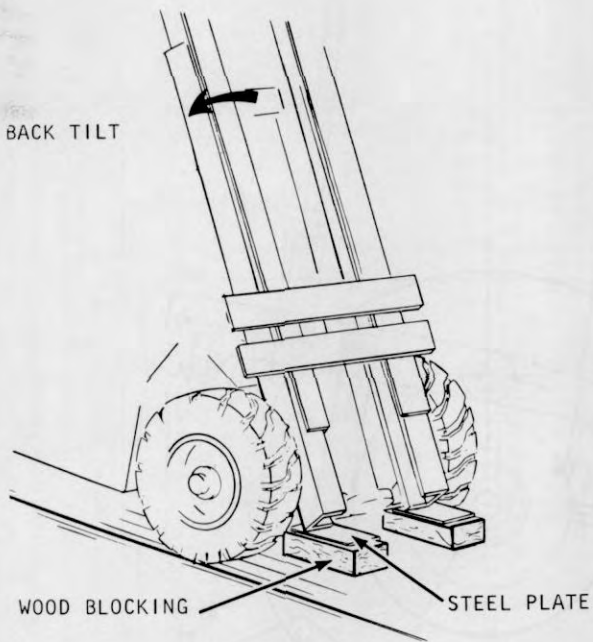
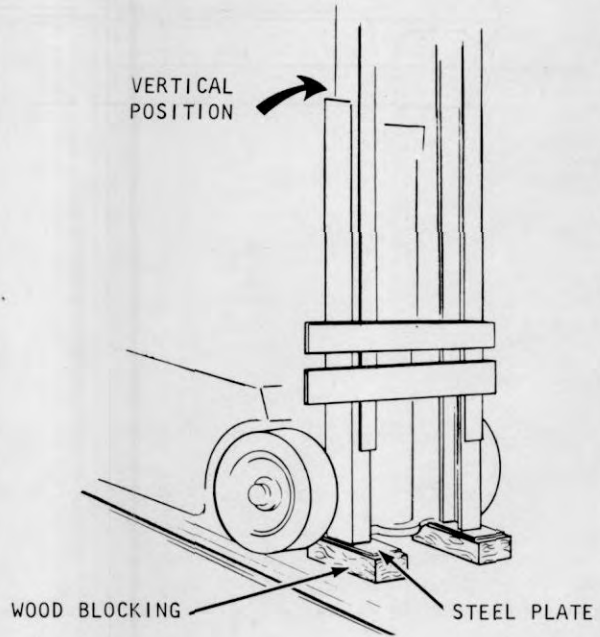
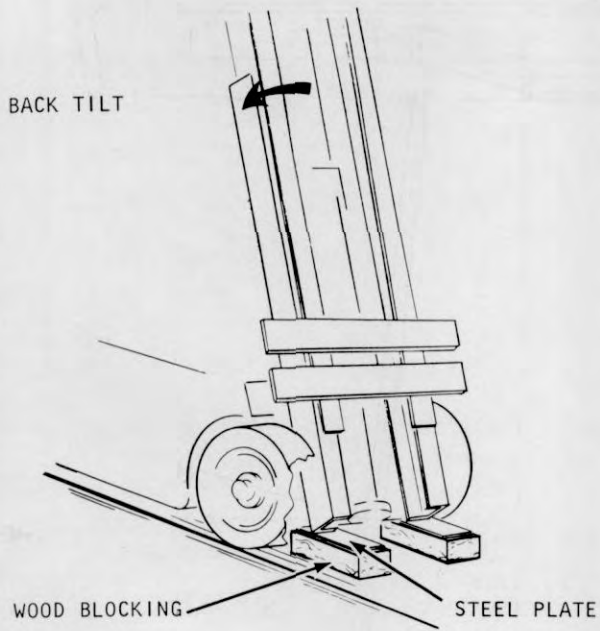


PLATE 10317. TO ELEVATE DRIVE WHEELS,
PLACE UPRIGHT BLOCKING AS SHOWN ABOVE.

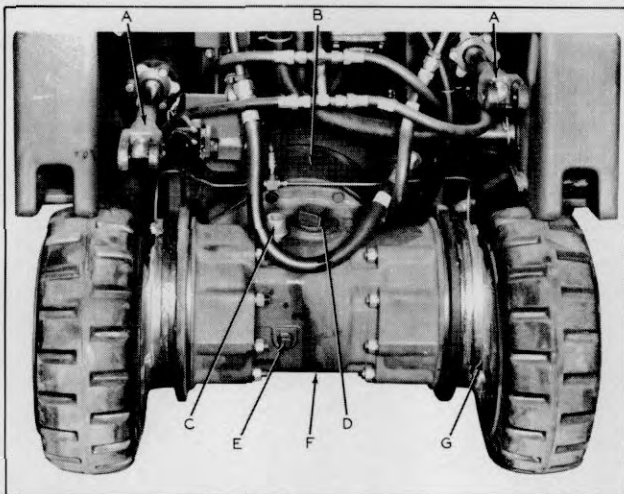


Plate 5988. Typical Axle Adaptor

AXLE ADAPTOR...DRAIN AND REFILL:

Drain and refill every 1000 operating hours at operating temperature. Remove drain plug from bottom of adaptor allowing old fluid to completely drain. Replace drain plug.

Clean dirt from level plug and remove. Fill with the recommended fluid until fluid reaches the plug opening. Do not overfill as the excess quantity will serve no useful purpose. If the level is too high it will cause excessive churning, high fluid temperature and possible leakage.

Use Type "A", Suffix "A", Automatic Transmission Fluid (fluid containers must display a qualification number prefixed by "AQ-ATF"...Clark Part Number 879803) or Dexron Automatic Transmission Fluid in all vehicles.

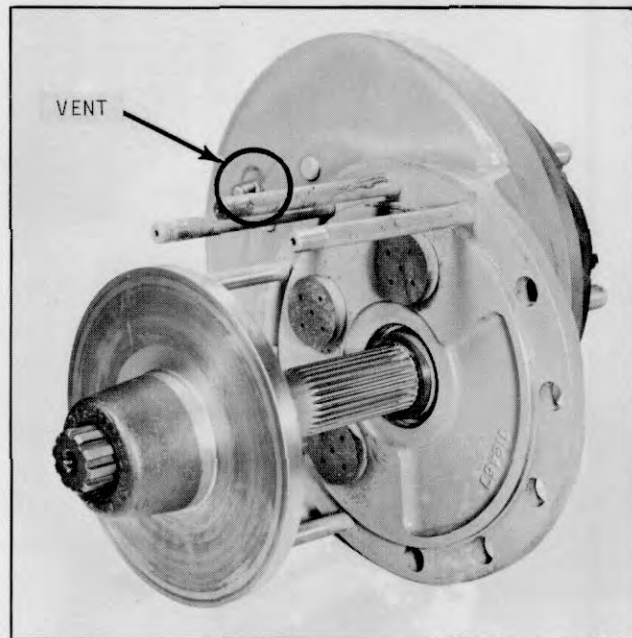


Plate 7550. Typical Axle End Vent

AXLE ADAPTOR (C) AND AXLE END VENTS:

Inspect vents to be sure they are free of obstructions. If a vent is not open, remove and clean in a Stoddard type cleaning solvent. Be sure vent is completely dry before replacing on axle.

INDUSTRIAL TRUCK DIVISION

EXHAUSTION AND PROTECTIVE EQUIPMENT

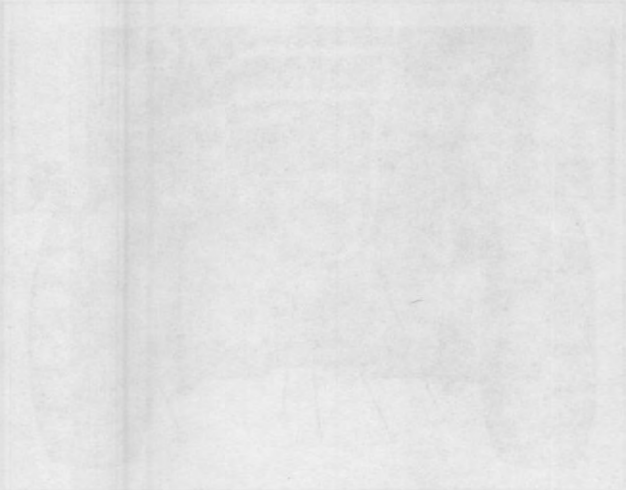
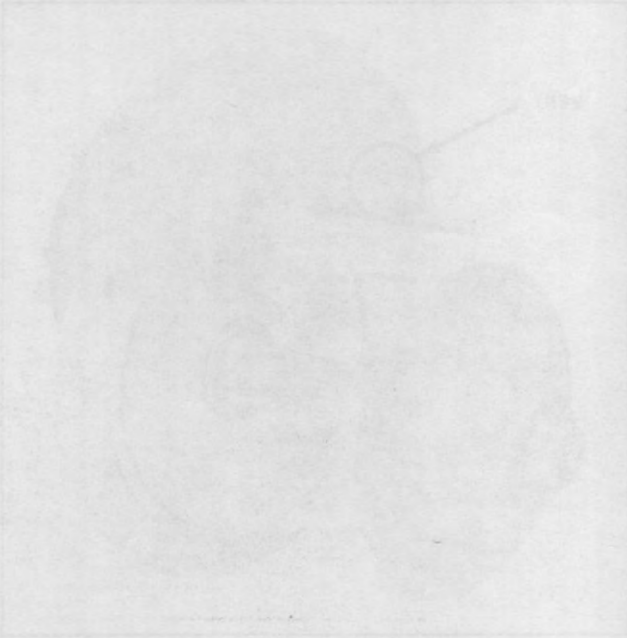


Figure 1: Exhaust System

EXHAUST SYSTEM

The exhaust system is designed to remove exhaust gases from the engine compartment and discharge them to the rear of the vehicle. It consists of a manifold, a catalytic converter, and a muffler. The system is designed to meet the requirements of the Federal Motor Vehicle Safety Standards (FMVSS) 125 and 126.

Figure 2: Protective Equipment

The protective equipment is designed to protect the operator from the heat and noise of the engine. It consists of a hood and a shield. The hood is designed to protect the operator's face and neck, while the shield is designed to protect the operator's torso. The equipment is designed to meet the requirements of the Federal Motor Vehicle Safety Standards (FMVSS) 127 and 128.

The hood and shield are made of a lightweight, heat-resistant material. The hood is attached to the engine compartment by a hinge, and the shield is attached to the front of the engine compartment by a hinge. The hood and shield are designed to be easily opened and closed by the operator.

The hood and shield are designed to meet the requirements of the Federal Motor Vehicle Safety Standards (FMVSS) 127 and 128. The hood is designed to withstand a minimum impact of 100 ft-lb, and the shield is designed to withstand a minimum impact of 50 ft-lb. The hood and shield are also designed to be resistant to heat and noise.

CHECK MAIN HYDRAULIC SYSTEM PRESSURE AT THE HYDRAULIC PUMP:

The hydraulic relief valve setting may be checked with a Mico Quadrigage (Clark Part No. 1800106) or, by installing a conventional pressure gauge with a 0-4000 PSI scale...at the discharge (pressure) line of the hydraulic pump.

1. Connect the pressure line from the gauge to the test port of the pump or valve by removing plug from test port, (Plate 10627).

2. Apply parking brake. Start engine and operate at governed rpm. Hold tilt lever back until the pressure builds up and moves the pressure relief valve off its seat...avoid holding the tilt lever longer than is necessary to check pressure reading on gauge...take reading...release accelerator and tilt lever.

3. The pressure reading will indicate the setting of the relief valve. If reading taken is not reasonably close to those listed in specifications, appropriate repairs should be made. Report to designated person in authority.

CHECK MAIN HYDRAULIC SYSTEM PRESSURE WITH A CIRCUIT TESTER.

If a Schroeder Hydraulic Circuit Tester (Clark Part No. 1800060) is available, the hydraulic relief valve setting and the rate of flow being delivered by the hydraulic pump may be checked as follows:

1. Connect the pressure line from the tester to the test port at the hydraulic pump. Remove sump tank breather and insert the return line from the tester into the sump tank.

2. Apply parking brake. Start engine and operate at governed rpm. Hold tilt lever back while gradually closing the load valve until pressure reaches 1500 psi. Continue to hold the tilt lever until hydraulic fluid reaches test temperatures (120 degrees F.). With the hydraulic fluid at this temperature, make a note of the flow reading so it may be compared with the rate of flow found in the following step.

3. With engine operating at governed rpm, hold tilt lever in back position and continue to close the load valve until the pressure no longer increases on the gauge. (Close the load valve ONLY ENOUGH to reach the peak pressure reading and avoid holding the lever longer than necessary to check rate of flow and pressure.)

The pressure reading will indicate the setting of the relief valve. The flow reading should be compared with the flow register at 1500 psi. If the pump or valve is worn, flow

will drop off appreciably as pressure is increased. This is due to internal oil slip-page in the components.

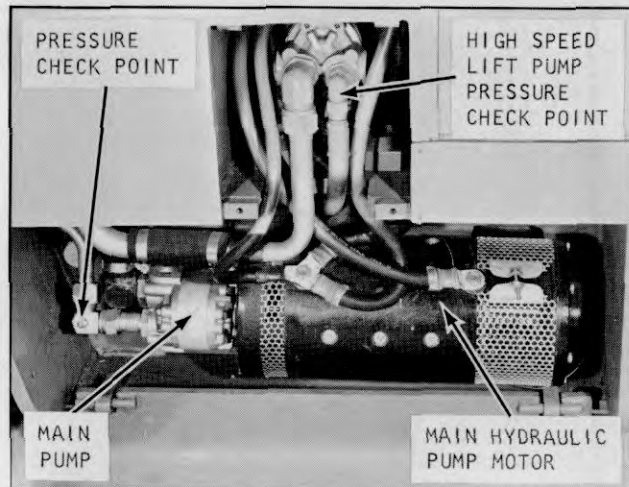


Plate 10627. Typical Hydraulic Pressure Check

N O T E

Severly vibrating gauges are often an indication of entrapped air...check for suction line leaks.

If readings taken are not reasonably close to those listed in specifications, appropriate repairs should be made. Report to designated person in authority.

INDUSTRIAL TRUCK DIVISION

OPERATION AND MAINTENANCE MANUAL

Will drop off automatically as pressure is increased. This is due to internal oil film pressure in the component.

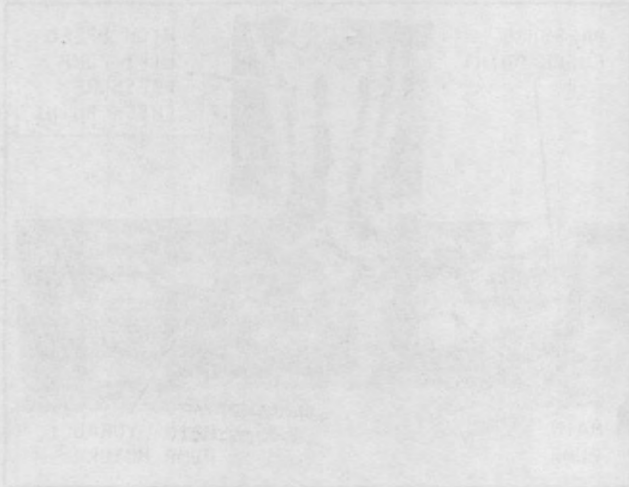


Figure 10-27. Typical Hydraulic Pressure Check

Leaking hydraulic hoses are often an indicator of an impending failure. Check for section line leakage.

If leakage occurs, do not attempt to repair. Close to those listed in the manual. Report to the manufacturer for repair. Report to the manufacturer for repair.

TESTING THE SYSTEM

The 1.5 cubic feet of water containing the oil should be used for testing. The test should be performed with a 1000 PSI gauge. The test should be performed with a 1000 PSI gauge. The test should be performed with a 1000 PSI gauge.

1. Connect the pressure line from the gauge to the test point of the pump or valve. The test should be performed with a 1000 PSI gauge. The test should be performed with a 1000 PSI gauge.

2. The pressure reading will indicate the status of the relief valve. If the pressure reading is below the set point, the relief valve is not functioning properly. The test should be performed with a 1000 PSI gauge.

TESTING THE SYSTEM WITH A TEST VALVE

1. Connect the test valve to the hydraulic system. The test should be performed with a 1000 PSI gauge. The test should be performed with a 1000 PSI gauge.

2. Connect the test valve to the hydraulic system. The test should be performed with a 1000 PSI gauge. The test should be performed with a 1000 PSI gauge.

3. Connect the test valve to the hydraulic system. The test should be performed with a 1000 PSI gauge. The test should be performed with a 1000 PSI gauge.

4. With engine operating at governed speed, the test valve should be closed. The test should be performed with a 1000 PSI gauge. The test should be performed with a 1000 PSI gauge.

The test valve reading will indicate the status of the relief valve. The test should be performed with a 1000 PSI gauge. The test should be performed with a 1000 PSI gauge.

STEERING SYSTEM PRESSURE CHECK:

The hydraulic relief valve setting may be checked with a Mico Quadrigage (Clark Part No. 1800106) or, by installing a conventional pressure gauge with a 0-3000 PSI scale....in the pressure line of the steer pump.

1. Connect the pressure line from the gauge by connecting a "T" fitting in the pressure line.
2. Place blocking between axle and axle stop so that when the wheels are turned, the pressure relief valve will move off its seat when pressure builds up.
3. Apply parking brake. Start engine and run at governed rpm. Rotate hand wheel all the way in one direction and hold....avoid holding the hand wheel (axle against stop) longer than is necessary to check pressure reading on gaugetake reading....release hand wheel and accelerator.
4. The pressure reading will indicate the setting of the relief valve. If reading taken is not reasonably close to those listed in specifications, appropriate repairs should be made. Report to designated person in authority.

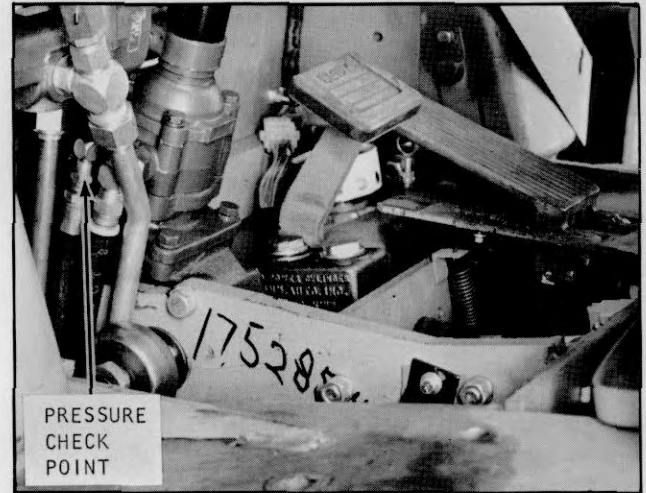


Plate 10628. Typical
Steering Pressure Check



INDUSTRIAL TRUCK DIVISION



LUBRICATION AND PREVENTIVE MAINTENANCE



Steering Pressure Check
Three-Port, Top-Off

STEERING SYSTEM PRESSURE CHECK:

The hydraulic oil at drive axles may be checked with a "D" gauge (Clark No. 1000) or, by installing a conventional pressure gauge with a 0-1000 PSI scale in the pressure line of the steel pump.

1. Connect the pressure line from the pump to a "T" fitting in the pressure line.

2. Place blocking between axle and axle shoe so that when the wheels are turned, the pressure relief valve will close off the steel pump pressure build up.

3. Apply parking brake, start engine and turn on governor valve. Rotate hand wheel all the way in one direction and hold... read holding line hand wheel, take against wheel, then... release to check pressure reading on gauge... take reading... release hand wheel and... accurate.

4. The pressure reading will indicate the setting of the relief valve. If reading taken is not reasonably close to those listed in... specifications, adjustment should be made... person in authority.

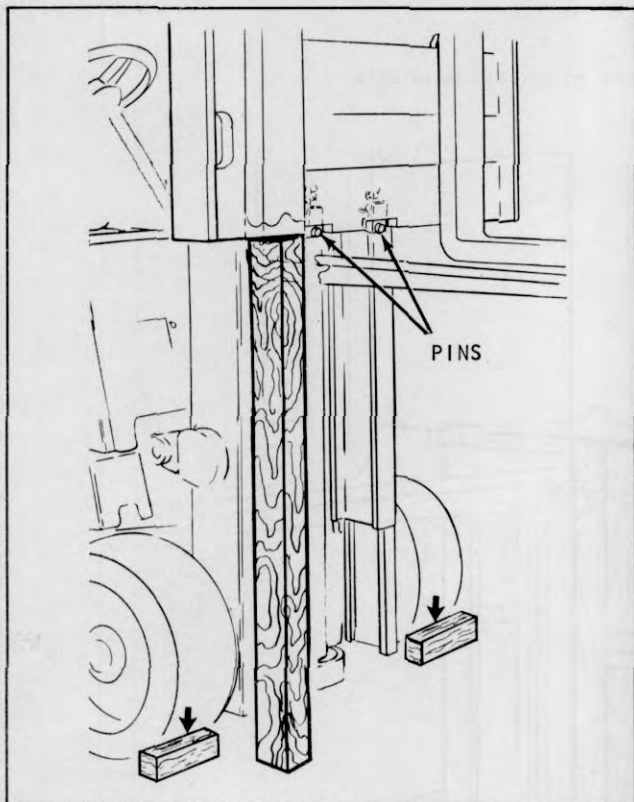


Plate 9593 Carriage Pin Replacement

Step 2. Remove anchor pins and replace with 3/8" x 2" bolts. FOR SAFETY REASONS, REMOVE ONLY ONE PIN AT A TIME. This will make pin removal easier when carriage is lowered.

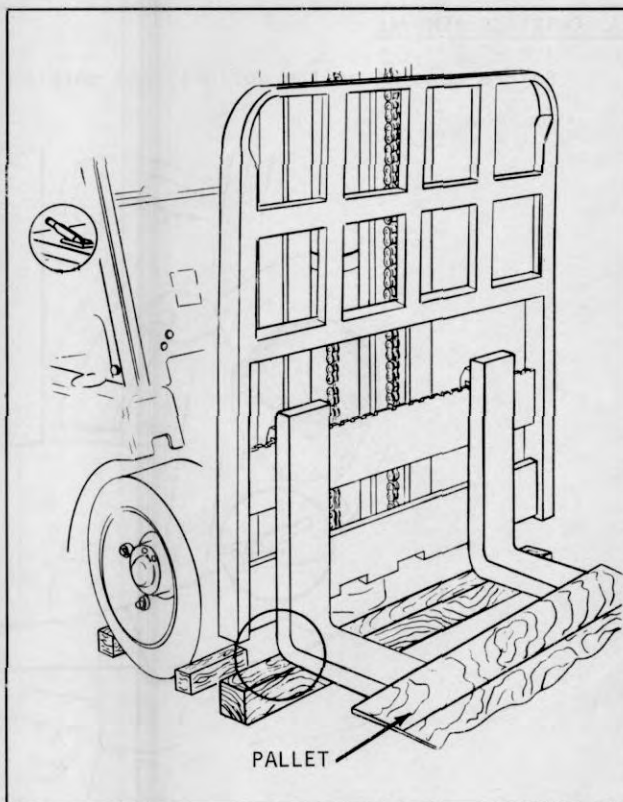


Plate 9560 Fork and Carriage Blocking

Step 3. Raise carriage off beam. Place beam on floor so, when lowered, the heel of the fork will rest on it as shown.

Step 4. Tilt upright full forward.

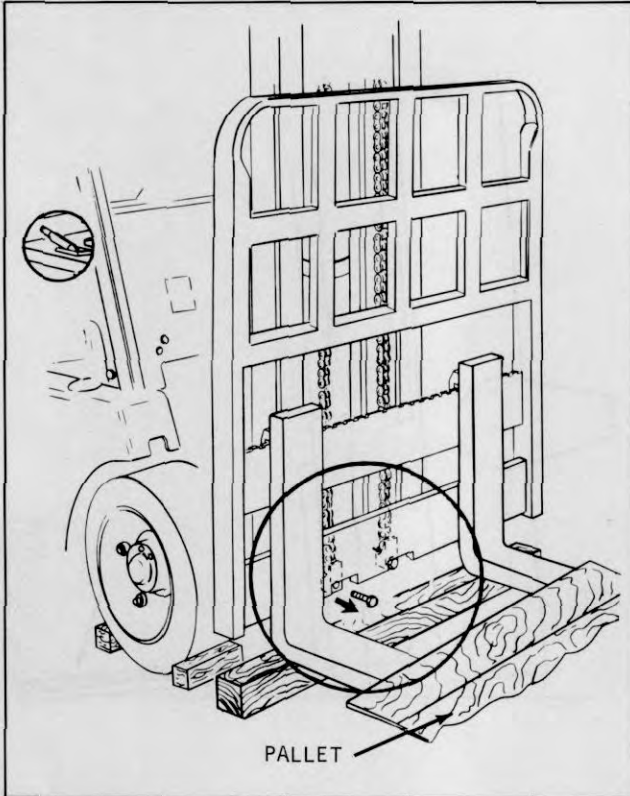


Plate 9561 Removing Bolts

Step 5. Remove 3/8" x 2" bolts. Place pallet on fork ends.

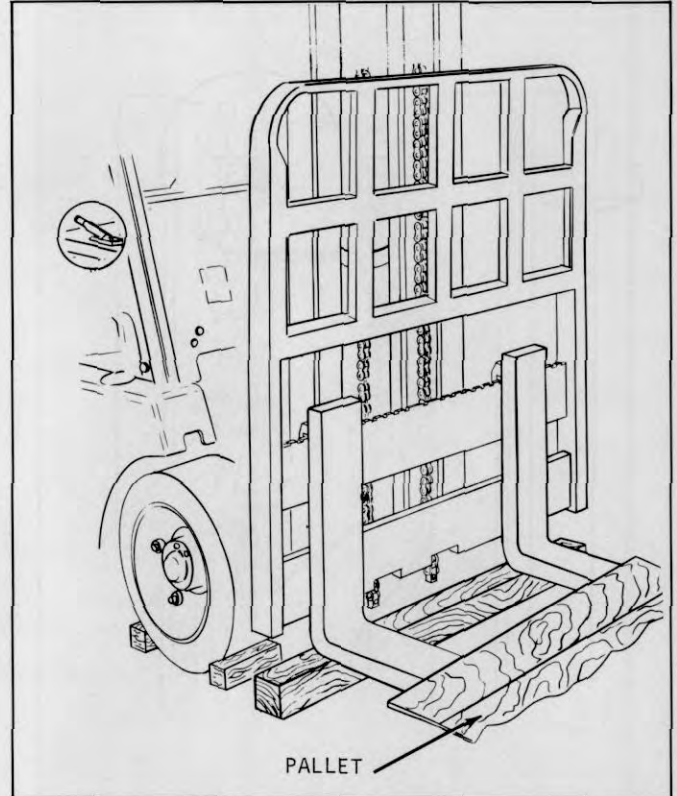


Plate 9562 Removing Chains From Anchors

Step 6. Pull chains out of carriage anchor brackets.

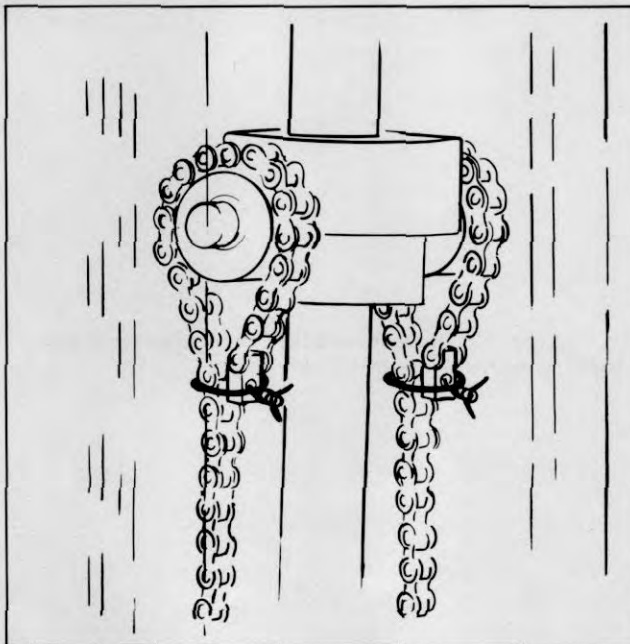


Plate 9563 Securing Chains (Typical)

Step 7. Wire chains around chain sheaves as shown

NOTE

Use the same method on all cylinders.

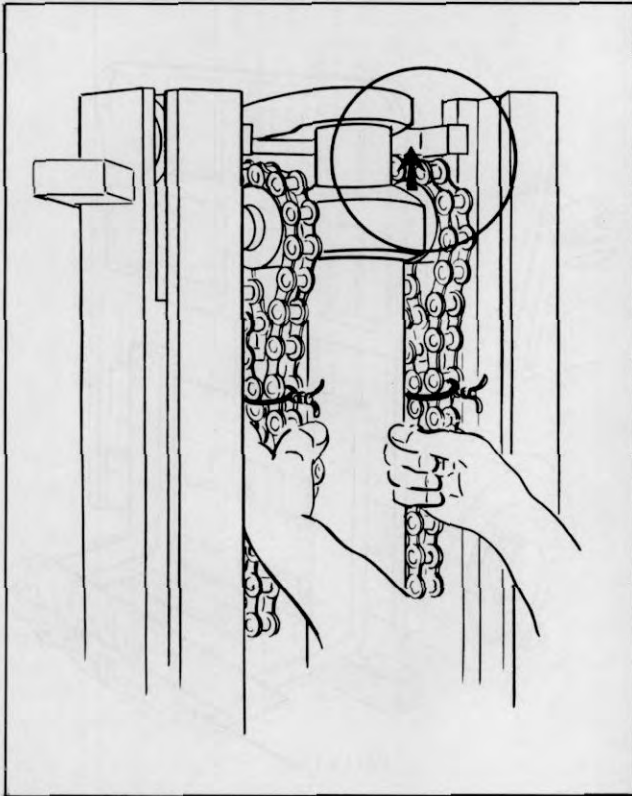


Plate 9564 Guiding Piston Head

Step 8. Guiding piston head with hands on chains raise piston to full up position.

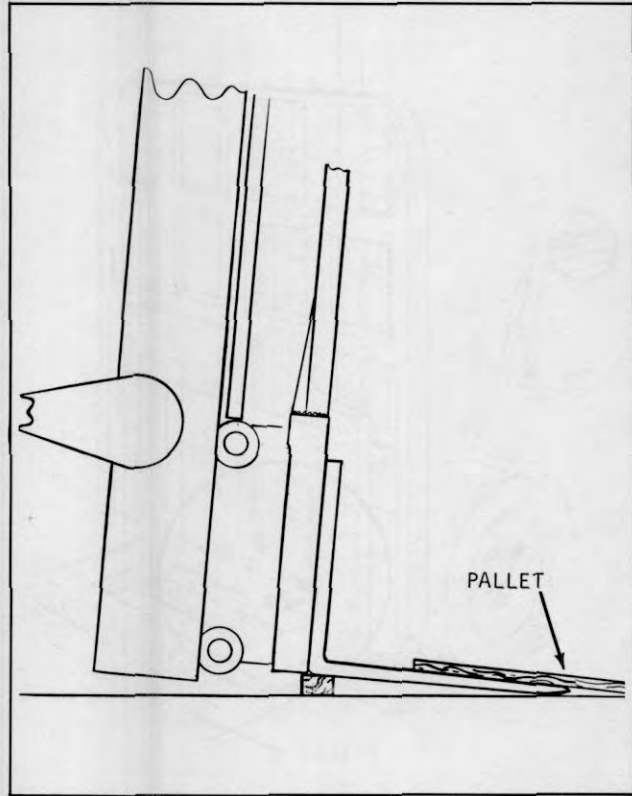


Plate 9565 Inner Rail Clearing Carriage Rollers

Step 9. Raise inner rail so it just clears upper carriage rollers. Leave upright at full forward tilt.

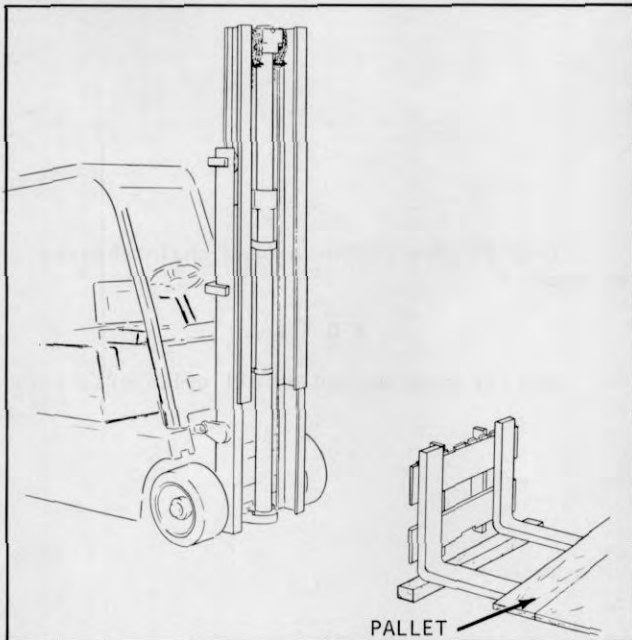


Plate 9566 Backing Machine Away From Carriage

Step 10. Remove blocks and release brake. Back machine away from carriage.

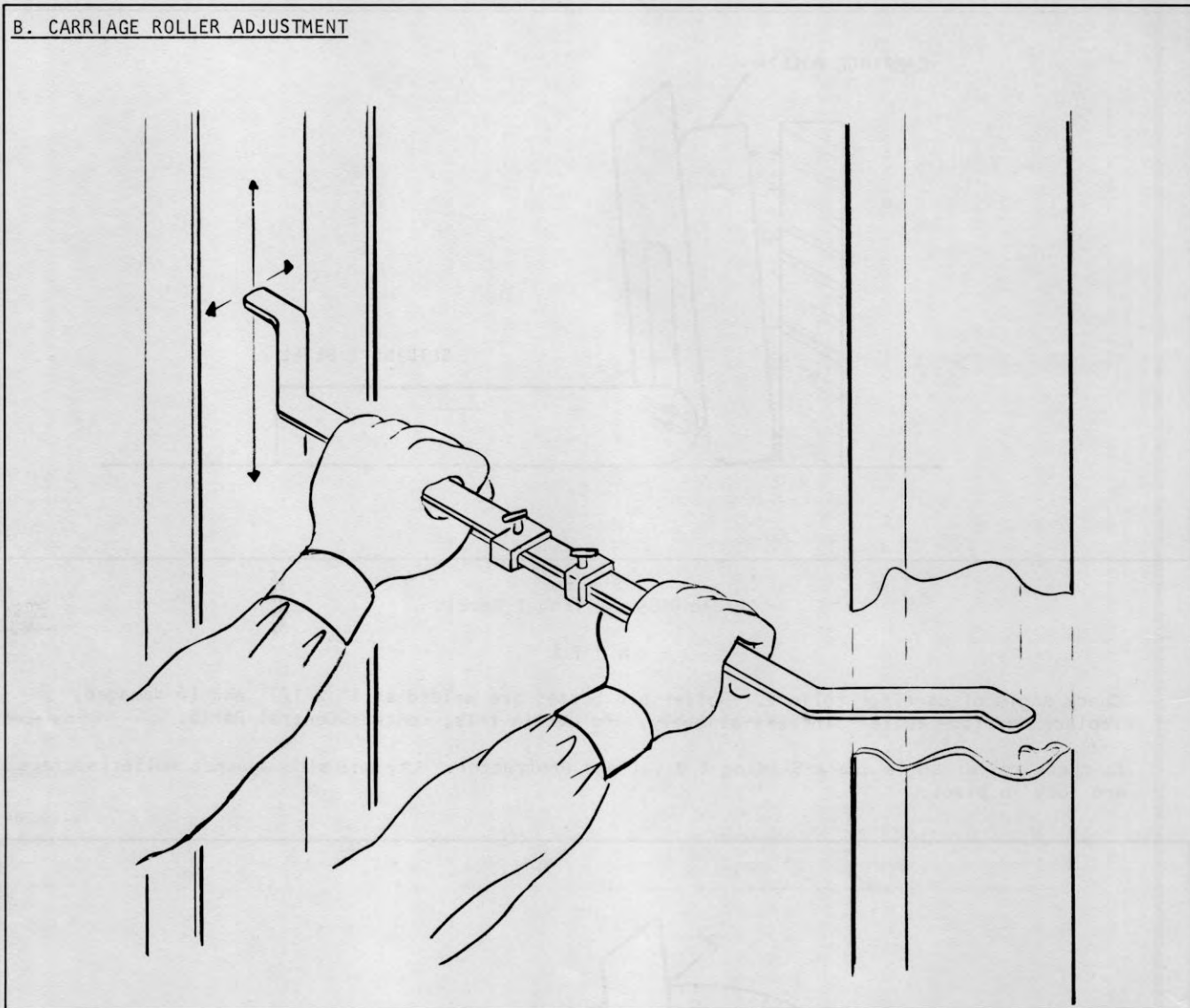
B. CARRIAGE ROLLER ADJUSTMENT

Plate 9567 Spanning Inner Rail

Step 1. Span inner rail with inside spanning tool to find the smallest distance between the rails. Lock tool in position.

NOTE**FOR SIX ROLLER CARRIAGE ONLY**

After finding the smallest distance between rails, place a shim between the spanning tool and the inner rail, then lock spanning tool in position.

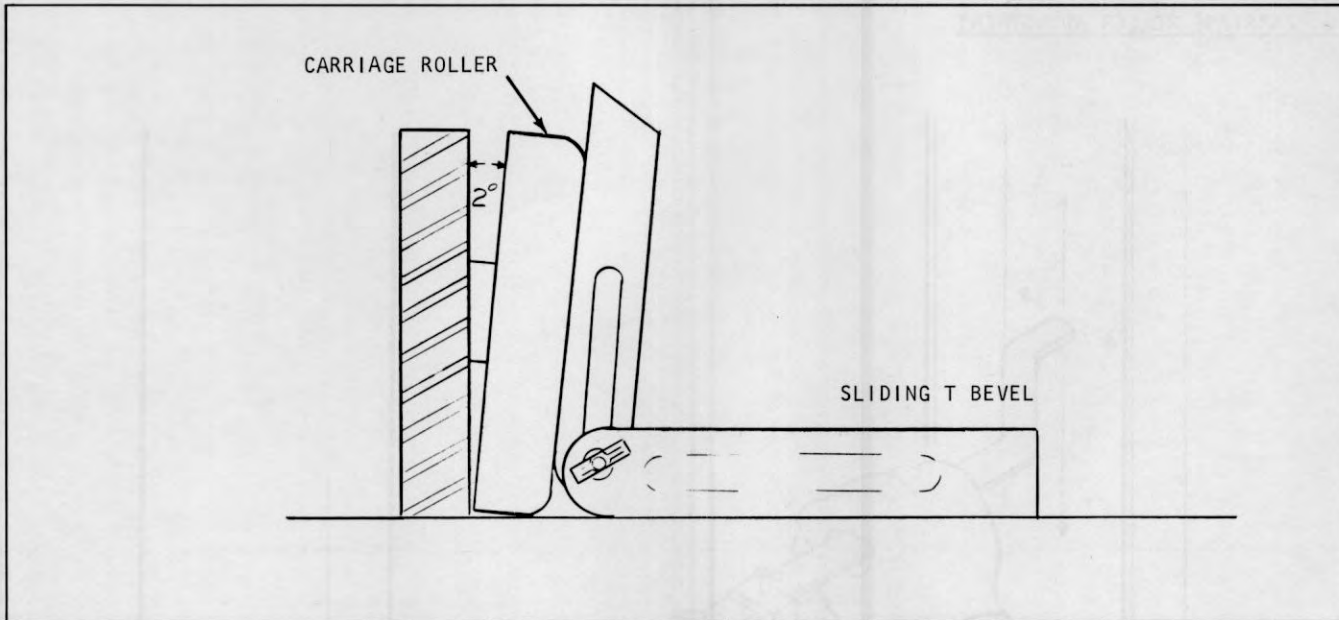


Plate 9589 Setting T Bevel

N O T E

Check angle of carriage rollers. Roller pin bosses are welded at $2^{\circ} \pm 1/2^{\circ}$ and if damaged, replace carriage roller pin boss assembly. To obtain this, contact Central Parts.

To check roller angle use a Sliding T Bevel and Protractor. Lay one side against roller surface and lock in place.

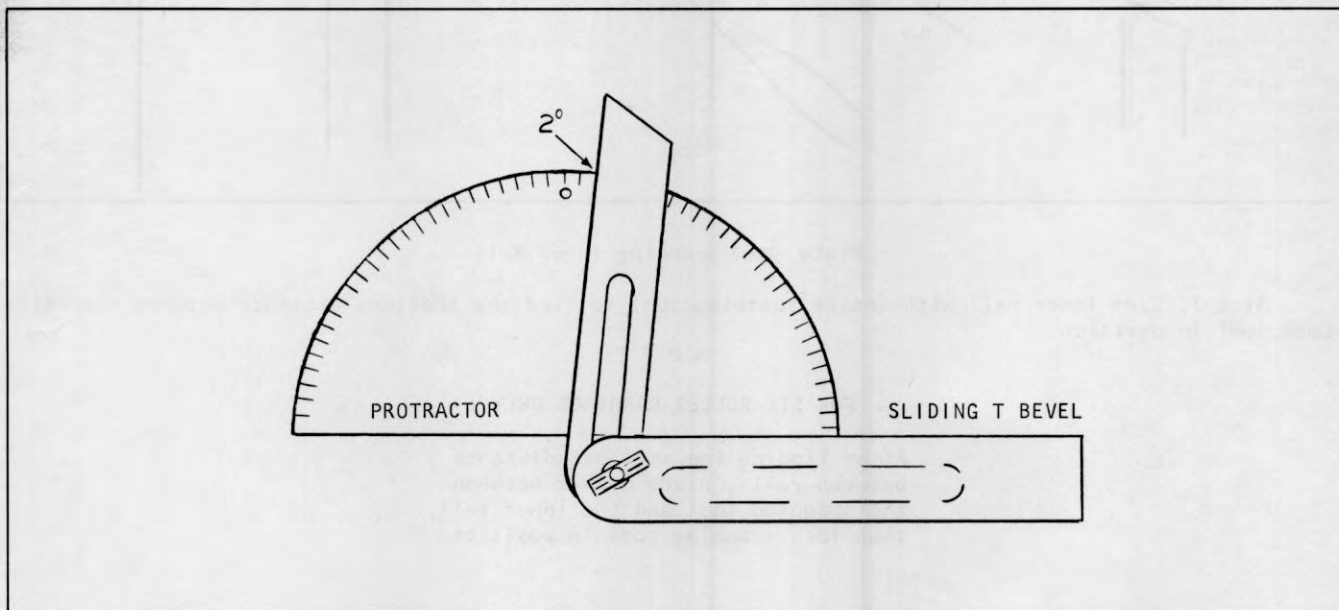


Plate 9590 Checking Roller Angle

Determine degree of angle by placing Protractor on Sliding T Bevel.

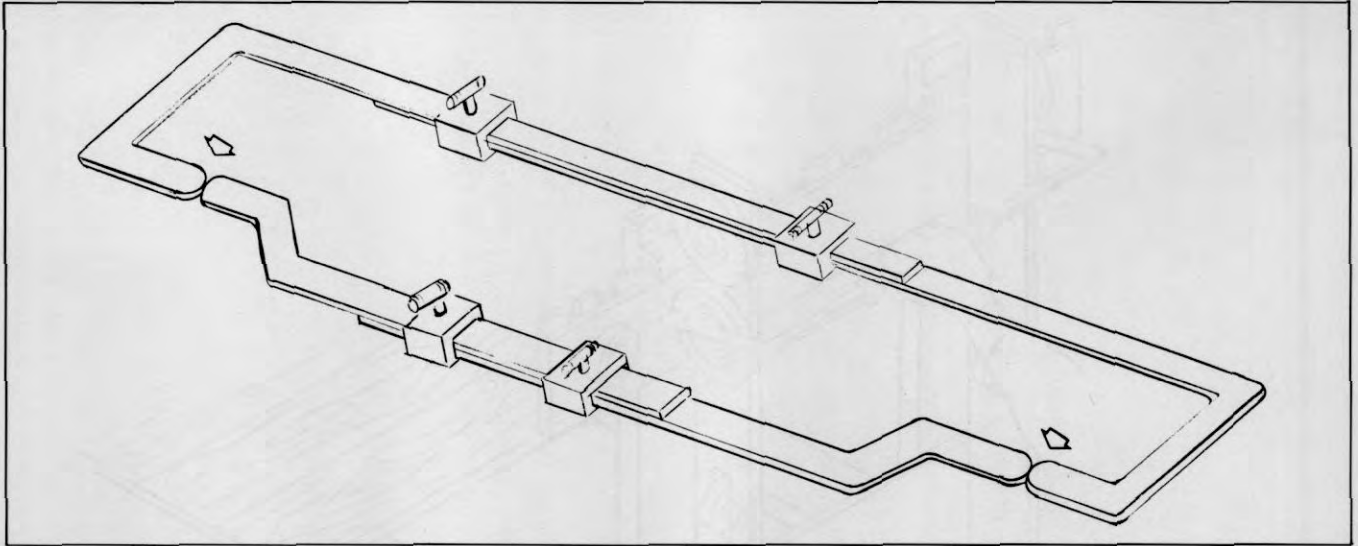


Plate 9568 Setting Outside Spanning Tool

Step 2. Set outside spanning tool to match inside spanning tool. Lock tool in position.

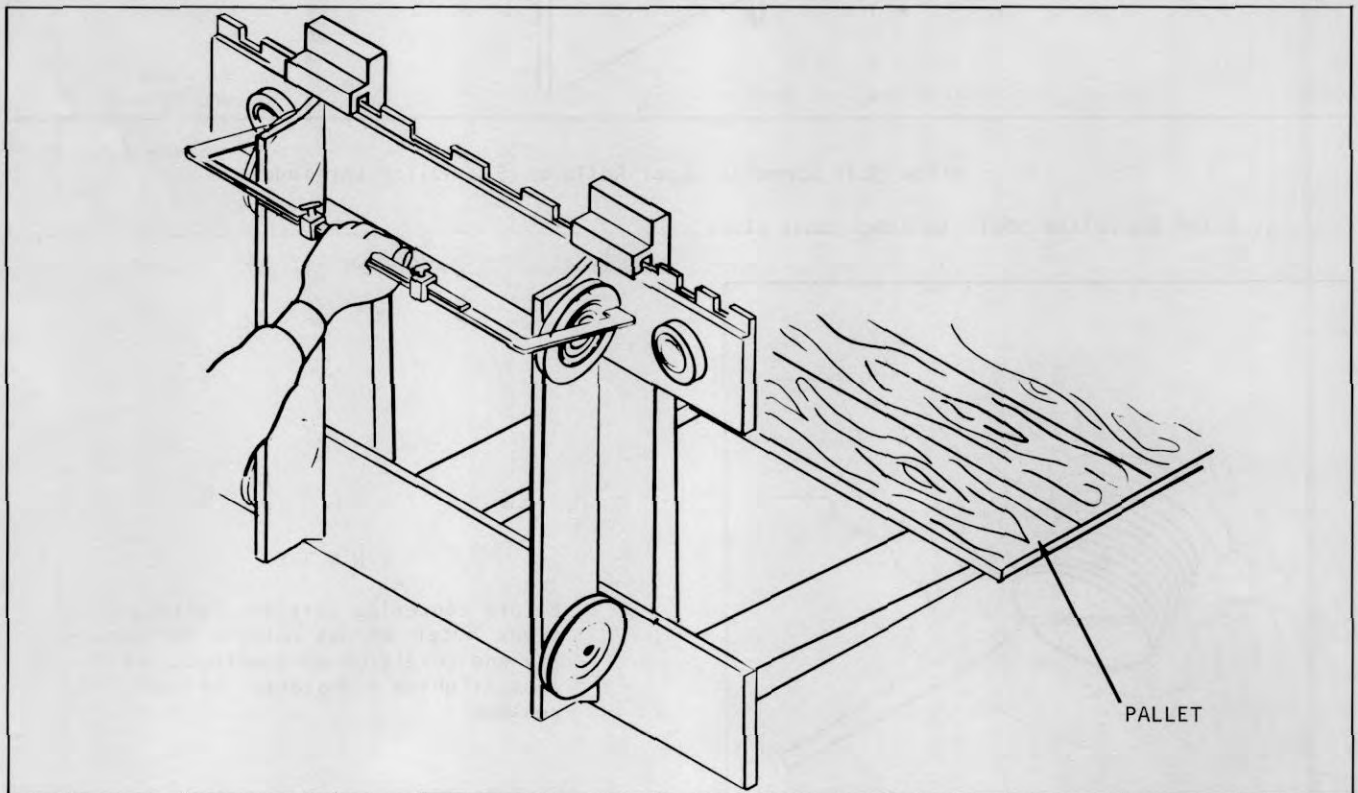


Plate 9569 Spanning Upper Rollers (Four Roller Carriage)

Step 3. Span upper carriage rollers at their outer most camber point. Add or subtract ...

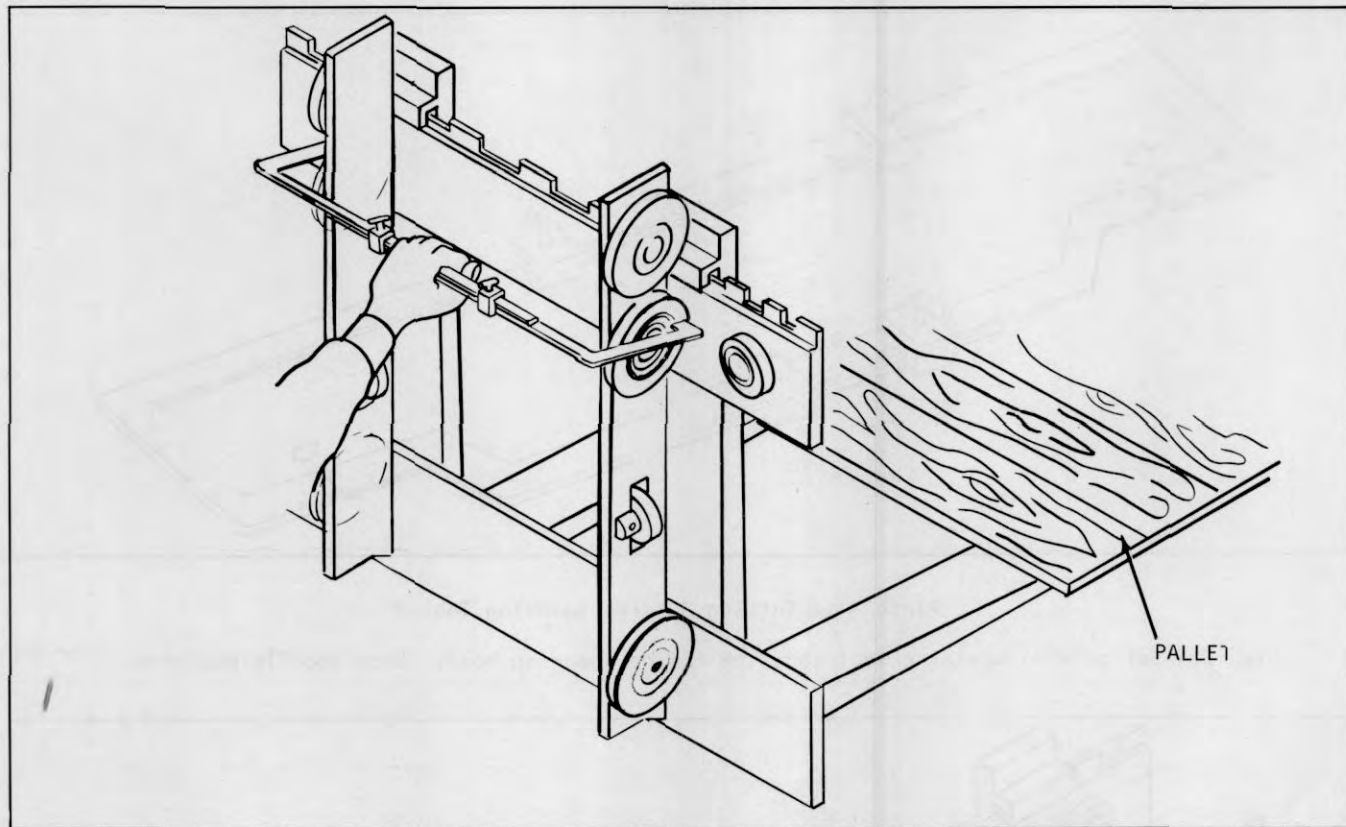


Plate 9570 Spanning Upper Rollers (Six Roller Carriage)

...shims at roller shaft to reach tool size.

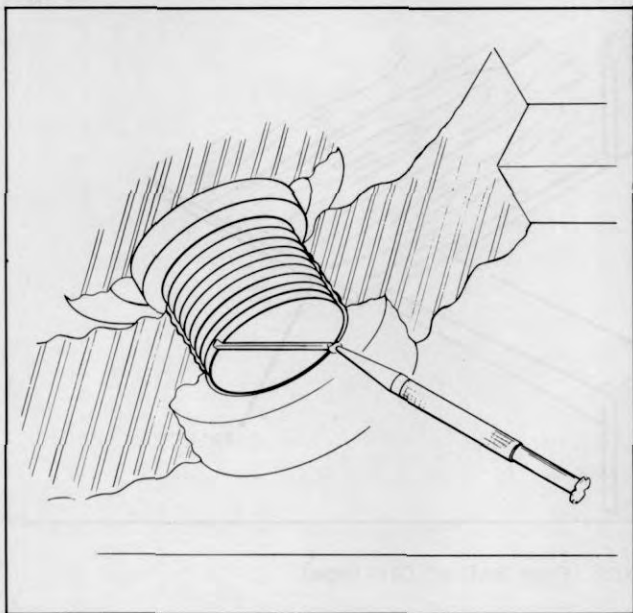


Plate 9571 Securing Outer Thrust Roller

NOTE

Before centering carriage rollers check outer thrust rollers for security and condition of bearings. If loose tighten and stake. If worn replace.

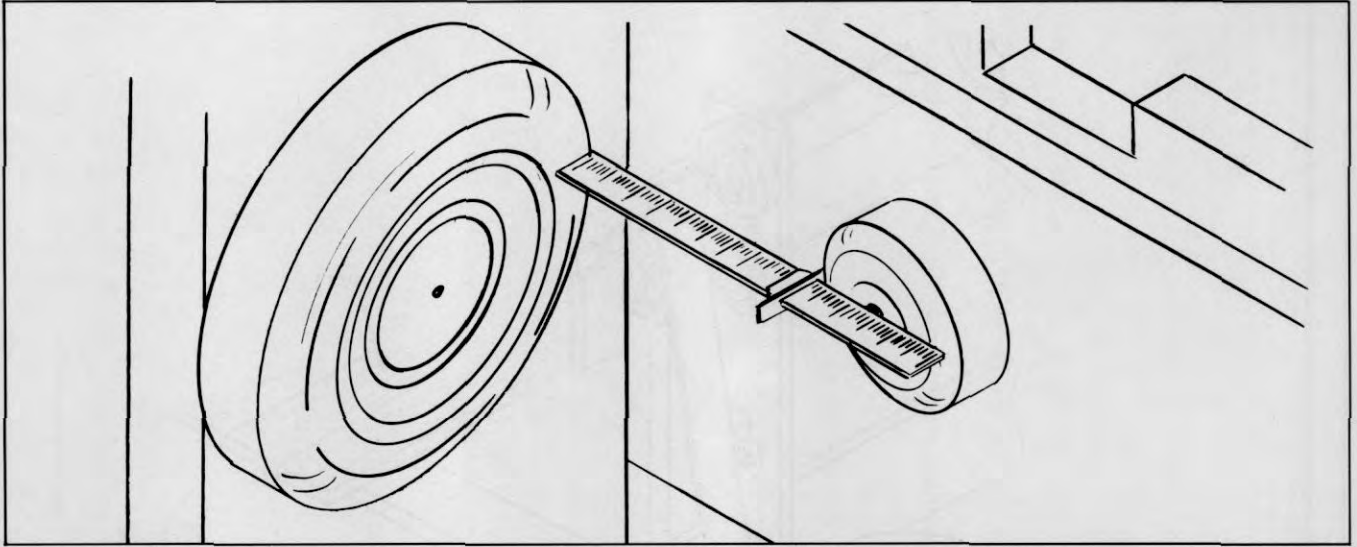


Plate 9572 Centering Carriage Rollers

Step 4. Center carriage rollers within outer thrust rollers by placing 6" scale on the carriage roller surface and measuring the distance to the outer thrust roller face. Add or subtract shims from one roller to the other to make measurement equal.

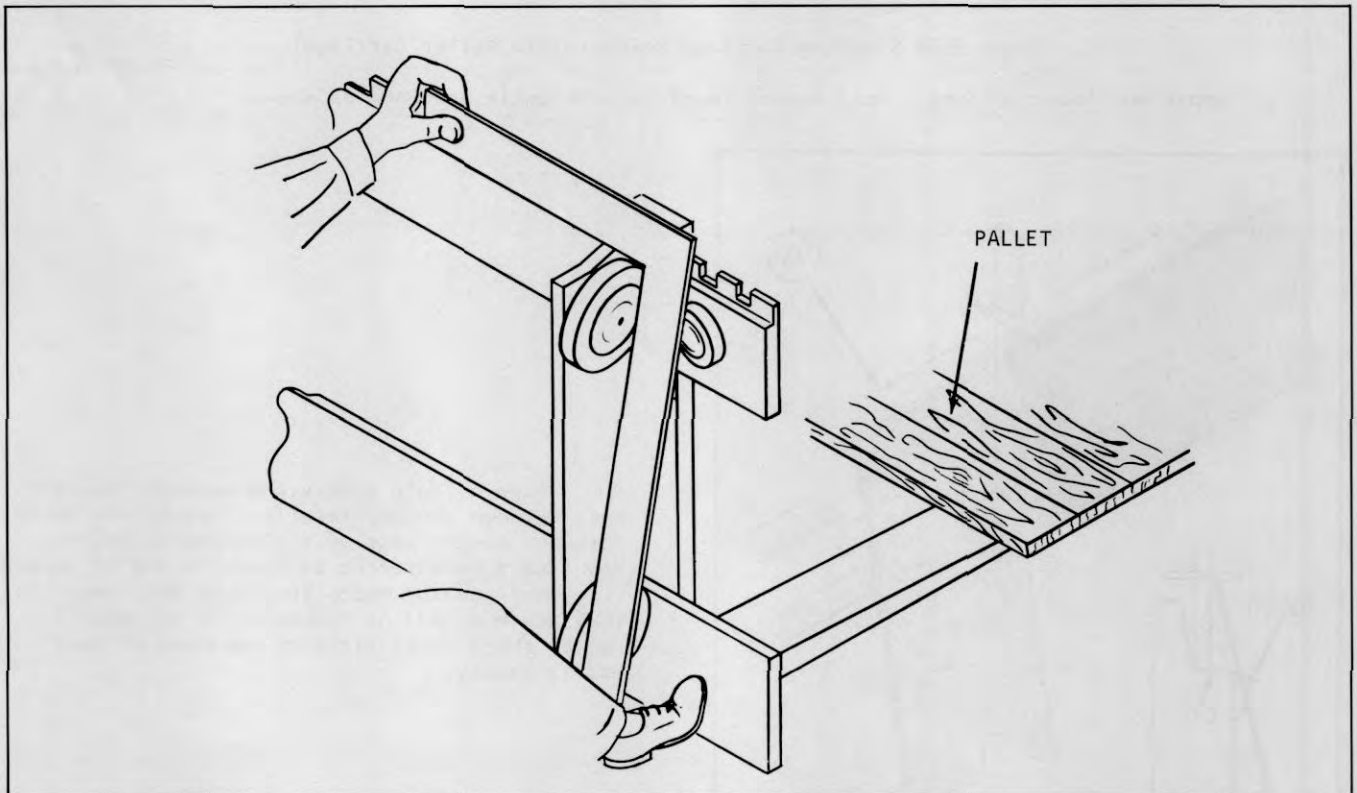


Plate 9573 Squaring Carriage Rollers (Four Roller Carriage)

Step 5. Square carriage rollers by placing carpenters square at the outer most camber of the ...

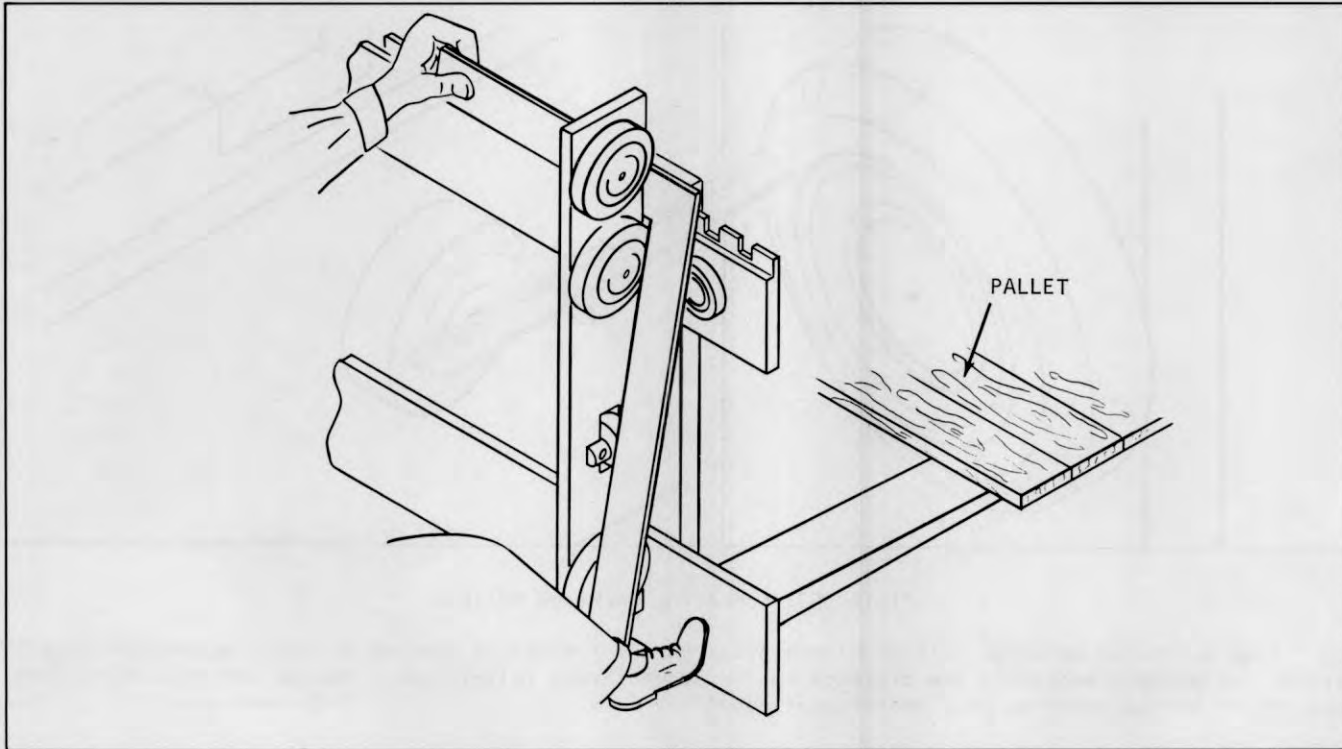
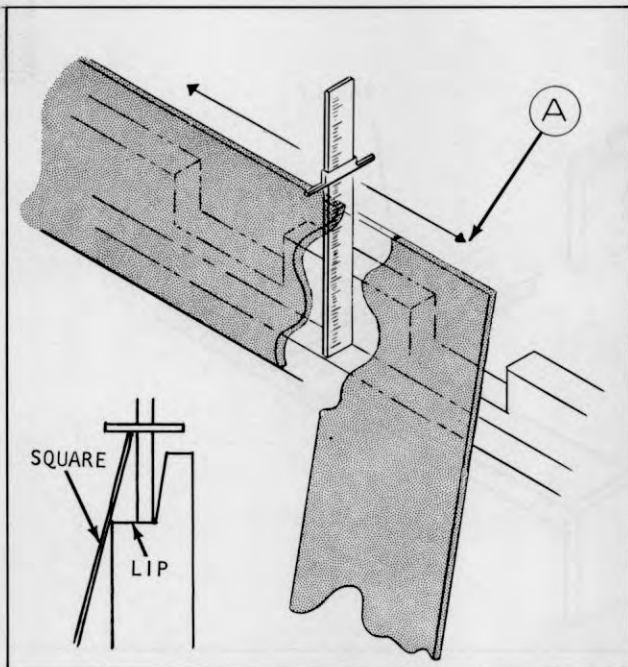


Plate 9574 Squaring Carriage Rollers (Six Roller Carriage)

... upper and lower rollers. Hold square in place with ankle and hand as shown.



Step 6. Hold square and measure the distance between the top face (or lip) of the upper fork bar to the edge of the square at Point A. Now take a measurement at opposite end of square ... these measurements should be the same. If they are not, add or remove shims on lower roller shaft until distance measured at each end is equal.

Plate 9575 Measuring For Squareness

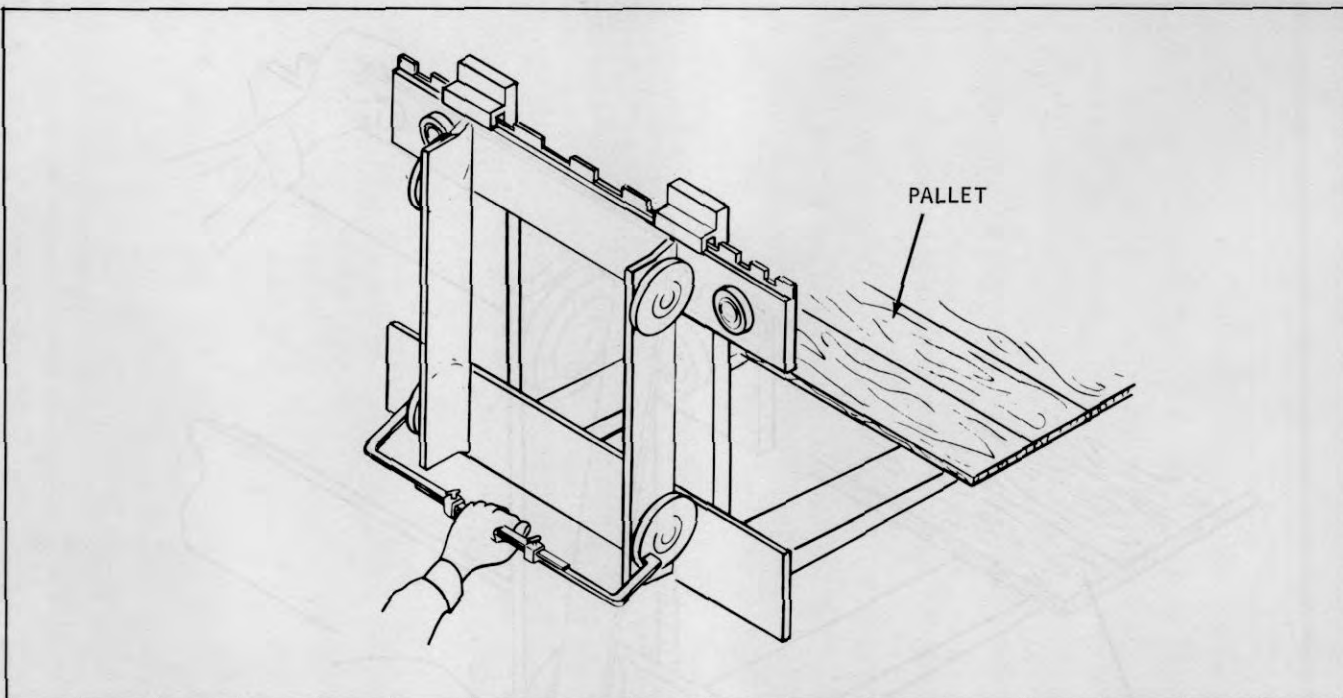


Plate 9576 Spanning Lower Rollers (Four Roller Carriage)

Step 7. Span lower rollers. Add or subtract shims to (the roller that has not been squared) ...

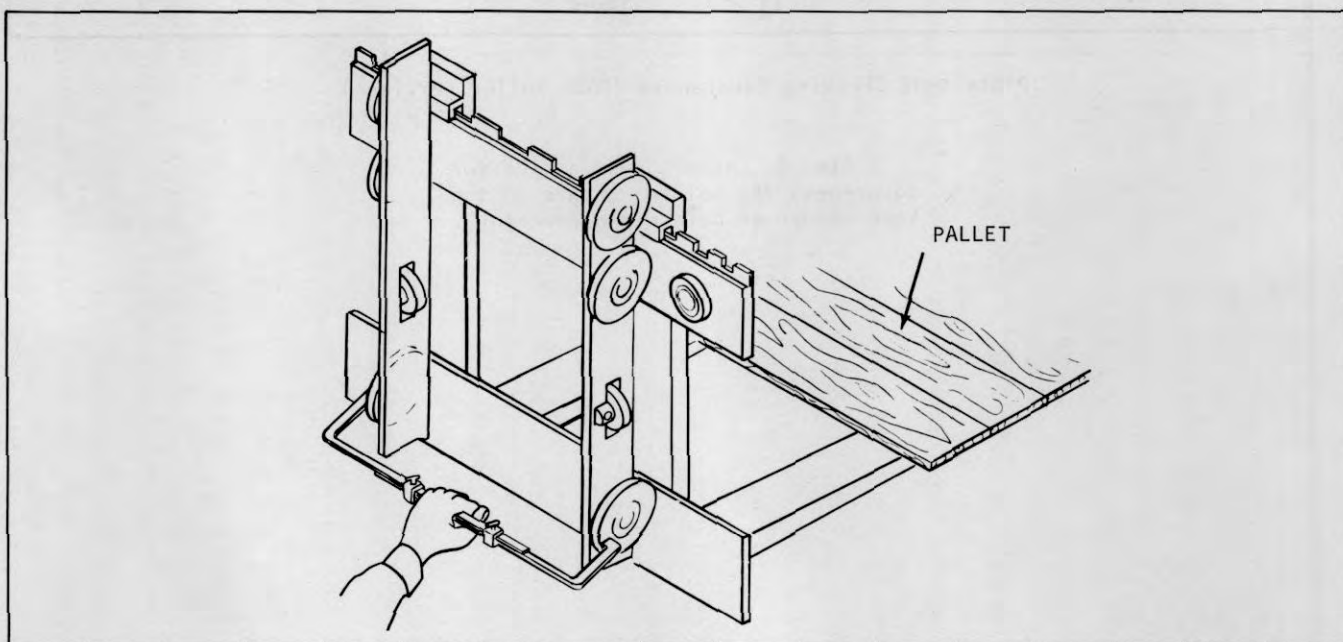


Plate 9577 Spanning Lower Rollers (Six Roller Carriage)

... reach the size of the outside spanning tool.

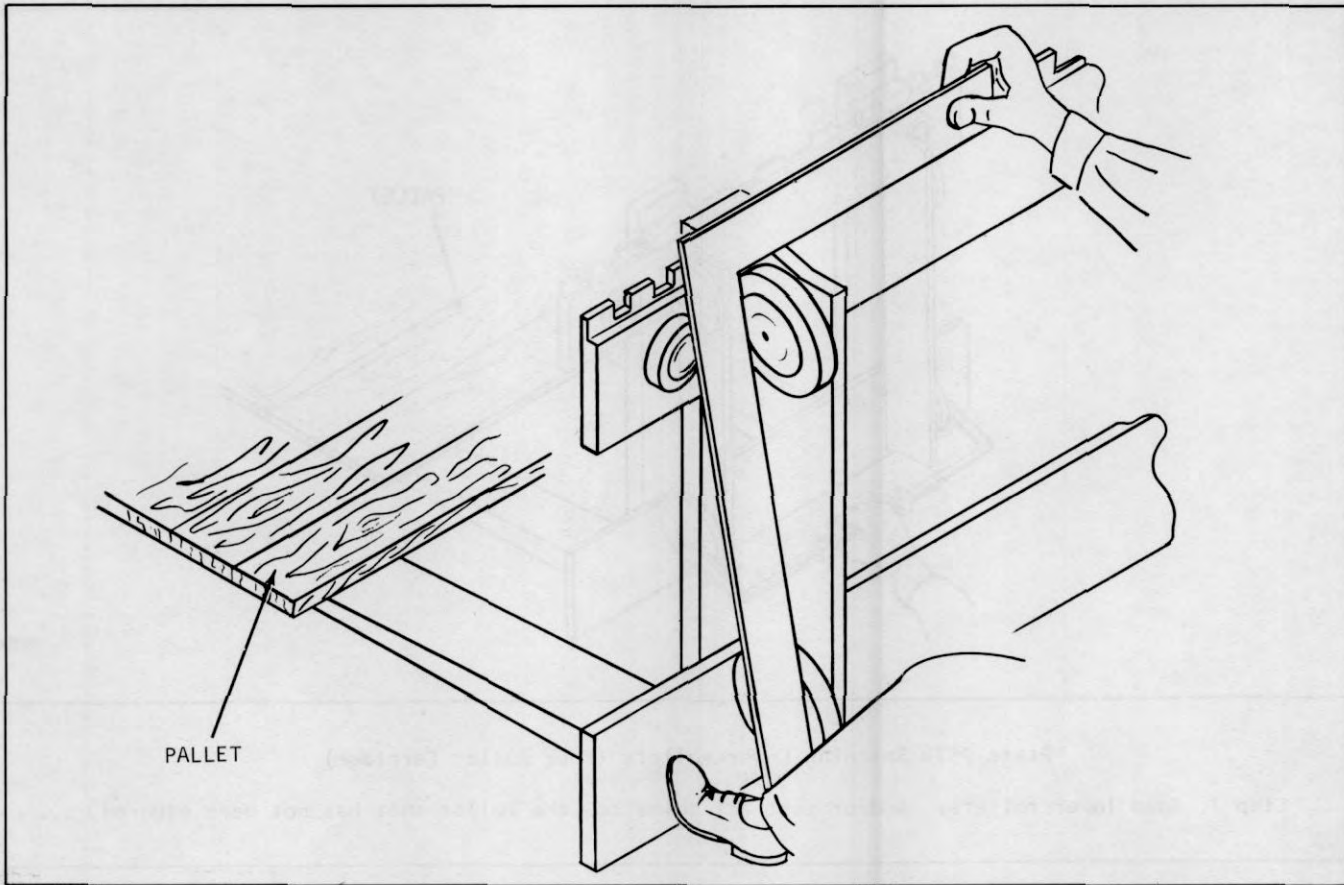


Plate 9578 Checking Squareness (Four Roller Carriage)

Step 8. Check opposite side for squareness (by holding square in the same manner as before and checking ...

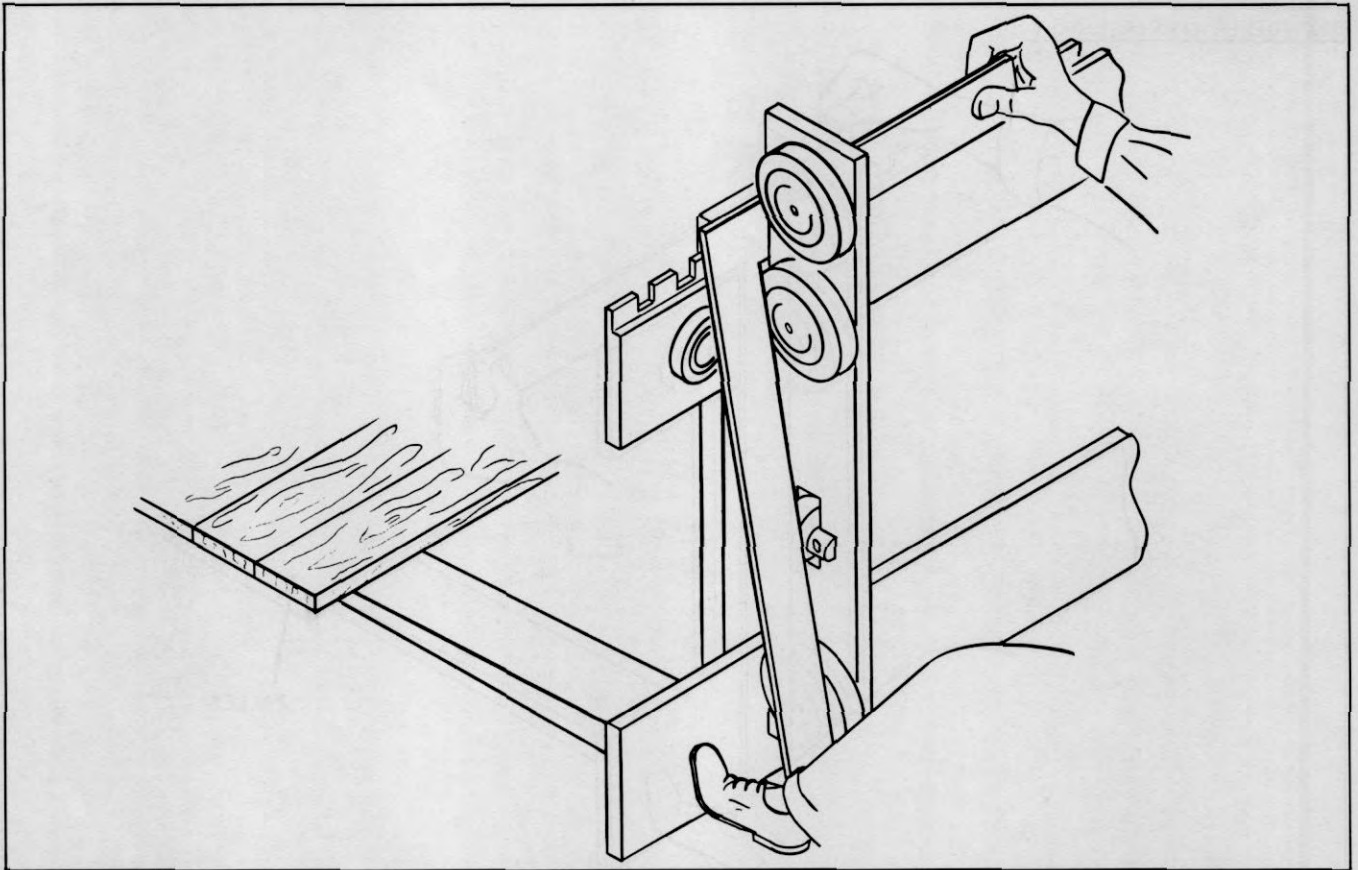


Plate 9579 Checking Squareness (Six Roller Carriage)

... measurement). This side will be square within $1/32''$; if not, return to Step 5. and repeat procedure.

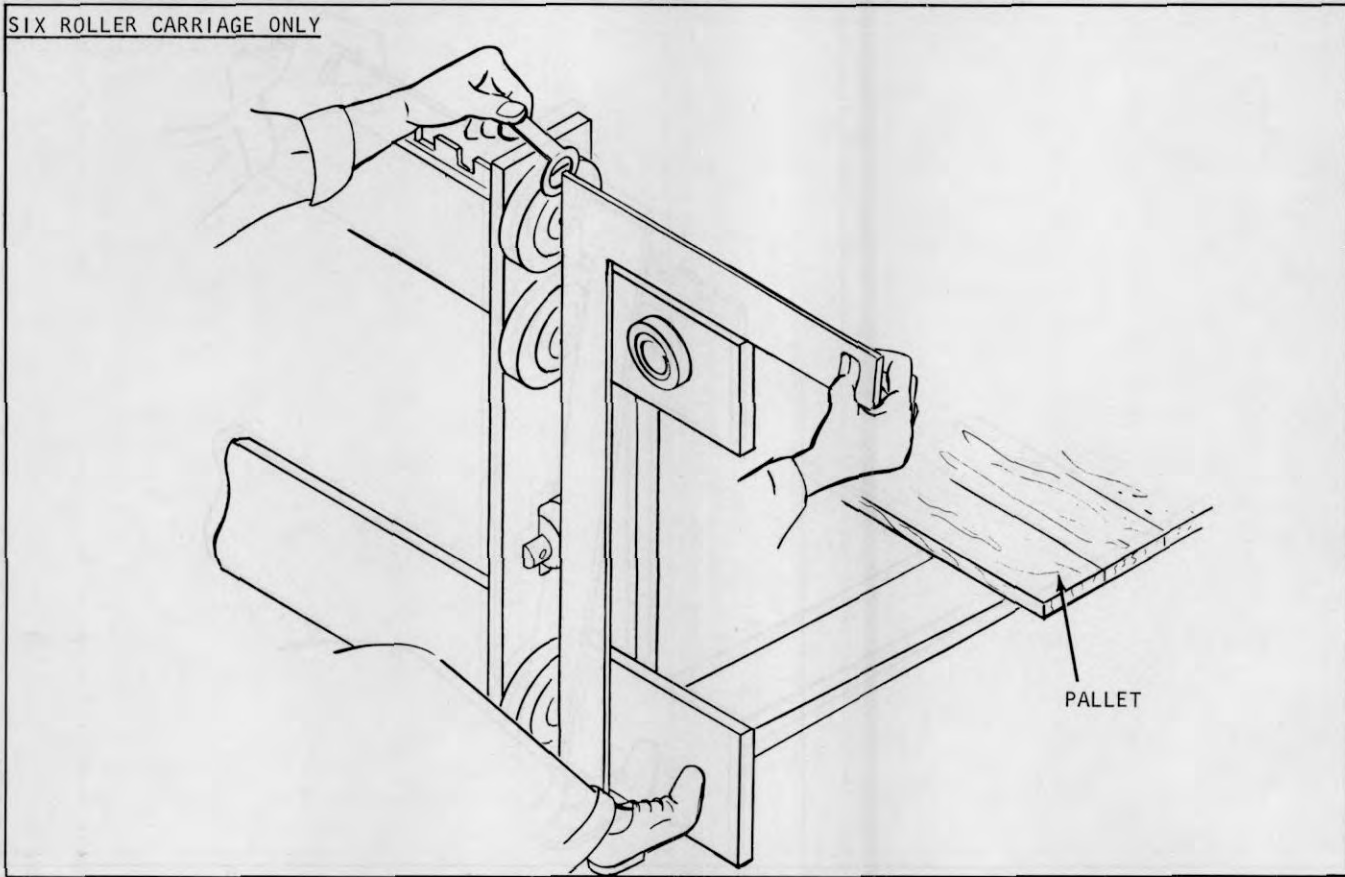
SIX ROLLER CARRIAGE ONLY

Plate 9580 Top Roller Clearance

Step 1. Place square on the vertical center line of the carriage rollers, as shown above. There must be some clearance between the square and the side surface of the top roller. This clearance should not exceed 1/32" or one shim

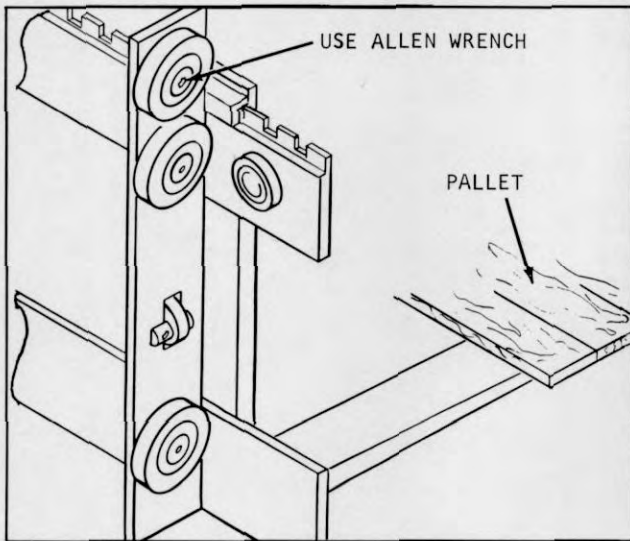


Plate 9581 Removing Top Roller

Step 2. If adjustment is necessary, remove allen screw, lock washer and flat washer to add or remove shims on shaft. Tighten screw securely after completing adjustment.

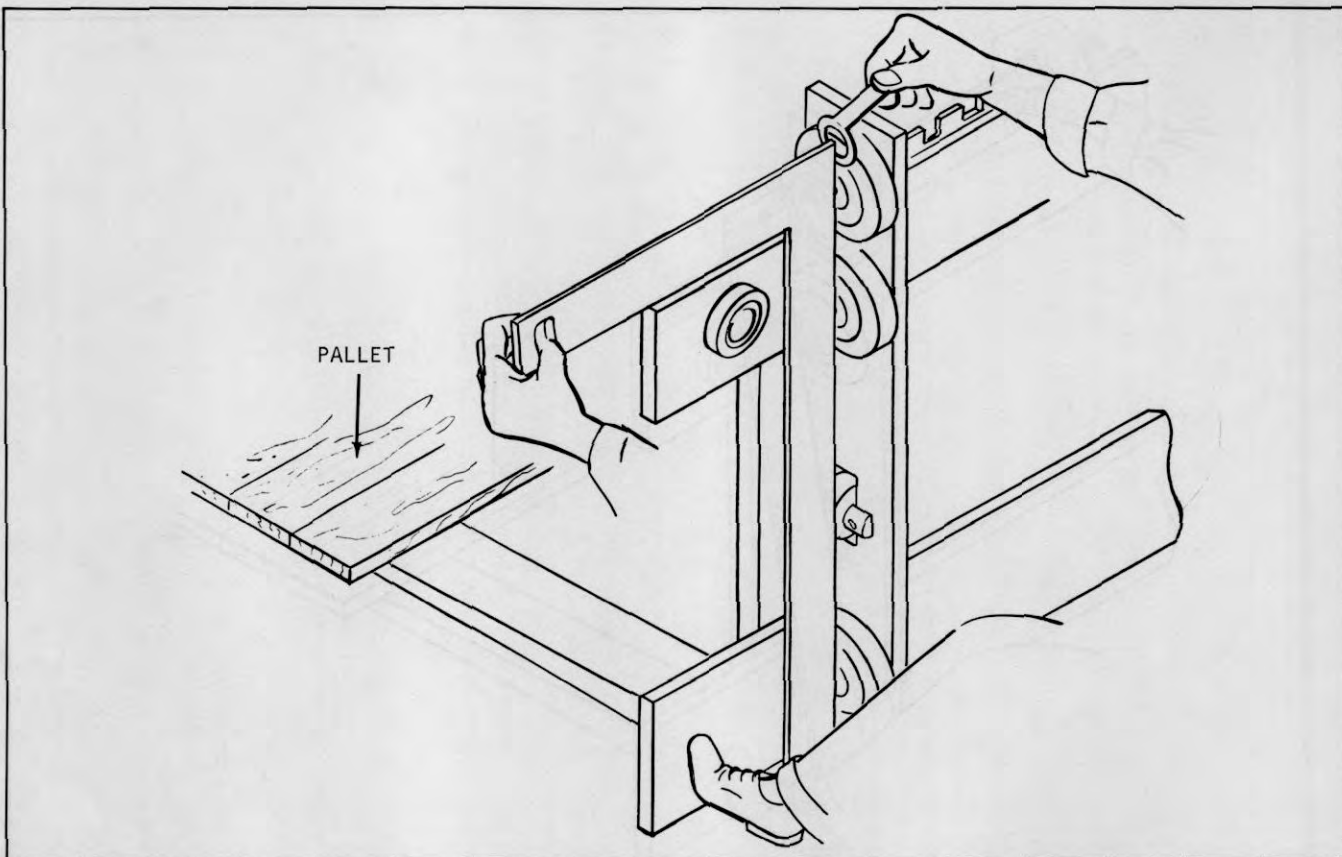


Plate 9582 Top Roller Clearance

Step 3. Check opposite upper roller in the same manner; adjust if necessary.

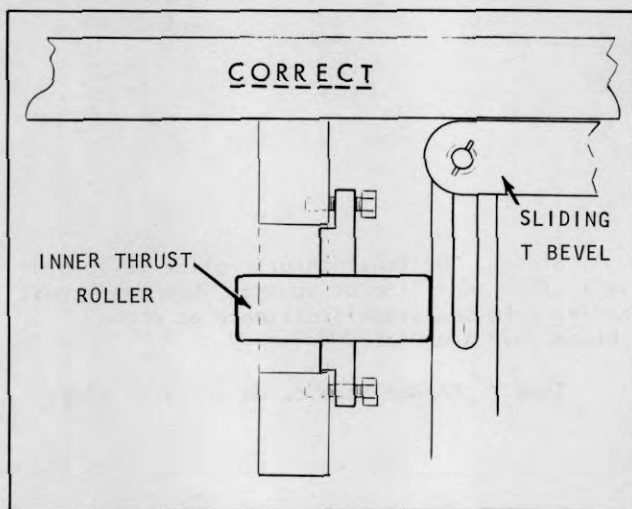


Plate 9583 Checking Squareness ■ CORRECT

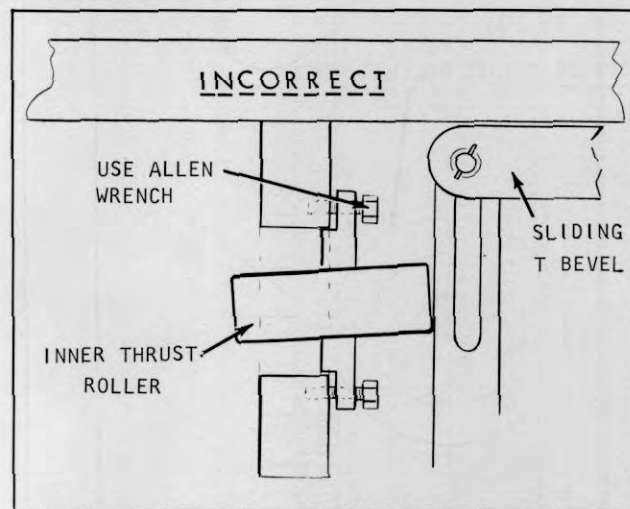


Plate 9584 Checking Squareness ■ INCORRECT

Step 4. Check squareness of inner thrust rollers with Sliding T Bevel. Set Sliding T Bevel to 90° using carpenter's square.

Step 5. Add or subtract shims for adjustment (Use allen wrench see Plate 9584).

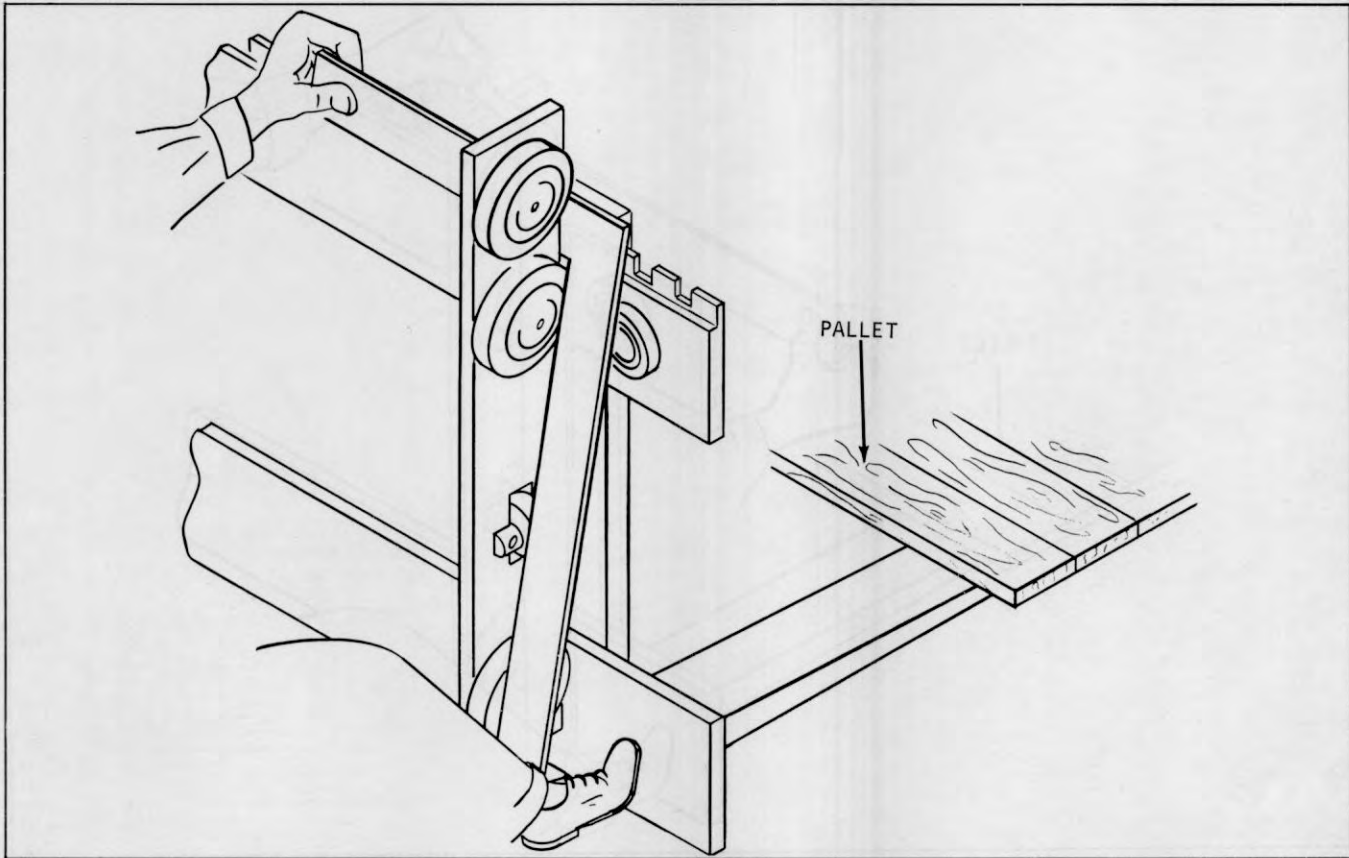


Plate 9574 Square And Side Thrust Roller

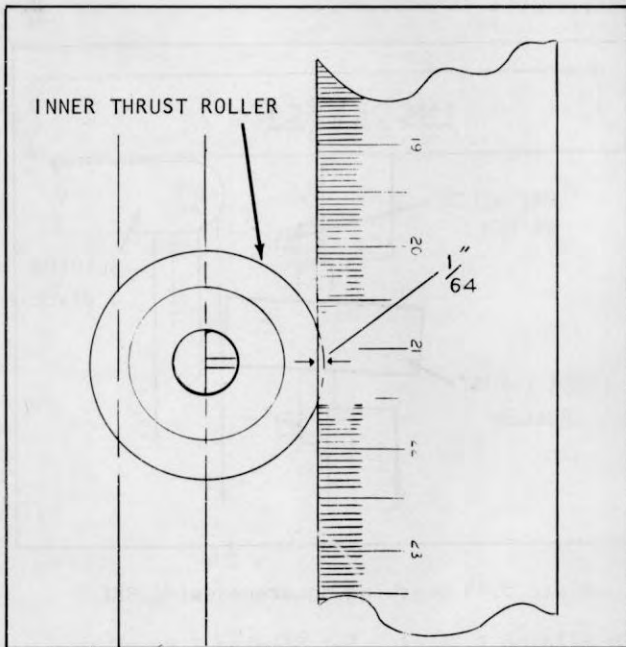


Plate 9585 Reading Roller Projection

Step 6. The inner thrust roller is to project $\frac{1}{64}$ " past line of square. Use one thrust roller shim and eyeball distance as shown (Plate 9573 and Plate 9585).

Step 7. Repeat Step 6. on opposite side.

C. CARRIAGE INSTALLATION

N O T E

Before installing carriage, check upright for proper shimming adjustment.

Step 1. Drive machine up to carriage and position upright to match tilt of carriage.

Step 2. Raise inner rails to just clear upper carriage rollers.

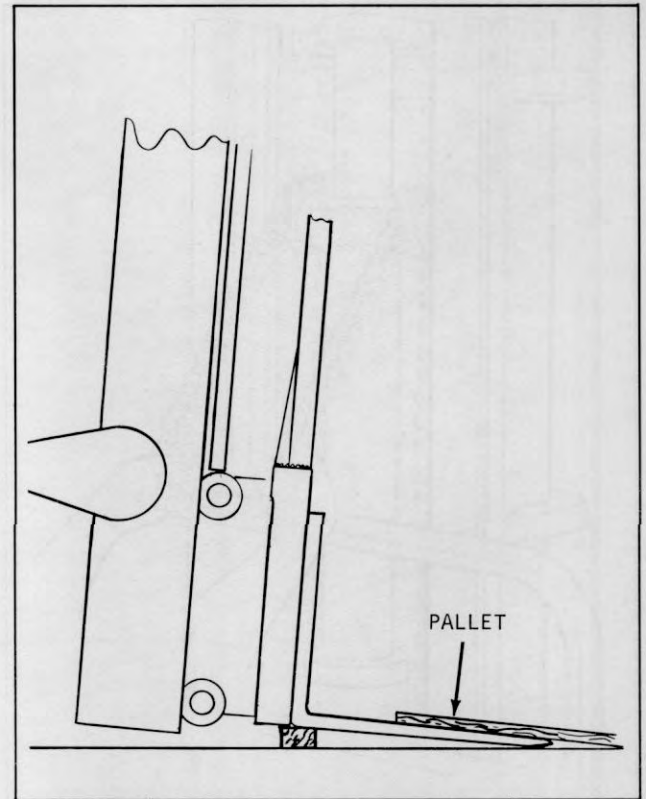


Plate 9565 Inner Rail Clearing Carriage Rollers

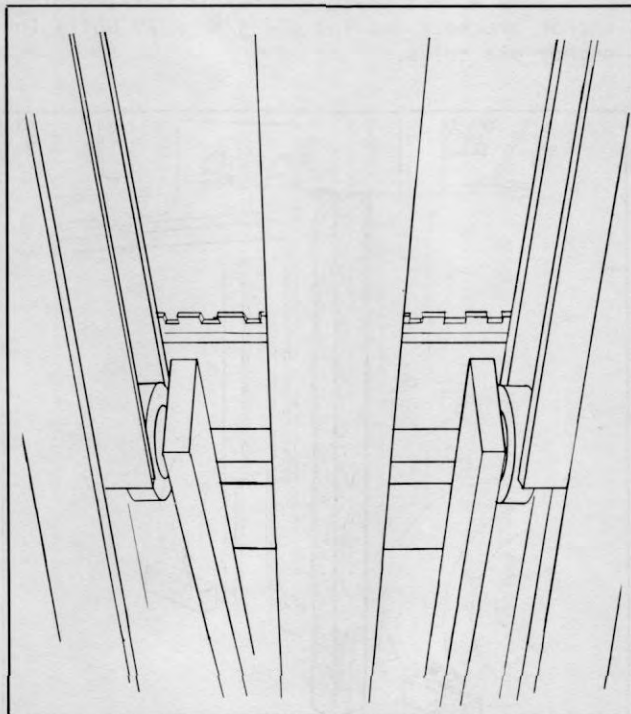


Plate 9591 Rollers Guiding Into Inner Rail

Step 3. Continue to drive machine forward until inner rails line up with upper carriage rollers, then... slowly lower inner rails to full down position.

C A U T I O N

CHECK TO BE SURE THE TOP CARRIAGE ROLLERS ARE GUIDING INTO INNER RAIL.

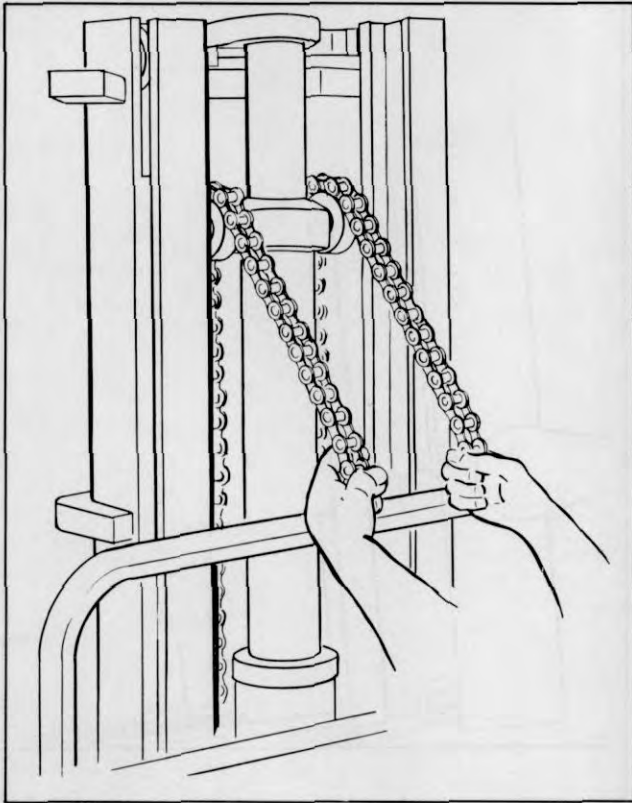


Plate 9586 Pulling Piston Head Down

Step 3(a). Remove wires holding lift chains.

(b). With a chain in each hand and someone holding the lift cylinder lever down, pull the piston to full down position. Place chains behind carriage.

Step 5. Raise carriage about 5' and place a 3' to 4' long 4"x4" wooden beam under it. DO NOT stand directly under forks. Lower carriage onto beam.

Step 6. Replace bolts with anchor pins.

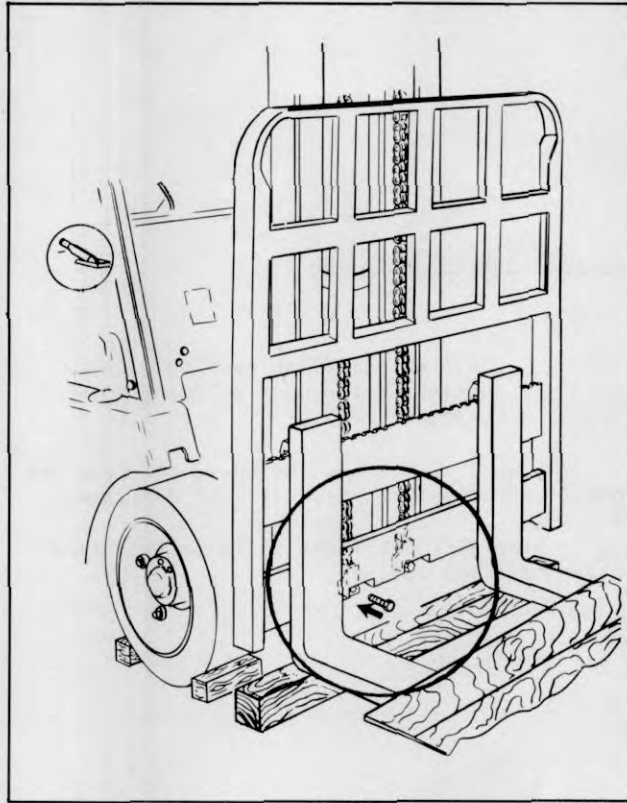


Plate 9587 Installing Bolts

Step 4. Put chain anchors in carriage anchor brackets and install 3/8" x 2" bolts in anchor pin holes.

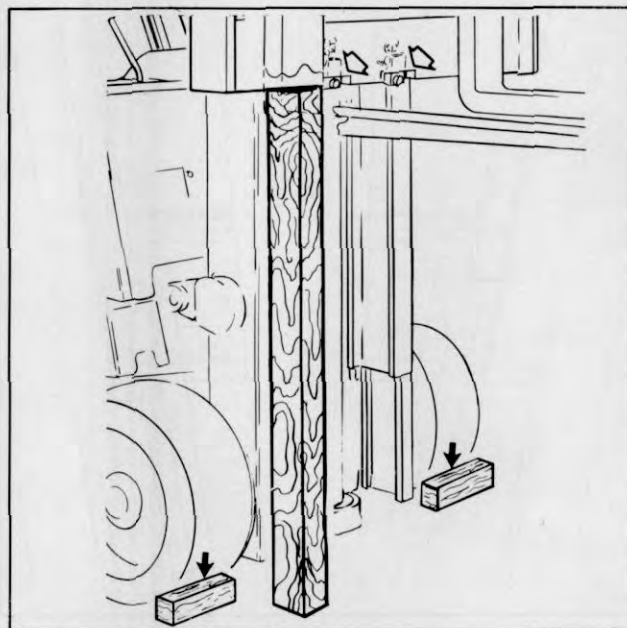


Plate 9593 Carriage Pin Replacement

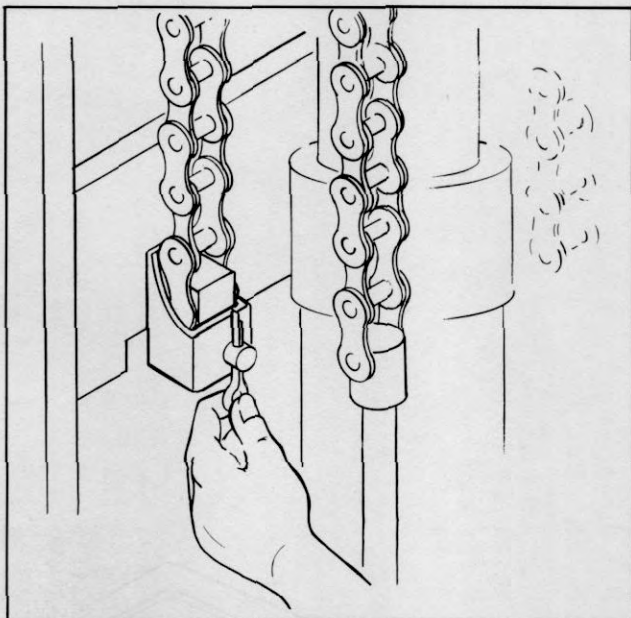
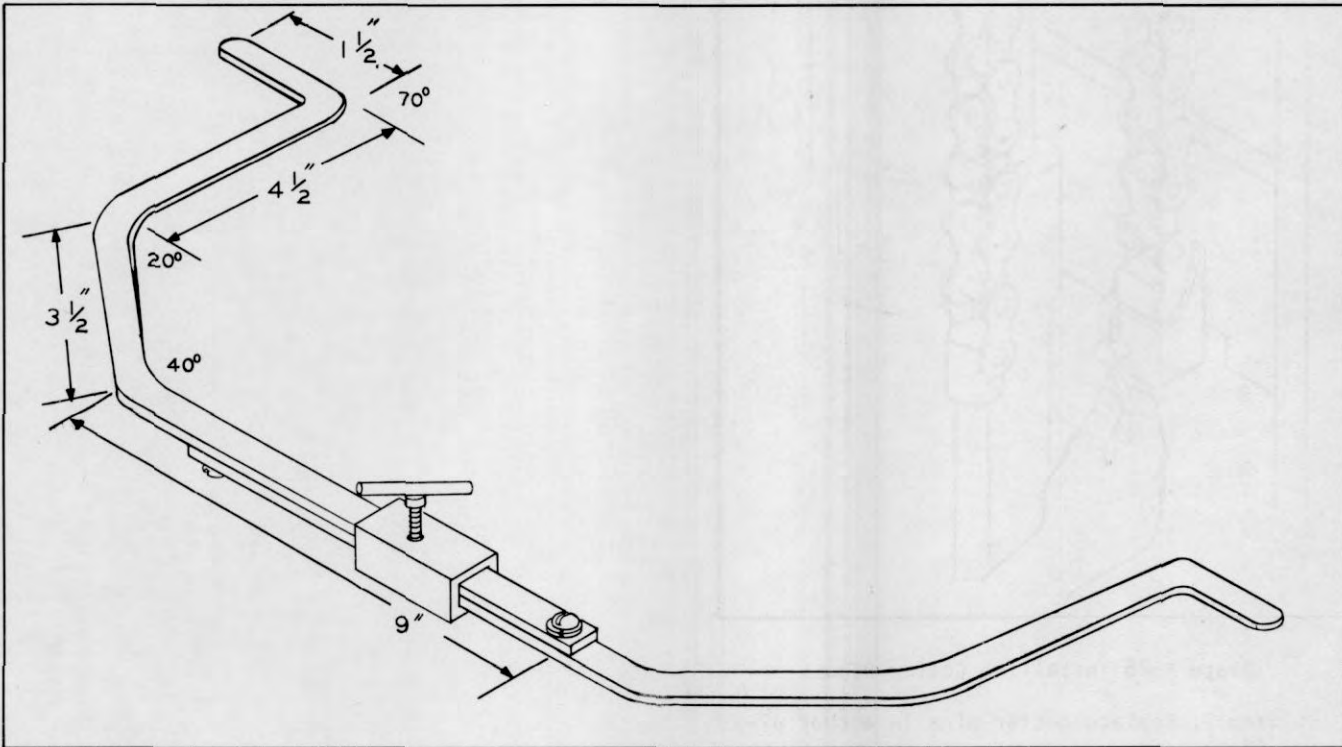


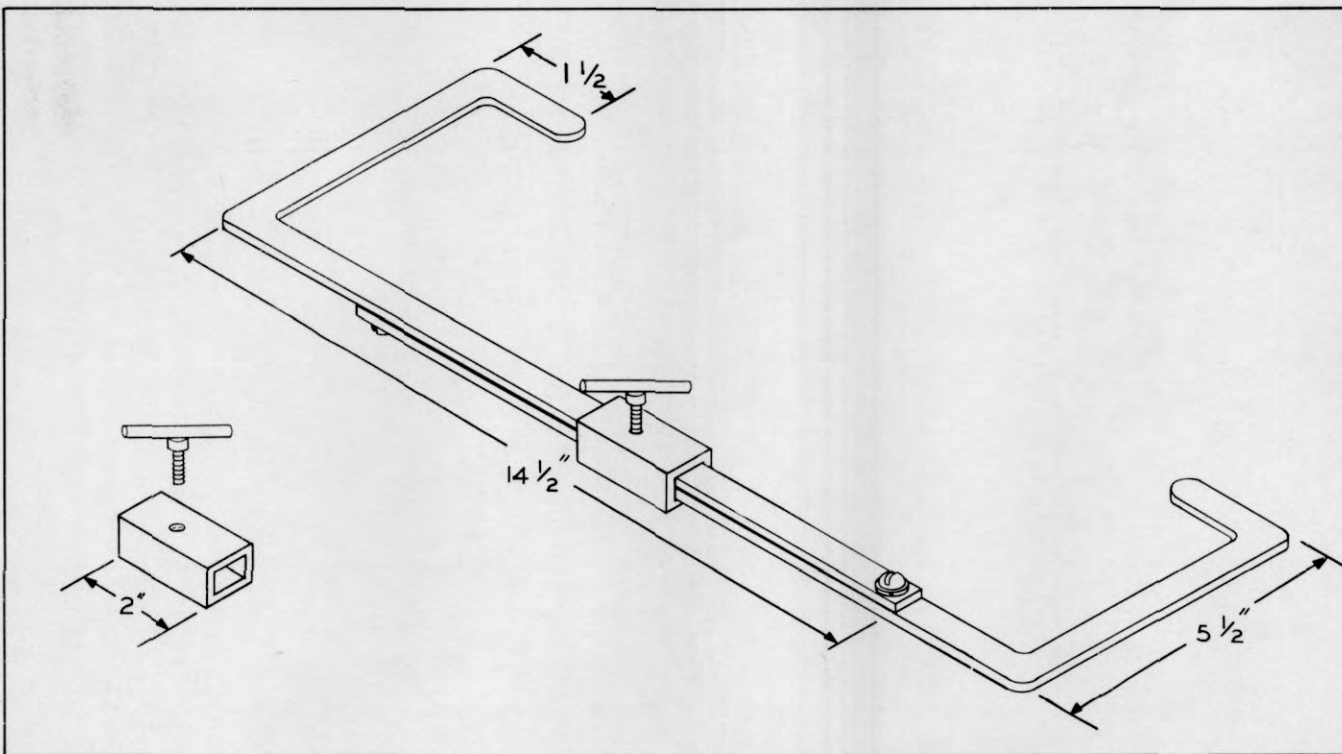
Plate 9588 Installing Cotter Pins

Step 7. Replace cotter pins in anchor pins.

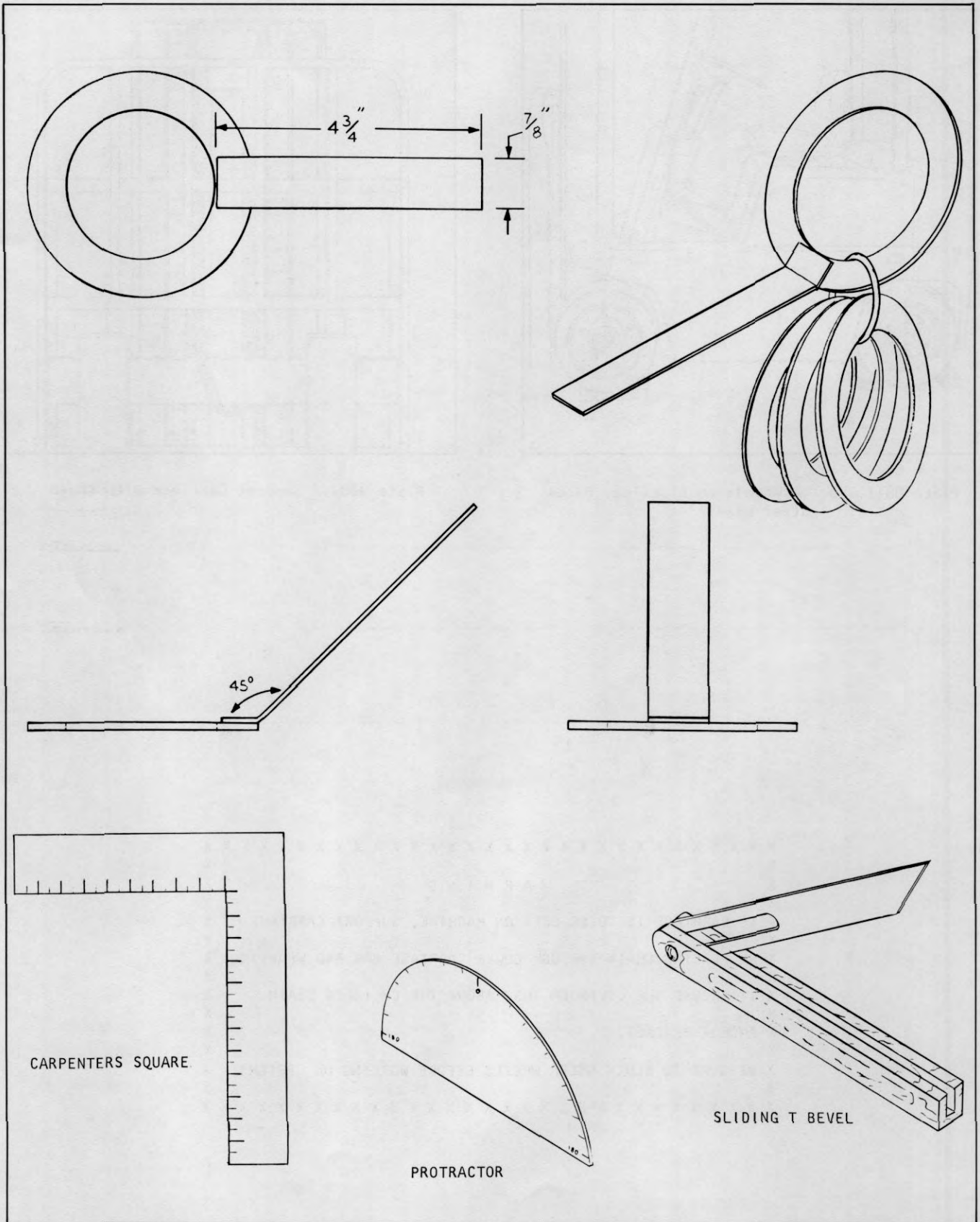
Step 8. Raise and lower carriage to full positions checking all phases of operation.



INSIDE SPANNING TOOL



OUTSIDE SPANNING TOOL





INDUSTRIAL TRUCK DIVISION



LUBRICATION AND PREVENTIVE MAINTENANCE



Plate 9811. Drive Wheels on Blocking, Block Steer Wheels

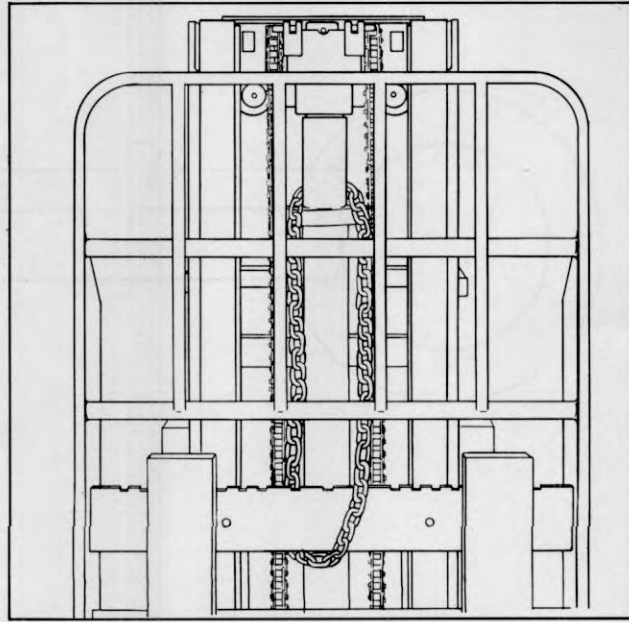


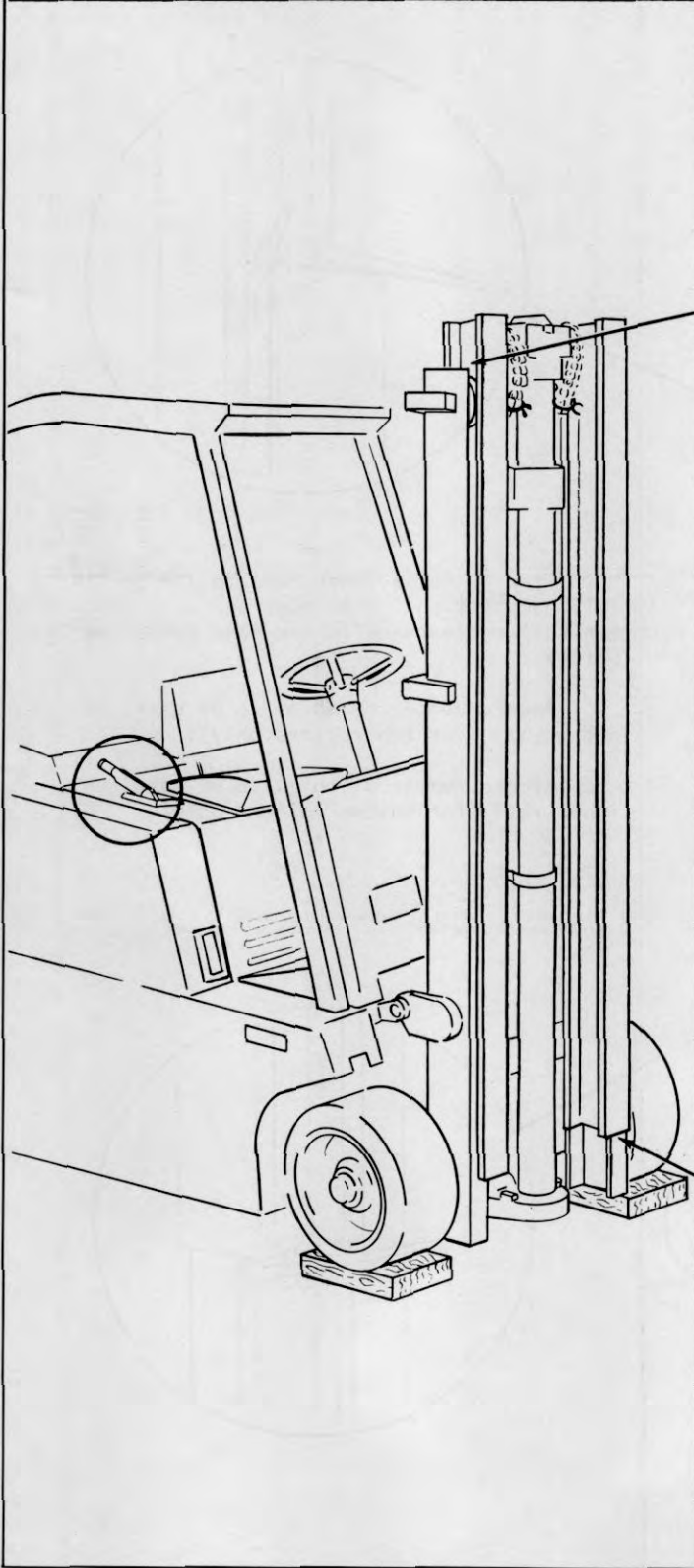
Plate 9807.. Support Carriage with Chain

```

X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X
X
X           W A R N I N G           X
X
X IF CARRIAGE IS TO BE LEFT ON MACHINE, SUPPORT CARRIAGE X
X
X BY PLACING CHAIN THROUGH LOWER CARRIAGE BAR AND WRAPPING X
X
X IT AROUND THE CYLINDER JUST ABOVE THE CYLINDER CHAIN X
X
X ANCHOR BRACKET. X
X
X BE SURE TO BLOCK STEER WHEELS BEFORE WORKING ON UPRIGHT. X
X
X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X

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UPRIGHT ROLLER ADJUSTMENT -- STANDARD AND HILO SERIES 500

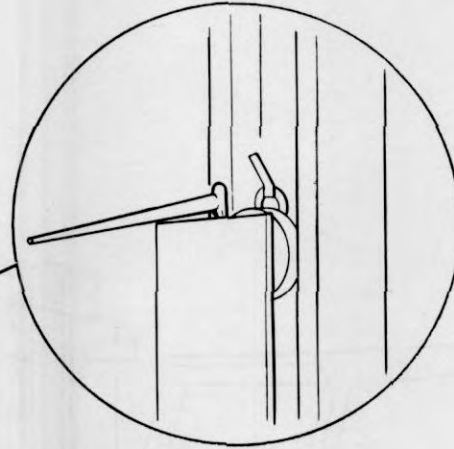
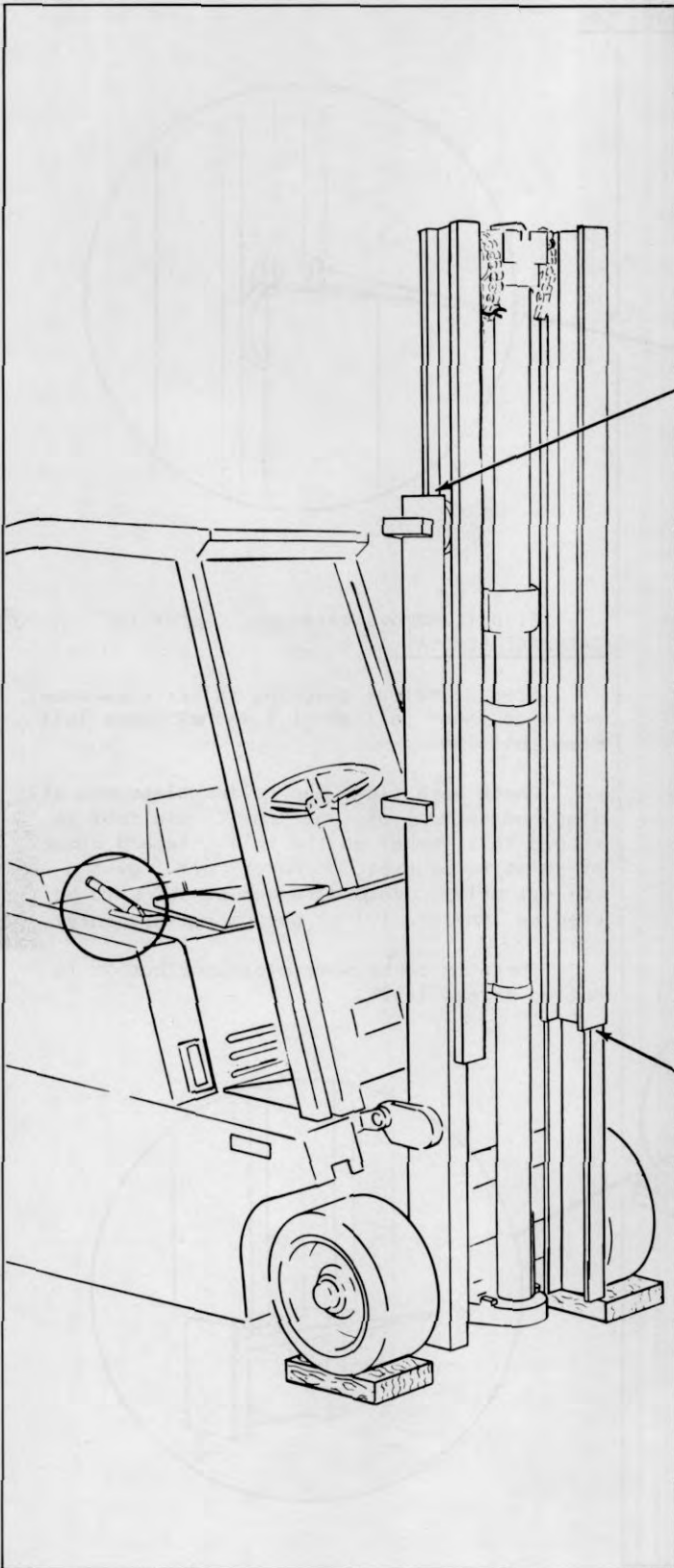


Step 1. Remove carriage. Refer to CARRIAGE REMOVAL.

Step 2. Before checking roller clearance, position inner rail about 5 inches above full down position.

Check both sides for roller clearance at (top and bottom) of inner rail. Use tool to record this number on the rail. Record number of shims to be used, on outer rail (for top rollers only). Record number of shims to be used on inner rail (for bottom rollers only).

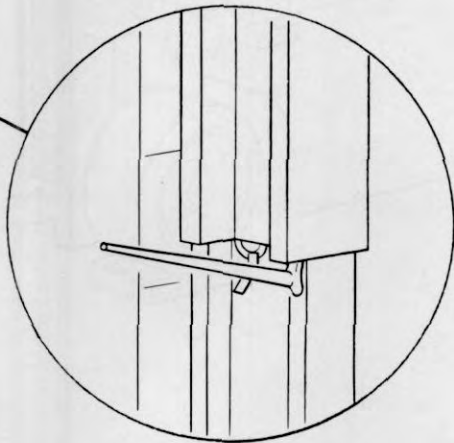
There is to be some clearance but it is not to exceed 1/32".

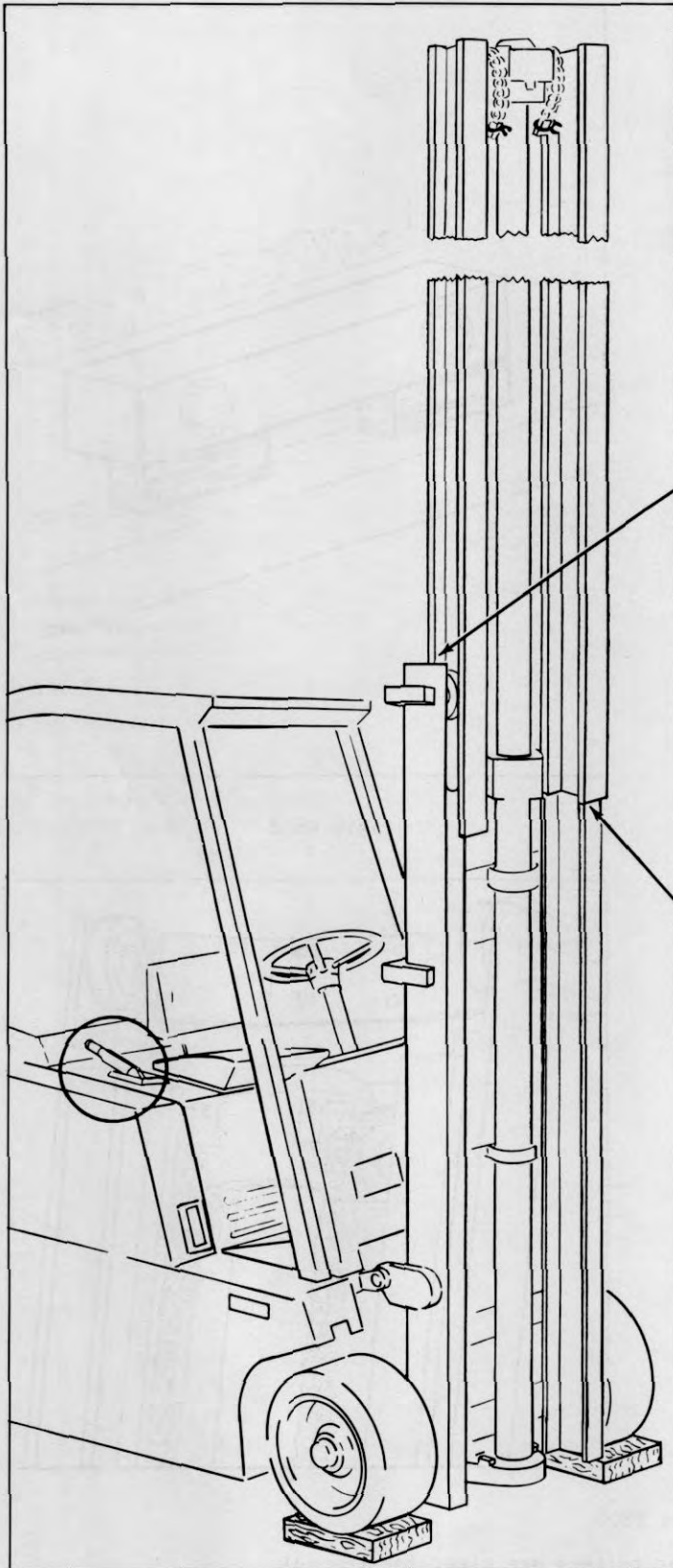


Step 3. Raise inner rail to 1/2 of its full up position. With tool and bar, check the roller clearance in the same manner as before.

Record number of shims to be used, on outer rail (for top rollers only).

Record number of shims to be used, on inner rail (for bottom rollers only).





Step 4. Raise inner rail to full up position and with tool and bar, check for roller clearance in the manner as before.

Record number of shims to be used, on outer rail (for top rollers only).

Record number of shims to be used, on inner rail (for bottom rollers only).

Step 5. Raise inner rail about 5 inches and remove stop block.

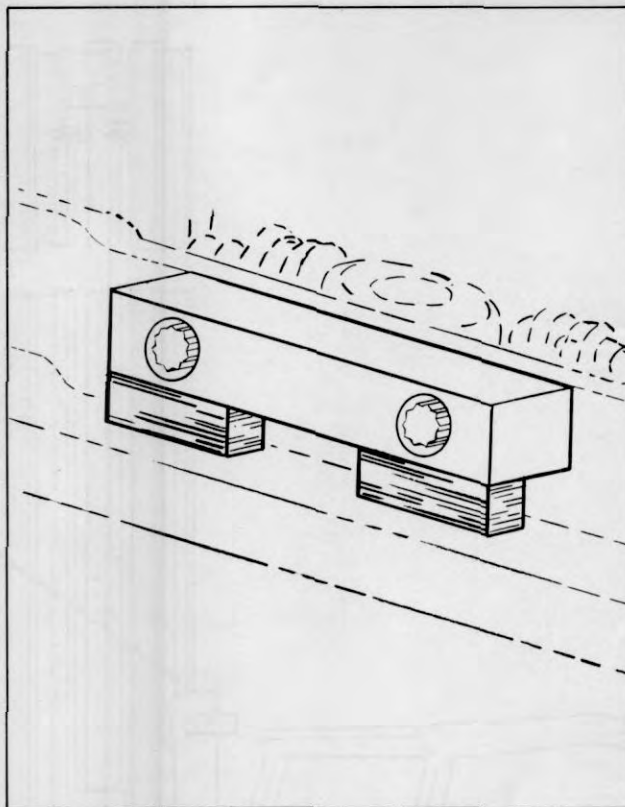


Plate 9808

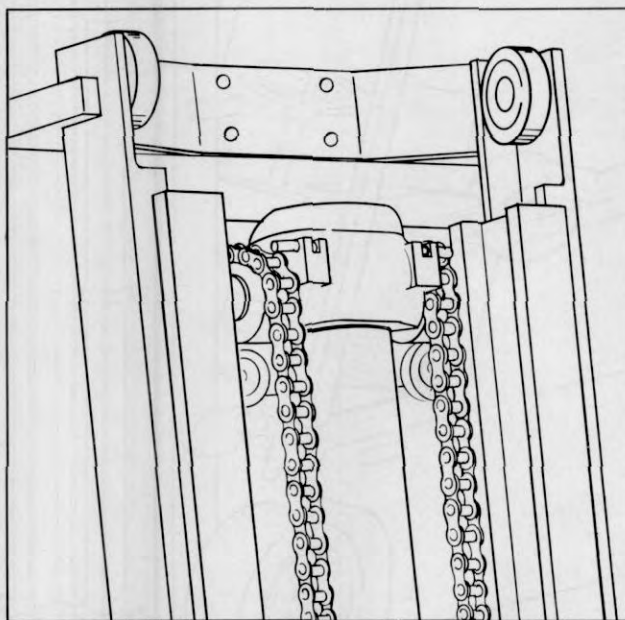
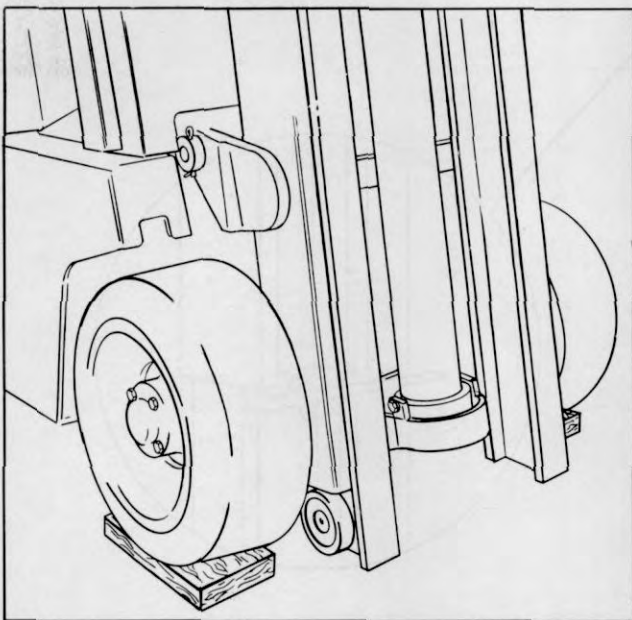


Plate 9809

Step 6. Lower inner rail until upper and lower rollers are clear for removal.

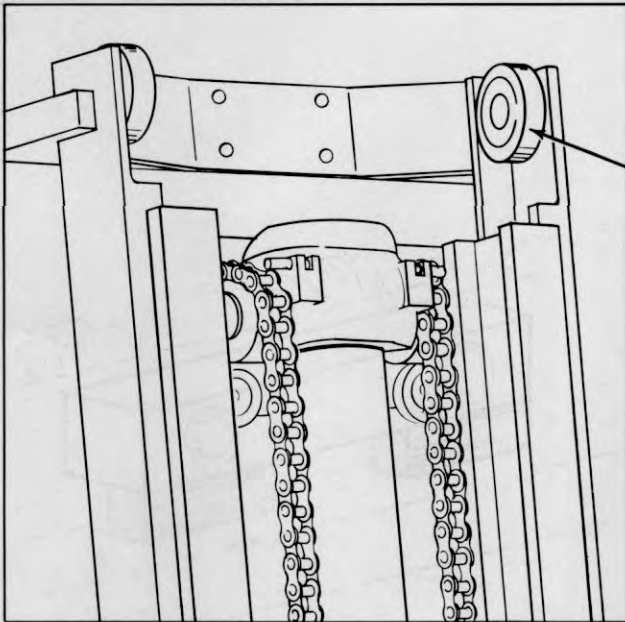


Plate 9810

Step 7. Adjusting upright rollers:

A. Outer rail rollers.

1. Count the number of shims at the right and left hand rollers.
2. Look at the three (3) numbers you recorded on the outer rail in Steps 2-3 & 4. The smallest of these numbers is the total number of shims to be added. "0" means DO NOT add shims.
3. Your target for adjustment is to have the same number of shims at each upper roller. If you end up with an extra shim DO NOT remove it. Mark the side having an extra shim.

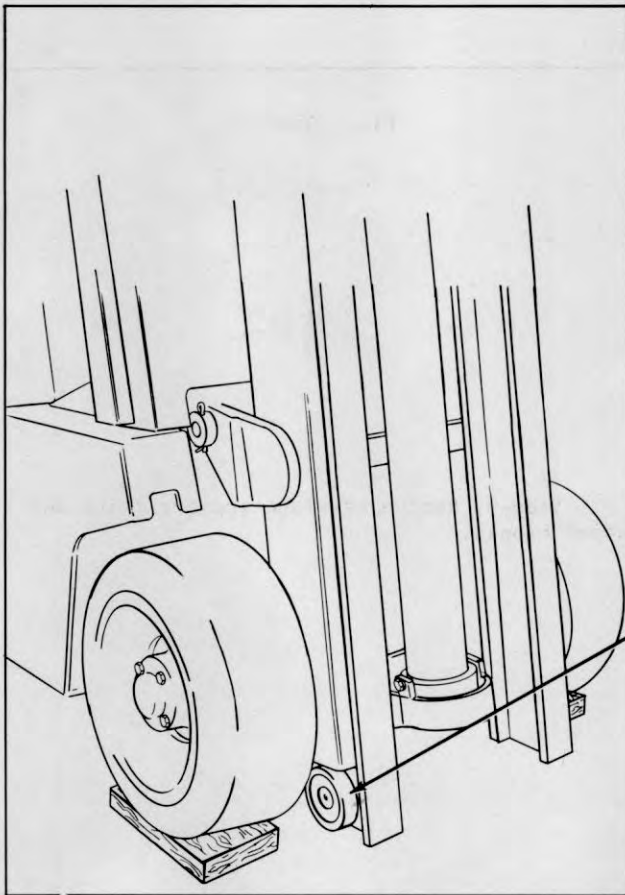


Plate 9812

B. Inner rail rollers.

1. Count the number of shims at the right and left hand rollers.
2. Look at the three (3) numbers you recorded on the inner rail in Step 2-3-& 4. Go through the same steps you followed in adjusting the upper rollers.
3. If you end up with an extra shim here too, be sure it is on the same side as the extra upper shim.

Step 8. Raise inner rail about 5 inches above upper tie bar (of the outer rail) and install stop block and pad assembly.

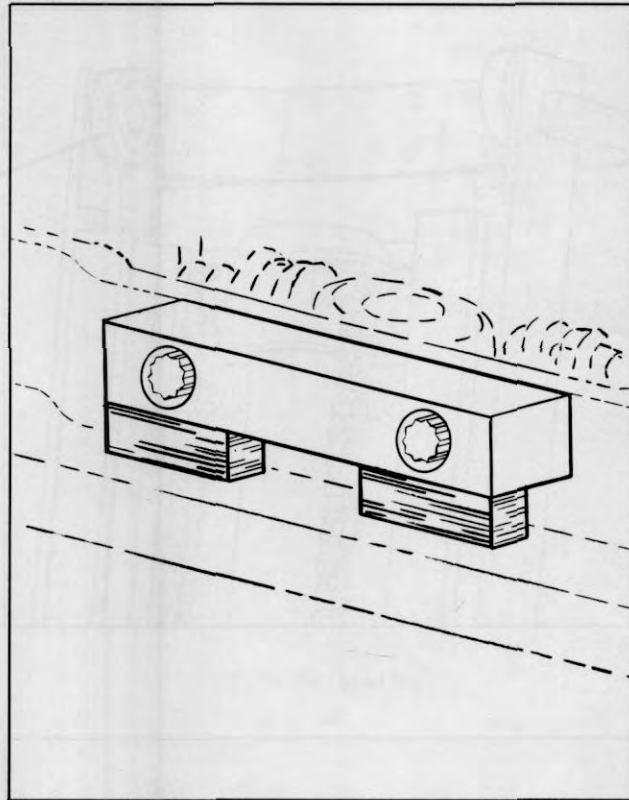


Plate 9808

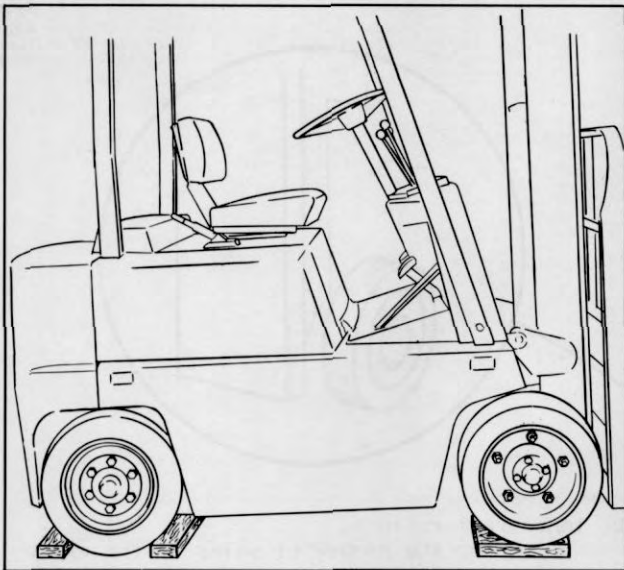


Plate 9811

Step 9. Remove carriage support chain and wheel blocks.



INDUSTRIAL TRUCK DIVISION



WORK SAFELY

DRIVE SAFELY

BE CAREFUL

ALWAYS

GIVE MACHINE SERIAL NUMBER

WHEN ORDERING PARTS



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING GUIDE

DRIVE AXLE

TROUBLE	PROBABLE CAUSE	REMEDY
Continuous Axle Noise.	Badly worn parts. Unevenly worn tires. Improperly adjusted wheel bearing. Lack of lubricant.	Replace worn parts with new. Replace tires. Adjust correctly. Add sufficient lubricant of correct grade.
Axle Noise on Drive or on Coast Only.	Differential pinion gear and ring gear out of adjustment or worn excessively.	Adjust, repair or replace entire unit if conditions warrants.
Excessive Backlash in Axle Driving.	Loose axle shaft drive flange cap screws. Flange loose on axle shaft. Worn splines on axle shaft at differential end. Differential drive pinion gear and ring gear out of adjustment or worn excessively.	Tighten cap screws. Reweld flange to shaft. Replace drive flange and shaft assembly. Adjust or replace as condition warrants.
Complete Failure to Function.	Broken axle shaft. Broken teeth on ring gear or pinion gear.	Replace axle shaft. Replace ring gear and pinion and other parts of differential necessary. Adjust ring gear and pinion gear correctly.



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING GUIDE

STEERING AXLE

TROUBLE	PROBABLE CAUSE	REMEDY
Trouble.	Damaged axle. Lubrication leaks. Incorrect caster or camber. Uneven tire wear.	Replace axle. Replace oil seals. (Refer to Lubrication Section). Report to designated individual in authority. Report to designated individual in authority. Inflate tires properly. Check wheel alignment.



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING GUIDE

BRAKES

TROUBLE	PROBABLE CAUSE	REMEDY
Brakes drag.	<p>Improper pedal adjustment.</p> <p>Brake pedal return spring broken or weak.</p> <p>Brakes improperly adjusted.</p> <p>Brake shoe anchor pin tight in shoe.</p> <p>Brake shoe return spring broken or weak.</p> <p>Loose or damaged wheel bearings.</p> <p>Insufficient brake shoe clearance, or improper brake anchor pin adjustment.</p> <p>Brake backing plate loose.</p> <p>Grease on linings.</p> <p>Dirt imbedded in lining.</p> <p>Drums scored or rough.</p>	<p>Adjust brake pedal free travel.</p> <p>Replace spring.</p> <p>Adjust brakes.</p> <p>Free-up pin and lubricate lightly.</p> <p>Replace spring.</p> <p>Adjust or replace wheel bearings.</p> <p>Adjust brakes.</p> <p>Tighten plate.</p> <p>Correct grease leakage; clean or install new shoes and lining assemblies.</p> <p>Clean lining with wire brush.</p> <p>Replace drum and brake shoe and lining assemblies.</p>
Severe brake action on light pedal pressure.	<p>Brake shoes improperly adjusted.</p> <p>Grease on linings.</p> <p>Loose brake shoe anchor.</p>	<p>Adjust brakes.</p> <p>Correct grease leakage; clean or install new shoes and lining assemblies.</p> <p>Adjust and tighten.</p>
Brake locked.	<p>Brake pedal lacks free travel.</p> <p>Brakes frozen to drums (cold weather).</p>	<p>Adjust pedal free travel.</p> <p>Break loose by driving vehicle.</p>
Brake noisy or chatters.	<p>Brake lining worn.</p> <p>Grease on linings.</p> <p>Dirt embedded in linings.</p> <p>Improper or loose linings.</p> <p>Brake shoe or drum distorted.</p>	<p>Replace shoe and lining assemblies.</p> <p>Correct leakage; clean or replace shoe and lining assemblies.</p> <p>Clean lining with wire brush.</p> <p>Replace shoe and lining assemblies.</p> <p>Straighten or replace.</p>



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING GUIDE

BRAKES (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Excessive pedal travel.	Lining worn. Brake improperly adjusted. Scored brake drums.	Adjust or replace shoe and lining assemblies. Adjust brake. Repair or replace drums.
Excessive pedal pressure.	Grease on linings; worn or glazed lining. Warped brake shoes, or defective brake linings. Shoes improperly adjusted. Brake drum scored or distorted. Shoes improperly adjusted. Insufficient fluid in master cylinder.	Correct grease leakage; clean up and replace shoe and lining assemblies. Replace shoe and lining assemblies. Adjust brakes. Repair or replace drums. Adjust brakes. Fill master cylinder to within 1/4 inch of the top.
Wheel troubles.	Wheel wobbles; bent. Wheel loose on hub. Wheel out of balance. Wheel bearings run hot.	Inspect mounting on hub, spindles, and drive axle; replace defective wheel or mounting. Tighten. Balance wheel. Adjust, lubricate wheel bearings.



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING GUIDE

HYDRAULIC SYSTEM

TROUBLE	PROBABLE CAUSE	REMEDY
Pump not delivering oil.	<p>Wrong direction *of rotation.</p> <p>Tank oil level low.</p> <p>Oil intake pipe or suction filter plugged.</p> <p>Air leak in suction line.</p> <p>Oil viscosity too heavy to pick up prime.</p> <p>Broken pump shaft or gear.</p>	<p>Must be reversed immediately to prevent seizure and breakage of parts due to lack of oil.</p> <p>Add recommended oil.</p> <p>Replace filter cartridge, clean strainer if so equipped.</p> <p>Will prevent priming, or cause noise and irregular action of control circuit.</p> <p>Thinner oil should be used, per recommendations for given perature and service.</p> <p>Report to designated individual in authority.</p>
Pump not developing pressure.	<p>Pump not delivering oil for any of the above reasons.</p> <p>Relief valve setting not high enough.</p> <p>Relief valve sticking open.</p> <p>Leak in hydraulic control system (cylinders or valves).</p> <p>Partially clogged intake line, intake filter or restricted intake pipe.</p>	<p>Check oil circulation by watching oil in tank.</p> <p>Refer to relief valve instructions.</p> <p>Dirt under pressure adjustment valve. Refer relief valve instructions.</p> <p>Find leak and correct.</p> <p>Pump must receive intake oil freely or cavitation will take place.</p>
Pump making noise.	<p>Small air leak at pump intake piping joints.</p> <p>Air leak at pump shaft packing.</p> <p>Tank air vent plugged.</p> <p>Too high oil viscosity.</p> <p>Shaft packing worn.</p> <p>Oil filter dirty.</p>	<p>Test by pouring oil on joints while listening for change in operation. Tighten as required.</p> <p>Repair or replace.</p> <p>Must be open thru breather opening or air filter.</p> <p>Use recommended oils.</p> <p>Replace shaft packing per preceding instructions.</p> <p>Replace filter element.</p>
Forks do not lift to maximum height.	<p>Hydraulic Oil level low.</p>	<p>Fill sump tank.</p>



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING GUIDE

HYDRAULIC SYSTEM CONTINUED

TROUBLE	PROBABLE CAUSE	REMEDY
Lift or tilt action fails.	Loss of oil pressure.	Report to designated individual in authority.
Oil leak at top of lift cylinder assembly.	Worn or damaged lift piston seal. Scored cylinder wall. Plugged vent line.	Replace seal. Replace cylinder. Clean out vent line. Replace if collapsed.
Oil leak around piston rod at tilt cylinder.	Worn seal. Scored piston rod.	Replace seal. Replace rod and eliminate cause of scoring which may be caused by misalignment, worn bearing or foreign matter.
With load centered on lift forks load is lifted unevenly.	Lift chains out of adjustment.	Adjust chains.

INDUSTRIAL TRUCK DIVISION



PROJECT: [Illegible]

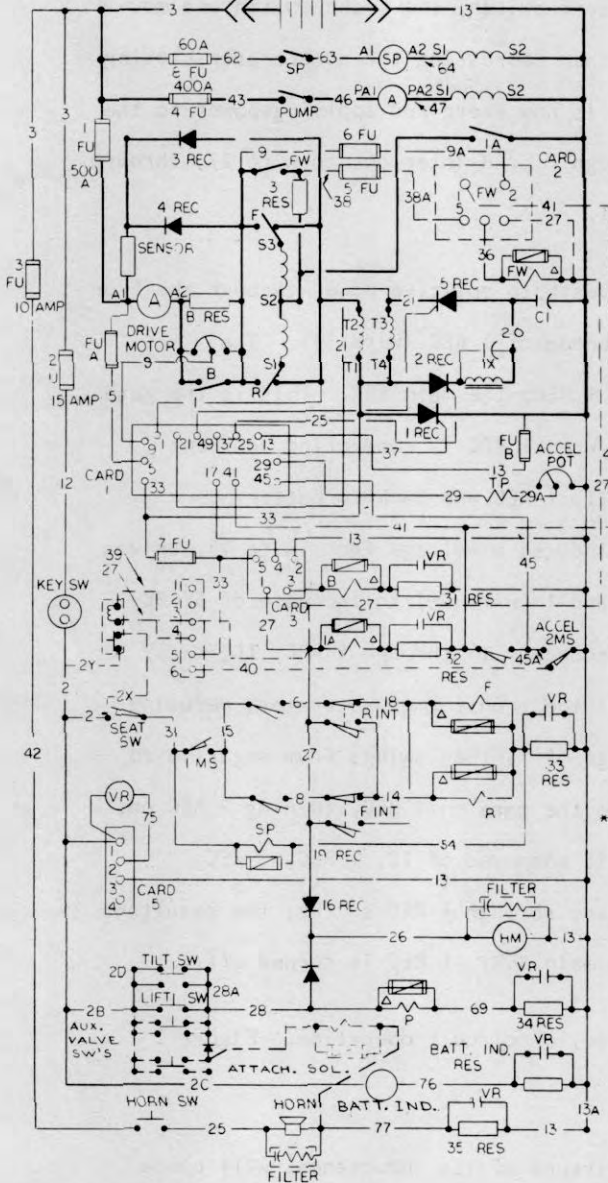
MECHANICAL SYSTEM CONTINUED

READY	PROPOSED CHANGE	PROJECT
Refer to design manual in column 1.	Loss of oil pressure.	Loss of oil pressure.
Replace valve.	Valve to be changed to piston.	The valve is to be replaced with a piston valve.
Refer to column 1. Item and part list. Revision to be completed.	Refer to column 1.	Refer to column 1.
Refer to column 1. Refer to design manual in column 1. Refer to design manual in column 1.	Refer to column 1.	Refer to column 1.
Refer to column 1.	Refer to column 1.	Refer to column 1.

TRUBLE SHOOTING

Δ FILTERS ARE AN
INTEGRAL PART OF
COILS WHERE MARKED

36V-48V
(+) BATTERY (-)



EC 60B

EC 70B

EC 80B

SOLID STATE CONTROL SYSTEM

Check-Out Procedures

Trouble Shooting Procedures

General Maintenance Instructions

- | | |
|-------------------------------|-------------------------|
| ●—○ NORM CLOSED LIMIT SW | □ FUSE |
| ○—○ NORM OPEN LIMIT SW | □ RESISTOR |
| ○—○ N.O. LIMIT SW HELD CLOSED | ▶ DIODE OR RECTIFIER |
| ○—○ N.C. LIMIT SW HELD OPEN | ⊕ CAPACITOR |
| ⊕ CONTACTOR COIL | ⊕ COIL |
| ⊕ N.C. CONTACTOR | ⊕ POTENTIOMETER |
| ⊕ N.O. CONTACTOR | ⊕ RESISTOR (SYMBOL OPT) |
| ⊕ INTERLOCK - N.O. | ⊕ VARISTOR |
| ⊕ INTERLOCK - N.C. | |

INSTRUCTIONS FOR ADDITION OF HIGH SPEED OR FIELD WEAKENING KIT IF USED CONNECT TWO POWER LEADS AS SHOWN -- CONTROL LEADS -- CONNECT TO F.W. CONNECTOR (SEE SCHEMATIC)
INSTRUCTION FOR FAULT DETECTOR (SEE PICTORIAL UPPER RIGHT)



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

EC-60B, EC-70B AND EC-80B

CIRCUIT OPERATION:

The circuit is energized by closing the key switch, the seat switch, the brake switch and moving the Forward or Reverse Lever to either position and then depressing the accelerator closing the accelerator start switch. The F or R contactor coil is now energized applying power to the drive motor circuit. Positive control power is fed through F or R interlock to wire 27, through the 1A coil to wire 41 to an oscillator located in Card 1.

The oscillator section will oscillate only when it receives both positive power through the F or R interlock and a synchronizing control signal from the anode of 1 REC (wire 33). The oscillator output is fed from terminal 37 to the gate of 1 REC, the main SCR. This is the gate signal which will switch 1 REC to the conducting state. When 1 REC is conducting, current flow from battery positive through 1FU, drive motor, T2-T1, 1 REC and back to battery negative. The initial rising d-c current through T2-T1 induces a voltage from T4 to T3, drives T3 below battery negative, causes current to flow from Card 1 (wire 49) to the gate of 5 REC, turning 5 REC on. Current then flows from transformer secondary T4 through 1 REC, 1C, 5 REC and back to T3 charging 1C (wire 20) negative until the transformer saturates, reducing this current flow to zero, turning off 5 REC. The voltage of T3 then swings from negative to positive, causes current to flow from Card 1 (wire 25) to the gate to 2 REC, turning 2 REC on. 2 REC conducts, capacitor 1C discharges around the circuit composed of 1C, 1 REC, 2 REC and 1X. This discharge current opposes the battery current through 1 REC so that the resultant current is zero. With reverse voltage across 1 REC (the main SCR), 1 REC is turned off.

This explanation has been for one complete cycle, or pulse, or circuit operation. Figure 2 illustrates the pulsing of current from the battery.

During the off time the energy stored in the motor, by virtue of its inductance, will cause current to circulate through the motor around the loop formed by 3 REC, thus providing what is called "flyback current." Figure 3 shows the nature of the motor current which is composed of both battery current and the inductive flyback current. It should be noted that the average motor current measured will be greater than the average battery current. The SCR control, in effect, converts battery current at battery volts into a higher motor current and a lower motor volts.

The time for the next cycle to start is determined by the time that the oscillator section of the card takes to oscillate. This frequency of oscillation is controlled by the potentiometer in the accelerator. Slow speed is obtained by having maximum ohms in the potentiometer. As the resistance in the pot decreases, the speed of the motor increases. With level operation, the SCR circuit is capable of delivering approximately 70-90% speed. For full-speed operation, the 1A contactor is closed to apply full battery voltage to the motor. 1A coil is energized by closing the 1A switchette in the accelerator.

CARD 1

CURRENT LIMIT: The current-limit section of Card 1 provides protection to the motor and control by limiting currents during acceleration and stall. This circuit is sensitive to load current and overrides the oscillator under heavy loads so as to limit the pulse frequency (thus the average current) to a value based on the maximum rating of 1 REC. Because of the flyback current through 3 REC, the motor current usually runs 2 to 3 times this current-limit value. The CURRENT LIMIT is adjustable by means of a trimpot on Card 1.

OSCILLATOR: The oscillator section of the card has two adjustable modes and one fixed feature. With the accelerator pot at maximum resistance, the CREEP SPEED can be adjusted with a trimpot on the card. With the accelerator pot at minimum resistance, the TOP SCR SPEED is adjustable by means of a trimpot on the card. The fixed feature is controlled acceleration. When the accelerator is set for maximum speed and the directional switch is closed, the controlled acceleration provides a gradual buildup of pulses, thus giving a smooth acceleration to top SCR speed. This feature also provides a smooth reacceleration during a plugging reversal of direction.

PLUGGING: Slowdown is accomplished when reversing by providing a small amount of retarding torque for deceleration. If the truck is moving and the direction lever is moved from forward to reverse, the motor field is reversed. During the 1 REC off time the motor armature, driven by the inertia of the truck, acts as a generator. This generated current passes through 4 REC. A signal taken from 4 REC, when plugging current is present, is fed to Card 1 retarding the pulse frequency and provides a soft reverse stopping action. The distance or severity of the reversal is adjustable by means of a PLUGGING trimpot on the card.



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

1A TIMER: A time-delay pickup of 1A is provided by a circuit in Card 1. This allows the truck to accelerate through the SCR range before 1A picks up even if the accelerator 1A switch is closed immediately. This time delay is adjustable by means of a 1A is rendered inoperative any time plugging is in process.

1A CONTACTOR (By-pass contactor around the SCR control): The 1A contactor is used to provide top truck speed, torque, and efficiency when called for. The 1A contactor is picked up when the accelerator is moved to its extreme end of travel.

THERMAL PROTECTOR: A thermal protector (TP) is mounted on the heat sink between 1 REC and 2 REC. This is a temperature sensitive device which increases resistance with an increase in temperature. During the normal operating range, the thermal protector has a resistance of approximately 50 ohms. If the temperature of the 1 REC heat sink exceeds 80 deg. C., the resistance of the thermal protector increases. Being in series with the accelerator potentiometer, this increased resistance decreases the speed of the truck. The truck will operate at a reduced speed until the temperature reaches a safe value, then full SCR power will be available.

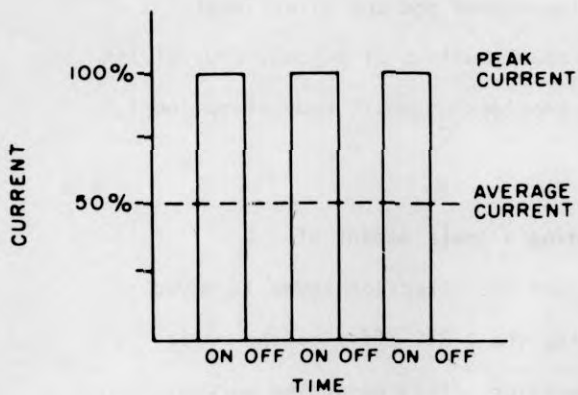


Figure 2. Battery Current

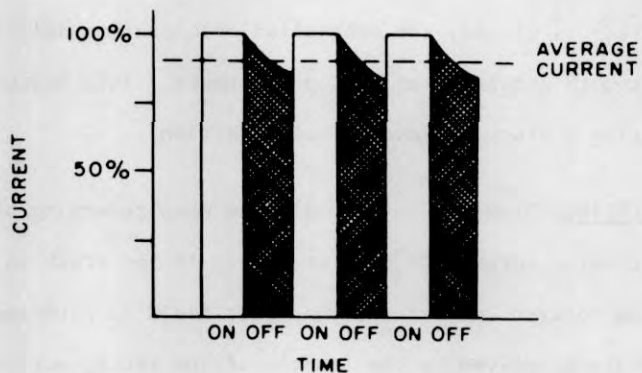


Figure 3. Motor Current



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

GENERAL MAINTENANCE INSTRUCTIONS:

The SCR control, like all electrical apparatus, does have some thermal losses. The semi-conductor junctions have finite temperature limits above which these devices may be damaged. For these reasons, normal maintenance should guard against any action which will expose the components to excessive heat, such as steam cleaning; or which will reduce the heat dissipating ability of the control, such as restricting air flow.

The following DO'S and DON'TS should be observed:

1. Any controls that will be used in altitudes of 5000 feet or over and in ambients of 100 deg. F (40 deg. C) or over should be brought to the attention of the Clark Dealer.
2. The control should not be steam cleaned. In dusty areas, use low pressure air to blow off the control. In oily or greasy areas, a mild solution of detergent can be used to wash off the control and then blow completely dry with low pressure air or Freon TF (registered trademark)* degreaser. *(Registered trade mark of the DuPont Company)
3. Terminal boards and other exposed SCR control parts should be kept free of dirt and paint which might change the effective resistance between points.
4. The truck should not be plugged when the truck is jacked up and the drive wheels are in a free wheeling position. This can create excessive voltages that can be harmful to the control.

INDUSTRIAL TRUCK DIVISION

GENERAL MAINTENANCE INSTRUCTIONS

The air control, steering and electrical systems, when they have been checked, should be checked again. The engine should be checked for oil level and water level. The battery should be checked for electrolyte level and water level. The tires should be checked for air pressure and tread. The brakes should be checked for wear and adjustment. The suspension should be checked for wear and adjustment. The steering should be checked for wear and adjustment. The electrical system should be checked for proper operation. The air control system should be checked for proper operation. The steering system should be checked for proper operation. The electrical system should be checked for proper operation.

The following tools and equipment are required for the maintenance of the truck.

Any contractor that will be used in the repair of the truck should be licensed and insured.

The truck should be brought to the attention of the driver.

The truck should be checked for oil level and water level.

The truck should be checked for air pressure and tread.

The truck should be checked for wear and adjustment.

The truck should be checked for proper operation.

The truck should be checked for proper operation.

The truck should be checked for proper operation.

The truck should be checked for proper operation.

The truck should be checked for proper operation.

I M P O R T A N T

This machine must be thoroughly checked before it is put into service.

The attached CHECKING FORM must be filled out and has to accompany the installation report before we will accept any warranty claims for this machine.

DO NOT use a Motor Generator unit such as Ready Power to move and/or check this machine as serious damage may occur.

If, for any reason, the machine does not comply with the adjustment, inspection and test procedures, the figures you enter on the checking form will have to be known prior to contacting the factory.

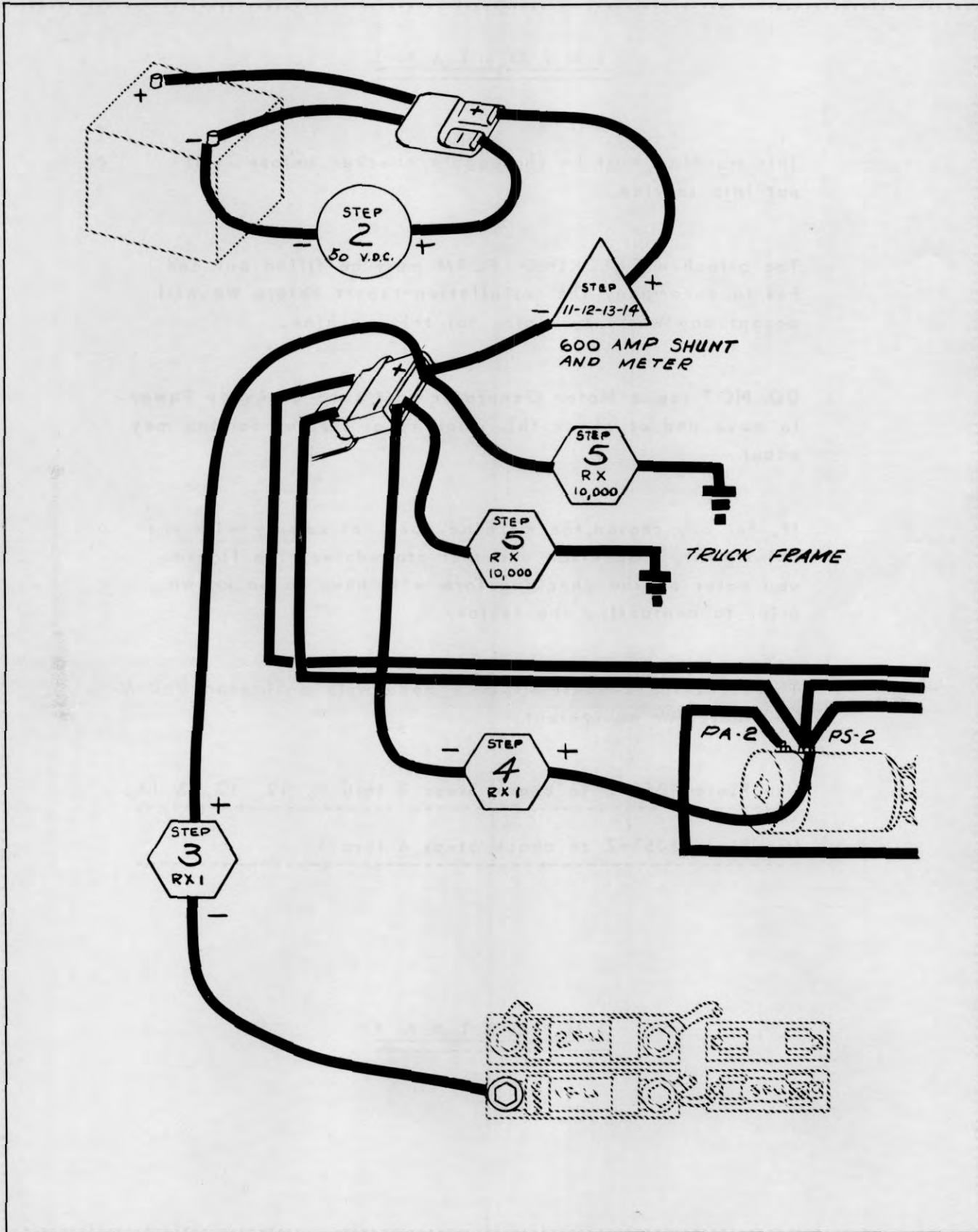
The following checks **MUST** be made with a Simpson V-0-M 260 Meter or equivalent.

Use Plate 1050-Z to check Steps 2 thru 5, 12, 13, & 14.

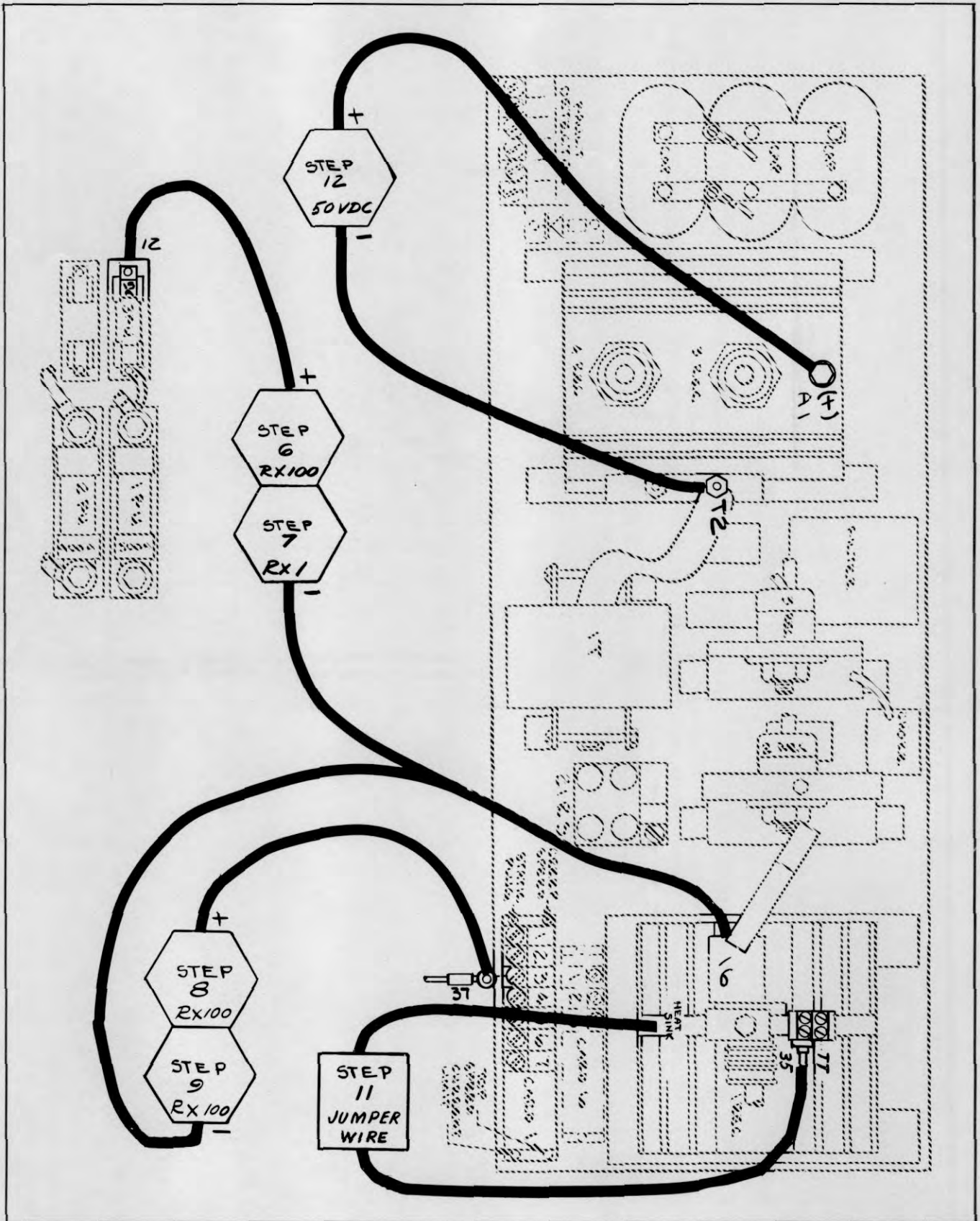
Use Plate 1051-Z to check Steps 6 thru 12.

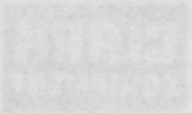
 I M P O R T A N T

TROUBLE SHOOTING



TROUBLE SHOOTING

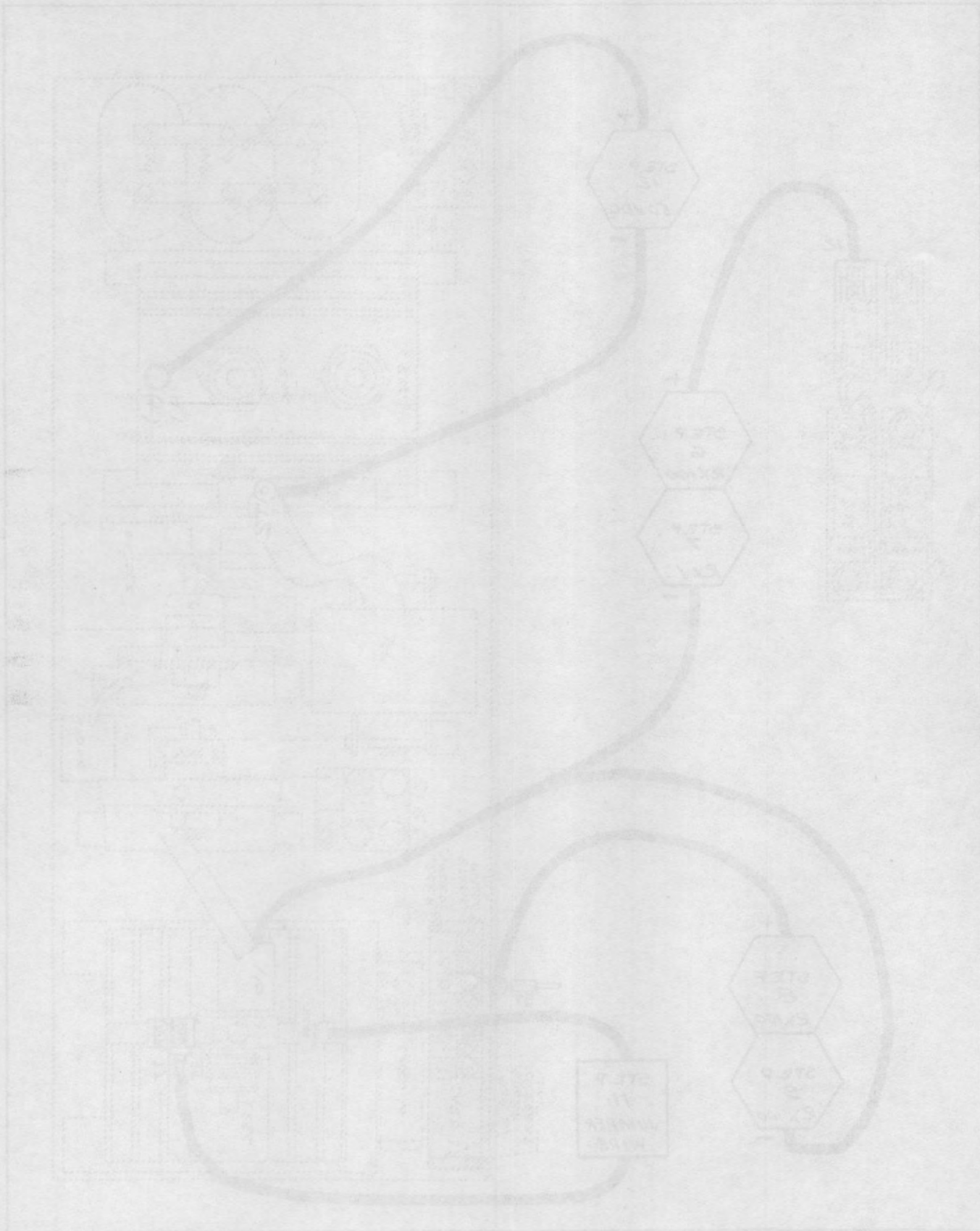




INDUSTRIAL TRUCK DIVISION



TRUCK SHOOTING





INDUSTRIAL TRUCK DIVISION



DEALER CHECK-OUT SHEET FOR GE C-290 MODEL 300
SOLID STATE CONTROL SYSTEM

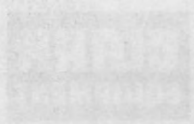
EC-60B, EC-70B AND EC-80B

Truck Serial No. _____ Date _____

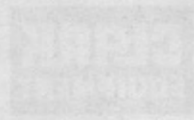
1. Battery Polarity Checked? _____ Battery Voltage _____ Volts
2. Truck Polarity
 - A. Positive Lead TO 1FU fuse checked? _____
 - B. Negative lead to pump contactors checked? _____
3. GROUND TEST (+) to frame _____ ohms, (-) to frame _____ ohms
4. CHECKING CONTROL WIRING.
 - A. Terminals 12 (+) to 13 (-) (all switches open) _____ ohms
 - B. Terminals 12 (+) to 13 (-) (key switch closed) _____ ohms
 - C. Terminals 12 (+) to 13 (-) (key, seat, 1ms & directional switch closed)
 - Directional Switch Forward Closed _____ ohms
 - Directional Switch Reverse Closed _____ ohms
5. SPEED POTENTIOMETER 1MS AND 2MS AND 1A SWITCHETTE OPERATION
 - A. Wires 29A and negative (-) 1ms switch actuates _____ ohms
 - B. Wires 29A and negative (-) 2ms switch actuates _____ ohms
6. CHECKED contactors manually? _____
7. Checked contactors electrically? _____
8. Checked creep speed? _____
9. CHECKING SPEED VOLTAGE AND CURRENT LIMIT
 - C. Maximum speed voltage _____ volts
 - D. Current limit _____ amps
10. Plugging distance _____ feet
11. Field Weaking: Pickup current _____ amps
Dropout current _____ amps

SEAL ADJUSTMENT TRIMPOTS ON CARD #1

MECHANIC _____ HOUR METER READING _____



INDUSTRIAL TRUCK DIVISION



REPAIR MANUAL - ORN SWIFT FOR OR C-150 MODEL 300
 200% TEST CONTROL SYSTEM
 SECTION 1 - 100 AND 200

1. Check battery electrolyte level and specific gravity.
2. Check battery terminals for tightness and corrosion.
3. Check battery cables for tightness and corrosion.
4. Check battery voltage (12.6 to 13.8).
5. Check battery current (10 to 15) (all switches open).
6. Check battery current (10 to 15) (all switches closed).
7. Check battery current (10 to 15) (all switches in operational switch closed).
8. Check battery current (10 to 15) (all switches in forward flow).
9. Check battery current (10 to 15) (all switches in reverse flow).
10. Check battery current (10 to 15) (all switches in neutral).
11. Check battery current (10 to 15) (all switches in stop).
12. Check battery current (10 to 15) (all switches in start).
13. Check battery current (10 to 15) (all switches in stop).
14. Check battery current (10 to 15) (all switches in start).
15. Check battery current (10 to 15) (all switches in stop).
16. Check battery current (10 to 15) (all switches in start).
17. Check battery current (10 to 15) (all switches in stop).
18. Check battery current (10 to 15) (all switches in start).
19. Check battery current (10 to 15) (all switches in stop).
20. Check battery current (10 to 15) (all switches in start).



INDUSTRIAL TRUCK DIVISION



DEALER CHECK-OUT SHEET FOR GE C-290 MODEL 300
SOLID STATE CONTROL SYSTEM

EC-60B, EC-70B AND EC-80B

Truck Serial No. _____ Date _____

1. Battery Polarity Checked? _____ Battery Voltage _____ Volts

2. Truck Polarity

A. Positive Lead TO 1FU fuse checked? _____

B. Negative lead to pump contactors checked? _____

3. GROUND TEST (+) to frame _____ ohms, (-) to frame _____ ohms

4. CHECKING CONTROL WIRING.

A. Terminals 12 (+) to 13 (-) (all switches open) _____ ohms

B. Terminals 12 (+) to 13 (-) (key switch closed) _____ ohms

C. Terminals 12 (+) to 13 (-) (key, seat, 1ms & directional switch closed)

Directional Switch Forward Closed _____ ohms

Directional Switch Reverse Closed _____ ohms

5. SPEED POTENTIOMETER 1MS AND 2MS AND 1A SWITCHETTE OPERATION

A. Wires 29A and negative (-) 1ms switch actuates _____ ohms

B. Wires 29A and negative (-) 2ms switch actuates _____ ohms

6. CHECKED contactors manually? _____

7. Checked contactors electrically? _____

8. Checked creep speed? _____

9. CHECKING SPEED VOLTAGE AND CURRENT LIMIT

C. Maximum speed voltage _____ volts

D. Current limit _____ amps

10. Plugging distance _____ feet

11. Field Weaking: Pickup current _____ amps

Dropout current _____ amps

SEAL ADJUSTMENT TRIMPOTS ON CARD #1

MECHANIC _____ HOUR METER READING _____

INDUSTRIAL TRUCK DIVISION

OF THE CHECK-OUT SHEET FOR THE CONTROL SYSTEM
DATE: _____
BY: _____

- 1. Check the following items:
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
 - f. _____
 - g. _____
 - h. _____
 - i. _____
 - j. _____
 - k. _____
 - l. _____
 - m. _____
 - n. _____
 - o. _____
 - p. _____
 - q. _____
 - r. _____
 - s. _____
 - t. _____
 - u. _____
 - v. _____
 - w. _____
 - x. _____
 - y. _____
 - z. _____

TROUBLE SHOOTING

CHECK-OUT PROCEDURE FOR GE C-290 MODEL 300
SOLID STATE CONTROL SYSTEM

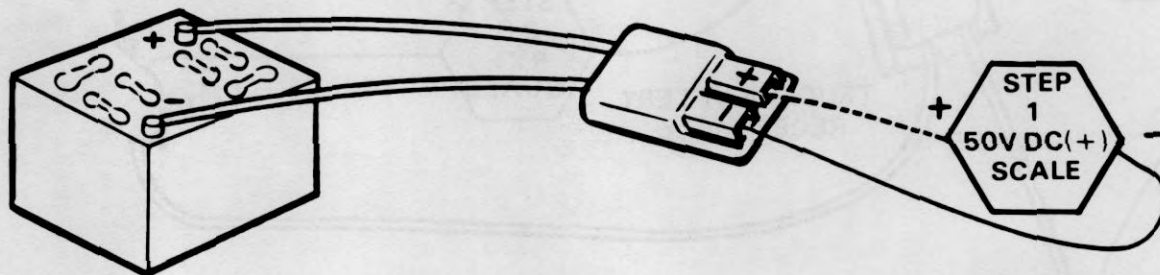
NOTE

If meter readings are not within SPECIFICATIONS of each step, refer to additional TROUBLE SHOOTING instructions following this check-out procedure.

EC-60B, EC-70B AND EC-80B

1. CHECKING BATTERY POLARITY AND BATTERY VOLTAGE:

With VOLTMETER set on 50 V DC (+) scale, place the RED lead on POSITIVE (+) and BLACK lead on NEGATIVE (-) battery connector.....you should read BATTERY VOLTS.....if meter needle moves BACKWARDS, the POWER CABLES are connected wrong on the BATTERY and should be reversed before connecting to machine.

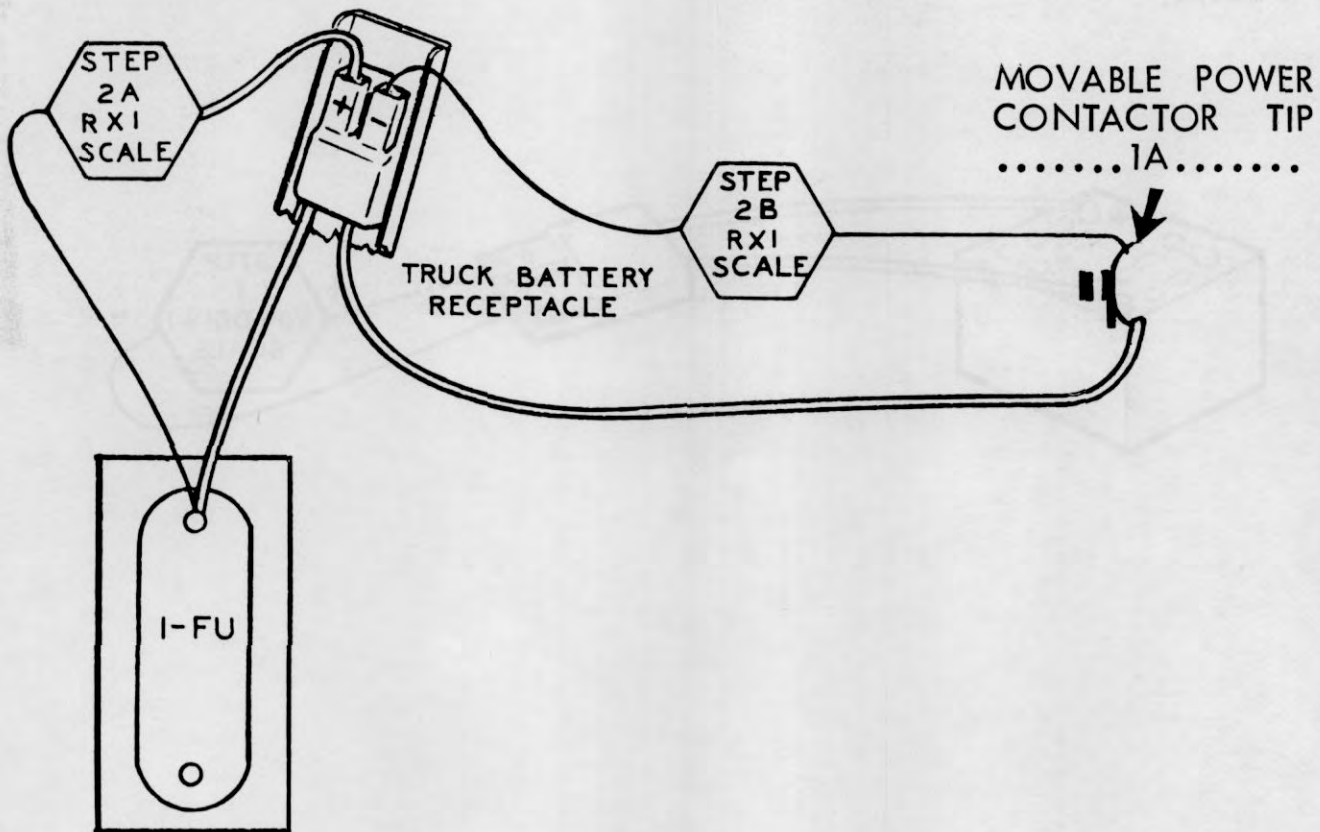


TROUBLE SHOOTING

2. CHECKING TRUCK POLARITY:

Checking CONTINUITY of POWER CABLES for proper polarity.

- A) With OHMMETER on RX1 scale, connect either lead (RED or BLACK) on the POSITIVE side of truck BATTERY RECEPTACLE.....the other lead on the 1FU fuse.....should have no resistance.
- B) With OHMMETER still set on RX1 scale...connect either (RED or BLACK) meter lead to the NEGATIVE side of the truck BATTERY RECEPTACLE....connect the other lead to the movable power tip of the 1A contactor and the meter should indicate...no resistance.



TROUBLE SHOOTING

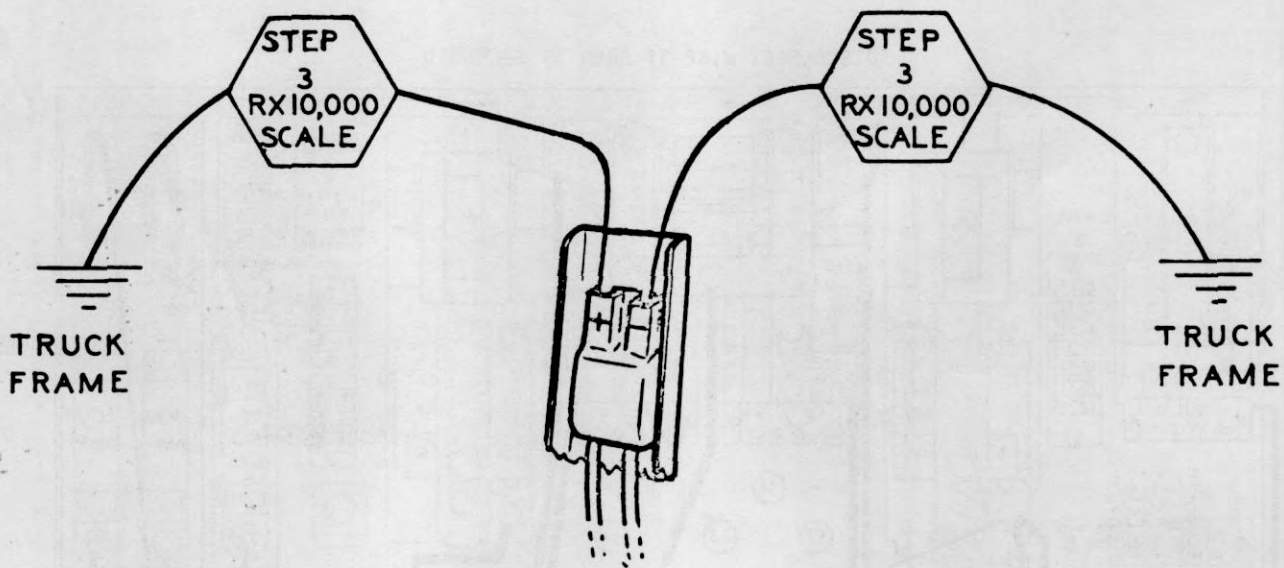
3. GROUND TEST:

With OHMMETER set on RX10,000 ohm scale.....check for grounds.

A) Connect POSITIVE (+) of truck RECEPTACLE to truck frame.

B) Connect NEGATIVE of truck RECEPTACLE to truck FRAME.

With 1A CONTACTOR held closed.....resistance for 3A and 3B should be 50,000 ohms or higher on new trucks.....30,000 ohms is acceptable on used trucks.



TRUBLE SHOOTING

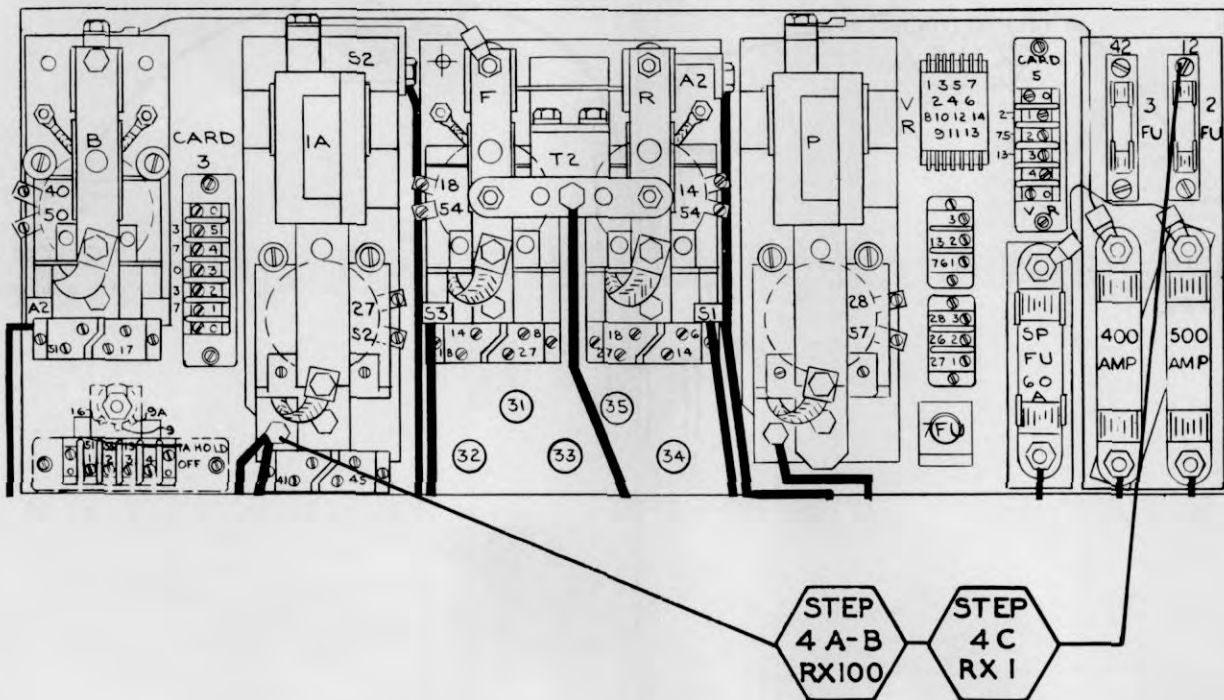
4. CHECKING CONTROL WIRING USING OHMMETER:

- A) With ALL SWITCHES open, measure OPEN CIRCUIT between wires 12(+) and 13(-).....meter set on RX100 scale.
- B) Close KEY SWITCH and measure approximately 700 ohms between wires 12(+) and 13(-).....meter set on RX100 scale.
- C) Close KEY, SEAT, ACCELERATOR 1MS AND DIRECTIONAL (FORWARD) SWITCHES and measure approximately 35 ohms between wires 12(+) and 13(-).....meter set on RX1 scale.

N O T E

Remove BACKUP LIGHT (if used) at the REVERSE CONTACTOR.

DISCONNECT WIRE 31 FROM SP SOLENOID



TROUBLE SHOOTING

5. CHECKING SPEED POTENTIOMETER, 1MS AND 2MS SWITCHETTE OPERATION:

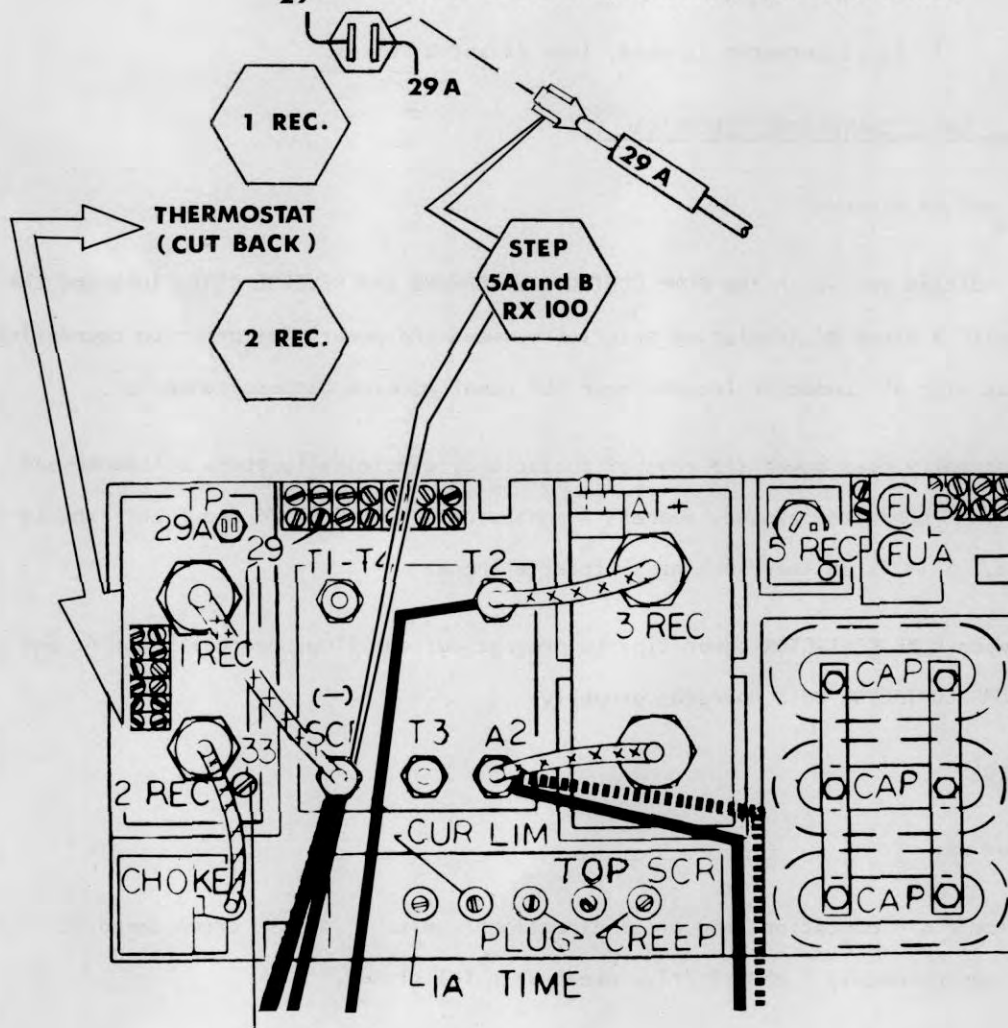
A) Disconnect wire spade 29A on SCR PANEL THERMOSTAT (cutback). Connect OHMMETER.....RX100 scale..... on wire 29A and NEGATIVE POWER TERMINAL on scr panel.....measure 8,500 to 9,500 ohms as 1MS SWITCH clicks, when PEDAL is depressed slightly.

B) With OHMMETER on RX1 scale.....depress ACCELERATOR completely.....2MS SWITCH should click..... ohmmeter should read 300 ohms or less.

N O T E

If 1MS, 2MS or SPEED POTENTIOMETER are improperly adjusted

29refer to write-up covering this adjustment.





INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

6. CHECKING CONTACTORS MANUALLY:

Before connecting BATTERY.....manually push the ARMATURE PLATE in until power tips CONTACT and WIPE.

N O T E

Interlocking switches should not actuate until after power tips make contact. This check is performed to detect contactor binding, switchette operation and wire interference with contactor tips.

C A U T I O N

DO NOT USE ANY OTHER POWER SOURCE.....BATTERY ONLY AND WITH NO POWER CABLE EXTENSIONS.

N O T E

If fault detector is used, jump 2X and 2Y wires.

7. CONNECT BATTERY.....CHECK CONTACTORS ELECTRICALLY:

With key, seat and 1ms switch closed:

- A) Make the following voltage test with the PUMP CONTACTOR, FORWARD and REVERSE CONTACTORS and the 1A CONTACTOR isolated with a piece of insulating material between the power tips prior to connecting the battery. Disconnect wire 45 connector located near SCR panel machine harness connector.
- B) With insulator in normally open power tip gaps of contactors, electrically operate FORWARD and REVERSE contactors. With F contactor closed, depress R contactor ARMATURE PLATE and F coil should drop out and vice versa. This is an interlocking switchette check.
- C) With insulator between PUMP CONTACTOR power tips to prevent current flow, operate the lift and tilt lever to see if PUMP CONTACTOR COIL operates properly.

8. CHECKING CREEP SPEED:

With DRIVE WHEELS jacked up:

- A) Remove insulator from F & R contactors and close directional switch. Adjust creep speed on Card 1 as desired.....approximately 1 RPM of drive wheel with 1MS closed.

C A U T I O N ----- (See next page)

TROUBLE SHOOTING

C A U T I O N

WITH INSULATOR IN POWER TIPS OF 1A CONTACTOR.....CHECK MAXIMUM SPEED VOLTAGE AND CURRENT LIMIT.
THESE ADJUSTMENTS HAVE BEEN PRESET AT THE FACTORY AND SHOULD NOT REQUIRE ADJUSTMENT.

9. CHECKING SPEED VOLTAGE AND CURRENT LIMIT:C A U T I O N

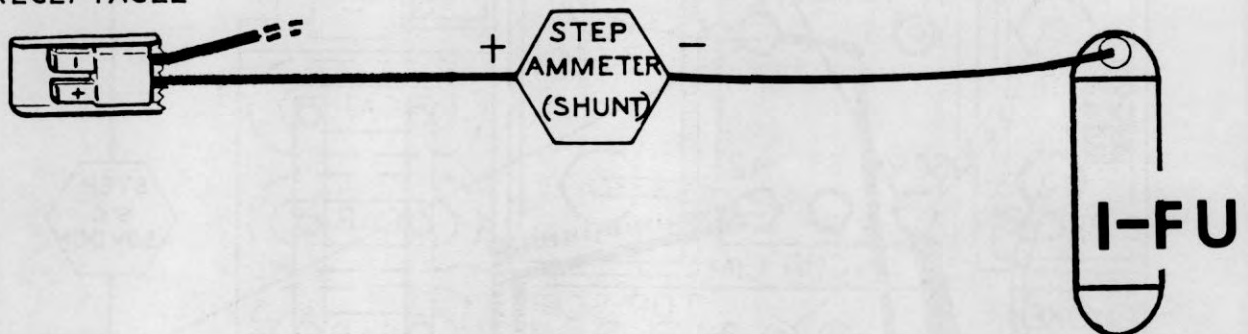
DO NOT STALL MOTOR FOR MORE THAN 30 SECONDS AT A TIME.....ALLOW TIME FOR MOTOR COOLING BETWEEN STALLS.
DO NOT OPERATE MOTOR AT HIGH SPEEDS OR REVERSE DRIVE MOTOR WITH DRIVE WHEELS JACKED UP.

Equipment Required;

1. Volt Ohmmeter, Simpson 260-5P or equivalent.
2. 50 MV 600 AMP Shunt and 50 MV 600 Ammeter.....
or.....Sun Ammeter, Clark Part #1800979.

A) Disconnect the POSITIVE POWER CABLE from 1FU fuse and connect the ammeter (shunt) between the power cable and the 1FU fuse.

TRUCK BATTERY
RECEPTACLE



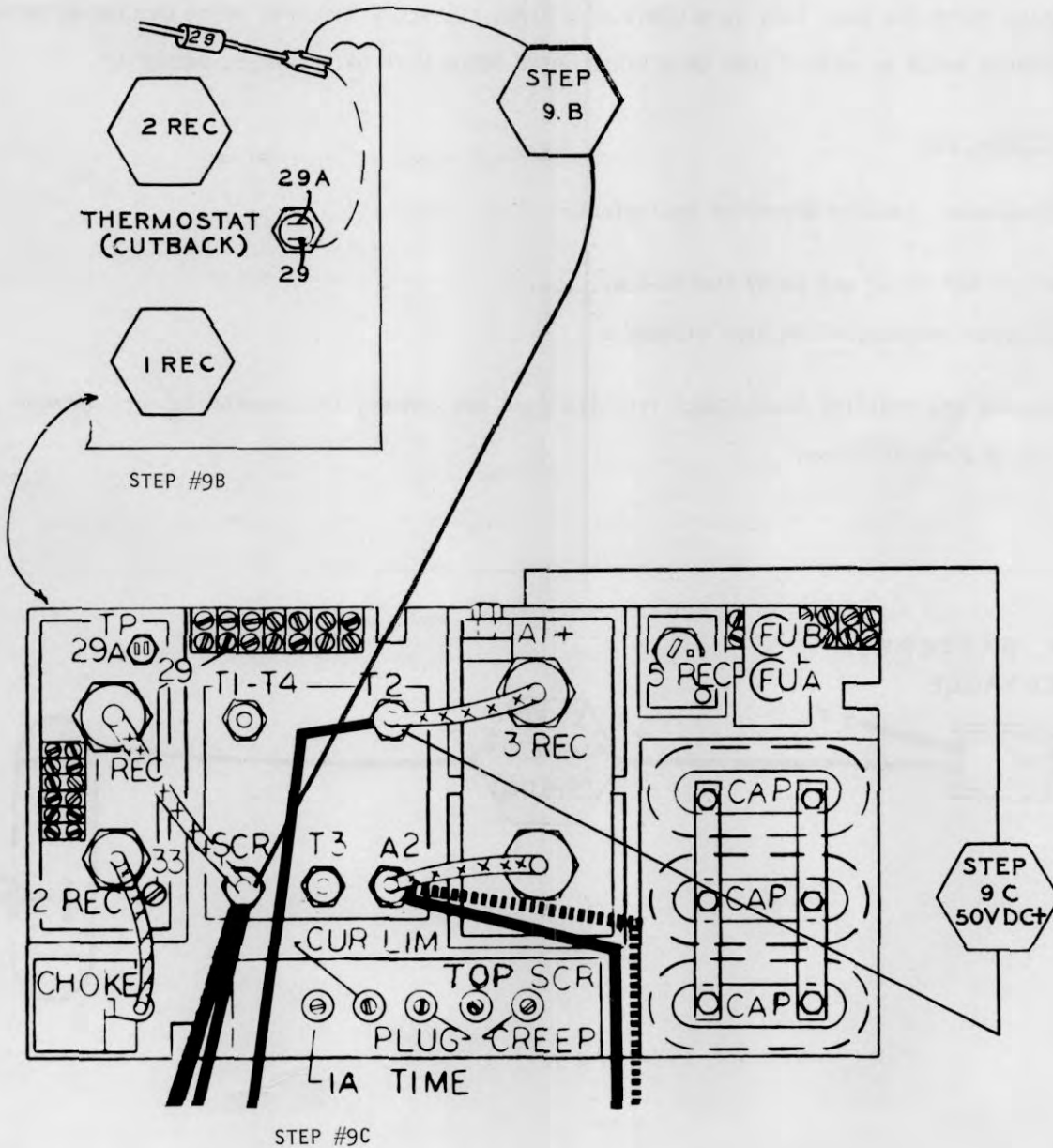
TROUBLE SHOOTING

B) Remove wire spade 29 from the thermostat (cut back). Connect a jumper from wire spade 29 to NEGATIVE of the SCR panel.

CAUTION

THIS PRODUCES FULL SCR WITH ACTUATION OF 1MS WHEN DIRECTIONAL CONTACTOR IS PICKED UP.

C) Connect the volt meter between the positive (sensor connection) terminal and T2 on the SCR panel.





INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

D) Check MAXIMUM SPEED VOLTAGE first by depressing ACCELERATOR PEDAL for full SCR speed and applying the brakes until battery current is 120 to 130 amps.....volt meter reading should be:

25 - 32 volts 36 Volt Battery

34 - 43 volts 48 Volt Battery

If not, adjust the top SCR speed on Card 1.

E) Now....check CURRENT LIMIT by depressing ACCELERATOR PEDAL for maximum SCR and applying the brakes until the wheels come to a standstill.....there must be no rotation of drive wheel/s for this check.

The meter should read:

270 amps minimum 280 amps maximum 36 Volt Battery

245 amps minimum 255 amps maximum 48 Volt Battery

If not.....adjust the current limit on Card 1.

F) Remove jumper and reconnect wire spade 29 to thermostat (cutback). Remove voltmeter and ammeter (shunt).

10. OPERATION:

Reconnect wires 45 connector (Machine Harness), remove insulator from 1A contactor tips and check 1A contactor pick up time for approximately 1 second: If adjustment is required, adjust 1A TIMER on Card 1. (Clockwise to increase time delay.) With DRIVE WHEELS on the ground.....give truck a general operational check-out.....including plugging without load from various speeds. Adjust plugging distance with TRIMPOT on Card 1 as desired (Clockwise to decrease distance). If unable to adjust plugging, see TABLE 6, Note Item F in this table. SEAL ALL TRIMPOTS ON CARD 1.

11. TRUCKS EQUIPPED WITH FIELD WEAKENING KIT (Optional 36V Only):

Install ammeter (shunt) per STEP #9 and remove insulators from all contactors. With wheels jacked up.....check FW CONTACTOR picks up and drops out at correct values of current.....stall the DRIVE MOTOR by depressing the brake pedal, then.....release brake pedal until pick-up occurs and then depress brake pedal until drop out occurs.

EC-60B, EC-70B AND EC-80B:

PICK-UP: 260 to 290 amps, DROP OUT: 500 to 550 amps.

If values are incorrect, adjust current trimpot at Card #2 (counterclockwise to increase current values and visa-versa to decrease values).

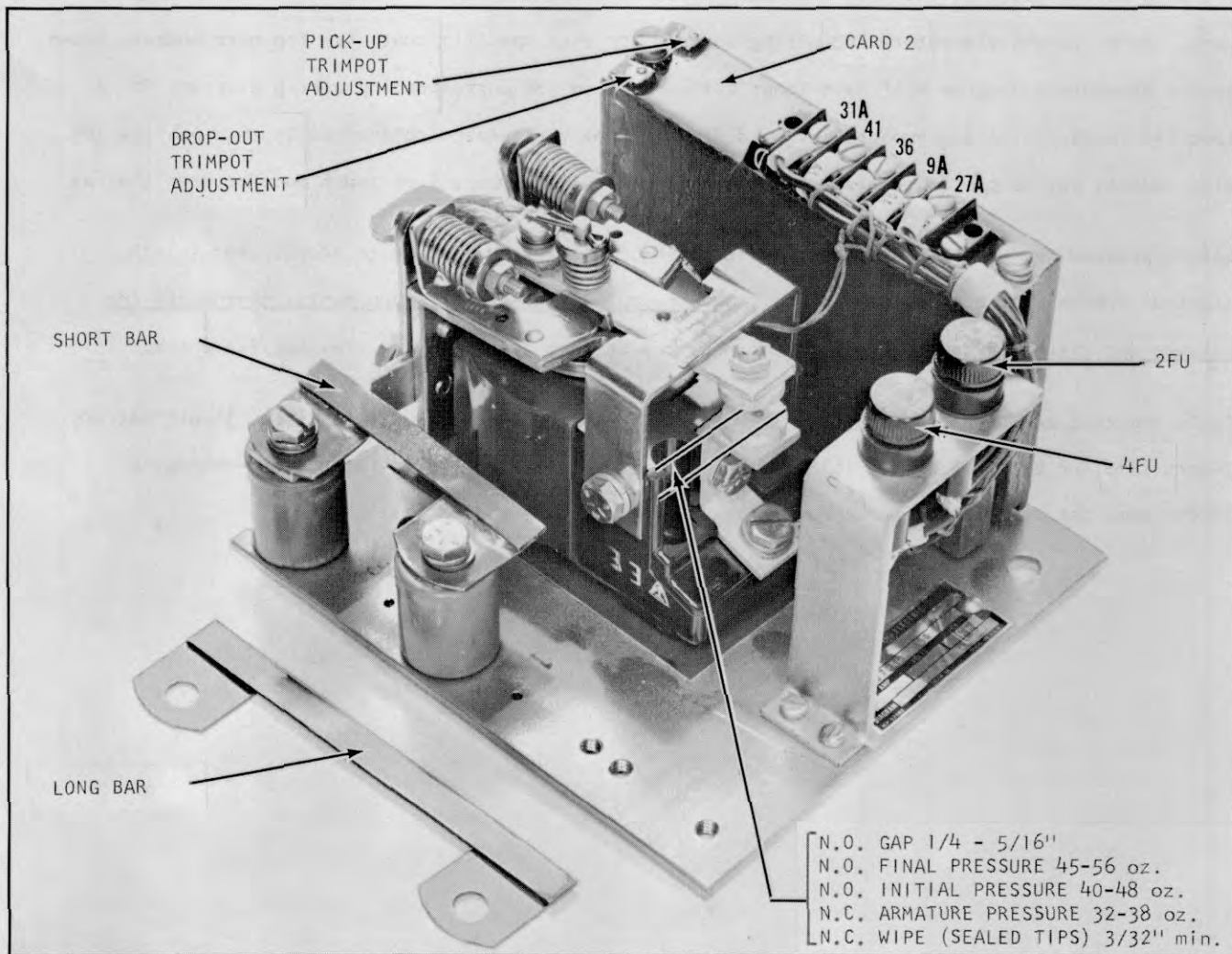


Plate 10595. Typical Field Weakening Unit



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

TROUBLE SHOOTING INSTRUCTIONS

Solid State Control System

The pulsing of the main SCR is too fast for conventional instruments to measure. When the control is functioning properly, a low hum can be heard.

Malfunctions of the SCR will generally fall into one of two categories. They are either no power (TABLE 1) or full power (TABLE 2), when operating in the SCR control range.

These simple and easy-to-follow tables outline the various symptoms and the corrective action to be taken.

The same device designations have been maintained on different controls but the wire numbers may vary. Refer to the elementary and wiring diagram for your specific control. The wire numbers shown on the elementary diagram will have identical numbers on the corresponding wiring diagrams for a specific truck, but these numbers may be different from the numbers referenced in this publication. Wire numbers may be preceded with a "G" to distinguish GE numbers from truck manufacturer's wires.

Before proceeding, visually check for loose wiring, maladjusted linkage to accelerator switch, signs of overheating of components, etc. Before touching electrical components, disconnect the battery and discharge capacitor 1C. Reconnect the battery as needed for the specific check.

Tools and test equipment required are 36-volt test battery, 25-ohm 2-watt resistor, 3-volt battery, 3-volt lamp (or Bright Star No. 1618CT circuit continuity tester), clip leads, volt-ohm meter (20,000 ohms per volt) and general hand tools.



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

Failures Which Cause No Motor Torque With
SCR Control GE C-290 SCR Control...Solid State

SYMPTOMS

WHAT TO DO

- 1A. Contactors do not pick up. No control voltage from positive to negative.
- 1B. Contactors do not pick up. Control volts present from positive to negative.

Check power fuses.

Check battery for low specific gravity connections and for looseness or broken fittings.

(For these tests, if fault detector is used, disconnect wire 27 from fault detector terminal 3.)

*Connect jumper from battery positive to positive side of F or R coil. If device does not pick up, check coil for continuity. Also jumper negative to opposite terminal to check for opens in negative connections.

*(Truck/s with 36 Volt Battery) Connect jumper from negative side F or R Coil to negative (by passing F & R Contactor Resistor). If device does pick-up, check operation of voltage relay.

*With jumper on battery positive move other end to wire 8 on F interlock or wire 6 on R interlock. Coils should pick up. This proves F and R electrical interlocks.

*Using jumper continue to check remaining components in circuit such as directional switch, seat switch and key switch by moving end of jumper to positive side of each of these devices.

- 1C. Contactors Close. No power and no SCR hum with accelerator in SCR range.

*With F or R picked up and wire 45 disconnected at wire #45 connector (part of wire harness...located near SCR panel). Check for control volts positive at SCR terminal board (wire 41) to negative (wire 13A). If there is zero volts at this point, check F or R normally open interlocks and 1A coil for continuity.

*With F or R picked up and wire 45 disconnected at SCR terminal (cont. next page)

*Drive wheels should be off the floor.



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TROUBLE SHOOTING

SYMPTOMS

WHAT TO DO

1C. (Continued)

board, check for control volts positive at 1 REC heat sink (wire 33) to negative (wire 13A). If there is zero volts at this point, check: FUB, F or R power tips, and continuity of wiring from battery positive to 1 REC heat sink.

NOTE #1:

Drive wheels should be off the floor.

... continued next page ...

TROUBLE SHOOTING

1C. (Continued)

(See Note #1) With the F or R picked up and wire #45 disconnected at the wire #45 connector located near the SCR panel connector (machine harness), measure approximately 3 volts from (wire #29) to negative (wire #13A) with accelerator potentiometer near creep speed. Volts will drop to zero as accelerator is moved toward full speed. If readings are not correct, first place a jumper wire between wires #29 and #29A which bypasses the thermal protector. Depress the accelerator and check for the above voltage. If voltage readings are correct, replace thermal protector.

If the above tests will produce no voltage change, place a jumper between wires #29A and #13A. This bypasses the accelerator and the truck should now run at top SCR speed. If top speed is obtained, check accelerator potentiometer per Table #41. If motor fails to operate, check card per Table #4A.

Check #1 REC for open circuit or open gate (See 4H).

Check card (See 4A).

1D. Contactors close, but very little power and high-pitch SCR hum.

Check #2REC for a shorted condition in the conducting direction (See 4E).

1E. Contactors close. Very little or no power with low SCR hum, even when accelerator is in top SCR position.

(See Note #1) Disconnect wire #5A from 3 and 4 REC heat sink and wire #9 from F and R contactors. Reapply power and if control operates normally, replace card.

(See Note #1) Check setting on card, creep speed and top speed. Also if current limit is full counter-clockwise speed will be slow.

1F. Contactors close. Very little power with a normal SCR hum.

Check 3REC for open condition (See 4D). If 3 REC is found to be open, check 1, 2, and 5 REC for proper operation.

Check #4 REC for short (See 4D).

NOTE #1: Drive wheels should be off the floor.



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

Failures Which Cause Full Motor Torque With SCR Control

TABLE 2

2A. Contactors close. Full SCR speed immediately with audible hum.	Check potentiometer for proper resistance (see #41). Check for grounds in wires #29 and #29A or shorted accelerator potentiometer.
2B. Contactors close. Full speed immediately with no audible hum.*	Check for welded power tips on 1A contactor. Check timer section of card (See #4Ad).
2C. Contacts close. Full speed immediately with no audible hum.* Capacitor not charged.	Check for open gate circuit to 5 REC (See 4E and 4Aa). Check 5 REC for shorted condition (See 4E). If 5 REC shorted, also check 4Ac. Check continuity of wiring from 1C to 5 REC and from 5 REC through T3, T4 to T1 and 1 REC wire #33. Check capacitor 1C (See 4B). Check 1 REC for short (See 4E).
2D. Contactors close. Full speed immediately with no audible hum.* Capacitor Charged.	Check for open 2 REC (See 4E). Check for open gate in 2 REC (See 4E). Check for open gate circuit to 2 REC (See 4Ab).

*If truck is equipped with a fault detector and it fails to shut down the control on the above faults, check fault detector per instructions listed in following pages.

Misoperation Of Special Features

TABLE 3

3A. Failure of 1A contactor to operate.	(See Note #1) With all direction switches closed, jumper negative to SCR terminal board (wire #41). 1A should pick up immediately. This checks the 1A coil. (See Note #1) Move negative jumper to SCR terminal board (wire #45). 1A should pick up after approximately 1 delay. This checks the timer section of Card #1.
3B. Failures in FW circuit.	Refer to procedures in this section.
3C. Severe reversal.	Check #1 (See 6b...Card Tune-Up Instruc). Check 4 REC (See 4D). Check continuity of wires #5 and #9.
3D. Very soft reversal.	Check FUA (if used). Check same as 3C.

NOTE #1: Drive wheels should be off the floor.



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

TABLE 4

Before touching electrical components, disconnect the battery and discharge capacitor 1C.

4A. CARD 1 (See Table 6 for tuneup of Card 1):

The following is a list of simple tests that can be performed with a volt-ohm meter. Remove card from panel by loosening two screws at bottom of box, pull box straight up to disengage from receptacle. Connection can be made to card pins with insulated clips.

a) 5 REC FIRING CIRCUIT:

VOM on RX100 scale. Connect VOM positive lead to pin 13, negative lead to pin 49, circuit should read 1700 to 2100 ohms. Reverse leads and read infinity.

b) 2 REC FIRING CIRCUIT:

VOM on RX100 scale. Connect VOM positive lead to pin 21, negative lead to pin 25; circuit should read infinity.

c) TRANSFORMER FILTER: NOTE: The 6-trim pot card does not have a transformer filter....no test required on 6-trim pot card units. VOM on RX100 scale. Connect VOM positive lead to pin 21, negative lead to pin 33; circuit should read 2050 to 2750 ohms. Reverse leads and read infinity.

d) 1A TIMER:

Connect volt-ohm meter positive to 41, negative to 45, and set scale to 50-volts d-c. Using a 36-volt test battery, connect battery positive through a 25-ohm 2-watt resistor to terminal 41. Connect battery negative through a normally open switch to terminal 45. Close switch and observe battery voltage on VOM, after approximately 1 second voltage should drop to 0 volts indicating timer action. Do not hold power on after timer turns on.

4B. CAPACITOR 1C:

Disconnect battery and discharge capacitor. Remove Card 1. Measure ohms through the capacitor using the RX10,000 scale. Meter should read zero ohms and then swing to above 100,000 scale. Meter should read zero ohms and then swing to above 100,000 ohms. Replace capacitor if above reading is not obtained.

4C. CONTACTOR COIL AND ACCESSORY FILTER:

(7, 8, 9, and 12 REC)

On some magnetic panels, the contactor coils will either be varnish tape-wound or encapsulated in green epoxy. For the varnish tape-wound type, a separate filter is required and will be mounted adjacent to the coil. The new green epoxy encapsulated coil contains the necessary filtering and is not visible from the exterior of the device.

a) Separate Filter (Typical Cat. No. 148B6203G14)

These are varistors and should be checked as follows: Disconnect battery and discharge capacitor 1C.

Disconnect the leads to the filter block. Connect a 36-volt d-c test battery in series with the varistor and a volt-ohm meter set on the 1ma. scale as shown in Figure 1. If the varistor is good, there will be a noticeable deflection of the meter needle when the leads are touched to the filter block terminals. If no deflection is obtained, replace the filter block.

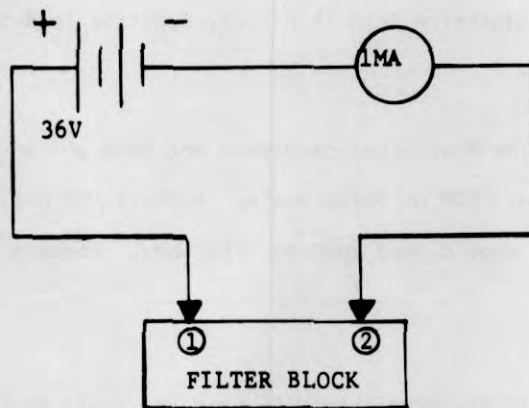


Figure 1

b) Integral Coil Filter

When this filter fails, it will be evident by a severe cracking of the coils in the vicinity of the coil terminals.

4D. RECTIFIERS:

When checking diodes, disconnect battery and discharge capacitor 1C to prevent burning out the ohmmeter. When reassembling rectifiers, refer to TABLE 5.

3 and 4 REC: *Disconnect pigtail.* 3 and 4 REC are diodes with about 7 to 12 ohms in the conducting direction (+ —) measured on the RX1 scale, and infinite resistance in the nonconducting direction (— +) measured on the RX10,000 scale.

15 and 16 REC: Disconnect one lead. Check same as 3 and 4 REC on preceding page.

4E. SCR'S (1REC, 2REC, 5REC):

These are silicon control rectifiers. Before checking, disconnect battery and discharge capacitor 1C. Remove card and box from panel and lay aside, this opens the gate circuits to all three devices. Disconnect pigtail of 1 and 2 REC or lead to terminal of 5 REC.

To check an SCR, it is necessary to have a 3-volt lamp. (A test flashlight such as a Bright Star No 1618CT, or equivalent, circuit continuity tester is excellent for this test.)

Connect the plus lead to the stud (1), connect negative lead to the pigtail (3) as shown in Figure 2 below.

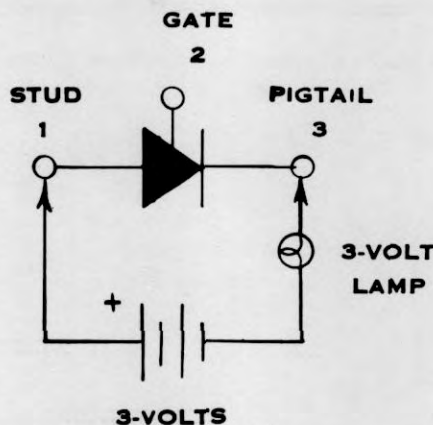


Figure 2

- a) The lamp should not light...if the lamp does light, the SCR is shorted and must be replaced.
- b) If check (a) was satisfactory, test the SCR for its ability to be turned on by the gate. Touch gate (point 2) to point 1. If gate is operative, the lamp should come on and must remain on when the gate is removed.
- c) If lamp cannot be lit under step (b) the SCR is open and must be replaced.

Ohmmeter Method of Checking RECS

- continued next page -

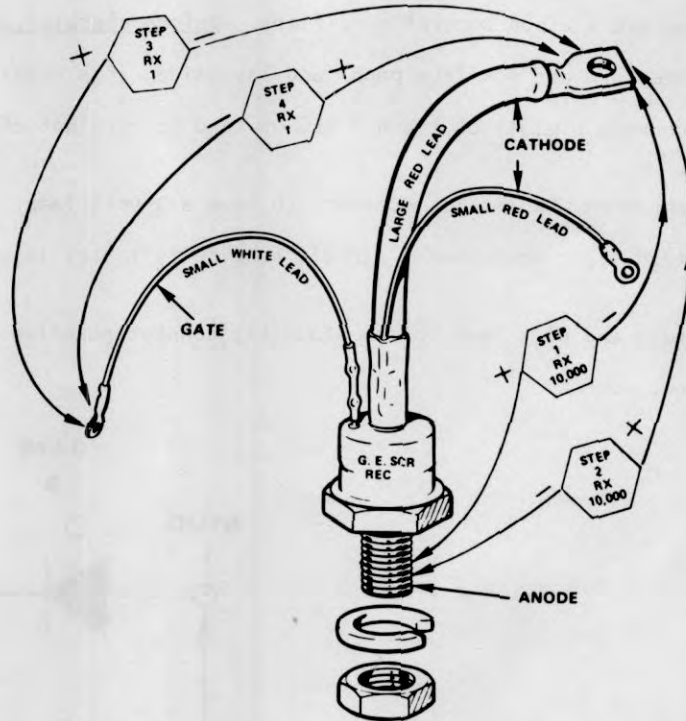
4C. - continued -

ALTERNATE OHMMETER METHOD OF CHECKING REC'S:
(if light is not available)

---- REC #1 -----
STEP 1 & 2 100,000 ohms min.
STEP 3 Acceptable reading:
1 to 1,000 ohms
STEP 4 70 ohms min.

---- REC #2 -----
STEP 1 & 2 same as #1 REC
STEP 3 same as #1 REC
STEP 4 100 ohms min.

---- REC #5 -----
STEP 1 & 2 same as #1 REC
STEP 3 same as #1 REC
STEP 4 700 ohms min.

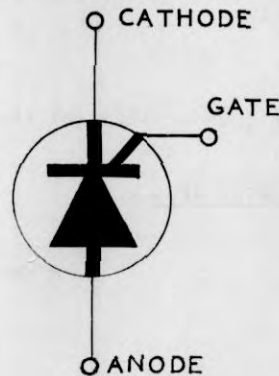


When checking RECS 1-2 & 5 on all G.E. SCR
Systems

WHAT IS AN SCR?:

Since the heart of the control is a silicon controlled rectifier (SCR), a general understanding of the characteristics of the device will be helpful. The SCR is a semiconductor rectifier used as a latching switch; i.e., it may assume either a conducting or nonconducting state (On or Off).

The SCR can be turned on by a momentary application of control current to the gate. To turn it off, it is necessary in addition to remove the turn-on signal from the gate, either to remove all power from the SCR or to apply momentary reverse voltage between cathode and anode.





INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

TABLE 5

Replacement of Semiconductors:

When replacing semiconductors such as 1, 2, 3, 4 and 5 REC; it is not necessary to torque these devices to a specific value. However...the device should be screwed into the heat sink and tightened to a snug fit.

The use of a heat transfer grease (such as GE Versilube G-350-M equivalent) is recommended.

Locking devices must be properly adjusted to prevent semiconductor from becoming loose.

TABLE 6

Number 1 Card Tuneup Procedure:

1. Turn CURRENT LIMIT trimpot fully clockwise.
2. Turn PLUGGING trimpot fully clockwise.

N O T E

Some cards have six trimpots. The sixth trimpot is a coarse plug trimpot, is not marked and is located in the side slot. (STEPS '1' and '2' prevent any interaction when setting the speed adjustment.)

3. Adjust CREEP SPEED as desired.
4. TOP SCR SPEED....(refer to checkout procedure for specific truck).
5. CURRENT LIMIT:

Turn the current limit trimpot fully counterclockwise. When the trimpot is fully counterclockwise, the card is designed so that the control may be cut off. (No pulsing occurs.)

Check to be sure the PLUGGING TRIMPOTS are fully clockwise. Depress the accelerator until F or R operate but not the 1A. Apply the brakes until the wheels come to a standstill and remain at a standstill. Slowly turn the CURRENT (Continued to Next Page).....



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

LIMIT TRIMPOT in a clockwise direction until the current reaches the desired value for the specific truck.

N O T E

Do not stall the motor for more than 30 seconds at a time.

6. STATIC PLUGGING:

To adjust the static plugging, the truck should be in its normal running condition and on the ground. Turn the COARSE PLUGGING TRIMPOT approximately 3/4 of a turn counterclockwise, then...adjust the plugging distance with the marked STATIC PLUG trimpot for the desired stopping distance.

7. 1A TIMER:

The 1A timer is factory set at approximately 1 second on all models. Check truck performance. If the 1A contactor picks up too early, resulting in jerky operation, turn the 1A timer trimpot CW to increase time delay, to a value that provides desired operation.

After all the trimpots have been set, each should be sealed with a silicon rubber compound such as RTV (bath-tub sealer). This will discourage further adjusting by unauthorized personnel.



INDUSTRIAL TRUCK DIVISION



WORK SAFELY

DRIVE SAFELY

BE CAREFUL

ALWAYS

GIVE MACHINE SERIAL NUMBER

WHEN ORDERING PARTS



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

SOLID STATE CONTROL

ACCELERATOR ADJUSTMENT:

STEP #1

- A. Disconnect BALL JOINT (Item A), position pedal to 2-7/8" dimension, from machined surface of casting.
- B. Turn STOP NUT (Item B) to hold this position.

STEP #2

- A. Loosen NUTS (Item C) and back off (2) SET SCREWS (Item D) until flush with cast surface of SPRING ACTUATOR (Item E).
- B. Do not tighten SET SCREWS (Item F) in coupler at this time.

STEP #3

- A. Adjust LINKAGE ROD (Item G) to 2-3/16" dimension.

STEP #4

- A. Adjust PEDAL STOP BOLT (Item H) to 7/16" dimension, and lock in place with JAM NUT (Item J).

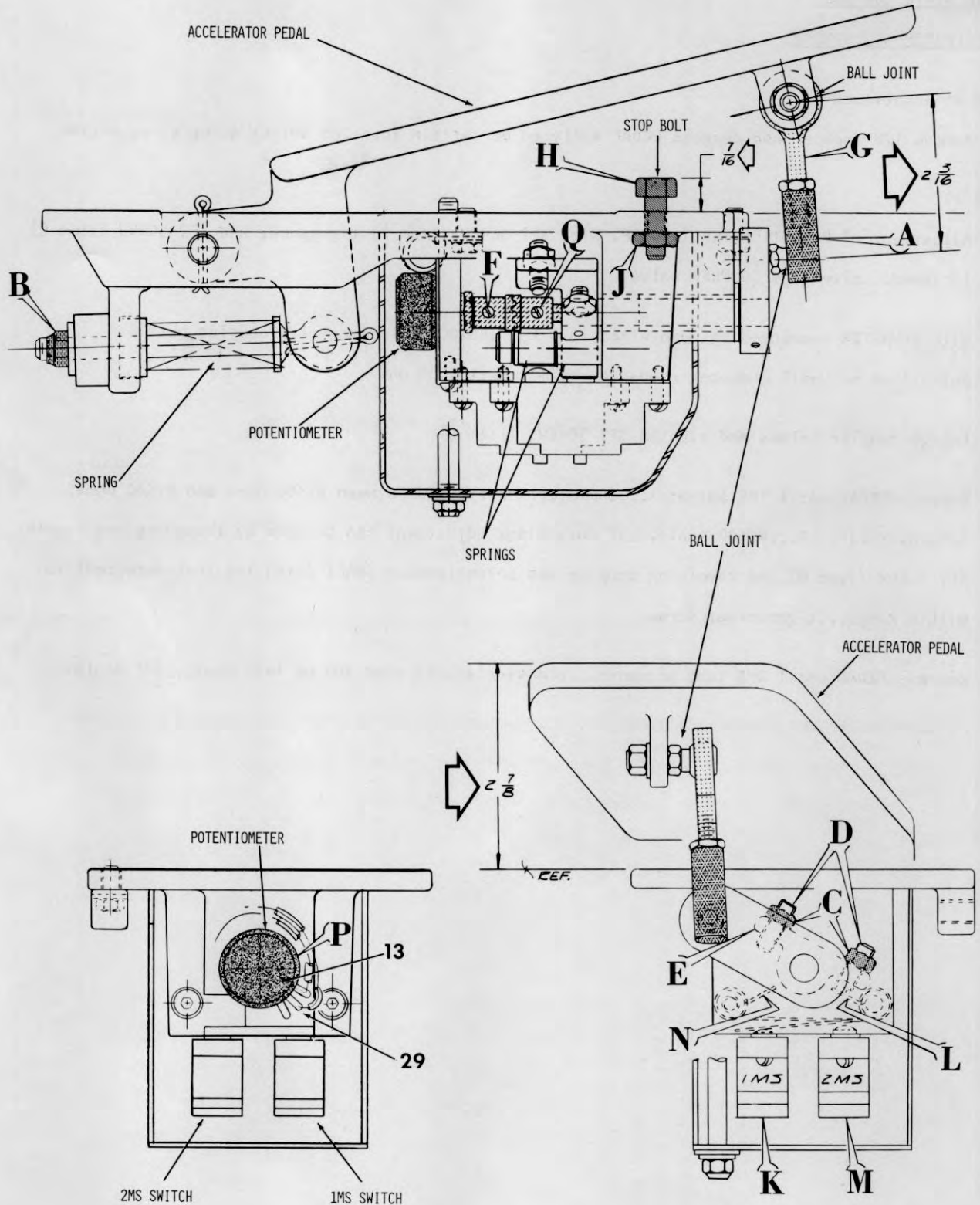
STEP #5

- A. Adjustment of 1MS SWITCH with PEDAL in the UP position: ...adjust 1MS switch (Item K) with SET SCREW (Item D) by turning screw in against SPRING (Item L) until 1MS just actuates. Turn SCREW an additional 1/4 turn...tighten LOCK NUT (Item C).
- B. Depress PEDAL several times to be certain 1MS is actuated each time. If not, unlock NUT (item C) and turn SCREW (Item D) in an additional 1/4 turn....lock NUT and repeat above.

STEP #6

- A. Adjustment of 2MS SWITCH: ...with 1/8" spacer placed between PEDAL and STOP BOLT (Item H)... and with pedal depressed...adjust 2MS SWITCH (Item M) with SET SCREW (Item D) (off-set TAB of spring actuator) by turning screw in against SPRING (Item N) until 2MS actuates....tighten LOCK NUT (Item C).

TROUBLE SHOOTING



ACCELERATOR CONTROL ASSEMBLY ADJUSTMENT



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

SOLID STATE CONTROL

ACCELERATOR ADJUSTMENT:

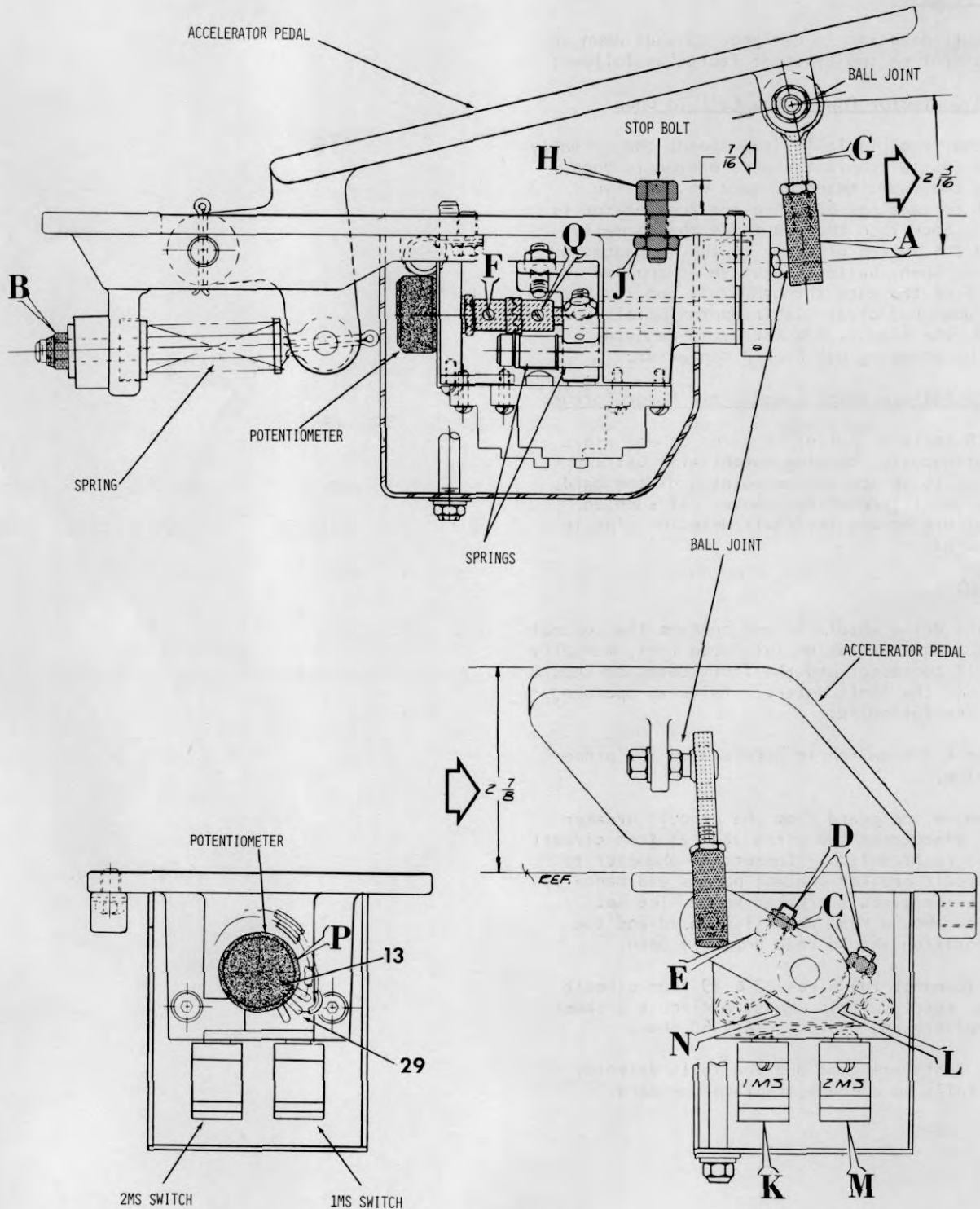
STEP #6 -continued-

- B. Remove 1/8" spacer and depress PEDAL fully to be certain that 2MS SWITCH actuates each time.

STEP #7

- A. Adjustment of POTENTIOMETER (Item P) with SET SCREW (Item F) tightened, and SET SCREW (Item Q) loosened...disengage COUPLER halves.
- B. With OHMMETER connected between WIRES 13 & 29...RS100 scale...revolve coupler half & potentiometer until ohmmeter reads approximately 10,000 ohms.
- C. Engage coupler halves and tighten SET SCREWS (Item Q).
- D. Depress PEDAL until 1MS actuates...ohmmeter should read between 8,500 ohms and 9,500 ohms... terminals 13 & 29...RS100 scale. If not, minor adjustment can be made by loosening the coupler SET SCREW (Item Q) and revolving coupler and potentiometer SHAFT (with 1MS just actuated) to within range...tighten set screw.
- E. Depress PEDAL until 2MS just actuates...ohmmeter should read 300 or less ohms...RS1 scale.

TROUBLE SHOOTING



ACCELERATOR CONTROL ASSEMBLY ADJUSTMENT



INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

TABLE 7

FAULT DETECTOR:

The fault detector is designed to shut down an SCR control on two types of faults as follows:

(1) 1A Contactor Power Tips Fail To Open:

When the truck is in 1A (top speed) the normally closed 2MS switch in the accelerator is open, giving the fault detector card no negative signal to terminal 6. When the accelerator is brought back into the SCR range the normally closed 2MS switch closes. If the 1A contactor fails to open, battery negative is applied to point 5 of the card through T2-T1 and if the fault does not clear within approximately 0.1 second, the circuit breaker tips, removing power by dropping out F or R contactor.

(2) SCR Failure Which Causes Full Motor Torque:

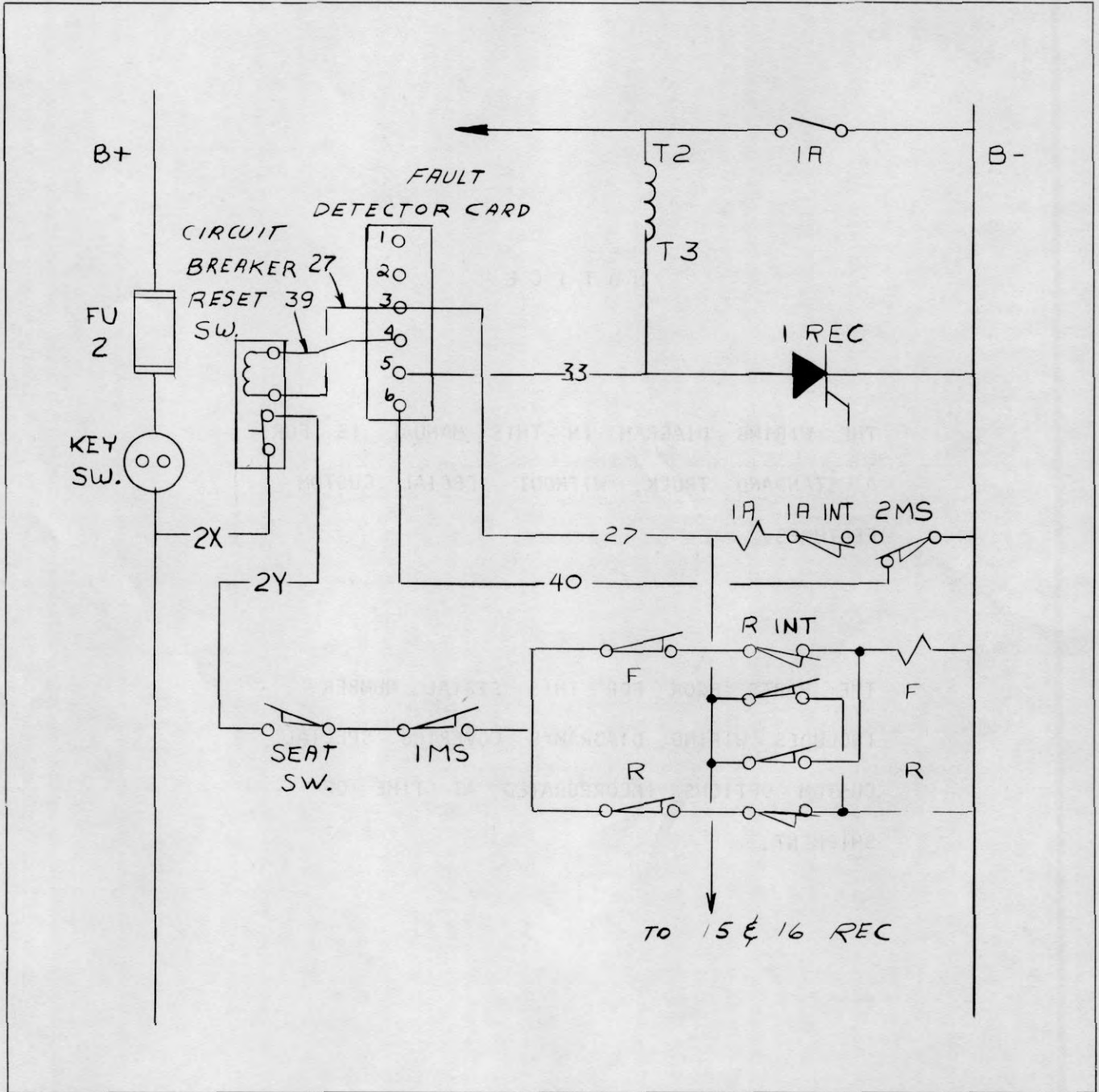
The SCR fails to pulse; it turns on and stays on continuously, causing essentially battery negative to be applied to point 5 of the card, similar to (1) described above. If such an SCR failure occurs the fault detector tips in 0.1 second.

Testing:

Jack the drive wheels up and operate the control in SCR range. Using an insulated tool, manually close 1A contactor and the fault detector should trip. If the fault detector fails to operate, check the following:

1. Check 2MS switch in accelerator for proper operation.
2. Remove the guard from the circuit breaker knob. Disconnect the wires 2X & 2Y from circuit breaker reset switch. Connect an ohmmeter to the circuit breaker contact points and manually operate the circuit breaker knob. The set position should read normally closed and the trip position should read normally open.
3. Disconnect the wires 27 & 39 from circuit breaker reset switch. Measure circuit breaker coil resistance, approximately 60 ohms.

If all tests are good and the fault detector still fails to operate, replace the card.



FAULT DETECTOR SCHEMATIC



INDUSTRIAL TRUCK DIVISION



NOTICE

THE WIRING DIAGRAM IN THIS MANUAL IS FOR
A STANDARD TRUCK, WITHOUT SPECIAL CUSTOM
FEATURES.

THE PARTS BOOK FOR THIS SERIAL NUMBER
INCLUDES WIRING DIAGRAM/S COVERING SPECIAL
CUSTOM OPTIONS INCORPORATED AT TIME OF
SHIPMENT.

