

# Shop Manual

HYDRAULIC  
EXCAVATOR

**PC228USLC-10**

SERIAL NUMBERS 1002 and up

**KOMATSU**



SHOP MANUAL

# HYDRAULIC EXCAVATOR

## PC228USLC-10

Model                      Serial Number

PC228USLC-    1002 and up  
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# 00 Index and foreword

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# 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 .....	00-14
Important safety notice .....	00-14
How to read the shop manual .....	00-21
Explanation of terms for maintenance standard .....	00-23
Handling equipment of fuel system devices .....	00-25
Handling of intake system parts .....	00-26
Handling of hydraulic equipment .....	00-27
Method of disconnecting and connecting of push-pull type coupler .....	00-29
Handling of electrical equipment .....	00-32
How to read electric wire code .....	00-40
Precautions when performing operation .....	00-43
Practical use of KOMTRAX .....	00-48
Standard tightening torque table .....	00-49
List of abbreviation .....	00-55
Conversion table .....	00-60
01 Specification .....	01-1
Table of contents .....	01-2
Specifications .....	01-3
Specification drawing .....	01-3
Working range drawings .....	01-4
Specifications .....	01-5
Weight table .....	01-8
Table of fuel, coolant, and lubricants .....	01-10
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 .....	10-12
EGR system circuit diagram .....	10-14
EGR valve .....	10-16
EGR cooler .....	10-18
KCCV layout drawing .....	10-19
KCCV ventilator .....	10-21
KDPF .....	10-23
Cooling system .....	10-27
Power train .....	10-29
Power train system .....	10-29
Swing circle .....	10-31
Swing machinery .....	10-32
Final drive .....	10-34
Undercarriage and frame .....	10-36
Track frame and idler cushion .....	10-36
Hydraulic system .....	10-38
Hydraulic component layout .....	10-38
Valve control .....	10-40
Hydraulic tank .....	10-41
CLSS .....	10-43
Main pump .....	10-48
Control valve .....	10-79
Swing motor .....	10-135
Travel motor .....	10-147
PPC valve .....	10-160
Solenoid valve .....	10-183
Attachment circuit selector valve (for high pressure circuit) .....	10-187

Attachment circuit selector valve (for low pressure circuit).....	10-190
Center swivel joint.....	10-193
Accumulator.....	10-195
Work equipment.....	10-197
Work equipment.....	10-197
Work equipment shim.....	10-198
Bucket play adjustment shim.....	10-199
Cab and its attachments.....	10-200
Cab mount and cab tipping stopper.....	10-200
ROPS cab.....	10-201
Electrical system.....	10-202
Electrical control system.....	10-202
Machine monitor system.....	10-257
KOMTRAX system.....	10-279
Sensor.....	10-282
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.....	20-4
Standard value table for electrical system.....	20-18
30 Testing and adjusting.....	30-1
Table of contents.....	30-2
Related information on testing and adjusting.....	30-3
Tools for testing and adjusting.....	30-3
Sketch of tools for testing and adjusting.....	30-7
Engine and cooling system.....	30-8
Testing engine speed.....	30-8
Testing boost pressure.....	30-9
Testing exhaust gas color.....	30-11
Testing and adjusting valve clearance.....	30-13
Testing compression pressure.....	30-16
Testing blowby pressure.....	30-20
Testing engine oil pressure.....	30-21
Testing EGR valve and KVGT oil pressures.....	30-22
Measuring fuel pressure.....	30-23
Measuring fuel delivery, return and leakage.....	30-29
Bleeding air from fuel system.....	30-34
Testing fuel circuit for leakage.....	30-36
Handling cylinder cutout mode operation.....	30-37
Handling no-injection cranking operation.....	30-38
Checking and adjusting air conditioner compressor belt tension.....	30-39
Replacing fan belt.....	30-41
Power train.....	30-42
Testing swing circle bearing clearance.....	30-42
Undercarriage and frame.....	30-43
Testing and adjusting track tension.....	30-43
Hydraulic system.....	30-44
Releasing remaining pressure from hydraulic circuit.....	30-44
Testing and adjusting oil pressure in work equipment, swing, and travel circuits.....	30-49
Testing oil pressure of control circuit.....	30-53
Testing and adjusting oil pressure in pump PC control circuit.....	30-54
Testing and adjusting oil pressure in pump LS control circuit.....	30-58
Testing outlet pressure of solenoid valve.....	30-66
Testing PPC valve outlet pressure.....	30-69
Adjusting play of work equipment and swing PPC valves.....	30-71
Testing pump swash plate sensor.....	30-72
Isolating the parts causing hydraulic drift in work equipment.....	30-73
Testing and adjusting travel deviation.....	30-75

Testing oil leakage .....	30-77
Bleeding air from hydraulic circuit .....	30-80
Work equipment .....	30-83
Testing and adjusting boom angle potentiometer .....	30-83
Cab and its attachments .....	30-84
Checking cab tipping stopper .....	30-84
Adjusting mirrors .....	30-85
Electrical system .....	30-87
Special functions of machine monitor .....	30-87
KOMTRAX terminal start-up procedure .....	30-157
Adjusting rearview camera angle .....	30-160
Handling voltage circuit of engine controller .....	30-162
Handling battery disconnect switch .....	30-163
Testing diodes .....	30-164
Pm clinic .....	30-165
Pm Clinic service .....	30-165
40 Troubleshooting .....	40-1
Table of contents .....	40-2
Related information on troubleshooting .....	40-9
Troubleshooting points .....	40-9
Sequence of events in troubleshooting .....	40-11
Testing before troubleshooting .....	40-13
Inspection procedure before troubleshooting .....	40-15
Preparation work for troubleshooting of electrical system .....	40-34
Classification and procedure for troubleshooting .....	40-39
Symptom of probable failure and troubleshooting No. ....	40-42
Information in troubleshooting table .....	40-45
Diagnostic procedure for wiring harness open circuit of pressure sensor system .....	40-47
Connector list and layout .....	40-49
Connector contact identification .....	40-60
T-branch box and T-branch adapter table .....	40-98
Fuse location table .....	40-103
Precautions for KDPF (KCSF and KDOC) Cleaning and Replacement .....	40-105
Preparation of dummy temperature sensor (for KDOC and KDPF temperature sensors) .....	40-108
Preparation of short circuit electrical connector (for failure codes [CA1883] and [CA3135]) .....	40-109
Failure codes table .....	40-110
Troubleshooting by failure code (Display of code) .....	40-119
Failure code [879AKA] A/C Inner Sensor Open Circuit .....	40-119
Failure code [879AKB] A/C Inner Sensor Short Circuit .....	40-120
Failure code [879BKA] A/C Outer Sensor Open Circuit .....	40-121
Failure code [879BKB] A/C Outer Sensor Short Circuit .....	40-122
Failure code [879CKA] Ventilating Sensor Open Circuit .....	40-123
Failure code [879CKB] Ventilating Sensor Short Circuit .....	40-124
Failure code [879DKZ] Sunlight Sensor Open Or Short Circuit .....	40-125
Failure code [879EMC] Ventilation Damper Abnormality .....	40-126
Failure code [879FMC] Air Mix Damper Abnormality .....	40-127
Failure code [879GKX] Refrigerant Abnormality .....	40-128
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@BAZK] Eng Oil Level Low .....	40-141
Failure code [B@BCNS] Eng Water Overheat .....	40-142

Failure code [B@BCZK] Eng Water Level Low .....	40-143
Failure code [B@HANS] Hyd Oil Overheat .....	40-145
Failure code [CA115] Eng Ne and Bkup Speed Sens Error .....	40-146
Failure code [CA122] Chg Air Press Sensor High Error .....	40-147
Failure code [CA123] Chg Air Press Sensor Low Error .....	40-149
Failure code [CA131] Throttle Sensor High Error.....	40-151
Failure code [CA132] Throttle Sensor Low Error .....	40-153
Failure code [CA144] Coolant Temp Sens High Error .....	40-155
Failure code [CA145] Coolant Temp Sens Low Error .....	40-157
Failure code [CA153] Chg Air Temp Sensor High Error.....	40-159
Failure code [CA154] Chg Air Temp Sensor Low Error.....	40-161
Failure code [CA187] Sensor 2 Supply Volt Low Error .....	40-163
Failure code [CA221] Ambient Press Sensor High Error .....	40-165
Failure code [CA222] Ambient Press Sensor Low Error .....	40-167
Failure code [CA227] Sensor 2 Supply Volt High Error.....	40-169
Failure code [CA234] Eng Overspeed .....	40-170
Failure code [CA238] Ne Speed Sensor Supply Volt Error .....	40-171
Failure code [CA239] Ne Speed Sens Supply Volt High Error.....	40-172
Failure code [CA271] IMV/PCV1 Short Error .....	40-173
Failure code [CA272] IMV/PCV1 Open Error .....	40-175
Failure code [CA295] Ambient Press Sens In Range Error.....	40-177
Failure code [CA322] Inj #1(L#1) Open/Short Error .....	40-178
Failure code [CA323] Inj #5(L#5) Open/Short Error .....	40-180
Failure code [CA324] Inj #3(L#3) Open/Short Error .....	40-182
Failure code [CA325] Inj #6(L#6) Open/Short Error .....	40-184
Failure code [CA331] Inj #2(L#2) Open/Short Error .....	40-186
Failure code [CA332] Inj #4(L#4) Open/Short Error .....	40-188
Failure code [CA343] ECM Critical Internal Failure .....	40-190
Failure code [CA351] Injectors Drive Circuit Error .....	40-191
Failure code [CA352] Sensor 1 Supply Volt Low Error .....	40-192
Failure code [CA356] Mass Air Flow Sensor High Error .....	40-194
Failure code [CA357] Mass Air Flow Sensor Low Error.....	40-196
Failure code [CA386] Sensor 1 Supply Volt High Error.....	40-198
Failure code [CA428] Water in Fuel Sensor High Error .....	40-199
Failure code [CA429] Water in Fuel Sensor Low Error .....	40-201
Failure code [CA435] Eng Oil Press Sw Error .....	40-203
Failure code [CA441] Battery Voltage Low Error .....	40-204
Failure code [CA442] Battery Voltage High Error.....	40-206
Failure code [CA449] Rail Press Very High Error.....	40-207
Failure code [CA451] Rail Press Sensor High Error.....	40-208
Failure code [CA452] Rail Press Sensor Low Error .....	40-210
Failure code [CA488] Chg Air Temp High Torque Derate.....	40-212
Failure code [CA515] Rail Press Sens Sup Volt High Error .....	40-213
Failure code [CA516] Rail Press Sens Sup Volt Low Error .....	40-215
Failure code [CA553] Rail Press High Error .....	40-217
Failure code [CA555] Crankcase Press High Error 1 .....	40-218
Failure code [CA556] Crankcase Press High Error 2 .....	40-219
Failure code [CA559] Rail Press Low Error.....	40-220
Failure code [CA595] Turbo Speed High Error 2 .....	40-222
Failure code [CA687] Turbo Speed Low Error.....	40-223
Failure code [CA689] Eng Ne Speed Sensor Error.....	40-225
Failure code [CA691] Intake Air Temp Sens High Error.....	40-227
Failure code [CA692] Intake Air Temp Sens Low Error.....	40-229
Failure code [CA697] ECM Int Temp Sensor High Error .....	40-231
Failure code [CA698] ECM Int Temp Sensor Low Error.....	40-232
Failure code [CA731] Eng Bkup Speed Sens Phase Error .....	40-233
Failure code [CA778] Eng Bkup Speed Sensor Error.....	40-235
Failure code [CA1117] Persistent Data Lost Error.....	40-240
Failure code [CA1664] KDOC Malfunction.....	40-241

Failure code [CA1691] Regeneration Ineffective .....	40-243
Failure code [CA1695] Sensor 5 Supply Volt High Error .....	40-246
Failure code [CA1696] Sensor 5 Supply Volt Low Error .....	40-248
Failure code [CA1843] Crankcase Press Sens High Error .....	40-250
Failure code [CA1844] Crankcase Press Sens Low Error .....	40-252
Failure code [CA1879] KDPF Delta P Sensor High Error .....	40-254
Failure code [CA1881] KDPF Delta P Sensor Low Error .....	40-256
Failure code [CA1883] KDPF Delta P Sens In Range Error .....	40-258
Failure code [CA1921] KDPF Soot Load High Error 1 .....	40-261
Failure code [CA1922] KDPF Soot Load High Error 2 .....	40-264
Failure code [CA1942] Crankcase Press Sens In Range Error .....	40-269
Failure code [CA1993] KDPF Delta Pressure Low Error .....	40-270
Failure code [CA2185] Throt Sensor Sup Volt High Error .....	40-273
Failure code [CA2186] Throt Sensor Sup Volt Low Error .....	40-275
Failure code [CA2249] Rail Press Very Low Error .....	40-277
Failure code [CA2271] EGR Valve Pos Sens High Error .....	40-278
Failure code [CA2272] EGR Valve Pos Sens Low Error .....	40-280
Failure code [CA2288] Turbo Speed High Error 1 .....	40-283
Failure code [CA2311] IMV Solenoid Error .....	40-284
Failure code [CA2349] EGR Valve Solenoid Open Error .....	40-285
Failure code [CA2353] EGR Valve Solenoid Short Error .....	40-287
Failure code [CA2357] EGR Valve Servo Error .....	40-289
Failure code [CA2373] Exhaust Manifold Press Sens High error .....	40-290
Failure code [CA2374] Exhaust Manifold Press Sens Low error .....	40-292
Failure code [CA2375] EGR Orifice Temp Sens High Error .....	40-294
Failure code [CA2376] EGR Orifice Temp Sens Low Error .....	40-296
Failure code [CA2381] KVGT Pos Sens High Error .....	40-298
Failure code [CA2382] KVGT Pos Sens Low Error .....	40-300
Failure code [CA2383] KVGT Solenoid Open Error .....	40-303
Failure code [CA2386] KVGT Solenoid Short Error .....	40-305
Failure code [CA2387] KVGT Servo Error .....	40-307
Failure code [CA2554] Exh Manifold Press Sens In Range Error .....	40-308
Failure code [CA2555] Grid Htr Relay Volt Low Error .....	40-309
Failure code [CA2556] Grid Htr Relay Volt High Error .....	40-311
Failure code [CA2637] KDOC Face Plugging .....	40-313
Failure code [CA2639] Manual Stationary Regeneration Request .....	40-315
Failure code [CA2961] EGR Orifice Temp High Error 1 .....	40-318
Failure code [CA2973] Chg Air Press Sensor In Range Error .....	40-319
Failure code [CA3133] KDPF Outlet Press Sens High Error .....	40-320
Failure code [CA3134] KDPF Outlet Press Sens Low Error .....	40-322
Failure code [CA3135] KDPF Outlet Press Sens In Range Error .....	40-324
Failure code [CA3251] KDOC Inlet Temp High Error .....	40-328
Failure code [CA3253] KDOC Temp Error - Non Regeneration .....	40-331
Failure code [CA3254] KDOC Outlet Temp High Error 1 .....	40-334
Failure code [CA3255] KDPF Temp Error - Non Regeneration .....	40-337
Failure code [CA3256] KDPF Outlet Temp High Error 1 .....	40-340
Failure code [CA3311] KDOC Outlet Temp High Error 2 .....	40-343
Failure code [CA3312] KDPF Outlet Temp High Error 2 .....	40-346
Failure code [CA3313] KDOC Inlet Temp Sensor Low Error .....	40-349
Failure code [CA3314] KDOC Inlet Temp Sens High Error .....	40-352
Failure code [CA3315] KDOC Inlet Temp Sens In Range Error .....	40-356
Failure code [CA3316] KDOC Outlet Temp Sens Low Error .....	40-360
Failure code [CA3317] KDOC Outlet Temp Sens High Error .....	40-363
Failure code [CA3318] KDOC Outlet Temp Sens In Range Error .....	40-367
Failure code [CA3319] KDPF Outlet Temp Sens High Error .....	40-371
Failure code [CA3321] KDPF Outlet Temp Sens Low Error .....	40-375
Failure code [CA3322] KDPF Outlet Temp Sens In Range Error .....	40-378
Failure code [CA3419] Mass Air Flow Sensor Sup Volt High Error .....	40-382
Failure code [CA3421] Mass Air Flow Sensor Sup Volt Low Error .....	40-384



Failure code [CA3741] Rail Press Valve Trip Error.....	40-386
Failure code [D110KB] Battery Relay Drive Short Circuit.....	40-387
Failure code [D19JKZ] Personal Code Relay Abnormality.....	40-389
Failure code [D811MC] KOMTRAX Error.....	40-392
Failure code [D862KA] GPS Antenna Open Circuit.....	40-393
Failure code [D8ALKA] System Operating Lamp Disconnection (KOMTRAX).....	40-394
Failure code [D8ALKB] System Operating Lamp Short Circuit (KOMTRAX).....	40-396
Failure code [D8AQKR] CAN2 Discon (KOMTRAX).....	40-397
Failure code [DA20MC] Pump Controller.....	40-398
Failure code [DA22KK] Pump Solenoid Power Low Error.....	40-399
Failure code [DA25KP] 5V Sensor 1 Power Abnormality.....	40-401
Failure code [DA26KP] 5V Sensor 2 Power Abnormality.....	40-404
Failure code [DA29KQ] Model Selection Abnormality.....	40-405
Failure code [DA2LKA] System Operating Lamp Disconnection (Pump Con).....	40-407
Failure code [DA2LKB] System Operating Lamp Short Circuit (Pump Con).....	40-409
Failure code [DA2QKR] CAN2 Discon (Pump Con).....	40-410
Failure code [DA2RKR] CAN1 Discon (Pump Con).....	40-412
Failure code [DAF0MB] Monitor ROM Abnormality.....	40-413
Failure code [DAF0MC] Monitor Error.....	40-414
Failure code [DAF8KB] Camera Power Supply Short Circuit.....	40-415
Failure code [DAF9KQ] Model Selection Abnormality.....	40-417
Failure code [DAFGMC] GPS Module Error.....	40-418
Failure code [DAFLKA] Operating Lamp Open Circuit(Monitor).....	40-419
Failure code [DAFLKB] System Operating Lamp Short Circuit (Monitor).....	40-421
Failure code [DAFQKR] CAN2 Discon (Monitor).....	40-422
Failure code [DAZ9KQ] A/C Model Selection Abnormality.....	40-423
Failure code [DAZQKR] CAN2 Discon (Aircon ECU).....	40-424
Failure code [DB2QKR] CAN2 Discon (Engine Con).....	40-428
Failure code [DB2RKR] CAN1 Discon (Engine Con).....	40-432
Failure code [DGH2KB] Hyd Oil Sensor Short Circuit.....	40-436
Failure code [DHA4KA] Air Cleaner Clog Sensor Open Circuit.....	40-438
Failure code [DHPAMA] F Pump Press Sensor Abnormality.....	40-439
Failure code [DHPBMA] R Pump Press Sensor Abnormality.....	40-442
Failure code [DHS3MA] Arm IN PPC Sen. Abnormality.....	40-445
Failure code [DHS4MA] Bucket Curl PPC Press Sensor Abnormality.....	40-447
Failure code [DHS8MA] Boom Raise PPC Press Sensor Abnormality.....	40-450
Failure code [DHS9MA] Boom LOWER Press Sensor Abnormality.....	40-453
Failure code [DHSAMA] Swing RH PPC Press Sensor Abnormality.....	40-456
Failure code [DHSBMA] Swing LH PPC Press Sensor Abnormality.....	40-459
Failure code [DHSCMA] Arm Dump PPC Press Sensor Abnormality.....	40-462
Failure code [DHSDMA] Bucket Dump PPC Press Sensor Abnormality.....	40-465
Failure code [DHSFMA] Travel Fwd LH PPC Press Sensor Abnormality.....	40-468
Failure code [DHSGMA] Travel Fwd RH PPC Press Sensor Abnormality.....	40-471
Failure code [DHSHMA] Travel Rev LH PPC Press Sensor Abnormality.....	40-474
Failure code [DHSJMA] Travel Rev RH PPC Press Sensor Abnormality.....	40-477
Failure code [DKA0KA] Failure of Boom Angle Sensor (Open circuit).....	40-480
Failure code [DKA0KB] Failure of Boom Angle Sensor (Short circuit).....	40-482
Failure code [DKA0PH] Boom Angle Sensor installation error.....	40-484
Failure code [DKR0MA] F Pump Swash Plate Sensor Abnormality.....	40-485
Failure code [DKR1MA] R Pump Swash Plate Sensor Abnormality.....	40-487
Failure code [DR21KX] Camera 2 Picture Rev. Drive Abnormality.....	40-489
Failure code [DR31KX] Camera 3 Picture Rev. Drive Abnormality.....	40-491
Failure code [DV20KB] Travel Alarm Short Circuit.....	40-493
Failure code [DW43KA] Travel Speed Sol Open Circuit.....	40-495
Failure code [DW43KB] Travel Speed Sol Short Circuit.....	40-497
Failure code [DW45KA] Swing Brake Sol Open Circuit.....	40-499
Failure code [DW45KB] Swing Brake Sol Short Circuit.....	40-502
Failure code [DW4GKA] Boom slow down EPC sol disconnection.....	40-504
Failure code [DW4GKB] Boom slow down EPC sol short circuit.....	40-506

Failure code [DW91KA] Travel Junction Sol Open Circuit .....	40-508
Failure code [DW91KB] Travel Junction Sol Short Circuit.....	40-510
Failure code [DWA2KA] Attachment Sol Open Circuit.....	40-512
Failure code [DWA2KB] Attachment Sol Short Circuit.....	40-514
Failure code [DWK0KA] 2-Stage Relief Sol Open Circuit .....	40-516
Failure code [DWK0KB] 2-Stage Relief Sol Short Circuit.....	40-518
Failure code [DWK2KA] Variable Back Press Sol Open Circuit.....	40-520
Failure code [DWK2KB] Variable Back Press Sol Short Circuit.....	40-522
Failure code [DWK8KA] Swing Press C/O Sol Open Circuit .....	40-524
Failure code [DWK8KB] Swing Press C/O Sol Short Circuit .....	40-526
Failure code [DXA8KA] PC-EPC (F) Sol Open Circuit.....	40-528
Failure code [DXA8KB] PC-EPC (F) Sol Short Circuit.....	40-530
Failure code [DXA9KA] PC-EPC (R) Sol Open Circuit .....	40-532
Failure code [DXA9KB] PC-EPC (R) Sol Short Circuit .....	40-534
Failure code [DXE0KA] LS-EPC Sol Open Circuit .....	40-536
Failure code [DXE0KB] LS-EPC Sol Short Circuit .....	40-538
Failure code [DXE4KA] Attachment Flow EPC Open Circuit .....	40-540
Failure code [DXE4KB] Attachment Flow EPC Short Circuit.....	40-542
Failure code [DXE5KA] Merge-divide Main Sol Open Circuit .....	40-544
Failure code [DXE5KB] Merge-divide Main Sol Short Circuit .....	40-546
Failure code [DXE6KA] Merge-divide LS Sol Open Circuit .....	40-548
Failure code [DXE6KB] Merge-divide LS Sol Short Circuit .....	40-550
Failure code [DY20KA] Wiper Working Abnormality .....	40-552
Failure code [DY20MA] Wiper Parking Abnormality.....	40-554
Failure code [DY2CKB] Washer Drive Short Circuit.....	40-556
Failure code [DY2DKB] Wiper Drive (Fwd) Short Circuit .....	40-558
Failure code [DY2EKB] Wiper Drive (Rev) Short Circuit.....	40-560
Troubleshooting of electrical system (E-mode) .....	40-562
E-1 Engine does not start (Engine does not crank).....	40-562
E-2 Manual preheating system does not work.....	40-567
E-3 Automatic preheating system does not work.....	40-570
E-4 While preheating is working, preheating monitor does not light up .....	40-572
E-5 When starting switch is turned to ON position, machine monitor displays nothing.....	40-574
E-6 While starting switch is turned to ON position (with engine stopped), engine oil level monitor lights up in yellow.....	40-577
E-7 While starting switch is turned to ON position (with engine stopped), radiator coolant level monitor lights up in yellow.....	40-578
E-8 Engine coolant temperature monitor lights up in red while engine is running .....	40-579
E-9 Hydraulic oil temperature monitor lights up in white while engine is running .....	40-580
E-10 Charge level monitor lights up in red while engine is running .....	40-581
E-11 Fuel level monitor lights up in red while engine is running.....	40-582
E-12 Air cleaner clogging monitor lights up in yellow while engine is running .....	40-583
E-13 Water separator monitor lights up in red while engine is running .....	40-584
E-14 Engine coolant temperature monitor lights up in red while engine is running .....	40-585
E-15 Hydraulic oil temperature monitor lights up in red while engine is running .....	40-586
E-16 Engine oil pressure monitor lights up in red while engine is running .....	40-587
E-17 Fuel gauge display does not move from minimum or maximum .....	40-588
E-18 Fuel gauge indicates incorrect amount (indicates neither full nor empty).....	40-589
E-19 Engine coolant temperature gauge display does not move from minimum or maximum .....	40-590
E-20 Engine coolant temperature gauge indicates incorrect temperature (indicates neither full nor empty).....	40-591
E-21 Hydraulic oil temperature gauge does not move from minimum or maximum .....	40-592
E-22 Hydraulic oil temperature gauge indicates incorrect temperature (indicates neither full nor empty) .....	40-594
E-23 Contents of display on machine monitor is different from actual machine condition .....	40-595
E-24 Some areas of machine monitor screen are not displayed.....	40-596
E-25 Function switch does not work.....	40-597

E-26 Automatic warm-up system does not operate (in cold season).....	40-598
E-27 Auto-deceleration monitor does not light up, or does not go out, while auto-deceleration switch is operated .....	40-599
E-28 Auto-deceleration function does not operate or is not canceled while lever is operated .....	40-600
E-29 Working mode selection screen is not displayed while working mode selector switch is operated .....	40-601
E-30 Setting of engine and hydraulic pump is not changed while working mode is changed.....	40-602
E-31 Travel speed monitor does not change when travel speed switch is operated .....	40-603
E-32 Travel speed does not change while travel speed selection is changed .....	40-604
E-33 Alarm buzzer does not stop sounding.....	40-605
E-34 Service meter is not displayed, while starting switch is in OFF position.....	40-606
E-35 Service mode cannot be selected .....	40-607
E-36 Any of work equipment, swing and travel does not work.....	40-608
E-37 Any of work equipment, swing and travel cannot be locked .....	40-610
E-38 Upper structure does not swing while swing parking brake cancel switch is set to CANCEL position.....	40-612
E-39 Swing brake does not operate while swing parking brake cancel switch is set to NORMAL position .....	40-614
E-40 One-touch power maximizing function does not operate, or indicator is not displayed on monitor .....	40-616
E-41 One-touch power maximizing function cannot be canceled .....	40-618
E-42 Alarm does not sound during travel .....	40-619
E-43 Alarm does not stop sounding while machine is stopped .....	40-621
E-44 Horn does not sound .....	40-622
E-45 Horn does not stop sounding.....	40-624
E-46 Wiper monitor does not light up, or does not go out, while wiper switch is operated .....	40-625
E-47 Wiper does not operate while wiper switch is operated .....	40-626
E-48 Window washer does not operate while window washer switch is operated .....	40-628
E-49 Boom LOWER is not displayed correctly with monitoring function .....	40-629
E-50 Arm OUT is not displayed correctly with monitoring function .....	40-630
E-51 Arm IN is not displayed correctly with monitoring function .....	40-631
E-52 Boom RAISE is not displayed correctly with monitoring function .....	40-632
E-53 Bucket CURL is not displayed correctly with monitoring function.....	40-633
E-54 Bucket DUMP is not displayed correctly with monitoring function .....	40-634
E-55 Swing is not displayed correctly with monitoring function.....	40-635
E-56 Travel is not displayed correctly with monitoring function .....	40-636
E-57 Service is not displayed correctly with monitoring function .....	40-637
E-58 Attachment hydraulic circuit cannot be changed.....	40-639
E-59 KOMTRAX system does not operate normally .....	40-640
Troubleshooting of hydraulic and mechanical system (H-mode).....	40-642
Information described in troubleshooting table (H-mode) .....	40-642
System chart of hydraulic and mechanical systems.....	40-643
Failure mode and cause table .....	40-645
H-1 All of work equipment, swing and travel operation lacks speed or power .....	40-653
H-2 Engine speed drops significantly or engine stalls .....	40-656
H-3 All work equipment, swing and travel does not work .....	40-659
H-4 Unusual sound is heard from around hydraulic pump .....	40-660
H-5 Fine control performance or response is poor .....	40-661
H-6 Boom speed or power is low .....	40-663
H-7 Arm speed or power is low .....	40-667
H-8 Bucket speed or power is low .....	40-671
H-9 Work equipment does not move in single operation.....	40-674
H-10 Hydraulic drift of boom is large .....	40-675
H-11 Hydraulic drift of arm is large .....	40-676
H-12 Hydraulic drift of bucket is large .....	40-677
H-13 Time lag of work equipment is large .....	40-678

H-14	When part of work equipment is relieved singly, other parts of work equipment move .....	40-680
H-15	One-touch power maximizing function does not operate .....	40-681
H-16	In combined operation of work equipment, equipment having heavier load moves slower .....	40-682
H-17	In combined operations of swing and boom RAISE, boom rising speed is low .....	40-683
H-18	In combined operations of swing and travel, travel speed drops largely .....	40-684
H-19	Machine does not travel straight .....	40-685
H-20	Travel speed is slow .....	40-688
H-21	Machine is hard to steer or travel power is low .....	40-690
H-22	Travel speed does not change, or travel speed is too slow or fast .....	40-693
H-23	One of tracks does not run .....	40-694
H-24	Upper structure does not swing to the right or left .....	40-696
H-25	Upper structure swing only to the right or left .....	40-697
H-26	Swing acceleration or swing speed is low in both directions (right and left) .....	40-698
H-27	Swing acceleration performance is poor or swing speed is slow in only one direction .....	40-699
H-28	Upper structure overruns excessively when it stops swinging (both right and left) .....	40-700
H-29	Upper structure overruns excessively when it stops swinging (either right or left) .....	40-701
H-30	Shock is large when upper structure stops swinging .....	40-702
H-31	Large unusual noise is heard when upper structure stops swinging .....	40-703
H-32	Swing drift on a slope is large while swing holding brake is applied .....	40-704
H-33	Swing drift on a slope is large while swing holding brake is released .....	40-705
H-34	Attachment hydraulic circuit cannot be changed while attachment is installed .....	40-706
H-35	Oil flow in attachment circuit cannot be controlled .....	40-707
Troubleshooting of engine (S-mode) .....		40-708
Information mentioned in troubleshooting table (S mode) .....		40-708
S-1	When starting switch is turned to START position, engine does not crank .....	40-709
S-2	Engine cranks but no exhaust smoke comes out .....	40-710
S-3	Fuel is being injected but engine does not start (misfiring: engine cranks but does not start) .....	40-711
S-4	Engine startability is poor .....	40-712
S-5	Engine does not pick up smoothly .....	40-714
S-6	Engine stops during operation .....	40-716
S-7	Engine runs rough or is unstable .....	40-718
S-8	Engine lacks power .....	40-719
S-9	Exhaust smoke is black (KDPF clogs up early) .....	40-721
S-10	Engine oil consumption is excessive .....	40-723
S-11	Engine oil becomes contaminated early .....	40-724
S-12	Fuel consumption is excessive .....	40-725
S-13	Oil is in coolant (or coolant spurts or coolant level goes down) .....	40-726
S-14	Engine oil pressure drops .....	40-727
S-15	Fuel is contaminated in engine oil .....	40-728
S-16	Coolant is contaminated in engine oil (Oil becomes cloudy white) .....	40-729
S-17	Coolant temperature rises too high (overheating) .....	40-730
S-18	Unusual noise is heard .....	40-731
S-19	Vibration is excessive .....	40-732
S-20	Air cannot be bled from fuel circuit .....	40-733
S-21	Active regeneration is executed frequently .....	40-734
S-22	Active regeneration takes time .....	40-735
S-23	White smoke is exhausted during active regeneration .....	40-736
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 .....	50-22
Removal and installation of supply pump assembly .....	50-22
Removal and installation of injector assembly .....	50-27
Removal and installation of cylinder head assembly .....	50-36
Removal and installation of radiator assembly .....	50-57
Removal and installation of hydraulic oil cooler assembly .....	50-60
Removal and installation of aftercooler assembly .....	50-64
Removal and installation of engine assembly .....	50-66
Removal and installation of engine front oil seal .....	50-75
Removal and installation of engine rear oil seal .....	50-80
Removal and installation of fuel cooler assembly .....	50-83
Removal and installation of fuel tank assembly .....	50-85
Removal and installation of engine hood assembly .....	50-87
Removal and installation of KDPF assembly .....	50-89
Disassembly and assembly of KDPF assembly .....	50-98
Removal and installation of KCCV assembly .....	50-106
Removal and installation of air cleaner assembly .....	50-109
Removal and installation of EGR (Exhaust Gas Recirculation) valve assembly .....	50-111
Removal and installation of EGR (Exhaust Gas Recirculation) cooler assembly .....	50-113
Power train .....	50-115
Removal and installation of travel motor and final drive assembly .....	50-115
Disassembly and assembly of final drive .....	50-116
Removal and installation of swing motor and swing machinery assembly .....	50-125
Disassembly and assembly of swing machinery assembly .....	50-127
Removal and installation of swing circle assembly .....	50-134
Undercarriage and frame .....	50-135
Separation and connection of track shoe assembly .....	50-135
Removal and installation of sprocket .....	50-138
Removal and installation of idler and idler cushion assembly .....	50-139
Disassembly and assembly of idler assembly .....	50-140
Disassembly and assembly of idler cushion assembly .....	50-143
Disassembly and assembly of track roller assembly .....	50-145
Disassembly and assembly of carrier roller assembly .....	50-147
Removal and installation of revolving frame assembly .....	50-150
Removal and installation of counterweight assembly .....	50-153
Removal and installation of counterweight assembly for maintenance .....	50-156
Hydraulic system .....	50-157
Removal and installation of center swivel joint assembly .....	50-157
Disassembly and assembly of center swivel joint assembly .....	50-159
Removal and installation of hydraulic tank assembly .....	50-161
Removal and installation of main pump assembly .....	50-164
Removal and installation of main pump input shaft oil seal .....	50-169
Removal and installation of control valve assembly .....	50-170
Disassembly and assembly of control valve assembly .....	50-177
Disassembly and assembly of work equipment PPC valve assembly .....	50-182
Disassembly and assembly of travel PPC valve assembly .....	50-184
Work equipment .....	50-186
Removal and installation of work equipment assembly .....	50-186
Disassembly and assembly of work equipment cylinder assembly .....	50-189
Cab and its attachments .....	50-197
Removal and installation of operator's cab assembly .....	50-197
Removal and installation of operator's cab glass (adhered glass) .....	50-200
Removal and installation of front window assembly .....	50-215
Removal and installation of floor frame assembly .....	50-221
Removal and installation of air conditioner unit assembly .....	50-227
Removal and installation of operator's seat .....	50-232
Removal and installation of seat belt .....	50-233
Removal and installation of front wiper assembly .....	50-234
Removal and installation of air conditioner compressor assembly .....	50-240

## 00 Index and foreword

### Index

---


Removal and installation of air conditioner condenser assembly .....	50-242
Electrical system .....	50-244
Removal and installation of engine controller assembly .....	50-244
Removal and installation of pump controller assembly .....	50-245
Removal and installation of machine monitor assembly .....	50-248
Removal and installation of pump swash plate sensor .....	50-250
Removal and installation of mass air flow and temperature sensor .....	50-251
Removal and installation of KOMTRAX terminal .....	50-252
60 Maintenance standard .....	60-1
Table of contents .....	60-2
Engine and cooling system .....	60-3
Engine mount .....	60-3
Cooling system .....	60-4
Power train .....	60-5
Swing circle .....	60-5
Swing machinery .....	60-6
Final drive .....	60-8
Sprocket .....	60-10
Undercarriage and frame .....	60-12
Track frame and idler cushion .....	60-12
Idler .....	60-14
Track roller .....	60-16
Carrier roller .....	60-17
Track shoe .....	60-18
Hydraulic system .....	60-24
Hydraulic tank .....	60-24
Main pump .....	60-25
Control valve .....	60-26
Swing motor .....	60-36
Travel motor .....	60-38
PPC valve .....	60-41
Solenoid valve .....	60-51
Attachment circuit selector valve (for high-pressure circuit) .....	60-52
Attachment circuit selector valve (for low-pressure circuit) .....	60-53
Center swivel joint .....	60-54
Work equipment .....	60-55
Work equipment .....	60-55
Work equipment cylinder .....	60-64
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 .....	80-15
Air conditioner controller .....	80-16
Compressor .....	80-17
Air conditioner condenser .....	80-18
Sunlight sensor .....	80-20
Outer temperature sensor (outside air temperature sensor) .....	80-21
Procedure for testing and troubleshooting .....	80-22
Circuit diagram and arrangement of connector pins .....	80-24
System diagram .....	80-26
Input and output signals of the air conditioner controller .....	80-27
Air conditioner unit .....	80-29
Parts and connectors layout .....	80-31
Testing air leakage (duct) .....	80-37

Testing with self-diagnosis function .....	80-40
Testing vent (mode) changeover.....	80-43
Testing FRESH/RECIRC air changeover.....	80-44
Testing sunlight sensor .....	80-45
Testing (dual) pressure switch for refrigerant.....	80-46
Testing relays .....	80-48
Troubleshooting chart 1 .....	80-49
Troubleshooting chart 2 .....	80-50
Information in troubleshooting table .....	80-53
Failure code list related to air conditioner.....	80-54
Failure code [879AKA] A/C Inner Sensor Open Circuit .....	80-55
Failure code [879AKB] A/C Inner Sensor Short Circuit.....	80-56
Failure code [879BKA] A/C Outer Sensor Open Circuit.....	80-57
Failure code [879BKB] A/C Outer Sensor Short Circuit.....	80-59
Failure code [879CKA] Ventilating Sensor Open Circuit.....	80-61
Failure code [879CKB] Ventilating Sensor Short Circuit.....	80-62
Failure code [879DKZ] Sunlight Sensor Open or Short Circuit.....	80-63
Failure code [879EMC] Ventilation Damper Abnormality.....	80-65
Failure code [879FMC] Air Mix Damper Abnormality .....	80-66
Failure code [879GKX] Refrigerant Abnormality.....	80-67
A-1 Troubleshooting for power supply system (Air conditioner does not operate) .....	80-68
A-2 Troubleshooting for compressor and refrigerant system (Air is not cooled) .....	80-70
A-3 Troubleshooting for blower motor system (No air comes out or air flow is abnormal) .....	80-73
A-4 Troubleshooting for FRESH/RECIRC air changeover .....	80-75
Troubleshooting with gauge pressure.....	80-77
Connection of service tool.....	80-80
Precautions for disconnecting and connecting refrigerant piping.....	80-82
Handling of compressor oil.....	80-84
Desiccant replacement.....	80-86
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
Electrical circuit diagram of air conditioner unit.....	90-25
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 2 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.

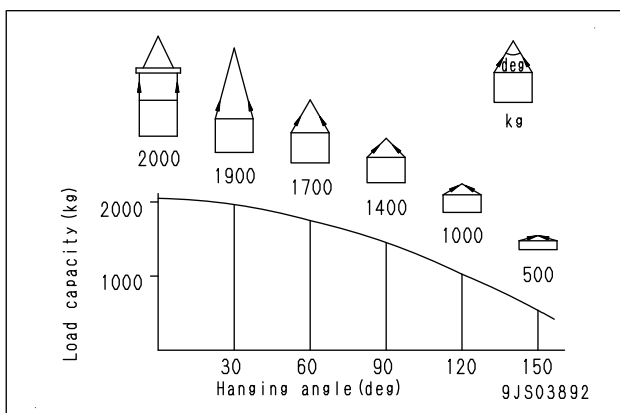
## 00 Index and foreword

### 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.

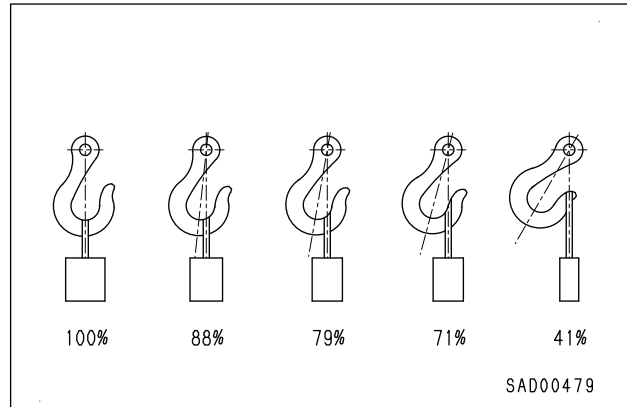
**⚠ Slings with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original slinging position on the load, which can result in a dangerous accident.**

- Hanging angle must be 60 deg. 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 kg when hoisting is made with 2 ropes, each of which is allowed to sling up to 9.8 kN {1,000kg} a load vertically, at various hanging angles. When the 2 ropes sling a load vertically, up to 2,000 kg of total weight can be suspended. This weight is reduced to 1,000 kg when the 2 ropes make a hanging angle of 120 deg.. If the 2 ropes sling a 2,000 kg load at a hanging angle of 150 deg., each rope is subjected to a force as large as 4,000 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.
  - ★ Slings 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 .

- Before starting work, check the wire ropes, brake, clutch, controller, rails, over winding prevention device, ground fault circuit interrupter for electric shock prevention, crane collision prevention device, and energizing warning lamp, and check the following safety items.
- Observe the signals for sling work.
- Operate the hoist at a safe place.
- Be sure to check the directions of the direction indication plate (north, south, east and west) and the operating button.
- Do not sling a load at an angle. Do not move the crane while the slung load is swinging.
- Do not raise or lower a load while the crane is moving longitudinally or laterally.
- Do not drag a sling.
- When lifting up a load, stop it just after it leaves the ground and check safety, and then lift it up.
- Consider the travel route in advance and lift up a load to a safe height.
- Place the control switch in a position where it will not be an obstacle to work and passage.
- After operating the hoist, do not swing the control switch.
- Remember the position of the main switch so that you can turn off the power immediately in an emergency.
- Shut down the main switch when the hoist stops because of a blackout. When turning on a switch which is turned OFF by the ground fault circuit interrupter for electric shock prevention, check that the devices related to that switch are not in operating condition.
- If you find an obstacle around the hoist, stop the operation.
- After finishing the work, stop the hoist at the specified position and raise the hook to at least 2 meters above the floor. Do not leave the sling attached to the hook.

**Selecting wire ropes**

- Select adequate ropes depending on the weight of the parts to be hoisted, referring to the table below

Wire rope (JIS G3525, 6 x 37 - Type A)

(Standard Z twist wire ropes without galvanizing)

Nominal diameter of rope	Allowable load	
	kN	ton
mm		
10	8.8	0.9
12	12.7	1.3
14	17.3	1.7
16	22.6	2.3
18	28.6	2.9
20	35.3	3.6
25	55.3	5.6
30	79.6	8.1
40	141.6	14.4

Nominal diameter of rope	Allowable load	
	kN	ton
mm		
50	221.6	22.6
60	318.3	32.4

- ★ The allowable load is calculated as one sixth of the breaking load of the rope to be used (safety coefficient: 6).

**Precautions for disconnecting and connecting hoses and tubes in air conditioner circuit**

**Disconnection**

**⚠ When replacing the air conditioner unit, air conditioner compressor, condenser or receiver drier, etc., collect the refrigerant (air conditioner gas: R134a) from the air conditioner circuit before disconnecting the air conditioner hoses.**

- ★ Ask a qualified person for collecting, adding and filling operations of the refrigerant (air conditioner gas: R134a). (Only registered persons can work.)
- ★ Never release the refrigerant (air conditioner gas: R134a) to the atmosphere.

**⚠ If refrigerant gas (air conditioner gas: R134a) gets in your eyes, you may lose your sight. And if it touches your skin, you may suffer from frostbite. Put on protective eyeglasses, gloves and working clothes with long sleeves while collecting the refrigerant or filling the air conditioner circuit with the refrigerant.**

- When loosening the nuts fixing air conditioner hoses and tubes, be sure to use 2 wrenches; use one wrench to fix and use the other one to loosen the nut.

**Connection**

- When installing the hose for the air conditioner circuit, take care not to allow invasion of dirt, dusts and water into the hose.
- Check that the O-rings are fitted to the joints when connecting the air conditioner piping.
- Once an O-ring is used, it is deformed and deteriorated. Accordingly, do not reuse it.
- When removing the O-rings, use a soft tool so that the piping is not damaged.
- Check that the O-ring is not damaged or deteriorated.
- Apply compressor oil for refrigerant (R134a) to the O-ring.
- ★ However, do not apply oil to the threaded part of a bolt, nut or union.

**00 Index and foreword**

**Foreword, safety and general information**

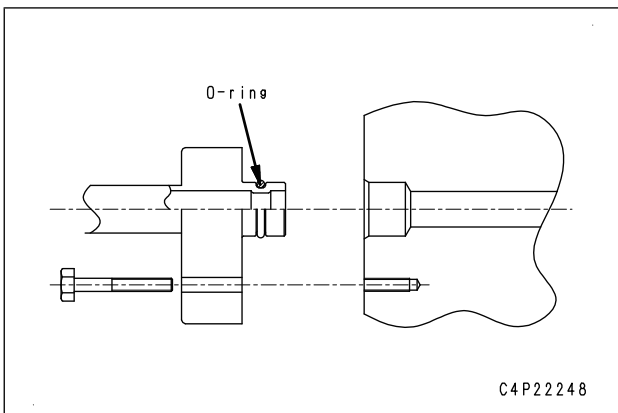
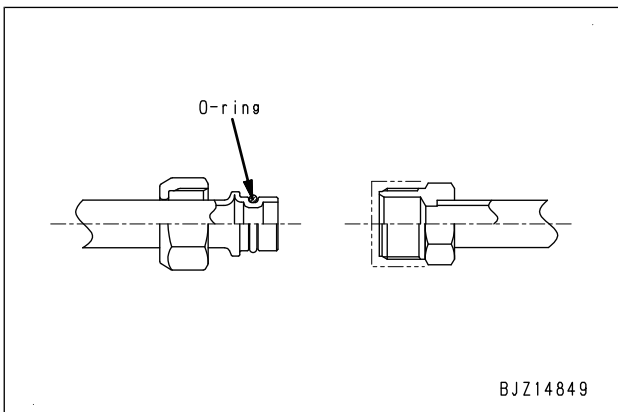
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Manufacturer	Part name
DENSO	ND-OIL8
VALEO THERMAL SYSTEMS	ZXL100PG (equivalent to PAG46)
SANDEN	SP-10

- When tightening nuts of the air conditioner hoses and tubes, be sure to use 2 wrenches. Use one wrench to fix and tighten the nut with the other wrench to the specified torque (Use a torque wrench for tightening).

★ Example of fitting of O-ring

- An O-ring is fitted to every joint of the air conditioner piping.



**For tightening torques, see "Others",  
"Precautions for disconnection and connection  
of air conditioner piping".**