

SERVICE MANUAL

This Manual has been prepared for and is considered part of -

RT535E

Crane Model Number

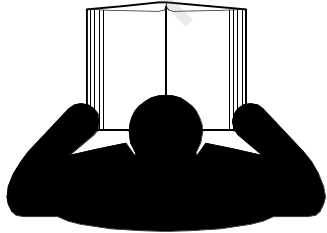
This Manual is divided into the following Sections:

SECTION 1	INTRODUCTION
SECTION 2	HYDRAULIC SYSTEM
SECTION 3	ELECTRIC SYSTEM
SECTION 4	BOOM
SECTION 5	HOIST AND COUNTERWEIGHT
SECTION 6	SWING SYSTEM
SECTION 7	POWER TRAIN
SECTION 8	UNDERCARRIAGE
SECTION 9	LUBRICATION

NOTICE

The crane serial number is the only method your distributor or the factory has of providing you with correct parts and service information.

The crane serial number is stamped on the top of the outrigger box. **Always furnish crane serial number** when ordering parts or communicating service problems with your distributor or the factory.



! WARNING

To prevent death or serious injury:

- Avoid unsafe operation and maintenance.
- This crane must be operated and maintained by trained and experienced personnel. Manitowoc is not responsible for qualifying these personnel.
- Do not operate or work on this crane without first reading and understanding Operator's Manual and Rating Plate supplied with crane.
- Store Operator's Manual in holder provided on crane.
- Attach laminated Capacity Charts supplied with crane to chain in operator's cab.
- If Operator's Manual or Capacity Charts are missing from cab, contact your distributor for new ones.

Table 1-5
Torque Values For Metric Fasteners With No Special Lubrication - Coarse Threads

Bolt Diameter - Metric															
TORQUE VALUES (Nm)															
Grade	M4 0.157	M5 0.197	M6 0.236	M7 0.276	M8 0.315	M10 0.394	M12 0.472	M14 0.551	M16 0.630	M18 0.709	M20 0.787	M22 0.866	M24 0.945	M27 1.06	M30 1.18
8.8	3.1	6.5	11	19	27	53	93	148	230	391	447	608	774	1134	1538
	2.8	5.9	10	17	25	49	85	136	212	294	413	562	714	1046	1420
10.9	4.5	9.2	16	26	38	75	130	212	322	455	629	856	1089	1591	2163
	4.1	8.5	14	24	35	69	120	195	298	418	581	790	1005	1469	1997
12.9	5.4	11	19	31	45	89	156	248	387	532	756	1029	1306	1910	2595
	4.9	10	17	28	42	83	144	228	357	490	698	949	1206	1763	2395

NOTE 1: Torque values for fine threads are 8% higher.

Table 1-6
Torque Values For Metric Fasteners With No Special Lubrication - Coarse Threads

Bolt Diameter - Metric															
TORQUE VALUES (Pounds - Foot)															
Grade	M4 0.157	M5 0.197	M6 0.236	M7 0.276	M8 0.315	M10 0.394	M12 0.472	M14 0.551	M16 0.630	M18 0.709	M20 0.787	M22 0.866	M24 0.945	M27 1.06	M30 1.18
8.8	2.3	4.8	8.1	14.0	20	39	69	109	170	235	329	448	548	836	1134
	2.1	4.3	7.4	12.5	18	36	63	100	156	217	304	414	526	771	1047
10.9	3.3	6.8	11.8	19.0	29	55	96	156	237	335	464	631	803	1173	1594
	3.0	6.3	10.3	17.6	26	51	88	144	220	308	428	582	741	1083	1472
12.9	4.0	8.1	14.0	23.0	33	66	115	183	285	392	557	758	963	1408	1913
	3.6	7.4	12.5	20.6	31	61	106	168	263	361	514	699	889	1299	1765

NOTE 1: Torque values for fine threads are 8% higher.

WIRE ROPE

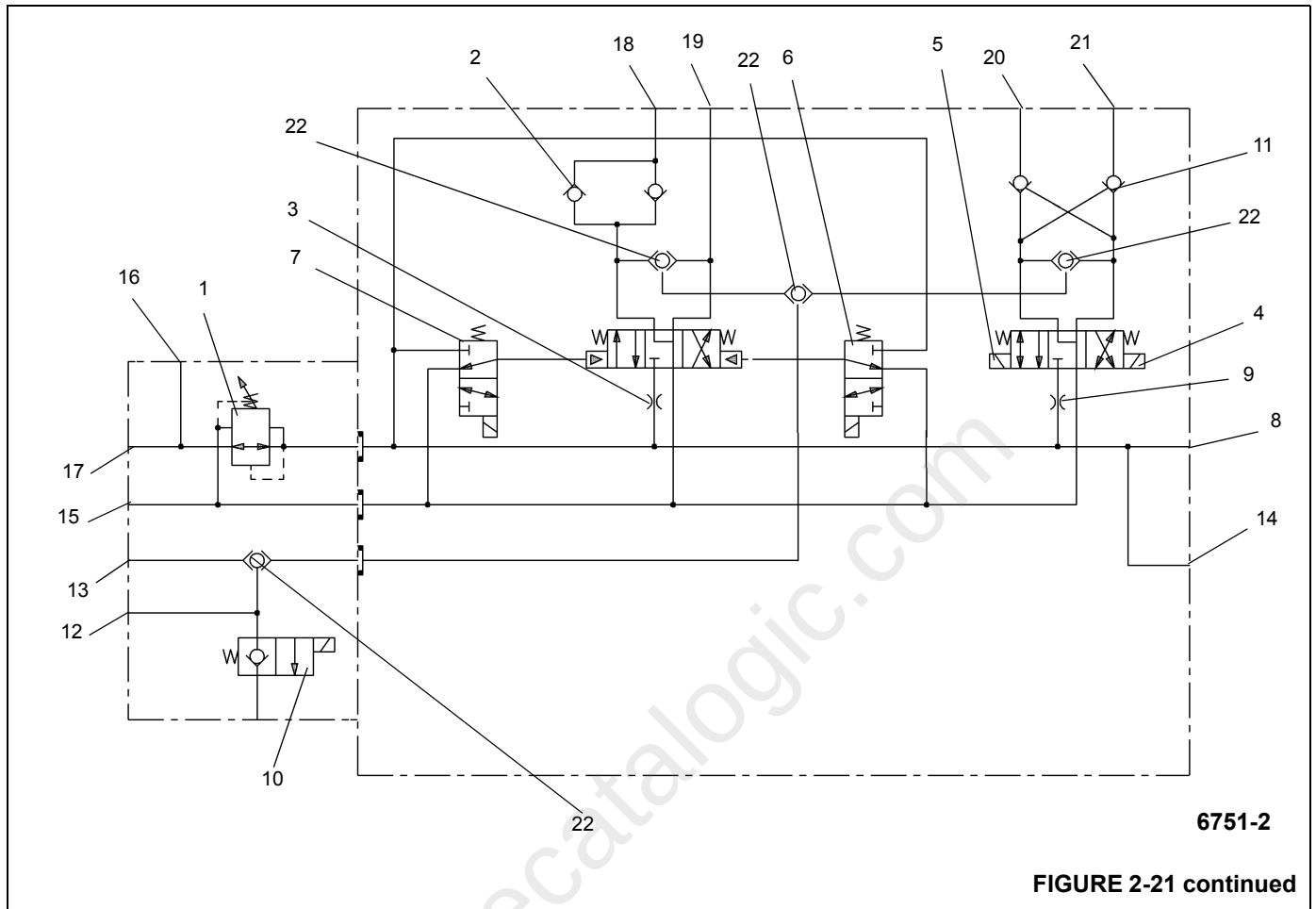
General

The following information is a compendium of information from various wire rope manufacturers and includes inspection, replacement, and maintenance guidelines for wire rope as established by ANSI/ASME B30.5, federal regulations, and Grove Worldwide. The inspection interval shall be determined by a qualified person and shall be based on such factors as expected rope life as determined by experience on the particular installation or similar installations, severity of environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads. Periodic Inspections need not be at equal calendar intervals and should be performed at shorter time intervals as the wire rope approaches the end of its useful life. A periodic inspection shall be performed at least once a year.

The following provides inspection and maintenance procedures for wire ropes used on Grove products (e.g. wire rope used as load lines [hoisting cables], boom extension and retraction cables, pendant cables, tow winch cables, and hook block tie down cables).

Environmental Conditions

The life expectancy of wire rope may vary due to the degree of environmental hostility and other conditions to which these mechanical devices are subjected. Variation in temperature, continuous excessive moisture levels, exposure to corrosive chemicals or vapors or subjecting the wire rope to abrasive material may shorten normal wire rope life. Frequent/periodic inspections and maintenance of your wire rope is recommended for preventing premature wear and to insure long-term satisfactory performance.



Item	Description
1	Pressure Reducing Valve - PR1
2	Check Valve - CV1
3	Orifice - ORF1
4	Solenoid Valve - Rear Steer S1
5	Solenoid Valve - Rear Steer S2
6	Solenoid Valve - SV2
7	Solenoid Valve - SV1
8	Gauge Port - G2
9	Orifice - ORF2
10	Solenoid - SF1
11	Check Valve - CV4

Item	Description
12	Load Sense - LS0
13	Load Sense - LS1
14	Port ALO - To Axle Lockout Valve
15	Port T - Tank
16	Port G1 - Gauge Port
17	Port P - Pressure From Pump #1
18	Port A - Outrigger Retract
19	Port B - Outrigger Extend
20	Port RSA - Left Rear Steer
21	Port RSB - Right Rear Steer
22	Load Sense Shuttle valve

CYLINDERS

General

This subsection provides descriptive information for all the hydraulic cylinders used on this crane. The description of the cylinder given here is for the cylinder itself. For information on how the cylinder functions in the individual circuits, refer to the Description and Operation of that circuit.

Table 2-3
Wear Ring Gap

Head (or Piston) Size		Wear Ring Gap	
Inch	mm	Inch	mm
1 to 4.75	25.4 to 120.7	0.125	3.18
5 to 10.0	127.0 to 254.0	0.187	4.75
greater than 10.0	greater than 254.0	0.250	6.35

Surface Protection for Cylinder Rods

Steel cylinder rods include a thin layer of chrome plating on their surfaces to protect them from corroding. However, chrome plating inherently has cracks in its structure which can allow moisture to corrode the underlying steel. At typical ambient temperatures, hydraulic oil is too thick to penetrate these cracks. Normal machine operating temperatures will allow hydraulic oil to warm sufficiently to penetrate these cracks and if machines are operated daily, protect the rods. Machines that are stored, transported, or used in a corrosive environment (high moisture, rain, snow, or coastline conditions) need to have the exposed rods protected more frequently by applying a protectant. Unless the machine is operated daily, exposed rod surfaces will corrode. Some cylinders will have rods exposed even when completely retracted. Assume all cylinders have exposed rods, as corrosion on the end of the rod can ruin the cylinder.

It is recommended that all exposed cylinder rods be protected using Boeshield® T-9 Premium Metal Protectant. Manitowoc CraneCARE has Boeshield® T-9 Premium Metal Protectant available in 12 oz. cans that can be ordered through the Parts Department.

NOTE: Cylinder operation and inclement weather will remove the Boeshield® protectant; therefore, inspect machines once a week and reapply Boeshield® to unprotected rods.

Leakage Check

A hydraulic cylinder should not be disassembled unless it is essential. The following checks will provide a means of determining if a cylinder has a faulty or leaking piston seal.

Maintenance

General

There must be a gap between the ends of each wear ring when it is installed onto the piston (as applicable) or head. In addition, each wear ring gap is to be located as follows: Divide 360 degrees by the number of wear rings on the component. The resulting value is the number of degrees each wear ring gap is to be located with respect to each other.

The approximate wear ring gaps are as follows:

1. Extend the rod to its maximum stroke. Remove the retract hose from the cylinder. Cap the retract hose.



DANGER

Ensure pressure is applied to the piston side of the cylinder only and the retract hose is capped.

2. Apply hydraulic pressure to the piston side of the cylinder and observe the open cylinder port for leakage. If leakage is observed, the seals in the cylinder must be replaced.
3. Fully retract the cylinder rod (except the telescope cylinder). Remove the extend hose from the cylinder. Cap the extend hose.



DANGER

Ensure pressure is applied to the retract (rod) side of the cylinder only and that the extend hose is capped.

4. Apply hydraulic pressure to the retract (rod) side of the cylinder and observe the open cylinder port for leakage. If leakage is observed, the seals in the cylinder must be replaced.
5. Reconnect all cylinder ports.

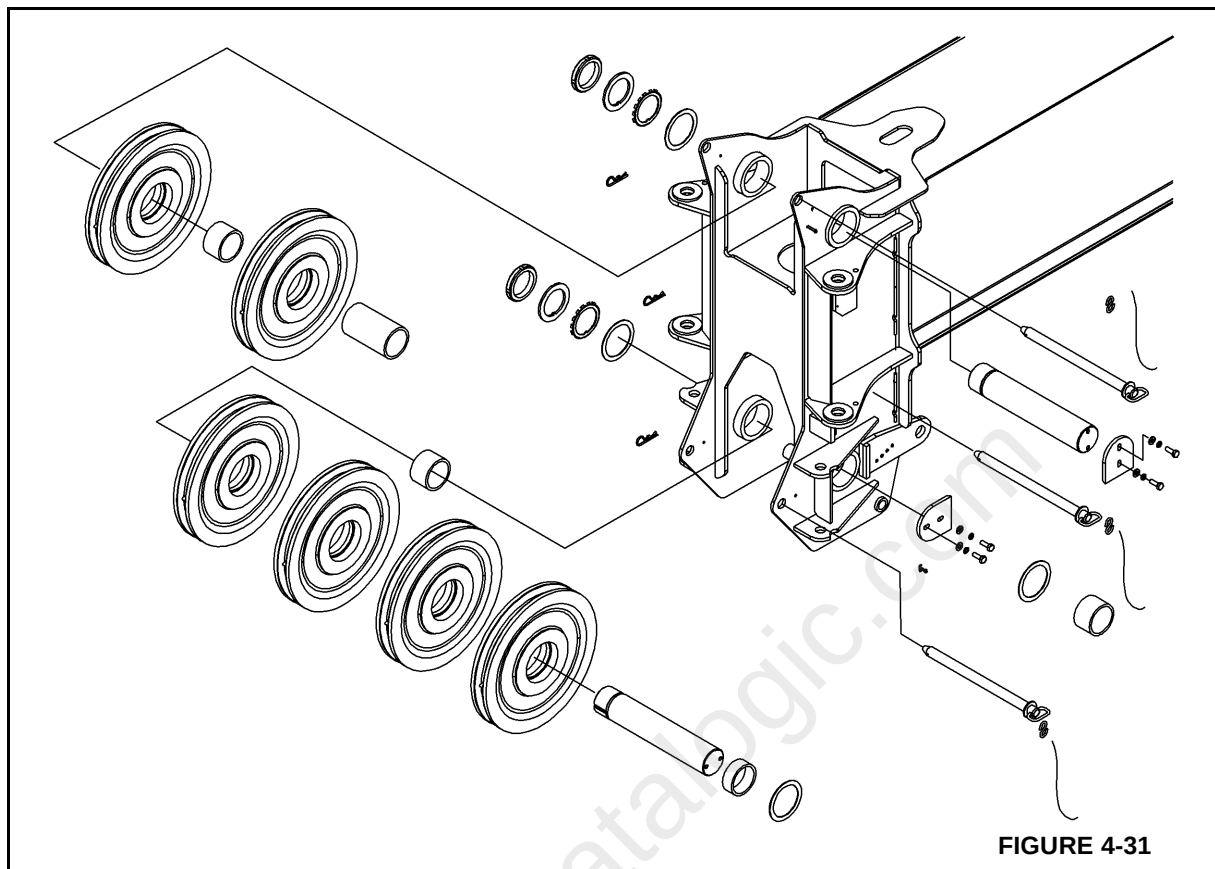


FIGURE 4-31

RT535E SERVICE MANUAL BOOM ASSEMBLY PROCEDURE

Assemble Cylinder to Fly Section



CAUTION

When adjusting cables, hold the cable end and turn the nut. do not turn cable.

Turning or twisting of the cable while adjusting will result in damage or failure of cable.

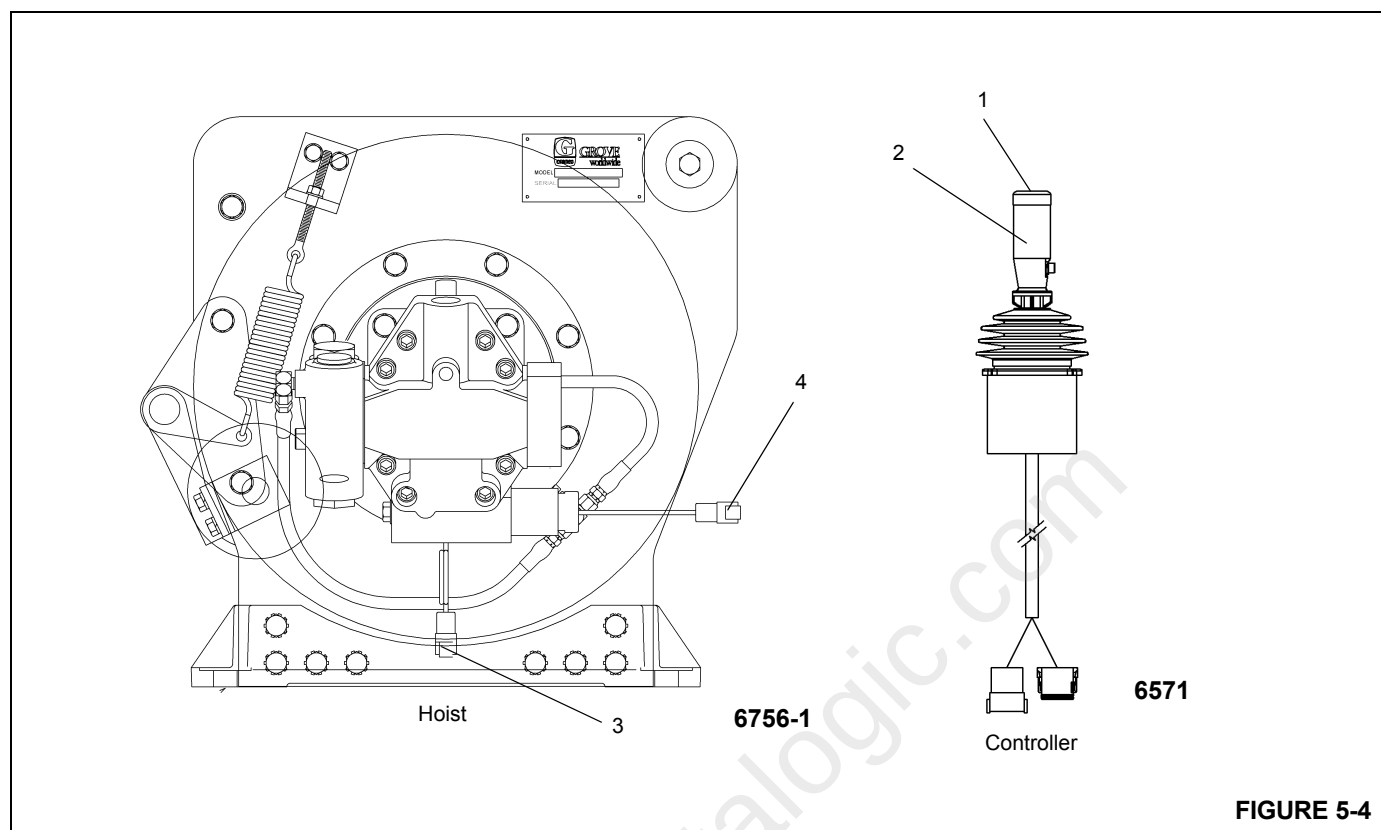
Install cables in their natural untwisted condition.

NOTE: Apply Loctite 242 to the threads of all attaching hardware except cable ends and cable lock nuts.

Apply multipurpose grease (MPG) to all wear surfaces.

Use standard torque values specified in Section 1 of this Manual unless otherwise specified.

NOTE: Wear Pads. When installing upper and lower side wear pad, use shims as necessary so wear pad is within 1.52 mm (0.06 inch) from side plate of next inner section. Use equal number of shims on each



Item	Description
1	Thumb Thumper
2	Controller

Item	Description
3	Rotation Sensor Connection
4	Two Speed Solenoid Connection

Two Port Water Swivel

Description

The two port water swivel allows engine coolant to flow from the carrier-mounted engine to the hot water heater in the operator's cab. Through an internally drilled passage in the 12 port hydraulic swivel spool, coolant is transferred to a circumferential groove on the water spool exterior. This groove corresponds with a mating port on the outer case of the water swivel. The spool grooves are separated by a quad ring/teflon bronze ring seal. The lip seal prevents coolant from leaking externally. Return engine coolant flow from the hot water heater is accomplished in the same manner through the opposite port of the water swivel.

Maintenance

Removal

1. Perform steps 1 thru 4 of HYDRAULIC SWIVEL - REMOVAL in this section.
2. Remove the electrical swivel. Refer to ELECTRICAL SWIVEL - REMOVAL in this section.
3. Tag and disconnect the lines from the case of the water swivel. Cap or plug all lines and openings.
4. Remove the four capscrews and washers securing the water swivel and electrical swivel center post to the hydraulic swivel. Remove the water swivel case and center post.

Disassembly

NOTE: Any maintenance requiring disassembly of the water swivel should include replacement of all seals and rings.

CAUTION

When removing seals and rings, avoid scratching grooved and gland surfaces.

NOTE: Aligning discarded seals and rings in the order of disassembly will assist with installation of new seals and rings.

1. Remove the seals and rings from the spool.

Cleaning and Inspection



DANGER

Cleaning solvents can be toxic, flammable, an irritant to the skin, or give off harmful fumes. Avoid prolonged skin contact, inhalation of vapors, or smoking. Failure to comply can result in injury or death to personnel.

1. Clean the spool and case with a suitable solution and dry with compressed air. Plug all ports with plastic caps.
2. Check the spool and inside of the case for scratches, grooves, scoring, etc. If any grooves have developed with a depth of 0.127 mm (0.005 in) the unit should be replaced.

Assembly

NOTE: Lubricate the interior of the swivel to prevent rusting from condensation.

1. Lubricate the spool, seals, and rings.

CAUTION

When installing seals and rings, avoid stretching seals or scratching grooved or gland surfaces.

2. Install new seals and rings on the spool.

CAUTION

Proper alignment when installing the case is required. Do not force the spool into the case.

3. Insert the spool into the barrel.

Installation

1. Install the water swivel on top of the hydraulic swivel. Secure the water swivel and the electrical swivel center post with the capscrews and washers.
2. Connect the lines to the swivel case as tagged during removal.
3. Install the electrical swivel. Refer to ELECTRICAL SWIVEL - INSTALLATION in this Section.
4. Perform steps 8 and 9 of HYDRAULIC SWIVEL - INSTALLATION in this Section.
5. Activate all systems, cycle all functions, and observe for proper operation and any leakage.

Outrigger Control Valves

Description

There are four valve assemblies responsible for controlling the outrigger system, the integrated outrigger/rear steer valve, the front and rear outrigger control manifolds, and the pilot operated check valves.

NOTE: For a more detailed description and maintenance of the valves, refer to Valves in Section 2 - HYDRAULIC and PRESSURE SETTINGS.

Pilot Operated Check Valve

The pilot operated check valves are located in the outrigger stabilizer port blocks. The check valve provides two

functions; the first function is a holding valve, the second function provides a thermal relief of the stabilizer.

Integrated Outrigger/Rear Steer Manifold

The integrated outrigger/rear steer valve is mounted on the frame center section to the rear of the front axle. Refer to Section 2 - HYDRAULIC and PRESSURE SETTINGS.

Outrigger Control Manifold

The front and rear outrigger control manifolds are located on the respective outrigger boxes. Each manifold consists of four 2 way solenoid valves.

Full Version Available

Grove RT535E Rough Terrain Crane Service Manual

Grove RT535E rough terrain crane service manual, with repair procedures, adjustments and troubleshooting for the main systems. Instant PDF download.

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