

# Shop Manual

BULLDOZER

***D61EXi -23***

***D61PXi -23***

SERIAL NUMBERS

D61EXi-30324

D61PXi-30324

and up

**KOMATSU**



# BULLDOZER

## D61EXI-23 D61PXI-23

Model	Serial Number
-------	---------------

D61EXI-23	30324 and up
D61PXI-23	30324 and up

---

## 00 Index and foreword

---

---

# 00 Index and foreword

## Index

### Index (ALL-0310-001-A-00-A)

00 Index and foreword .....	00-1
Index .....	00-2
Foreword, safety and general information .....	00-16
Important safety notice .....	00-16
How to read the shop manual .....	00-23
Explanation of terms for maintenance standard .....	00-25
Handling equipment of fuel system devices .....	00-27
Handling of intake system parts .....	00-28
Handling of hydraulic equipment .....	00-29
Method of disconnecting and connecting of push-pull type coupler .....	00-31
Handling of electrical equipment .....	00-34
How to read electric wire code .....	00-42
Precautions when performing operation .....	00-45
Practical use of KOMTRAX .....	00-50
Standard tightening torque table .....	00-51
List of abbreviation .....	00-57
Conversion table .....	00-62
01 Specification .....	01-1
Table of contents .....	01-2
Specifications .....	01-3
Specification drawing .....	01-3
Specifications .....	01-5
Weight table .....	01-15
Table of fuel, coolant, and lubricants .....	01-19
10 Structure and function .....	10-1
Table of contents .....	10-2
Engine and cooling system .....	10-3
Engine related parts .....	10-3
KVTG .....	10-5
EGR system piping drawing .....	10-13
EGR system circuit diagram .....	10-15
EGR valve .....	10-17
EGR cooler .....	10-19
KCCV layout drawing .....	10-21
KCCV ventilator .....	10-23
KDPF .....	10-25
Cooling system .....	10-31
Cooling fan motor .....	10-33
Oil cooler bypass and HST charge safety valve .....	10-40
Power train .....	10-46
Power train system .....	10-46
Damper .....	10-49
Hydraulic component layout of HST .....	10-50
Steering and brake control .....	10-51
HST pump .....	10-53
HST motor .....	10-67
Charge pump .....	10-82
Solenoid valve .....	10-83
Final drive .....	10-92
Undercarriage and frame .....	10-96
Main frame .....	10-96
Suspension .....	10-97
Track frame and idler cushion .....	10-99
Hydraulic system .....	10-102
Hydraulic component layout of work equipment .....	10-102
Work equipment control system .....	10-104
Hydraulic tank .....	10-106
CLSS .....	10-108

Work equipment and cooling fan pump .....	10-111
Control valve .....	10-122
Ripper PPC valve.....	10-144
Quick drop valve .....	10-150
Angle control EPC valve .....	10-153
Accumulator .....	10-158
Work equipment .....	10-160
Blade .....	10-160
Ripper.....	10-161
Piston valve.....	10-162
Cab and its attachments.....	10-163
ROPS cab.....	10-163
Cab mount .....	10-165
Electrical system .....	10-166
Electrical control system .....	10-166
Machine monitor system.....	10-208
KOMTRAX system.....	10-231
System component parts .....	10-235
Sensor .....	10-261
20 Standard value tables.....	20-1
Table of contents .....	20-2
Standard service value table.....	20-3
Standard value table for engine .....	20-3
Standard value table for machine .....	20-5
Standard value table for electrical system.....	20-14
30 Testing and adjusting .....	30-1
Table of contents .....	30-2
Related information on testing and adjusting .....	30-4
Tools for testing and adjusting .....	30-4
Sketch of tools for testing and adjusting .....	30-7
Engine and cooling system.....	30-9
Testing engine speed .....	30-9
Testing boost pressure .....	30-11
Testing exhaust gas color .....	30-13
Testing and adjusting valve clearance.....	30-15
Testing compression pressure.....	30-18
Testing blowby pressure .....	30-22
Testing engine oil pressure .....	30-24
Testing EGR valve and KVGT oil pressures .....	30-25
Testing fuel pressure .....	30-26
Testing fuel discharge, return and leakage.....	30-31
Bleeding air from fuel system .....	30-36
Testing fuel circuit for leakage .....	30-38
Handling cylinder cutout mode operation.....	30-39
Handling no-injection cranking operation.....	30-40
Testing of KDPF and muffler stack for looseness and damage .....	30-41
Testing of installed condition of cylinder heads and manifolds .....	30-42
Testing engine piping for damage and looseness .....	30-43
Replacing alternator belt.....	30-44
Power train.....	30-45
Testing and adjusting HST oil pressure.....	30-45
Testing output pressure of solenoid valve .....	30-50
Testing if machine travels straight .....	30-54
Simple test procedure for brake performance .....	30-55
Adjusting deceleration/brake pedal .....	30-56
Adjusting parking brake lever .....	30-59
Move disabled machine urgently .....	30-61
Undercarriage and frame.....	30-64
Adjusting idler clearance.....	30-64

Checking sprocket wear .....	30-65
Testing and adjusting track tension .....	30-66
Hydraulic system .....	30-67
Releasing remaining pressure in work equipment cylinder .....	30-67
Testing and adjusting work equipment oil pressure .....	30-68
Testing source pressure of control circuit .....	30-70
Testing output pressure of work equipment EPC valve and fan EPC valve .....	30-71
Isolating the parts causing hydraulic drift in blade and ripper .....	30-73
Testing internal oil leakage of work equipment cylinder .....	30-74
Testing fan speed .....	30-76
Testing fan circuit oil pressure .....	30-77
Bleeding air from hydraulic circuit .....	30-78
Work equipment .....	30-79
Adjusting work equipment lock lever .....	30-79
Adjusting play of blade center ball .....	30-81
Electrical system .....	30-82
Special functions of machine monitor .....	30-82
Special functions of iB monitor .....	30-166
Testing stroke sensor for lift cylinder .....	30-195
Testing stroke sensor for tilt cylinder .....	30-197
Testing stroke sensor for angle cylinder .....	30-198
Testing and adjusting reset sensor for lift cylinder .....	30-199
Testing and adjusting reset sensor for angle cylinder .....	30-200
Adjustment method when HST controller has been replaced .....	30-201
Adjustment method when ICT sensor controller has been replaced .....	30-204
Adjustment method when devices have been repaired or replaced .....	30-207
Adjusting rearview camera angle .....	30-209
Handling voltage circuit of engine controller .....	30-210
Handling battery disconnect switch .....	30-211
Testing diodes .....	30-212
Pm clinic .....	30-213
Pm Clinic service .....	30-213
Pm Clinic check sheet .....	30-215
40 Troubleshooting .....	40-1
Table of contents .....	40-2
Related information on troubleshooting .....	40-11
Troubleshooting points .....	40-11
Sequence of events in troubleshooting .....	40-13
Checks before troubleshooting .....	40-15
Inspection procedure before troubleshooting .....	40-17
Preparation for troubleshooting of electrical system .....	40-34
Classification and procedures for troubleshooting .....	40-38
Symptom and troubleshooting numbers .....	40-40
Information in troubleshooting table .....	40-43
Procedure for troubleshooting wiring harness of pressure sensor system for open circuit .....	40-45
Connector list and layout .....	40-48
Connector contact identification .....	40-62
T-branch box and T-branch adapter table .....	40-100
Fuse location table .....	40-105
Precautions for KDPF (KCSF and KDOC) Cleaning and Replacement .....	40-110
Preparation of dummy temperature sensor (for KDOC and KDPF temperature sensors) .....	40-113
Preparation of short circuit electrical connector (for failure codes [CA1883] and [CA3135]) .....	40-114
Failure codes table .....	40-115
Troubleshooting by failure code (Display of code) .....	40-127
Failure code [6091NX] HST Oil Filter Clogging .....	40-127
Failure code [989L00] Engine Controller Lock Caution 1 .....	40-129

Failure code [989M00] Engine Controller Lock Caution 2 .....	40-130
Failure code [989N00] Engine Controller Lock Caution 3 .....	40-131
Failure code [A1U0N3] HC Desorb Request 1 .....	40-132
Failure code [A1U0N4] HC Desorb Request 2 .....	40-134
Failure code [AA10NX] Air Cleaner Clogging .....	40-136
Failure code [AB00KE] Charge Voltage Low .....	40-138
Failure code [B@BAZG] Eng Oil Press Low .....	40-140
Failure code [B@BCNS] Eng Water Overheat .....	40-141
Failure code [B@CRNS] HST Oil Overheat .....	40-142
Failure code [B@CRZG] HST Charge Press Low .....	40-143
Failure code [CA115] Eng Ne and Bkup Speed Sens Error .....	40-144
Failure code [CA122] Chg Air Press Sensor High Error .....	40-145
Failure code [CA123] Chg Air Press Sensor Low Error .....	40-147
Failure code [CA131] Throttle Sensor High Error .....	40-149
Failure code [CA132] Throttle Sensor Low Error .....	40-151
Failure code [CA144] Coolant Temp Sens High Error .....	40-153
Failure code [CA145] Coolant Temp Sens Low Error .....	40-155
Failure code [CA153] Chg Air Temp Sensor High Error .....	40-157
Failure code [CA154] Chg Air Temp Sensor Low Error .....	40-159
Failure code [CA187] Sensor 2 Supply Volt Low Error .....	40-161
Failure code [CA234] Eng Overspeed .....	40-163
Failure code [CA221] Ambient Press Sensor High Error .....	40-164
Failure code [CA222] Ambient Press Sensor Low Error .....	40-166
Failure code [CA227] Sensor 2 Supply Volt High Error .....	40-168
Failure code [CA238] Ne Speed Sensor Supply Volt Error .....	40-169
Failure code [CA239] Ne Speed Sens Supply Volt High Error .....	40-170
Failure code [CA271] IMV/PCV1 Short Error .....	40-171
Failure code [CA272] IMV/PCV1 Open Error .....	40-173
Failure code [CA295] Ambient Pressure Sensor In Range Error .....	40-175
Failure code [CA322] Inj #1(L#1) Open/Short Error .....	40-176
Failure code [CA323] Inj #5(L#5) Open/Short Error .....	40-178
Failure code [CA324] Inj #3(L#3) Open/Short Error .....	40-180
Failure code [CA325] Inj #6(L#6) Open/Short Error .....	40-182
Failure code [CA331] Inj #2(L#2) Open/Short Error .....	40-184
Failure code [CA332] Inj #4(L#4) Open/Short Error .....	40-186
Failure code [CA343] ECM Critical Internal Failure .....	40-188
Failure code [CA351] Injectors Drive Circuit Error .....	40-189
Failure code [CA352] Sensor 1 Supply Volt Low Error .....	40-190
Failure code [CA356] Mass Air Flow Sensor High Error .....	40-192
Failure code [CA357] Mass Air Flow Sensor Low Error .....	40-194
Failure code [CA386] Sensor 1 Supply Volt High Error .....	40-196
Failure code [CA428] Water in Fuel Sensor High Error .....	40-197
Failure code [CA429] Water in Fuel Sensor Low Error .....	40-199
Failure code [CA435] Eng Oil Press Sw Error .....	40-201
Failure code [CA441] Battery Voltage Low Error .....	40-202
Failure code [CA442] Battery Voltage High Error .....	40-204
Failure code [CA449] Rail Press Very High Error .....	40-205
Failure code [CA451] Rail Press Sensor High Error .....	40-206
Failure code [CA452] Rail Press Sensor Low Error .....	40-208
Failure code [CA488] Chg Air Temp High Torque Derate .....	40-210
Failure code [CA515] Rail Press Sens Sup Volt High Error .....	40-211
Failure code [CA516] Rail Press Sens Sup Volt Low Error .....	40-213
Failure code [CA553] Rail Press High Error .....	40-215
Failure code [CA555] Crankcase Press High Error 2 .....	40-216
Failure code [CA556] Crankcase Press High Error 2 .....	40-217
Failure code [CA559] Rail Press Low Error .....	40-218
Failure code [CA595] Turbo Speed High Error 2 .....	40-220
Failure code [CA687] Turbo Speed Low Error .....	40-221
Failure code [CA689] Eng Ne Speed Sensor Error .....	40-223

Failure code [CA691] Intake Air Temp Sens High Error.....	40-225
Failure code [CA692] Intake Air Temp Sens Low Error.....	40-227
Failure code [CA697] ECM Internal Temp Sensor High Error.....	40-229
Failure code [CA698] ECM Int Temp Sensor Low Error.....	40-230
Failure code [CA731] Eng Bkup Speed Sens Phase Error.....	40-231
Failure code [CA778] Eng Bkup Speed Sensor Error.....	40-233
Failure code [CA1117] Persistent Data Lost Error.....	40-238
Failure code [CA1664] KDOC Malfunction.....	40-239
Failure code [CA1691] Regeneration Ineffective.....	40-242
Failure code [CA1695] Sens 5 Supply Volt High Error.....	40-245
Failure code [CA1696] Sens 5 Supply Volt Low Error.....	40-246
Failure code [CA1843] Crankcase Press Sens High Error.....	40-248
Failure code [CA1844] Crankcase Press Sens Low Error.....	40-250
Failure code [CA1879] KDPF Delta P Sensor High Error.....	40-252
Failure code [CA1881] KDPF Delta P Sensor Low Error.....	40-254
Failure code [CA1883] KDPF Delta P Sens In Range Error.....	40-256
Failure code [CA1921] KDPF Soot Load High Error 1.....	40-260
Failure code [CA1922] KDPF Soot Load High Error 2.....	40-263
Failure code [CA1942] Crankcase Press Sens In Range Error.....	40-268
Failure code [CA1993] KDPF Delta Pressure Low Error.....	40-269
Failure code [CA2185] Throt Sensor Sup Volt High Error.....	40-272
Failure code [CA2186] Throt Sensor Sup Volt Low Error.....	40-273
Failure code [CA2249] Rail Press Very Low Error.....	40-274
Failure code [CA2271] EGR Valve Pos Sens High Error.....	40-275
Failure code [CA2272] EGR Valve Pos Sens Low Error.....	40-277
Failure code [CA2288] Turbo Speed High Error 1.....	40-280
Failure code [CA2311] IMV Solenoid Error.....	40-281
Failure code [CA2349] EGR Valve Solenoid Open Error.....	40-282
Failure code [CA2353] EGR Valve Solenoid Short Error.....	40-284
Failure code [CA2357] EGR Valve Servo Error.....	40-286
Failure code [CA2373] Exhaust Manifold Press Sens High error.....	40-287
Failure code [CA2374] Exhaust Manifold Press Sens Low error.....	40-289
Failure code [CA2375] EGR Orifice Temp Sens High Error.....	40-291
Failure code [CA2376] EGR Orifice Temp Sens Low Error.....	40-293
Failure code [CA2381] KVGTT Pos Sens High Error.....	40-295
Failure code [CA2382] KVGTT Pos Sens Low Error.....	40-297
Failure code [CA2383] KVGTT Solenoid Open Error.....	40-300
Failure code [CA2386] KVGTT Solenoid Short Error.....	40-302
Failure code [CA2387] KVGTT Servo Error.....	40-304
Failure code [CA2554] Exh Manifold Press Sens In Range Error.....	40-305
Failure code [CA2555] Grid Htr Relay Volt Low Error.....	40-306
Failure code [CA2556] Grid Htr Relay Volt High Error.....	40-308
Failure code [CA2637] KDOC Face Plugging.....	40-310
Failure code [CA2639] Manual Stationary Regeneration Request.....	40-312
Failure code [CA2961] EGR Orifice Temp High Error 1.....	40-315
Failure code [CA2973] Chg Air Press Sensor In Range Error.....	40-316
Failure code [CA3133] KDPF Outlet Press Sens High Error.....	40-317
Failure code [CA3134] KDPF Outlet Press Sens Low Error.....	40-319
Failure code [CA3135] KDPF Outlet Press Sens In Range Error.....	40-321
Failure code [CA3251] KDOC Inlet Temp High Error.....	40-325
Failure code [CA3253] KDOC Temp Error - Non Regeneration.....	40-328
Failure code [CA3254] KDOC Outlet Temp High Error 1.....	40-331
Failure code [CA3255] KDPF Temp Error - Non Regeneration.....	40-334
Failure code [CA3256] KDPF Outlet Temp High Error 1.....	40-338
Failure code [CA3311] KDOC Outlet Temp High Error 2.....	40-341
Failure code [CA3312] KDPF Outlet Temp High Error 2.....	40-344
Failure code [CA3313] KDOC Inlet Temp Sensor Low Error.....	40-347
Failure code [CA3314] KDOC Inlet Temp Sens High Error.....	40-350
Failure code [CA3315] KDOC Inlet Temp Sens In Range Error.....	40-354



Failure code [CA3316] KDOC Outlet Temp Sens Low Error .....	40-358
Failure code [CA3317] KDOC Outlet Temp Sens High Error.....	40-361
Failure code [CA3318] KDOC Outlet Temp Sens In Range Error .....	40-365
Failure code [CA3319] KDPF Outlet Temp Sens High Error .....	40-369
Failure code [CA3321] KDPF Outlet Temp Sens Low Error .....	40-373
Failure code [CA3322] KDPF Outlet Temp Sens In Range Error.....	40-376
Failure code [CA3419] Mass Air Flow Sensor Sup Volt High Error .....	40-380
Failure code [CA3421] Mass Air Flow Sensor Sup Volt Low Error.....	40-382
Failure code [CA3741] Rail Press Valve Trip Error.....	40-384
Failure code [D130KA] Neutral relay Open .....	40-385
Failure code [D130KB] Neutral relay Short circuit.....	40-387
Failure code [D130KY] Neutral relay: Hot Short .....	40-389
Failure code [D19JKZ] Personal Code Relay Abnormality.....	40-391
Failure code [D811MC] KOMTRAX Error.....	40-394
Failure code [D862KA] GPS Antenna Open Circuit .....	40-395
Failure code [D8ALKA] Operating Lamp Open Circuit (KOMTRAX) .....	40-396
Failure code [D8ALKB] Operating Lamp Short Circuit (KOMTRAX) .....	40-398
Failure code [D8AQKR] CAN2 Discon (KOMTRAX) .....	40-399
Failure code [DAF0MB] Monitor ROM Abnormality.....	40-400
Failure code [DAF0MC] Monitor Error .....	40-401
Failure code [DAF8KB] Camera Power Supply Short Circuit .....	40-402
Failure code [DAF9KQ] Model Selection Abnormality .....	40-403
Failure code [DAFGMC] GPS Module Error.....	40-404
Failure code [DAFLKA] Operating Lamp Open Circuit (Monitor) .....	40-405
Failure code [DAFLKB] Operating Lamp Short Circuit (Monitor).....	40-407
Failure code [DAFQKR] CAN2 Discon (Monitor) .....	40-408
Failure code [DAJ000] HST controller: Abnormality in controller .....	40-409
Failure code [DAJ0KQ] HST controller: Type select signal .....	40-410
Failure code [DAJ0KT] HST controller: Abnormality in controller.....	40-411
Failure code [DAJ0MC] HST Con Error.....	40-412
Failure code [DAJ1KK] HST controller: Source voltage low .....	40-413
Failure code [DAJ2KK] HST controller: Output voltage low.....	40-415
Failure code [DAJ5KK] HST: Sensor volt 5V (0) Out of normal range .....	40-417
Failure code [DAJ6KK] HST: Sensor volt 5V (1) Out of normal range .....	40-419
Failure code [DAJLKA] Operating Lamp Open Circuit (HST Con) .....	40-421
Failure code [DAJLKB] Operating Lamp Short Circuit (HST Con) .....	40-423
Failure code [DAJPMA] Inconsistency of Option Selection (HST) .....	40-424
Failure code [DAJQKR] CAN2 Discon ( HST Con) .....	40-425
Failure code [DAJRKR] CAN1 Discon ( HST Con) .....	40-426
Failure code [DB2QKR] CAN2 Discon (Engine Con) .....	40-427
Failure code [DB2RKR] CAN1 Discon (Engine Con) .....	40-432
Failure code [DBR0KT] ICT Controller: Abnormality in controller .....	40-437
Failure code [DBR0MC] ICT Con Error.....	40-438
Failure code [DBR1KK] ICT controller: Source voltage low.....	40-439
Failure code [DBR2KK] ICT controller: Output voltage low .....	40-441
Failure code [DBR5KK] ICT: Sensor volt 5V (0) Out of normal range.....	40-443
Failure code [DBRLKA] Operating Lamp Open Circuit (ICT Con).....	40-445
Failure code [DBRLKB] Operating Lamp Short Circuit (ICT Con).....	40-447
Failure code [DBRPMA] Inconsistency of Option Selection (ICT).....	40-448
Failure code [DBRQKR] CAN2 Discon (ICT Con).....	40-449
Failure code [DBRRKR] CAN1 Discon (ICT Con).....	40-450
Failure code [DBTSKR] LAN Discon (iB Monitor) .....	40-451
Failure code [DBUTKA] GNSS Antenna Open Circuit.....	40-453
Failure code [DD12KA] Shift up SW: Open.....	40-454
Failure code [DD12KB] Shift up SW: Short Circuit.....	40-456
Failure code [DD13KA] Shift down SW: Open.....	40-458
Failure code [DD13KB] Shift down SW: Short Circuit.....	40-460
Failure code [DD14KA] Parking lever SW: Open.....	40-462
Failure code [DD14KB] Parking lever SW: Short circuit.....	40-464

Failure code [DDKAKA] Blade float Sw: Open .....	40-466
Failure code [DDKAKB] Blade float Sw: Short circuit .....	40-468
Failure code [DDKFL4] Left Angle Sw: Signal mismatch .....	40-470
Failure code [DDKGL4] Right Angle Sw: Signal mismatch .....	40-472
Failure code [DDKHKA] iB Sw: Open .....	40-474
Failure code [DDKHKB] iB Sw: Short circuit.....	40-476
Failure code [DDNLKA] Weq lock Sw: Open.....	40-478
Failure code [DDNLKB] Weq lock Sw: Short circuit .....	40-480
Failure code [DDP6KA] Brake Pressure Sensor: Open.....	40-482
Failure code [DDP6KB] Brake Pressure Sensor: Hot Short.....	40-484
Failure code [DDP6MA] Brake pressure sensor: Malfunction .....	40-486
Failure code [DDU1FS] Parking lever Switch 2: Signal mismatch .....	40-488
Failure code [DDU1KA] Parking lever Sw2: Open .....	40-490
Failure code [DDU1KY] Parking lever Sw2: Hot Short .....	40-492
Failure code [DFA4KX] Blade lift lever: Main and Sub Error .....	40-494
Failure code [DFA4KZ] Blade lift lever: Main and Sub Error.....	40-495
Failure code [DFA4L8] Blade lift lever: Signal mismatch .....	40-496
Failure code [DFA5KA] Blade lift lever1: Open .....	40-497
Failure code [DFA5KB] Blade lift lever1: Hot Short .....	40-500
Failure code [DFA6KA] Blade lift lever2: Open .....	40-502
Failure code [DFA6KB] Blade lift lever2: Hot Short .....	40-504
Failure code [DFA7KX] Blade tilt lever: Main and Sub Error .....	40-506
Failure code [DFA7KZ] Blade tilt lever: Main and Sub Error.....	40-507
Failure code [DFA7L8] Blade tilt lever: Signal mismatch .....	40-508
Failure code [DFA8KA] Blade tilt lever1: Open .....	40-509
Failure code [DFA8KB] Blade tilt lever1: Hot Short .....	40-512
Failure code [DFA9KA] Blade tilt lever2: Open .....	40-514
Failure code [DFA9KB] Blade tilt lever2: Hot Short .....	40-517
Failure code [DGS1KA] HST oil temp sensor: Open .....	40-519
Failure code [DGS1KX] HST oil temp sensor: Out of normal range .....	40-521
Failure code [DH21KA] Weq pressure sensor: Open .....	40-522
Failure code [DH21KB] Weq pressure sensor: Hot Short .....	40-524
Failure code [DHA4KA] Air Cleaner Clog Sensor Open Circuit .....	40-526
Failure code [DHH7KA] LF HST Pressure Sensor: Open .....	40-528
Failure code [DHH7KB] LF HST Pressure Sensor: Hot Short .....	40-530
Failure code [DHH8KA] RF HST Pressure Sensor: Open .....	40-532
Failure code [DHH8KB] RF HST Pressure Sensor: Hot Short.....	40-534
Failure code [DHH9KA] LR HST Pressure Sensor: Open.....	40-536
Failure code [DHH9KB] LR HST Pressure Sensor: Hot Short.....	40-538
Failure code [DHHAKA] RR HST Pressure Sensor: Open.....	40-540
Failure code [DHHAKB] RR HST Pressure Sensor: Hot Short.....	40-542
Failure code [DK30KA] ST lever1: Open .....	40-544
Failure code [DK30KB] ST lever1: Hot Short.....	40-546
Failure code [DK30KX] ST lever: Main and Sub Error.....	40-548
Failure code [DK30KZ] ST lever: Main and Sub Error .....	40-549
Failure code [DK30L8] ST lever: Signal mismatch .....	40-550
Failure code [DK31KA] ST lever2: Open .....	40-551
Failure code [DK31KB] ST lever2: Hot Short.....	40-553
Failure code [DK40KA] Decel/Brake potentiometer: Open .....	40-555
Failure code [DK40KB] Decel/Brake potentiometer: Hot Short.....	40-558
Failure code [DK55KX] FR lever: Main and Sub Error.....	40-560
Failure code [DK55KZ] FR lever: Main and Sub Error.....	40-561
Failure code [DK55L8] FR lever: Signal mismatch.....	40-562
Failure code [DK56KA] FR lever1: Open .....	40-563
Failure code [DK56KB] FR lever1: Hot Short .....	40-565
Failure code [DK57KA] FR lever2: Open .....	40-567
Failure code [DK57KB] FR lever2: Hot Short .....	40-569
Failure code [DK80KA] IMU Sensor: Open .....	40-571
Failure code [DKS0L8] Blade lift Stroke sensor: Signal mismatch .....	40-573

Failure code [DKS1KA] Blade lift Stroke sensor A: Open .....	40-574
Failure code [DKS1KB] Blade lift Stroke sensor A: Hot Short .....	40-576
Failure code [DKS2KA] Blade lift Stroke sensor B: Open .....	40-578
Failure code [DKS2KB] Blade lift Stroke sensor B: Hot Short .....	40-580
Failure code [DKS3KA] Blade lift Reset sensor: Open .....	40-582
Failure code [DKS3KB] Blade lift Reset sensor: Hot Short .....	40-584
Failure code [DKS3MB] Blade lift Reset sensor: Signal mismatch.....	40-586
Failure code [DKS4L8] Blade tilt Stroke sensor: Signal mismatch .....	40-587
Failure code [DKS5KA] Blade tilt Stroke sensor A: Open .....	40-588
Failure code [DKS5KB] Blade tilt Stroke sensor A: Hot Short .....	40-590
Failure code [DKS6KA] Blade tilt Stroke sensor B: Open .....	40-592
Failure code [DKS6KB] Blade tilt Stroke sensor B: Hot Short .....	40-594
Failure code [DKS7MB] Blade tilt Reset sensor: Signal mismatch.....	40-596
Failure code [DKSCL8] Angle left Stroke sensor: Signal mismatch .....	40-597
Failure code [DKSDKA] Angle left Stroke sensor A: Open .....	40-598
Failure code [DKSDKB] Angle left Stroke sensor A: Hot Short.....	40-600
Failure code [DKSEKA] Angle left Stroke sensor B: Open.....	40-602
Failure code [DKSEKB] Angle left Stroke sensor B: Hot Short.....	40-604
Failure code [DKSFKA] Angle left Reset sensor: Open .....	40-606
Failure code [DKSFKB] Angle left Reset sensor: Hot Short .....	40-608
Failure code [DKSFMB] Angle left Reset sensor: Signal mismatch .....	40-610
Failure code [DLM0KX] HST Motor Speed Sensor: Left/Right Error .....	40-611
Failure code [DLM0MA] HST motor speed sensor: Malfunction .....	40-612
Failure code [DLM1KA] Left HST motor speed sensor: Open .....	40-613
Failure code [DLM1KB] Left HST motor speed sensor: Short circuit.....	40-615
Failure code [DLM1MA] Left HST motor speed sensor: Malfunction.....	40-617
Failure code [DLM2KA] Right HST motor speed sensor: Open.....	40-618
Failure code [DLM2KB] Right HST motor speed sensor: Short circuit .....	40-620
Failure code [DLM2MA] Right HST motor speed sensor: Malfunction .....	40-622
Failure code [DLM3KA] Fan rev. sensor: Open .....	40-623
Failure code [DLM3KB] Fan rev. sensor: Short circuit .....	40-625
Failure code [DLM3MB] Fan control: Mismatch .....	40-627
Failure code [DN21FS] Decel/Brake pedal SW: Signal mismatch .....	40-628
Failure code [DR21KX] Camera 2 Picture Rev. Drive Abnormality .....	40-630
Failure code [DR31KX] Camera 3 Picture Rev. Drive Abnormality .....	40-631
Failure code [DV20KB] Back-up alarm: Short circuit.....	40-632
Failure code [DW4BKA] Parking brake solenoid: Open.....	40-634
Failure code [DW4BKB] Parking brake solenoid: Short circuit .....	40-636
Failure code [DW4BKY] Parking brake solenoid: Hot Short.....	40-638
Failure code [DW7BKA] Fan reverse solenoid: Open .....	40-640
Failure code [DW7BKB] Fan reverse solenoid: Short circuit .....	40-642
Failure code [DW7EKA] Slow brake solenoid: Open.....	40-643
Failure code [DW7EKB] Slow brake solenoid: Short circuit .....	40-645
Failure code [DW7EKY] Slow brake solenoid: Hot Short.....	40-647
Failure code [DWN5KA] Fan EPC: Open.....	40-649
Failure code [DWN5KB] Fan EPC: Short circuit .....	40-651
Failure code [DWN5KY] Fan EPC: Hot Short.....	40-652
Failure code [DXA4KA] LF HST pump EPC: Open.....	40-654
Failure code [DXA4KB] LF HST pump EPC: Short circuit.....	40-656
Failure code [DXA4KY] LF HST pump EPC: Hot Short.....	40-657
Failure code [DXA5KA] LR HST pump EPC: Open .....	40-659
Failure code [DXA5KB] LR HST pump EPC: Short circuit .....	40-661
Failure code [DXA5KY] LR HST pump EPC: Hot Short.....	40-663
Failure code [DXA6KA] RF HST pump EPC: Open .....	40-665
Failure code [DXA6KB] RF HST pump EPC: Short circuit.....	40-667
Failure code [DXA6KY] RF HST pump EPC: Hot Short.....	40-668
Failure code [DXA7KA] RR HST pump EPC: Open.....	40-670
Failure code [DXA7KB] RR HST pump EPC: Short circuit.....	40-672
Failure code [DXA7KY] RR HST pump EPC: Hot Short .....	40-673

Failure code [DXHRKA] Blade lift up EPC: Open .....	40-675
Failure code [DXHRKB] Blade lift up EPC: Short circuit .....	40-677
Failure code [DXHRKY] Blade lift up EPC: Hot short .....	40-678
Failure code [DXHSKA] Blade lift down EPC: Open .....	40-680
Failure code [DXHSKB] Blade lift down EPC: Short circuit .....	40-682
Failure code [DXHSKY] Blade lift down EPC: Hot short .....	40-683
Failure code [DXHTKA] Blade tilt left EPC: Open .....	40-685
Failure code [DXHTKB] Blade tilt left EPC: Short circuit .....	40-687
Failure code [DXHTKY] Blade tilt left EPC: Hot short .....	40-688
Failure code [DXHUKA] Blade tilt right EPC: Open .....	40-690
Failure code [DXHUKB] Blade tilt right EPC: Short circuit .....	40-692
Failure code [DXHUKY] Blade tilt right EPC: Hot short .....	40-693
Failure code [DXJ4KA] Weq lock Sol.: Open .....	40-695
Failure code [DXJ4KB] Weq lock Sol.: Short circuit .....	40-697
Failure code [DXJCKA] Blade angle left EPC: Open .....	40-699
Failure code [DXJCKB] Blade angle left EPC: Short circuit .....	40-700
Failure code [DXJCKY] Blade angle left EPC: Hot short .....	40-701
Failure code [DXJDKA] Blade angle right EPC: Open .....	40-703
Failure code [DXJDKB] Blade angle right EPC: Short circuit .....	40-704
Failure code [DXJDKY] Blade angle right EPC: Hot short .....	40-705
Failure code [DXK1KA] Left HST motor EPC: Open .....	40-707
Failure code [DXK1KB] Left HST motor EPC: Short circuit .....	40-709
Failure code [DXK1KY] Left HST motor EPC: Hot Short .....	40-710
Failure code [DXK2KA] Right HST motor EPC: Open .....	40-712
Failure code [DXK2KB] Right HST motor EPC: Short circuit .....	40-714
Failure code [DXK2KY] Right HST motor EPC: Hot Short .....	40-715
Troubleshooting of electrical system (E-mode) .....	40-717
E-1 Engine does not start (Engine does not crank) .....	40-717
E-2 Manual preheating system does not work .....	40-723
E-3 Automatic preheating system does not work .....	40-726
E-4 While preheating is working, preheating monitor does not light up .....	40-728
E-5 When starting switch is turned to ON position, machine monitor displays nothing .....	40-730
E-6 When starting switch is turned to ON position (with engine stopped), basic check monitor lights up .....	40-733
E-7 Air cleaner clogging monitor lights up in yellow while engine is running .....	40-734
E-8 Charge level monitor lights up in red while engine is running .....	40-735
E-9 Engine coolant temperature monitor lights up in red while engine is running .....	40-736
E-10 Engine oil pressure monitor lights up in red while engine is running .....	40-737
E-11 HST charge pressure monitor lights up in red while engine is running .....	40-738
E-12 Hydraulic oil temperature monitor lights up in red while engine is running .....	40-739
E-13 HST oil filter clogging monitor lights up in red while engine is running .....	40-740
E-14 Fuel level gauge does not indicate correct level .....	40-741
E-15 Engine coolant temperature gauge does not indicate correct temperature .....	40-744
E-16 Hydraulic oil temperature gauge does not indicate correct temperature .....	40-745
E-17 Operation mode does not change .....	40-746
E-18 Service mode cannot be selected .....	40-747
E-19 Operating customize switch does not display customize screen .....	40-748
E-20 Modifying setting on customize screen does not change setting of machine .....	40-749
E-21 Service meter is not displayed, while starting switch is in OFF position .....	40-750
E-22 Work equipment does not operate .....	40-751
E-23 Foot heater does not operate .....	40-753
E-24 Horn does not sound .....	40-758
E-25 Horn does not stop sounding .....	40-760
E-26 Backup alarm does not sound .....	40-761
E-27 Backup alarm does not stop sounding .....	40-762
E-28 Headlamp does not light up .....	40-763
E-29 Rear lamp does not light up .....	40-766
E-30 No wiper operates continuously or intermittently .....	40-769
E-31 Front wiper does not operate .....	40-771

E-32 Rear wiper does not operate .....	40-773
E-33 Left door wiper does not operate (failed in both continuous and intermittent operations).....	40-775
E-34 Right door wiper does not operate (failed in both continuous and intermittent operations).....	40-779
E-35 Front washer does not operate .....	40-783
E-36 Rear washer does not operate.....	40-785
E-37 Left door washer does not operate .....	40-787
E-38 Right door washer does not operate.....	40-789
E-39 KOMTRAX system does not operate normally .....	40-791
E-40 iB monitor shuts down after displaying the messages [GPS receiver not connected!] and [Slope sensor not connected!].....	40-793
E-41 iB monitor displays the messages [GPS receiver not connected!] and [Slope sensor not connected!] .....	40-797
E-42 iB monitor displays the message [Waiting for radio link...].....	40-800
E-43 iB monitor displays the message [IMU sensor not connected] .....	40-801
E-44 iB monitor displays the message [Waiting for satellites...].....	40-802
E-45 iB monitor displays the message [Komatsu controller not connected!].....	40-803
E-46 iB monitor displays the message [Cylinder Stroke Reading Abnormal] .....	40-805
E-47 iB monitor displays the message [Komatsu CAN Comms Abnormal].....	40-806
E-48 iB monitor displays the message [Komatsu Machine Trouble] .....	40-807
E-49 iB monitor displays the message [Waiting to initialize...] .....	40-808
E-50 iB monitor displays the message [System Initializing...].....	40-809
E-51 iB monitor displays the message [Initializing...].....	40-810
E-52 iB monitor displays the message [Configuring GPS] .....	40-811
E-53 iB monitor displays the message [No GPS Localization...].....	40-812
E-54 iB monitor displays the message [Low precisions...] .....	40-813
E-55 iB monitor displays the message [Heading Initializing] .....	40-814
E-56 iB monitor displays [Out of design area...].....	40-815
E-57 iB monitor can not be turned on .....	40-816
E-58 iB monitor does not display intelligent Machine Control screen .....	40-817
E-59 iB monitor does not display bulldozer image .....	40-818
E-60 iB monitor does not display design surface .....	40-819
E-61 iB monitor touch panel does not respond .....	40-820
E-62 iB monitor touch panel is inaccurate.....	40-821
E-63 Cylinder stroke reset indication does not go out .....	40-822
E-64 AUTO is not displayed when auto/manual switch is pressed (AUTO indication goes out).....	40-823
E-65 Blade automatic lower control does not start while AUTO is displayed .....	40-824
E-66 Blade automatic raise control does not start while AUTO is displayed .....	40-825
E-67 Blade automatic control function is not activated while AUTO is displayed (Blade automatic control stops) .....	40-826
E-68 When checking and adjusting the blade elevation, the value is different from actual machine.....	40-827
E-69 Finished surface is inaccurate (The average height of finished surface is lower than designed surface or blade does not touch the surface).....	40-828
E-70 Finished surface is inaccurate (The finished surface is not smooth) .....	40-829
E-71 Finished surface is inaccurate (When finishing slope horizontally, steps are made in each direction).....	40-830
E-72 Machine can not escape from shoes slip while blade automatic control is activated (Shoes frequently slips).....	40-832
E-73 Machine speed does not increase while blade automatic control is activated .....	40-833
E-74 Blade tilt angle does not coincide with design surface.....	40-834
E-75 Blade tilts back while blade automatic control is activated .....	40-836
Troubleshooting of hydraulic and mechanical system (H-mode).....	40-839
Information described in troubleshooting table (H-mode) .....	40-839
System chart of hydraulic and mechanical systems.....	40-840
Failure mode and cause table .....	40-842

H-1 Neither RH nor LH of tracks does not travel forward nor reverse (None of the travel system operates) .....	40-846
H-2 Either RH or LH of track does not travel forward nor reverse (Only RH or LH of travel system operates) .....	40-848
H-3 Either RH or LH of track travel only forward or reverse (Only forward or reverse of RH or LH of travel system does not operate).....	40-849
H-4 Travel speed or power is low .....	40-851
H-5 Travel speed range does not change .....	40-852
H-6 Shock is large when machine starts or stops .....	40-853
H-7 Machine deviates largely .....	40-854
H-8 Machine drift on a slope is large .....	40-856
H-9 Engine stalls during travel or engine speed drops significantly .....	40-857
H-10 Unusual noise is heard from around HST pump or motor .....	40-858
H-11 All work equipment do not operate .....	40-859
H-12 All work equipment operates slowly or lacks power .....	40-861
H-13 Blade lift speed or power is low .....	40-862
H-14 Blade tilt speed or power is low .....	40-863
H-15 Blade angle speed or power is low.....	40-864
H-16 Time lag of blade lift is large .....	40-865
H-17 Hydraulic drift of lifted blade is large.....	40-866
H-18 Hydraulic drift of tilted blade is large.....	40-867
H-19 Unusual noise is heard from around work equipment pump or control valve .....	40-868
H-20 HST oil temperature (hydraulic oil temperature) rises too high .....	40-869
H-21 Fans speed is abnormal (high, low, or no rotation).....	40-871
H-22 Unusual noise is heard from around fan .....	40-873
Troubleshooting of engine (S-mode).....	40-874
Information described in troubleshooting table (S mode).....	40-874
S-1 Engine does not crank when starting switch is turned to START position.....	40-875
S-2 Engine cranks but no exhaust smoke comes out.....	40-876
S-3 Fuel is being injected but engine does not start (misfiring: engine cranks but does not start).....	40-877
S-4 Engine startability is poor .....	40-878
S-5 Engine does not pick up smoothly .....	40-880
S-6 Engine stops during operation .....	40-882
S-7 Engine runs rough or is unstable .....	40-884
S-8 Engine lacks power .....	40-885
S-9 KDPF gets clogged in a short time .....	40-887
S-10 Engine oil consumption is excessive .....	40-889
S-11 Engine oil becomes contaminated early.....	40-890
S-12 Fuel consumption is excessive .....	40-891
S-13 Oil is in coolant (or coolant spurts or coolant level goes down).....	40-892
S-14 Oil pressure drops .....	40-893
S-15 Fuel mixes into engine oil.....	40-894
S-16 Water mixes into engine oil (milky).....	40-895
S-17 Coolant temperature rises too high (overheating) .....	40-896
S-18 Unusual noise is heard .....	40-897
S-19 Vibration is excessive .....	40-898
S-20 Air cannot be bled from fuel circuit .....	40-899
S-21 Active regeneration is executed frequently .....	40-900
S-22 Active regeneration takes time.....	40-901
S-23 White smoke is exhausted during active regeneration .....	40-902
50 Disassembly and assembly .....	50-1
Table of contents .....	50-2
Related information on disassembly and assembly.....	50-4
How to read this manual .....	50-4
Coating materials list .....	50-6
Special tools list .....	50-10
Sketches of special tools .....	50-16
Engine and cooling system.....	50-30

Removal and installation of supply pump assembly.....	50-30
Removal and installation of fuel injector assembly.....	50-35
Removal and installation of cylinder head assembly.....	50-43
Removal and installation of radiator assembly.....	50-59
Removal and installation of aftercooler assembly.....	50-63
Removal and installation of hydraulic oil cooler assembly.....	50-66
Removal and installation of cooling fan drive assembly.....	50-69
Removal and installation of cooling fan motor assembly.....	50-72
Removal and installation of engine assembly.....	50-74
Disassembly and assembly of damper assembly.....	50-81
Removal and installation of engine front oil seal.....	50-82
Removal and installation of engine rear oil seal.....	50-84
Removal and installation of engine hood assembly.....	50-87
Removal and installation of fuel tank assembly.....	50-90
Removal and installation of KDPF assembly.....	50-94
Disassembly and assembly of KDPF assembly.....	50-97
Removal and installation of KCCV assembly.....	50-106
Removal and installation of KVGT assembly.....	50-107
Removal and installation of EGR (Exhaust Gas Recirculation) cooler assembly.....	50-110
Removal and installation of EGR (Exhaust Gas Recirculation) valve assembly.....	50-113
Removal and installation of belt for alternator and air conditioner compressor.....	50-114
Removal and installation of air cleaner assembly.....	50-115
Power train.....	50-117
Removal and installation of HST pump assembly.....	50-117
Removal and installation of HST motor and final drive assembly.....	50-119
Disassembly and assembly of final drive.....	50-122
Undercarriage and frame.....	50-132
Removal and installation of track frame assembly.....	50-132
Removal and installation of idler assembly.....	50-136
Disassembly and assembly of idler.....	50-138
Removal and installation of recoil spring assembly.....	50-142
Disassembly and assembly of recoil spring.....	50-143
Removal and installation of track roller assembly.....	50-147
Disassembly and assembly of track roller assembly.....	50-149
Removal and installation of carrier roller assembly.....	50-152
Disassembly and assembly of carrier roller assembly.....	50-154
Removal and installation of segment teeth.....	50-156
Separation and connection of track shoe assembly (Standard type track shoe).....	50-157
Separation and connection of track shoe assembly (PLUS type track shoe).....	50-160
Overall disassembly and assembly of track shoe assembly (Standard type track shoe).....	50-161
Overall disassembly and assembly of track shoe assembly (PLUS type track shoe).....	50-177
Disassembly and assembly of one track link assembly in field (Standard type track shoe).....	50-184
Disassembly and assembly of one track link assembly in field (PLUS type track shoe).....	50-190
Removal and installation of pivot shaft assembly.....	50-195
Removal and installation of equalizer bar assembly.....	50-197
Removal and installation of equalizer bar side bushing.....	50-199
Hydraulic system.....	50-200
Removal and installation of hydraulic tank assembly.....	50-200
Removal and installation of control valve assembly.....	50-204
Disassembly and assembly of hydraulic cylinder assembly.....	50-207
Work equipment.....	50-215
Removal and installation of work equipment assembly.....	50-215
Removal and installation of blade assembly.....	50-218
Removal and installation of U-frame assembly.....	50-220
Cab and its attachments.....	50-223
Removal and installation of ROPS cab assembly.....	50-223

Removal and installation of operator's cab glass (adhesion glass) .....	50-228
Removal and installation of operator's seat .....	50-234
Removal and installation of seat belt .....	50-235
Removal and installation of foot heater assembly .....	50-236
Disassembly and assembly of foot heater assembly .....	50-238
Removal and installation of air conditioner unit assembly .....	50-239
Removal and installation of air conditioner compressor assembly .....	50-243
Electrical system .....	50-245
Removal and installation of machine monitor assembly .....	50-245
Removal and installation of engine controller assembly .....	50-246
Removal and installation of HST controller assembly .....	50-248
Removal and installation of mass air flow and temperature sensor .....	50-249
Removal and installation of KOMTRAX terminal .....	50-250
Removal and installation of ICT sensor controller assembly .....	50-251
Removal and installation of iB monitor .....	50-252
Removal and installation of GNSS receiver .....	50-253
Removal and installation of iB GNSS antenna .....	50-254
Removal and installation of IMU sensor .....	50-257
60 Maintenance standard .....	60-1
Table of contents .....	60-2
Engine and cooling system .....	60-3
Engine mount .....	60-3
Cooling fan motor .....	60-4
Oil cooler bypass and HST charge safety valve .....	60-6
Power train .....	60-7
Damper .....	60-7
HST pump .....	60-8
HST motor .....	60-10
Charge pump .....	60-11
Solenoid valve .....	60-12
Final drive .....	60-13
Sprocket .....	60-14
Full-scale drawing of sprocket tooth profile .....	60-15
Undercarriage and frame .....	60-17
Suspension .....	60-17
Track frame and idler cushion .....	60-19
Idler .....	60-21
Track roller .....	60-23
Carrier roller .....	60-27
Track shoe .....	60-29
Hydraulic system .....	60-35
Hydraulic tank .....	60-35
Work equipment and cooling fan pump .....	60-36
Control valve .....	60-39
Ripper PPC valve .....	60-46
Quick drop valve .....	60-48
Angle control EPC valve .....	60-50
Work equipment .....	60-51
Blade .....	60-51
Cutting edge and end bit .....	60-54
Ripper .....	60-55
Lift cylinder .....	60-57
Lift cylinder with stroke and reset sensor .....	60-58
Tilt cylinder with stroke sensor .....	60-59
Angle cylinder .....	60-60
Angle cylinder with stroke and reset sensor .....	60-61
Ripper cylinder .....	60-62
Cab and its attachments .....	60-63
Cab mount .....	60-63




Electrical system .....	60-64
System component parts .....	60-64
Sensor .....	60-65
80 Appendix.....	80-1
Table of contents .....	80-2
Air conditioner components .....	80-3
Precautions for refrigerant.....	80-3
Air conditioner component .....	80-4
Configuration and function of refrigeration cycle .....	80-7
Outline of refrigeration cycle.....	80-8
Air conditioner unit .....	80-10
Dual pressure switch .....	80-14
Pressure switch .....	80-15
Compressor.....	80-16
Condenser .....	80-17
Receiver drier .....	80-19
Procedure for testing and troubleshooting .....	80-20
Electrical circuit diagram .....	80-23
System diagram.....	80-24
Parts and connectors layout.....	80-26
Testing relays .....	80-31
Troubleshooting chart 1 .....	80-33
Troubleshooting chart 2 .....	80-34
Information described in troubleshooting table .....	80-36
A-1 Troubleshooting for condenser fan.....	80-37
A-2 Troubleshooting for compressor and refrigerant system (Air is not cooled) .....	80-40
A-3 Troubleshooting for blower motor system (No air comes out or air flow is abnormal) .....	80-44
A-4 Troubleshooting for temperature control.....	80-46
Troubleshooting with gauge pressure.....	80-49
Connection of service tool.....	80-52
Precautions for disconnecting and connecting hoses and tubes in air conditioner circuit.....	80-54
Handling of compressor oil.....	80-56
90 Diagrams and drawings.....	90-1
Table of contents .....	90-2
Hydraulic circuit diagram .....	90-3
Symbols in hydraulic circuit diagram .....	90-3
Hydraulic circuit diagram.....	90-7
Electric circuit diagram .....	90-9
Symbols in electric circuit diagram .....	90-9
Electrical circuit diagram .....	90-13
Index.....	1


**Foreword, safety and general information** (ALL-0370-001-A-00-A)

**Important safety notice** (ALL-1120-012-A-01-A)

(Rev. 2012/10)

- Appropriate servicing and repair are extremely important to ensure safe operation of the machine. The shop manual describes the effective and safe servicing and repair methods recommended by Komatsu. Some of these methods require the use of the special tools designed by Komatsu for the specific purpose.
- The symbol mark  is used for such matters that require special cautions during the work. The work indicated by the caution mark should be performed according to the instructions with special attention to the cautions. Should hazardous situation occur or be anticipated during such work, be sure to keep safe first and take every necessary measure.

**General precautions**

 **Inappropriate handling causes an extreme danger. Read and understand what is described in the operation and maintenance manual before operating the machine. Read and understand what is described in this manual before starting the work.**

- Before performing any greasing or repairs, read all the safety labels stuck to the machine. For the locations of the safety labels and detailed explanation of precautions, see the operation and maintenance manual.
- Locate a place in the repair workshop to keep the tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt, water or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.
- When performing any work, always wear the safety shoes and helmet. Do not wear loose work cloths, or clothes with buttons missing.
  1. Always wear the protective eyeglasses when hitting parts with a hammer.
  2. Always wear the protective eyeglasses when grinding parts with a grinder, etc.
- When performing any work with two or more workers, always agree on the working procedure before starting. While working, always keep conversations of the work between your fellow workers and your self on any step of the work. During the work, hang the warning tag of "UNDER WORKING" in the operator's compartment.
- Only qualified workers must perform the work and operation which require license or qualification.
- Keep the tools in good condition. And learn the correct way to use the tools, and use the proper ones among them. Before starting the work, thoroughly check the tools, lift truck, service vehicle, etc.
- If welding repairs is required, always have a trained and experienced welder with good

knowledge of welding perform the work. When performing welding work, always wear welding gloves, apron, shielding goggles, cap, etc.

- Before starting work, warm up your body thoroughly to start work under good condition.
- Avoid continuing work for long hours and take rests with proper intervals to keep your body in good condition. Take a rest in a specified safe place.

**Safety points**

1	Good arrangement
2	Correct work clothes
3	Observance of work standard
4	Practice of making and checking signals
5	Prohibition of operation and handling by unlicensed workers
6	Safety check before starting work
7	Wearing protective goggles (for cleaning or grinding work)
8	Wearing shielding goggles and protectors (for welding work)
9	Good physical condition and preparation
10	Precautions against work which you are not used to or you are used to too much

**Preparation**

- Before adding oil or making any repairs, place the machine on a firm and level ground, and apply the parking brake and chock the wheels or tracks to prevent the machine from moving.
- Before starting work, lower the work equipment (blade, ripper, bucket, etc.) to the ground. If it is not possible to lower the equipment to the ground, insert the lock pin or use blocks to prevent the work equipment from falling. And be sure to lock all the work equipment control levers and hang a warning tag on them.
- When performing the disassembling or assembling work, support the machine securely with blocks, jacks, or stands before starting the work.
- Remove all of mud and oil from the steps or other places used to get on and off the machine completely. Always use the handrails, ladders of

steps when getting on or off the machine. Never jump on or off the machine. When the scaffold is not provided, use steps or stepladder to secure your footing.

#### **Precautions during work**

- For the machine equipped with the battery disconnect switch, check that the system operating lamp is turned off before starting the work. Then, turn the battery disconnect switch to OFF (○) position and remove the switch key. For the machine not equipped with the battery disconnect switch, remove the cable from the battery before starting the work. Be sure to remove the negative end (-) of the battery cable first.
- Release the remaining pressure in the circuits completely before the work when the parts in the circuits of oil, fuel, coolant and air are disconnected or removed. When the cap of the oil filter, drain plug or oil pressure pickup plug is removed, loose them slowly to prevent the oil from spurting out.
- When removing or installing the checking plug or the piping in the fuel circuit, wait 30 seconds or longer after the engine is shut down and start the work after the remaining pressure is released from the fuel circuit.
- Immediately after the engine is shut down, the coolant and oil in the circuits are hot. Be careful not to get scalded by the hot coolant and oil. Start the work after checking that the coolant and oil are cooled down sufficiently.
- Start the work after the engine is shut down. Be sure to shut down the engine when working on or around the rotating parts in particular. When checking the machine without shutting down the engine (measuring oil pressure, rotational speed, oil or coolant temperature), take extreme care not to get caught in the rotating parts or the working equipment.
- The hoist or crane must be used to sling the components weighing 25 kg or heavier. Check the slings (wire rope, nylon sling, chain and hook) for damage before the work. Use the slings with ample capacity and install them to the proper places. Operate the hoist or crane slowly to prevent the component from hitting any other part. Do not work with any part still raised by the hoist or crane.
- When removing the part which is under internal pressure or reaction force of the spring, always leave 2 bolts in diagonal positions. Loosen those 2 bolts gradually and alternately and release the pressure, then, remove the part.
- When removing the part, be careful not to break or damage the electrical wiring. The damaged wiring may cause electrical fires.
- When removing piping, prevent the fuel or oil from spilling out. If any fuel or oil drips onto the floor, wipe it off immediately. Fuel or oil on the floor can cause you to slip and can even cause fires.
- As a general rule, do not use gasoline to wash parts. Do not use gasoline to clean the electrical parts, in particular.
- Reinstall the parts removed to their original places. Replace the damaged parts and the parts which must not be used with new ones. When installing the hoses and wiring harnesses, be careful that they are not damaged by contacting with other parts when the machine is operated.
- When connecting the high pressure hoses and tubes, make sure that they are not twisted. The damaged high pressure hoses and tubes are very dangerous when they are installed. So, be extremely careful when connecting the high pressure pipings. In addition, check that their connections are correct.
- When assembling or installing the parts, be sure to tighten the bolts to the specified torque. When installing the protective parts such as guards, or the parts which vibrate violently or rotate at high speeds, be sure to check that they are installed correctly.
- When aligning 2 holes, never insert your fingers or hand into the holes. Align the holes with care so that your fingers are not caught in the hole.
- When measuring hydraulic pressure, check that the measuring tools are correctly installed.
- Pay attention to safety when removing and installing the tracks of the track type machines. When removing the track, it separates suddenly. The workers should not stand at either end of the track.
- If the engine is operated for a long time in a closed place which is not ventilated well, you may suffer from gas poisoning. Accordingly, open the windows and doors to ventilate the place well.

#### **Precautions for slinging work and making signals**

- Only one appointed worker must make signals and co-worker must communicate with each other frequently. The appointed signaler must make specified signals clearly at the place where the signaler is well seen from the operator's seat and where the signaler can see the working condition easily. The signaler must always stand in front of the load and guide the operator safely.
  1. Do not stand under the load.
  2. Do not step on the load.
- Check the slings before starting sling work.

**00 Index and foreword**

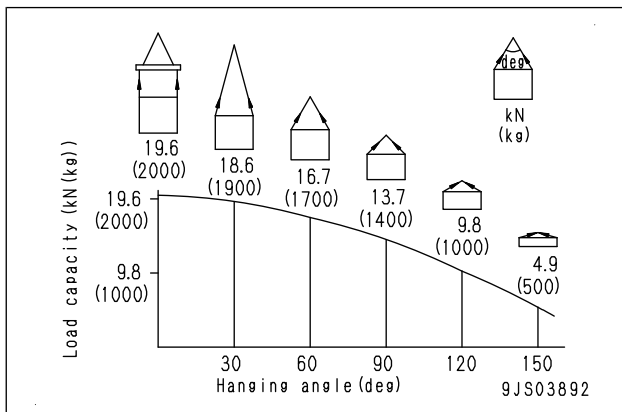
**Foreword, safety and general information**

- Keep putting on the gloves during sling work. (Put on the leather gloves, if available.)
- Measure the weight of the load by the eye and check its center of gravity.
- Use the proper sling according to the weight of the load and method of slinging. If too thick wire ropes are used to sling a light load, the load may slip and fall.
- Do not sling a load with 1 wire rope only. If do so, the load may rotate or the sling gets loose and the sling may slip off. Install 2 or more wire ropes symmetrically.

**⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original slinging position on the load, which can result in a dangerous accident.**

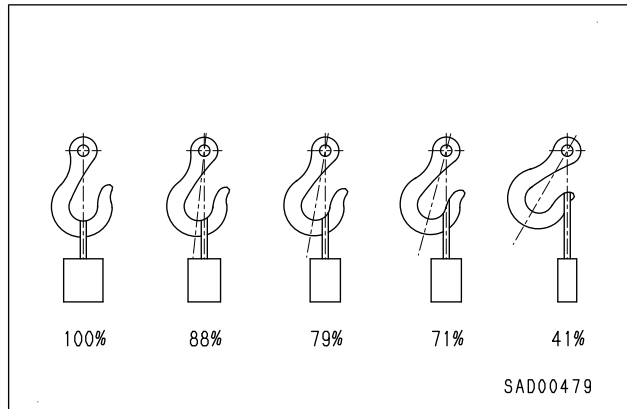
- Hanging angle must be 60 degrees or smaller as a rule.
- When hanging a heavy load (25kg or heavier), the hanging angle of the rope must be narrower than that of the hook.

★ When slinging a load with 2 ropes or more, the larger the hanging angle is, the larger the tension of each rope. The figure below shows the variation of allowable load in kN {kg} when hoisting is made with 2 ropes, each of which is allowed to sling up to 9.8 kN {1000kg} a load vertically, at various hanging angles. When the 2 ropes sling a load vertically, up to 19.6 kN {2000 kg} of total weight can be suspended. This weight is reduced to 9.8 kN {1000 kg} when the 2 ropes make a hanging angle of 120 degrees. If the two ropes sling a 19.6 kN {2000 kg} load at a hanging angle of 150 degrees, each rope is subjected to a force as large as 39.2 kN {4000 kg}.



- When installing wire ropes to an angular load, apply pads to protect the wire ropes. If the load is slippery, apply proper material to prevent the wire rope from slipping.

- Use the specified eye bolts and fix wire ropes, chains, etc. to them with shackles, etc.
- Apply wire ropes to the middle part of the hook.
  - ★ Slinging near the tip of the hook may cause the rope to slip off the hook during hoisting. The strength of the hook is maximum at its central part.




- Do not use twisted or kinked wire ropes.
- When slinging up a load, observe the following.
  1. Wind up the rope slowly until the wire rope tensions. When putting your hands on the wire ropes, do not grasp them but press them down from above. If you grasp them, your fingers may be caught.
  2. After the wire ropes are stretched, stop the crane and check the condition of the slung load, wire ropes, and pads.
  3. If the load is unstable or the wire rope or chains are twisted, lower the load and lift it up again.
  4. Do not lift up the load at an angle.
- When lowering a load, pay attention to the following.
  1. When lifting down a load, stop it temporarily at 30 cm above the floor, and then lower it slowly.
  2. Check that the load is stable, and then remove the sling.
  3. Remove kinks and dirt from the wire ropes and chains used for the sling work, and put them in the specified place.

**Precautions for using mobile crane**

- ★ Read the Operation and Maintenance Manual of the crane carefully in advance and operate the crane safely.

**Precautions for using overhead traveling crane**

- ⚠ **The hoist or crane must be used to sling the components weighing 25 kg or heavier. A part weighing 25 kg or heavier in "disassembly and assembly" section is indicated with the symbol of .**