

Section-0 General

Serial No.

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Front And Rear Drum Shaft Structure And Outline -----	ES01-10-0061.0R0	1001-
Front And Rear Drum Shaft Maintenance Chart -----	ES01-10-2061.0R0	1001-
Front And Rear Drum Shaft Disassembly And Reassembly -----	ES01-10-6061.0R0	1001-
Boom Hoist Drum Shaft Structure And Outline -----	ES01-15-0061.0R0	1001-
Boom Hoist Drum Shaft Maintenance Chart -----	ES01-15-2061.0R0	1001-
Boom Hoist Drum Shaft Disassembly And Reassembly -----	ES01-15-6061.0R0	1001-
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Clutch Maintenance Chart (1-Cylinder Type) -----	ES01-17-2061.0R0	1001-
Clutch Troubleshooting (1-Cylinder Type) -----	ES01-17-4023.0R0	1001-
Clutch Disassembly And Reassembly (1-Cylinder Type) -----	ES01-17-6061.0R0	1001-
Swing Mechanism Maintenance Chart -----	ES01-29-2061.0R0	1001-
Turntable Bearing Maintenance Chart -----	ES01-30-2030.0R1	1001-
Turntable Bearing Inspection And Adjustment -----	ES01-30-5050.0R0	1001-
Power Divider (Pump Splitter) Maintenance Chart -----	ES01-40-2061.0R0	1001-
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Front And Rear Drum Brakes Control Disassembly And Reassembly -----	ES03-05-6061.0R0	1001-
Front, Rear And Boom Hoist Drum Lock Pawl Control Maintenance Chart -----	ES03-10-2061.0R0	1001-

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Hydraulic Circuit Outline -----	ES04-01-0061.2R0	1029-
Hydraulic Circuit Pressure Adjustment -----	ES04-01-5061.0R0	1001-1020
Hydraulic Circuit Pressure Adjustment -----	ES04-01-5061.1R0	1021-1028
Hydraulic Circuit Pressure Adjustment -----	ES04-01-5061.2R0	1029-

Section-5 Hydraulic Unit

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WET0031-00

Variable Delivery Pump Disassembly And Reassembly	ES05-02-6011.0R0	1001-
Gear Pump Troubleshooting (Single Type)	ES05-03-4023.0R0	1001-
Gear Pump Disassembly And Reassembly (Single Type)	ES05-03-6023.0R0	1001-
Gear Pump Troubleshooting (3-Series Type)	ES05-03-4050.0R0	1001-
Gear Pump Disassembly And Reassembly (3-Series Type)	ES05-03-6050.0R0	1001-
Accumulator Structure And Working	ES05-05-0009.1R0	1001-1028
Accumulator Structure And Working	ES05-05-0009.2R0	1029-
Accumulator Inspection And Adjustment	ES05-05-5009.1R0	1001-
Accumulator Disassembly And Reassembly	ES05-05-6009.2R0	1001-
Rotating Joint Disassembly And Reassembly	ES05-14-6029.0R0	1001-1028
Rotating Joint Disassembly And Reassembly	ES05-14-6029.1R0	1029-
Brake Booster Function And Operation	ES05-16-0011.0R0	1001-
Remote Control Valve Structure And Operation	ES05-17-0009.1R0	1001-
Remote Control Valve Troubleshooting	ES05-17-4009.0R0	1001-
Remote Control Valve Disassembly And Reassembly	ES05-17-6009.1R0	1001-
Clutch Cylinder Disassembly And Reassembly (1-Cylinder Type)	ES05-18-6061.0R0	1001-
Automatic Brake Cylinder Disassembly And Reassembly	ES05-19-6032.0R0	1001-
Boom Foot Pin Cylinder Disassembly And Reassembly	ES05-27-6050.0R0	1001-
Line Filter Inspection	ES05-30-5061.0R0	1001-
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Return Filter Inspection	ES05-32-5011.0R1	1001-
Return Filter Disassembly And Reassembly	ES05-32-6011.0R0	1001-
Swing Control Valve Structure And Outline	ES05-35-0051.0R0	1001-
Check Block Structure And Outline	ES05-49-0011.0R0	1001-
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HC-248H Series – Master Keysheet (Carrier, Third Drum, & Boom)
(C5N Prefix On Crane Serial Number)**AREA 00 GENERAL INFORMATION**

SM00-000-000.00 How To Use This Manual, General Service Instructions, And Safety Procedures

AREA 01 RUBBER TIRE LOWER

SM01-002-012.00 Front Axle, Recondition
SM01-002-015.00 Front Wheel & Brake Drum, R & I
SM01-003-010.00 Brakes, Recondition (Eaton/Dana)
SM01-003-014.00 Adjusting The Brakes (Eaton/Dana & Rockwell/Meritor)
SM01-004-005.00 Front Axles & Suspension, R & I
SM01-004-006.00 Front Axle & Air Suspension, R & I
SM01-005-003.00 Master Steering Gear, Recondition (92 Series)
SM01-005-004.00 Slave Steering Gear, Recondition (92 Series)
SM01-005-006.00 Miter Box, Recondition
SM01-005-008.00 Steering Gear T-Box, Recondition
SM01-005-015.00 Steering Column, Recondition
SM01-005-018.00 Steering Column, R & I
SM01-005-019.00 Steering Miter Boxes, R & I (Generation 1)
SM01-005-023.00 Steering Gears, Recondition ("M" Series)
SM01-005-027.00 Troubleshooting Steering Gears ("M" Series)
SM01-005-030.00 Steering Miter Boxes, R & I (Generation 2)
SM01-006-013.00 Torque Generator, Recondition
SM01-006-018.00 Steering Gears, R & I (Generation 1)
SM01-006-019.00 Front Wheel Alignment & Steering Linkage Adjustment (Generation 1)
SM01-006-020.00 Torque Generator, R & I
SM01-006-026.00 Steering Gears, R & I (Generation 2)
SM01-006-027.00 Front Wheel Alignment & Steering Linkage Adjustment (Generation 2)
SM01-010-012.00 Outrigger/Steer Pump, Recondition (JSB Corporation)
SM01-010-020.00 Load Adaptor, Recondition (Outrigger/Steer Pump, Series 92)
SM01-010-021.00 Outrigger/Steer Pump, R & I (Series 92)
SM01-010-022.00 Load Adaptor, R & I (Outrigger/Steer Pump, Series 92)
SM01-010-023.00 Outrigger/Steer Pump, R & I (Series 60)
SM01-010-024.00 Outrigger/Steer Pump, Recondition (Commercial-Intertech)
SM01-010-029.00 Power Steering Pump Priority Valve, Recondition (Commercial-Intertech)
SM01-017-008.00 Clutch, R & I And Recondition
SM01-018-031.00 Transmission, R & I (Series 92 w/Automatic)
SM01-018-032.00 Automatic Transmission, Recondition
SM01-018-041.00 Transmission, Recondition (Eaton/Dana Manual)
SM01-018-043.00 Transmission, R & I (Series 92 w/Manual)
SM01-018-044.00 Transmission, R & I (Series 60 w/Manual – Generation 1)
SM01-018-045.00 Transmission, R & I (Series 60 w/Automatic)
SM01-018-052.00 Transmission, R & I (Series 60 w/Manual – Generation 2)
SM01-019-014.00 Transmission Air Shift Control, Recondition (Main Transmission)
SM01-019-021.00 Transmission Master Control, R & I
SM01-019-022.00 Transmission Slave Control, R & I
SM01-019-023.00 Transmission Master Control, Recondition
SM01-019-032.00 Transmission Slave Control, Recondition
SM01-020-002.00 Suspended Brake Pedal, Recondition
SM01-020-007.00 Suspended Brake Pedal, R & I
SM01-021-003.00 Auxiliary Transmission, Recondition
SM01-021-006.00 Auxiliary Transmission, R & I
SM01-021-010.00 Auxiliary Transmission, Troubleshooting
SM01-022-004.00 U-Joint Installation – Square Flange
SM01-022-005.00 U-Joint Installation – Round Flange

SM01-024-008.00	Rear Axles, Recondition
SM01-025-008.00	Brakes, Recondition (Rockwell/Meritor)
SM01-025-010.00	Brakes, Recondition (Lift Axle)
SM01-027-009.00	Air Dryer, Recondition (Sycon)
SM01-027-028.00	Front Air Brake Chambers, Recondition
SM01-027-056.00	Air Dryer, R & I (Horton)
SM01-027-057.00	Air Dryer, Recondition (Horton)
SM01-027-061.00	Spring Brake Valve, Recondition
SM01-027-066.00	Shift Control Valve, Recondition (Auxiliary Transmission)
SM01-027-067.00	Shift Control Valve, R & I (Auxiliary Transmission)
SM01-027-068.00	Caging Dual Air Brake Chamber
SM01-027-069.00	Dual Air Brake Chamber, Recondition
SM01-027-070.00	Carrier Air System Schematic Diagram (Generation 1 – DDEC Engine)
SM01-027-071.00	Air System Components, R & I (Generation 1)
SM01-027-072.00	Air Dryer, R & I (Sycon)
SM01-027-102.00	Air System Components, R & I (Generation 2)
SM01-027-103.00	Dual Air Brake Chamber, R & I (Midland)
SM01-027-104.00	Lift Axle Brake Chamber, R & I
SM01-027-105.00	Front Axle Brake Chamber, R & I
SM01-027-116.00	Carrier Air System Schematic Diagram (Generation 2 – DDEC Engine)
SM01-027-119.00	Air System Schematic Diagram (Lift Axle w/Dual Air Dryers)
SM01-027-120.00	Air System Schematic Diagram (Lift Axle w/Solo Air Dryers)
SM01-027-121.00	Air System Schematic Diagram (Generation 3 – w/Solo Air Dryer)
SM01-027-122.00	Air System Components, R & I (Generation 3 – w/Solo Air Dryer)
SM01-028-002.00	Rear Wheel Hub & Brake Drum, R & I
SM01-028-003.00	Rear Wheel Hub & Brake Drum, R & I (Lift Axle)
SM01-029-013.00	Rear Axles & Suspension, R & I (Generation 1)
SM01-029-014.00	Lift Axle, R & I
SM01-029-023.00	Rear Axles & Suspension, R & I (Generation 2)
SM01-036-001.00	Selector Valve, Recondition
SM01-036-002.00	Selector Valve, R & I
SM01-039-003.00	Hydraulic System Cleaning Procedure
SM01-039-006.00	Hydraulic Reservoir Filter, R & I (Internal To Reservoir Type)
SM01-039-007.00	Hydraulic Reservoir Filter, Recondition (Internal To Reservoir Type)
SM01-043-044.00	Fifth Outrigger Directional Control Valve, R & I (Solenoid Type)
SM01-044-003.00	Lock Valve, Recondition
SM01-044-007.00	Lock Valve, Recondition (Fifth Outrigger)
SM01-044-013.00	Lock Valve, R & I
SM01-044-014.00	Fifth Outrigger Lock Valve, R & I (Generation 1 – Jack Cylinder w/Lever Control)
SM01-044-021.00	Fifth Outrigger Lock Valve, R & I (Generation 2 – Jack Cylinder w/Lever Control)
SM01-044-024.00	Fifth Outrigger Lock Valve, R & I (Generation 3 – Jack Cylinder w/Switch Control)
SM01-045-007.00	Outrigger Beam Cylinder, Recondition
SM01-045-034.00	Front & Rear Outrigger Beam Assembly, R & I
SM01-045-035.00	Outrigger Beam Cylinder, R & I
SM01-046-012.00	Jack Cylinder, Recondition
SM01-046-016.00	Jack Cylinder, Recondition (Fifth Outrigger)
SM01-046-029.00	Jack Cylinder, R & I
SM01-046-030.00	Fifth Outrigger Jack Cylinder, R & I (Gen 1 – Jack Cylinder w/Lever Control)
SM01-046-038.00	Fifth Outrigger Jack Cylinder, R & I (Gen 2 – Jack Cylinder w/Lever Control)
SM01-046-042.00	Fifth Outrigger Jack Cylinder, R & I (Gen 3 – Jack Cylinder w/Switch Control)
SM01-047-008.00	Outrigger Control Valve, Recondition
SM01-047-012.00	Deceleration Valve, Recondition
SM01-047-013.00	Flow Control Valve, Recondition
SM01-047-014.00	Deceleration Valve, R & I
SM01-047-016.00	Fifth Outrigger Control Valve, R & I
SM01-047-017.00	Front Outrigger Box Control Valves, R & I
SM01-047-018.00	Rear Outrigger Box Control Valves, R & I
SM01-047-025.00	Flow Control Valve, R & I (Cranes w/Hydraulic Radiator Fan)

SM01-047-031.00	Priority Flow Control Valve, R & I
SM01-047-033.00	Priority Flow Control Valve, Recondition
SM01-063-092.00	Radiator Fan Clutch, Recondition
SM01-063-094.00	Radiator Fan Clutch, R & I (Series 92)
SM01-063-095.00	Radiator, R & I (Generation 1 – Series 92)
SM01-063-096.00	Starter, R & I (Series 92)
SM01-063-097.00	Alternator, R & I (Series 92)
SM01-063-098.00	Radiator, R & I (Generation 2 – Series 60)
SM01-063-099.00	Radiator Fan Clutch, R & I (Series 60)
SM01-063-100.00	Starter, R & I (Series 60 – Generation 1)
SM01-063-101.00	Alternator, R & I (Series 60)
SM01-063-102.00	Starter, R & I (Series 60 – Generation 2)
SM01-063-104.00	Radiator, R & I (Generation 3 – w/Hydraulic Radiator Fan)
SM01-066-000.00	Electrical System Wire Identification Code
SM01-066-017.00	Carrier Electrical System Schematic Diagram – Series 92 w/DDEC II (Gen 1)
SM01-066-018.00	Carrier Electrical System Schematic Diagram – Series 92 w/DDEC III (Gen 2)
SM01-066-019.00	Carrier Electrical System Schematic Diagram – Series 60 w/DDEC III (Gen 3)
SM01-066-022.00	Carrier Electrical System Schematic Diagram – Series 60 w/DDEC III (Gen 4)
SM01-066-025.00	Carrier Electrical System Schematic Diagram – Series 60 w/DDEC III (Gen 5)
SM01-066-028.00	Battery, R & I
SM01-069-011.00	Front Tire & Rim, R & I (Front & Lift Axles)
SM01-069-012.00	Dual Rear Tires & Rims, R & I
SM01-071-001.00	Throttle Treadle Assembly, R & I
SM01-071-002.00	Throttle Treadle Assembly, Recondition
SM01-073-001.00	Electronic Gauges, Troubleshooting (Generation 1 – AMETEK/Dixson)
SM01-073-002.00	Electronic Gauges, Troubleshooting (Generation 2 – AMETEK/Dixson)
SM01-079-004.00	Lower Hydraulic Components, R & I (Generation 1)
SM01-079-017.00	Lower Hydraulic Components, R & I (Generation 2)
SM01-079-025.00	Carrier Hydraulic System Schematic Diagram (Generation 2)
SM01-079-032.00	Hydraulic Oil Cooler, R & I
SM01-079-033.00	Lower Hydraulic Components, R & I (Generation 3 – w/Hydraulic Radiator Fan)
SM01-081-035.00	Radiator Fan Motor, R & I
SM01-081-036.00	Radiator Fan Motor, Recondition
SM01-082-005.00	Front Outrigger Box Pin Cylinder, R & I
SM01-082-006.00	Front Outrigger Box Pin Cylinder, Recondition
SM01-082-007.00	Rear Outrigger Box Pin Cylinder, R & I
SM01-082-008.00	Rear Outrigger Box Pin Cylinder, Recondition

AREA 03 UPPER REVOLVING FRAME

SM03-001-060.00 Upper Frame & Turntable Bearing, R & I

AREA 05 HORIZONTAL SHAFTS

SM05-005-013.00	Winch, Recondition (Third Drum – Generation 1)
SM05-005-014.00	Third Drum Winch, R & I (Generation 1)
SM05-005-015.00	Third Drum Winch, R & I (Generation 2)
SM05-005-016.00	Winch, Recondition (Third Drum – Generation 2)

AREA 06 UPPER ENGINE

SM06-044-001.00 Generator & Light Plant Schematic Diagram

AREA 07 HYDRAULIC POWER SUPPLY

SM07-000-113.00 Hydraulic System Schematic Diagram – Carrier (Generation 1)
SM07-006-056.00 Hydraulic Motor, Recondition (Third Drum – Rexroth Series 63)
SM07-006-065.00 Third Drum Hydraulic Motor, R & I (Generation 1)
SM07-006-066.00 Hydraulic Motor, Recondition (Third Drum – Rexroth Series 61)
SM07-006-070.00 Third Drum Hydraulic Motor, R & I (Generation 2)
SM07-018-001.00 Hydraulic System Tube Fittings

AREA 09 TUBULAR BOOM, FLY, & JIB

SM09-001-002.00 Repairing Damaged Tubular Booms, Flys, & Jibs

AREA 18 SPECIAL ATTACHMENTS

SM18-000-001.00 Capscrew Torques
SM18-000-002.00 Bearing, Gear, Shaft, & Housing Inspection
SM18-000-003.00 Crane System Schematics

How To Use This Manual, General Service Instructions, And Safety Procedures

The following information is provided to help guide the user of this manual. An explanation of how this manual is organized, as well as general information and safety considerations which should be understood when performing any service or maintenance procedure, is given. This information is general in nature and should supplement any of the specific procedures in this manual along with a constant awareness of safety and common sense.

How To Use This Manual

This Service Manual is a collection of written procedures which are used to service and maintain a specific crane model. The index, which is called a “Keysheet”, is used to organize the procedures within this manual and serve as a Table Of Contents as well. Each procedure, in this manual, is written so that it can stand alone and typically covers only one procedure. Procedures are given a numerical designation, or “SM Code” Number, (Example: ES01–01–0032.0R for HSC/SCM items or SM01–005–034.00 for LBCE items) which is unique to that procedure and that procedure only. The following is a listing of the general area definitions which are designated by the first digits in the SM Code Number sequence:

General Area Descriptions - HSC/SCM Items

ES00–	Section – 0	General
ES01–	Section – 1	Upper Mechanism
ES02–	Section – 2	Lower Mechanism
ES03–	Section – 3	Control System
ES04–	Section – 4	Hydraulic System
ES05–	Section – 5	Hydraulic Unit
ES06–	Section – 6	Gantry
ES07–	Section – 7	Crane Attachment
ES13–	Section – 13	Electrical System
ES14–	Section – 14	Tightening Torque Table

General Area Descriptions - LBCE Items

SM01 –	Rubber Tire Lower
SM02 –	Crawler Lower
SM03 –	Upper Revolving Frame & Machinery
SM04 –	Vertical Shafts
SM05 –	Horizontal Shafts
SM06 –	Upper Engine
SM07 –	Hydraulic Power Supply
SM08 –	Angle Boom
SM09 –	Tubular Boom
SM10 –	Tagline Winder
SM11 –	Fairleader
SM12 –	Shovel Attachment
SM13 –	Trench Hoe, Logger & Scraper Attachment & Prop Handler
SM14 –	Cab & House Assembly
SM15 –	Rotascope Attachment (Discontinued)
SM16 –	Wire Rope Requirements
SM17 –	Hydraulic Boom And Attachments
SM18 –	Special Attachments
SM19 –	Diesel Pile Hammer (Discontinued)
SM20 –	Tower, Climbing Assembly, Traveling Base & Gantry (Discontinued)
SM21 –	Log Skidder (Discontinued)
SM22 –	Hydraulic Hammer (Discontinued)

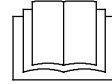
The procedures in this manual are collated by SM Code Number sequence. Use the Keysheet in the front of this manual, the general area descriptions shown previously, and the SM Code title shown on the Keysheet to find the specific procedure required to service the crane.

Throughout this manual, reference is made to the left, right, front, and rear, pertaining to directions and locations. These reference directions are relative to the operator, sitting in the operator's seat, with the upper directly over the front of the lower, unless otherwise stated. (Crawler mounted cranes: upper over the front of the crane with travel motors to the rear.)

Danger, warning, and caution captions as well as special notes are used throughout this manual and on the crane to emphasize important and critical instructions. **If any instruction, caution, warning, or danger labels, decals, or plates become lost, damaged, or unreadable, they must be replaced.** Information contained on such labels, decals, and plates is important and failure to follow the information they contain could result in an accident. Replacement labels, decals, and plates can be ordered through a Link-Belt Distributor. For the purpose of this manual, danger, warning, and caution captions and notes are defined as follows:

NOTES

Note: An operating procedure step, condition, etc. which is essential in order for the process to be completed properly.



This symbol may appear in manuals or on a label on the crane to alert personnel that additional instructions are included in the crane Operator's Manual.

Service Safety And Set Up Guidelines

The following is a list of safety and set up considerations which may apply to any service or maintenance procedure. Review the entire list and understand the type of things you must consider to perform a safe service procedure and then apply these guidelines to each specific service or maintenance procedure.

Service Safety

1. Read and understand the service or maintenance procedure to be performed before beginning work. By reading the procedure ahead of time, you can be sure to have the replacement parts and tools on hand that are required to complete the job.
2. Wear protective gear to prevent injury; hard hat, safety glasses, mask, gloves, steel toed shoes, etc.
3. First aid supplies and a fire extinguisher should be on the job site to assist in an unexpected situation. The location of these items should be known to all as well as access to a telephone for emergencies.
4. Work in a clean, dry, firm, level area whenever possible. Choosing the correct work site can make a big difference on how well the job goes.
5. Use caution around flammable materials. Be aware of all the materials in the work area which are a threat. Also make others aware of volatile materials; post signs if necessary.



Figure 1
Keep hands and tools clear of moving parts.

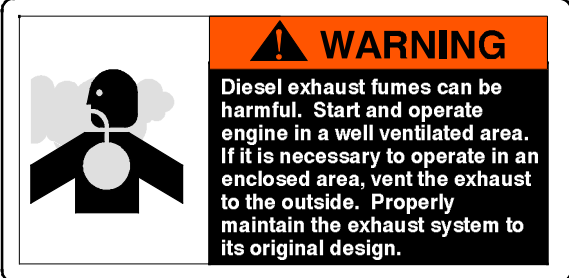


Figure 2
Diesel Exhaust Fumes.

DANGER

An operating procedure, practice, etc. which, if not correctly followed, may result in severe personal injury, dismemberment, or loss of life.

WARNING

An operating procedure, practice, etc. which, if not correctly followed, may result in personal injury.

CAUTION

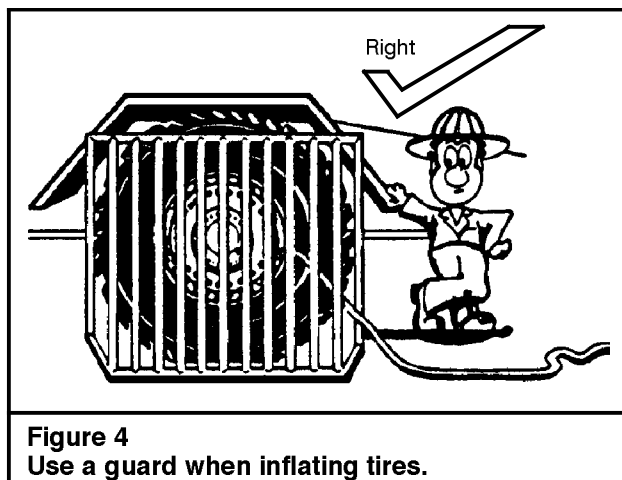
An operating procedure, practice, etc. which, if not correctly followed, may result in damage to or destruction of equipment or property.

DANGER

Do not operate the crane unless you are qualified. Unauthorized operation by untrained personnel could result in an accident. Crane operation is to be performed by a certified operator only.



6. Release all trapped pressure in air and hydraulic circuits before disconnecting any line or component. Shutdown the crane, exhaust all pressure from the crane's air reservoir(s) and work the hydraulic control levers back and forth before servicing the crane.
7. Do not disconnect any hydraulic line from a crane which has its attachment in the air. Trapped pressure may be all that is suspending it. Disconnecting a line could release the trapped pressure, causing the attachment to fall. Lower the attachment to the ground or on to its rest before servicing the crane.
8. Do not work on a crane which is in motion. Fans, belts, gear trains, etc. can catch an unexpected person and quickly dismember them.
9. Do not climb on the attachment or other hard to reach areas. If the steps and/or ladders which are installed on the crane do not provide adequate access to the area of the crane which needs servicing, use a step ladder or other approved device.
10. Pinch points exist between the upper and lower frames. Death or dismemberment may result from personnel caught in these points. Learn where these pinch points are and stay clear of the rotating upper frame.
11. If working in a confined area, always provide adequate ventilation when running the engine(s), using toxic solvents, welding, or any other operation which contaminates the fresh air supply.
12. Post a sign in the operator's cab to alert others that the crane is under service. Starting the crane while it is being serviced could severely injure someone. Crane damage could also occur if systems are operated prematurely. Imagine starting the engine(s) before the oil is replaced!



13. Secure access panels, doors, and machinery hoods when in the open position to ensure they do not fall or slam shut due to wind or accidental disruption.
14. Crane parts may be heavy. Always use an appropriate lifting device to support work. Do not attempt to lift an object without knowing its weight. Get help if necessary.
15. Always use a safety rim cage when inflating or deflating tires. Worn or misassembled parts can "explode" from the assembly causing serious injury. Use a safety rim cage, clip on air chuck, and stand aside when inflating or deflating tires.

Crane Set Up And Disassembly

1. Properly park the crane as described in the Operator's Manual. Park the crane in an area which provides the most comfortable working conditions. However, do not park the crane where it will be an obstruction or an intrusion to traffic, coworkers, or to the public. Keep in mind that a major service procedure, or a repair part which requires a long lead time, could have the crane disabled for an extended period of time.
2. Keep in mind the mess which is sometimes caused by a crane under repair. Oil or other fluid leaks should be contained or prevented. Consider your responsibility of maintaining a safe clean work area and a healthy environment for all.
3. If the crane is equipped with outriggers, it may be safer as well as an advantage to raise and level the crane on outriggers to provide better safety and easier access to areas underneath. Do not work under a crane that is improperly supported.
4. Shutdown the engine(s) per the instructions given in the Operator's Manual.
5. Post a sign in the operator's cab to alert others that the crane is being serviced.



Figure 5
Allow engine to cool before removing the radiator cap.

6. Engines, transmissions, hydraulic systems, etc. generate extreme heat during operation. Temperatures can reach levels which may cause serious burns. Allow the crane to cool before attempting to service it.

WARNING

Engine coolant is hot. Failure to allow engine(s) to sufficiently cool before draining coolant could result in severe burns or other personal injury. Allow the engine(s) and radiator(s) to cool before draining coolant from the radiator(s).

7. Pressure is generated inside the engine's cooling system due to the heat transfer process from the engine(s) to the radiator(s). Do not attempt to open or drain the radiator(s) until it/they has/have had sufficient time to cool. Disconnecting hoses before the engine(s) and radiator(s) has/have cooled is even more dangerous. Wait until the engine(s) and radiator(s) has/have cooled and then drain the radiator(s) before disconnecting any hoses. Properly store or dispose of used coolant.

WARNING

Solvents and cleaning solutions can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all the manufacturer's recommendations concerning solvents and cleaning solutions.

8. Thoroughly clean the area of the crane which is to be serviced. Dirt or other contamination could enter the hydraulic, air, lubricating systems, etc. and cause immediate and/or long term problems.

Cleaning the service area not only prevents contamination problems but it also makes working on the crane easier and sometimes problems are more recognizable.

9. Before beginning any removal or disassembly procedure, take a moment to observe critical features of the assembly which may greatly simplify the installation or assembly process. Label electrical, hydraulic, air, or other connections. Index mark pump, motor, and valve sections. Lightly spray paint or count the threads of adjustment screws. Simple steps such as these can minimize the effort needed to put the crane back in service.

WARNING

Hydraulic oil is under pressure and may be hot. A sudden release of hot oil could cause severe burns and/or other serious injury. Shutdown the engine(s) and exhaust all trapped hydraulic pressure from the system before removing any line or component.

10. Hydraulic systems, while operating, are under high pressure. Even after the crane is shutdown these pressures can remain trapped in the hydraulic lines and system components. Some hydraulic systems utilize an air pressurized reservoir which maintains pressure on the system after the crane is shutdown. It is critical that all residual pressure, which is trapped in the system, be neutralized before disconnecting any line or hydraulic component. Use the following techniques to exhaust trapped hydraulic pressure from the system:
- Lower the attachment to the boom rest, onto blocking, or onto the ground and shutdown the engine(s).
 - Open the drain valves on the air system reservoir(s), if equipped, to bleed the air system pressure.
 - Relieve any residual or precharge pressure by pushing the button on the pressure relief valve, on the hydraulic reservoir, if equipped. Otherwise, loosen the filler cap 1/4 turn.
 - Turn the ignition switch to the **ON POSITION**, but **DO NOT START THE ENGINE**.
 - Operate the steering control(s) back and forth repeatedly until steering becomes hard. (On cranes equipped with emergency steering system, it will take several rotations of steering wheel before steering becomes hard.)
 - Work the crane control levers and outrigger switches, if equipped, back and forth several times.
 - Turn ignition switch to the **OFF POSITION**.

- h. Check that all control levers are in the neutral position and move the gate lock lever, if equipped, to the "STOP" position.
- i. When pressure is fully relieved, close the drain valves on the air system reservoir(s), if equipped.



WARNING

Air lines may contain high pressure. Opening lines and fittings before relieving air pressure may result in serious injury. Shutdown the engine(s) and drain the air system reservoir(s) before opening any line or fitting.

11. Air system circuits, like hydraulic circuits, may contain high pressures also. Although the threat of a hot working fluid does not exist, highly pressurized lines and components can possibly "fly off" if lines are disconnected before the system pressure is relieved. Open the drain valve on the air system reservoir(s) to exhaust system pressure before working on the crane.



WARNING

Use care not to cause sparks at the battery terminals while disconnecting or connecting the battery. Battery gasses are volatile and could be ignited by a spark or flame causing the battery to explode. Keep the area around the battery well ventilated and disconnect the negative side of the battery first, with the ignition switch "OFF", to minimize hazard.

Battery posts, terminals, and related accessories contain lead and lead compounds. Eating or smoking with lead residue on hands may cause lead poisoning. Wash hands after handling lead products.

12. When working on electrical circuits, disconnect the battery to minimize shock, burn, spark, or other hazard. When disconnecting the battery, confirm that the ignition switch is in the "OFF" position. Disconnect the negative side of the battery first to minimize the potential for sparks at the battery. Battery gases which are exposed to such sparks, could cause an explosion. Likewise when connecting the battery, confirm that the ignition switch is in the "OFF" position and install the positive cable(s) first, and the negative connection(s) last.
13. It is a good practice when disassembling hydraulic components to lay the parts out in the order that they were disassembled. Keeping the parts in this order during disassembly, cleaning, and inspection will aid in the assembly process.

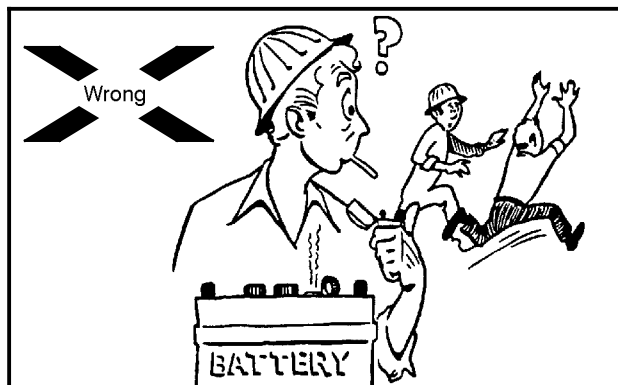


Figure 6

Do not use an open flame near the battery.

Welding

1. When making repairs which require welding, disconnect any electronic equipment (such as rated capacity limiters and engine computers) to prevent damage to them. Use the battery disconnect switch(es), if equipped.
2. Be aware of systems adjacent to areas being welded. Residual heat from the welding process could cause damage to other components. Heat may also vaporize materials which may become toxic or volatile.
3. Remove paint from areas to be welded to prevent toxic fumes.
4. The ground connection should be within 3 feet (1 m) of the welded parts.
5. Connect the ground to the lower, if welding on the lower, or to the upper if welding on the upper. Electrical current through the turntable bearing could cause an arc which could damage it.
6. Do not position the ground connection where seals or bearing, as in transmissions or valves, will be between it and the welded parts.
7. Remove any flammable materials from the area.
8. Use the appropriate setting on the welder for the size of the welding operation. Do not use more than 200 Volts continuously.

Cleaning And Inspection



WARNING

Solvents and cleaning solutions can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all the manufacturer's recommendations concerning solvents and cleaning solutions.

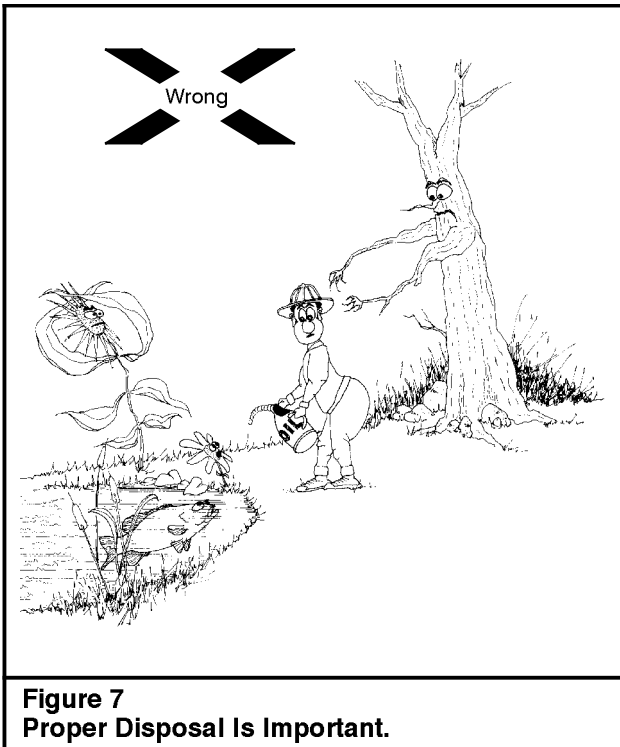


Figure 7
Proper Disposal Is Important.

1. All components should be thoroughly cleaned with an approved cleaning solvent, air dried and carefully inspected for damage, wear, and/or corrosion.
2. All Loctite[®] or other sealant residue should be removed from threads of hardware and parts that are going to be reused.
3. All "soft parts", such as seals, gaskets, back up rings, and o-rings, should be replaced.
4. Replacement of bearings and bushings is generally a good preventive maintenance measure. Even though a bearing or bushing seems to be intact and is functioning properly, its life span is limited. Replacing a simple bearing or bushing while the opportunity is at hand could save a complete component failure later.
5. In the event of major defects, contact factory personnel for directions whether to repair or replace any major component.

Crane Assembly

1. Loosely assemble parts to ensure all parts are in place and fasteners started before beginning torquing procedure. Always use a cross torquing sequence to ensure even and uniform installation.

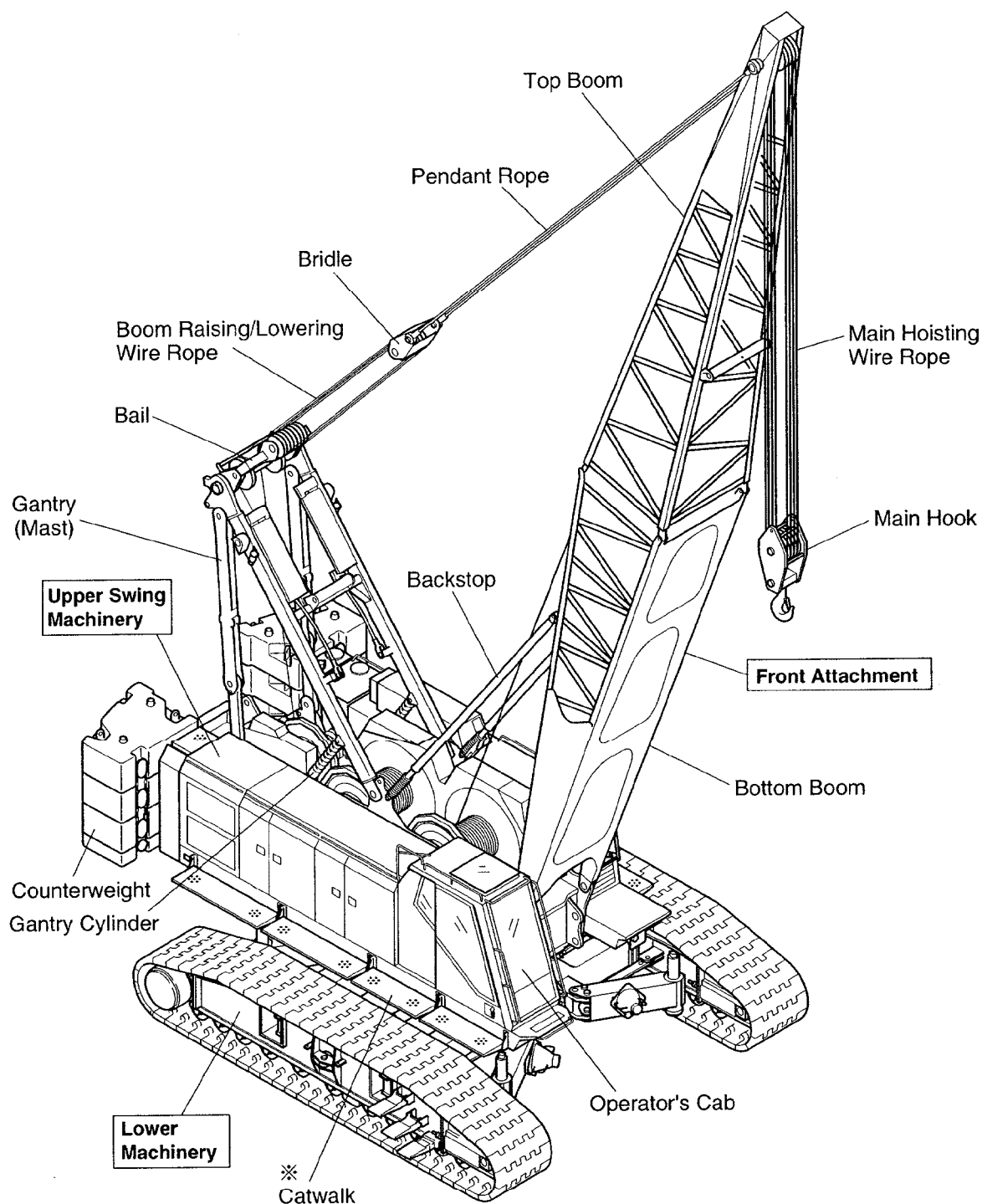


WARNING

Lubricants, sealants, joint and thread locking compounds, etc. can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all manufacturer's recommendations concerning these products.

2. Unless otherwise stated, torque all fasteners per the instructions given in SM Code Area 18-000.
3. When installing hydraulic hoses, lines, and fittings, use two wrenches to ensure the hoses and lines are not twisted. One wrench must be on the male fitting, the other wrench on the female fitting.
4. Unless otherwise stated, torque all hydraulic fittings per the instructions given in SM Code Area 07-018.
5. Check all fluid levels before returning the crane to service; hydraulic reservoir oil level, transmission fluid level, engine(s) oil level, etc. Add oil as required. See Operator's Manual and/or engine(s) manufacturer's manual(s) for correct type of fluids and procedures.
6. Always replace guards, grilles, and other types of protective shields. Also, confirm that any systems which were disconnected such as load indicating systems, anti-two block devices, control cables, etc. are functioning properly before returning the crane to service.
7. Start the appropriate engine and let it idle for five minutes. Inspect the connections on the hydraulic, air, transmission, etc. lines for leaks. Repair if needed.
8. Check that all hydraulic, air, and electrical functions are operating normally before returning the crane to service.
9. After crane is assembled, refer to the Operator's Manual for any periodic type of adjustments which may have been affected by the service procedure.
10. Properly dispose of any used oils, solvents, cleaners, etc.

1 Crane Main Body External View And Names



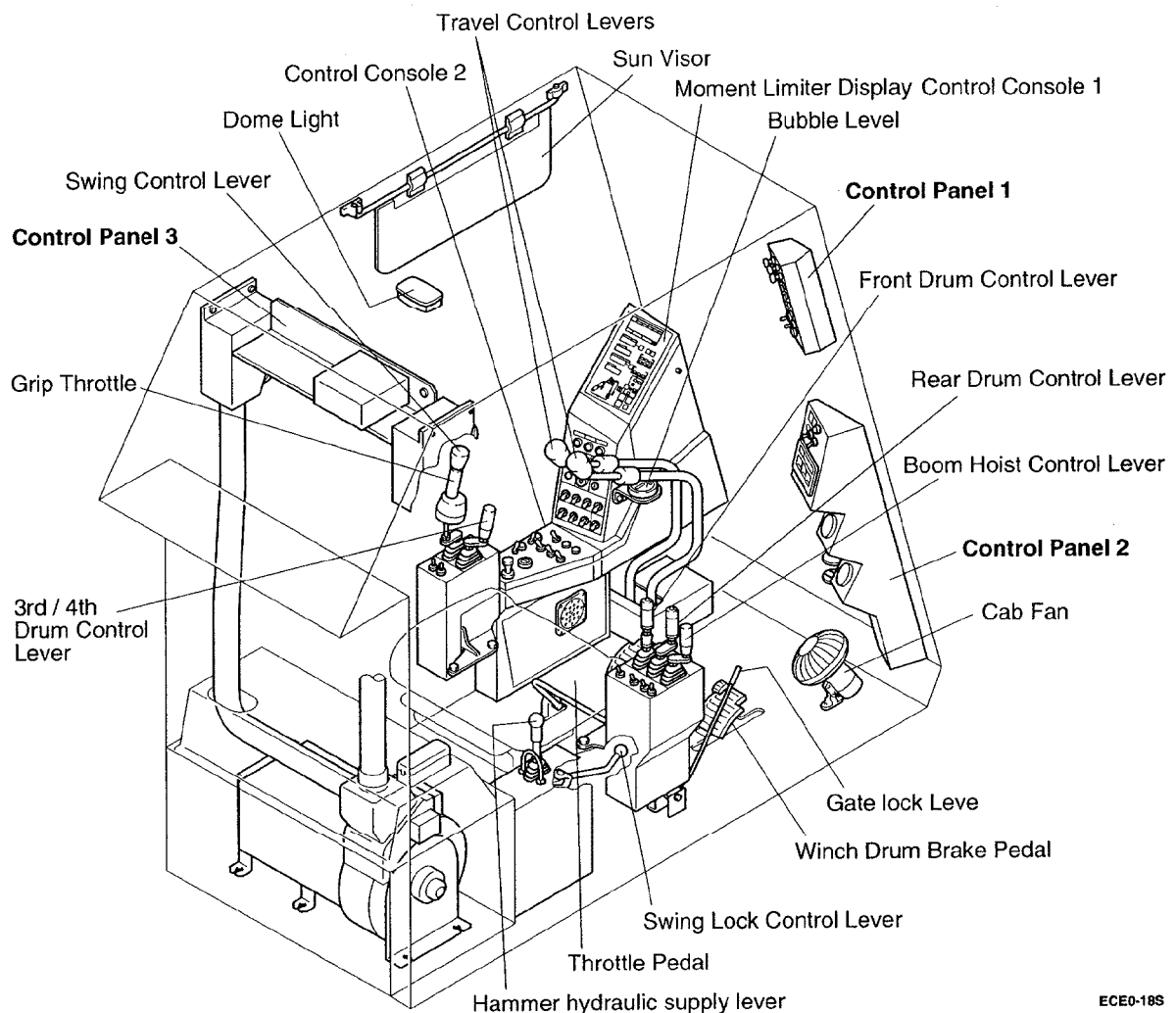
ECE0-16S

※ : Indicates options.

- For hydraulic equipment layout, refer to ES05-01-00--in this manual.
- For electric equipment layout, refer to ES13-10-00--in this manual.

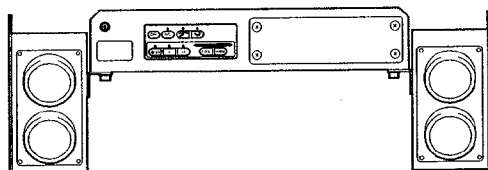
2 Upper Machinery

2.1 Operating Equipment Inside Operator's Cab

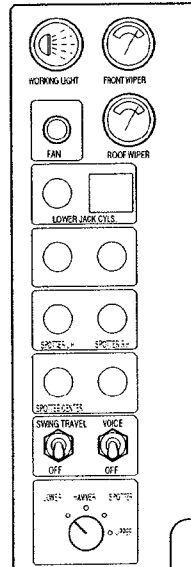


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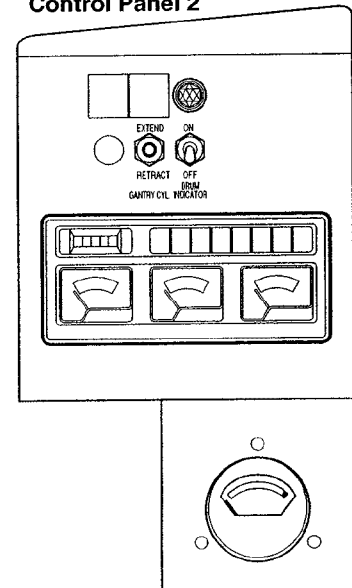
Control Panel 3



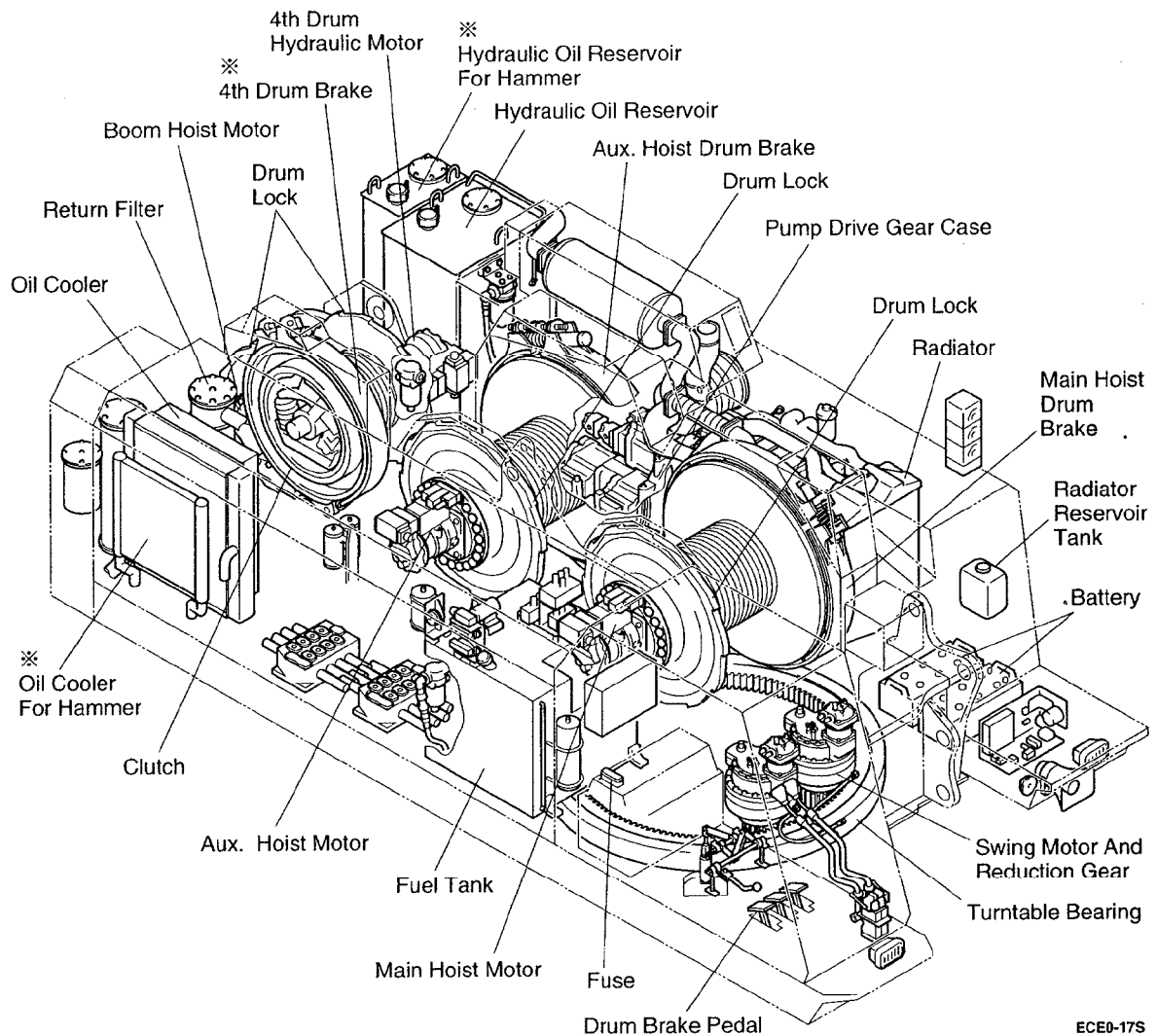
Control Panel 1



Control Panel 2



2.2 General Equipment Of Upper Machinery



3 Lower Machinery

