Manitowoc

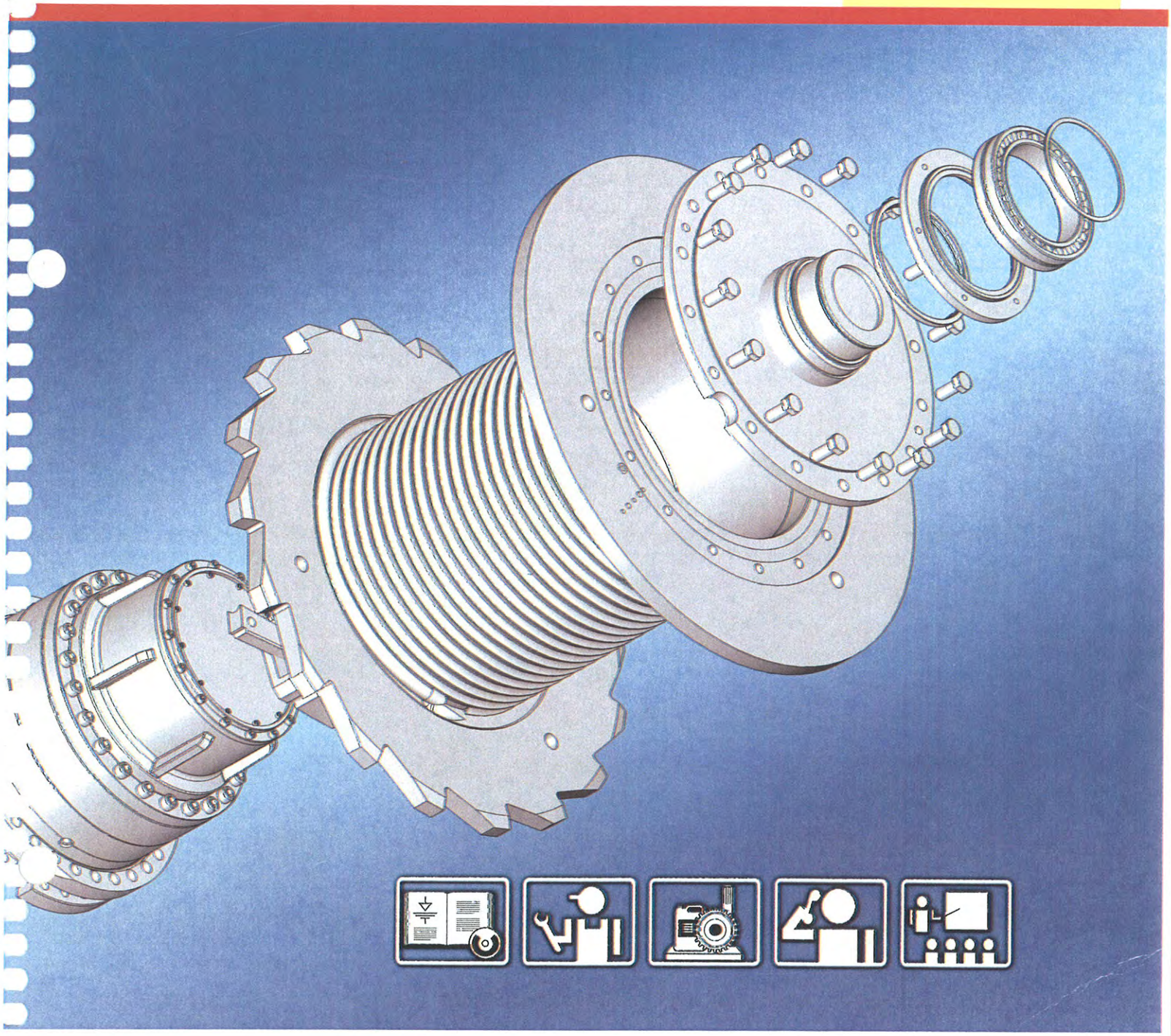
Crane Care

TM 890

CARRIER

GROVE

TM890 - 72977
Operator's Manual



OPERATOR'S AND SAFETY HANDBOOK

TM 890 CARRIER

S/N 72977

PUBLISHED: JULY, 1980
CHANGE 1 – SEPTEMBER, 1981

LIST OF EFFECTIVE PAGES

Page Number	Change In Effect	Page Number	Change In Effect
Title Page thru ii	Change 1		
iii thru x	Original		
xi, xii	Change 1		
1-1 thru 1-16	Original		
2-1 thru 2-14	Original		
3-1 thru 3-12	Original		
4-1 thru 4-18	Original		
4-19 thru 4-26	Change 1		
5-1 thru 5-14	Original		

WARNING

ELECTROCUTION HAZARD
TO PREVENT DEATH OR SERIOUS BODILY INJURY

NEVER OPERATE THIS CRANE WITHIN ANY DISTANCE OF A POWER SOURCE OR POWER LINE WITHOUT FIRST NOTIFYING THE POWER OR UTILITY COMPANY

NEVER OPERATE CRANE ANY PART THEREOF OR LOAD WITHIN 20 FEET OF ANY ELECTRICAL POWER LINE OR POWER SOURCE OR SUCH DISTANCE AS IS SPECIFIED OR REQUIRED BY LOCAL OR OTHER APPLICABLE SAFETY CODES OR REGULATIONS

NEVER OPERATE CRANE WITHOUT CONSULTING LOCAL OR OTHER APPLICABLE SAFETY CODES OR REGULATIONS

NEVER OPERATE SERVICE OR MAINTAIN THIS CRANE WITHOUT PROPER INSTRUCTIONS REMEMBER IT IS THE EMPLOYER'S RESPONSIBILITY TO IMPLEMENT THE ABOVE AND TO PROVIDE ALL SAFETY DEVICES OR MEANS THAT MAY BE NECESSARY OR REQUIRED FOR ANY USE OPERATION, SET UP OR SERVICE

MAKE SAFETY FIRST---NOT LAST!!! READ YOUR OPERATOR'S HANDBOOK!

NOTE DO NOT REMOVE THIS SIGN OR OPERATOR'S MANUAL FROM THIS CRANE.

CHANGE RECORD

Change No.	Effective Date	Date Entered	Entered By

NOTICE TO OWNER/USER

Should this crane become involved in an accident, please contact your local Grove distributor immediately and relate details of the incident so he can notify the Grove Manufacturing Company. If the distributor is unknown and/or cannot be reached, please contact the Grove Manufacturing Company, (717) 263-5100. (Address: 1086 Wayne Avenue, P.O. Box 695, Chambersburg, Pennsylvania, 17201).

FOREWORD

This manual has been compiled to assist you in properly operating and maintaining your Grove Crane.

Before placing the crane in service, take time to thoroughly familiarize yourself with the contents of this manual. After all sections have been read and understood, retain the manual for future reference in a readily accessible location.

The Grove Crane has been designed for maximum performa ıce with minimum maintenance. With proper care, years of trouble-free service can be expected.

Constant improvement and engineering progress makes it necessary that we reserve the right to make specification and equipment changes without notice.

Engine operating procedures and routine maintenance procedures are supplied in a separate manual with each crane, and should be referred to for detailed information.

Information in this manual does not replace federal, state, or local regulations, safety codes, or insurance requirements.

Any reference to PAT in this manual is to be used for general information only. For detailed operating instructions of the PAT System, refer to the PAT Operator's Handbook.

Changes from the first printing of this manual that have been made in the text are marked by a vertical bar (ǀ) on the margin of the page opposite the change.

In the event some text is removed, and is not replaced with new or changed material, a deletion arrow is used where the text was deleted.

In the event there is a change in an illustration, a hand with a pointing finger will be used to point out where the change occurred.

A CHANGE RECORD page is included as page iv herein. It is intended that the recipient of the changes keep this CHANGE RECORD updated as each change is received by him.

The definitions of WARNING, CAUTION, and NOTE as used in this manual apply as follows.

WARNING

A WARNING IS USED TO EMPHASIZE THAT IF AN OPERATION, PROCEDURE, OR PRACTICE IS NOT FOLLOWED EXACTLY, DEATH OR INJURY TO PERSONNEL MAY RESULT.

CAUTION

A CAUTION IS USED TO EMPHASIZE THAT IF AN OPERATION, PROCEDURE, OR PRACTICE IS NOT FOLLOWED EXACTLY, EQUIPMENT DAMAGE MAY RESULT.

NOTE

A note is used to emphasize an important procedure or condition.

TABLE OF CONTENTS

Page

SECTION I

GENERAL

SECTION II

SAFETY PRECAUTIONS

SECTION III

DESCRIPTION

SECTION IV

OPERATING PROCEDURES

SECTION V

LUBRICATION

LIST OF FIGURES

SECTION I

GENERAL

INTRODUCTION.

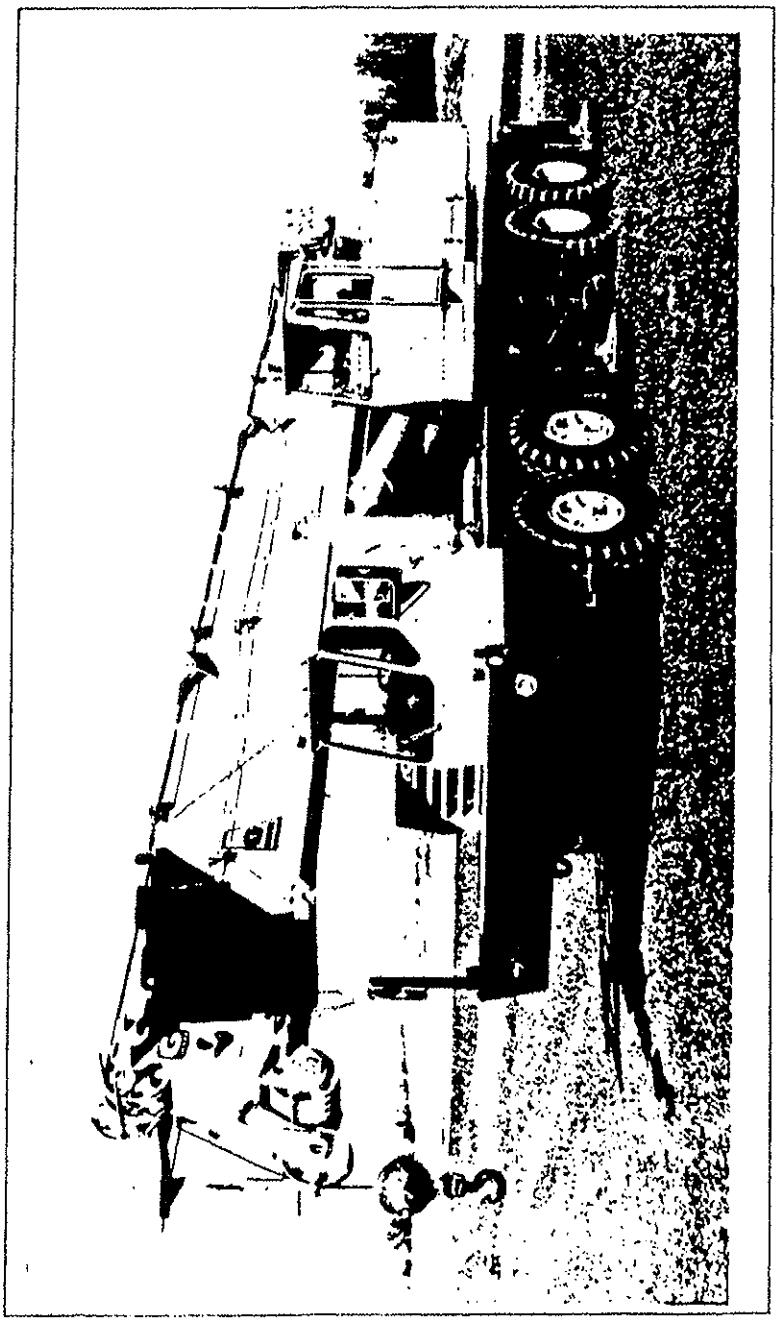
This Handbook provides information for the operator of the Grove Crane.

The mobile hydraulic crane incorporates an all welded steel frame. The 8 x 4 carrier utilizes two non-drive steer axles and two drive axles. The 12 x 6 carrier utilizes three non-drive steer axles and three drive axles. A hydraulic steer cylinder is mounted on each steer axle. The engine is mounted in the front of the carrier and provides motive power through a 13 speed forward and 2 speed reverse manual transmission.

Hydraulic, double box, sliding beam outriggers are integral with the carrier frame.

NOTE

Throughout this handbook, reference is made to left, right, front, and rear when describing locations. These reference locations are to be considered as those viewed from the operator's seat.



0026

LIST OF SPECIFICATIONS.

CAPACITIES.

Fuel Tank		100 gallons (379 liters)
Coolant System		(See Engine Specifications)
Engine Lubricating System		(See Engine Specifications)
Rear Axles	Differential 12 x 6	37 pints (17.39 liters)
	Differential 8 x 4	21 pints (9.87 liters)
	Wheel End 12 x 6	8 pints (3.76 liters)
	Wheel End 8 x 4	8 pints (3.76 liters)
Transmission		27 pints (12.69 liters)
Power Steering Reservoir	Earlier Models	8 quarts (7.52 liters)
	Later Models	4.4 quarts (4.14 liters)
Steering Gearbox		2.26 quarts (2.12 liters)

FIRE EXTINGUISHER.

Manufacturer		Kidde
Type		Dry
Rating	Earlier Models	10 BC
Weight		2.75 lbs (1.2 kg)
Rating	Later Models	5 BC
Weight		3.75 lbs (1.7 kg)

AIR INTAKE FILTER.

Manufacturer		Donaldson
Type		Dry
Model	12 x 6	EBB16-0049
Element		P11 8047
Model	8 x 4	FHG16-0049
Element		P11 7443

TRANSMISSION.

Manufacturer		Fuller
Model		RTOO-9513
Speeds	13 forward	2 reverse

Gear Ratios . . . . . .

Forward	Low	1st	12.10
		2nd	7.28
		3rd	5.10
	Intermediate	4th	3.69
		5th	2.70
		6th	1.97
		7th	1.66
		8th	1.38
	Direct	9th	1.16
		10th	1.00
		11th	.84
		12th	.73
		13th	.62
Reverse	Intermediate		12.66
	Direct		3.43

CLUTCH.

Manufacturer . . . . . .Lipe
Model . . . . . .12 x 6 carrier 15.5-2LP
Model . . . . . .8 x 4 carrier 14-2LP

AXLES.

Manufacturer.....Schuler
Model.....DCB 34L-12
Capacity.....12x6.....66,000lb(29,938 kg)
8x4.....44,000lb(19,958kg)
Manufacturer.....Rockwell
Model.....FL951
Capacity.....12x6.....66,000 lb(29,938 kg)
Manufacturer.....Kessler
Model.....A1548U3A
Capacity.....12x6.....66,000 lb(29,938 kg)
8x4.....44,000lb(19,958 kg)
Manufacture . . . . . .Rear . . . . . Clark
Model . . . . . .12 x 6 Carrier . . . . . BD 50-60
Capacity . . . . . 108,000 pounds (48,989 kg)
Total Overall Reduction . . . . . .10.218 to 1
Model . . . . . .8 x 4 Carrier . . . . . BD 57,000
Capacity . . . . . 85,000 pounds (38,556 kg)
Total Overall Reduction . . . . . .10.218 to 1

FRONT WHEELS AND TIRES.

Lugs	6
Torque	200 to 250 pounds-foot (27.7 to 34.6 kgm)
Tire Size	14.00 x 20
Load and Ply Rating	L-20
Construction	Bias ply
Pressure . . . . . Cold	110 psi (760 kPa)
Tire Size	14.00 x 20
Load and Ply Rating	L-22
Construction	Radial
Pressure . . . . . Cold	110 psi (760 kPa)

REAR WHEELS AND TIRES.

Lugs	6
Torque	200 to 250 pounds-foot (27.7 to 34.6 kgm)
Tire Size	14.00 x 20
Load and Ply	L-20
Construction	Bias ply
Pressure	100 psi (690 kPa)
Tire Size	14.00 x 20
Load and Ply	L-22
Construction	Radial
Pressure	110 psi (760 kPa)

FRONT BRAKES.

Manufacturer	Eaton
Type Operator	Air
Type	Cam
Manufacturer	Rockwell
Type Operator	Air
Type	Double Wedge
Manufacturer	Webco
Type Operator	Air
Type	Duplex Wedge

REAR BRAKES.

Manufacturer	Clark
Type Operator	Air
Type	Cam

KESSLER.....REFER TO KESSLER SERVICE MANUAL

STEERING PUMP.

With CAT and Cummins Engine.

Manufacturer . . . . . Parker Hannifin
Type . . . . . Gear
Model (Later Crane Models) H77AT2D
Output . . . . . .7 gpm (26.5 lpm) at 1000 RPM
Model (Earlier Crane Models) H77BT2Y-002
Output . . . . . 8 gpm (30 lpm) at 1200 rpm

With GMC Engine.

Manufacturer . . . . . Vickers
Type . . . . . Vane
Model V-230-11-1C-RH
Output . . . . . .11 gpm (42 lpm) at 1500 rpm

STEERING CONTROL VALVE.

Manufacturer . . . . . Garrison
Model GB2116L
Capacity . . . . . 8 gpm (30 lpm)

AIR COMPRESSOR.

Bendix (Used With CAT and GMC Engines).

Model . . . . . Tu-Flo 501
Number of Cylinders 2
Piston Displacement at 1250 RPM . . . . . .12 ft^3/min (5,664 cm^3/sec)
Maximum Recommended RPM 3000
Minimum Pressure Required to Unload . . . . . 60 psi (7,080 cm^3/sec)

Cummins (Used With Cummins Engine).

Number of Cylinders 1
Piston Displacement at 1250 RPM . . . . . 8 x 4 Carrier
13.2 ft^3/min (6230 cm^3/sec)
Piston Displacement at 1250 RPM . . . . . .12 x 6 carrier
15.0 ft^3/min (7080 cm^3/sec

OUTRIGGERS.

Type . . . . . Double box beam and box
Extended Length . . . . . 25.4 feet (7.6 m)
Retracted Length . . . . . 9.0 feet (2.7 m)

ELECTRICAL SYSTEM.

Type . . . . . Single wire ground return to chassis
System Voltage 12
Starting Voltage 24
Batteries 4
Earlier 12 x 6 Carrier
Manufacturer . . . . . Titan
Model 9268-D
Later 12 x 6 Carrier
Manufacturer . . . . . Titan or Douglas
Model . . . . . 9168-D or 6-12-25
8 x 4 Carrier
Manufacturer . . . . . Delco-Remy
Model . . . . . Delco - 1200

CAB HEATER AND DEFROSTER.

Manufacturer . . . . . (12 x 6 Carrier) . . . . . Hupp
Model.
(Defroster) . . . . . WH 2080
(Heater) 781-12V-D
Type . . . . . Hot Water

Manufacturer . . . . . (8 x 4 Carrier) . . . . . Hunter
Model 4-170240
Type . . . . . Hot water

TELMA RETARDER.

Manufacturer . . . . . (8 x 4 Carrier) . . . . . Telme
Model CC-250

CARRIER ENGINE SPECIFICATIONS

	GMC		CAT		CUMMINS	
Make and Model	8V-71N	8V-71T	3406T	3406TA	NTA-855C	NTC 335
Type	8 Cylinder	8 Cylinder	6 Cylinder	6 Cylinder	6 Cylinder	6 Cylinder
Bore	4.25 in. (10.80 cm)	4.25 in. (10.80 cm)	5.4 in. (13.72 cm)	5.4 in. (13.72 cm)	5.5 in. (13.97 cm)	5.5 in. (13.97 cm)
Stroke	5.0 in. (12.70 cm)	5.0 in. (12.70 cm)	6.5 in. (16.51 cm)	6.5 in. (16.51 cm)	6.0 in. (15.24 cm)	6.0 in. (15.24 cm)
Displacement	568 cu. in. (9309 cm^3)	568 cu. in. (9309 cm^3)	893 cu. in. (14,636 cm^3)	893 cu. in. (14,636 cm^3)	855 cu. in. (14,013 cm^3)	855 cu. in. (14,013 cm^3)
Horsepower (Net)	268 at 2100 rpm	312 at 2100 rpm	287 at 2100 rpm	294 at 2100 rpm	360 at 2100 rpm	297 at 2100 rpm
Governed rpm	2100	2100	2100	2100	2100	2100
Torque (Net)	814 lbs-ft. at 1400 rpm	965 lbs-ft. at 1600 rpm	1000 lbs-ft. at 1485 rpm	1000 lbs-ft. at 1260 rpm	1080 lbs-ft at 1300 rpm	930 lbs-ft. at 1500 rpm
Combustion System	2 cycle with blower	2 cycle, turbocharged	4 cycle, turbocharged	4 cycle, turbocharged, after cooled	4 cycle, turbocharged	4 cycle, turbocharged
Cooling System Capacity (approx.)	16.3 gal. (61.5 L)	18.4 gal. (69.6 L)	17 gal. (64.4 L)	13.3 gal. (50.2 L)	18.8 gal. (71 L)	14 gal. (53 L)
Lubrication System Capacity	5.8 gal. (21.9 L)	5.8 gal. (21.9 L)	10 gal. (37.9 L)	9 gal. (34.1 L)	11.0 gal. (42.0 L)	12.8 gal. (48.3 L)

SPEED AND GRADEABILITY

ENGINE	SPEED RANGES @ MAX. GOVERNED RPM	% OF GRADEABILITY @ MAX. TORQUE
Cummins NTA-855C(12x6)	2.35 to 45.84 mph (4 to 74 kmh)	36.70 to 0.43%
Cummins NTA-855C(8x4)	2.33 to 45.51 mph (4 to 73 kmh)	40.58 to 0.66%
Cummins NTC335	2.33 to 45.51 mph (4 to 73 kmh)	40.58 to 0.66%
GMC 8V-71N	2.33 to 45.51 mph (4 to 73 kmh)	35.33 to 0.39%
GMC 8V-71T	2.35 to 45.84 mph (4 to 74 kmh)	35.26 to 0.38%
CAT 3406T (8 x 4)	2.33 to 45.51 mph (4 to 73 kmh)	43.75 to 0.82%
CAT 3406T (12 x 6)	2.35 to 45.84 mph (4 to 74 kmh)	36.59 to 0.45%
CAT 3406TA	2.35 to 45.84 mph (4 to 74 kmh)	36.59 to 0.45%

NOTE

Performance is based on a standard machine with standard engine rating conditions using standard tires, transmission and axles. Performance data may vary plus or minus 10% due to variations in engine performance and vehicle weights.

AXLE WEIGHT DISTRIBUTION CHART (EARLIER 8 X 4)

ITEM	POUNDS			KILOGRAMS		
	GROSS	FRONT	REAR	GROSS	FRONT	REAR
Basic standard machine to include: 36 - 114 ft. (10.97 - 34.75 m) trapezoidal boom plus a 32 ft. (9.75 m) swingaway extension, Grove model 308-26 main hoist with 750 ft. (228.60 m) of 3/4 in. (19 mm) rope, 12,975 lb. (5,885 kg.) counterweight, Grove model 8x4 - 80 carrier, Cummins NTC 335 (Carrier Engine), Cummins **6BTA5.9L** (Superstructure Engine)	117,450	39,605	77,845	53,275	17,965	35,310
*Remove standard 12,975 lb. (5,885 kg.) counterweight	-12,975	+5,288	-18,263	-5,885	+2,399	-8,284
80 ton (72.56 mt), 6 sheave hook block (stowed)	+1,600	+2,571	-971	+726	+1,166	-440
Auxiliary boom head	+230	+455	-225	+104	+206	-102
**Model 158 Auxiliary hoist with 550 ft. (167.64 m) of 5/8 in. (16 mm) dia. rope	+1,140	-468	+1,608	+517	-212	+729
** Model 25 free fall Auxiliary hoist with 550 ft. (167.64 M) of 1/2 in. (13 mm) dia. rope	+1,100	-452	+1,552	+499	-205	+704
***Model 308-16 Auxiliary hoist with 550 ft. (167.64 m) of 3/4 in. (19 mm) dia. rope and idler	+2,469	-1,014	+3,483	+1,120	-460	+1,580
**Substitute 12,300 lb. (5,579 kg.) counterweight	-675	+275	-950	-306	+125	-431
***Substitute 11,300 lb. (5,126 kg.) counterweight	-1,675	+683	-2,358	-760	+310	-1,070

Substitute GM8V-71N engine (carrier)	-365	-409	+44	-166	-186	+20
Substitute Caterpillar 3406T engine (carrier)	+90	+101	-11	+41	+46	-5
Substitute GM6V-53N engine (superstructure)	-170	-9	-161	-77	-4	-73
Substitute Caterpillar 3208 engine (superstructure)	-410	-22	-388	-186	-10	-176
Remove standard 32 ft. (9.75 m) swingaway extension	-1,550	-1,557	+7	-703	-706	+3
Remove standard main hoist with rope	-2,980	+818	-3,798	-1,352	+371	-1,723
Remove (2) front outrigger beams & jacks	-5,000	-3,259	-1,741	-2,268	-1,478	-790
Remove (2) rear outrigger beams & jacks	-5,000	+1,830	-6,830	-2,268	+830	-3,098

*Use 12,975 lb. (5,885 kg.) counterweight without auxiliary hoist.

**Use 12,300 lb. (5,579 kg.) counterweight with Grove 158 or Gearmatic model 25 free fall auxiliary hoist.

***Use 11,300 lb. (5,126 kg.) counterweight with Grove 30B-16 auxiliary hoist.

AXLE WEIGHT DISTRIBUTION CHART (LATER 8 X 4)

ITEM	POUNDS			KILOGRAMS		
	GROSS	FRONT	REAR	GROSS	FRONT	REAR
Basic standard machine to include 36-114 ft. (10.9 - 34.8 m) trapezoidal boom (power pinned fly) plus a 32 ft. (9.7 m) "Swingaway" extension, Grove Model 30B-26 main hoist with 750 ft. (228.6 m) of 3/4 in. (19 mm) rope, 12,975 lb. (5885 kg) counterweight, Grove Model 8 x 4-80 carrier, Cummins NTA855C(carrier engine), Cummins '6BTA5.9L (superstructure engine)	119,089	40,612	78,477	54,019	18,421	35,597
REMOVE:						
*Standard 12,975 lb. (5885 kg) counterweight	-12,975	+5,288	-18,263	-5,885	+2,399	-8,284
Standard 32 ft. (9.7 m) "Swingaway" extension	-1,654	-1,685	+31	-750	-764	+14
Standard main hoist with rope	-2,825	+776	-3,601	-1,281	+352	-1,633
(2) front outrigger beams & jacks	-5,000	-3,259	-1,741	-2,268	-1,478	-790
(2) rear outrigger beams & jacks	-5,000	+2,098	-7,098	-2,268	+952	-3,220
ADD:						
80-ton (72.5 mt), 6-sheave hookblock (stowed)	+1,600	+2,571	-971	+726	+1,166	-440
Auxiliary boom head	+230	+455	-225	+104	+206	-102
Fifth front outrigger jack	+600	+805	-205	+272	+365	-93
**Model 15B-16 auxiliary hoist with 550 ft. (167.6 m) of 5/8 in. (16 mm) dia. rope	+1,119	-460	+1,579	+508	-209	+716
** Model 11 SGECR free-fall auxiliary hoist with 550 ft. (167.6 m) of 1/2 in. (13 mm) dia. rope	+1,078	-443	+1,521	+489	-201	+690
***Model 30B-16 auxiliary hoist with 550 ft. (167.6 m) of 3/4 in. (19 mm) dia. rope and idler	+2,385	-980	+3,365	+1,082	-445	+1,526

SUBSTITUTE:						
36-114 Ft. (10.9-34.7 m) full power boom	+1,184	+506	+678	+537	+230	+307
**12,300 lb. (5579 kg) counterweight	-675	+275	-950	-306	+125	-431
***11,300 lb. (5126 kg) counterweight	-1,675	+683	-2,358	-760	+310	-1,070
GM8V - 71N engine (carrier)	-550	-617	+67	-249	-280	+30
Caterpillar 3406T engine (carrier)	-165	-185	+20	+75	+84	-9
GM6V - 53N engine (superstructure)	-170	-9	-161	-77	-4	-73
Caterpillar 3208 engine (superstructure)	-410	-22	-388	-186	-10	-176

*Use 12,975 lb. (5885 kg) counterweight without auxiliary hoist.

**Use 12,300 lb. (5579 kg) counterweight with Grove 158-16 or Gearmatic Model 11 SGECR free-fall auxiliary hoist.

***Use 11,300 lb. (5126 kg) counterweight with Grove 308-16 auxiliary hoist.

AXLE WEIGHT DISTRIBUTION CHART (12 X 6)

ITEM	POUNDS			KILOGRAMS		
	GROSS	FRONT	REAR	GROSS	FRONT	REAR
Basic standard machine to include 36-114 ft. (10.9 - 34.8 m) trapezoidal boom (power pinned fly) plus a 32 ft. (9.7 m) "Swingaway" extension, Grove Model 30B-26 main hoist with 750 ft. (228.6 m) of 3/4 in. (19 mm) rope, 12,975 lb. (5885 kg) counterweight, Grove Model 12 x 6 - 100 carrier, Cummins NTA855C (carrier engine), Cummins 6BTA5.9L (superstructure engine)	131,940	38,027	93,913	59,848	17,249	42,599
REMOVE:						
*Standard 12,975 lb. (5885 kg) counterweight	-12,975	+5,702	-18,677	-5,886	+2,586	-8,472
Standard 32 ft. (9.7 m) "Swingaway" extension	-1,654	-1,385	-269	-750	-628	-122
Standard main hoist with rope	-2,845	+912	-3,757	-1,290	+414	-1,704
(2) front outrigger beams & jacks	-5,600	-3,302	-2,298	-2,540	-1,498	-1,042
(2) rear outrigger beams & jacks	-5,600	+2,253	-7,853	-2,540	+1,022	-3,562
ADD:						
80-ton (72.5 mt), 6-sheave hookblock (stowed)	+1,600	+2,756	-1,156	+726	+1,250	-524
Auxiliary boom head	+230	+389	-159	+104	+176	-72
Fifth front outrigger jack	+600	+809	-209	+272	+367	-95
**Model 15B-16 auxiliary hoist with 550 ft. (167.6 m) of 5/8 in. (16 mm) dia. rope	+1,119	-495	+1,614	+508	-225	+732
** Model 11 SGECR free-fall auxiliary hoist with 550 ft. (167.6 m) of 1/2 in. (13 mm) dia. rope	+1,078	-477	+1,555	+489	-216	+705
***Model 30B-16 auxiliary hoist with 550 ft. (167.6 m) of 3/4 in. (19 mm) dia. rope and idler	+2,385	-1,055	+3,440	+1,082	-479	+1,560

SUBSTITUTE:						
36-114 Ft. (10.9-34.7 m) full power boom	+1,184	+351	+833	+537	+159	+378
**12,300 lb. (5579 kg) counterweight	-675	+297	-972	-306	+135	-441
***11,300 lb. (5126 kg) counterweight	-1,675	+736	-2,411	-760	+334	-1,094
GM8V - 71T engine (carrier)	-400	-447	+47	-181	-203	+21
Caterpillar 3406T engine (carrier)	-95	-106	+11	-43	-48	+5
GM6V - 53N engine (superstructure)	-170	+5	-175	-77	+2	-79
Caterpillar 3208 engine (superstructure)	-410	+12	-422	-186	+5	-191

*Use 12,975 lb. (5885 kg) counterweight without auxiliary hoist.

**Use 12,300 lb. (5579 kg) counterweight with Grove 158-16 or Gearmatic Model 11 SGECR free-fall auxiliary hoist.

***Use 11,300 lb. (5126 kg) counterweight with Grove 30B-16 auxiliary hoist.

SECTION II

SAFETY PRECAUTION

GENERAL.

It is impossible to compile a list of safety precautions covering all situations. However, there are basic safety precautions that MUST be followed during your daily routine. Safety is YOUR PRIME RESPONSIBILITY, since any piece of equipment is only as safe - AS THE PERSON AT THE CONTROLS.

With this thought in mind, this information has been provided to assist you, the operator, in promoting a safe working atmosphere for yourself and those around you. It is not meant to cover every conceivable circumstance which could arise. It is intended to present basic safety precautions that should be followed in daily operation.

Because you, the operator, are the only part of the crane that can think and reason, your responsibility it not lessened by the addition of warning devices. Indeed, you must guard against acquiring a false sense of security when using them. They are there to assist, NOT direct the operation. Warning devices can be mechanical, electrical, electronic, or a combination thereof. They are subject to failure or misuse.

You, the operator, are the only one who can be relied upon to assure the safety of yourself and those around you. Be a PROFESSIONAL and follow the RULES of safety.

REMEMBER, failure to follow just one safety precaution can cause that accident to people or equipment.

You are responsible for the safety of yourself and those around you.

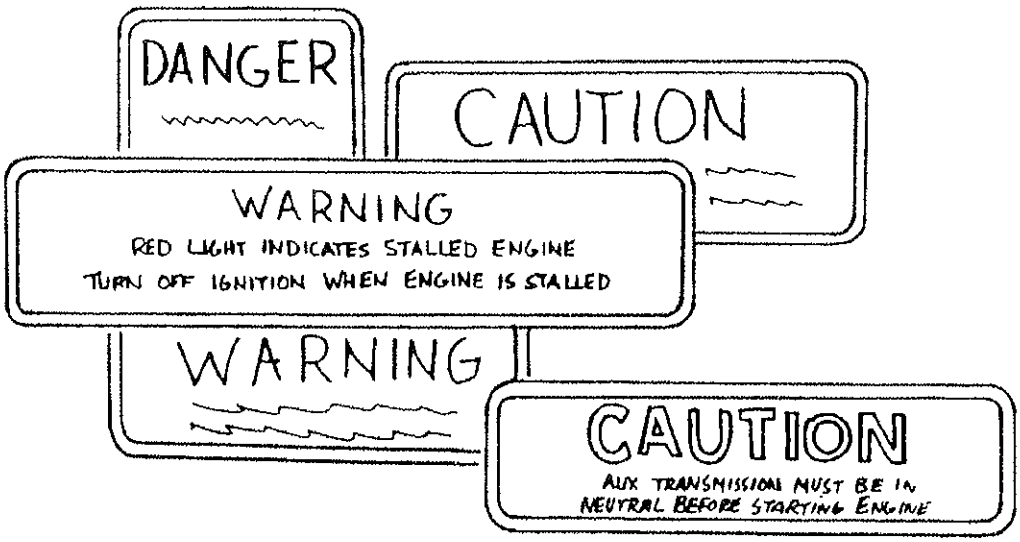
Ensure you and those working with you are aware of any special dangers where you are operating the crane. Be especially careful of dangerous ground and objects, including buildings, near the crane.

Be aware at all times that you are responsible for the safety of yourself, your co-workers, the crane and everything around it. Make certain the crane is properly maintained, and then pay attention to any unusual things, which you, as the operator, may notice which would not be important to others.

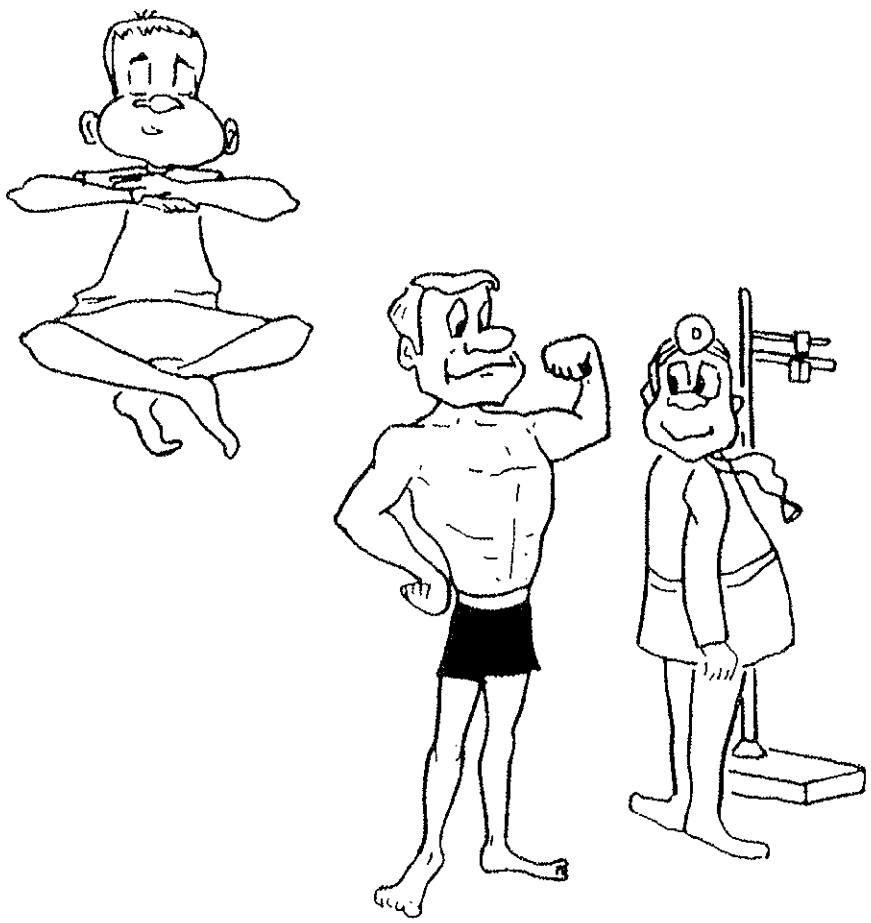
Know and abide by the basic safety rules.

Read and understand the operator's handbook before entering the cab.

Follow directions on all placards. Know what they mean and follow their instructions.



Be prepared for the work day.



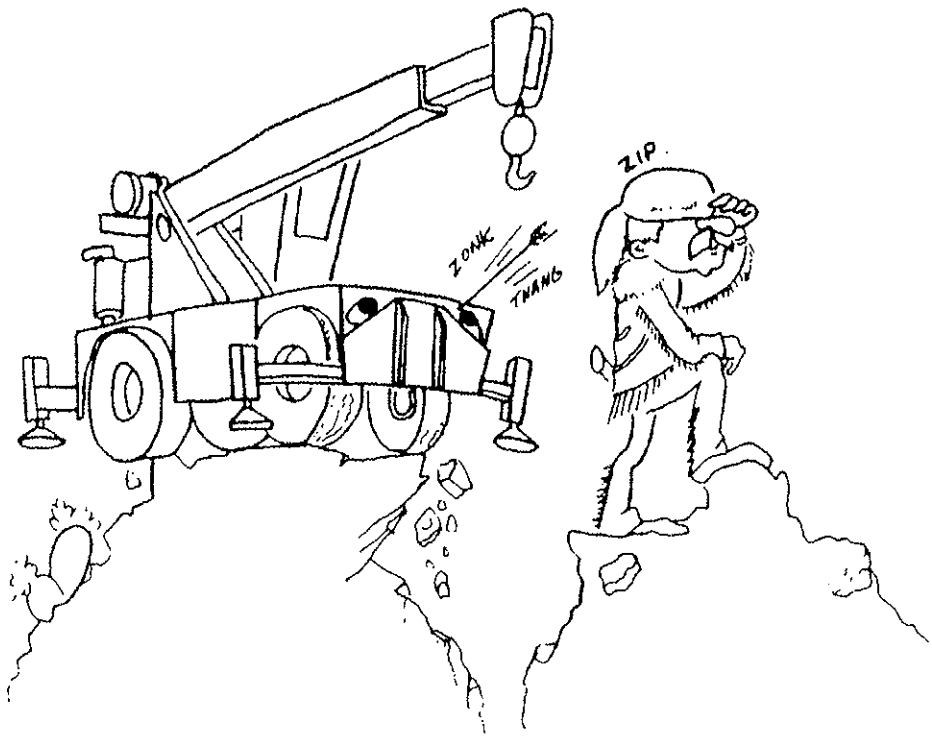
Operators must be thoroughly familiar with safe operating practices and have a complete understanding of all operation and maintenance instructions provided. Operators should be physically fit and thoroughly trained, with related experience, not be easily excitable, not be subject to epileptic seizures, and not be using any drug that could impair physical, visual, or mental reactions or capabilities.

Wear the proper clothing for the job. Wear personnel protective equipment as required by local or job regulations.

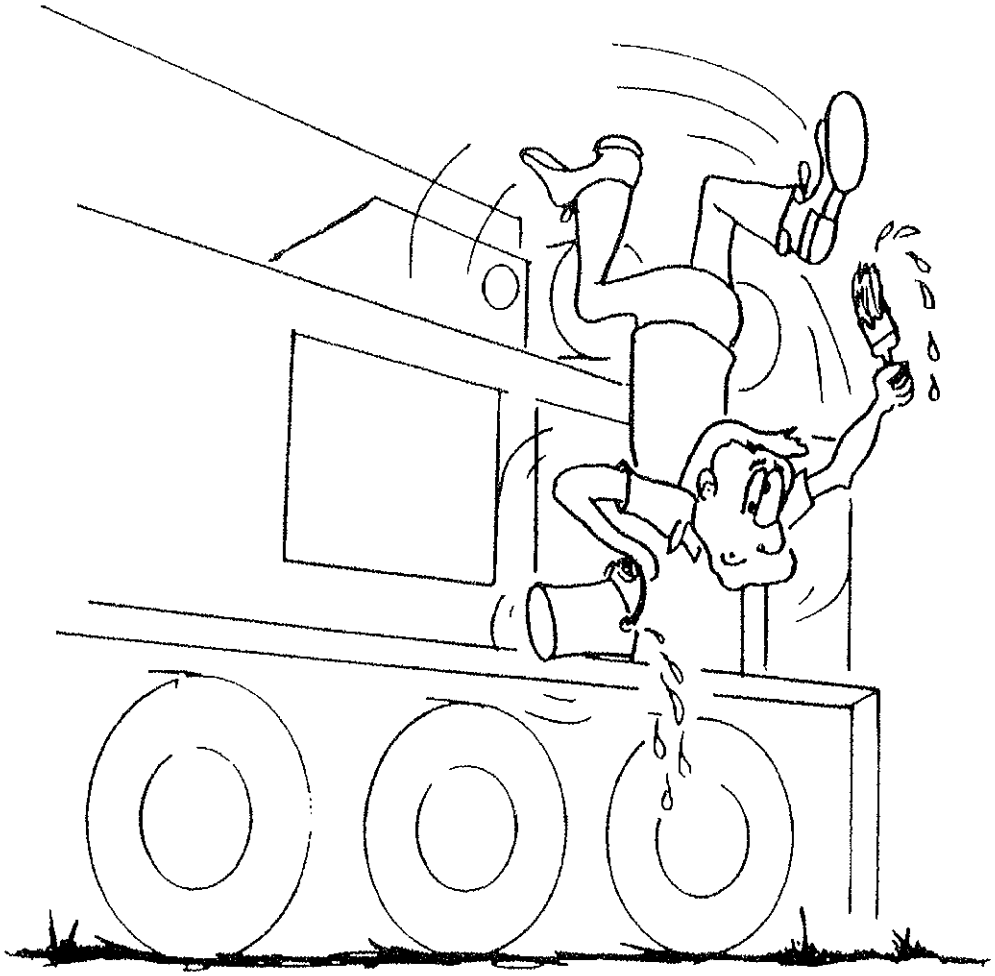
Inspect the crane every day. Ensure that routine maintenance and lubrication are being dutifully performed. Don't operate a damaged or poorly maintained crane. You risk lives when operating faulty machinery, including your own.

Know the area in which you are working. Familiarize yourself with work site obstructions and other potential hazards in the area.

Use caution when in the vicinity of overhanging banks or edges.



Keep your shoes clean. Before entering the cab, clean any mud or grease from your shoes. This will reduce the possibility of your foot slipping off a control pedal, possibly resulting in an accident.



Since certain shoe sole materials are more slip resistant than others, all operating and service personnel should wear footwear with high slip resistant sole material.

Avoid a dirty or greasy crane. Keep the cab, deck, and foot and hand holds free of mud and grease for operator safety. Dirty equipment fails rapidly and makes good maintenance difficult.

Observe and heed possible pinch points while performing maintenance or other work.

Check for WARNING tags placed on the crane. If found, refuse to operate the crane until repairs are made and WARNING tags are removed by authorized personnel.

Before performing maintenance, disconnect the battery, remove the ignition key, and place WARNING SIGNS in the cab.

Proper lubrication is a requirement in any heavy equipment operation. Follow the factory recommendations regarding the lubrication time intervals and types of lubricants used. Adjust time intervals accordingly, when working under severe conditions.

When adding oil to the hydraulic system, follow the manufacturer's recommendations. Mixing the wrong fluids could destroy seals, causing machine failure.

When performing maintenance, refer to the appropriate manual for instructions. Consult the factory if there is any question regarding procedures or specifications.

Do not attempt repairs you do not understand!

BEFORE performing maintenance on the crane, remove all weight from outrigger jack cylinders, and lower attachments to the ground or place them on suitable blocking.

Pressurized hydraulic oil can cause serious injury. Be certain all lines, components, and fittings are tight and serviceable. Use a piece of cardboard or wood to search for suspected leaks.

Never exceed the manufacturer's recommended relief valve pressure settings.

Always replace the guards or other safety devices which may have been removed during crane repair or adjustment.

Have an approved fire extinguisher available and know how to use it. Inspect as required to ensure it is fully charged and operable.

Maintain battery electrolyte at the proper level and check it with a flashlight

A spark or flame could cause a battery explosion. Don't short across the posts to check the charge.

Check battery condition only with proper test equipment

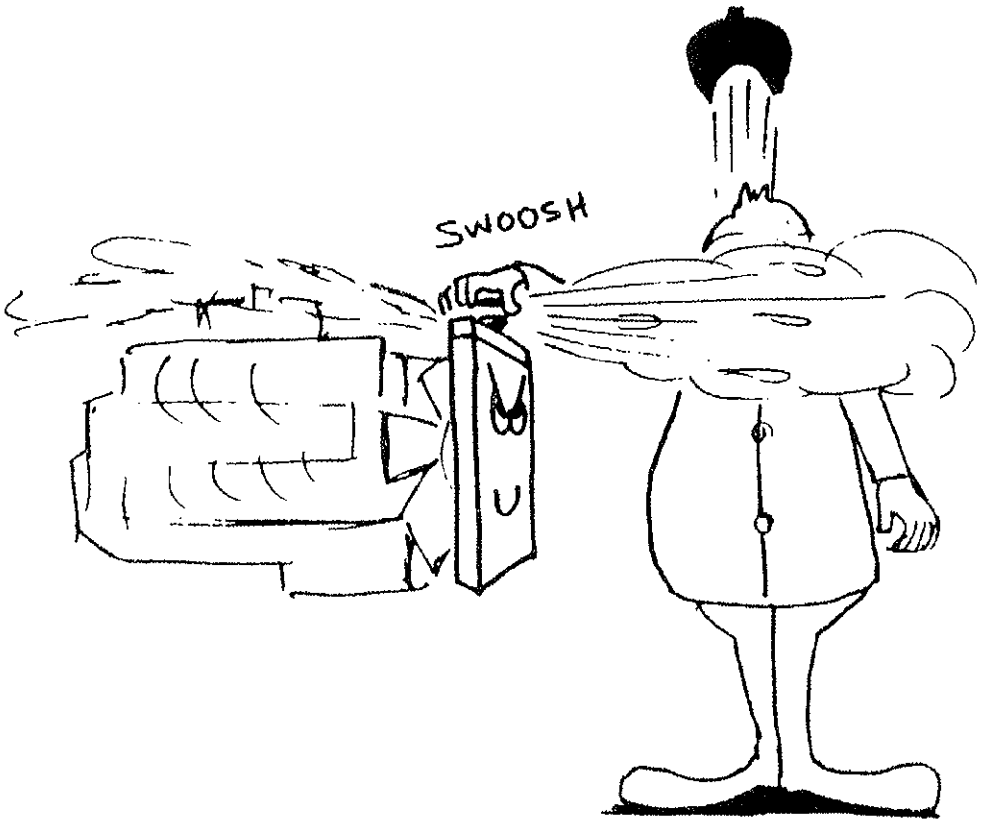
Wear your safety glasses when servicing batteries

Don't smoke while performing battery maintenance.

Disconnect the grounded battery clamp first when removing a battery and connect it last when installing battery.

Before charging a battery, remove the battery caps to allow gases to escape

Avoid battery acid contact with the skin and eyes. If accidently contacted, flush the area with water and consult a doctor immediately.



Be careful when checking the coolant level. Shutdown the engine and allow the radiator time to cool before removing the radiator cap.

Follow standard safety precautions when refueling. FUEL IT SAFELY

Unless authorized and approved by Grove Manufacturing Company, do not make any modifications, alterations, or changes to a cran which could in any way affect it's original design. Such action invalidates all warranties and capacity charts, and makes the owner/user liable for any resultant acci dents

Keep the crane properly maintained and adjusted at all times. Shutdown the crane while making repairs or adjustments.

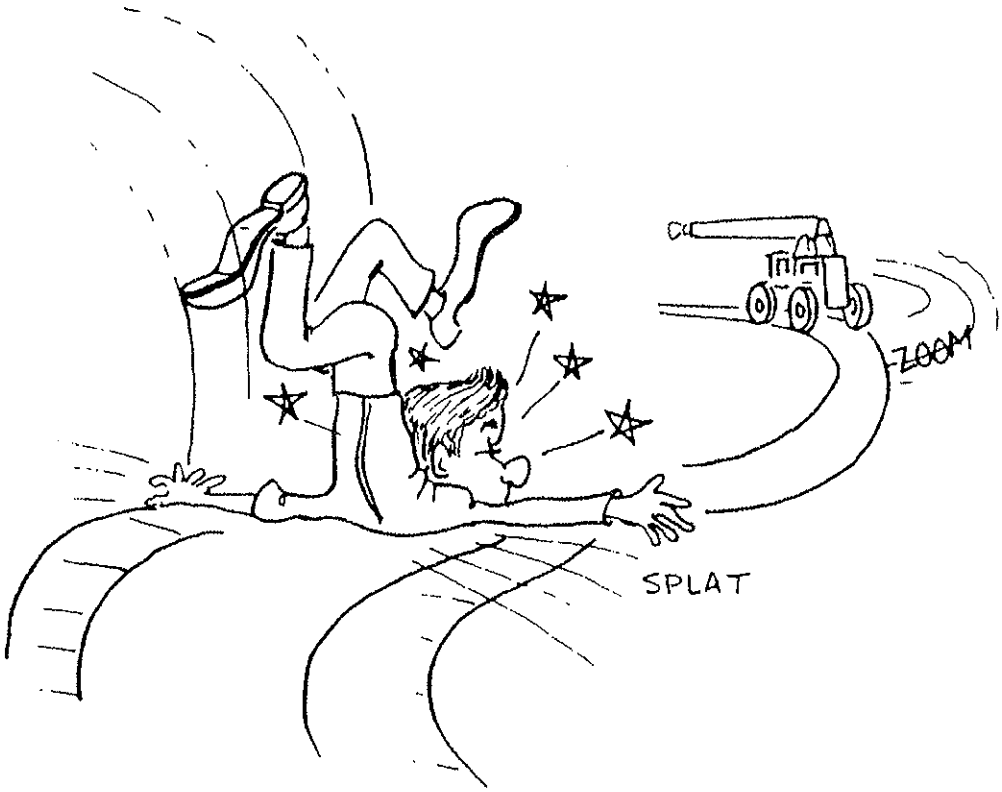
Keep your fingers away from potentially hazardous areas.

Keep brakes properly adjusted. Keep brake linings free of oil and grease. Do not over lubricate the bearings or brake anchor pins. Refer to the Service Manual.

Use cleaning solutions that are non-flammable and approved for the work being performed.

Always perform a function check after repairs have been made to ensure proper operation. Load tests should be performed when structural or lifting members are involved.

Do not store flammable materials on the crane at any time.

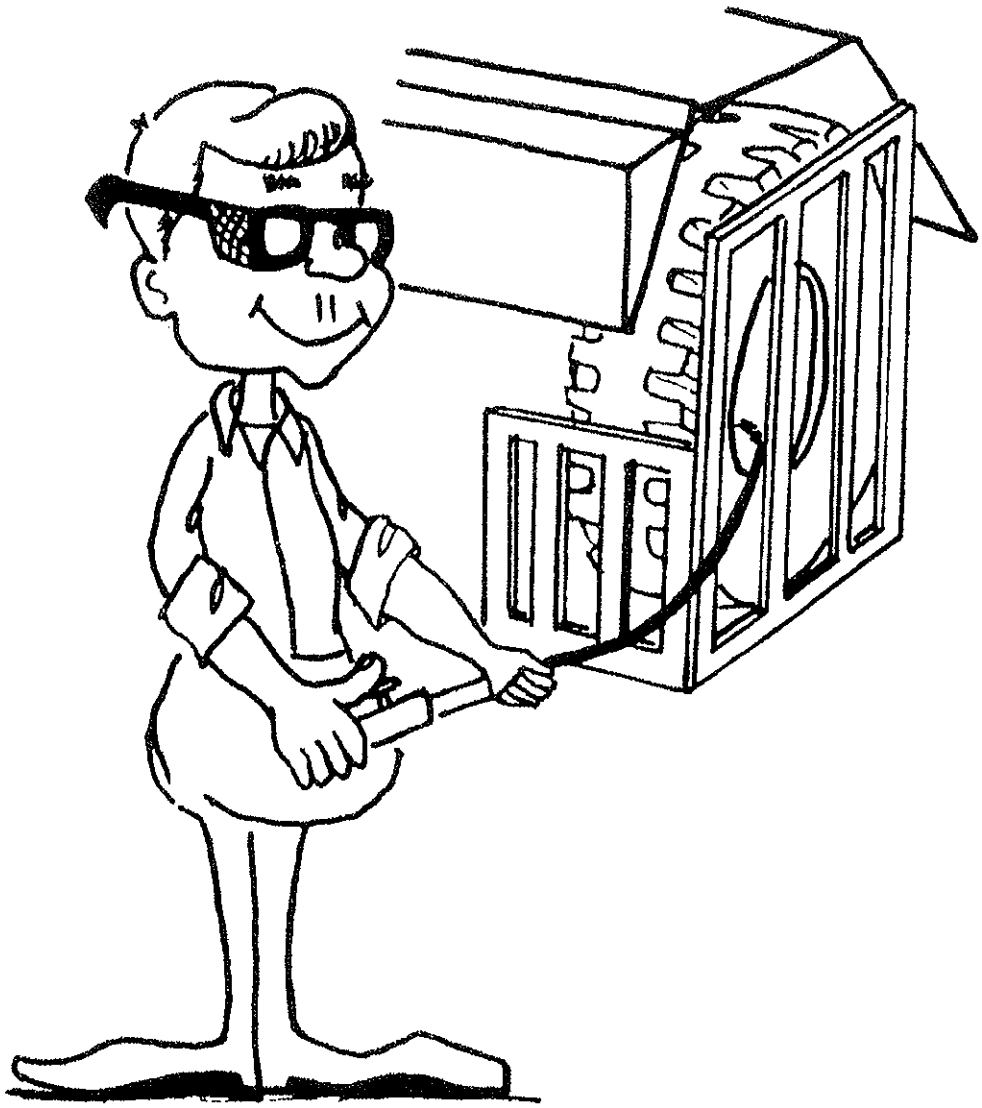


Never get off or on a moving crane.

When getting on or off a stationary crane, use both hands and use the hand rails and steps provided.

Allow No One other than the operator to be on the crane while the crane is functioning or moving, unless they are seated in a two-man cab.

Inspect the tires for nicks and cuts, imbedded stones, and abnormal wear. Make certain dual wheels are properly matched for diameter and tread wear. Check for stones and other objects wedged between tires on dual wheels. Ensure all lug nuts are properly torqued.



Check the tire pressure daily. When inflating or adding air to the tires, use a tire cage and clip-on inflator. Use an extension hose which will permit standing behind the tire tread when inflating.

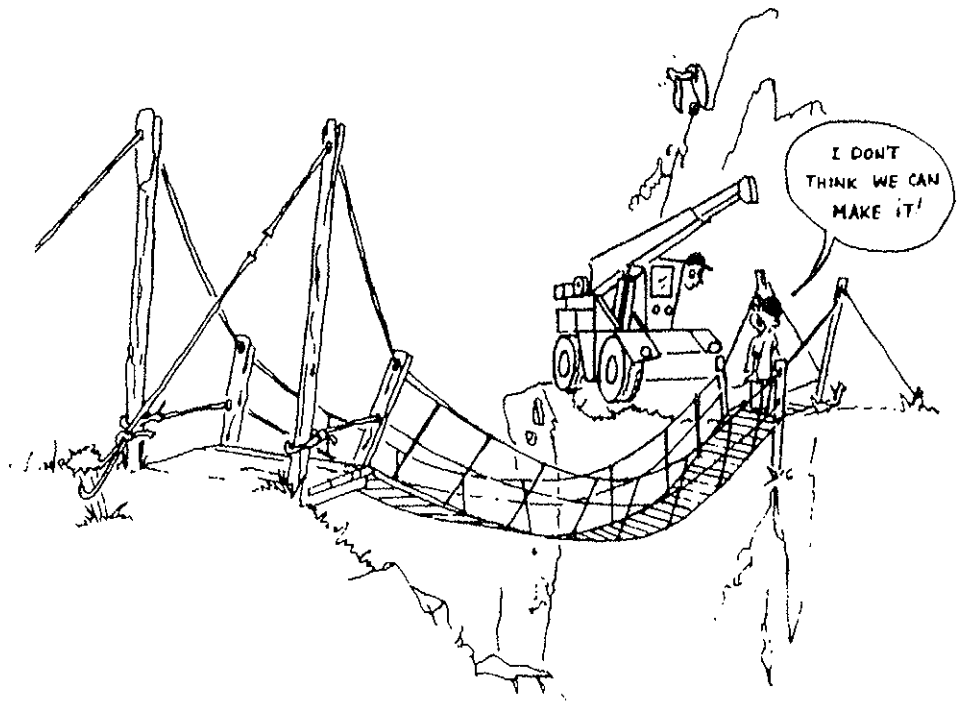
In freezing weather, park the crane in an area where it cannot become frozen to the ground. The drive line can be damaged when attempting to free a frozen crane.

When shutting down the crane:

Engage the parking brakes.
Put controls in neutral.
Chock the wheels.
Remove the ignition key.
Lock the machine and install vandal guards, if used.

Don't touch metal surfaces that could freeze you to them.

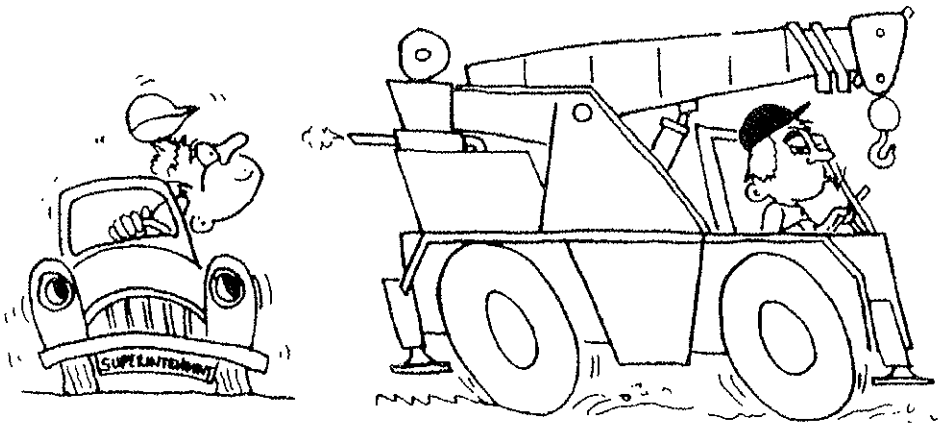
TRAVEL OPERATION.



Check load limit of bridges. Before traveling across bridges, ensure they will carry a load greater than the crane's weight

Watch clearances when traveling. Do not take a chance of running into over head or side obstructions.

When moving in tight quarters, post a look-out to help guard against collisions or bumping structures.



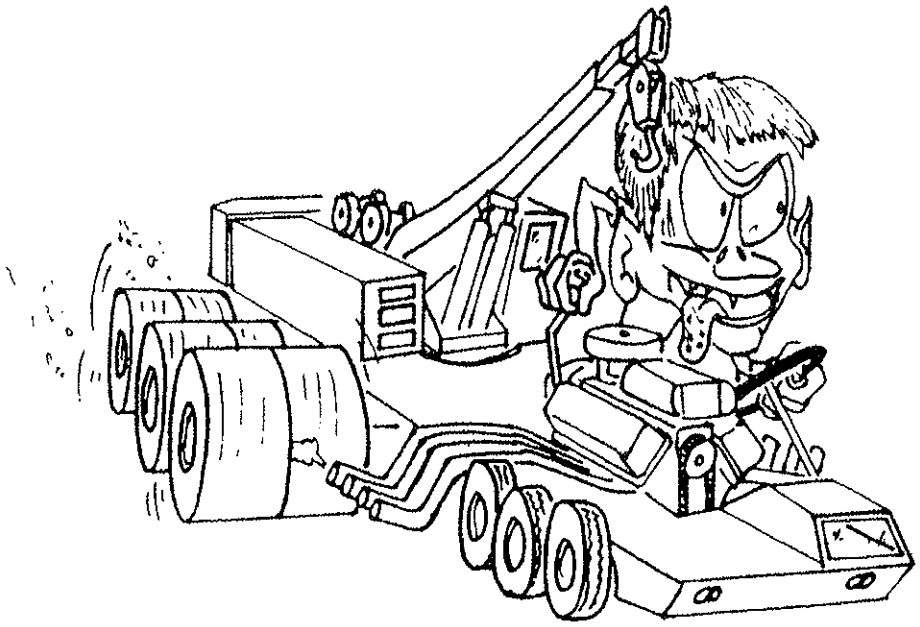
Never back up without the aid of a signalman to verify the area behind the crane is clear of obstructions and/or personnel.

When traveling, the boom should be completely retracted, lowered, and stowed in its travel position.

Do not attempt to move the crane until brake system air pressure is at operating level.

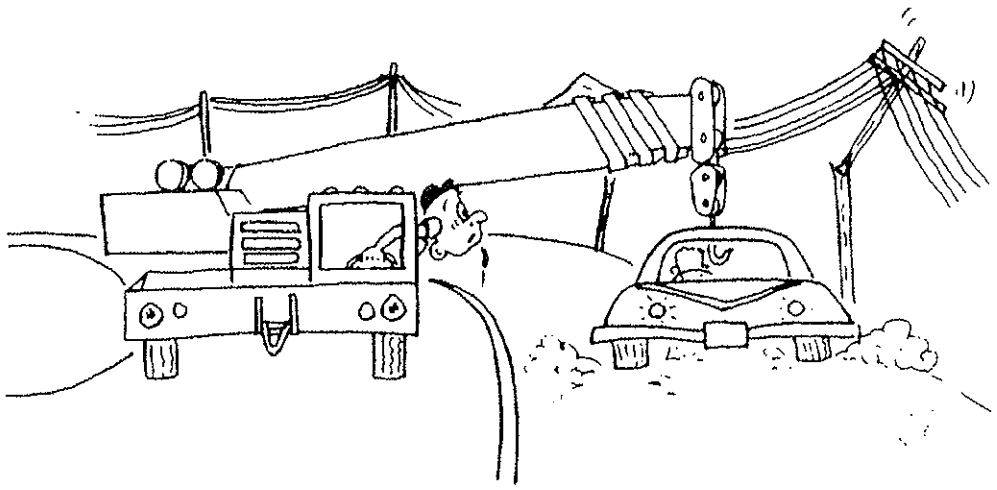
Secure the hook block and other items before moving the crane.

When traveling, keep the lights on, use traffic warning flags and signs, and use front and rear flag vehicles. Check state and local restrictions and regulations

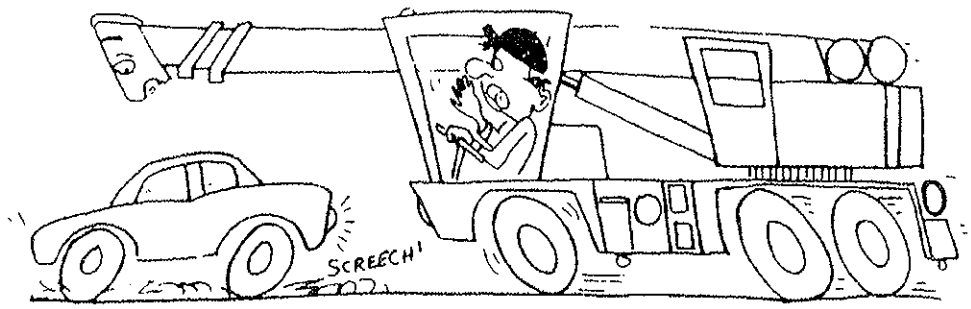


Drive carefully and avoid speeding.

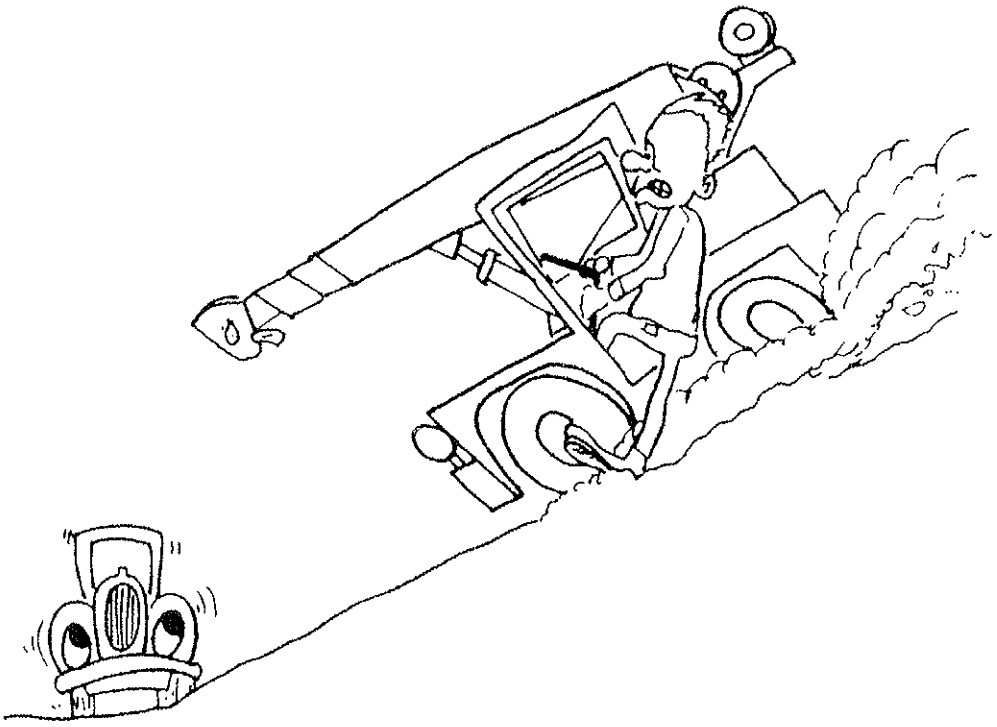
Before traveling a crane, check suitability of proposed route with regard to crane height, width, and length.



Secure the turntable before moving crane, use the swing lock.



Stay alert at the wheel.



When parking on a grade, apply the parking brake and chock the wheels.

COLD WEATHER OPERATION.

Cold weather operation requires additional caution on the part of the operator

Check operating procedures for cold weather starting.

Don't touch metal surfaces that could freeze you to them.

Clean the crane of all ice and snow.

Allow ample time for hydraulic oil to warm up.

In freezing weather, park the crane in an area where it cannot become frozen to the ground.

In freezing weather, frequently check all air tanks for water.

Always handle propane tanks according to the supplier's instructions.

Never store flammable materials on the crane.

If cold weather starting aids are provided on your crane, use them. The use of aerosol spray or other types of starting fluids containing ether/volatiles can cause explosions or fire.

SECTION III

DESCRIPTION

GENERAL.

The mobile hydraulic crane incorporates an all welded steel frame. The 8 x 4 carrier utilizes two non-drive steer axles and two drive axles. The 12 x 6 carrier utilizes three non-drive steer axles and three drive axles. A hydraulic steer cylinder is mounted on each steer axle. The engine is mounted in the front of the carrier and provides motive power through the transmission to the rear axles.

MAJOR COMPONENTS AND SYSTEMS.

CAB ASSEMBLY.

The cab is all steel, acoustically-treated, fully-enclosed with tinted safety glass windows (later models) throughout. The cab contains all controls and indicators for roading operations.

The cab also contains the heater, defroster, electric windshield wiper, dome light, and 10 BC rated 2.75 pound (1.2 kg) (early models) or 5 BC rated 3.75 (1.7 kg) (later models) dry type fire extinguisher. There is one seat in the 8 x 4 carrier and two seats in the 12 x 6 carrier. Later models have seats equipped with seat belts.

ENGINE.

The diesel engine is housed in the engine compartment alongside the carrier cab. The engine is used to provide crane mobility, charge the air system via the compressor, and supply electrical power used to charge the batteries and provide power for carrier control circuits, accessories, and lighting. All controls for the engine are located in the cab. Engines are available from GMC, CAT, and Cummins. Refer to the Carrier Engine Specifications in Section 1.

FUEL TANK.

A single 100 gallon (379 liter) capacity fuel tank is mounted on the left side of the frame between the axles. The filler cap is located on top of the tank and is accessible from ground level.

DRIVE TRAIN.

The drive train consists of the clutch assembly, transmission, drive shafts, and the associated linkages.

The clutch assembly has two plates. It is a heavy duty unit and is actuated hydraulically from the carrier cab.

The manual transmission provides thirteen forward speeds and two reverse speeds. The shift lever is located in the carrier cab to the right of the seat.

FRONT AXLES.

The two front axles in the 8 x 4 and the three front axles in the 12 x 6 are non-driving steer axles. They incorporate sealed knuckle pins and sealed tie-rod end assemblies.

REAR AXLES.

The rear axles are full floating drive axles with planetary wheel ends. The cast housing incorporates spiral bevel gears.

STEERING ASSEMBLY.

The power steering utilizes steering cylinders mounted on each axle to reduce steering effort. The steering is also linked mechanically to allow manual steering in the event of a system failure.

BRAKES.

The brakes are double wedge actuated and air controlled. The rear axles are also equipped with spring brakes to provide parking and emergency stop braking.

AIR SYSTEM.

The air system provides the air supply to operate the service brakes, the parking brake release, and the transmission range shift.

The engine driven compressor supplies the air to charge the air reservoirs. Current models employ an air dryer to remove moisture from the air before it reaches the reservoirs. Earlier models used an alcohol injection system.

CAB CONTROLS AND INDICATORS.

NOTE

The following paragraphs describe the controls and indicators located in the cab. The numbers in parentheses represent the index number from the figure titled Cab Controls and Indicators.

QUICK START SWITCH.

The QUICK START SWITCH (1) is located on the lower left side of the instrument panel. The switch is the push-button type and is used to inject shots of starting fluid into the cold engine during starting. The ignition switch must be in the START position for quick start operation.

VOLTMETER.

The voltmeter (2) is located on the left side of the instrument panel. With the ignition switch in the ON position and before starting the engine, the voltmeter shows the condition of the batteries. With the engine running, the voltmeter indicates output voltage of the alternator. This voltmeter indicates voltage from 10 - 16 volts.

ENGINE OIL PRESSURE GAUGE.

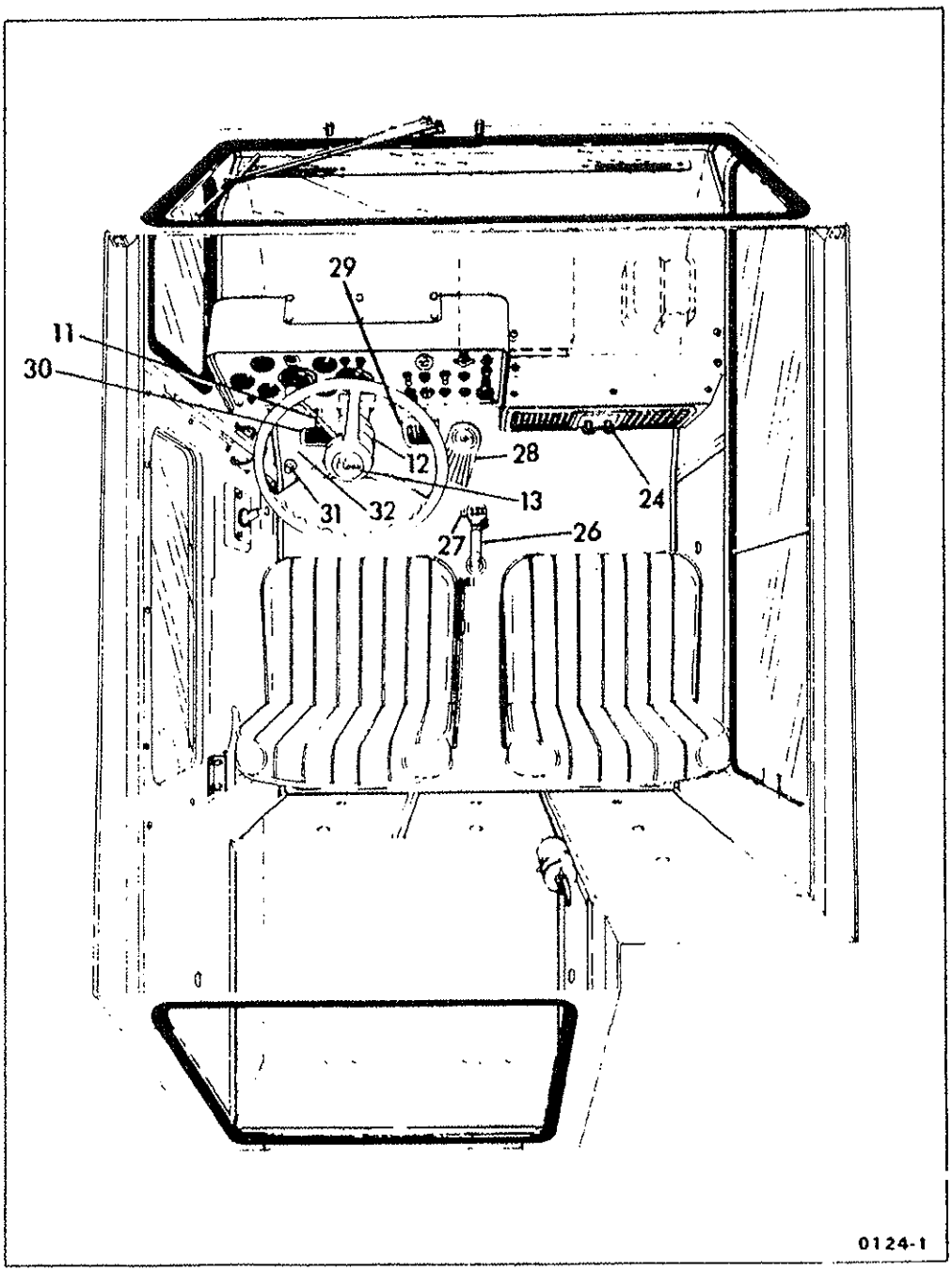
The engine oil pressure (OIL PRESS) gauge (3) is located on the left side of the instrument panel. The gauge indicates the engine oil pressure on the dual scale calibrated from zero (0) to 100 psi and zero (0) to 690 kPa. It receives a signal from an oil pressure sending unit on the engine.

WATER TEMPERATURE GAUGE.

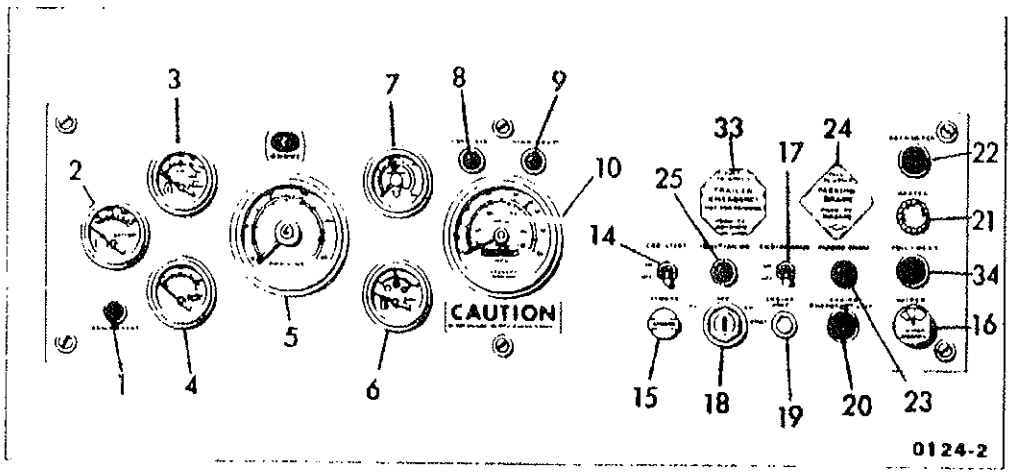
The engine coolant temperature (WATER TEMP) gauge (4) is located on the left side of the instrument panel. The gauge indicates the engine coolant temperature on a dual scale calibrated from 100 to 240 degrees F and 38 to 116 degrees C. The gauge receives a signal from a temperature sending unit in the engine cooling system.

TACHOMETER.

The tachometer (5) is located on the left side of the instrument panel. It is calibrated in rpm x 100 with a range of zero (0) to 50. It receives a signal

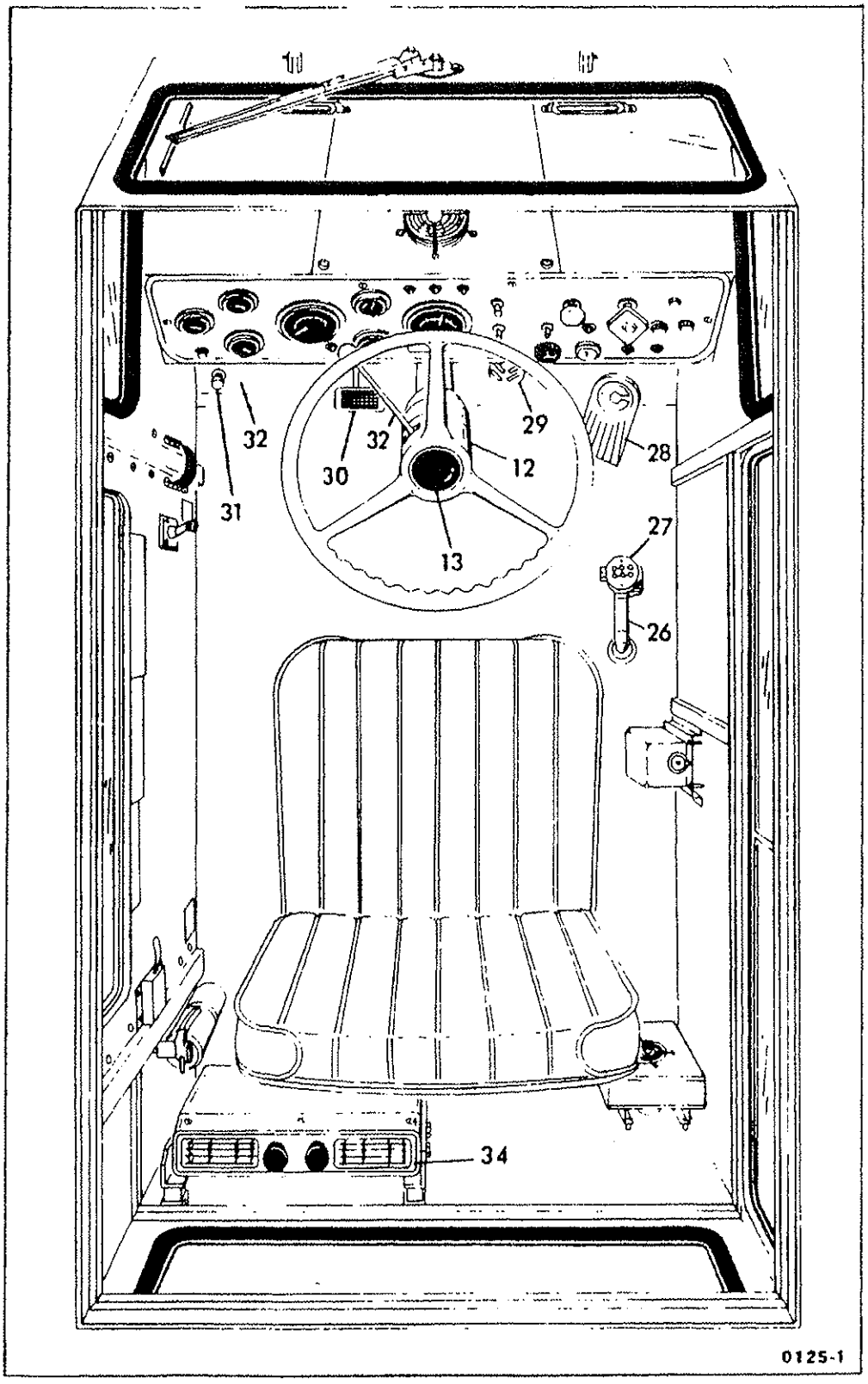


12 x 6 Cab Controls and Indicators (Sheet 1 of 2)

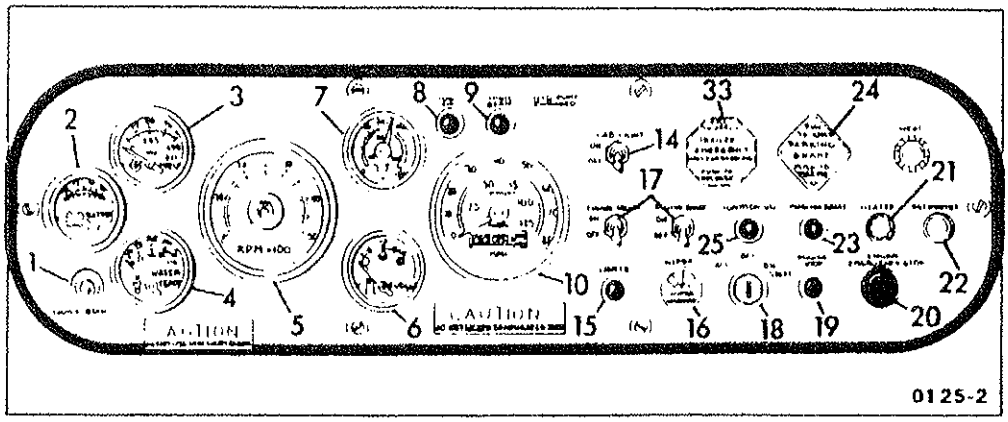


1. Quick Start Switch
2. Voltmeter
3. Engine Oil Pressure Gauge
4. Water Temperature Gauge
5. Tachometer
6. Fuel Quantity Gauge
7. Dual Air Pressure Gauge
8. Low Air Pressure Indicator
9. High Beam Indicator
10. Speedometer
11. Turn Signal Lever
12. Four Way Flasher
13. Horn Button
14. Cab Light Switch
15. Lights Switch
16. Windshield Wiper/Washer Switch
17. Engine Brake Switch (Optional)
18. Ignition Switch
19. Engine Stop Button (GMC Only)
20. Engine Emergency Stop Button (GMC Only)
21. Heater Air Flow Control Switch
22. Defrost Control
23. Park Brake Indicator
24. Parking Brake Control
25. Ignition On Indicator
26. Gearshift Lever
27. Range Control Button
28. Throttle Pedal
29. Brake Pedal
30. Clutch Pedal
31. Dimmer Switch
32. Windshield Washer Pump (Earlier Models)
33. Trailer Emergency Brakes Control (Optional)
34. Air Conditioner (Optional)

12 x 6 Cab Controls and Indicators (Sheet 2 of 2)



8 x 4 Cab Controls and Indicators (Sheet 1 of 2)



1. Quick Start Switch
2. Voltmeter
3. Engine Oil Pressure Gauge
4. Water Temperature Gauge
5. Tachometer
6. Fuel Quantity Gauge
7. Dual Air Pressure Gauge
8. Low Air Pressure Indicator
9. High Beam Indicator
10. Speedometer
11. Turn Signal Lever
12. Four Way Flasher
13. Horn Button
14. Cab Light Switch
15. Lights Switch
16. Windshield Wiper/Washer Switch
17. Engine Brake Switch (Optional)
18. Ignition Switch
19. Engine Stop Button (GMC Only)
20. Engine Emergency Stop Button (GMC Only)
21. Heater Air Flow Control Switch
22. Defrost Control
23. Park Brake Indicator
24. Parking Brake Control
25. Ignition On Indicator
26. Gearshift Lever
27. Range Control Button
28. Throttle Pedal
29. Brake Pedal
30. Clutch Pedal
31. Dimmer Switch
32. Windshield Washer Pump (Earlier Models)
33. Trailer Emergency Brakes Control (Optional)
34. Air Conditioner (Optional)

8 x 4 Cab Controls and Indicators (Sheet 2 of 2)

from a sending unit on the engine and does not utilize the machine 12-volt electrical system.

FUEL QUANTITY GAUGE.

The fuel quantity gauge (6) is located on the left side of the instrument panel. The gauge indicates the quantity of fuel in the tank and has a scale calibrated from zero (0) to 4/4. The fuel quantitiy gauge receives a signal from a sending unit in the fuel tank.

DUAL AIR PRESSURE GAUGE.

The dual air pressure gauge (7) is located on the left side of the instrument panel. The gauge is a direct reading pressure gauge with two indicating points, (green for the primary system and red for the secondary). The gauge has a dual scale calibrated from 10 to 150 psi and 100 to 1,000 kPa. The gauge is connected to each air system through tubing.

LOW AIR PRESSURE INDICATOR.

The LOW AIR pressure indicator (8) is located on the left side of the instrument panel. The indicator is a red light that illuminates when the pressure in either or both air systems is below 75 psi (557 kPa). The indicator is controlled by two pressure switches electrically connected in parallel. To determine which system pressure is low, observe the dual air pressure gauge. In addition to illuminating the LOW AIR indicator, the pressure switches also energize a warning buzzer.

HIGH BEAM INDICATOR.

The high beam indicator (9) is located in the center of the instrument panel above the speedometer. The indicator is a blue light that illuminates when the lights are on high beam.

SPEEDOMETER.

The speedometer (10) is located in the center of the instrument panel above the steering wheel. The speedometer indicates road speed in both mph (miles per hour) and km/hr (kilometers per hour). There is an odometer on the speedometer which shows the total mileage the vehicle has traveled.

ENGINE BRAKE SWITCH (OPTIONAL).

The ENGINE BRAKE switch (17) is located on the right side of the instru-

ment panel. It is a two position (ON - OFF) toggle switch. In the ON position, the engine brake is energized.

IGNITION SWITCH.

The IGNITION SWITCH (18) is located on the right side of the front console. It is a key operated switch with four positions; ACC, OFF, ON, and START. The switch is spring return from START to ON. With the switch in the OFF position, all electrical power for the machine is off except to the switches controlling headlights, marker lights, and dome light. Positioning the switch to ACC energizes all electrical components except the engine fuel solenoid valve (governor solenoid on GMC). Positioning the switch to ON is the same as ACC except the engine fuel solenoid valve becomes energized. Positioning the switch to START energizes the starter relay which in turn energizes the cranking motor solenoid and cranks the engine for starting. Releasing the switch will spring return it to ON. To shutdown the engine, except GMC, position the switch to OFF.

ENGINE STOP BUTTON (GMC ONLY).

The ENGINE STOP button (19) is located on the right side of the instrument panel. The button is the push type and when depressed, energizes a solenoid on the engine which closes the governor and thereby shuts down the engine.

ENGINE EMERGENCY STOP BUTTON (GMC ONLY).

The ENGINE EMERGENCY STOP button (20) is located on the right side of the instrument panel. It is used to shutdown the GMC engine if it will not shutdown by actuating the ENGINE STOP button.

HEATER AIR FLOW CONTROL SWITCH.

The HEATER switch (21) is located on the right side of the instrument panel. This switch controls the fan speed which adjusts heated air volume output.

DEFROST CONTROL.

The DEFROSTER control (22) is located on the right side of the instrument panel. This switch controls the defroster fan speed.

HEATER AIR TEMPERATURE CONTROL (12 x 6 CARRIER).

The heater air temperature control (34) is located on the right side of the

instrument panel. It is a push-pull cable control that positions the temperature control on the heater unit. Pull for heat.

PARK BRAKE INDICATOR.

The PARK BRAKE indicator (23) is located on the right-hand side of the instrument panel. The indicator is a red light that is illuminated when the PARK BRAKE is in the applied position and the ignition switch is in ACC or ON.

PARKING BRAKE CONTROL.

The PARKING BRAKE control knob (24) is located on the right side of the instrument panel. Pull out to apply the parking brakes and push in to release it.

IGNITION ON INDICATOR.

The IGNITION ON indicator (25) is located on the right side of the instrument panel. The indicator is a green light that illuminates when the ignition switch is in the ON or ACC position.

GEARSHIFT LEVER.

The gearshift lever (26) is located on the right side of cab. It is used to shift the transmission gears.

RANGE CONTROL BUTTON.

The range control button (27) is located on the side of the gearshift knob. It provides for a high and a low range.

THROTTLE PEDAL.

The throttle pedal (28) is lcoated on the right side of the cab floor. The pedal is used to control engine rpm.

BRAKE PEDAL.

The brake pedal (29) is located on the cab floor, to the left of the throttle pedal. The pedal is used to apply the service brakes.

CLUTCH PEDAL.

The clutch pedal (30) is located on the left side of the cab floor. It is used to engage or disengage the clutch.

DIMMER SWITCH.

The dimmer switch (31) is located on the left side of the cab. The switch is depressed and released by foot pressure. It provides for selection of either high or low headlight beams.

TURN SIGNAL LEVER.

The turn signal lever (11) is located on the steering column. Positioning the lever down causes the indicator light on the column and the left front and left rear signals to flash. Positioning the lever up causes the indicator light on the column and the right front and right rear signals to flash.

FOUR-WAY FLASHER.

The four-way flasher switch (12) is lcoated on the steering column. Pushing forward on the switch (in the direction of the arrow) causes all the turn signals and the indicator light on the column to flash.

HORN BUTTON.

The horn button (13) is located in the center of the steering wheel. Depressing the horn button energizes the circuit sounding the horn.

CAB LIGHT SWITCH.

The cab light switch (14) is located on the right side of the console. It is a two position (ON-OFF) toggle switch. In the ON position the cab light is illuminated.

LIGHTS SWITCH.

The LIGHTS switch (15) is located on the right side of the instrument panel. The switch is a push-pull type switch with a rheostat control. Pulling the switch to the first detent illuminates the marker lights and the gauge lights. Pulling the switch to the second detent illuminates the headlights, the marker lights, and the gauge lights. Rotating the switch knob controls the brightness of the gauge lights.

WINDSHIELD WIPER/WASHER SWITCH.

The windshield WASHER WIPER switch (16) is located on the right side of the instrument panel. The switch has three positions; off, low, and high. In addition, in later models, pushing the switch energizes the motor on the windshield washer pump assembly. Rotating the switch to the first detent energizes the wiper motor at low speed and rotating it to the second detent energizes the motor at high speed. Rotating the switch counterclockwise to off, stops the motor and causes the automatic park function of the wiper motor to return the wiper blade to the parked position.

WINDSHIELD WASHER PUMP (EARLIER MODELS).

The windshield washer pump (32) is located on the left side of the cab. The pump is activated by foot pressure to spray windshield washer fluid onto the windshield.

TRAILER EMERGENCY BRAKES CONTROL (OPTIONAL).

The TRAILER EMERGENCY brakes control knob (33) is located on the right side of the instrument panel. This knob is used with the trailing boom option. Pull to apply the trailer spring brakes. This should be done for an emergency stop only, because it does not provide controlled braking.

AIR CONDITIONER (OPTIONAL).

The air conditioner (34) is installed on the right front of the carrier cab in the 12 x 6 carrier and behind the operator's seat in the 8 x 4 carrier. All controls for the air conditioner are provided on the unit. The compressor is driven by a hydraulic motor.

SECTION IV

OPERATING PROCEDURES

BREAKING-IN A NEW CARRIER.

Your new Grove carrier has been thoroughly tested, adjusted, lubricated, and inspected prior to delivery. However, as road shock and crane operation occur, moving parts wear in or gaskets and hose connections take a set and an occasional oil, air, or coolant leak may develop. Immediate corrective action should be taken to avoid major repairs later. For detailed engine break-in, refer to the applicable engine manual.

Some important rules to follow to establish conditions for long service life are listed below.

1. Operate as much as possible in half to three-quarters throttle or load range.

2. Avoid long periods of operation at engine idle speeds or at continuous maximum horsepower levels.

3. Observe instruments often and shut down at the first indication of an abnormal reading.

4. Operate to a power requirement that allows acceleration to governed speed when conditions require more power.

5. Check all components frequently for proper operation, unusual noises, or excessive heating.

6. Check the engine oil and the coolant levels frequently.

These rules should not be considered as limitations in putting your equipment to work at maximum capacity, but rather to serve as a guide to familiarization and development of good operating habits.

PRE-STARTING CHECKS.

A complete walk-around, visual inspection of the machine should always be made with special attention to structural damage, loose equipment, leaks, or other conditions that would require immediate correction for safety of operation. The following checklist items are suggested specifically for the

operator's benefit to ensure his machine is prepared for starting the day's work.

FUEL SUPPLY.

Ensure the fuel tank is full and the cap is on tight.

ENGINE OIL.

Check the oil level in the crankcase; fill to the FULL mark on the dipstick. Do not overfill.

ENGINE COOLANT.

Check the coolant level in the radiator, fill to the proper level - do not overfill. Check the cap for security.

BATTERIES.

Currently some cranes use maintenance free type batteries. Check the state-of-charge indicator on these type batteries. On cranes not using the maintenance free batteries, check each cell for the correct electrolyte level. Add only clean distilled water. Do not overfill. On either type battery, ensure the cables and clamps are tight and not corroded.

SEATS.

Adjust seat and mirrors for clear vision and safe driving.

SEAT BELTS.

Seat Belt Maintenance.

Seat belt assemblies are maintenance-free; however, they should be periodically inspected to ensure that they have not become damaged and that they remain in proper operating condition, particularly if they have been subjected to severe stress.

Cleaning Seat Belt Webbing.

To clean the webbing, wash with any mild soap or detergent. Do not clean seat belts with commercial solvents. Also, bleaching or redyeing the webbing is not recommended because of possible loss of webbing strength.

TIRES.

Check pressure and condition of all tires before starting.

TIRE INFLATION – PSI (kPa) TM 875, TM 1075

SIZE [F=FRONT R=REAR]	LOAD RANGE	LIFTING SERVICE		HIGHWAY TRAVEL
		STATIC	2.5 MPH (4 km/h)	
14.00 20 [F]	L	110 (760)	110 (760)	110 (760)
14.00-20 [R]	L	100 (690)	100 (690)	100 (690)
14.00R20 [F&R]	M	NOT PERMITTED		110 (760)

SP4

Tire Inflation Chart 4685

WHEELS.

Maintain proper torque on wheel lugs and check for proper wheel mounting.

SAFETY EQUIPMENT.

Check all lights, windshield wipers, washers, washer liquid supply, horn, instruments, signalling devices, etc.

DAILY LUBRICATION.

Ensure all components requiring daily lubrication have been serviced. (Refer to Section V, Lubrication).

ENGINE OPERATION.

Starting and shutdown procedures for most diesel engines generally follow the same pattern. Therefore, the following procedures can be applied, except, where specific differences are noted. (Refer to the applicable engine manufacturer's manual for detailed procedures).

STARTING PROCEDURE.

WARNING

BEFORE STARTING THE ENGINE, ENSURE THE TRANSMISSION IS IN NEUTRAL, PARKING BRAKE APPLIED, AND SWING LOCK IS ENGAGED.

CAUTION

NEVER CRANK THE ENGINE FOR MORE THAN 30 SECONDS DURING AN ATTEMPTED START. IF THE ENGINE FAILS TO START AFTER 30 SECONDS, ALLOW THE STARTER MOTOR TO COOL FOR APPROXIMATELY TWO MINUTES BEFORE ATTEMPTING ANOTHER START.

CAUTION

IF THE ENGINE FAILS TO START AFTER FOUR ATTEMPTS, CORRECT THE MALFUNCTION BEFORE ATTEMPTING ANY FURTHER STARTS.

NOTE

When starting a cold engine, ensure the hydraulic pumps are disengaged.

1. Turn the ignition switch to START and release immediately when the engine starts.

2. When the start has been accomplished, check the engine instruments for proper indications.

WARNING

ENSURE BOTH AIR SYSTEM PRESSURES ARE IN THE NORMAL OPERATING RANGE PRIOR TO DISENGAGING THE PARK BRAKE.

CAUTION

IF OIL PRESSURE AND/OR TEMPERATURE INDICATOR(S) DO NOT DISPLAY THE PROPER READINGS, SHUT DOWN THE ENGINE AND CORRECT THE MALFUNCTION BEFORE RESUMING OPERATION.

3. Allow the engine to warm up at least five minutes before applying a load. Do not race the engine for faster warmup.

Normal Engine Gauge Readings

GAUGE	GMC	CAT	CUMMINS
Eng. Water Temp. °F(°C)	175-185 (79-85)	175-185 (79-85)	175-185 (79-85)
Eng. Oil Press psi (kPa)			
Idle	5 (35)	10 (69)	15 (103)
Rated	23-35 (159-241)	50-90 (345-621)	50-70 (345-483)
Air Pressure psi (kPa)	105-120 (724-825)	105-120 (724-827)	105-120 (724-827)

COLD WEATHER STARTING.

The correct grade of oil for the prevailing temperature should be used in the crankcase to prevent hard cranking. Diesel fuel should have a pour point of 10 degrees F (-12 degrees C) less than the lowest expected temperature. In case of an emergency, white kerosene may be added to the fuel to bring the pour point down to the required temperature to prevent clogging of filters and small passages by wax crystals. The addition of kerosene is NOT recommended for general use. If low temperatures are ONLY expected at start-up, it is advisable to use starting aids such as preheating, starting aid compound metering equipment, or starting aid spray application into the air cleaner intake.

CAUTION

AVOID OVERLOADING THE AIR BOX WITH HIGH VOLATILE FLUID WHICH COULD RESULT IN A MINOR EXPLOSION.

To start the engine, position the ignition switch to START and push the QUICK START button for one or two seconds and release. If the engine does not start within 30 seconds, allow the starter to cool at least two minutes and repeat the procedure.

IDLING THE ENGINE.

Idling the engine unnecessarily for long periods of time wastes fuel and fouls injector nozzles. Unburned fuel causes carbon formation; oil dilution; formation of lacquer or gummy deposits on the valves, pistons and rings; and rapid accumulation of sludge in the engine.

NOTE

When prolonged engine idling is necessary, maintain at least 800 rpm.

RACING THE ENGINE.

NEVER race the engine during the warm-up period. NEVER operate the engine beyond governed speed (as might occur in downhill operation or downshifting). Engine bearings, pistons, and valves may be damaged if these precautions are not taken.

SHUTDOWN PROCEDURE.

1. Allow the engine to operate at fast idle speed for approximately five minutes to avoid high internal heat rise and allow for heat dissipation.

2. Press the ENGINE STOP button (GMC only) and keep it depressed until the engine stops completely.

3. Position the ignition switch to OFF.

EMERGENCY ENGINE SHUTDOWN. (GMC ONLY).

1. Position the ignition switch to OFF.

CAUTION

THE ENGINE EMERGENCY STOP SHOULD BE USED ONLY IF DEPRESSING THE ENGINE STOP BUTTON DOES NOT SHUT DOWN THE ENGINE. DAMAGE TO THE ENGINE COULD RESULT WHEN THE ENGINE EMERGENCY STOP IS USED.

2. Push the ENGINE EMERGENCY STOP button

WARNING

IF AN OVERHEATING CONDITION NECESSITATES AN EMERGENCY SHUTDOWN, USE CAUTION WHEN CHECKING THE RADIATOR. WHEN LOOSENING THE RADIATOR CAP TO RELIEVE PRESSURE, USE A HEAVY CLOTH OR GLOVES. ALLOW THE ENGINE TO COOL BEFORE REMOVING THE CAP FROM THE RADIATOR.

CAUTION

CORRECT THE PROBLEM THAT CAUSED THE EMERGENCY SHUTDOWN BEFORE ATTEMPTING A RESTART OF THE ENGINE.

3. If the ENGINE EMERGENCY STOP was used, the emergency stop air shutoff valve, located on the right side of the engine air intake manifold, must be manually reset before the engine can be restarted.

CRANE TRAVEL OPERATION.

TRAVELING - GENERAL.

CAUTION

FOR EXTENDED TRAVEL, CHECK THE COLD TIRE PRESSURE PRIOR TO START. (REFER TO THE TIRE INFLATION CHART.)

Before attempting to move the crane, ensure adherence to the following conditions of the superstructure. Procedures for accomplishing the following can be found in the Superstructure Operator's and Safety Handbook.

1. Ensure all boom sections are fully retracted.

2. Ensure the boom is fully lowered into the boom rest.

3. Engage the swing brake.

4. Engage the positive swing lock

5. Ensure the swingaway extension is properly stowed and secured.

6. Remove the hook block and/or headache ball from the hoist cable(s) and stow securely before traveling or ensure the hook block or headache ball is properly secured to the tie down provided for that purpose.

7. Ensure the outrigger stabilizers and outrigger beams are fully retracted and the floats are removed.

8. Ensure the center front stabilizer (optional) is fully retacted and the float is removed.

9. Ensure the stabilizer floats are properly stowed in their holding racks.

10. Ensure the cover doors on the outrigger control panels and sight level bubble indicators are closed.

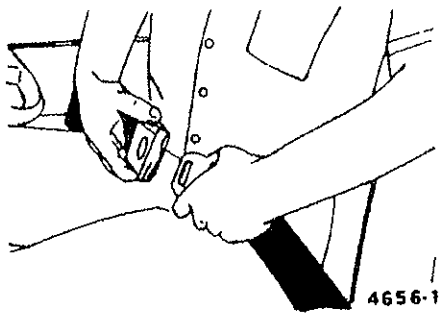
11. Close and/or install all superstructure cab windows and door.

12. Ensure the counterweight lock is in the locked position.

ACTIVE RESTRAINTS.

Seat Belts.

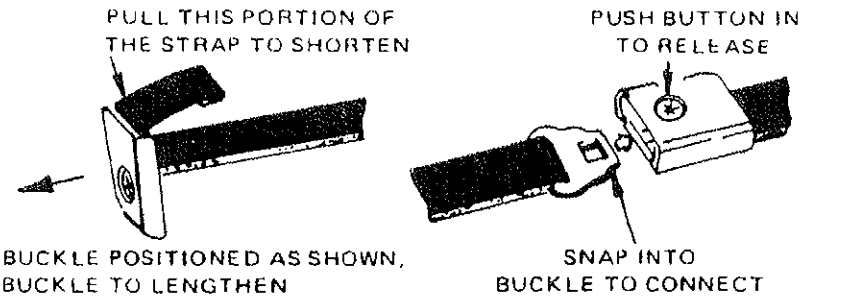
Before fastening a seat belt, always adjust the driver's seat to the position in which you will drive.



For greater restraint and comfort:

1. Be sure the belt is snugly fitted around the hips - not the waist - and not twisted. Failure to properly fit belts may result in unnecessary injury in the event of a collision.

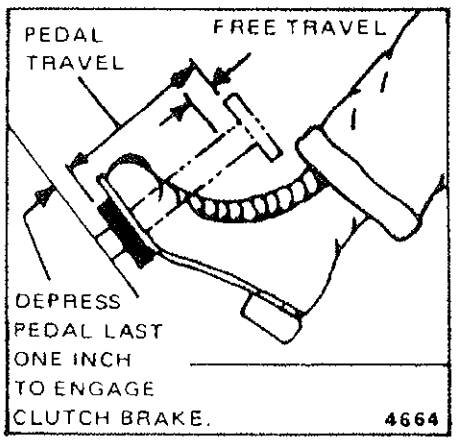
2. Only one person should be strapped in each seat belt.



To lengthen the belt, tip the buckle end downward, as shown, and pull the buckle until the belt ends can be joined. Insert the belt into the open end of the buckle until a snap is heard and check for latch engagement. This belt can be shortened, after connected, by pulling on the loose end until the belt is snug. Press the buckle release to remove the belt.

CLUTCH OPERATION.

Clutch pedal adjustment provides for approximately 2.25 to 3.25 inches (5.72 to 8.26 cm) for further free travel movement of the pedal after the first free travel of 0.5 inch (1.27 cm) is passed before engaging the release bearing fully. It is important that this free travel be maintained to avoid possible excessive wear on the bearing and/or clutch slippage. Approximately the last one inch of downward clutch pedal travel engages the clutch brake which overcomes the tendency of the clutch to rotate at high speed when the clutch is disengaged. A slight but definite resistance to clutch pedal downward movement will be felt at the last one inch of travel.



Clutch Travel

The clutch brake is particularly useful for initial gear engagement in the lower gears when going uphill, when the road speed drops off more quickly than the engine RPM requiring rapid shifts. The clutch brake MUST NOT BE USED when making a downshift.

Clutch engagement should always be made smoothly while synchronizing accelerator movement necessary to move the vehicle.

CAUTION

NEVER FULLY DEPRESS THE CLUTCH PEDAL BEFORE THE TRANSMISSION IS PUT IN NEUTRAL. IF THE CLUTCH BRAKE IS APPLIED WITH THE TRANSMISSION STILL IN GEAR, A REVERSE LOAD WILL BE PUT ON THE GEARS MAKING IT DIFFICULT TO GET THE TRANSMISSION OUT OF GEAR. AT THE SAME TIME, IT WILL HAVE THE EFFECT OF TRYING TO STOP OR DECELERATE THE VEHICLE WITH THE CLUTCH BRAKE, WITH RESULTANT RAPID WEAR AND GENERATION OF EXCESSIVE HEAT, NECESSITATING FREQUENT REPLACEMENT OF THE BRAKE FRICTION DISCS.

Double clutching is a means of bringing the speed of the transmission gears into synchronization so the shift can be made without clash. The engine is used to speed up the countershaft for a downshift and to slow it down for an upshift. Double clutching operation is accomplished as follows.

1. Depress the clutch (do not engage clutch brake) and shift into neutral.

2. Release clutch pedal and accelerate the engine (when making downshift) or allow engine to slow down (when upshifting) until engine speed approximately corresponds to road speed of the gear ratio selected.

3. Depress the clutch pedal (do not engage clutch brake) and shift into gear.

4. Release the clutch pedal.

Always use the double clutching technique.

NOTE

Never allow your foot to ride the clutch pedal when the clutch is engaged. This causes premature release bearing failure and short clutch facing life.

SHIFTING GEARS.

Next to concern for safety, good shifting habits are probably the most important capability a driver can have. Knowing how and when to shift can return savings in trip time and operating expense.

In the early stage of moving the vehicle, keep the engine speed down to the actual power requirement but anticipate the next shift demand and do not cause the engine to labor with the next shift. Start the vehicle in the lowest gear available and with the first few shifts, develop only the RPM needed to get rolling. Then as you upshift, increase vehicle speed in each gear with a progressive increase in engine speed. It should seldom be necessary to go to governed engine speed in the lower gears except in a peak load situation such as starting up a grade.

When driving conditions permit, maintain the desired road speed in a gear that permits running the engine preferable 15 to 20 percent below governed speed to allow engine to accelerate to or to maintain governed RPM when applying full throttle. In this cruise range, the engine affords better fuel economy than at higher speeds.

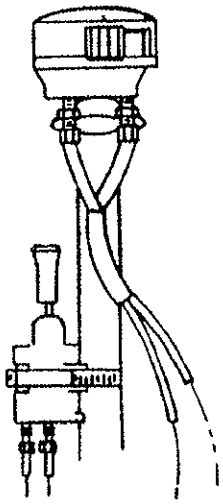
The biggest task when climbing a grade generally will be maintaining a reasonable rate of speed. When possible, preplan the climb and probable shift requirements according to traffic conditions and grade to be climbed. When approching a hill, gradually move the throttle all the way down if necessary to maintain governed RPM and remain at full throttle as the vehicle starts up the grade. If there is sufficient power to maintain satisfactory road speed without engine laboring, remain in that gear for the entire grade. Whenever a grade proves too great for the gear that you are in and the engine begins to labor, ease off on throttle as necessary and allow speed to drop off to the next lower shift point before downshifting to the next gear. Speed usually drops off quickly while shifting so shift should be made rapidly. Additional downshifting should be performed in the same way, as necessary. By riding each gear down to the next shift point, you will get over your grades in the best possible time with minimum shift-

On downhill operation, the engine provides most efficient braking when run at or near top RPM in the operating range BUT REMEMBER the governor has no control over the engine speed when it is being pushed by a heavy vehicle. When the engine exceeds the rated governed RPM while descending a grade or downshifting at the high end of the operating range, engine overspeed can result in serious damage. On downhill operation, use the vehicle brakes and gears in combination to keep vehicle speed under control and engine below rated governed RPM.

EARLIER MODELS

THREE-POSITION SPLITTER CONTROL
COMBINATION SPLITTER AND RANGE CONTROL

LATER MODELS



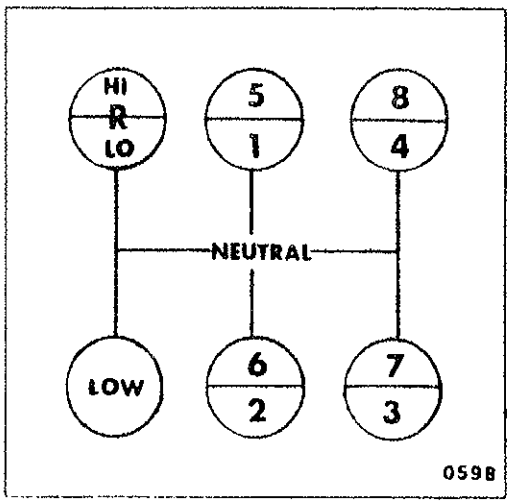
TWO-POSITION SPLITTER CONTROL
WITH TWO-POSITION RANGE CONTROL

0597

Splitter and Range Control

NOTE

Earlier model cranes had a three-position splitter control with a combination splitter and range control. Later models have a two-position splitter control with a two-position range control mounted on the side of the gearshift.



Shift Pattern

In the following instructions, it is assumed that the driver is familiar with motor trucks and tractors, and that he can coordinate the necessary movements of the shift lever and clutch pedal to make progressive and selective gear engagements in either direction, up or down.

1. Upshifting.

a. After making pre-operation checks of your vehicle, depress the clutch and move the shift lever to neutral.

b. Start the engine and check the gauges to ensure all systems are at proper operating levels.

c. Allow time for the engine to warm up and the air system to reach normal line pressure.

d. On cranes equipped with a separate range button, ensure the range button is down so the transmission will shift to low range.

e. On cranes equipped with the three-position splitter control, ensure the control is in LOW so the transmission will shift to low range.

f. Shift into the LOW gear ratio (use clutch brake) to start vehicle moving.

g. Shift progressively from LOW through 1st, 2nd, and 3rd to 4th.

NOTE

Step h is for cranes equipped with a three-position splitter. Step i is for cranes equipped with a separate range button.

h. While in 4th and ready for the upshift to the 5th gear, preselect the range by moving the range control selector to the DIR (DIRECT) position.

i. While in 4th and ready for the upshift to the 5th gear, pull up on the range control button with the splitter control in the DIR (DIRECT) position.

j. Complete the normal shift by moving the gear shift lever to the 5th gear position. The transmission will shift automatically to the high range as the lever passes through neutral.

k. Upshift from DIRECT 5th gear position to OVERDRIVE (5th) in the same gear position by positioning the selector from DIR to O.D. At the same time, quickly release the accelerator and depress the clutch. The transmission will shift when synchronization is reached. You do not have to move the gearshift lever.

l. Upshift from O.D. 5th to DIR 6th by moving the gear shift lever to the 6th speed position. Just before making the final clutch engagement and accelerating the engine, position the selector from O.D. to DIR.

m. Complete the upshifting sequence. Continue shifting upward through the shift pattern to 8th overdrive.

2. Downshifting.

a. Downshift from O.D. 8th to DIR 8th by positioning the selector from O.D. to DIR. Immediately, release the accelerator, disengage and engage

the clutch, and depress the accelerator. The transmission will shift when synchronization is reached. You do not have to move the gear shift lever.

b. Downshift from DIR 8th to O.D. 7th by positioning the selector from DIR to O.D. and immediately complete the normal shift moving the gear lever to the 7th speed gear position.

c. Shift down to 5th DIR using the normal downshifting pattern.

d. While in the 5th DIR and ready for the downshift to 4th, preselect the range shift by moving the range shift from HIGH to LOW. Complete the normal shift, moving the gear shift to the 4th speed gear position. The transmission will automatically shift to LOW range as the lever passes through neutral.

e. To downshift in LOW range, shift downward from 4th through 3rd, 2nd, and 1st to LOW.

CAUTION

DO NOT SELECT RATIOS WHERE ENGINE OVERSPEEDS OR ENGINE LABORING MIGHT OCCUR.

3. Skip Shifting. Skip shifting may be accomplished when upshifting through any range, providing the higher range position is selected prior to the gear shift. Down shifting, the selector valve is positioned to low before the shift which passes 5th gear.

CAUTION

DO NOT ATTEMPT TO MAKE ANY RANGE SHIFTS EITHER UP OR DOWN WHEN THE VEHICLE IS MOVING IN REVERSE. STAY IN THE RANGE ORIGINALLY SELECTED.

CAUTION

THE CLUTCH BRAKE MUST BE USED PRIOR TO SHIFTING INTO REVERSE GEAR.

4. Reverse Gears. Before shifting into reverse, the countershaft must be completely stopped.

5. Reducing Speed. When slowing down for a stop or slow sign, shift down through the individual short steps. By following this procedure the compression of the engine will slow the vehicle. The life of the brakes can thus be prolonged.

BRAKES.

For most effective braking and for maximum life from brake system components, the following suggestions are made.

1. Air brakes have light pedal operation and the driver is cautioned to use extreme care in application until a good feel is achieved.

2. Use the engine as a brake when approaching a stop or when going down a long grade. On a downgrade, use the same transmission gear as would be needed to go up the same grade.

3. When necessary to use brakes to reduce vehicle speed on a downgrade, use on-and-off application to minimize heat and wear. Do not hold a continuous brake application or slide the wheels.

4. When driving on slippery pavement or under icy conditions, alternately and smoothly apply and release the brakes to prevent skidding.

5. Keep the tires properly inflated. Improperly inflated tires can reduce the efficiency of the brakes.

6. After driving through water, dry the brakes by applying them lightly while maintaining a slow forward speed with an assured clear distance ahead until brake performance returns to normal.

WARNING

IF LOW PRESSURE OCCURS AND THE BUZZER SOUNDS DURING OPERATION, STOP IMMEDIATELY AND DETERMINE THE CAUSE OF AIR LOSS. DOWNSHIFT, USE THE ENGINE AS A BRAKE, AND MAKE THE FINAL STOP USING A SINGLE BRAKE PEDAL MOVEMENT TO AVOID EXCESSIVE LOSS OF AIR AND CONSEQUENT SUDDEN ENGAGEMENT OF THE AUTOMATIC SPRING BRAKES.

7. Regularly check on air pressure gauge indication. System air pressure should never be allowed to fall below 45 psi (310 kPa) or the automatic spring brakes will actuate. Normal operating pressure range is between 105 and 120 psi (724 and 827 kPa).

NOTE

If the pressure drops over 2 psi (14 kPa) per minute with the engine stopped, have the air system checked for leaks.

WARNING

ENSURE THE BRAKES ARE RELEASED BEFORE ANY ATTEMPT TO DRIVE, OR DRIVE TRAIN DAMAGE WILL RESULT. THE PARKING BRAKE IS TO BE USED FOR PARKING ONLY. DO NOT USE THE PARKING BRAKE FOR STOPPING THE VEHICLE EXCEPT IN CASE OF AN EMERGENCY, AS A SEVERE SUDDEN STOP WILL OCCUR.

8. Parking brakes are controlled by a readily identified push-pull knob on the dash panel. To apply the parking brake, pull the knob out. To release the parking brake, push the knob in.

OPTIONAL EQUIPMENT OPERATION.

ENGINE BRAKING.

The Jacobs Engine Brake is optional with the Cummins and Detroit Diesel engines. By energizing the engine brake, the power producing diesel engine, in effect, becomes a power absorbing air compressor. To retard a vehicle on a downgrade using the Jacobs Engine Brake, the operator selects a gear which will provide a balance between engine speed and road speed, then engages the engine brake. If the engine speed exceeds maximum rated rpm for a desired speed, a lower gear can be selected or intermittent use of the vehicle service brakes can be made. The selection of a lower gear will generally allow complete control of the vehicle by the "Jake", leaving the vehicle service brakes in reserve to be used for emergency stops. With the engine brake turned on, the "Jake" will not be energized until the momentum is driving the engine.

The Caterpillar engine comes equipped with a hydraulic retarder called the

Brakesaver. When the Brakesaver control is actuated, engine oil flows through a valve into the retarder. Inside the retarder, a rotor attached to the crankshaft directs the oil against stator elements, slowing the engine. There is a Brakesaver oil temperature gauge on the dash. When the gauge registers an oil temperature in the red zone, shut off the Brakesaver and use the service brakes.

TELMA RETARDER BRAKE.

On some carriers the Telma Retarder Brake is used. The retarder is an electromagnetic device designed to control downhill speeds of a heavy vehicle. This allows the standard friction brakes to remain cold and in an ideal condition, reserved for any emergency. Use of the retarder varies, depending upon the type of road and the nature of traffic which is encountered.

Control of the Retarder.

The retarder is controlled by a five position switch. Four of the positions are ON and the other is OFF. Amount of retardation increases from first to fourth position.

On Normal Roads.

The use of the retarder on normal roads provides smooth braking for all the "slowing down" needs in high speed traffic or on heavily congested roads.

The arrangement of four control positions (on the hand control) allow the selection of the degree of braking required.

The operation of the control should be done with a brief pause in each position. The return to OFF position may be made in a single movement. The retarder is very effective for town use in causing a vehicle to come almost to a halt. It provides nearly all the slowing down work for cross roads, turns, etc. Its' smooth action avoids the discomfort and jerky performance normally experienced with the standard friction brakes. It is absolutely essential to switch off the retarder whenever the vehicle comes to rest to avoid unnecessary discharge of the battery.

On Dangerous Roads and Descents.

On dangerous roads and descents always use a gear ratio that matches the slope of the hill or curve of the bends. In combining the action of the best gear ratios and an appropriate position of the retarder control, the required

speed control may be obtained.

When retarder braking is found to be sufficient, reduce the retarder power by one position. Then, if necessary, move back to the higher power position.

Additional Uses of the Retarder.

The braking action of the retarder is normally sufficient to give the required vehicle speed control. However, certain braking needs may demand the combined action of the retarder together with the friction brakes and the braking action of the engine.

These needs may be in the following cases.

1. For very heavy vehicles negotiating long descents of steep gradient.

2. For vehicles frequently negotiating hill descents at short intervals (such as mining and quarrying).

3. For vehicles which negotiate long descents at high speeds. It is necessary in such cases to occasionally rest the retarder for a few moments and replace its action with the friction brakes. In the case of long hill descents the use of no more than the second position of the retarder control is recommended in order to obtain the best overall efficiency for such severe and continuous braking action.

CAUTION

THE RETARDER CANNOT BE USED AS A PARKING BRAKE. THE DISCONNECTION OF THE RETARDER ELECTRICAL SUPPLY SHOULD BE CHECKED AT EVERY OCCASION WHEN THE VEHICLE COMES TO A COMPLETE HALT BY BEING SURE THE CONTROL LEVER IS IN THE OFF POSITION AND THAT THE WARNING LIGHT IS EXTINGUISHED.

Warning Light.

A warning lamp is lighted whenever the retarder is switched ON. It should be checked to be sure the retarder is OFF when the vehicle is at rest.

TRAILING BOOM.

In order to distribute crane weight over a greater number of axles to comply with roading axle weight requirements, a trailing boom option is available. Lift cylinder shutoff valves allow the boom to float vertically when roading. Also on later models, disengaging the swing brake allows the boom to move horizontally.

The trailer and crane carrier are equipped with quick disconnect electrical and air couplings to provide electrical power to the trailer lights and air to the trailer brakes.

Setting the Boom From the Operating Mode to the Trailing Mode.

1. Extend and set the outriggers.

2. Swing the boom to over-the-rear.

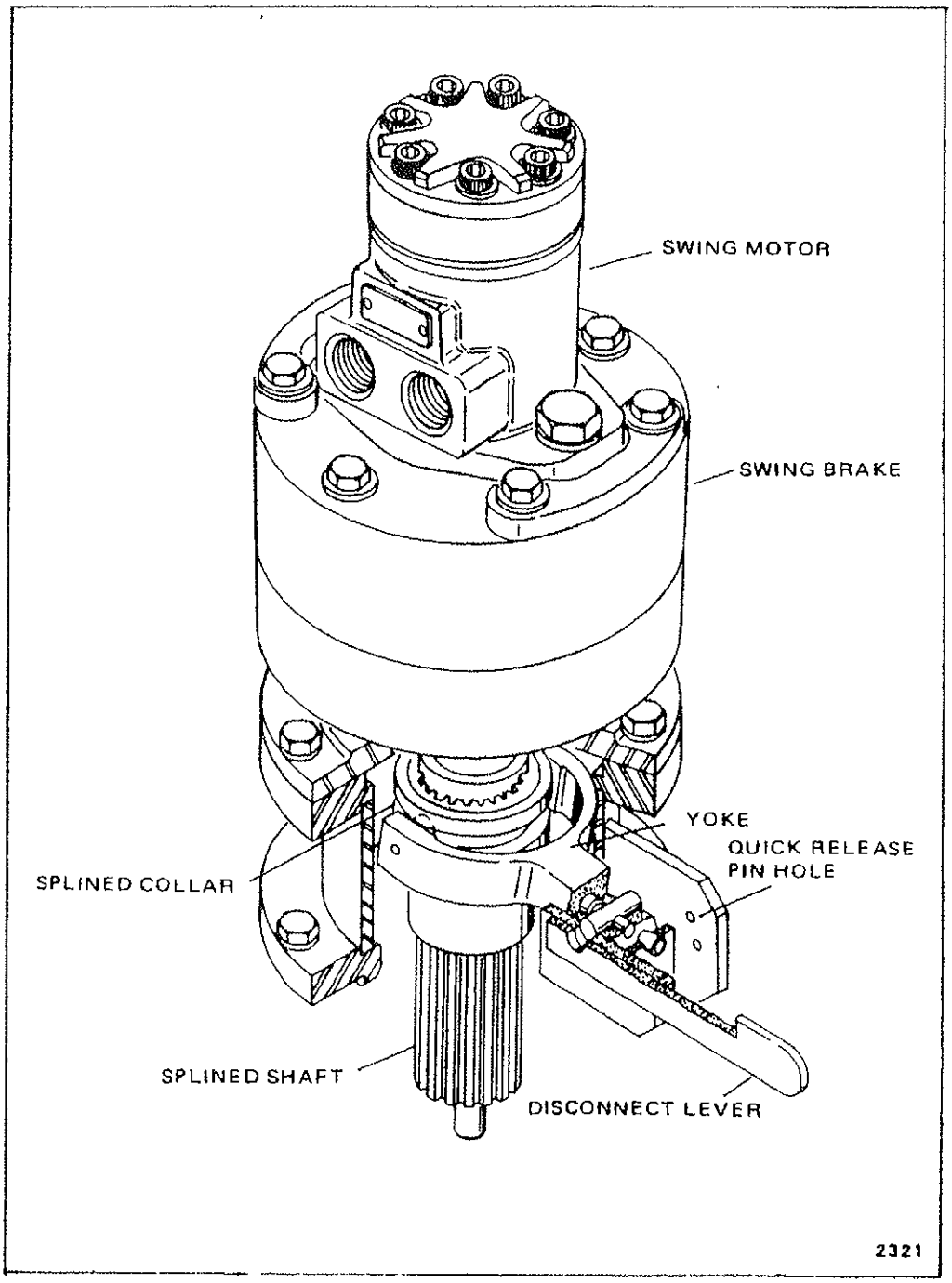
3. Position the boom on the trailer.

4. Open the three hand valves at the lift cylinder port blocks.

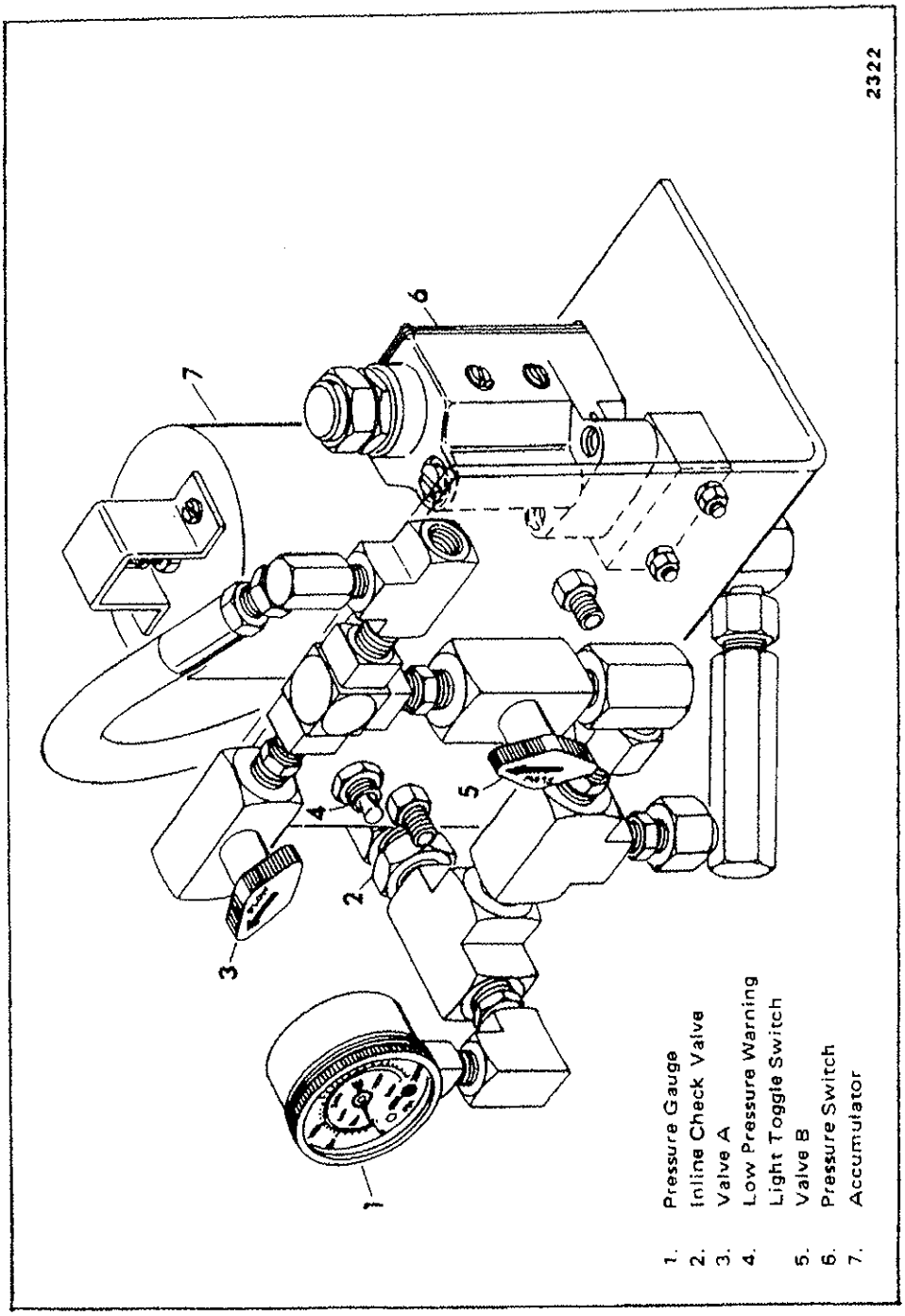
NOTE

Crane models manufactured up to and including April, 1978, are equipped with a puck-type swing brake and require no operation on the swing brake system for the trailing boom. Crane models manufactured between and including May, 1978, through March, 1980, are equipped with a disc and stator type swing brake with a mechanical lever disconnect for trailing boom. To disconnect the brake for these models follow step 5 and then proceed to step 10. Cranes manufactured from and including June, 1980, are equipped with a hydraulic swing brake disconnect assembly located in the rear of the valve compartment. Follow steps 6 through 10 for these models.

5. Remove the quick release pin from the handle and push down on the handle until the coupling disengages the swing drive. Insert the quick release pin through the lower hole on the housing and the handle to secure the handle in the disengaged position.



Mechanical Lever Disconnect Assembly



Hydraulic Swing Brake Disconnect Assembly

6. Engage the swing brake and set the positive swing lock.

CAUTION

DO NOT ATTEMPT TO SWING THE BOOM WITH THE SWING BRAKE ENGAGED AND VALVE B (REFER TO FIGURE TITLED HYDRAULIC SWING BRAKE RELEASE ASSEMBLY, OPEN SINCE THE SWING BRAKE COULD DISENGAGE CAUSING DAMAGE TO THE BOOM AND/OR TRAILER.

NOTE

The accumulator will not stay charged unless valve A is closed before valve B is opened.

7. Close valve A. Activate the swing control left to swing left. Note the pressure reading on the swing brake release gauge. The pressure should rise to 1500 psi (10,340 kPa/103.4 bar) and level off.

NOTE

With valve A closed and the accumulator charged to 1500 psi (10,340 kPa/103.4 bar) opening valve B will release the swing brake.

8. Open valve B.

NOTE

Positioning the LOW PRESSURE WARNING LIGHT switch to the ON position activates the low accumulator pressure electrical circuit. If pressure drops to 250 psi (1720 kPa/17.2 bar) a red light in the carrier cab illuminates to alert the operator.

CAUTION

IF THE LOW PRESSURE WARNING LIGHT SHOULD ILLUMINATE IN THE CARRIER CAB INDICATING A LOSS OF PRESSURE IN THE SWING BRAKE RELEASE SYSTEM, REPEAT STEPS 6 THROUGH 10 TO RE-ACTIVATE THE SYSTEM.

9. Position the LOW, PRESSURE WARNING LIGHT toggle switch to the ON position.

10. Release the positive swing lock.

Returning the Boom from the Trailing Mode to the Operating Mode.

WARNING

THE THREE HAND VALVES ON THE LIFT CYLINDER PORT BLOCKS MUST BE COMPLETELY CLOSED BEFORE OPERATING THE CRANE.

1. Close the three hand valves on the lift cylinder port blocks.

2. Extend and set the outriggers. Shutdown the engine.

NOTE

Crane models manufactured up to and including April, 1978, are equipped with a puck-type swing brake and require no operation on the swing brake system for the trailing boom. Crane models manufactured between and including May, 1978, through March, 1980, are equipped with a disc and stator type swing brake with a mechanical lever disconnect for trailing boom. To engage the brake for these models refer to step 3 and then proceed to step 6. Cranes manufactured from and including June, 1980, are equipped with a hydraulic swing brake disconnect assembly located in the rear of the valve compartment. Refer to step 4.

3. Remove the quick release pin from handle and housing and pull up on the handle until the coupling engages the swing drive. Insert the quick release pin through the upper hole on the housing and the handle to secure the handle in the engage position.

4. Completely open valve A and close valve B.

5. Position the LOW PRESSURE WARNING LIGHT toggle switch to the OFF position.

6. Start the engine. Release the swing brake.

7. Lift the boom from the trailer.

SECTION V

LUBRICATION

GENERAL.

Following the designated lubrication procedures is important in ensuring maximum crane lifetime and utilization. The procedures and lubrication charts in this section include information on the types of lubricants used, the location of the lubrication points, the frequency of lubrication, and other information.

The service intervals specified are for normal operation where moderate temperature, humidity, and atmospheric conditions prevail. In areas of extreme conditions, the service periods and lubrication specifications should be altered to meet existing conditions. For information on extreme condition lubrication, contact your local service representative or Grove Customer Services, Chambersburg, Pennsylvania.

LUBRICANTS.

CAUTION

CHASSIS GREASE LUBRICANTS MUST NOT BE APPLIED WITH AIR PRESSURE DEVICES AS THIS LUBRICANT IS USED ON SEALED FITTINGS.

CAUTION

THE MULTIPURPOSE GREASE INSTALLED DURING MANUFACTURE IS OF A LITHIUM BASE. USE OF A NON-COMPATIBLE GREASE COULD RESULT IN DAMAGE TO EQUIPMENT.

Specific recommendations of brand and grade of lubricants are not made here due to regional availability, operating conditions, and the continual development of improved products. Where questions arise, refer to the component manufacturer's manual and a reliable supplier.

SYMBOL	DESCRIPTION

CG — Chassis Grease. Lubricating grease of proper consistency is to be applied periodically at relatively frequent intervals with grease guns through grease fittings. Minimum apparent viscosity of 300 SUS (Saybolt Universal Seconds) at 100 degrees F (38 degrees C) is recommended.

Higher quality EP-MPG multipurpose grease may also be used. See EP-MPG for recommended consistency grades.

EP-MPG — Extreme Pressure Multipurpose Grease. This is a lithium soap base grease with a high load carrying capacity. The following properties are recommended.

Timken OK Load	40 lb. Minimum
Dropping Point	350 degrees F (177 degrees C) min.
Oil Viscosity	75 SUS Minimum at 210 degrees F 99 degrees C)
Water Resistance	Excellent

Under normal operation conditions, the following consistency grades are recommended.

NLGI No. 0 for sub-zero Fahrenheit temperatures.
NLGI No. 1 or No. 2 for normal ambient temperatures.
NLGI No. 2 or No. 3 for temperatures over 100 degrees F (38 degrees C).

WBG — Wheel Bearing Grease. This grease is of such composition, structure, and consistency that it is suitable for long time use in anti-friction wheel bearings. It must have high resistance to the deteriorating effects of temperature and the separating effects of centrifugal action. It shall not contain corrosive or abrasive materials and shall inhibit corrosion in the presence of moisture. NLGI grade No. 2 is recommended where not otherwise specified.

RGL — Regular Gear Lubricant. This is a straight-mineral gear oil of relatively high viscosity for the lubrication of spiral-bevel and worm gear rear axles and most manual transmissions operating under low unit pressures and sliding velocities.

API-GL-1 service classification. Unless otherwise specified, the following viscosity characteristics are recommended.

Viscosity Index 85 minimum
Summer Operation SAE90
Winter Operation SAE80

EPGL — Extreme Pressure Multipurpose Gear Lubricant. This gear lubricant is compounded to achieve high load carrying capacity and meet the requirements of either API-GL-5 or MIL-L-2105C. Unless otherwise specified, SAE80W-90 viscosity may be used for year-round service. Low temperature usage is restricted as follows.

SAE Viscosity Number	Minimum Ambient Temperature - °F (°C)
75W	-40 (-40)
80W	-15 (-26)
85W	+10 (-12)
90	+20 (-7)
140	+40 (+5)
250	+50 (+10)

EPGL (SCL) — Extreme Pressure Gear Lubricant, Sulpho-Chloro-Lead. This is a special gear lube formulated with EP additives of the sulfur-chlorine-lead types. Usage is restricted to those component parts for which the manufacturer specifies a lubricant of this composition. (Reference Clark MS-8-Specification).

OGL — Open Gear Lubricant. This is a special adhesive lubricant of heavy consistency for protection of wire rope and exposed gears where provision is not made for continuous lubricant replenishment. Select the viscosity that gives best protection and lubrication without peeling, scaling, or excessive throw off.

EO — Engine Oil. Internal combustion engine lubrication oils are classified primarily by viscosity characteristics and on performance as determined by a series of tests called MS test sequences. Lubricants marketed for heavy duty service consists of refined crude oil containing additives compounded to meet the desired engine performance levels. Use only good quality

oil provided by a reputable supplier in accordance with the service classification and viscosity requirements specified by the engine service manual.

ATF — Automatic Transmission Fluid. ATF shall meet the latest requirements for General Motors Dexron II specification.

HTF — Hydraulic Transmission Fluid. A fluid qualified to Detroit Diesel Allison (Div. of GMC) specification for Type C-3 transmission fluid, SAE 10W.

BF — Brake Fluid. A glycol ether fluid for use in hydraulic brake systems. Must meet or exceed SAE specification J1703.

HYDO — Hydraulic Oil. Oil in a hydraulic system serves as the power transmission medium, system lubricant, and coolant. Selection of the proper oil is essential to ensure satisfactory system performance and life. (See HYDRAULIC OIL RECOMMENDATIONS).

HYDRAULIC OIL RECOMMENDATIONS.

New machines come from the factory with Sun 2105 (5W20) hydraulic oil. This oil facilitates start up at temperatures down to -10 degrees F (-23 degrees C) and is satisfactory up through normal operating temperatures. When replenishment of hydraulic oil becomes necessary, the following types of oil are suitable under most operating conditions.

1. Good quality antiwear hydraulic oils.

2. Engine oil meeting the requirements of MIL-L-2104B or API Service Classification CB or CC, and having a minimum of 0.06% zinc by weight as zinc dithiophosphate.

The most important factors in selecting an oil for hydraulic service are:

1. Viscosity.

2. Anti-wear additives.

Viscosity.

The oil must have proper viscosity to provide a lubricating film at system operating temperature.

Oil viscosity is important because it has a direct bearing on efficient transmission of power. An oil must flow readily through the system with a minimum of pressure and flow loss. Positive lubrication depends on viscosity. The oil must be sufficiently light to get between the components machined surfaces, and maintain a lubricating film at system operating temperatures. Oil too light may cause the following condition in the system.

1. Excessive leakage.

2. Lower volumetric efficiency of the pump.

3. Increased component wear.

4. Loss of system pressure.

5. Lack of positive hydraulic control.

6. Lower overall efficiency.

Oil too heavy may cause the following conditions in the system.

1. System pressure drop.

2. Increases system temperature.

3. Sluggish system operation.

4. Low mechanical efficiency.

5. Higher power consumption.

The following oil viscosity characteristics are recommended.

80 to 180 SUS optimum at system operating temperature
60 SUS minimum at system operating temperature
7500 SUS maximum at starting temperature
90 Viscosity Index (VI), minimum

When an engine crankcase oil is selected, the following grades will usually meet the above viscosity requirements.

SAE VISCOSITY DESIGNATION	TEMPERATURE - °F(°C)
5W-20	-10 to 180 (-23 to 82)
10W	+10 to 180 (-12 to 82)
10W-30	+10 to 210 (-12 to 99)

Arctic Conditions. (Below 0 Degrees F [-18 Degrees C]).

In general, petroleum based fluids developed especially for low temperature service may be used with satisfactory results. However, certain fluids, such as hologenated hydrocarbons, nitro hydrocarbons, and phosphate ester hydraulic fluids, might not be compatible with hydraulic system seals and wear bands. If you are in doubt about the suitability of a specific fluid, check with your authorized Grove distributor or Grove Customer Services.

Regardless of temperature and oil viscosity, always use suitable start-up procedures to ensure adequate lubrication during system warm-up.

Antiwear Additives.

Excessive wear in the system may cause a loss in volumetric efficiency, and may cause shutdowns for maintenance. An efficient antiwear oil protects the components against rusting; resists oxidation, and helps prevent wear.

LUBRICATION POINTS.

A regular frequency of lubrication must be established for all lubrication points. Normally, this is based on component operating time. The most efficient method of keeping track of lube requirements is to maintain a job log indicating crane usage. The log must use the engine hourmeter and the odometer to ensure coverage of lube points that will receive attention based on their readings. Other lubrication requirements must be made on a time basis, i.e. weekly, monthly, etc.

All oil levels are to be checked with the crane parked on a level surface in transport position, and while the oil is cold, unless otherwise specified.

On plug type check points, the oil levels are to be at the bottom edge of the check port.

On all hoists with a check plug in the drum, the fill plug shall be directly on top of the hoist, and the check plug level.

All grease fittings are SAE STANDARD unless otherwise indicated. Grease non-sealed fittings until grease is seen extruding from the fitting. One ounce (28 grams) of EP-MPG equals one pump on a standard one pound (0.45 kg) grease gun.

Over lubrication of non-sealed fittings will not harm the fittings or components, but under lubrication will definitely lead to a shorter lifetime.

On sealed U-Joints, care must be exercised to prevent rupturing seals. Fill only until expansion of the seals first becomes visible.

Unless otherwise indicated, items not equipped with grease fittings, such as linkages, pin, levers, etc., should be lubricated with oil once a week. Motor oil, applied sparingly, will provide the necessary lubrication and help prevent the formation of rust. An Anti-Seeze compound may be used if rust has not formed. Otherwise the component must be cleaned first.

Grease fittings that are worn and will not hold the grease gun, or those that have a stuck check ball, must be replaced.

Where wear pads are used, cycle the components and relubricate to ensure complete lubrication of the entire wear area.

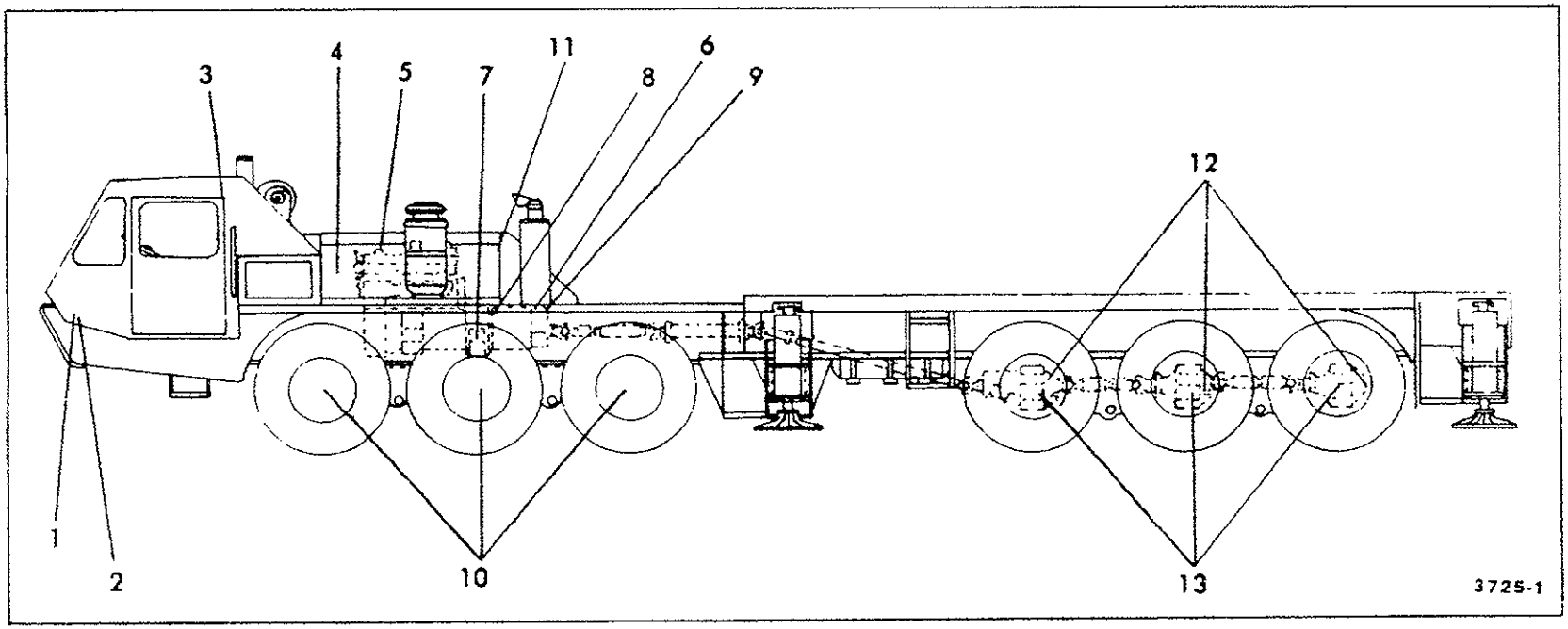
The following describe the lubrication points and gives the lube type, lube interval, lube amount, and application for each. Each lubrication point is numbered, and this number corresponds to the index number shown on the Lubrication Diagram.

1. **Accelerator Linkage.**

   Lube Type - EO
   Lube Interval - Weekly
   Lube Amount - Apply sparingly
   Application - Apply to the linkage at the pivot points

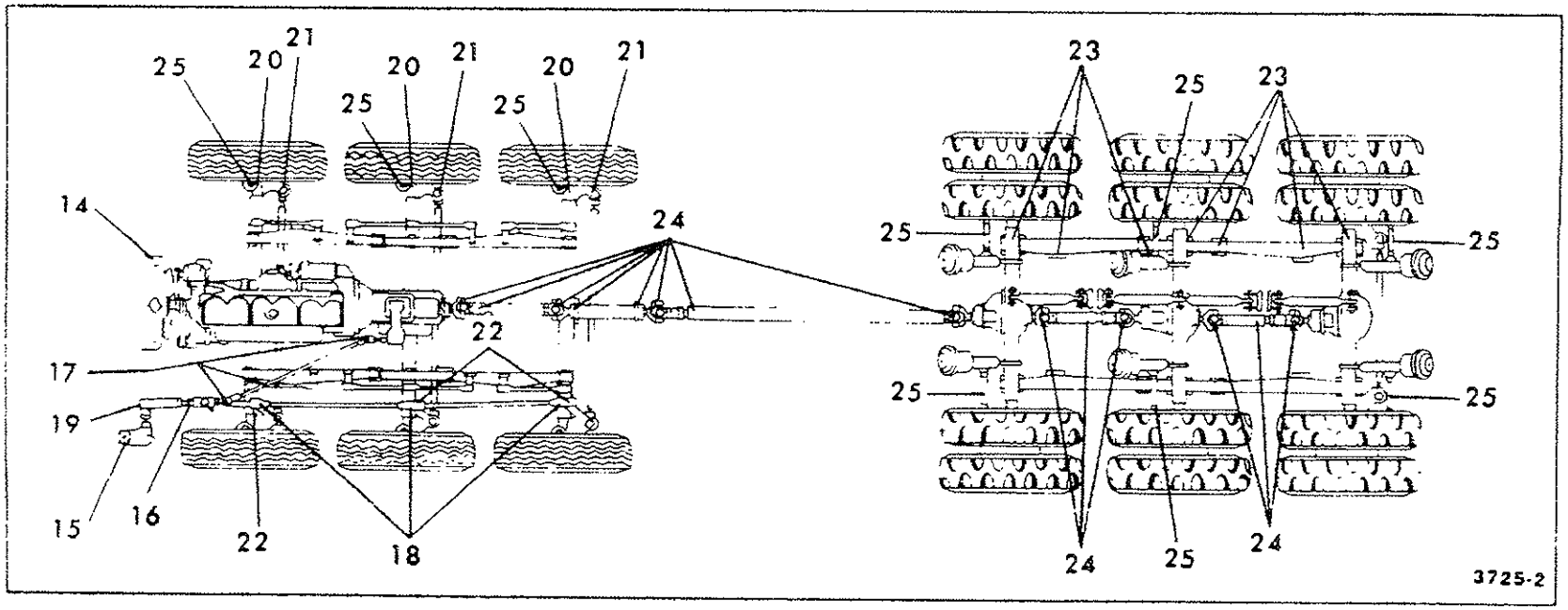
2. **Clutch Pedal Linkage.**

   Lube Type - EO
   Lube Interval - Weekly
   Lube Amount - Apply sparingly
   Application - Apply to the linkage at the pivot points



1. Accelerator Linkage
2. Clutch Pedal Linkage
3. Door Hinge
4. Engine Oil Filter
5. Engine
6. Transmission
7. Clutch Release Bearing
8. Clutch Cross Shaft
9. Speedometer Cable
10. Front Wheel Bearings
11. Power Steering Reservoir
12. Rear Axle Differential
13. Planetary Axle End

Lubrication Diagram (Sheet 1 of 2)



14.	Radiator Shutter	18.	Drag Link	22.	Relay Arm
15.	Steering Gearbox	19.	Steering Control Valve	23.	Equalizer Beam
16.	Gearshift Master Control	20.	Steering Knuckle	24.	Driveshaft
17.	Gearshift Linkage	21.	Tie Rod	25.	Brake Cam Shaft

Lubrication Diagram (Sheet 2 of 2)

3. **Door Hinge.**

Lube Type - EP-MPG
Lube Interval - Monthly
Lube Amount - Until grease extrudes
Application - 1 grease fitting per hinge

4. **Engine Oil Filter.**

Application - See Engine Service Manual

5. **Engine.**

Lube Type - EO
Lube Interval -
Check daily
Drain per Engine Service Manual
Application - See Engine Service Manual

6. **Transmission.**

Lube Type - EO-40
Lube Interval -
1. Change oil on new units after the first 3,000 to 5,000 miles (4,827 to 8,045 km)
2. Every 5,000 miles (8,045 km), inspect the oil level and check for leaks.
3. Every 50,000 miles (80,450 km) or yearly, change the transmission oil.

Lube Amount - Approximately 3.4 gallons (13.5 L)
Application - Fill to the level of the filler opening.

7. **Clutch Release Bearing.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - One ounce (28 grams) maximum
Application - 1 fitting visible through the cutout in the bottom of the housing.

8. **Clutch Cross Shaft.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - One ounce (28 grams) maximum
Application - 1 fitting on each end of the shaft

9. **Speedometer Cable.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - 0.5 ounce (14 grams) maximum
Application - 1 fitting on the elbow at the transmission

10. **Front Wheel Bearings.**

A. Gunite or Dayton Walther Wheel Hubs.

Lube Type - WBG
Lube Interval (Rockwell) - Change whenever seals are replaced or when the brakes are relined or at 30,000 miles (48,000 km). If yearly mileage is less than 30,000 miles (48,000 km), pack twice a a year (spring and fall).
Lube Interval (Schuler) - Change whenever seals are replaced or when the brakes are relined or at 10,000 miles (16,000 km). If yearly mileage is less than 10,000 miles (16,000 km), pack twice a year (spring and fall).
Lube Amount - Until full
Application - Force the grease into the cavities between the rollers and cage from the large end of the cone. Pack the hub between the two bearing cups with grease to the level of the cup's smallest diameter.
KESSLER.....REFER TO KESSLER SERVICE MANUAL

B. Stemco Wheel Hubs.

Lube Type - EPGL - 5
Lube Interval -
Check every 1,000 miles (1,600 km)
Change whenever seals are replaced, or brakes relined. Change at least once a year.
Lube Amount - 1 pint (0.4372 L)
Application - Fill to the full mark on the hub through the pipe plug in the hub

11. **Power Steering Reservoir.**

Lube Type - HYDO
Lube Interval -

Check every 1,000 miles (1,600 km)
Change if evidence of contamination is present
Change filter (if so equipped) if evidence of contamination is present

Lube Amount - Earlier models - 8 quarts (7.52 L)
Later models - 4.4 quarts (4.14 L)
Application - The reservoir is located on the inside rear of the engine hood. Oil should be at the FULL mark on the dipstick.

12. Rear Axle Differential.

Lube Type - EP-SCL
Lube Interval -
1. Check every 1,000 miles (1,600 km)
2. Change every 10,000 miles (16,000 km), or at least once yearly

Lube Amount (8 x 4) - 21 pints (9.9 L)
Lube Amount (12 x 6) - 37 pints (17.4 L)
Application - Run the axle, then allow to stand for a minimum of five minutes on a level surface. Remove oil filler plug in the rear center of the axle housing. The oil is to be to the bottom of the filler hole.

13. Planetary Axle End.

Lube Type - EP-SCL
Lube Interval -
1. Check every 1,000 miles (1,600 km)
2. Change whenever seals are replaced, or when brakes are relined. Change every 10,000 miles (16,000 km) or at least once a year.

Lube Amount - 8 pints (3.8 L)
Application - Always check with oil level plug in a down position. Oil plug will be within 35 degrees of top dead center.

14. Radiator Shutter (Earlier Models)

Lube Type - EO
Lube Interval - Monthly
Lube Amount - A few drops
Application - Apply to the cross member bearings and the pivot points

15. **Steering Gear Box.**

Lube Type - EPGL-90 (The gearbox is filled at the factory with SAE 90 Trojan gear oil.)
Lube Interval -
Check every 1,000 miles (1,600 km)
Drain if evidence of contamination is present
Lube Amount - 2.26 quarts (2.14 L)
Application - Fill through the top plug hole until oil is level with the bottom of the lowest port opening in the side of the gearbox

16. **Gear Shift Master Control.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - 1 ounce (28 grams)
Application - 1 fitting on the front of the control box

17. **Gear Shift Linkage.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - Until grease extrudes
Application - 1 grease fitting per joint. 1 grease fitting on the collar where the shaft goes through the frame.

18. **Drag Link.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - Until grease extrudes on drag links without a grease boot. On drag links with a grease boot, fill only until the boot begins to swell.
Application - 1 fitting on each drag link

19. **Steering Control Valve.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - Until the grease boot just begins to swell
Application - 1 grease fitting

20. **Steering Knuckle.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - Until grease extrudes
Application - 1 fitting on the top and bottom of each knuckle

21. **Tie Rod.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - Until grease extrudes
Application - 1 fitting on each tie rod end

22. **Relay Arm.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - Until grease extrudes
Application - 1 fitting at the top of each relay arm

23. **Equalizer Beam.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - Until grease extrudes
Application - 1 fitting on each end and 1 fitting on each center pin

24. **Drive Shafts.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - Until grease extrudes
Application - 1 fitting for each slip joint and universal

25. **Brake Cam Shaft.**

Lube Type - EP-MPG
Lube Interval - 1,000 miles (1,600 km)
Lube Amount - Until grease extrudes
Application - 1 fitting for each shaft. On front axles the fitting is on the slack adjuster housing.

Manitowoc
Crane Care

www.manitowoccranecare.com

AMERICAS

USA

Manitowoc Crane Care
2401 S. 30th Street
Manitowoc, WI 54220 USA
Tel: +1 920 684 6621
Fax: +1 920 683 6278

Manitowoc Crane Care
1565 Buchanan Trail East
Shady Grove, PA 17256 USA
Tel: + 1 717 597 8121
Fax: + 1 717 593 5929

Manitowoc Crane Care
16013 West Sardis Road
Bauxite, AR 72011 USA
Tel: + 1 501 557 5800
Fax: + 1 501 557 5029

Brazil

Manitowoc Crane Care
Alameda Mamoré, 989 – 10º And. – Cj. 1002/1003
Alphaville – Barueri
São Paulo, Brazil – Zip 06454-040
Tel: + 55 11 3103 0200
Fax: + 55 11 4688 2013

Mexico

Manitowoc Crane Care
Miravalle Center, piso PB, Suite 106
Calz San Pedro 250 Nte. Monterrey
Nuevo Leon, Mexico
Tel: (5281) 8124 – 0128
Fax: (5281) 8124 – 0129

EUROPE - MIDDLE EAST - AFRICA

United Kingdom

Manitowoc Crane Care
1 Azure Court
Doxford International Business Park
Sunderland, England SR3 3BE
Tel: + 44 191 565 6281
Fax: + 44 191 515 7475

France

Manitowoc Crane Care
16 chaussee Jules-Cesar
F-95523 Cergy Pontoise, France
Tel: + 33 130 313 150
Fax: + 33 130 386 085

Manitowoc Crane Care
Z.A. Les Pivolles -5 rue de Catalogne
F-69153 Decines Charpieu Cedex, France
Tel: + 33 4 72 81 50 00
Fax: + 33 4 72 81 50 10

EUROPE - MIDDLE EAST - AFRICA

Germany

Manitowoc Crane Care
Industriegelande West, Postfach 1853
26358 Wilhelmshaven
Postfach 1853, Germany
Tel: + 49 4421 294 153
Fax: + 49 4421 294 244

Manitowoc Crane Care
Carl-Leverkus-Str. 14
40764 Langenfeld, Germany
Tel: + 49 2173 8909 0
Fax: + 49 2173 8909 30

Italy

Manitowoc Crane Care
Via Caldara, 2
20015 Parabiago (MI), Italy
Tel: + 39 (0) 331 49 33 11
Fax: + 39 (0) 331 49 33 30

Netherlands

Manitowoc Crane Care
Veilingkade 15
4815 HC Breda, The Netherlands
Tel: + 31 76-5783999
Fax: + 31 76-5783978

Portugal

Manitowoc Crane Care
Rua da Serra (EN 105/2)
Apartado 3117
4449-908 Alfena, Portugal
Tel: + 35 1229 698 840
Fax: + 35 1229 698 848

United Arab Emirates (UAE)

Manitowoc Crane Care – M.E. (FZE)
P.O. Box 261734
Jebal Ali Free Zone
Dubai, UAE
Tel: + 971 4 8862677
Fax: + 971 4 8862678
Parts Fax: + 971 4 8862679

Russia

Manitowoc Crane CIS
3rd Street Yamskogo Polya, 18, 2nd Floor,
125 040, Moscow – Russia
Tel: + 7 495 641 2359
Fax: + 7 495 641 2358

ASIA - PACIFIC

Singapore

Manitowoc Crane Care
4 Kwong Min Road
Singapore, 628707 Singapore
Tel: + 65 626 41188
Fax: + 65 686 24040
(Sales/Admin)
+ 65 686 24142
(Parts/Service)

ASIA - PACIFIC

China

Manitowoc Crane Care
No. 55 East Zheng Bei Road
Zhangjiagang Economic Development Zone
(South Area)
Zhangjiagang, Jiangsu, PR China
Tel: + 86 512 5691 5000
Fax: + 86 512 5691 5015

Manitowoc Crane Care
Rm. F, 22F Cross Region Plaza
899 Lingling Road
Shanghai 200030, PR China
Tel: + 86 21 5489 1515
Fax: + 86 21 5489 3565

Manitowoc Crane Care
Rm. 1201-1205, 4933 Zhongshan West Road
Hongqiao Silver Tower
Shanghai 200051, PR China
Tel: + 86 21 5111 3579
Fax: + 86 21 5111 3578

Australia

Manitowoc Crane Care
2/22 Disney Avenue, East Keilor
VIC 3033 Australia
Tel: + 61 3 9336 1300
Fax: + 61 3 9336 1322

Manitowoc Crane Care
142 Magowar Road
Girraween NSW 2145 Australia
Tel: + 61 2 9896 4433
Fax: + 61 2 9896 3122

Korea

Manitowoc Crane Korea Co., Ltd.
1 - 511, ACE High Tech City Bldg. 55-20,
Mullaedong 3-Ga, Yeongdeungpo-Gu,
Seoul, Korea (150-834)
Tel: 82-2-3439-0400
Fax: 82-2-3439-0405

Philippines

Manitowoc Crane Care
G/F Southwest Centre Building
Cor Makiling Street South Super
Highway Palanan, Makati City
Philippines
Tel: + 63 2 844 9437
Fax: + 63 2 844 4712

India

Manitowoc Crane Care
72-76, Mundhwa Indl. Estate
Mundhwa, Pune-411036
Tel: + 91 20 2670 9321
Fax: + 91 20 2681 3078

"Working together providing premium lifting solutions" through:

Continual quality improvement - *Products and processes*
Superior customer support - *Whenever and wherever*
Value based decisions - *Financial and human*
People - *Attract, develop, engage*

Manitowoc

www.manitowoc.com