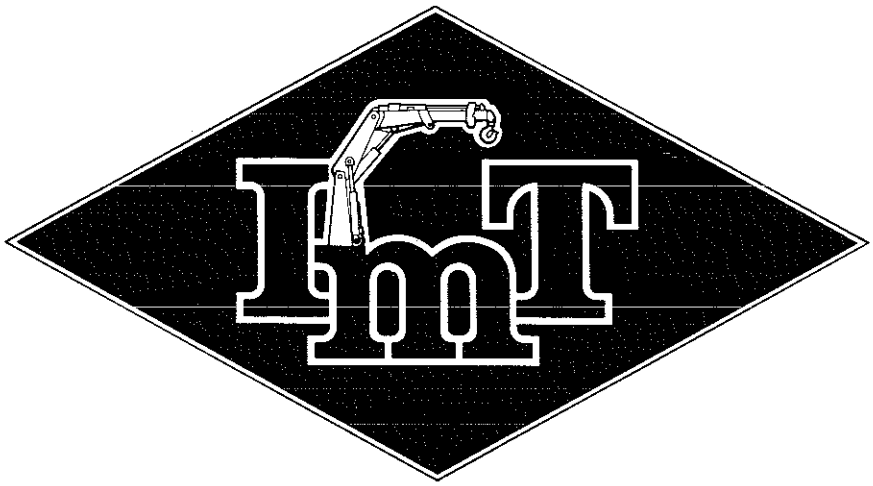
5016 CRANE
5016-20 CRANE



IOWA MOLD TOOLING CO., INC.
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S A SUDBURY COMPANY

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Introduction - Read Carefully!

This volume deals with information applicable to your particular crane. For operating, maintenance and repair instructions, refer to Volume 1, *OPERATION, MAINTENANCE AND REPAIR*. Volume 1 contains the following information:

SECTION 1. OPERATION
SECTION 2. MAINTENANCE
SECTION 3. REPAIR
SECTION 4. INSTALLATION - CHASSIS PREPARATION
SECTION 5. APPENDIX

We recommend that Volume 2, *PARTS AND SPECIFICATIONS* be kept in a safe place in the office.

This manual is provided to assist you with ordering parts for your IMT truck-mounted articulating crane. It also contains additional instructions regarding your particular installation.

Warranty of this unit will be void on any part of the unit subjected to misuse due to overloading, abuse, lack of maintenance and unauthorized modifications. No warranty - verbal, written or implied - other than the official, published IMT new machinery and equipment warranty will be valid with this unit.

It is the user's responsibility to maintain and operate this unit in a manner that will result in the safest working conditions possible.

In addition, it is also the user's responsibility to be aware of existing Federal, State and Local codes and regulations governing the safe use and maintenance of this unit. Listed below is a publication that the user should thoroughly read and understand.

ANSI/ASME B30.22
ARTICULATING BOOM CRANES
The American Society of Mechanical Engineers
United Engineering Center
345 East 47th Street
New York, NY 10017

Three means are used throughout this manual to gain the attention of personnel. They are NOTE's, CAUTION's and WARNING's and are defined as follows:

NOTE

A NOTE is used to either convey additional information or to provide further emphasis for a previous point.

CAUTION

A CAUTION is used when there is the strong possibility of damage to the equipment or premature equipment failure.

WARNING

A WARNING is used when there is the potential for personal injury or death.

Treat this equipment with respect and service it regularly. These two things can add up to a safer working environment.

Section 1. SPECIFICATIONS

1-1. GENERAL

	5016 Crane	5016-20 Crane
Crane Rating	50,000 ft.-lbs. 6.91 Ton-meters	50,000 ft.-lbs. 6.91 Ton-meters
Reach - from centerline of rotation	16'-0" 4.88 m	20'-0" 6.10 m
Hydraulic Extension	60" 152.4 cm	60" 152.4 cm
Manual Extension	---- ----	48" 121.9 cm
Lifting Height - from base of crane	18'-5" 5.61 m	22'-4" 6.81 m
Weight of Crane	1,700 lbs. 771 kg.	1,825 lbs. 828 kg.
Outrigger span (required option) crane side from centerline of chassis	90" 228.6 cm	90" 228.6 cm
opposite crane side from centerline of chassis	48" 121.9 cm	48" 121.9 cm
Storage Height - crane only	40-1/2" 102.9 cm	40-1/2" 102.9 cm
Mounting Space Required - for crane base	19" x 27-1/2" 48.3 cm x 69.9 cm	19" x 27-1/2" 48.3 cm x 69.9 cm
Tie-down Bolt Pattern	14-3/4" x 14-3/4" on center 27.5 cm x 27.5 cm on center	14-3/4" x 14-3/4" on center 27.5 cm x 27.5 cm on center
Horizontal Center of Gravity - from centerline of rotation	26" 66.0 cm	26" 66.0 cm
Vertical Center of Gravity - from bottom of base	18" 45.7 cm	18" 45.7 cm
Optimum Pump Capacity	7 U.S. Gallons/minute 24.5 liters/minute	7 U.S. Gallons/minute 24.5 liters/minute
Design Factors - pins and hydraulics	4 to 1	4 to 1

1-2. PERFORMANCE CHARACTERISTICS

Rotation - 450° (7.85 Rad.)	60 Seconds
Lower Boom Elevation - -10° to +80° (-0.17 Rad to +1.40 Rad.)	16 Seconds
Extension Cylinder - 60" (152.4 cm)	11 Seconds

1-3. CYLINDERS

	Bore	Stroke
Lower Boom Cylinder	5" 12.7 cm	21-1/8" 53.7 cm
Extension Boom Cylinder	2-1/2" 6.4 cm	60" 152.4 cm

1-4. POWER SOURCE

Integral-mounted hydraulic pump and PTO application. Other standard power sources may be used - minimum power required is 13 horsepower based on 7 GPM at 2,500 PSI (26.5 liters/min. at 175.7 kg/cm²).

1-5. ROTATION SYSTEM

Turntable bearing powered by a high-torque hydraulic motor through a ring-and-pinion type spur-gear train. Total gear reduction is 43:1.

1-6. CYLINDER HOLDING VALVES

The base end of the extension cylinder is equipped with a pilot operated locking holding valve to prevent sudden cylinder collapse in the event of a hose or other hydraulic failure.

The extend side of the lower boom cylinder is equipped with a 10-GPM counter-balance valve. The valve serves several functions. First, it is a holding valve. Secondly, it is so constructed that it will control the lowering function and allow that motion to be feathered while under load. Finally, if a hose breaks, the only oil loss will be that in the hose.

1-7. CAPACITY ALERT SYSTEM

A pressure switch mounted on the extend side of the lower boom cylinder and connected electrically to the lift side of the winch, the extend side of the extension boom and the down side of the lower boom, provides a capacity alert system. If the operator tries to pick up a load in excess of the crane capacity, the winch lift, extension out and lower boom down functions will not operate. To relieve the condition, the winch can be lowered or the extension boom retracted.

1-8. WINCH

The winch is powered by a hydraulic motor through a 27:1 worm gear arrangement with a mechanical brake. Line speed is 21 ft./min. (6.4 m/min.) at optimum oil flow of 7 GPM (26.5 liters/min.) and 1-part line - 11 ft./min. (3.4 m/min.) with a 2-part line. Maximum single line lifting capacity of the winch is 4,300 lbs. (1,950 kg.). The winch is equipped with 100' (30.5 m) of 3/8" (0.95 cm) 6 x 25 FW PRF RRL IWRC XIPS wire rope. Nylon sheaves are located at the tip of the extension boom. The ratio of winch drum and sheave pitch diameter to wire rope diameter is 19.7:1 for the winch drum, 18:1 for the snatch-block and boom tip sheave.

1-9. HYDRAULIC SYSTEM

Open-centered, full-pressure system that requires 7 GPM (26.5 liters/min.) optimum oil flow at 2,500 PSI (175.7 kg/cm^2). Four-spool, electric, remote, stack-type control valve with a 30'-0" (9.14 m) control cable. System includes separate oil reservoir, suction- and return-line filter and control valve.

1-10. MINIMUM CHASSIS SPECIFICATIONS

Body Style	Conventional Cab	Conventional Cab
Wheel Base	391 cm	154"
Cab to Axle	213 cm	84"
Frame Section Modulus	196.7 cc	12"^{3}
R B M	6,913 kg-m	600,000 in. lbs.
Front Axle Rating	2,722 kg.	6,000 lbs.
Rear Axle Rating	5,897 kg.	13,000 lbs.
Transmission	4-speed	4-speed

In addition to these specifications, heavy-duty electrical and cooling systems and dual rear wheels are required. It is recommended that the vehicle be equipped with an electric engine tachometer, auxiliary brake lock and power steering.

IMI reserves the right to change specifications and design without notice. These specification supersede any specifications prior to June 1, 1988.

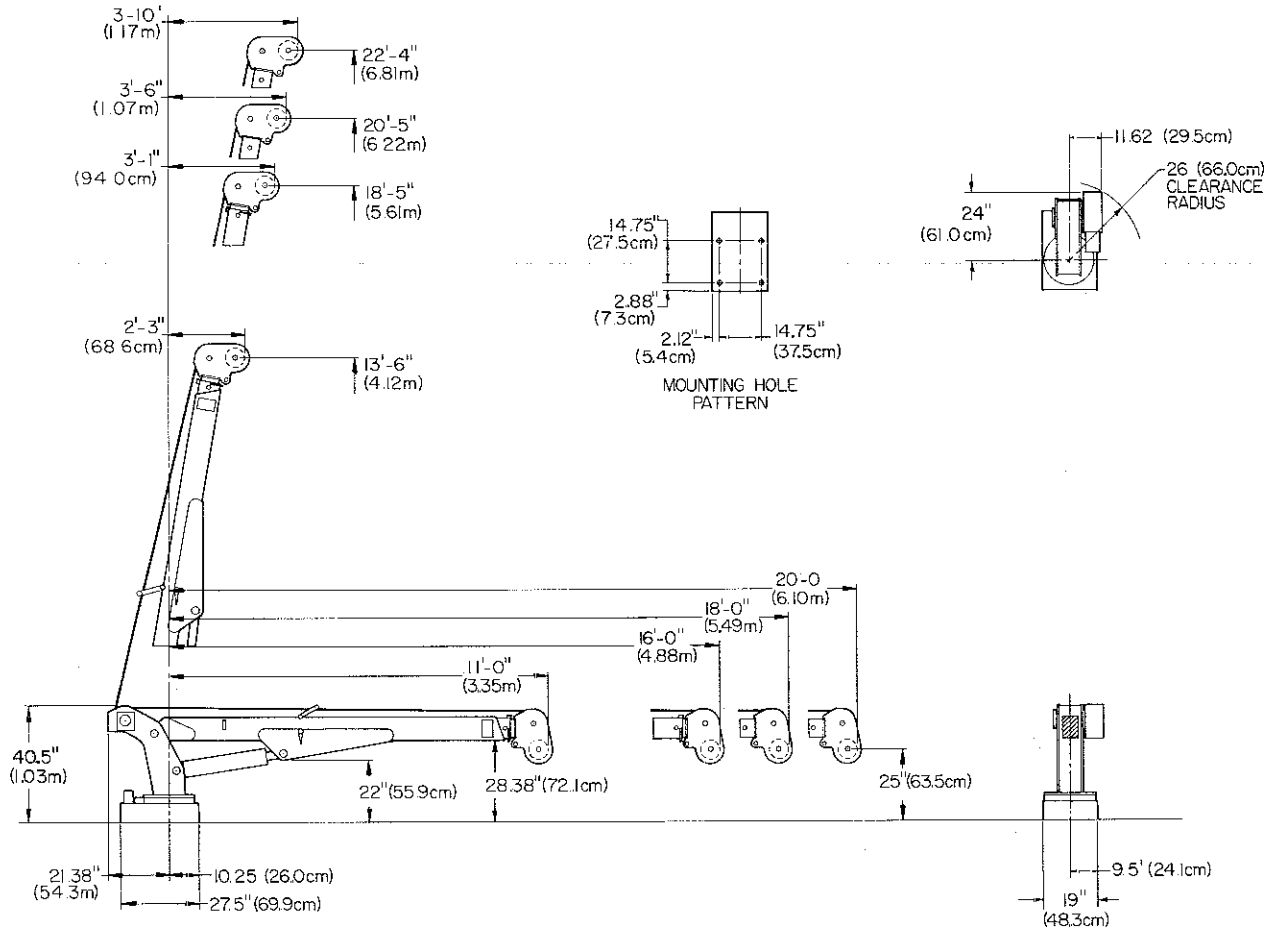
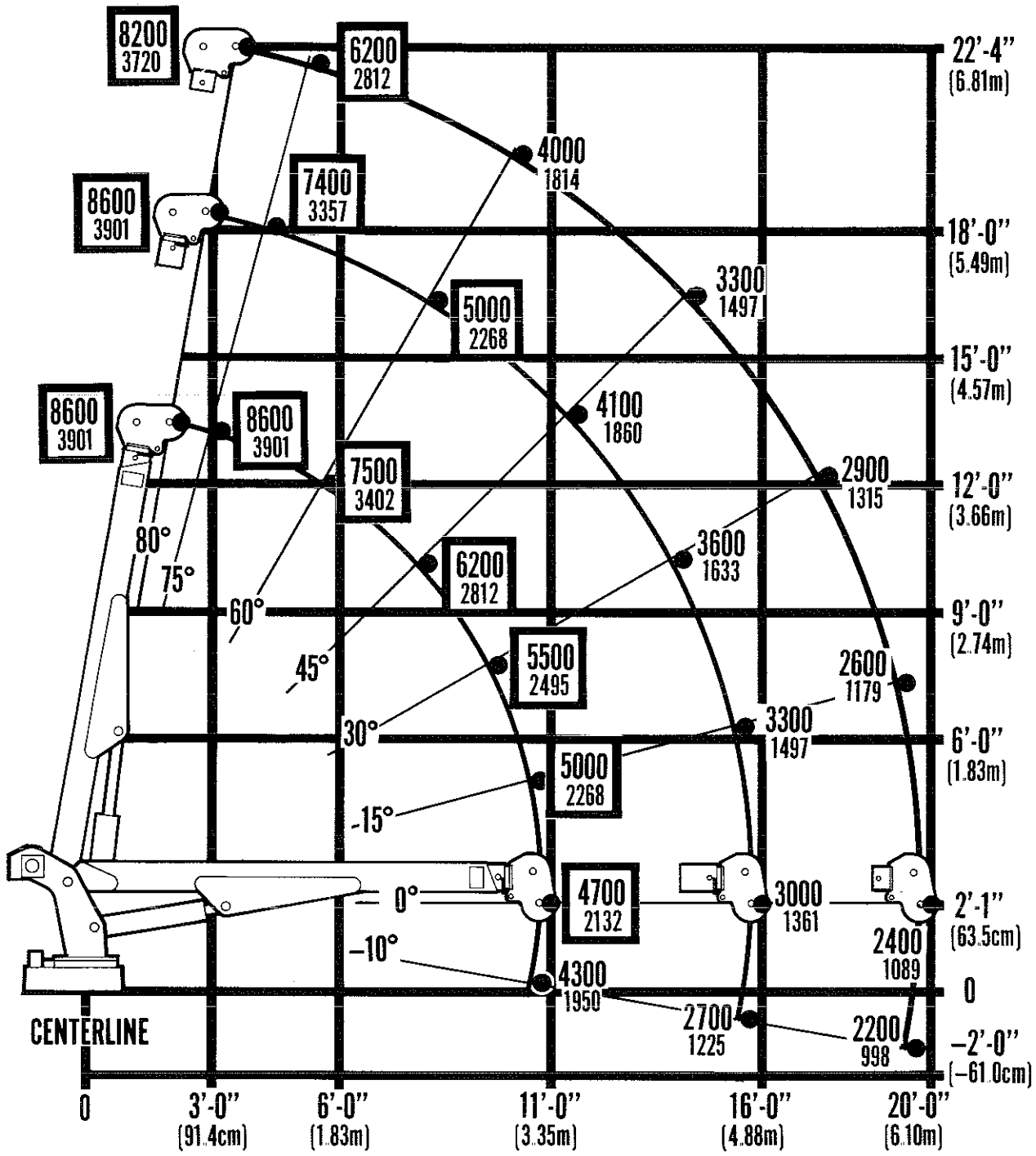


Figure A-1. Geometric Configuration



Maximum 1-part line capacity is 4300 lbs (1950 kgs). For greater loads, use 2-part line.

Weight of load handling devices are part of the load lifted and must be deducted from the capacity.

Figure A-2. 5016 & 5016—20 Capacity Chart

Section 2. CRANE DESCRIPTION

2-1. GENERAL

The 5016/5016-20 crane is designed primarily for use as a mechanic crane. This section describes the major assemblies on this crane and Figure B-1 illustrates their location.

2-2. BASE

The base provides the means for mounting the crane on the truck chassis. It incorporates the 450° (7.85 Rad.) rotation mechanism.

2-3. MAST

The mast provides the necessary elevation for crane operation as well as a hinge point for the lower boom. It houses the 27:1 ratio worm-gear driven winch mechanism.

2-4. LOWER BOOM

The lower boom will swing through a full 90° (1.57 Rad.) from -10° to +80° (-0.17 Rad. to +1.40 Rad.). It is raised and lowered through the use of a single, double-acting hydraulic cylinder.

2-5. EXTENSION BOOM

The single-stage extension boom increases the operating range from 11'-0" (3.35m) to 16'-0" (4.88m).

The two-stage extension boom - 1 hydraulic stage and 1 manual stage - increases the operating range from 11'-0" (3.35m) to 20'-0" (6.10m)

2-6. CONTROLS

The crane is operated remotely with a 4-function remote control unit on a 30-foot cable. In an overload condition, the winch up, extension out and boom down functions are inoperative. To relieve the condition, the winch can be lowered or the extension boom retracted.

2-7. HYDRAULICS

The crane hydraulics consist of double-braided pressure hoses, return hoses, filters, control valve bank and all necessary hydraulic fittings.

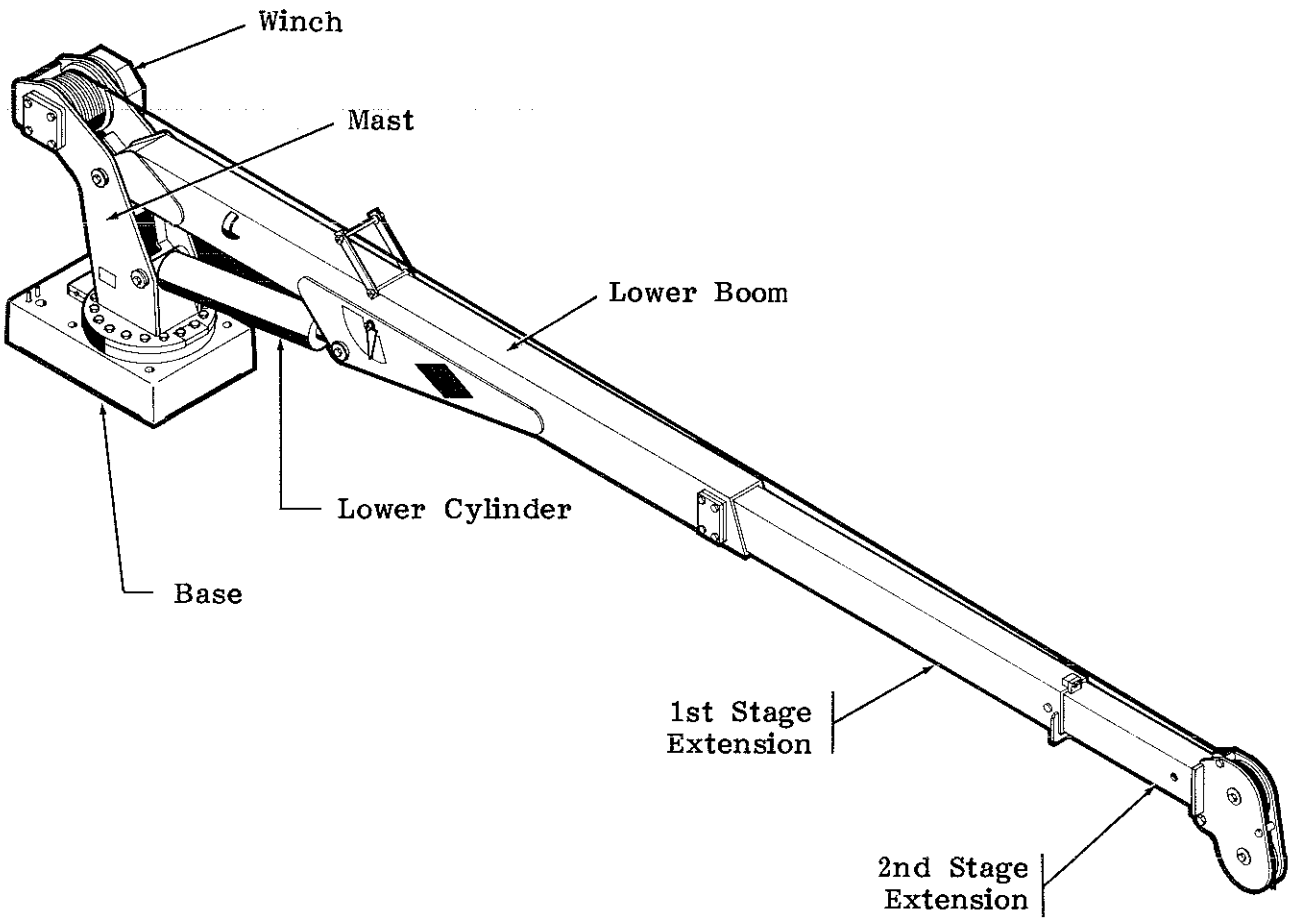


Figure B-1. 5016 Crane Group

Section 3. INSTALLATION

3-1. GENERAL

This section contains specific instructions for the installation of your crane. Prior to installing the crane and hydraulic components, make sure the chassis is ready to receive the crane (refer to Section 5, Installation - Chassis Preparation in Volume 1. Reinforce the chassis and install the hydraulic pump and PTO as necessary.

Each installation is considered unique, and certain components, such as the hydraulic hoses from the pump to the valve bank, must be cut to the proper length.

3-2. CRANE INSTALLATION

In addition to meeting the Minimum Chassis Specifications in Section 1, there must be sufficient room for mounting the crane and the platform must be strong enough to support the crane and the maximum rated load. Install the 5016 crane only on an IMT-designed and approved truck body. The body must be designed to sustain the forces imposed by the crane when lifting the full rated load. In addition, an IMT-designed body is configured to take full advantage of the standard hydraulic reservoir placement. This reservoir is installed in the cargo area of the body. Before attempting to install the crane, the body must be installed. To install the crane:

1. Use a lifting device capable of lifting the weight of the crane - 1,825 lbs (828 kg). Attach the lifting device to the lift brackets of the crane (located on both sides of the lower boom, approximately 30 inches from the mast hinge). Lift the crane, apply a bead of waterproof caulking compound such as a silicon-based caulk to the bottom of the base. Move the chassis under the crane and lower the crane into the desired position.

2. Install the mounting tie rods, washers and nuts to secure the crane base to the truck body (Figure C-1). Torque to 200 ft. lbs. (28 kg-m).

CAUTION

Do not attempt to apply the same torque to the self-locking nuts and tie rods as shown in the Torque Data Chart. Do not exceed 200 ft.-lbs. Exceeding the stated torque of 200 ft. lbs. (28 kg-m) may damage either the crane base or the body.

Power wrenching of the nut is not recommended until the lead thread of the nut insert is engaged by hand turning.

3-3. HYDRAULIC INSTALLATION

1. The suction and return filters are each installed directly on the suction and return ports of the standard reservoir with a nipple and gate valve.

2. Install the 1" ID hose between the suction filter and pump with barbed nipples and hose clamps (Figure C-2).

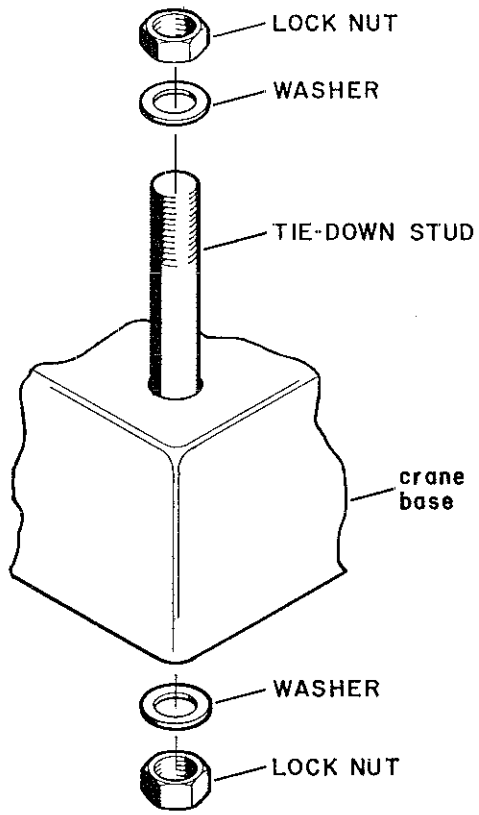


Figure C-1. Crane Installation

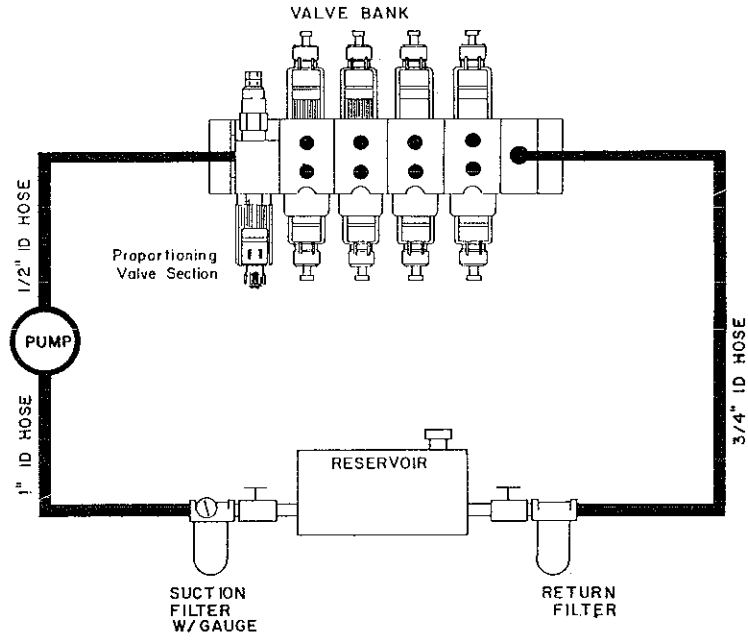


Figure C-2. Hydraulic Installation

3. Install the 1/2" ID hose between the pump and the valve bank proportioning valve.

4. Install the 3/4" ID return hose between the valve bank and hydraulic reservoir.

5. Fill the hydraulic reservoir with oil (refer to Volume 1 for hydraulic oil specifications).

6. Check the unit for leaks.

7. Start the vehicle engine and test operate the crane. Conduct a walk-around inspection to make certain there are no leaks and everything is functioning properly.

8. Check the oil level in the reservoir and top off if necessary.

3-4. ELECTRICAL INSTALLATION

To install the Engine Speed, Engine Start and Engine Stop functions:

NOTE

The Engine Speed and Engine Stop functions are required on all cranes. The Engine Start function is optional

1. Select a location under the vehicle hood that will provide the best protection from the elements. Install the engine kill, engine start and speed control relays. Install the underhood solenoid within 6" of the battery and connect the #1 cable from the battery positive (+) terminal to one of the large terminals on the underhood solenoid (Figure C-3).

2. Connect a wire from the accessory side of the ignition switch to normally open side of the speed control relay - pin 87 - the normally open side of the engine start relay - pin 87 - and the coil connector of the underhood solenoid.

3. Ground the other underhood solenoid coil connector. With the ignition turned on, the underhood solenoid will be energized.

4. Route the 4-wire cable from the 4-contact terminal strip to the engine compartment. Connect the red wire to the underhood solenoid output terminal (the large terminal opposite the battery connection). With the ignition on, the underhood solenoid will supply power to the remote control system.

5. Connect the white wire to the speed control relay - pin 86. Connect pin 85 of the speed control relay to ground. Connect pin 30 to the speed control solenoid.

6. Connect the green wire to the engine kill relay coil - pin 86. Connect pin 85 of the engine kill relay to ground.

7. Connect the black wire to the negative (-) side of the battery.

8. On a diesel engine, cut the wire leading to the fuel solenoid. Connect one end of the wire to pin 87a of the engine kill relay and the other end to pin 30. Under normal operation, the relay will remain closed, supplying power to the fuel solenoid. When the switch is pressed, the relay opens and disconnects power to the fuel solenoid.

   On a gas engine, disconnect the coil's ground wire from the chassis ground. Connect the wire to pin 30 of the engine kill relay. Connect another wire between pin 87a and ground. Under normal circumstances, the relay provides a path for grounding the coil. When the Engine Stop button is pressed, the path is broken and the engine stops.

9. Connect a green wire between the engine start relay coil - pin 86 - and the red/brown wire from the 12-pin connector. Connect pin 30 to the starter solenoid. Connect pin 85 to ground.

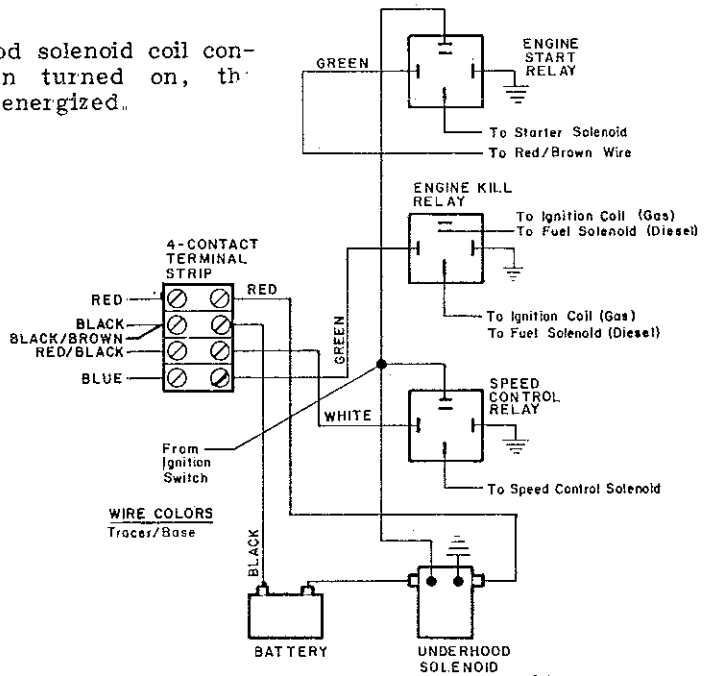


Figure C-3. Electrical Installation

Section 4. PARTS LIST

4-1. GENERAL

This section contains the exploded parts drawings with the accompanying parts list for the assemblies used on this crane. These drawings are intended to be used in conjunction with the instructions found in the REPAIR section in Volume 1. For optional equipment, refer to the appropriate manual.

WARNING

Do not attempt to repair any component without reading the information contained in the REPAIR section in Volume 1. Pay particular attention to the WARNINGs, CAUTIONs and NOTEs contained in that section. Failure to comply with these instructions may result in damage to the equipment, an injury or even death.

4-2. CRANE IDENTIFICATION

Every crane has an identification placard (Figure D-1) attached to the mast or one of the booms in a prominent location. When ordering parts, communicating warranty information or referring to the unit in correspondence, always include the assigned serial and model numbers. All inquiries should be directed to Iowa Mold Tooling Co., Inc.; P.O. Box 189; Garner, Iowa 50438-0189; telephone: (515) 923-3711 or IWX 910-523-6930. In Canada; IMI Cranes Canada, Ltd.; Orillia, Ontario; telephone: (705) 325-7458.

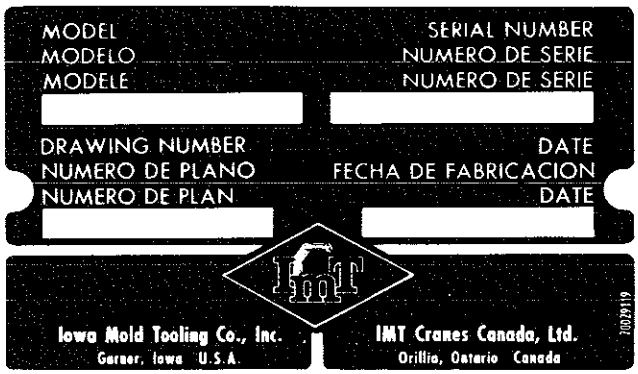


Figure D-1. Serial Number Placard

4-3. CYLINDER IDENTIFICATION

To ensure proper cylinder replacement parts are received, it is necessary to specify a complete number/letter sequence for any part request. Part numbers must be verified by checking the number stamped on the cylinder case (Figure D-2) against the information included in the service manual. You must use the part number stamped on the cylinder case when ordering parts.

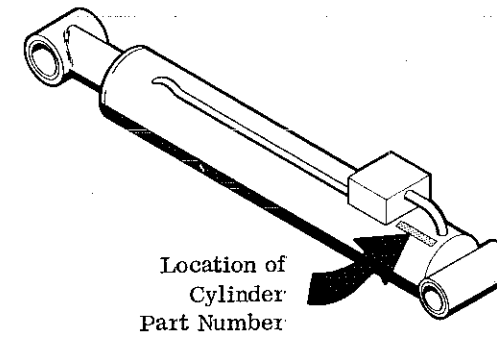


Figure D-2. Cylinder Part Number Location

4-4. WELDMENT IDENTIFICATION

Each of the major weldments - base, mast, lower boom, extension boom and outrigger weldments - bear a stamped part number. Any time a major weldment is replaced, you must specify the complete part number as stamped on the weldment. The locations of the part numbers are shown in Figure D-3.

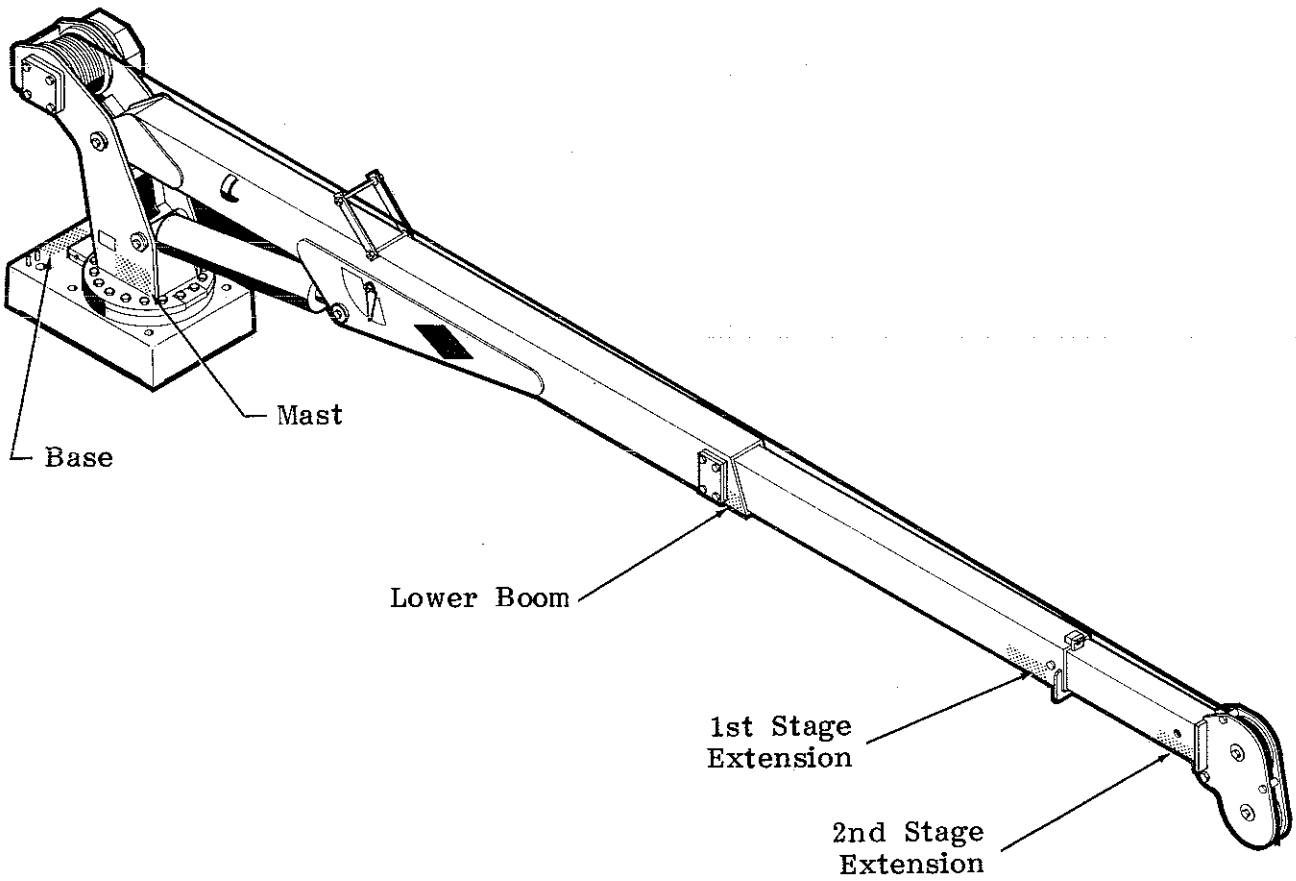
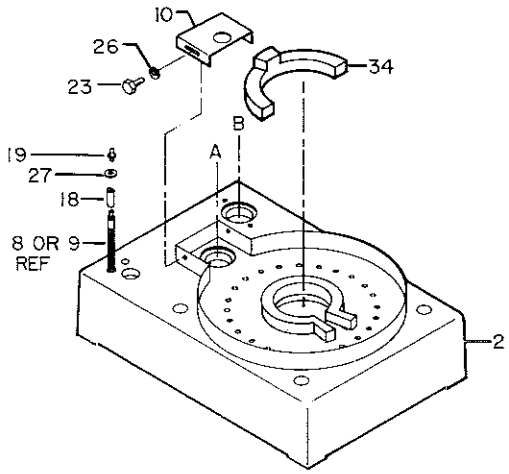


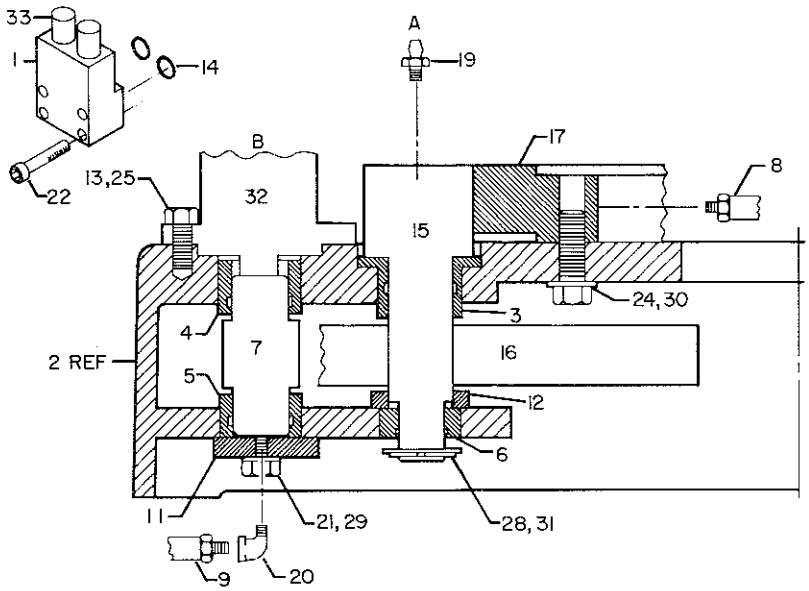
Figure D-3. Weldment Part Number Location

4-5. ORDERING REPAIR PARTS

When ordering replacement parts:

1. Give the model number of the unit.
2. Give the serial number of the unit.
3. Specify the complete part number. When ordering cylinder parts or one of the main weldments, always give the stamped part number.
4. Give a complete description of the part.
5. Specify the quantity required.



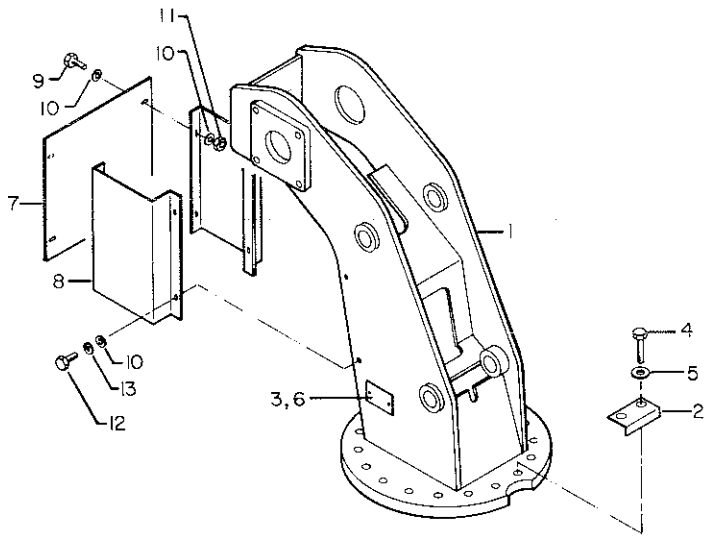


Item No.	Part No.	Description	Qty
1.	5V151830	BLOCK, rotation motor	1
2.	52707658	BASE (includes items 2 thru 7)	1
3.	60020114	- BUSHING, top pinion gear	1
4.	60020115	- BUSHING, top drive gear	1
5.	60020116	- BUSHING, bottom drive gear	1
6.	60020154	- BUSHING, bottom pinion gear	1
7.	71056011	- GEAR, drive	1
8.	53000704	EXTENSION, grease; 34"	1
9.	53000715	EXTENSION, grease; 18"	1
10.	60010235	COVER, pinion gear	1
11.	60010844	PLATE, grease	1
12.	60104694	SPACER, pinion gear	1
13.	60106032	STUD, motor	2
14.	7Q072112	O-RING	2
15.	71056010	GEAR, pinion	1
16.	71056012	GEAR, intermediate	1
17.	71056389	GEAR, turntable bearing	1
18.	72053301	COUPLING; 1/8" npt	2
19.	72053508	ZERK; 1/8" npt	3
20.	72053589	ELBOW, street, 90°; 1/8" npt	1
21.	72060092	SCREW, hex hd.; 1/2-13 x 1-1/4"	2
22.	72060738	SCREW, soc. hd.; 5/16-18 x 2-1/2"	4
23.	72060833	SCREW, hex hd.; 5/16-18 x 3/4"	2
24.	72060931	SCREW, hex hd.; 5/8-11 x 2-3/4" gr. 8	24
25.	72062080	NUT, lock; 1/2-13	2
26.	72063002	WASHER, wrt.; 5/16"	2
27.	72063003	WASHER, wrt.; 3/8"	2
28.	72063035	BUSHING, machy.; 1-1/4" x 10 ga.	1
29.	72063053	WASHER, lock; 1/2"	2
30.	72063119	WASHER, hardened; 5/8" gr. 8	24
31.	72066084	RING, retaining; 1-1/4"	1
32.	73051004	MOTOR, rotation	1
33.	73054538	VALVE, cartridge	2
34.	52707657	SLIDE, rotation	1

WARNING

Anytime the gear-bearing bolts have been removed, they must be replaced with a new bolt of the identical grade and size. Failure to replace gear-bearing bolts may result in bolt failure due to metal fatigue causing serious injury or death.

Figure D-4. Base (Part Number 41707659)

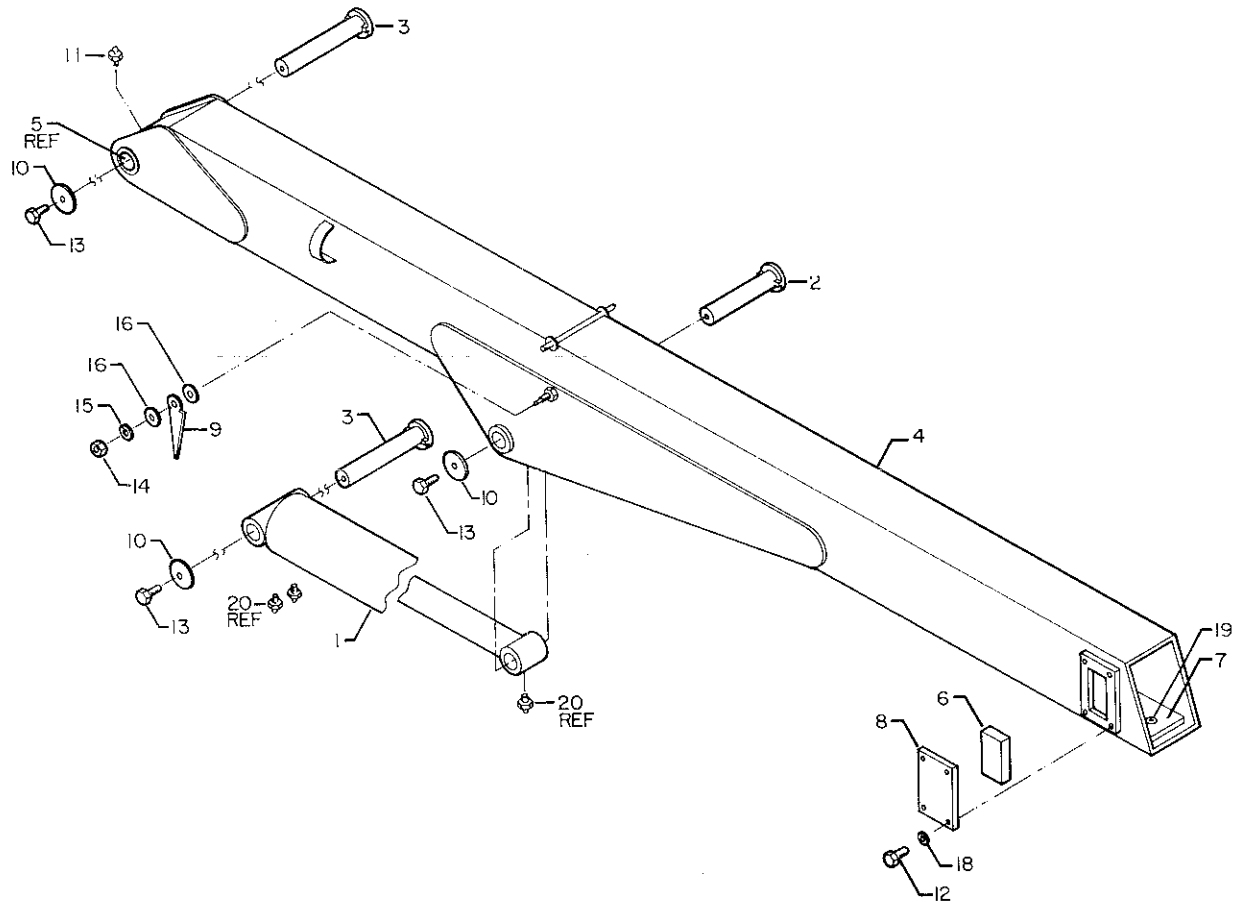


Item No.	Part No.	Description	Qty
1.	52707687	MAST	1
2.	60104540	COVER, pinion gear	1
3.	70029119	PLACARD, serial number	1
4.	72060931	SCREW, hex hd.; 5/8-11 x 2-3/4" gr. 8	18
5.	72063119	WASHER; 5/8" gr. 8	18
6.	72066340	RIVET, pop; 1/8" x 3/8"	2
7.	60111836	PLATE, back, valve bank cover	1
8.	60111835	PLATE, side, valve bank cover	2
9.	72060004	SCREW, hex hd.; 1/4-20 x 1"	4
10.	72063001	WASHER; 1/4" wrt.	12
11.	72062104	NUT, lock; 1/4-20	4
12.	72060002	SCREW, hex hd.; 1/4-20 x 3/4"	4
13.	72063049	WASHER, lock; 1/4"	4

WARNING

Anytime the gear-bearing bolts have been removed, they must be replaced with a new bolt of the identical grade and size. Failure to replace gear-bearing bolts may result in bolt failure due to metal fatigue causing serious injury or death.

Figure D-5. Mast (Part Number 41707660)



Item No.	Part No.	Description	Qty
1.	3C324870	CYLINDER, lower (includes item 20)	1
2.	52703765	PIN	1
3.	52707685	PIN	2
4.	52707717	BOOM, lower (includes item 5)	1
5.	7BF81215	BUSHING (part of item 4)	4
6.	60030015	PAD, wear	2
7.	60030139	PAD, wear	1
8.	60103463	PLATE, wear pad retainer	2
9.	60105544	INDICATOR, angle	2
10.	60106333	PLATE, pin retainer	3
11.	72053508	ZERK; 1/8" npt	1
12.	72060002	SCREW, hex hd.; 1/4-20 x 3/4"	8
13.	72060147	SCREW, hex hd.; 5/8-11 x 1"	3
14.	72062103	NUT, lock; 3/8-16	2
15.	72063003	WASHER, wrt.; 3/8"	2
16.	72063005	WASHER, wrt.; 1/2"	4
17.	----	NOT USED	-
18.	72063049	WASHER, lock; 1/4"	8
19.	72060915	SCREW, flat hd.; 3/8-16 x 1"	2
20.	72053507	ZERK; 1/4-28 (part of item 1)	3

NOTE

Anytime the pin retainer plate bolts have been removed, apply Loctite 262 to the threads before reassembly.

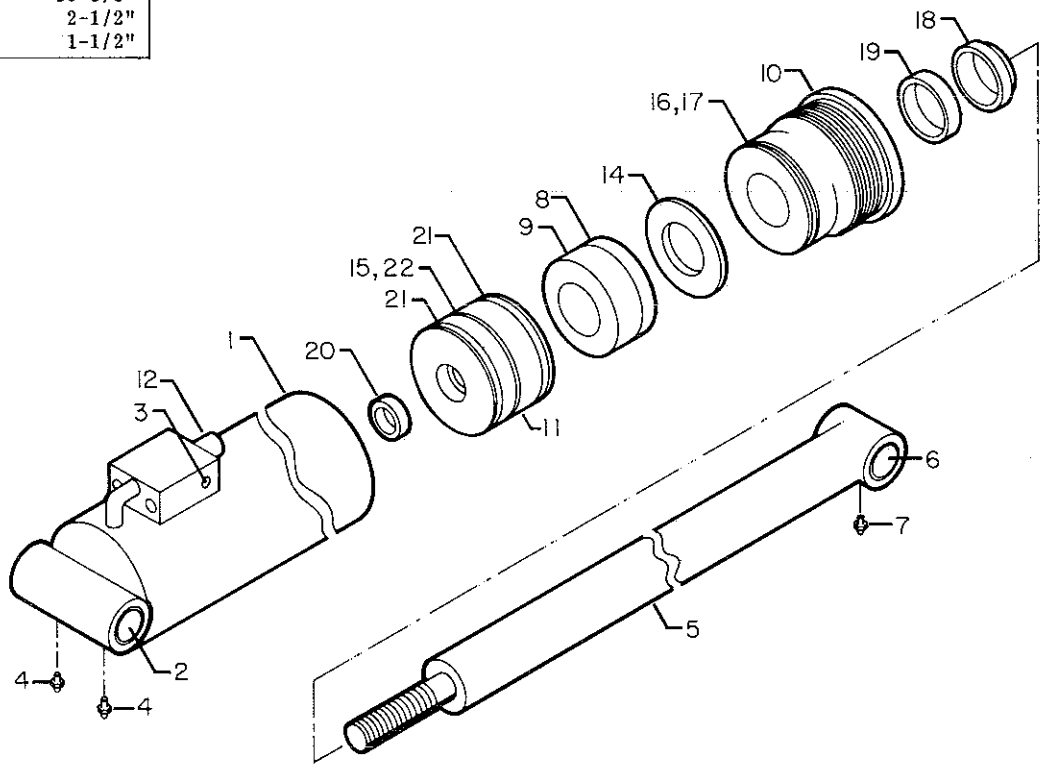
Figure D-6. Lower Boom (Part Number 41707661)

NOTE

Whenever the cylinder is disassembled, we strongly recommend replacing all of the components in the seal kit. This may save expensive down-time in the near future. In addition, use NEVER-SEEZ between the head and case when assembling the cylinder.

DIMENSIONS

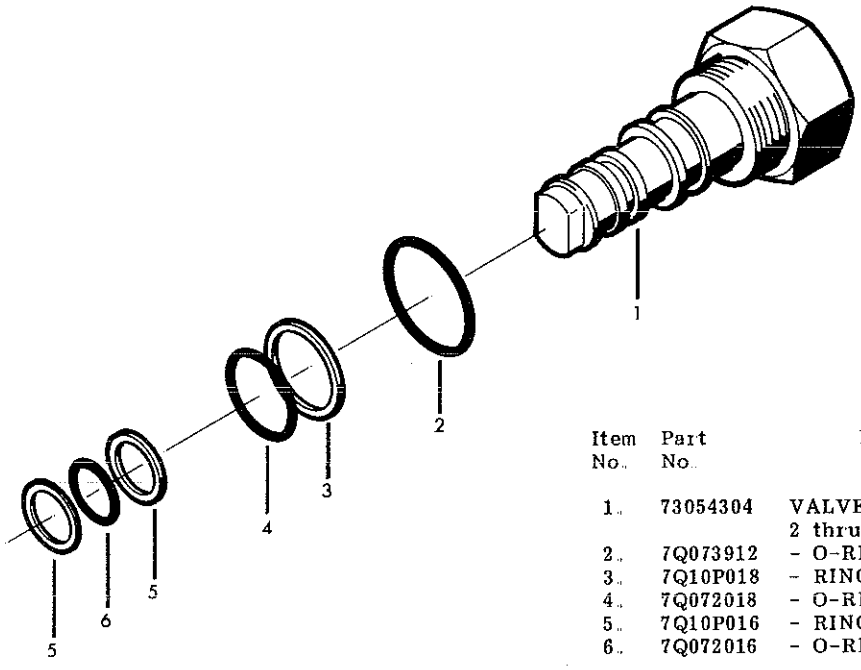
Bore	5"
Stroke	21-1/8"
C - C Closed	35-3/8"
Rod Diameter	2-1/2"
Pin Diameter	1-1/2"



Item No.	Part No.	Description	Qty
1.	4C324870	CASE (includes items 2 thru 4)	1
2.	7BF81015	- BUSHING	4
3.	7PNPXT02	- PLUG, pipe; 1/8" npt	3
4.	72053507	- ZERK; 1/4-28	2
5.	4G324870	ROD (includes items 6 and 7)	1
6.	7BF81215	- BUSHING	2
7.	72053507	- ZERK; 1/4-28	1
8.	6C075025	TUBE, stop	1
9.	6C150025	TUBE, stop	1
10.	6H050025	HEAD	1
11.	6I050181	PISTON	1
12.	73054304	VALVE, counter-balance; 10-gpm	1
13.	----	NOT USED	-
14.	6A025025	* RING, wafer lock	1
15.	7Q072157	* O-RING	1
16.	7Q072350	* O-RING	1
17.	7Q10P350	* RING, back-up	1
18.	7R14P025	* WIPER, rod	1
19.	7R546025	* SEAL, rod	1
20.	7T61N181	* RING, seal lock	1
21.	7I65I050	* RING, piston	2
22.	7I66P050	* SEAL, piston	1

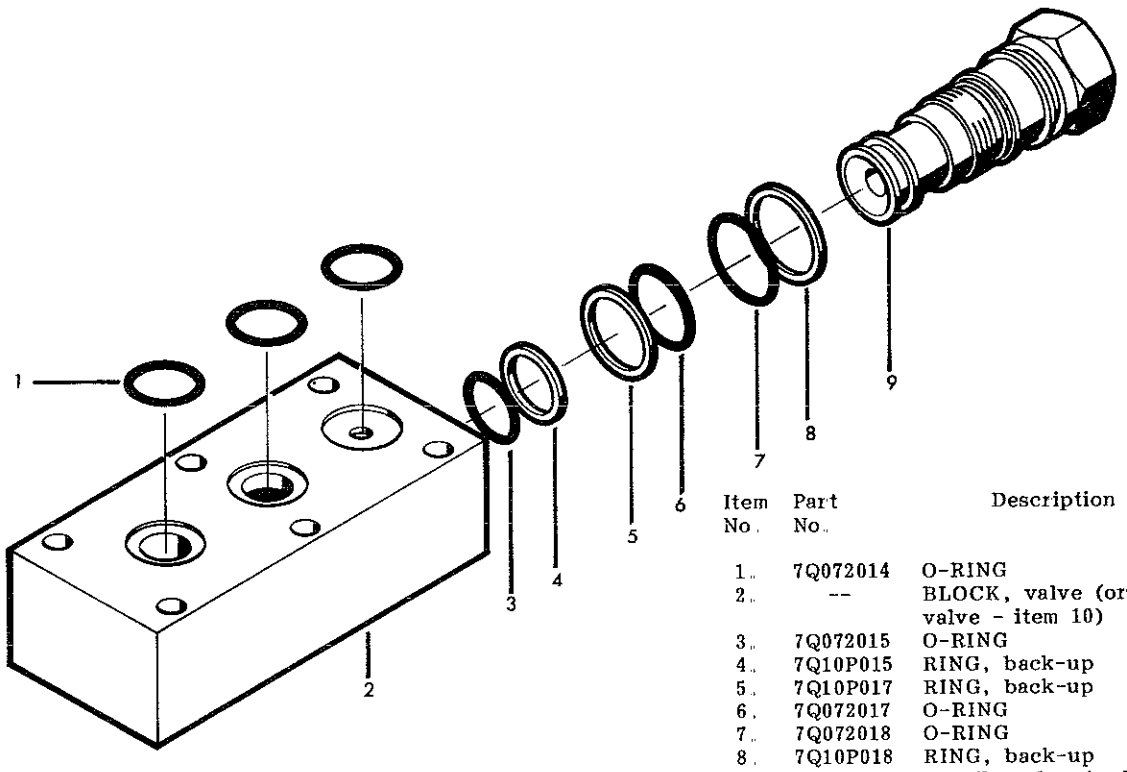
* Part of seal kit (Part Number 9C202029)

Figure D-7. Lower Cylinder (Part Number 3C324870)



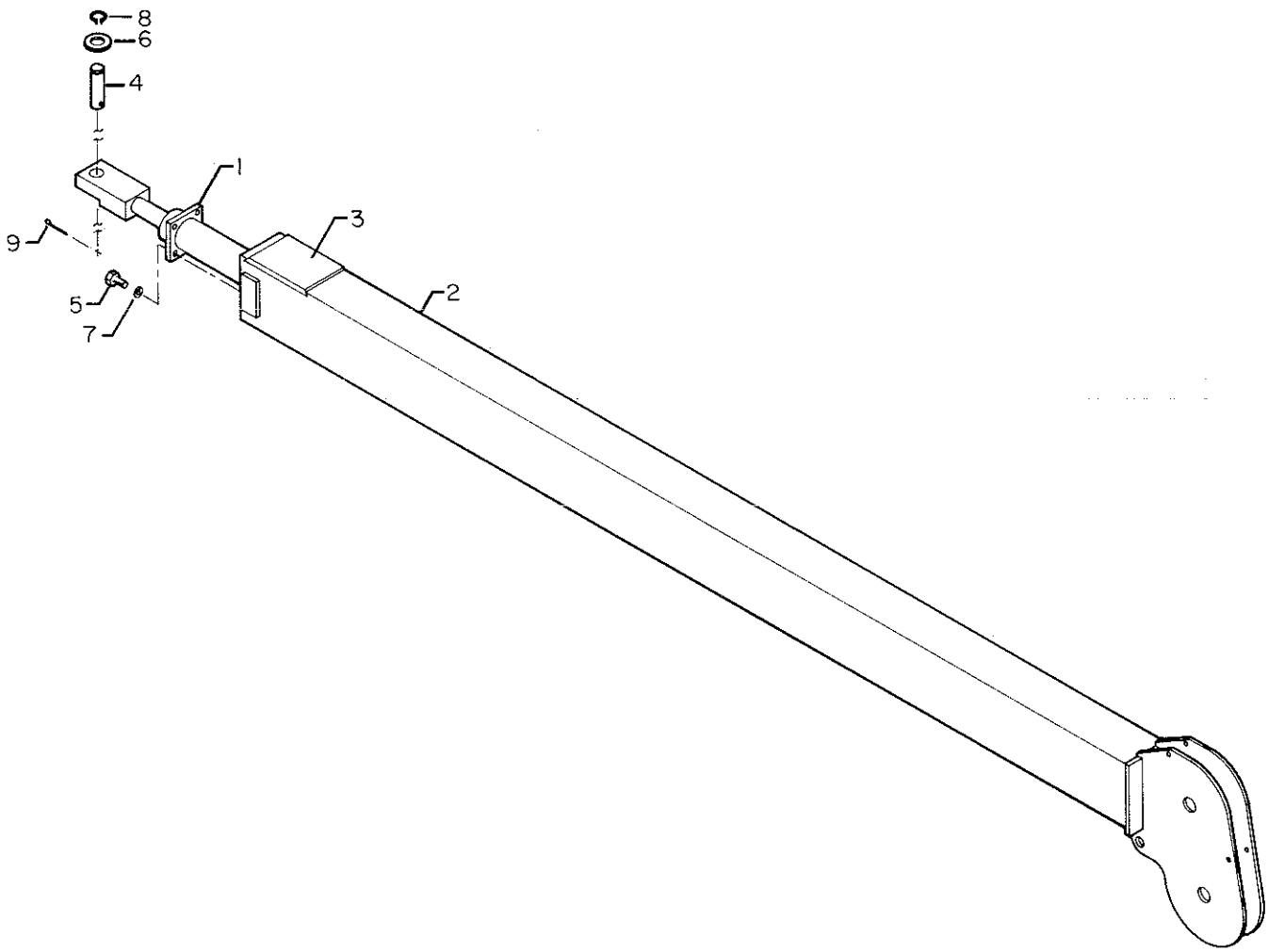
Item No.	Part No.	Description	Qty
1.	73054304	VALVE, complete (includes items 2 thru 6)	1
2.	7Q073912	- O-RING	1
3.	7Q10P018	- RING, back-up	1
4.	7Q072018	- O-RING	1
5.	7Q10P016	- RING, back-up	2
6.	7Q072016	- O-RING	1

Figure D-8. Counter-Balance Valve (Part Number 73054304)



Item No.	Part No.	Description	Qty
1.	7Q072014	O-RING	3
2.	--	BLOCK, valve (order complete valve - item 10)	1
3.	7Q072015	O-RING	1
4.	7Q10P015	RING, back-up	1
5.	7Q10P017	RING, back-up	1
6.	7Q072017	O-RING	1
7.	7Q072018	O-RING	1
8.	7Q10P018	RING, back-up	1
9.	--	BODY, valve (order complete valve - item 10)	1
10.	73054004	VALVE, complete (includes items 1 thru 9)	1

Figure D-9. Holding Valve (Part Number 73054004)



Item No.	Part No.	Description	Qty
1.	3B309820	CYLINDER, extension	1
2.	52707725	BOOM, extension	1
3.	60030189	PAD, wear, beveled	1
4.	60101905	PIN	1
5.	72060092	SCREW, hex hd.; 1/2-13 x 1-1/4"	4
6.	72063034	BUSHING, machy.; 1" x 10 ga.	1
7.	72063053	WASHER, lock; 1/2"	4
8.	72066125	RING, retaining; 1"	1
9.	72066194	PIN, cotter; 3/16"	1

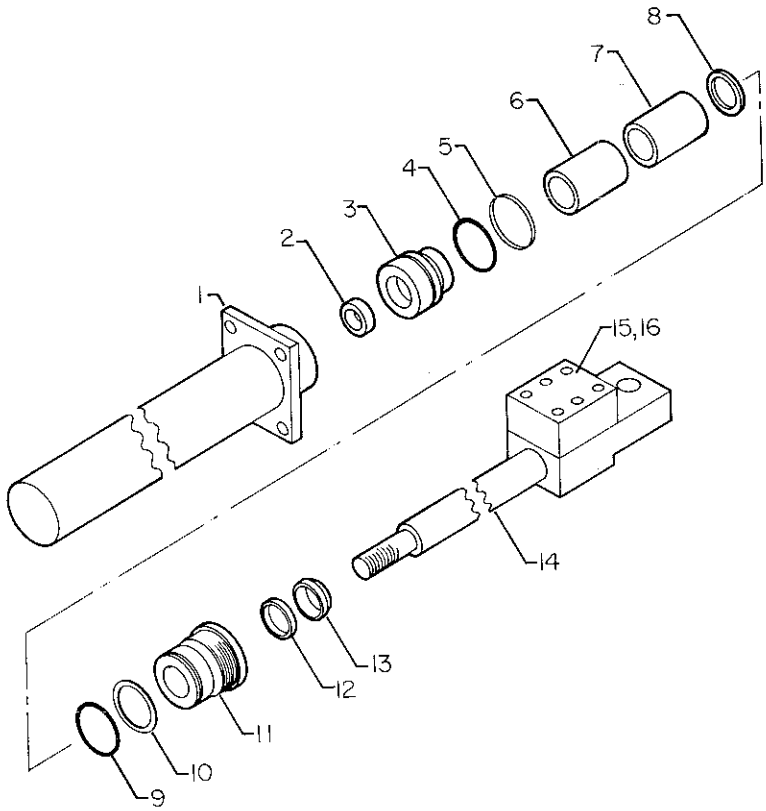
Figure D-10. 5016 Extension Boom (Part Number 41707662)

NOTE

Whenever the cylinder is disassembled, we strongly recommend replacing all of the components in the seal kit. This may save expensive down-time in the near future. In addition, use NEVER-SEEZ between the head and case when assembling the cylinder.

DIMENSIONS

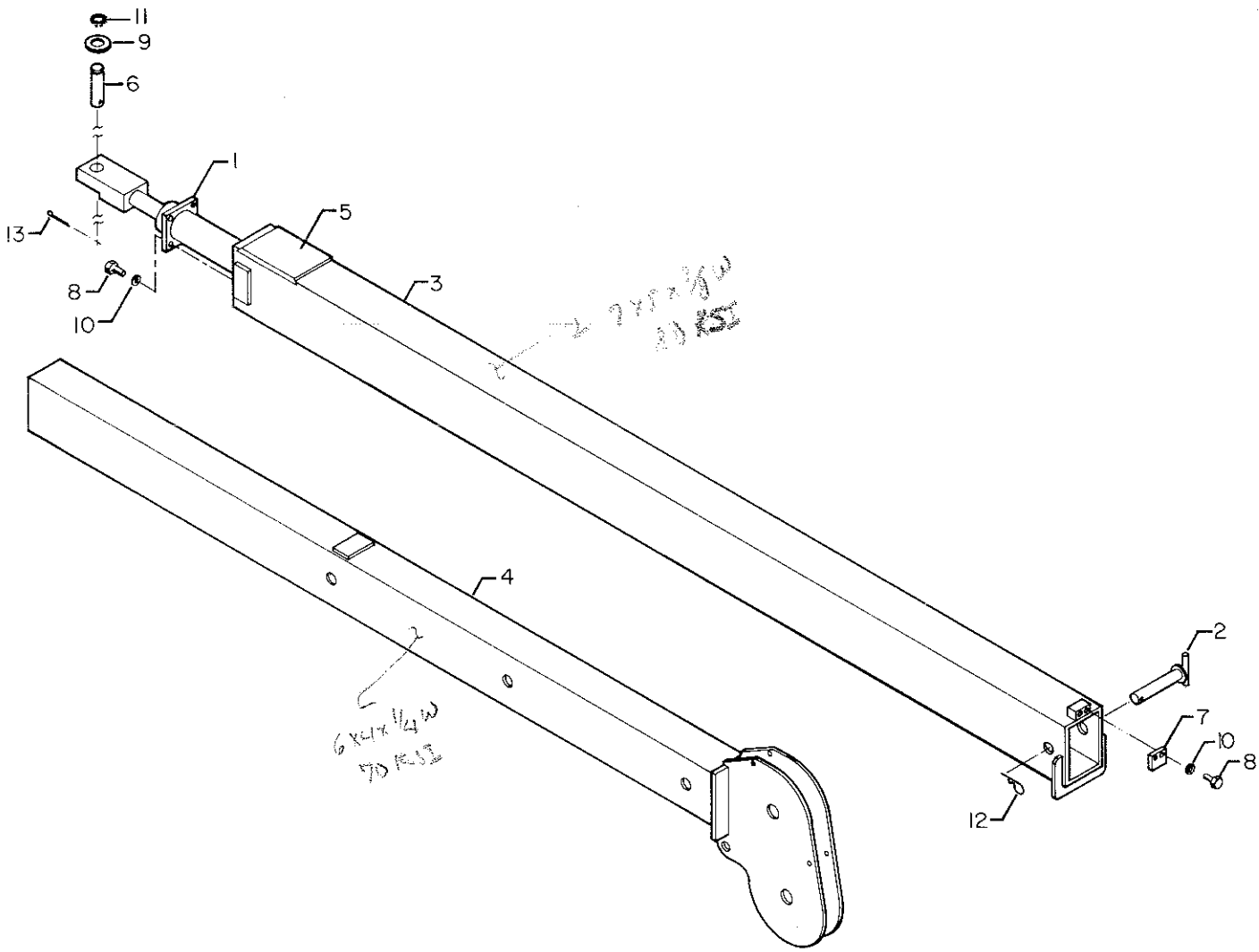
Bore	2-1/2"
Stroke	60"
C-C Closed	8-1/8"
Rod Diameter	1-1/2"
Pin Diameter	1"



Item No.	Part No.	Description	Qty
1.	4B309820	CASE, cylinder	1
2.	7T61N125	* SEAL, lock ring	1
3.	6IX02512	PISTON	1
4.	7Q072137	* O-RING	1
5.	7T66P025	* SEAL, piston	1
6.	6C300015	TUBE, stop	1
7.	6C309820	TUBE, stop	1
8.	6A025015	* RING, wafer lock	1
9.	7Q072228	* O-RING	1
10.	7Q10P228	* RING, back-up	1
11.	6H025015	HEAD	1
12.	7R546015	* SEAL, rod	1
13.	7R14P015	* WIPER, rod	1
14.	4H309820	ROD	1
15.	73054004	VALVE, holding	1
16.	72060708	SCREW, soc. hd.; 1/4-20 x 1-1/4"	6
17.	7PNPXT02	PLUG, pipe; 1/8" npt (not shown)	3

* Part of seal kit (Part Number 9B101220)

Figure D-11. Extension Cylinder (Part Number 3B309820)



Item No.	Part No.	Description	Qty
1.	3B309820	CYLINDER, extension	1
2.	52070152	PIN	1
3.	52707723	BOOM, extension; 1st stage	1
4.	52707724	BOOM, extension; 2nd stage	1
5.	60030189	PAD, wear, beveled	1
6.	60101905	PIN	1
7.	60107294	PLATE, stroke stop	1
8.	72060092	SCREW, hex hd.; 1/2-13 x 1-1/4"	6
9.	72063034	BUSHING, machy.; 1" x 10 ga.	1
10.	72063053	WASHER, lock; 1/2"	6
11.	72066125	RING, retaining; 1"	1
12.	72066145	PIN, hair; 3/16"	1
13.	72066194	PIN, cotter; 3/16"	1

Figure D-12. 5016-20 Extension Boom (Part Number 41707663)

Item No.	Part No.	Description	Qty
1.	70142224	HOUSING	1
2.	70056257	GEAR, worm	1
3.	70143071	BRACKET (part of item 14)	2
4.	71014644	RING, thrust	2
5.	76039191	GASKEI, bearing container	*
6.	76039192	GASKEI, bearing container	*
7.	76391592	GASKEI, safety brake	1
8.	76039189	GASKEI, cover	2
9.	76039190	GASKET, cover	1
10.	76039295	GASKEI	1
11.	----	NOI USED	-
12.	70142225	HOUSING, safety brake	1
13.	70056258	WORM, right hand	1
14.	70142226	COVER	1
15.	70142227	REIAINER, bearing	1
16.	70142228	SPACER	1
17.	70142229	CONTAINER, bearing	1
18.	70142230	SHAFI, cable drum	1
19.	72601134	SCREW, hex hd.; 7/16-14 x 1-1/2"	4
20.	----	NOI USED	-
21.	----	NOI USED	-
22.	----	NOI USED	-
23.	71014833	PLAIE, pressure	1
24.	71014836	NUT, worm brake adjust	1
25.	76039293	GASKET	1
26.	76039296	DISC, friction	2
27.	71014835	SPRING (includes items 28 thru 33)	1
28.	70142231	SPRING, main (part of item 27)	1
29.	70142232	SPRING, secondary (part of item 27)	1
30.	70142233	STUD (part of item 27)	1
31.	70142234	CLIP (part of item 27)	2
32.	72062039	NUT, jam; 1/2-20 (part of item 27)	1
33.	72063112	WASHER, lock; 1/2" (part of item 27)	1
34.	71014837	ROTOR (includes items 35 thru 41)	1
35.	70142235	DRIVER (part of item 34)	1
36.	70142236	RACE (part of item 34)	1
37.	70142237	SPRING (part of item 34)	4
38.	70142238	PLUNGER (part of item 34)	4
39.	70142239	RING, retainer (part of item 34)	2
40.	70142240	ROLLER (part of item 34)	4
41.	72066796	RING, snap (part of item 34)	2
42.	----	NOT USED	-
43.	----	NOT USED	-
44.	----	NOT USED	-
45.	70055017	BEARING, cone	2
46.	70055020	BEARING, cup	2
47.	----	NOT USED	-
48.	----	NOI USED	-
49.	70024233	BUSHING	1
50.	70024234	BUSHING	1
51.	----	NOT USED	-
52.	----	NOT USED	-
53.	70142241	SEAL	1
54.	----	NOI USED	-
55.	----	NOI USED	-
56.	7Q072022	O-RING	1
57.	7Q072266	O-RING	1
58.	----	NOT USED	-
59.	----	NOI USED	-
60.	72661124	PLUG, expansion	1
61.	70142242	VENI; 1/8" npt	1
62.	72053244	PLUG, pipe; 1/8" npt	1
63.	72053393	PLUG, pipe; 3/8" npt	2
64.	72053394	PLUG, pipe; 1/2" npt	1
65.	----	NOT USED	-
66.	----	NOI USED	-
67.	----	NOI USED	-
68.	72066283	KEY	1
69.	71014645	KEY	1
70.	----	NOI USED	-
71.	----	NOT USED	-
72.	72060062	SCREW, hex hd.; 7/16-14 x 1"	4
73.	----	NOT USED	-
74.	----	NOI USED	-
75.	72601133	SCREW; 7/16-14 x 1"	6
76.	----	NOT USED	-
77.	----	NOI USED	-
78.	----	NOI USED	-
79.	72601133	SCREW; 7/16-14 x 1"	4
80.	----	NOT USED	-
81.	----	NOI USED	-
82.	----	NOI USED	-
83.	----	NOI USED	-
84.	----	NOT USED	-
85.	----	NOI USED	-
86.	72063052	WASHER, lock; 7/16"	4
87.	----	NOT USED	-
88.	72063113	WASHER, lock; 7/16" shakeproof	8

* Use quantities as required for proper spacing.

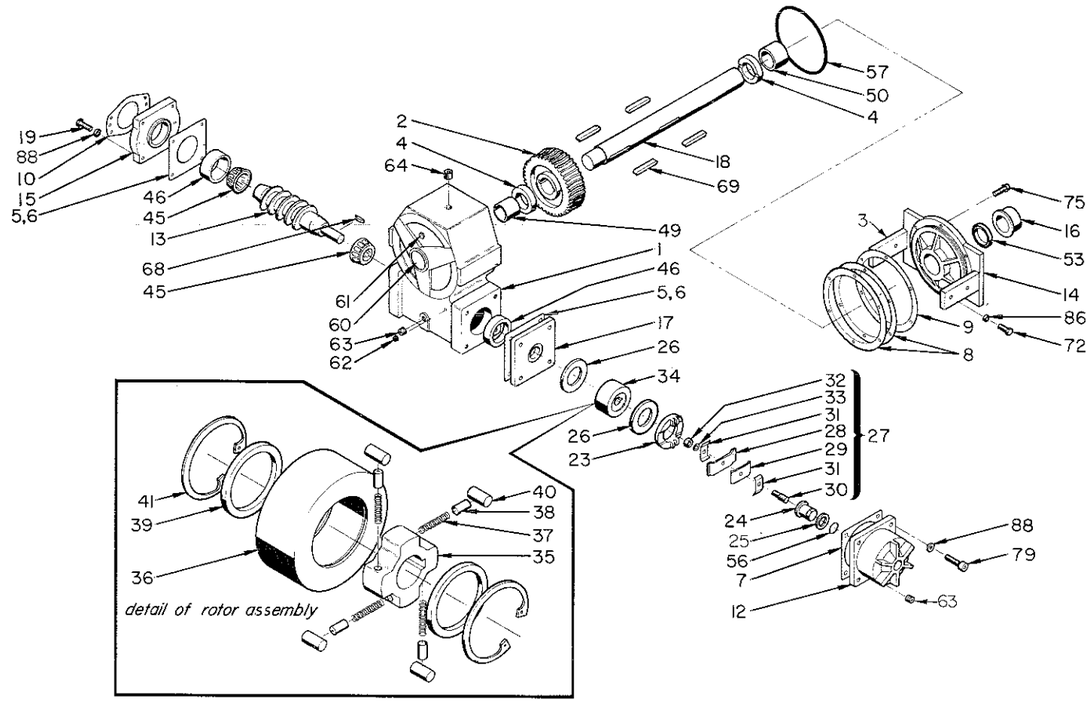
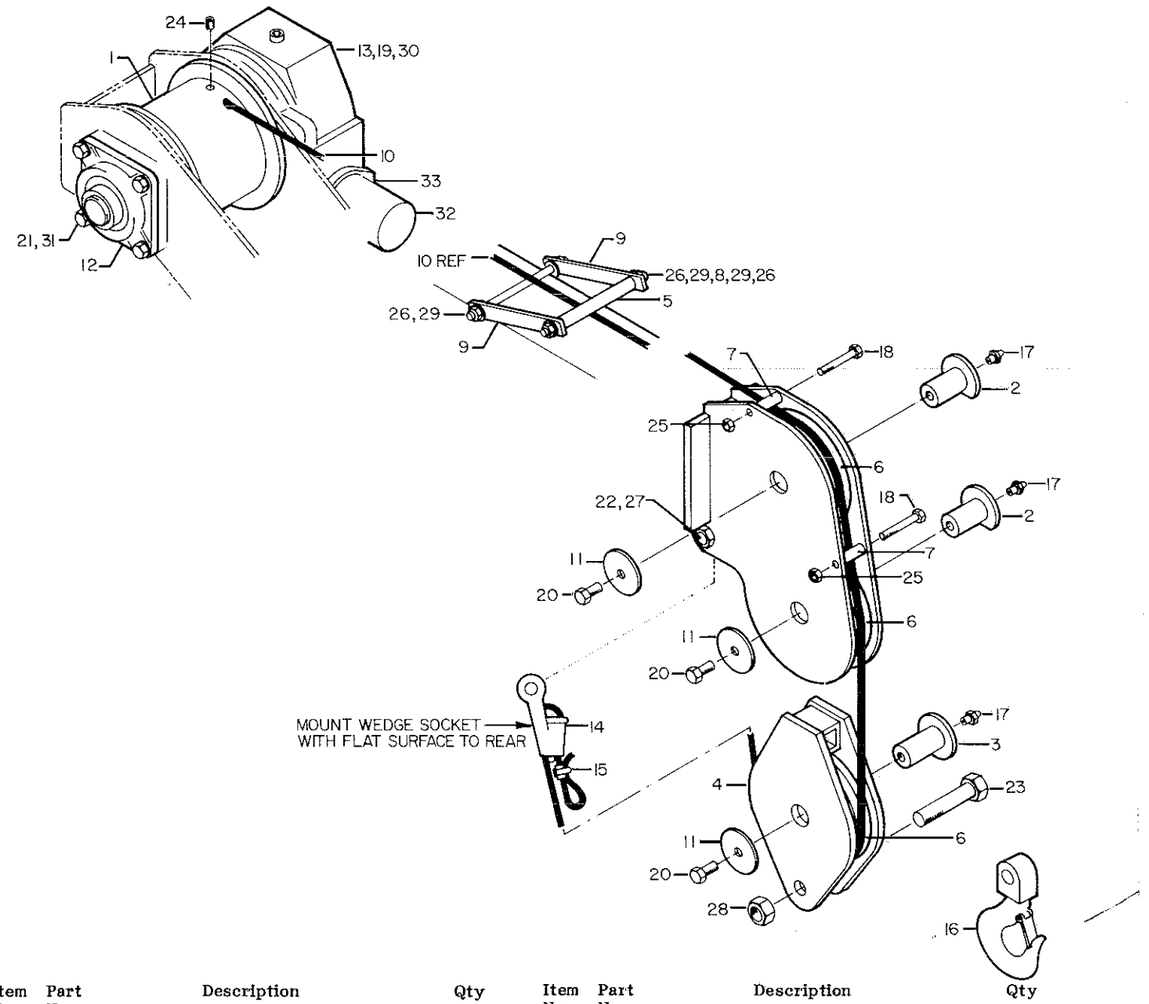


Figure D-14. Winch (Part Number 70057028)

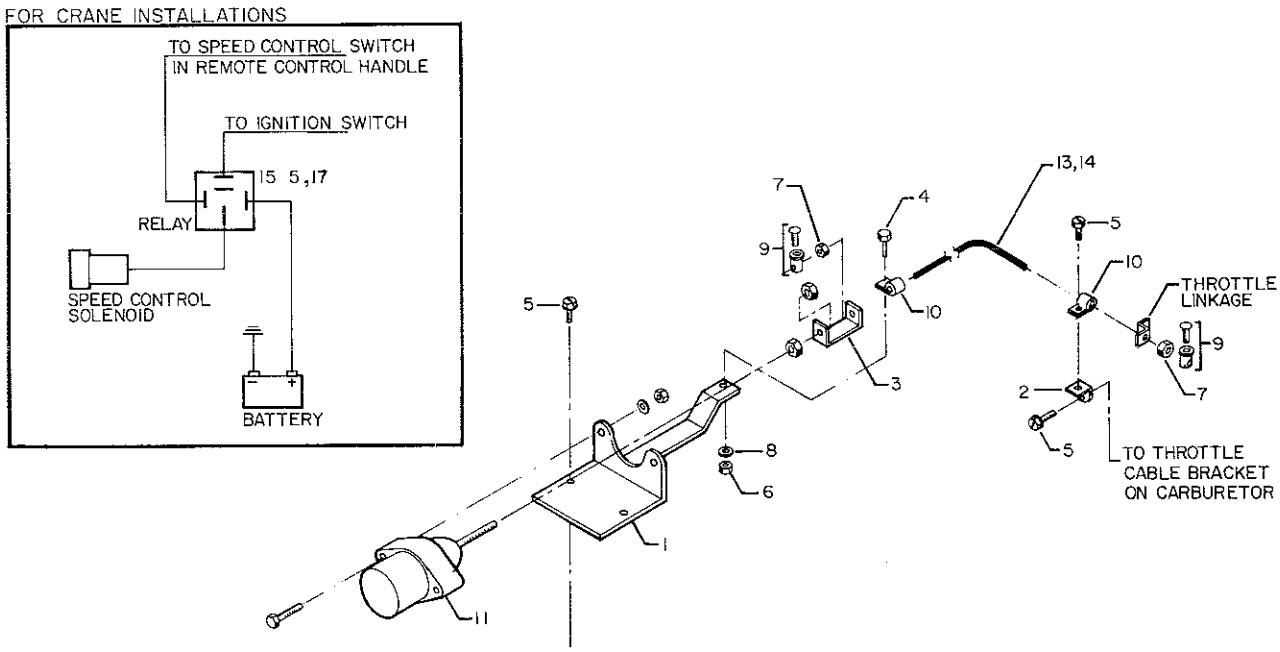


Item No.	Part No.	Description	Qty
1.	51707739	DRUM, winch	1
2.	52707730	PIN, 1-1/2" x 2-1/2"	2
3.	52707731	PIN, 1-1/2" x 3"	1
4.	52707735	BLOCK, snatch	1
5.	60030108	ROLLER, cable guide	1
6.	60030134	SHEAVE; 8"	3
7.	60102596	SPACER	2
8.	60105538	STUD, cable guide	1
9.	60105540	BAR, side, cable guide	2
10.	60108886	CABLE; 3/8" ID x 100'	1
11.	60109337	PLATE, pin retainer	3
12.	70055117	BEARING, flange block	1
13.	70057028	WINCH	1
14.	70058015	SOCKEI, wedge	1
15.	70058033	CLAMP, cable; 3/8"	1
16.	71073035	HOOK, swivel; 4-1/2 ton	1
17.	72053508	ZERK; 1/8" npt	3
18.	72060054	SCREW, hex hd.; 3/8-16 x 3"	2
19.	72060093	SCREW, hex hd.; 1/2-13 x 1-1/2"	4
20.	72060147	SCREW, hex hd.; 5/8-11 x 1"	3
21.	72060148	SCREW, hex hd.; 5/8-11 x 1-1/4"	4
22.	72060217	SCREW, hex hd.; 7/8-9 x 4"	1
23.	72060247	SCREW, hex hd.; 1-8 x 4-1/2"	1
24.	72060596	SCREW, soc. hd.; 1/2-13 x 3/4"	1
25.	72062103	NUT, lock; 3/8-16	2
26.	72062080	NUT, lock; 1/2-13	4
27.	72062120	NUI, lock; 7/8-9	1
28.	72062137	NUI, lock; 1-8	1
29.	72063005	WASHER, wrt.; 1/2"	4
30.	72063053	WASHER, lock; 1/2"	4
31.	72063055	WASHER, lock; 5/8"	4
32.	73051513	MOTOR, hydraulic	1
33.	72060795	SCREW, soc. hd.; 1/2-13 x 1-1/2"	2

NOIE

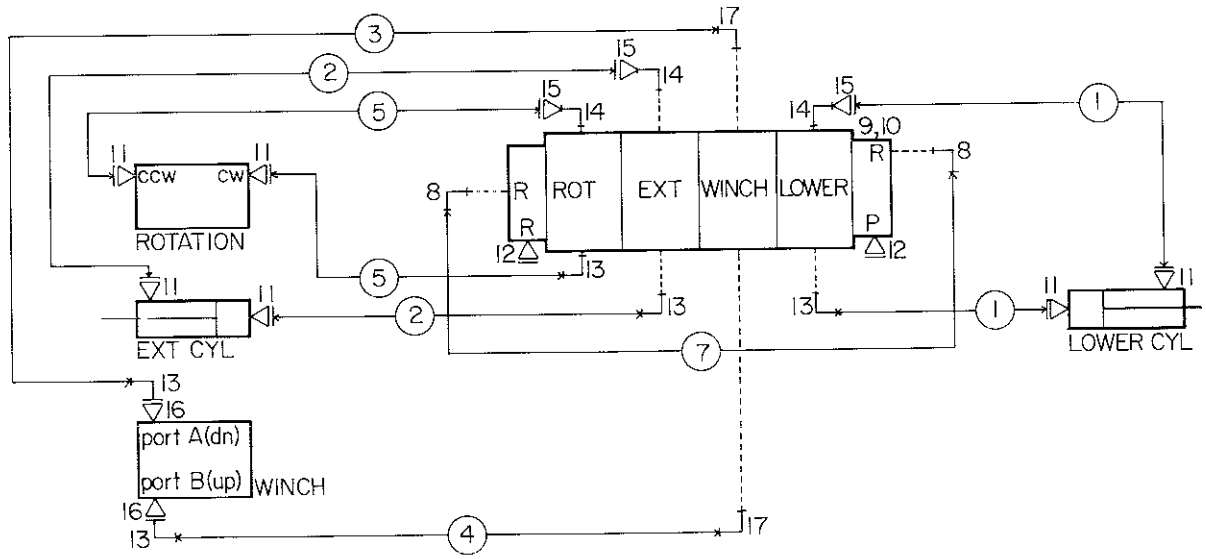
Anytime the pin retainer plate bolts have been removed, apply Loctite 262 to the threads before reassembly.

Figure D-13. Winch, Rope and Hook Kit (Part Number 41707665)



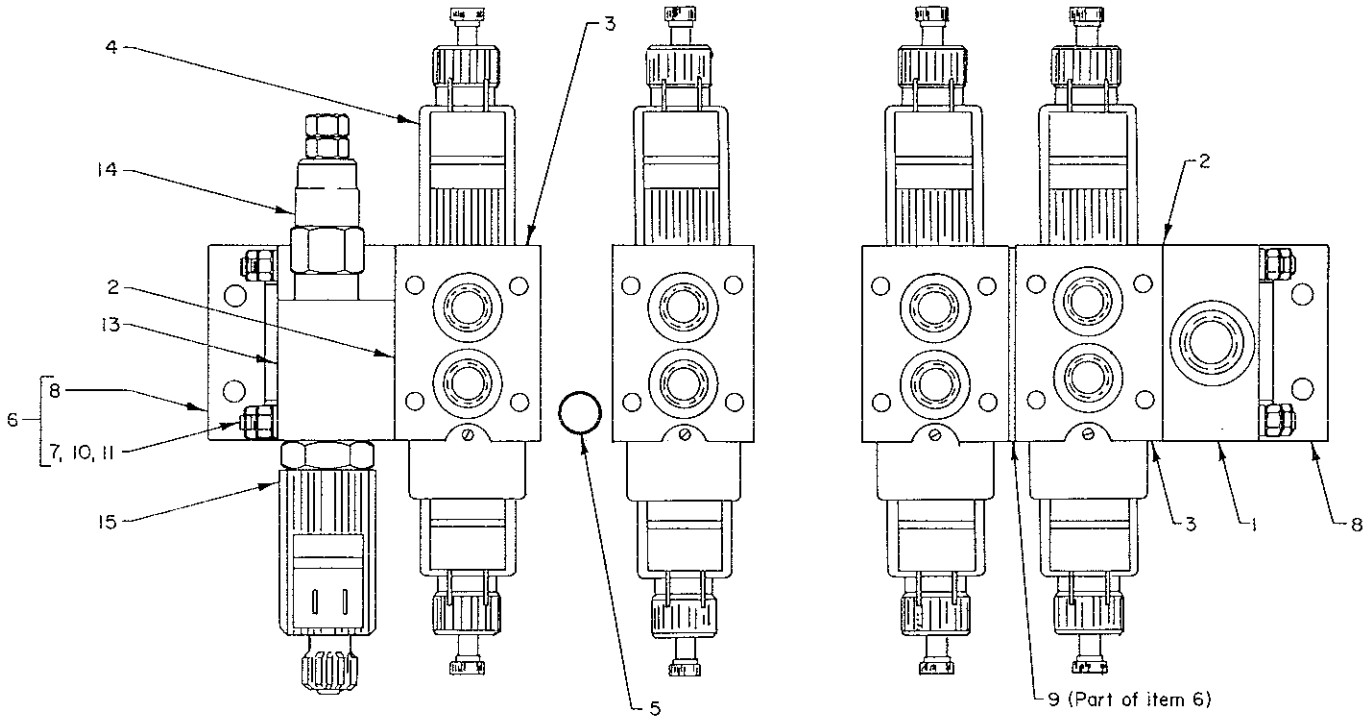
Item No.	Part No.	Description	Qty
1	52705080	BRACKET, speed control	1
2	60106760	BRACKET, linkage	1
3	60108086	BRACKET, plunger adjustment	1
4	72060002	SCREW, hex hd.; 1/4-20 x 3/4"	1
5	72061004	SCREW, slotted hex; #14 x 3/4"	5
6	72062000	NUT; 1/4-20	1
7	72062093	NUT; #8-32	2
8	72063049	WASHER, lock; 1/4"	1
9	72066377	CABLE, stop	2
10	72066523	CLAMP	2
11	77041239	SOLENOID; 12 VDC	1
12	----	NOT USED	-
13	89058892	CASING, cable; 42"	1
14	89058934	CABLE; 48"	1
15	77041251	RELAY, Bosch	1
16	89044233	WIRE, brown; 14 ga. x 20'	1
17	77040186	TERMINAL, female slip-on	4

Figure D-15. Throttle Control (Part Number 31705270)



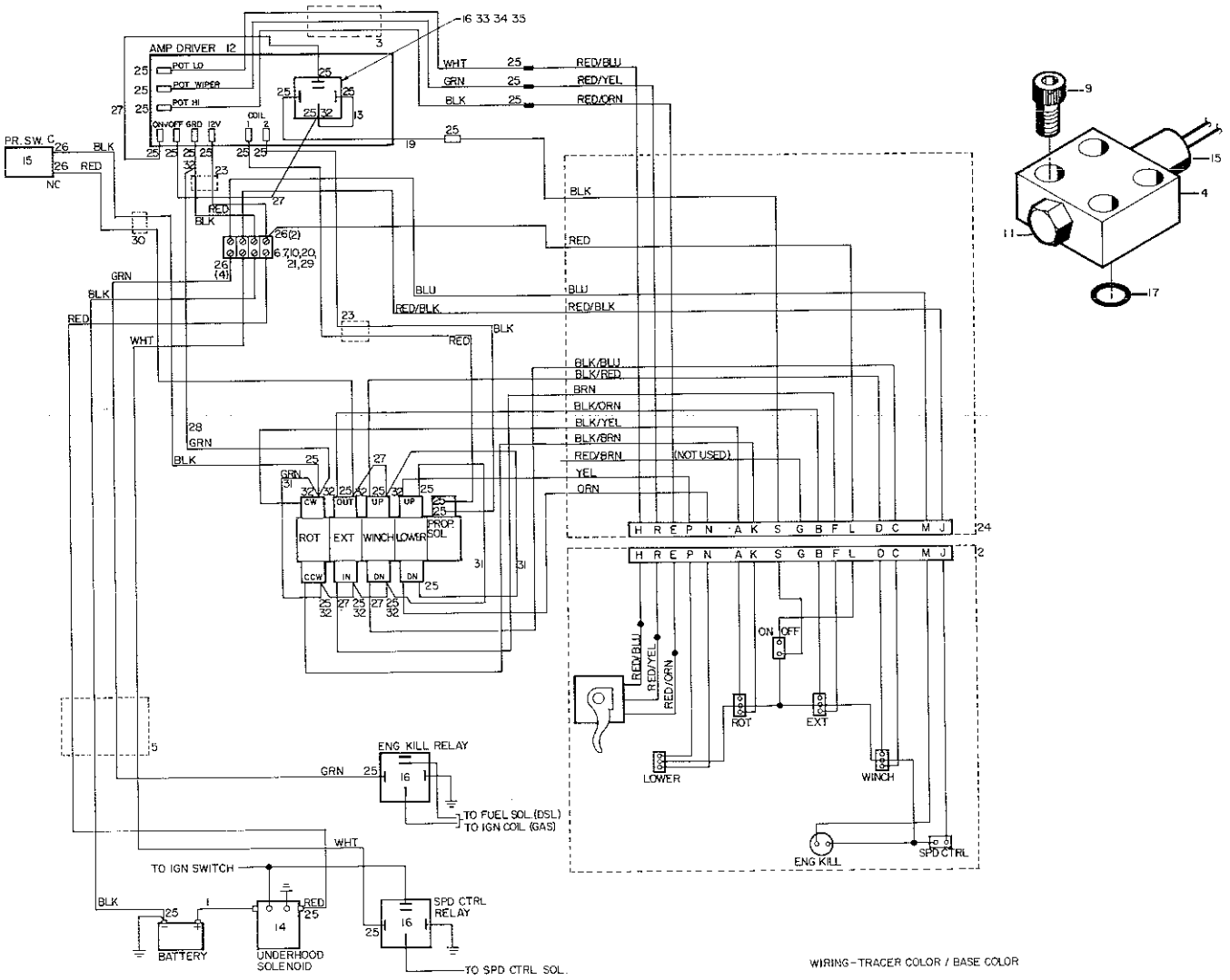
Item No.	Part No.	Description	Qty
1.	51704622	HOSE; 1/4" ID x 23" lg.	2
2.	51704623	HOSE; 1/4" ID x 31" lg.	2
3.	51707340	HOSE; 1/4" ID x 17" lg	1
4.	51707964	HOSE; 1/4" ID x 18" lg.	1
5.	51708155	HOSE; 1/4" ID x 58" lg.	2
6.	----	NOT USED	-
7.	51707967	HOSE; 1/2" ID x 17" lg.	1
8.	72053763	ELBOW, 90°; 3/4-16 str. thd.(m) x 3/4-16 JIC(m)	2
9.	72060000	SCREW, hex hd.; 1/4-20 x 1/2"	4
10.	72063049	WASHER, lock; 1/4"	4
11.	72532351	ADAPTER; 7/16-20 str. thd.(m) x 7/16-20 JIC(m)	6
12.	72532358	ADAPTER; 3/4-16 str. thd.(m) x 3/4-16 JIC(m)	2
13.	72532699	ELBOW, 90°; 9/16-18 str. thd.(m) x 7/16-20 JIC(m)	5
14.	72532700	ELBOW, extra-long 90°; 9/16-18 str. thd.(m) x 9/16-18 JIC(m)	3
15.	72532707	ADAPTER; 7/16-20 JIC(m) x 9/16-18 JIC(f)	3
16.	72532722	ADAPTER; 7/8-14 str. thd.(m) x 9/16-18 str. thd.(f)	2
17.	72532985	ELBOW, 45°; 9/16-18 str. thd.(m) x 7/16-20 JIC(m)	2

Figure D-16. Hydraulic Kit (Part Number 91707667)



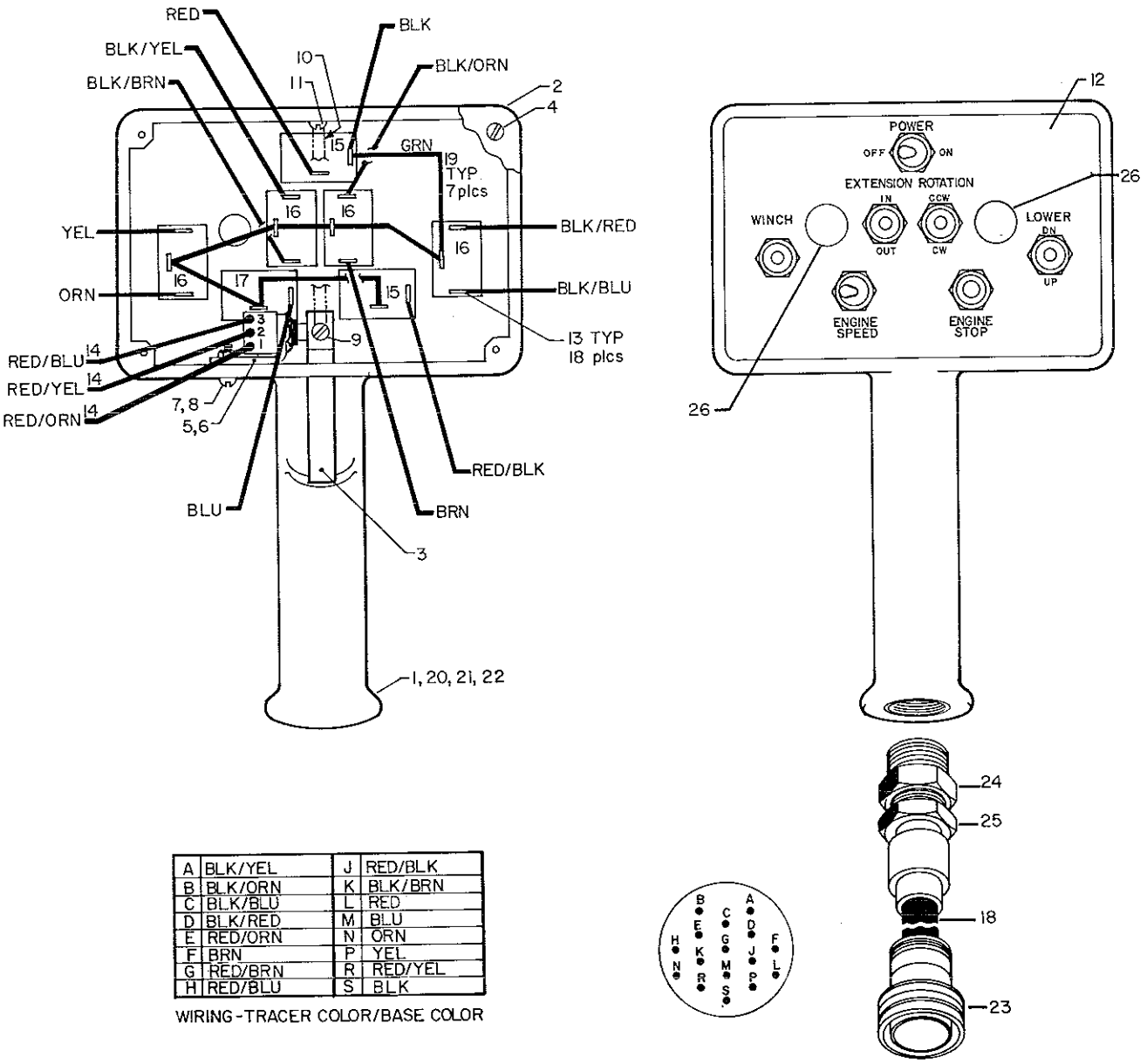
Item No.	Part No.	Description	Qty
1.	60025709	BLOCK, outlet	1
2.	7Q072205	O-RING	2
3.	73054636	SECTION, valve (includes item 4)	4
4.	77041361	- COIL, valve section	2/section
5.	76392808	O-RING	6
6.	94731957	KIT, tie rod (includes items 7 thru 11)	1
7.	70143335	- STUD, valve bank	4
8.	70143336	- FOOT, valve bank mounting	2
9.	70143337	- PLATE, o-ring	3
10.	72062000	- NUT; 1/4-20	8
11.	72063049	- WASHER, lock; 1/4"	8
12.	94731958	ASSEMBLY, inlet (includes items 13 thru 15)	1
13.	60025664	- BLOCK, inlet	1
14.	73054623	- VALVE, relief; 2500 PSI	1
15.	73054624	- VALVE, solenoid, proportioning	1

Figure D-17. Valve Bank (Part Number 73731911)



Item No.	Part No.	Description	Qty
1.	51704784	CABLE; #1 wire x 6" lg.	1
2.	51707752	HANDLE, control	1
3.	89044039	CABLE, 14-ga., 3-wire, 25" lg.	1
4.	60025221	MANIFOLD, capacity alert	1
5.	89044034	CABLE, 14-ga., 4-wire, 35' lg.	1
6.	77044341	BLOCK, terminal; 4-contact	1
7.	60111832	PLATE, mounting, terminal strip	1
8.	70034060	TIE, plastic; 6-3/4" lg.	10
9.	72060731	SCREW, soc. hd.; 5/16-18 x 3/4"	4
10.	72061009	SCREW, pan hd.; #6 x 3/4"	2
11.	72532140	PLUG; 9/16-18 str. thd.	1
12.	77041329	DRIVER, amp.	1
13.	89044231	WIRE, green; 14-ga. x 1"	2
14.	77041003	SOLENOID; 12 VDC, 100 amp.	1
15.	77041283	SWITCH, pressure; 2800 PSI	1
16.	77041251	RELAY, Bosch	3
17.	7Q072015	O-RING	1
18.	70392352	DECAL, electrocution danger	1
19.	89044231	WIRE, green; 14-ga.	25"
20.	60111833	SPACER	2
21.	72060006	SCREW, hex hd.; 1/4-20 x 1-1/2"	2
22.	----	NOT USED	-
23.	89044188	CABLE; 14-ga, 2-wire, 36" lg.	2
24.	51707980	CABLE; 18-ga, 16-wire, 48" lg.	1
25.	77040186	TERMINAL, female slip on	31
26.	77040051	IERMINAL, spring spade	8
27.	89044231	WIRE, green; 14-ga. x 3"	5
28.	89044231	WIRE, green; 14-ga. x 36"	1
29.	72063049	WASHER, lock; 1/4"	6
30.	89044188	CABLE; 14-ga., 2-wire, 33" lg.	1
31.	89044231	WIRE, green; 14-ga. x 10"	3
32.	77040282	TERMINAL, piggy-back	9
33.	72060002	SCREW, hex hd.; 1/4-20 x 3/4"	5
34.	72063001	WASHER, wrt.; 1/4"	1
35.	72062104	NUT, lock; 1/4-20	1

Figure D-18. Control Kit (Part Number 90707666)

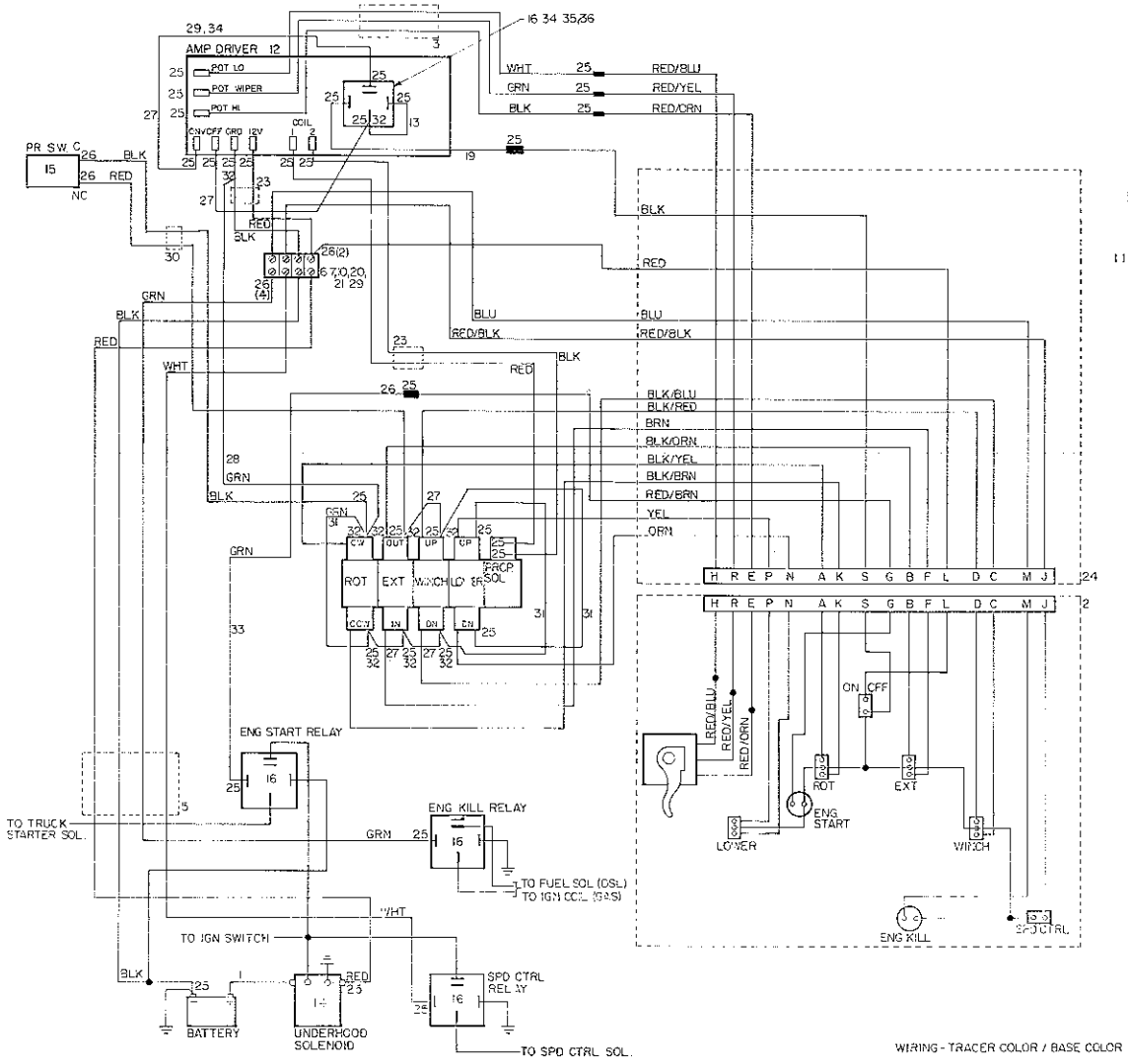


A	BLK/YEL	J	RED/BLK
B	BLK/ORN	K	BLK/BRN
C	BLK/BLU	L	RED
D	BLK/RED	M	BLU
E	RED/ORN	N	ORN
F	BRN	P	YEL
G	RED/BRN	R	RED/YEL
H	RED/BLU	S	BLK

WIRING-TRACER COLOR/BASE COLOR

Item No.	Part No.	Description	Qty
1	60111140	HANDLE	1
2	70034306	BACK, control handle	1
3	60111141	TRIGGER	1
4	72061009	SCREW, pan hd.; #6 x 3/4"	4
5	51707507	POTENTIOMETER, trigger	1
6	60111142	BRACKET, potentiometer mounting	1
7	72060670	SCREW, soc. hd.; #10-32 x 3/4"	2
8	72062130	NUT, lock; #10-32	2
9	72060669	SCREW, soc. hd.; #10-32 x 5/8"	1
10	70143223	SPRING, tension	1
11	72061000	SCREW, pan hd.; #6 x 1/2"	1
12	70392696	DECAL, remote control	1
13	77040186	TERMINAL, female slip-on	18
14	77040047	TERMINAL, male slip-on	3
15	77041345	SWITCH, toggle, SPST	2
16	77041346	SWITCH, toggle, SPDT	4
17	77041347	SWITCH, momentary contact	1
18	89044116	CABLE; 18-ga., 16-wire	360"
19	60045031	WIRE, green; 18 ga. x 4"	7
20	70392351	DECAL, electrocution, small (not shown)	1
21	70029119	PLACARD, identification (not shown)	1
22	72066340	RIVET, pop; 1/8" (not shown)	2
23	77044170	CONNECTOR; 16-pin	1
24	72531833	BUSHING, reducer; 3/4" npt(m) x 1/2" npt(f)	1
25	77044096	GRIP, cord	1
26	70392785	PLUG, hole; 1/2"	2

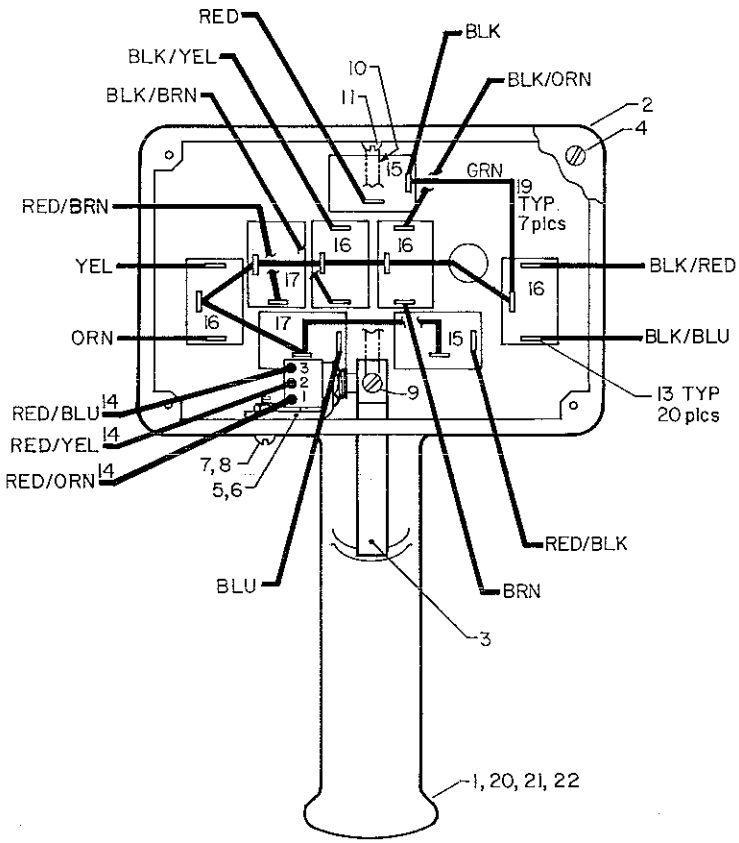
Figure D-19. Control Handle (Part Number 51707752)

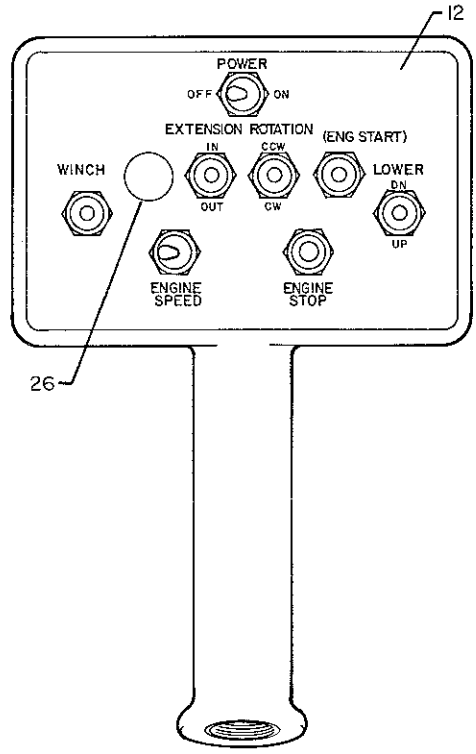


Item No.	Part No.	Description	Qty
1.	51704784	CABLE; #1 wire x 6" lg.	1
2.	51707981	HANDLE, control	1
3.	89044039	CABLE, 14.-ga., 3-wire, 25" lg.	1
4.	60025221	MANIFOLD, capacity alert	1
5.	89044034	CABLE, 14-ga., 4-wire, 35' lg.	1
6.	77044341	BLOCK, terminal; 4-contact	1
7.	60111832	PLATE, mounting, terminal strip	1
8.	70034060	TIE, plastic; 6-3/4" lg.	10
9.	72060731	SCREW, soc. hd.; 5/16-18 x 3/4"	4
10.	72061009	SCREW, pan hd.; #6 x 3/4"	2
11.	72532140	PLUG; 9/16-18 str. thd.	1
12.	77041329	DRIVER, amp.	1
13.	89044231	WIRE, green; 14-ga. x 1"	1
14.	77041003	SOLENOID; 12 VDC, 100 amp.	1
15.	77041283	SWITCH, pressure; 2800 PSI	1
16.	77041251	RELAY, Bosch	4
17.	7Q072015	O-RING	1
18.	70392352	DECAL, electrocution danger	1

Item No.	Part No.	Description	Qty
19.	89044231	WIRE, green; 14-ga.	25"
20.	60111833	SPACER	2
21.	72060006	SCREW, hex hd.; 1/4-20 x 1-1/2"	2
22.	----	NOT USED	-
23.	89044188	CABLE; 14-ga, 2-wire, 36" lg.	2
24.	51707980	CABLE; 18-ga, 16-wire, 48" lg.	1
25.	77040186	TERMINAL, female slip on	33
26.	77040051	TERMINAL, spring spade	9
27.	89044231	WIRE, green; 14-ga. x 3"	5
28.	89044231	WIRE, green; 14-ga. x 36"	1
29.	72063049	WASHER, lock; 1/4"	6
30.	89044188	CABLE; 14-ga., 2-wire, 33" lg.	1
31.	89044231	WIRE, green; 14-ga. x 10"	3
32.	77040282	TERMINAL, piggy-back	9
33.	89044231	WIRE, green; 14-ga. x 35'	1
34.	72060002	SCREW, hex hd.; 1/4-20 x 3/4"	5
35.	72063001	WASHER, wrt.; 1/4"	1
36.	72062104	NUT, lock; 1/4-20	1

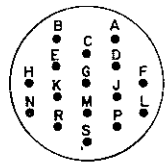
Figure D-20. Control Kit with Engine Start (Part Number 90707982)

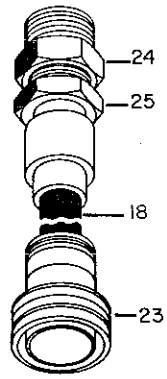




A	BLK/YEL	J	RED/BLK
B	BLK/ORN	K	BLK/BRN
C	BLK/BLU	L	RED
D	BLK/RED	M	BLU
E	RED/ORN	N	ORN
F	BRN	P	YEL
G	RED/BRN	R	RED/YEL
H	RED/BLU	S	BLK

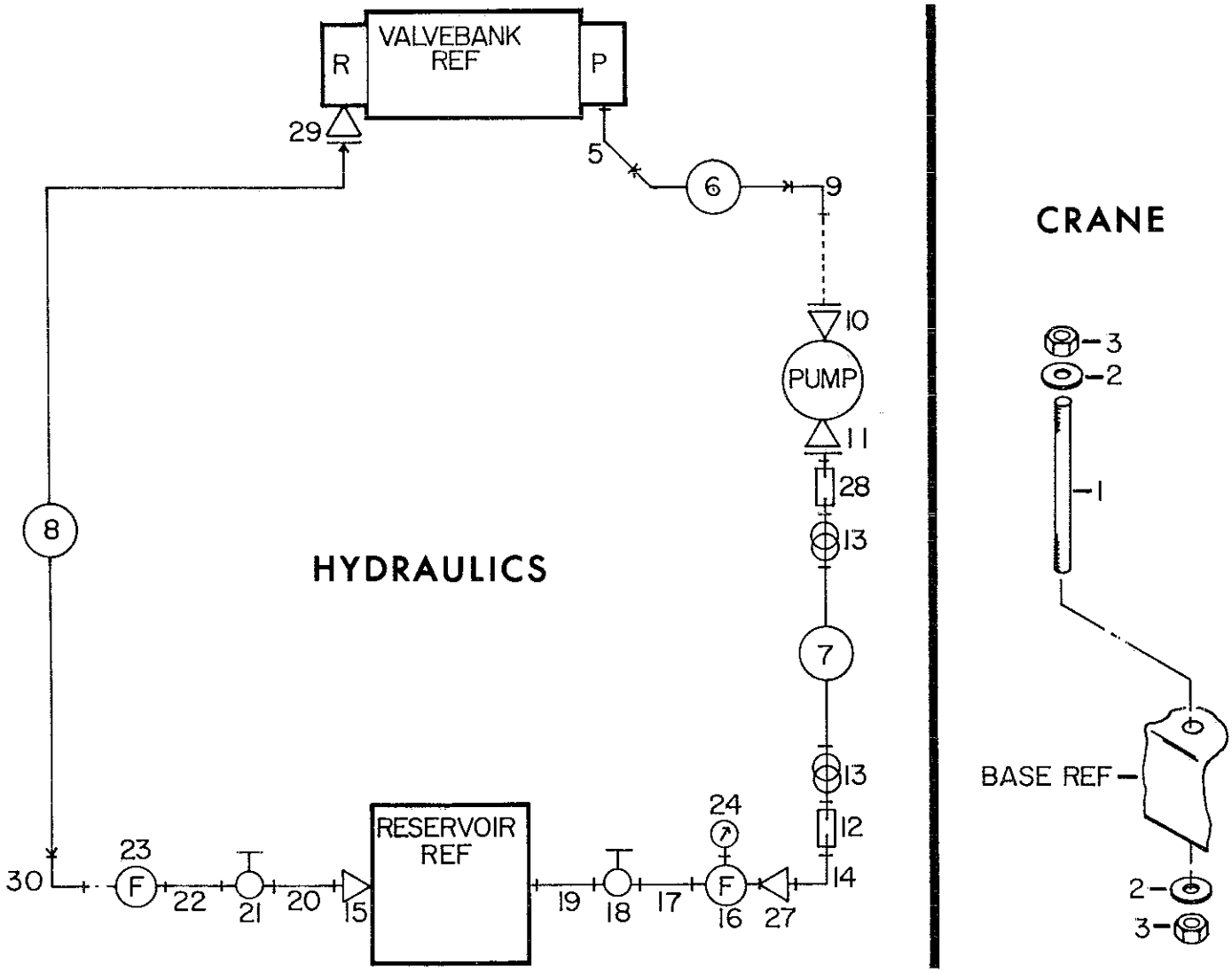
WIRING-TRACER COLOR/BASE COLOR





Item No.	Part No.	Description	Qty
1	60111140	HANDLE	1
2	70034306	BACK, control handle	1
3	60111141	TRIGGER	1
4	72061009	SCREW, pan hd.; #6 x 3/4"	4
5	51707507	POTENTIOMETER, trigger	1
6	60111142	BRACKET, potentiometer mounting	1
7	72060670	SCREW, soc. hd.; #10-32 x 3/4"	2
8	72062130	NUT, lock; #10-32	2
9	72060669	SCREW, soc. hd.; #10-32 x 5/8"	1
10	70143223	SPRING, tension	1
11	72061000	SCREW, pan hd.; #6 x 1/2"	1
12	70392696	DECAL, remote control	1
13	77040186	TERMINAL, female slip-on	20
14	77040047	TERMINAL, male slip-on	3
15	77041345	SWITCH, toggle, SPST	2
16	77041346	SWITCH, toggle, SPDT	4
17	77041347	SWITCH, momentary contact	2
18	89044116	CABLE; 18-ga., 16-wire	360"
19	60045031	WIRE, green; 18 ga. x 4"	7
20	70392351	DECAL, electrocution, small (not shown)	1
21	70029119	PLACARD, identification (not shown)	1
22	72066340	RIVET, pop; 1/8" (not shown)	2
23	77044170	CONNECTOR; 16-pin	1
24	72531833	BUSHING, reducer; 3/4" npt(m) x 1/2" npt(f)	1
25	77044096	GRIP, cord	1
26	70392785	PLUG, hole; 1/2"	1

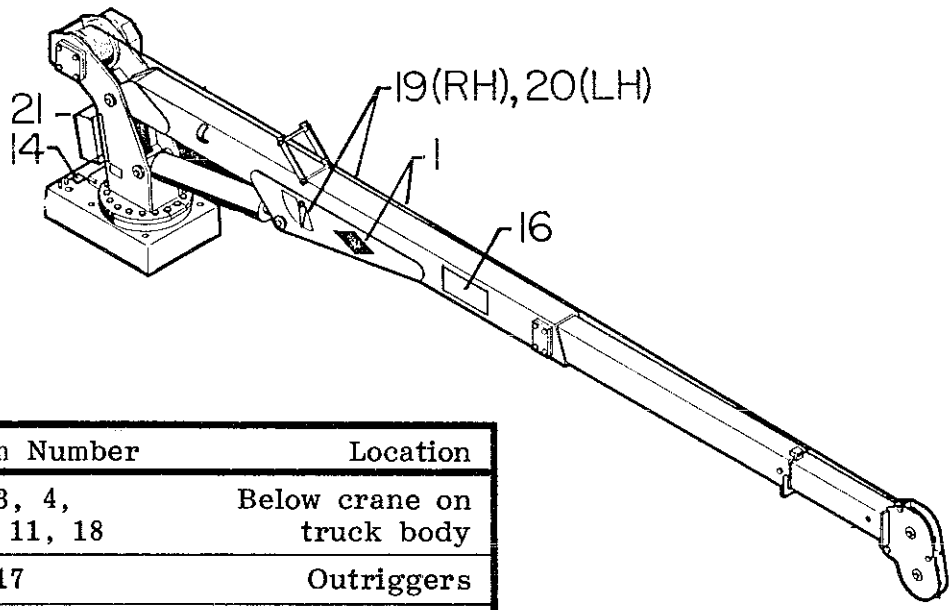
Figure D-21. Control Handle with Engine Start (Part 51707981)



Item No.	Part No.	Description	Qty
1.	60106481	STUD, tie down	4
2.	72063066	WASHER, hi-strength; 1"	8
3.	72062141	NUT, lock; 1-8	8
4.	95707753	KIT, decal (not shown)	1
5.	72532670	ELBOW, 45°; 3/4-16 JIC(m) x 3/4-16 JIC(f)	1
6.	51704458	HOSE; 1/2" ID x 252" lg.	1
7.	89039481	HOSE; 1" ID	48"
8.	51708184	HOSE; 3/4" ID x 192" lg.	1
9.	72053763	ELBOW, 90°; 3/4-16 str. thd.(m) x 3/4-16 JIC(m)	1
10.	*	ADAPTER, pump	1
11.	*	ADAPTER, pump	1
12.	72532470	NIPPLE, barbed; 1"	1
13.	72066515	CLAMP, hose; 1"	2
14.	72053286	ELBOW, street, 90°; 1" npt	1
15.	72531836	BUSHING, reducer; 1-1/4" npt(m) x 3/4" npt(f)	1
16.	73052012	FILTER, suction	1
17.	72053211	NIPPLE, close; 1-1/4"	1
18.	73054130	VALVE, gate; 1-1/4"	1
19.	72053216	NIPPLE; 1-1/4" npt x 6" lg.	1
20.	72053146	NIPPLE; 3/4" npt x 6" lg.	1
21.	73054129	VALVE, gate; 3/4"	1
22.	72053141	NIPPLE, close; 3/4" npt	1
23.	73052000	FILIER, return	1
24.	70048031	GAUGE, vacuum	1
25.	----	NOT USED	-
26.	72053670	ELBOW, 90°; 3/8" npt(m) x 3/4-16 JIC(m)	1
27.	72053377	BUSHING, reducer; 1-1/4" npt(m) x 1" npt(f)	1
28.	72531195	NIPPLE, barbed, 45°	1
29.	72532364	ADAPTER; 3/4-16 str. thd.(m) x 1-1/16" JIC(m)	1
30.	72531427	ELBOW, 90°; 3/4" npt(m) x 1-1/16" JIC(m)	1

* Determined by pump ports.

Figure D-22. Installation Kit (Part Number 93707664)



Item Number	Location
2, 3, 4, 10, 11, 18	Below crane on truck body
5, 17	Outriggers
6, 7	Near grease zerks
8, 9	Reservoir
12, 13	At control cable connectors
15	Remote control handle

Item No.	Part No.	Description	Qty
1.	70029251	DIAMOND, IMI	2
2.	70391390	DECAL, caution operation	2
3.	70391391	DECAL, danger electrocution	2
4.	70391392	DECAL, operation caution	2
5.	70391598	DECAL, outrigger warning	2
6.	70391612	DECAL, grease weekly, left	5
7.	70391613	DECAL, grease weekly, right	2
8.	70392108	DECAL, suction line	1
9.	70392109	DECAL, return line	1
10.	70392213	DECAL, washing precautions	1
11.	70392273	DECAL, electrocution danger; small	3
12.	70392351	DECAL, electrocution danger, remote control; small	1
13.	70392352	DECAL, electrocution danger, remote control; large	1
14.	70392524	DECAL, rotate while greasing	1
15.	70392696	DECAL, remote control	1
16.	70392767	DECAL, 5016 ID	2
17.	71039129	DECAL, outrigger warning	2
18.	71039134	DECAL, oil level caution	1
19.	71391522	DECAL, angle	1
20.	71391523	DECAL, angle	1
21.	71392768	PLACARD, capacity	1

Figure D-23. Decal Kit (Part Number 95707753)

Section 5. REMOTE CONTROLS

5-1. GENERAL

This section contains information regarding the proportional remote controls used on this crane.

5-2. OPERATION

The remote controls on this crane are proportional - the greater the movement of the trigger switch the greater the flow of oil to the cylinder or motor.

The switches for the various functions - lower boom, extension boom, winch and rotation - are simply on/off switches. They provide no proportional control for these functions. The trigger in the control handle operates a potentiometer which increases and decreases voltage depending on the switch travel. This increase and decrease in voltage, provides the actual proportional control. The output from the control handle trigger is supplied to the amp driver and the output of the amp driver is applied to the coil of the proportioning solenoid on the valve bank. The proportioning solenoid increases or decreases the flow of oil to the crane's valve bank. With this arrangement, it is not possible to operate more than one function with each function independently proportional. The reduced flow affects all functions equally.

5-3. ADJUSTMENTS

There are three potentiometers that may be adjusted. Two of them (R5 and R15) are located inside the amp driver on the circuit board and one is located inside the control handle and operated by the trigger. Normally, these adjustments will not need to be made, but if the control handle or amp driver is replaced, it may be necessary.

To adjust the potentiometers:

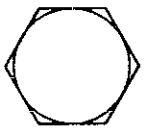
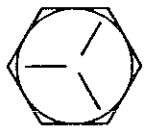
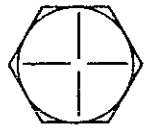
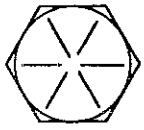
1. Remove the cover from the amp driver and adjust potentiometer R15 fully in one direction. The potentiometer will make a clicking noise when fully adjusted.

2. Remove the cover from the control handle and turn on the POWER switch. With any function switch deflected and the trigger relaxed, loosen the screw securing the trigger potentiometer and rotate the potentiometer until the crane just begins to move. Tighten the screw securing the potentiometer.

TABLE E-1. TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	RECOMMENDED COURSE OF ACTION
Crane will not operate	No power.	Black lead on terminal board should be 12 VDC. If not check for blown fuse or broken wire.
	No power to control valve.	Check for manual control valve operation. Valve spools may be operated manually by pushing on the red-tipped spools. If crane operates manually, continue.
	Pump failure.	Check pump for operation.
	Proportioning solenoid	Check proportioning solenoid for proper operation. Check for 3 - 9 VDC at coil.
	Pressure build-up valve	Valve bank spools do not shift. Check.
Crane operates too slow	Dirty filter	Check vacuum gauge. Change filter element if necessary
	Proportioning solenoid	Check voltage at proportioning solenoid coil. Should vary between 3 VDC and 9 VDC depending on position of trigger.
	Proportioning solenoid	Check that proportioning solenoid is providing sufficient flow to valve bank
Extension and Winch function inoperative.	Excessive load	Reduce load.
	Defective pressure switch	Check pressure switch for proper operation. By-pass pressure switch with a jumper wire and check for proper operation. Do not operate crane with jumper installed.
		Defective wiring between valve bank, pressure switch and terminal board.
Controls not proportional	Proportioning solenoid	Check proportioning solenoid for proper operation. Should be 3 to 9 VDC at the coil with trigger deflected. If present, replace flow control valve.
	Defective amp driver	Perform adjustments in Paragraph 5-3. Check for 12 VDC at Amp Driver. If present, replace amp driver.
	Defective trigger pot	Check for voltage at pot wiper connection inside amp driver. If present, check for varying voltage at HI and LO pot connections inside amp driver. If absent or unvarying, replace trigger pot in handle.

TORQUE DATA CHART

GRADE BOLT	SAE J429 GRADE 2		SAE J429 GRADE 5		SAE J429 GRADE 7		SAE J429 GRADE 8	
MARKING								
MATERIAL AND TREATMENT	Low or Medium Carbon Steel		Medium Carbon Steel Q & T		Medium Carbon Alloy Steel Q & T		Medium Carbon Alloy Steel Q & T	
MINIMUM TENSILE STRENGTH	74,000 psi*		120,000 psi*		133,000 psi*		150,000 psi*	
	RECOMMENDED TORQUE VALUE IN Ft.-Lbs.							
BOLT SIZE	Coarse Thread	Fine Thread	Coarse Thread	Fine Thread	Coarse Thread	Fine Thread	Coarse Thread	Fine Thread
1/4"	5	5	7	8	9	10	10	12
5/16"	10	11	15	16	18	20	21	23
3/8"	17	19	26	30	32	37	37	42
7/16"	27	30	42	47	52	58	60	66
1/2"	41	47	64	72	79	89	90	102
9/16"	60	67	93	103	114	127	130	146
5/8"	82	94	128	145	157	179	180	204
3/4"	147	163	226	253	280	312	320	357
7/8"	141*	156*	365	403	451	496	515	568
1"	213*	233*	547	599	676	740	772	846

* Minimum tensile strength of 7/8" and 1" grade 2 bolts is 60,000 psi instead of 74,000 psi.

In using the torque data above, the following rules should be observed:

1. Bolt manufacturer's particular specifications should be consulted when provided.
2. All torque values are given in ft.-lbs. To convert these values to in.-lbs., multiply by 12.
3. Flat washers of equal bolt strength must be used.
4. The torque values in the table apply under the following conditions:
   a. Black finished fasteners with residual oil, giving a torque coefficient of friction (K) of approximately 0.17.
   b. Fastener clamp load after torquing is equal to 75% of fastener proof load.

WARNING

Anytime a gear-bearing bolt is removed, it must be replaced with a new bolt of the identical grade and size. Once a bolt has been torqued to 75% of its proof load and then removed, the torque coefficient may no longer be the same as when the bolt was new, thus giving indeterminate clamp loads after torquing. Failure to replace gear-bearing bolts may result in bolt failure due to metal fatigue causing serious injury or death.

SPARE PARTS LIST

1-Year Supply

This spare parts list does not necessarily indicate that the items can be expected to fail in the course of a year. It is intended to provide the user with a stock of parts sufficient to keep the unit operating with no down-time waiting for parts. Obviously, there may be part failures not covered by this list.

The item numbers below correspond to the item numbers in the figures listed.

Figure No.	Item No.	Part Number	Description	Qty
D-4.	3.	60020114	BUSHING, top pinion gear	1
D-4.	4.	60020115	BUSHING, top drive gear.	1
D-4.	5.	60020116	BUSHING, bottom drive gear	1
D-4.	6.	60020154	BUSHING, bottom pinion gear	1
D-4.	7.	71056011	GEAR, drive	1
D-4.	15.	71056010	GEAR, pinion	1
D-4.	16.	71056012	GEAR, intermediate	1
D-4.	17.	71056389	GEAR-BEARING, turntable	1
D-4.	24.	72060931	SCREW, hex hd.; 5/8-11 x 2-3/4" gr. 8.	20
D-4.	30.	72063119	WASHER, hardened; 5/8"	20
D-4.	32.	73051004	MOTOR, crane rotation	1
D-4.	33.	73054538	VALVE, cartridge, crane rotation	2
D-5.	4.	72060931	SCREW; 5/8-11 x 2-3/4" gr. 8	20
D-5.	5.	72063119	WASHER, hardened; 5/8"	20
D-6.	5.	7BF81215	BUSHING, hinge	4
D-6.	6.	60030015	PAD, wear	2
D-6.	7.	60030139	PAD, wear	1
D-7.	2.	7BF81015	BUSHING, lower cylinder base and rod end.	5
D-7.	6.	7BF81215	BUSHING, lower cylinder rod end	1
D-7.	12.	73054304	VALVE, counter-balance; 25-gpm	1
D-7.	--	9C202029	SEAL KIT, lower cylinder	1
D-10.	3.	60030076	PAD, wear, extension boom top.	1
D-11.	21.	73054004	VALVE, locking holding	1
D-11.	--	9C121617	SEAL KIT, extension cylinder	1
D-12.	5.	60030189	PAD, wear	1
D-13.	10.	60108886	ROPE, wire; 3/8"dia. x 100'	1
D-13.	12.	70055117	BEARING, flange, winch shaft	1
D-13.	14.	70058033	SOCKET, wedge	1
D-13.	16.	71073035	HOOK	1
D-13.	32.	73051513	MOTOR, hydraulic, winch	1
D-17.	14.	73054636	SECTION, control valve	1
D-17.	15.	73054624	VALVE, solenoid proportioning	1
*D-18.	12.	77041329	AMP DRIVER	1
*D-18.	14.	77041003	SOLENOID; 12 VDC.	1
*D-19.	5.	51707507	POTENTIOMETER.	1
*D-19.	15.	77041345	SWITCH, toggle, SPST	3
*D-19.	16.	77041346	SWITCH, toggle, SPDT momentary contact	4
*D-19.	17.	77041347	SWITCH, momentary contact	1
D-22.	24.	70048031	GAUGE, vacuum	1
----	--	73052006	ELEMENT, return filter	3
----	--	73052014	ELEMENT, suction filter	3

* Components shown for Figure D-18 are the same as for Figure D-20 - components shown for Figure D-19 are the same as for Figure D-21.