

SERVICE MANUAL

CX Forklift Truck

S/N 130001A - 134999A

S/N 135001A~

EPA Tier 1

EPA Tier 2

Gasoline & LP FG35/45ST-8, FG35/45BCS-8
FG40ZT(2)-8, FG40/45T(2)-8
FG50AT2-8

Diesel FD40ZT(2)-8, FD40/45T(2)-8
FD50AT2-8

CX20



WARNING

Read and observe all warnings on this unit before operating it.

DO NOT operate this equipment unless all factory-installed guards and shields are properly secured in place.

KOMATSU

ISSUED: APRIL 2008

The information and specifications contained herein were accurate at the time of publication, but may change without notice as required for product improvements. Neither Komatsu Forklift USA, LLC, nor its parent company nor any of its subsidiaries will be held responsible for damages due to misuse or inappropriate use of its products.

© Copyright 2011, Komatsu Forklift USA, LLC. All rights reserved. No part of this document may be photocopied or reproduced in any way without prior written consent of Komatsu Forklift USA, LLC.

CONTENTS

CONTENTS	1
INTRODUCTION	9
ENGINE SERIAL NUMBER LOCATION	10
FORKLIFT TRUCKS COVERED IN THIS PUBLICATION	11
FEDERAL EPA EMISSION CONTROL STATEMENTS	12
1. SAFETY	
1.1. SAFETY MANAGEMENT	1-2
1.2. SAFE TRAVEL	1-6
1.3. LOADING OPERATIONS	1-14
1.4. SAFETY IN PERIODIC MAINTENANCE	1-19
1.5. TOWING	1-25
1.6. STRUCTURE AND STABILITY OF THE LIFT TRUCK	1-26
1.7. SAFETY LABELS	1-29
1.8. OPTIONAL EQUIPMENT	1-35
1.8.1 REAR LAMP	1-35
1.8.2 HIGH LOAD BACKREST	1-35
1.8.3 WIDE FORK CARRIAGE	1-35
1.8.4 AUDIBLE SPEED ALARM	1-35
1.8.5 WARNING LAMPS	1-35
2. GENERAL INFORMATION & SPECIFICATIONS	
2.1 SPECIFICATIONS - MAST DATA & FEATURES - INDOOR (CUSHION) TRUCK	2-2
2.2 SPECIFICATIONS - MAST DATA & FEATURES - OUTDOOR (PNEUMATIC) TRUCKS	2-4
2.3 TRUCK DATA - CUSHION TIRE LIFT TRUCKS (INDOOR)	2-6
2.4 TRUCK DATA - PNEUMATIC TIRE LIFT TRUCKS	2-10
2.5 PERIODIC REPLACEMENT OF CONSUMABLE PARTS	2-20
2.6 STANDARD TIGHTENING TORQUE FOR PIPE JOINTS	2-21
2.7 STANDARD TIGHTENING TORQUE FOR BOLTS	2-22
3. SERVICE DATA	
3.1 SERVICE DATA - GASOLINE ENGINE TRUCKS	3-2
3.2 SERVICE DATA - DIESEL ENGINE TRUCKS	3-5
4. TESTING, ADJUSTING AND MEASURING	
4.1 CHECK ENGINE OIL (TB45E)	4-2
4.2 ADJUST ENGINE OIL LEVEL	4-2
4.3 ADJUST IGNITION TIMING (TB45E)	4-3
4.4 ADJUST SPARK PLUG GAP (TB45E)	4-4
4.5 ADJUST VALVE CLEARANCE (TB45E)	4-4
4.6 ADJUST VALVE CLEARANCE (S6D102E)	4-6
4.7 ADJUST ENGINE DRIVE BELTS (TB45E)	4-8
4.7.1 BELTS IN SERVICE ON ENGINE - GENERAL	4-8
4.7.2 INSTALL NEW BELT(S) - GENERAL	4-8

CONTENTS

4.8	MEASURE ENGINE CYLINDER COMPRESSION (TB45E)	4-9
4.9	MEASURE HYDRAULIC DRIFT ON LIFT & TILT CYLINDERS.	4-11
4.10	ADJUST TYPICAL MAST	4-12
4.10.1	OUTER MAIN ROLLER	4-12
4.10.2	INNER MAIN ROLLER.	4-12
4.10.3	FORK CARRIAGE - TYPICAL	4-13
4.10.4	ADJUST CLEARANCE - THRUST PAD AND RAIL	4-14
4.10.5	CHANGE PAD	4-14
4.10.6	ADJUST CLEARANCE BETWEEN INNER MAST AND FORK CARRIAGE.	4-14
4.10.7	ADJUST CLEARANCE BETWEEN INNER MAST AND INTERMEDIATE MAST.	4-15
4.11	ADJUST PARKING BRAKE LEVER.	4-16
4.12	ADJUST ACCELERATOR PEDAL (TB45E ENGINE)	4-16
4.13	TESTING, ADJUSTING AND MEASURING THROTTLE POSITION SENSOR SYSTEM	4-17
4.14	ACCELERATOR PEDAL POSITION SENSOR - TB45 ENGINE	4-18
4.15	ADJUST ACCELERATOR PEDAL (S6D102E ENGINE)	4-20
4.16	MEASURE BRAKE STOPPING DISTANCE (BRAKING EFFECT)	4-21
4.17	ADJUST INCHING/BRAKE PEDAL (TORQFLOW TRUCKS)	4-21
4.17.1	BRAKE PEDAL	4-21
4.17.2	INCHING PEDAL	4-21
4.17.3	INCHING PEDAL/BRAKE PEDAL INTERCONNECTED TRAVEL	4-22
4.18	ADJUST STOP LAMP SWITCH	4-23
4.19	ADJUST WHEEL BRAKE	4-24
4.20	CHECK OPERATION OF THE AUTOMATIC ADJUSTMENT DEVICE	4-25
4.21	CHECK TORQFLOW CLUTCH ACTUATION PRESSURE - PNEUMATIC TIRE	4-25
4.22	CHECK TORQUE CONVERTER STALL SPEED	4-26
4.23	CHECK TORQFLOW CLUTCH ACTUATION PRESSURE - CUSHION TIRE.	4-26
4.24	CHECK TORQUE CONVERTER STALL SPEED	4-27
4.25	ADJUST INCHING VALVE/SPOOL	4-27
4.26	TEST SPECIFIC GRAVITY OF BATTERY ELECTROLYTE	4-28
4.27	CHECK TIRES AND ADJUSTING PNEUMATIC TIRE PRESSURE	4-29
4.28	MEASURE MINIMUM LEFT AND RIGHT TURNING RADIUS.	4-30
4.29	ADJUST TURNING RADIUS	4-31
4.30	ADJUST REAR AXLE - THRUST CLEARANCE	4-32

5. INSPECTION

5.1	INSPECT ENGINE STARTING OPERATION	5-2
5.2	INSPECT ENGINE RUNNING CONDITION.	5-2
5.3	INSPECT AIR CLEANER ASSEMBLY	5-2
5.4	INSPECT THE FILTER ELEMENT.	5-3
5.5	INSPECT/RE-TORQUE CYLINDER HEAD MOUNTING BOLTS (TB45E)	5-3
5.6	INSPECT / RE-TORQUE CYLINDER HEAD BOLTS (S6D102E)	5-4
5.7	INSPECT ENGINE MOUNTS.	5-5
5.8	INSPECT THE ENGINE LUBRICATING SYSTEM.	5-5
5.9	INSPECT ENGINE FUEL SYSTEM	5-5
5.10	INSPECT DIESEL FUEL INJECTION NOZZLES.	5-6

5.11	INSPECT LPG VAPORIZER FOR TAR BUILDUP (TB45E)	5-6
5.12	INSPECT BLOW-BY GAS RECIRCULATION SYSTEM (TB45E).	5-7
5.13	INSPECT COOLING SYSTEM AND RADIATOR	5-8
5.14	INSPECT COOLANT SUB-TANK LEVEL	5-8
5.15	INSPECT FAN ASSEMBLY.	5-8
5.16	INSPECT CHARGING SYSTEM WIRING.	5-8
5.17	INSPECT FRONT AXLE AND RE-TORQUE MOUNTING BOLTS	5-9
5.18	INSPECT REAR AXLE AND RE-TORQUE MOUNTING BOLTS	5-9
5.19	INSPECT WHEELS	5-9
5.20	INSPECT RIM SIDE RING.	5-9
5.21	INSPECT WHEEL BEARINGS	5-10
5.22	INSPECT STEERING AXLE	5-10
5.23	INSPECT STEERING WHEEL	5-10
5.24	INSPECT LIGHTING/TURN SIGNAL SWITCH - W/O DIMMER SWITCH	5-11
5.25	INSPECT LIGHTING/TURN SIGNAL SWITCH - WITH DIMMER SWITCH	5-12
5.26	INSPECT LIGHTING/TURN SIGNAL SWITCH.	5-13
5.27	INSPECT F/R SWITCH	5-14
5.28	INSPECT POWER STEERING SYSTEM	5-14
5.29	INSPECT BRAKE SYSTEM RODS, CABLES AND LINKS	5-15
5.30	INSPECT BRAKE PIPING AND CONNECTIONS.	5-15
5.31	INSPECT BRAKE MASTER AND WHEEL CYLINDERS	5-15
5.32	INSPECT BRAKE SHOES AND ASSOCIATED PARTS.	5-16
5.33	INSPECT BRAKE DRUMS	5-16
5.34	INSPECT BRAKE BACKING PLATES	5-16
5.35	INSPECT LOAD FORKS	5-17
5.36	INSPECT MAST.	5-17
5.37	INSPECT FORK CARRIAGE.	5-17
5.38	INSPECT LIFT CHAINS.	5-18
5.39	INSPECT CHAIN WHEELS	5-18
5.40	INSPECT ATTACHMENTS	5-18
5.41	INSPECT HYDRAULIC TANK.	5-19
5.42	INSPECT CHASSIS AND ATTACHMENT PIPING	5-19
5.43	INSPECT HYDRAULIC PUMP	5-19
5.44	INSPECT LIFT CYLINDER	5-19
5.45	INSPECT TILT CYLINDERS	5-19
5.46	INSPECT ATTACHMENT CYLINDERS (IF EQUIPPED)	5-19
5.47	INSPECT LIFT TRUCK CHASSIS AND FRAME.	5-20
5.48	INSPECT CAB (IF EQUIPPED).	5-20
5.49	INSPECT OPERATOR'S SEAT.	5-21
	5.49.1 VEHICLE CONTROLLER.	5-21
	5.49.2 KOMATSU OPERATOR PRESENCE SYSTEM (KOPS).	5-21
	5.49.3 CONTROLLER TROUBLESHOOTING	5-22
5.50	INSPECT EQUIPMENT USED FOR ACCESSING THE LIFT TRUCK.	5-25
5.51	INSPECT DISPLAY PANEL.	5-25

CONTENTS

5.52	INSPECT OVERHEAD GUARD	5-25
5.53	INSPECT LIGHTS, GAUGES AND WARNING DEVICES	5-25
5.54	INSPECT REAR VIEW MIRROR AND REFLECTORS	5-25

6. MAINTENANCE OPERATIONS

6.1	LUBRICANT LIST - GASOLINE ENGINE LIFT TRUCKS.	6-2
6.2	LUBRICANT LIST - DIESEL ENGINE LIFT TRUCKS	6-3
6.3	OIL AND GREASING CHART	6-8
6.4	CHANGE OIL AND FILTER IN GASOLINE ENGINES.	6-9
6.5	CHANGE OIL AND FILTER IN DIESEL ENGINES	6-11
6.6	CHANGE GEAR OIL IN DIFFERENTIAL CASE.	6-12
6.6.1	CHECK DIFFERENTIAL OIL LEVEL.	6-12
6.6.2	CHANGE DIFFERENTIAL OIL	6-12
6.7	CHANGE TRANSMISSION FLUID IN TORQFLOW TRANSMISSION CASE	6-13
6.7.1	CHECK TORQFLOW TRANSMISSION FLUID LEVEL.	6-13
6.7.2	CHANGE TORQFLOW TRANSMISSION FLUID AND CLEAN THE STRAINER.	6-13
6.8	CHANGE OIL IN HYDRAULIC TANK.	6-14
6.9	REPLACE FUEL FILTER - GASOLINE ENGINES.	6-15
6.10	REPLACE FUEL FILTER - DIESEL ENGINES.	6-16
6.11	REPLACE AIR CLEANER ELEMENT	6-17
6.12	CLEAN RADIATOR.	6-19
6.13	CLEAN RADIATOR FINS	6-20
6.14	BLEED AIR FROM BRAKE SYSTEM.	6-21

7. REMOVAL, DISASSEMBLY, ASSEMBLY, INSTALLATION

7.1	UNIT INSTALLATION POSITIONS DIAGRAM.	7-2
7.2	OVERALL DISASSEMBLY/ASSEMBLY FLOW CHART	7-3
7.3	WEIGHT TABLE - COMPONENT ASSEMBLIES AND PARTS	7-4
7.4	MAST	7-5
7.4.1	MAST REMOVAL - TYPICAL	7-5
7.4.2	MAST INSTALLATION - TYPICAL	7-6
7.5	ENGINE	7-7
7.5.1	ENGINE REMOVAL FROM CHASSIS	7-7
7.5.2	ENGINE DISASSEMBLY/ASSEMBLY	7-8
7.5.3	ENGINE INSTALLATION.	7-8
7.6	TRANSMISSION AND DRIVE AXLE	7-10
7.6.1	REMOVE TORQUE CONVERTER, TRANSMISSION, AND DRIVE AXLE	7-10
7.6.2	TORQUE CONVERTER INSTALLATION	7-12
7.6.3	TRANSMISSION AND DRIVE AXLE INSTALLATION	7-12
7.6.4	DRIVE AXLE SUPPORT MOUNTING BOLTS AND NUTS.	7-12
7.6.5	INSTALL COUNTERWEIGHT	7-12
7.7	TORQUE CONVERTER/TRANSMISSION CONTROL VALVE - PNEUMATIC TRUCKS.	7-13
7.7.1	OVERVIEW	7-13
7.7.2	TORQUE CONVERTER ASSEMBLY	7-14
7.7.3	CONTROL VALVE ASSEMBLY.	7-15
7.7.4	TRANSMISSION HYDRAULIC FLUID CIRCULATION PATH.	7-15

7.7.5	TORQUE CONVERTER ASSEMBLY - FLUID DIAGRAM	7-16
7.7.6	TRANSMISSION CONTROL VALVE ASSEMBLY EXTERNAL VIEW.....	7-17
7.7.7	TRANSMISSION CONTROL VALVE INTERNAL VIEW.....	7-17
7.7.8	POSITION OF CONTROL VALVE HYDRAULIC PORTS.....	7-18
7.7.9	TRANSMISSION CONTROL VALVE - PARTS BREAKDOWN	7-19
7.7.10	TRANSMISSION CONTROL VALVE - SPECIFICATIONS	7-20
7.7.11	HYDRAULIC CHARACTERISTICS OF THE INCHING VALVE	7-22
7.7.12	REMOVE TRANSMISSION CONTROL VALVE.....	7-23
7.7.13	INSTALL TRANSMISSION CONTROL VALVE	7-23
7.7.14	POSITION OF TORQUE CONVERTER HOUSING HYDRAULIC PORTS	7-24
7.7.15	TORQUE CONVERTER - TORQUE SPECIFICATIONS	7-25
7.7.16	TORQUE CONVERTER PARTS BREAKDOWN	7-26
7.7.17	TORQUE CONVERTER - PART STANDARD	7-27
7.7.18	GEAR PUMP ASSEMBLY - PARTS BREAKDOWN	7-28
7.7.19	DISASSEMBLE TORQUE CONVERTER (PNEUMATIC)	7-29
7.7.20	ASSEMBLE TORQUE CONVERTER (PNEUMATIC)	7-30
7.7.21	ASSEMBLED TORQUE CONVERTER	7-31
7.7.22	TEST F1/R1 TRANSMISSION (SINGLE SPEED)	7-32
7.7.23	F1/R1 TRANSMISSION - PART STANDARD	7-33
7.7.24	TEST F2/R1 TRANSMISSION (TWO SPEED).....	7-34
7.7.25	F2/R1 TRANSMISSION - PART STANDARD	7-35
7.7.26	DISASSEMBLE TORQFLOW TRANSMISSION (PNEUMATIC TRUCKS)	7-36
7.7.27	DISASSEMBLE INPUT SHAFT CLUTCH PACK	7-39
7.7.28	DISASSEMBLE INTERMEDIATE SHAFT CLUTCH PACK	7-41
7.7.29	ASSEMBLE F1/R1 AND F2/R1 TRANSMISSION - INPUT SHAFT	7-43
7.7.30	ASSEMBLED F1/R1 AND F2/R1 TRANSMISSION - INPUT SHAFT.....	7-45
7.7.31	ASSEMBLE F2/R1 TRANSMISSION - INTERMEDIATE SHAFT (2ND SPEED).....	7-46
7.7.32	ASSEMBLED F2/R1 TRANSMISSION - INTERMEDIATE SHAFT (2ND SPEED)	7-48
7.7.33	ASSEMBLE OUTPUT SHAFT	7-49
7.7.34	ASSEMBLE F1/R1 TRANSMISSION	7-51
7.7.35	ASSEMBLED F1/R1 TRANSMISSION - TORQFLOW TRANSMISSION.....	7-56
7.7.36	ASSEMBLE F2/R1 TRANSMISSION	7-57
7.8	TORQFLOW TRANSMISSION W/ TORQUE CONVERTER - CUSHION TRUCKS.....	7-61
7.8.1	TRANSMISSION CONTROL VALVE - PARTS BREAKDOWN	7-61
7.8.2	TRANSMISSION CONTROL VALVE - SPECIFICATIONS	7-62
7.8.3	DISASSEMBLE TRANSMISSION CONTROL VALVE (CUSHION TRUCKS)	7-63
7.8.4	TORQUE CONVERTER PARTS BREAKDOWN	7-64
7.8.5	TORQUE CONVERTER - PARTS SPECIFICATION	7-65
7.8.6	HYDRAULIC CIRCUIT DIAGRAM	7-66
7.8.7	TORQUE CONVERTER PRESSURE TESTING PORTS	7-67
7.8.8	SERVICE AND INSPECTION.....	7-68
7.8.9	DISASSEMBLE TORQFLOW TRANSMISSION (CUSHION TRUCKS).....	7-69
7.8.10	DISASSEMBLE REVERSE MAIN SHAFT	7-73
7.8.11	DISASSEMBLE THE FORWARD MAIN SHAFT	7-74
7.8.12	ASSEMBLE REVERSE MAIN SHAFT	7-75
7.8.13	ASSEMBLED MAIN SHAFT (REVERSE).....	7-76
7.8.14	ASSEMBLE FORWARD MAIN SHAFT	7-77

CONTENTS

7.8.15	ASSEMBLED MAIN SHAFT (FORWARD)	7-78
7.8.16	ASSEMBLE THE OUTPUT SHAFT	7-79
7.8.17	ASSEMBLE TORQFLOW TRANSMISSION (CUSHION TRUCKS)	7-81
7.9	DRIVE AXLE	7-85
7.9.1	DRIVE AXLE - PARTS BREAKDOWN (PNEUMATIC)	7-85
7.9.2	DRIVE AXLE - TORQUE CHART (PNEUMATIC)	7-86
7.9.3	DRIVE AXLE - PARTS BREAKDOWN (CUSHION)	7-87
7.9.4	DRIVE AXLE - TORQUE CHART (CUSHION)	7-88
7.10	DIFFERENTIAL	7-89
7.10.1	DIFFERENTIAL - TORQFLOW TRANSMISSION - PARTS BREAKDOWN	7-89
7.10.2	DIFFERENTIAL - TORQFLOW TRANSMISSION - SPECIFICATIONS	7-90
7.10.3	ADJUST DIFFERENTIAL	7-92
7.10.4	ADJUSTING TOOTH CONTACT	7-93
7.11	BRAKE BOOSTER AND MASTER CYLINDER	7-95
7.11.1	BRAKE MASTER CYLINDER - PARTS BREAKDOWN	7-95
7.11.2	BRAKE MASTER CYLINDER/BRAKE BOOSTER DIAGRAM	7-97
7.11.3	BRAKE MASTER CYLINDER - DISASSEMBLY	7-98
7.11.4	DISASSEMBLE BRAKE BOOSTER UNIT	7-99
7.11.5	BRAKE BOOSTER & MASTER CYLINDER - SPECIFICATIONS	7-100
7.11.6	BRAKE BOOSTER & MASTER CYLINDER - INSPECTION & TESTING	7-100
7.11.7	ASSEMBLE BRAKE MASTER CYLINDER	7-102
7.11.8	BRAKE BOOSTER - ASSEMBLY	7-103
7.12	WHEEL BRAKE	7-106
7.12.1	WHEEL BRAKE REMOVAL	7-106
7.12.2	WHEEL BRAKE - STRUCTURE	7-107
7.12.3	WHEEL BRAKE - DISASSEMBLY/ASSEMBLY DRAWING - CUSHION	7-109
7.12.4	WHEEL BRAKE - DISASSEMBLY/ASSEMBLY DRAWING - PNEUMATIC	7-110
7.12.5	INSTALL WHEEL BRAKE	7-111
7.12.6	INSTALL PEDAL ASSEMBLY - BRAKE PIPING	7-111
7.12.7	BRAKE SYSTEM - BLEEDING AIR FROM LINES	7-112
7.13	STEERING AXLE	7-113
7.13.1	REMOVE STEERING AXLE AND POWER STEERING CYLINDER	7-113
7.13.2	POWER STEERING CYLINDER - STRUCTURE	7-114
7.13.3	STEERING AXLE BREAKDOWN	7-115
7.13.4	STEERING AXLE - LUBRICATION AND TORQUE VALUES	7-116
7.13.5	STEERING AXLE SPECIFICATIONS	7-117
7.13.6	STEERING AXLE AND POWER STEERING CYLINDER INSTALLATION	7-118
7.13.7	POWER STEERING CYLINDER - PARTS BREAKDOWN	7-119
7.13.8	POWER STEERING VALVE - PARTS BREAKDOWN	7-120
7.13.9	REMOVE POWER STEERING VALVE	7-121
7.13.10	DISASSEMBLE POWER STEERING VALVE	7-122
7.13.11	CLEAN POWER STEERING VALVE	7-126
7.13.12	ASSEMBLE POWER STEERING VALVE	7-126
7.13.13	INSTALL POWER STEERING VALVE	7-134
7.14	HYDRAULIC PUMP - GASOLINE ENGINES	7-135
7.14.1	HYDRAULIC PUMP - GASOLINE ENGINE (PNEUMATIC) PARTS BREAKDOWN ...	7-135
7.14.2	DISASSEMBLE REAR PUMP SECTION - GASOLINE (PNEUMATIC)	7-136

7.14.3	DISASSEMBLE FRONT PUMP SECTION - GASOLINE (PNEUMATIC)	7-136
7.14.4	ASSEMBLE REAR PUMP SECTION - GASOLINE (PNEUMATIC)	7-136
7.14.5	ASSEMBLE FRONT PUMP SECTION - GASOLINE (PNEUMATIC)	7-137
7.14.6	HYDRAULIC PUMP - GASOLINE ENGINE (CUSHION) PARTS BREAKDOWN	7-138
7.14.7	DISASSEMBLE REAR PUMP SECTION - GASOLINE (CUSHION)	7-139
7.14.8	DISASSEMBLE FRONT PUMP SECTION - GASOLINE (CUSHION)	7-139
7.14.9	ASSEMBLE REAR PUMP SECTION - GASOLINE (CUSHION)	7-139
7.14.10	ASSEMBLE FRONT PUMP SECTION - GASOLINE (CUSHION)	7-140
7.14.11	INSPECTION AND REPAIR - HYDRAULIC PUMP - GASOLINE (CUSHION)	7-141
7.15	HYDRAULIC PUMP - DIESEL ENGINES	7-142
7.15.1	HYDRAULIC PUMP - FRONT UNIT - DIESEL	7-142
7.15.2	DISASSEMBLE HYDRAULIC PUMP - FRONT PUMP UNIT - DIESEL	7-143
7.15.3	INSPECT AND REPAIR HYDRAULIC PUMP - DIESEL	7-144
7.15.4	REASSEMBLE HYDRAULIC PUMP FRONT PUMP UNIT - DIESEL	7-145
7.15.5	HYDRAULIC PUMP - OIL SEAL INSTALLATION JIG DIAGRAM	7-148
7.15.6	HYDRAULIC PUMP - REAR UNIT - DIESEL - PARTS BREAKDOWN	7-149
7.15.7	DISASSEMBLE HYDRAULIC PUMP REAR PUMP UNIT - DIESEL	7-150
7.15.8	INSPECT AND REPAIR HYDRAULIC PUMP - DIESEL	7-151
7.15.9	REASSEMBLE HYDRAULIC PUMP - REAR PUMP UNIT - DIESEL	7-152
7.16	TEST HYDRAULIC PUMP	7-155
7.17	HYDRAULIC CONTROL VALVE	7-156
7.17.1	ASSEMBLE CONTROL VALVE	7-156
7.17.2	SET PRESSURE ON WORK PORT RELIEF	7-157
7.17.3	SERVICING AND REPAIR INFORMATION	7-158
7.17.4	SHUT-OFF VALVE	7-158
7.17.5	COMBINATION WORK PORT RELIEF/ANTI-VOID UNIT	7-159
7.18	TILT CYLINDER	7-160
7.18.1	TILT CYLINDER - PARTS BREAKDOWN	7-160
7.18.2	DISASSEMBLE TILT CYLINDER	7-161
7.18.3	INSPECT TILT CYLINDER PARTS	7-161
7.18.4	ASSEMBLE TILT CYLINDER	7-162
7.19	SIDESHIFTER	7-164
7.20	COMBINATION SWITCH	7-164
7.20.1	COMBINATION SWITCH PARTS BREAKDOWN	7-164
7.20.2	REPLACE COMBINATION SWITCH ASSEMBLY	7-165
7.20.3	REPLACE LIGHTING AND F/R SWITCH	7-166

8. TROUBLESHOOTING

ENGINE	8-2
TORQFLOW	8-3
TORQFLOW CONVERTER - CUSHION TRUCKS	8-6
TORQFLOW CONVERTER - PNEUMATIC TRUCKS	8-7
CONTROL VALVE - CUSHION TRUCKS	8-9
CONTROL VALVE - PNEUMATIC TRUCKS	8-9
ELECTRICAL SYSTEM	8-10
STEERING SYSTEM	8-11

CONTENTS

POWER STEERING VALVE	8-12
BRAKE SYSTEM	8-14
HYDRAULIC SYSTEM	8-16
HYDRAULIC PUMP	8-16
9. 80D/100D/110D - MS 2-STAGE MAST	
INTRODUCTION	9-2
INSTALLATION INSTRUCTIONS	9-3
PERIODIC MAINTENANCE	9-8
TROUBLESHOOTING	9-9
SERVICE	9-10
10. 80D/100D/110D - MT 3-STAGE MAST	
INTRODUCTION	10-2
INSTALLATION INSTRUCTIONS	10-3
PERIODIC MAINTENANCE	10-18
TROUBLESHOOTING	10-19
SERVICE	10-20
11. CONVERSION TABLES	
MILLIMETERS TO INCHES	11-48
INCHES TO MILLIMETERS	11-48
CUBIC METERS TO CUBIC YARDS	11-49
CUBIC YARDS TO CUBIC METERS	11-49
LITER TO U.S. GALLON	11-50
U.S. GALLON TO LITER	11-50
KILOGRAM TO POUND	11-51
POUND TO KILOGRAM	11-51
KILOGRAMS PER SQUARE CENTIMETER TO POUNDS PER SQUARE INCH	11-52
KILOGRAM TO FOOT POUNDS OF FORCE	11-53
TEMPERATURE - FAHRENHEIT TO CENTIGRADE CONVERSION	11-54
A. SERVICE DIAGRAMS	
CONTENTS	A-1
WIRING DIAGRAMS	A-3
ELECTRICAL ASSEMBLY DRAWINGS	A-21
TRANSMISSION DRAWINGS	A-33
DRIVE AXLE DRAWINGS	A-41
STEERING AXLE DRAWINGS	A-50
FRAME DRAWINGS	A-54
PIPING DIAGRAMS	A-60
CONTROL VALVE DIAGRAM	A-73
B. E-SERIES SIDESHIFTER	
C. D-SERIES SIDESHIFTER	