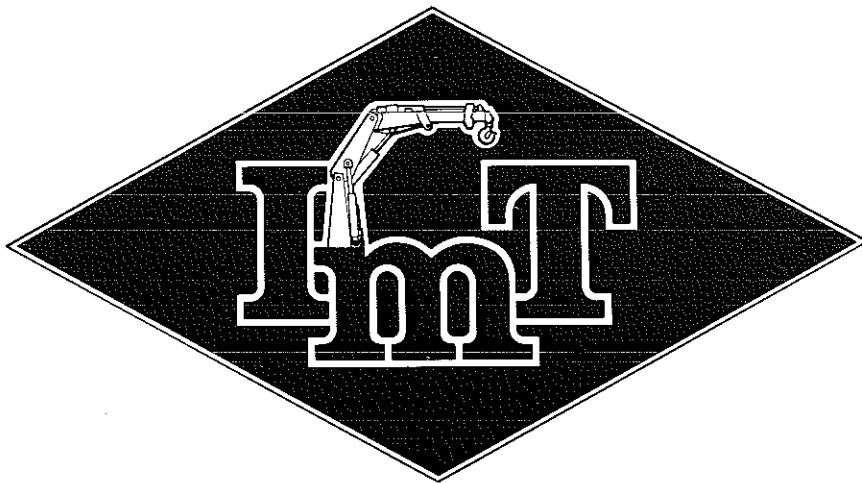


3016 CRANE

3016-20 CRANE



IOWA MOLD TOOLING CO., INC.

500 HWY 18 WEST, GARNER, IA 50438

515·923·3711

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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

	3016 Crane	3016-20 Crane
Crane Rating	30,000 ft.-lbs. 4.15 Ton-meters	30,000 ft.-lbs. 4.15 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'-0" 5.49 m	22'-4" 6.81 m
Weight of Crane	1040 lbs. 472 kg.	1150 lbs. 522 kg.
Outrigger Span (required option)		
crane side from centerline of chassis	83" 210.8 cm	83" 210.8 cm
Opposite crane side from centerline of chassis	47" 119.4 cm	47" 119.4 cm
Storage Height - crane only	28" 71.1 cm	28" 71.1 cm
Mounting Space Required - for crane base	17" x 18-3/4" 43.2 cm x 47.6 cm	17" x 18-3/4" 43.2 cm x 47.6 cm
Tie-Down Bolt Pattern	14-3/4" x 14-3/4" on center 37.5 cm x 37.5 cm on center	14-3/4" x 14-3/4" on center 37.5 cm x 37.5 cm on center
Horizontal Center of Gravity - from centerline of rotation	28" 71.1 cm	28" 71.1 cm
Vertical Center of Gravity - from bottom of crane base	16" 40.6 cm	17" 43.2 cm
Optimum Pump Capacity	5 U.S. Gallons/minute 18.9 liters/minute	5 U.S. Gallons/minute 18.9 liters/minute
Design Factors - pins and hydraulics	4 to 1	4 to 1

1-2. PERFORMANCE CHARACTERISTICS

Rotation - 400° (6.98 Rad.)	56 Seconds
Lower Boom Elevation - -5° to +80° (-0.09 Rad. to +1.40 Rad.)	15 Seconds
Extension Cylinder - 60" (152.4 cm)	15 Seconds

1-3. CYLINDERS

	<u>Bore</u>	<u>Stroke</u>
Lower Boom Cylinder	4" (10.2 cm)	21-5/8" (54.9 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 9 horsepower based on 5 GPM at 2,350 PSI (18.9 liters/min. at 165.2 kg/cm²).

1-5. ROTATION SYSTEM

Turntable bearing with external worm gear powered with a high-torque hydraulic motor through a self-locking worm. Total gear reduction is 73:1.

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 component failure.

The extend side of the lower boom cylinder is equipped with a 10-GPM counter-balance valve. The counter-balance 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 and the extend side of the extension boom provides a capacity alert system. If the operator tries to pick up a load in excess of the crane capacity, the winch lift and extension out functions will not operate. To relieve the condition, the winch can be lowered or the extension boom retracted.

1-10. MINIMUM CHASSIS SPECIFICATIONS

Body Style	Conventional Cab
Wheel Base	391 cm
Cab to Axle	213 cm
Frame Section Modulus	163.9 cc
R B M	4,149 kg-m
Front Axle Rating	2,268 kg.
Rear Axle Rating	4,309 kg.
Gross Vehicle Weight Rating	6,577 kg.
Transmission	4-speed

Conventional Cab	154"
	84"
	10" ³
360,000 in.-lbs.	
5,000 lbs.	
9,500 lbs.	
14,500 lbs.	
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.

1-8. WINCH

The winch is powered by a hydraulic motor through a 30:1 worm gear arrangement with a mechanical brake. Line speed is 15 ft./min. (4.5 m/min.) at optimum oil flow of 5 GPM (18.9 liters/min.) and 1-part line - 7.5 ft./min. (2.29 m/min.) with a 2-part line. Maximum single line lifting capacity of the winch is 3,000 lbs. (1,361 kg.). The winch is equipped with 80' (24.4 m) of 5/16" (0.79 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 18.6:1 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 5 GPM (18.9 liters/min.) optimum oil flow at 2,350 PSI (165.2 kg/cm²). 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 filters, and control valve.

IMT reserves the right to change specifications and design without notice.

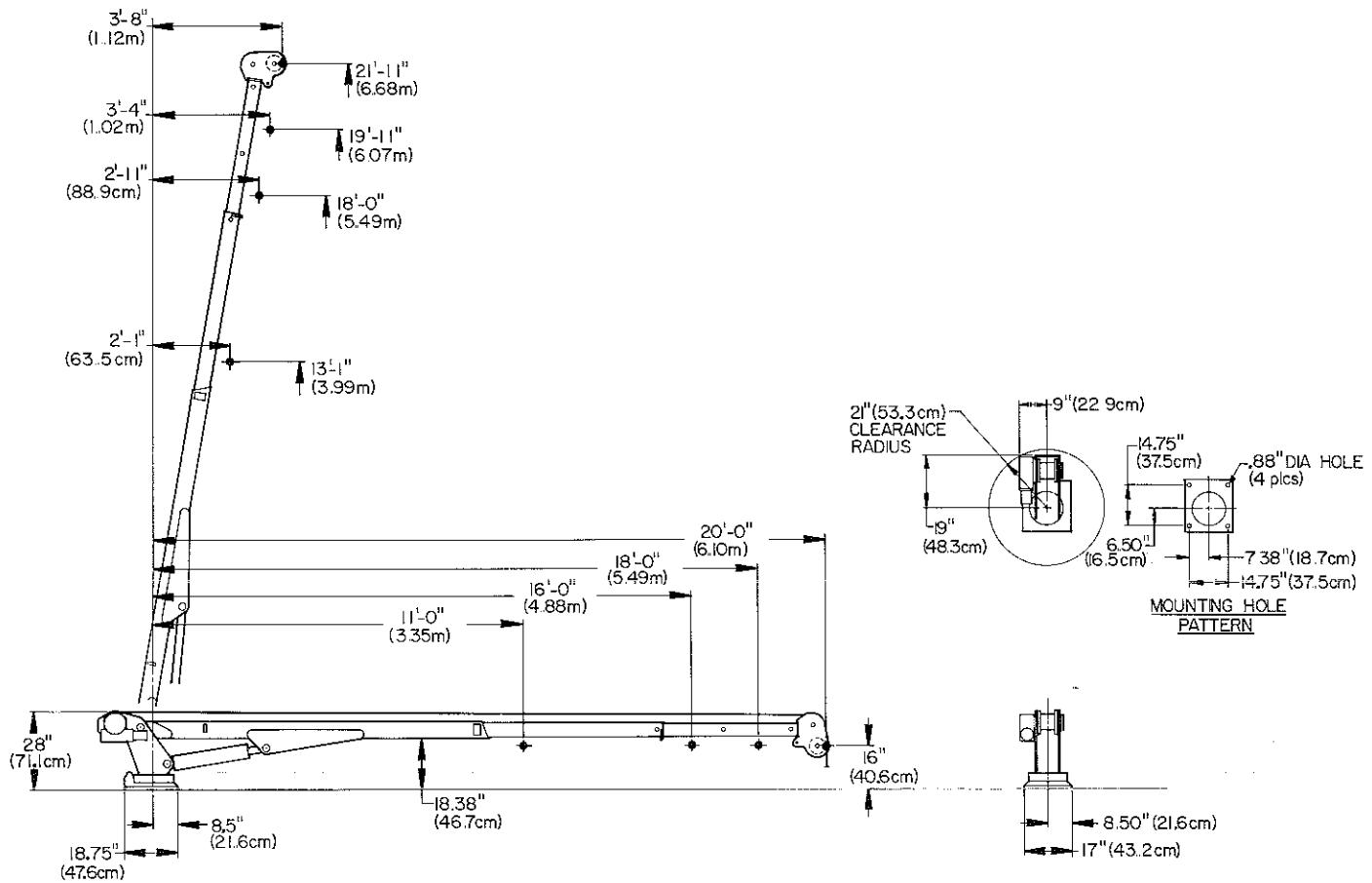
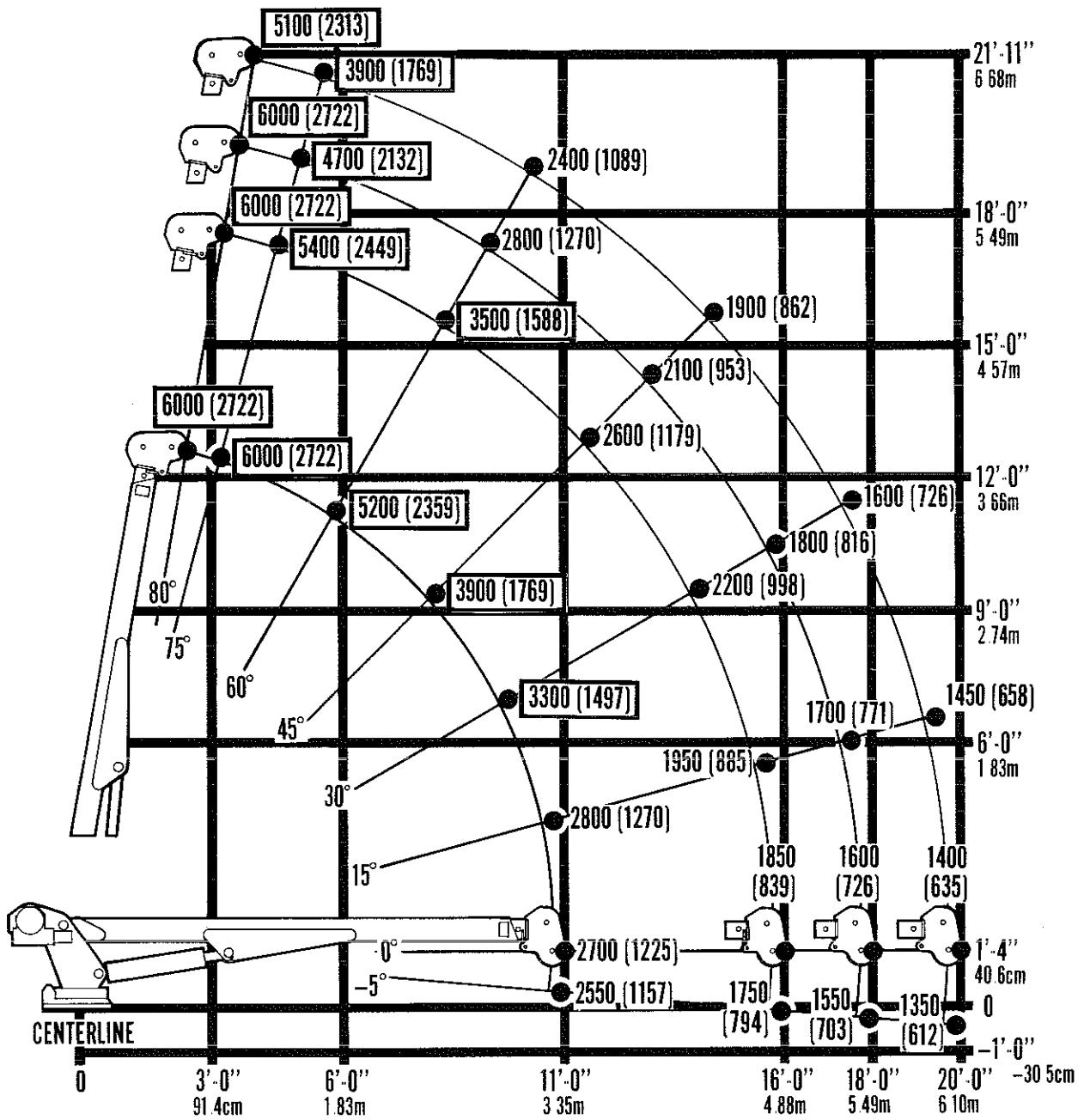


Figure A-1. Geometric Configuration



REACH IN FEET (METERS)

● CAPACITY IN POUNDS (KILOGRAMS)

Maximum 1-part line capacity is 3000 lbs (1360 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. Capacity Chart

Section 2. CRANE DESCRIPTION

2-1. GENERAL

The 3016/3016-20 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 400° (6.98 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 30:1 ratio worm-gear driven winch mechanism.

2-4. LOWER BOOM

The lower boom will swing through a full 85° (1.48 Rad.) from -5° to +80° (-0.09 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 (9.14m) cable. In an overload condition, the winch up and extension out functions are inoperative. Those functions can be reversed to alleviate the overload condition.

2-7. HYDRAULICS

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

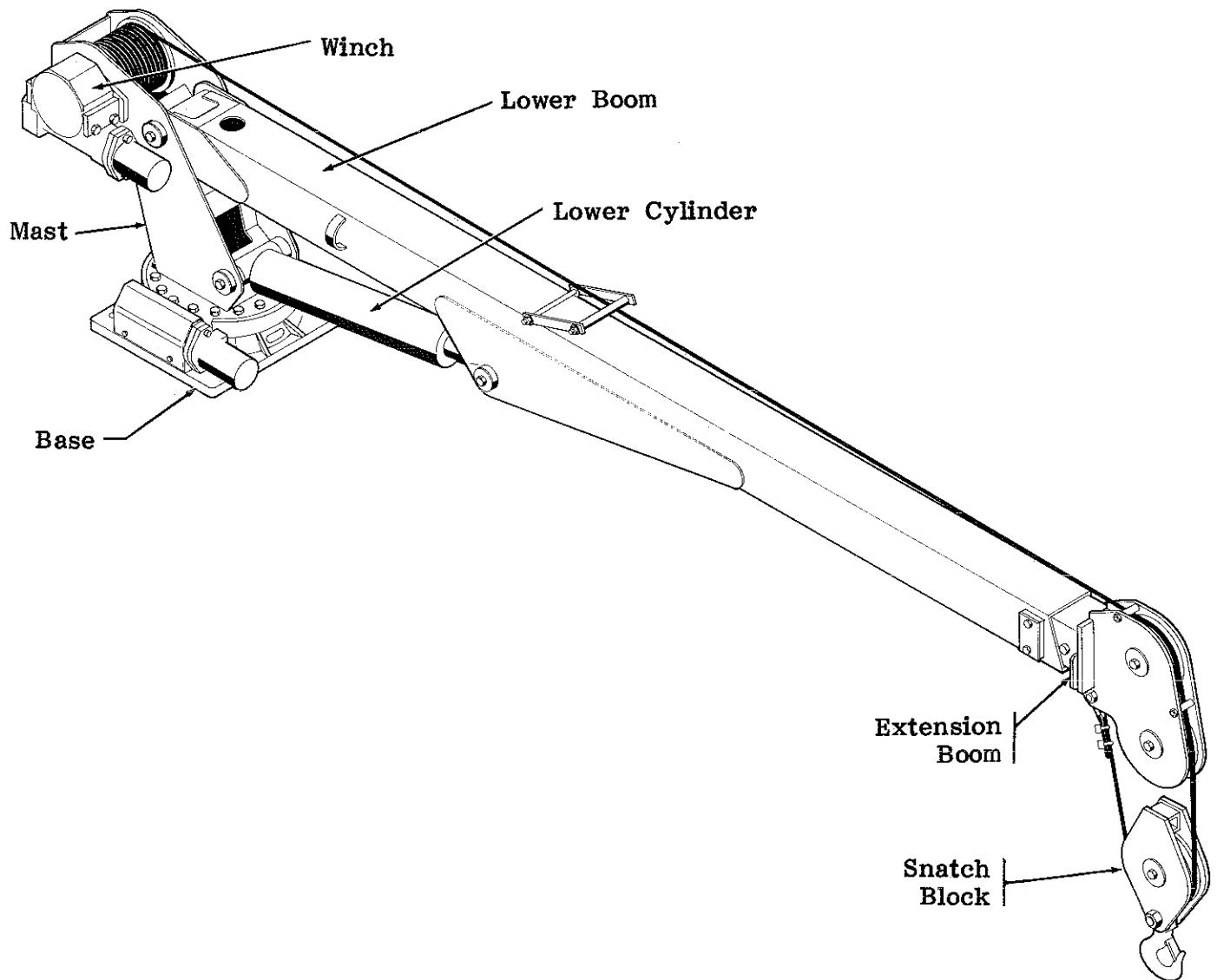


Figure B-1. 3016 Crane Group

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 3016 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 - 1,150 lbs (522 kg.). Attach the lifting device to the lift brackets of the crane (located on both sides of the lower boom, approximately 32" 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 3/4-10 x 3" hex head bolts, the washers and the 3/4-10 lock nuts to secure the crane base to the truck body (Figure C-1). Torque to 225 ft. lbs. (31 kg-m).

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).

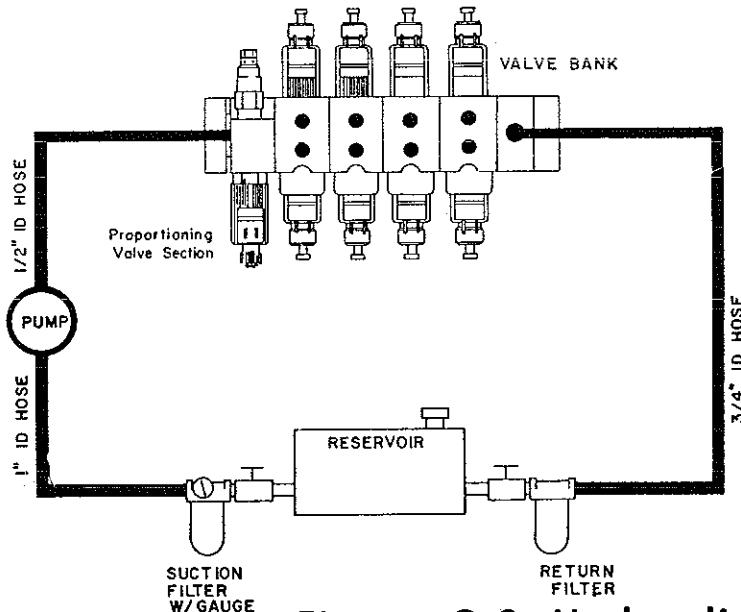
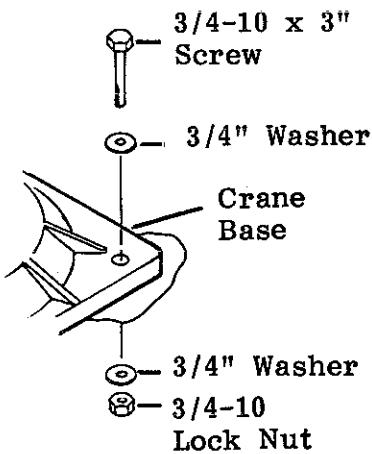


Figure C-2. Hydraulic Installation

Figure C-1. Crane 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 under-hood 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 86 - , the normally open side of the engine start relay - pin 86 - 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.

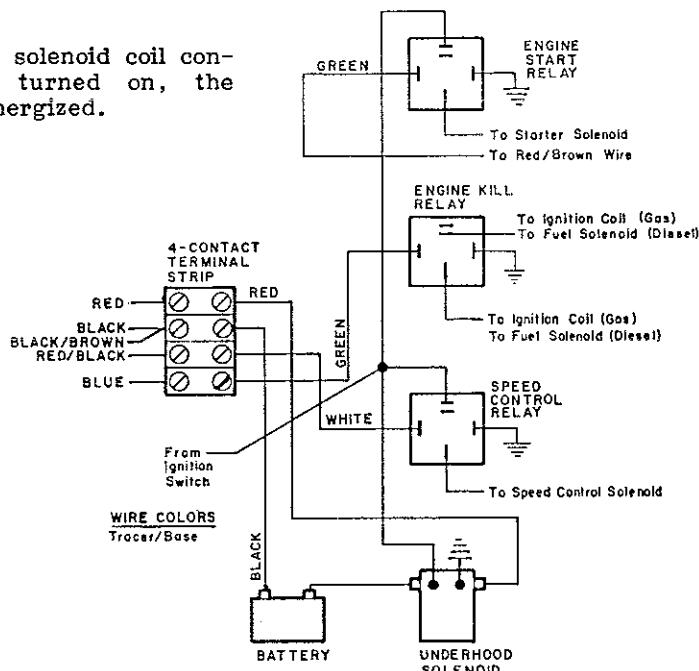


Figure C-3. Electrical Installation

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 TWX 910-523-6930. In Canada; IMT Cranes Canada, Ltd.; Orillia, Ontario; telephone: (705) 325-7458.

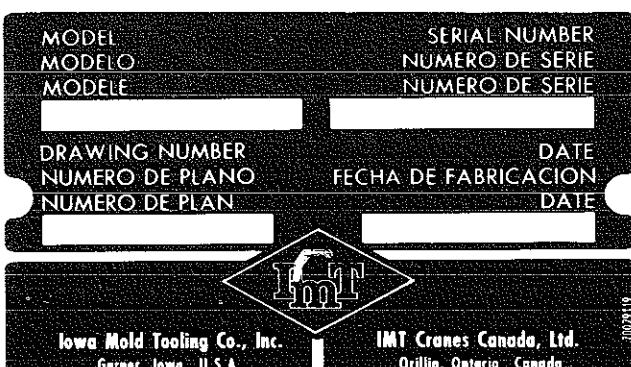


Figure D-1. Serial Number Placard

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.

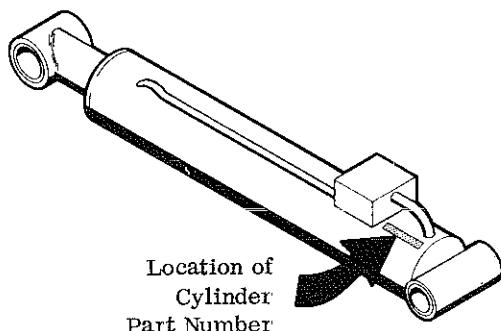


Figure D-2. Cylinder Part Number Location

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.

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.

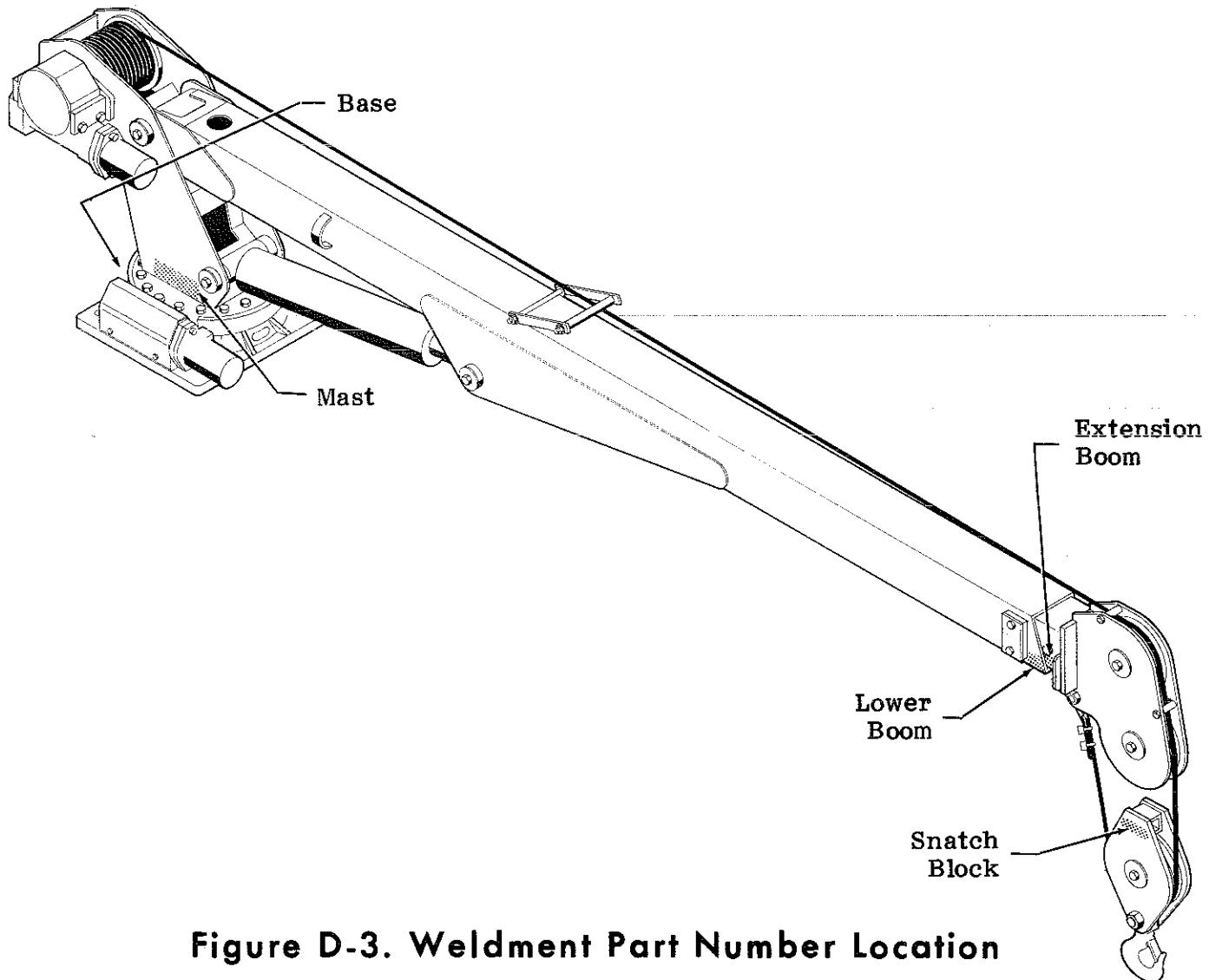
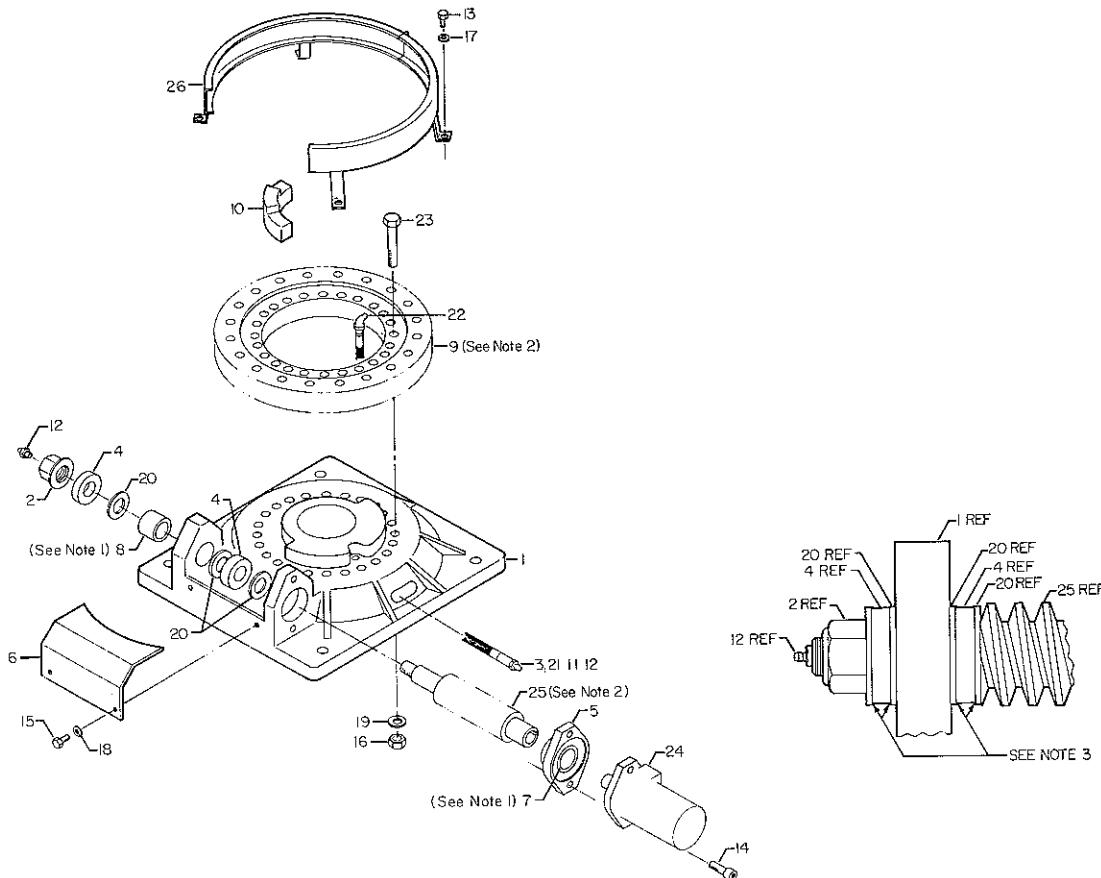


Figure D-3. Weldment Part Number Location



Item No.	Part No.	Description	Qty
1..	51707512	BASE	1
2..	52705551	NUT, lock	1
3..	60030086	TUBING	1
4..	60030116	BEARING, thrust	2
5..	60107543	PLATE, worm support	1
6..	60111627	COVER, worm	1
7..	70055147	BEARING, roller	1
8..	70055148	BEARING, roller	1
9..	71056395	GEAR-BEARING, turntable	1
10..	71143165	SLIDE, rotation stop	1
11..	72053301	COUPLING; 1/8" npt	1
12..	72053508	ZERK; 1/8" npt	2
13..	72060000	SCREW, hex hd.; 1/4-20 x 1/2"	4
14..	72060796	SCREW, soc. hd.; 1/2-13 x 2"	2
15..	72060857	SCREW, hex hd.; 5/16-18 x 5/8"	2
16..	72062162	NUT; 9/16-12 gr. 8	23
17..	72063049	WASHER, lock; 1/4"	4
18..	72063050	WASHER, lock; 5/16	2
19..	72063117	WASHER; 9/16" gr. 8	23
20..	72063161	WASHER, wrt.; 1-1/8"	3
21..	72531731	ADAPTER; 1/8" npt x 1/4" tube	1
22..	72531746	ELBOW, 90°; 1/8" npt x 1/4" tube	1
23..	72601510	SCREW; 9/16-12 x 3-3/4" gr. 8	23

Item No.	Part No.	Description	Qty
24..	73051482	MOTOR, hydraulic	1
25..	70056397	GEAR, worm	1
26..	52707845	GUARD, gear	1

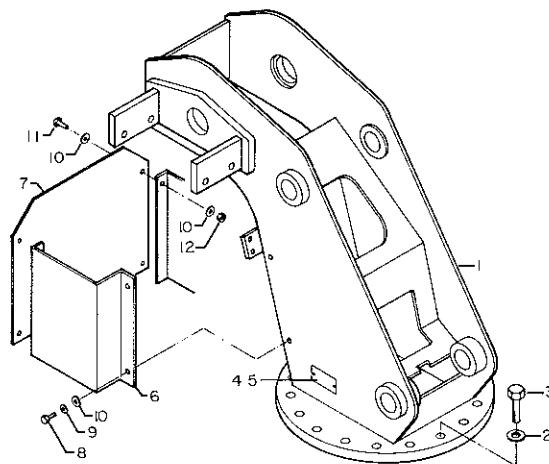
WARNING

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.

NOTE

1. Bearings must be packed with grease at assembly.
2. Apply Molub-Alloy 936 to turntable bearing and worm teeth at assembly.
3. Initial lubrication of both sides of thrust bearings (item 4) is required at time of assembly. See note 4 for approved lubricants.
4. Approved lubricants are Slip Plate, Lubri-Plate or other lubricants containing graphite or MSO_2 .

Figure D-4. Base (Part Number 41707846)

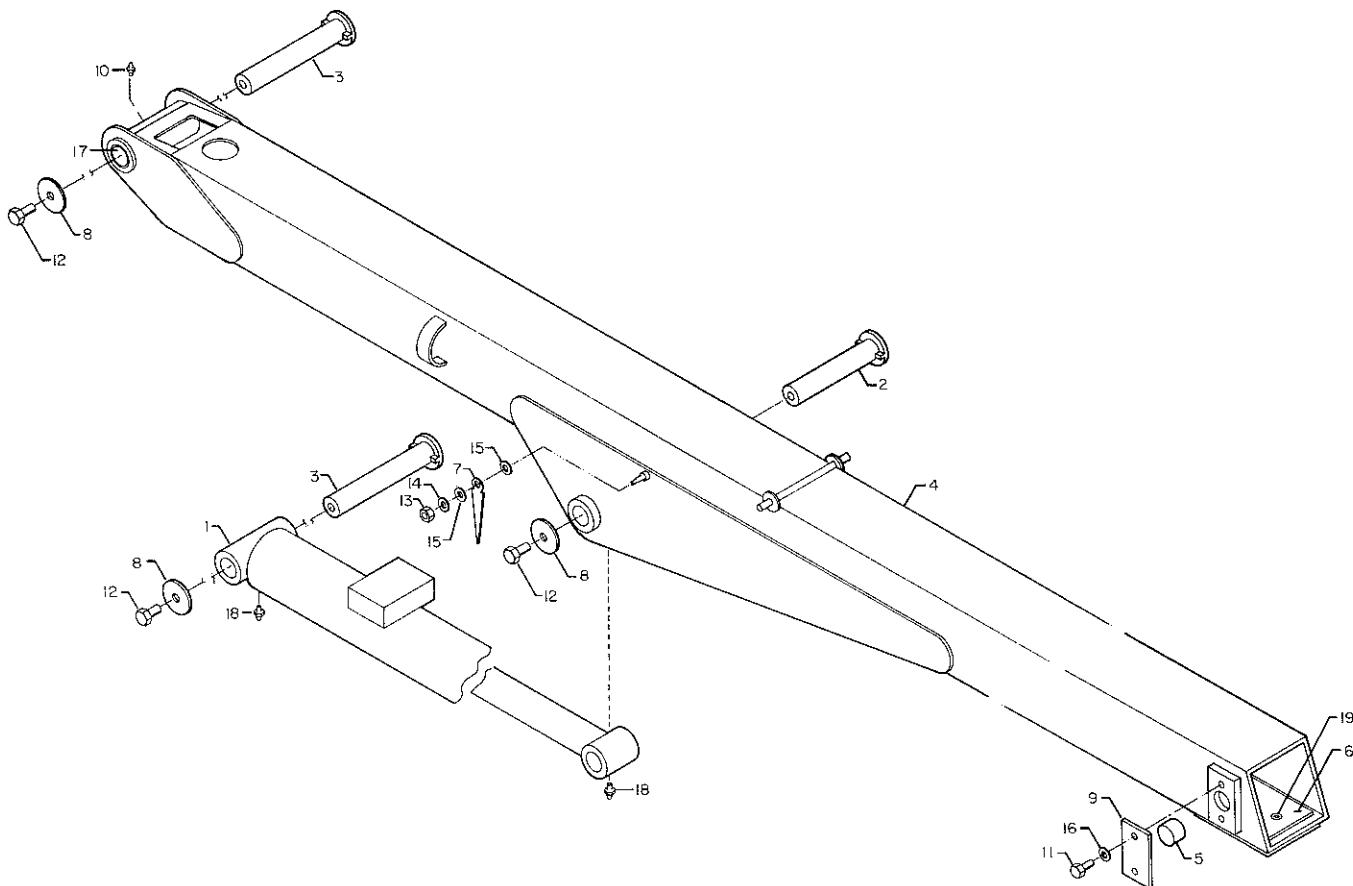


Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	52707912	MAST	1	11.	72060004	SCREW, hex hd.; 1/4-20 x 1"	4
2.	72063117	WASHER; 9/16" gr. 8	18	12.	72062104	NUT, lock; 1/4-20	4
3.	72601144	SCREW; 9/16-12 x 2" gr. 8	18				
4.	70029119	PLACARD, serial number	1				
5.	72066340	RIVET, pop; 1/8"	2				
6.	60111997	PLATE, valve bank cover, side	2				
7.	60111996	PLATE, valve bank cover, back	1				
8.	72060002	SCREW, hex hd.; 1/4-20 x 3/4"	4				
9.	72063049	WASHER, lock; 1/4"	4				
10.	72063001	WASHER, wrt.; 1/4"	12				

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 41707847)



Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1..	3B036880	CYLINDER (includes item 18)	1	13..	72062103	NUT, lock; 3/8-16	2
2..	52703765	PIN	1	14..	72063003	WASHER, wrt.; 3/8"	2
3..	52707685	PIN	2	15..	72063005	WASHER, wrt.; 1/2"	4
4..	52707915	BOOM, lower (includes item 17)	1	16..	72063051	WASHER, lock; 3/8"	4
5..	60030007	PAD, wear	2	17..	7BF81215	BUSHING (part of item 4)	4
6..	60030139	PAD, wear	1	18..	72053507	ZERK; 1/4-28 (part of item 1)	2
7..	60105544	INDICATOR, angle	2	19..	72060915	SCREW, flat hd.; 3/8-16 x 1"	2
8..	60106333	PLATE, pin retainer	3				
9..	60107550	PLATE, wear pad retainer	2				
10..	72053508	ZERK; 1/8" npt	1				
11..	72060044	SCREW, hex hd.; 3/8-16 x 3/4"	4				
12..	72060147	SCREW, hex hd.; 5/8-11 x 1"	3				

NOTE
Anytime the pin retainer plate bolts have been removed, apply Loctite 262 to the threads before re-assembly.

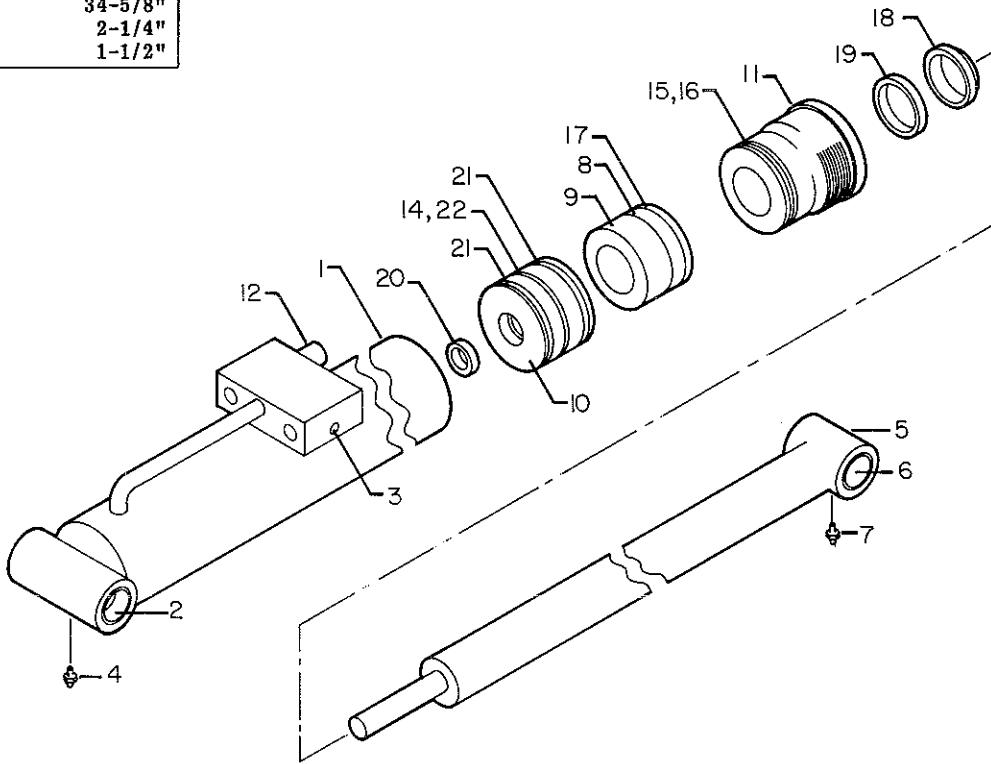
Figure D-6. Lower Boom (Part Number 41707848)

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.

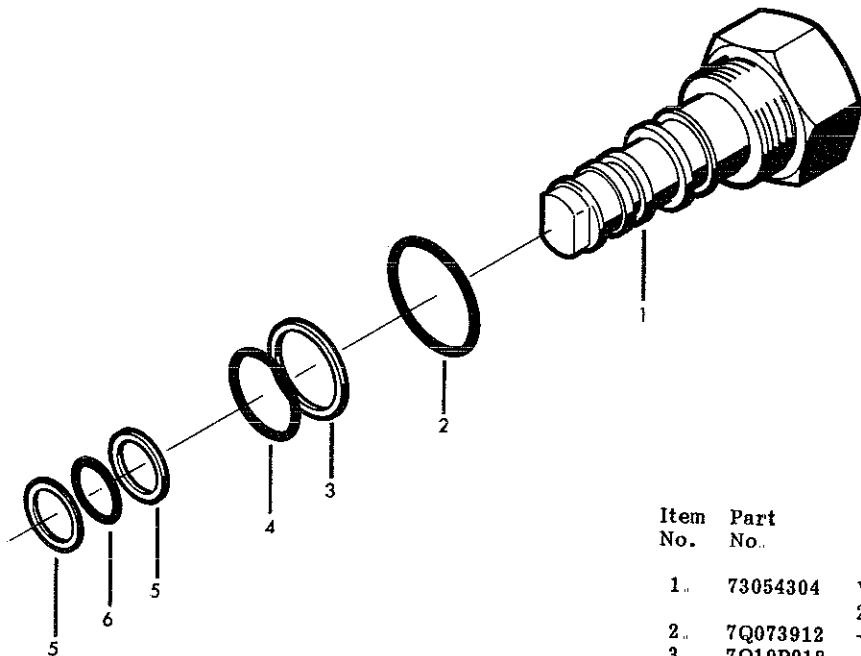
DIMENSIONS

Bore	4"
Stroke	21-5/8"
C-C Closed	34-5/8"
Rod Diameter	2-1/4"
Pin Diamter	1-1/2"



Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	4B036880	CASE (includes items 2 thru 4)	1	13.	9C161823	SEAL KIT (includes items 14 thru 22)	1
2.	7BF81015	- BUSHING (part of item 1)	4	14.	7Q072153	- O-RING	1
3.	7PNPXT02	- PLUG; 1/8" npt (part of item 1)	3	15.	7Q072342	- O-RING	1
4.	72053507	- ZERK; 1/4-28 (part of item 1)	1	16.	7Q10P342	- RING, back-up	1
5.	4G036880	ROD (includes item 6 & 7)	1	17.	6A025022	- RING, wafer lock	1
6.	7BF81215	- BUSHING (part of item 5)	2	18.	7R14P022	- ROD, wiper	1
7.	72053507	- ZERK; 1/4-28 (part of item 5)	1	19.	7R546022	- SEAL, rod	1
8.	6C075022	TUBE, stop	1	20.	7T61N143	- RING, seal lock	1
9.	6C150022	TUBE, stop	1	21.	7T65I040	- RING, piston	2
10.	6I040143	PISTON	1	22.	7T66P040	- SEAL, piston	1
11.	6H040022	HEAD	1				
12.	73054304	VALVE, counterbalance; 10-gpm	1				

Figure D-7. Lower Cylinder (Part Number 3B036880)



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)

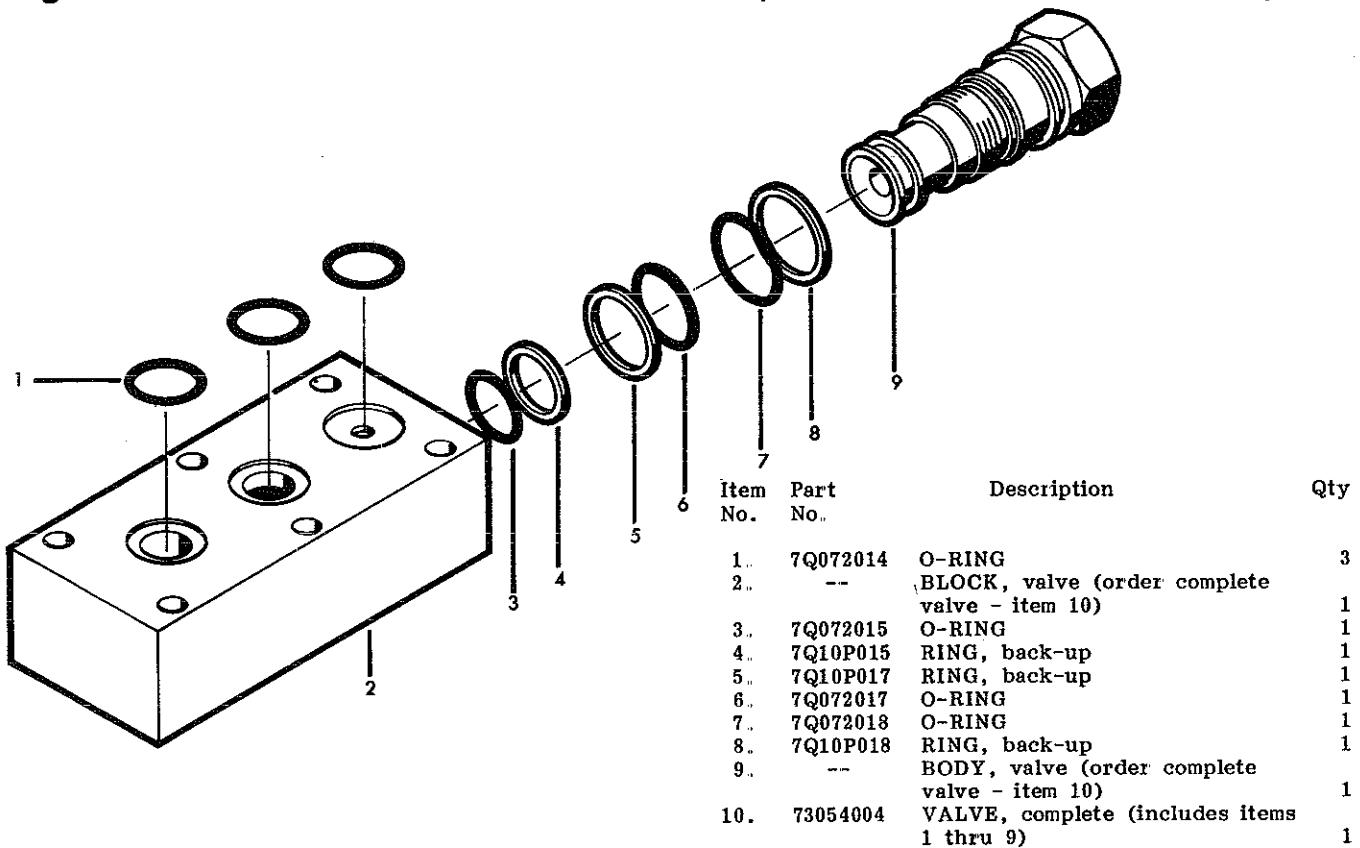
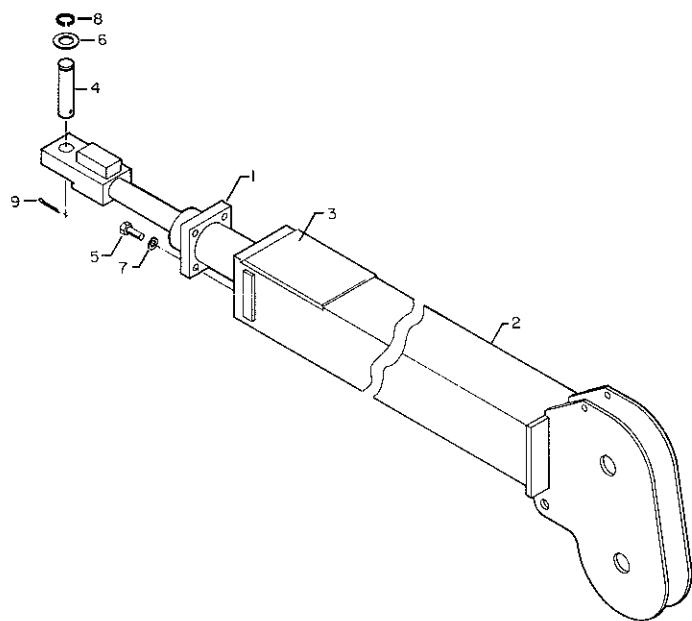


Figure D-9. Holding Valve (Part Number 73054004)



Item No.	Part No.	Description	Qty
1.	3B040880	CYLINDER, extension	1
2.	52707921	BOOM, extension	1
3.	60030189	PAD, wear	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	1

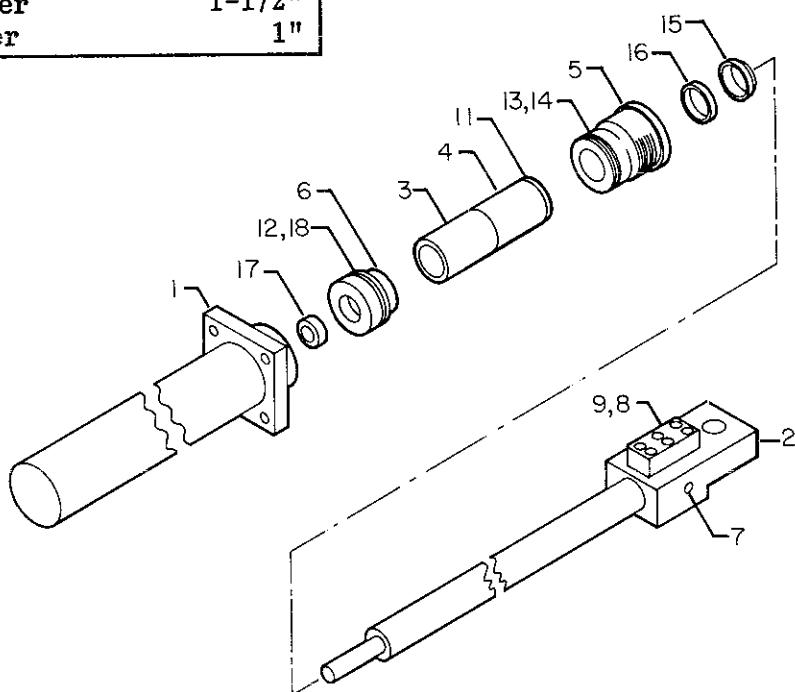
Figure D-10. 3016 Extension Boom (Part Number 41707849)

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

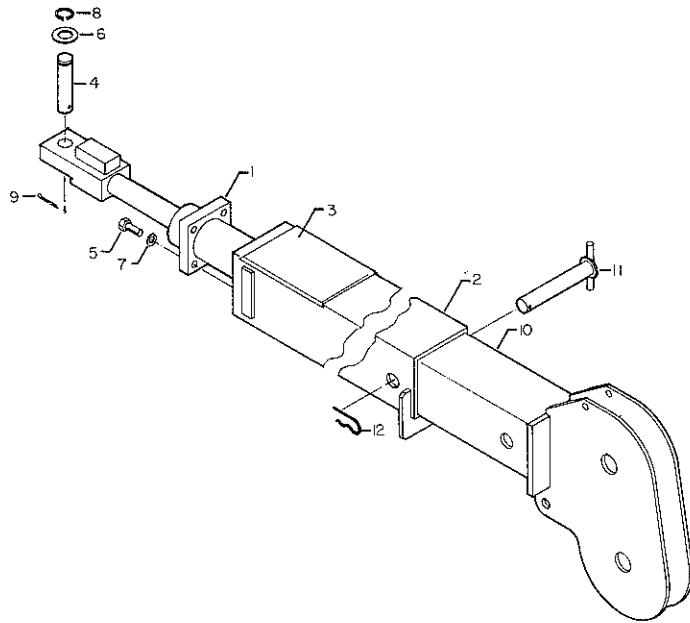
Bore	2-1/2"
Stroke	60"
C-C Closed	8-1/8"
Rod Diameter	1-1/2"
Pin Diameter	1"



Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	4B040880	CASE, cylinder	1	11..	6A025015	* RING, wafer lock	1
2.	4H309820	ROD, cylinder (includes item 7)	1	12..	7Q072137	* O-RING	1
3.	6C300015	TUBE, stop	1	13..	7Q072228	* O-RING	1
4.	6C309820	TUBE, stop	1	14..	7Q10P228	* RING, back-up	1
5.	6H025015	HEAD	1	15..	7R14P015	* WIPER, rod	1
6.	6IX02512	PISTON	1	16..	7R546015	* SEAL, rod	1
7.	7PNPXT02	PLUG; 1/8" npt (part of item 2)	3	17..	7T61N125	* SEAL, lock ring	1
8.	72060708	SCREW, soc. hd.; 1/4-20 x 1-1/4"	6	18..	7T66P025	* SEAL, piston	1
9..	73054004	VALVE, holding	1				
10..	----	NOT USED	-				

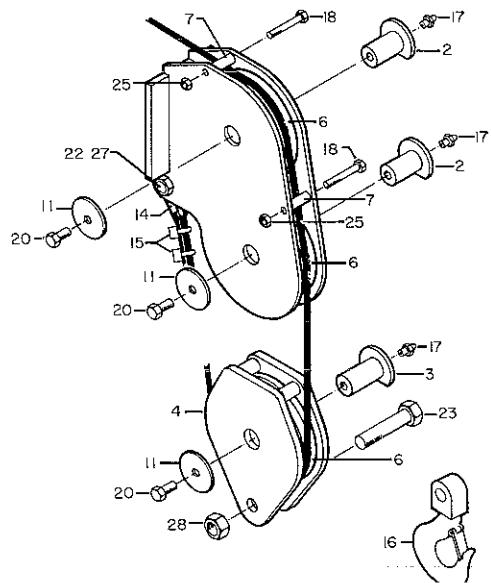
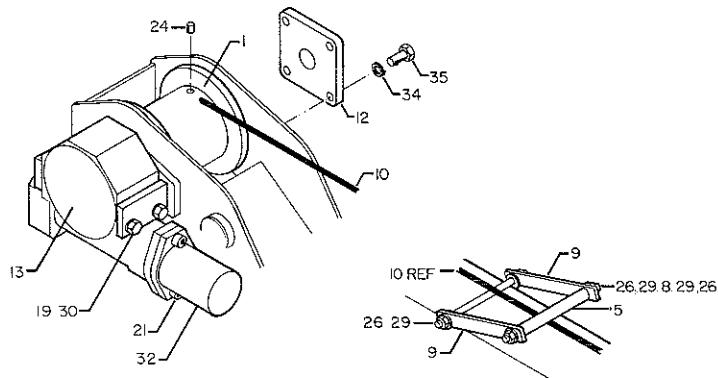
* Part of seal kit (Part Number 9B101220)

Figure D-11. Extension Cylinder (Part Number 3B040880)



Item No.	Part No.	Description	Qty
1.	3B040880	CYLINDER, extension	1
2.	52707922	BOOM, extension, 1st stage	1
3.	60030189	PAD, wear	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	1
10.	52707923	BOOM, extension, 2nd stage	1
11.	52070152	PIN	1
12.	72066145	PIN, hair	1

Figure D-12. 3016-20 Extension Boom (Part Number 41707924)

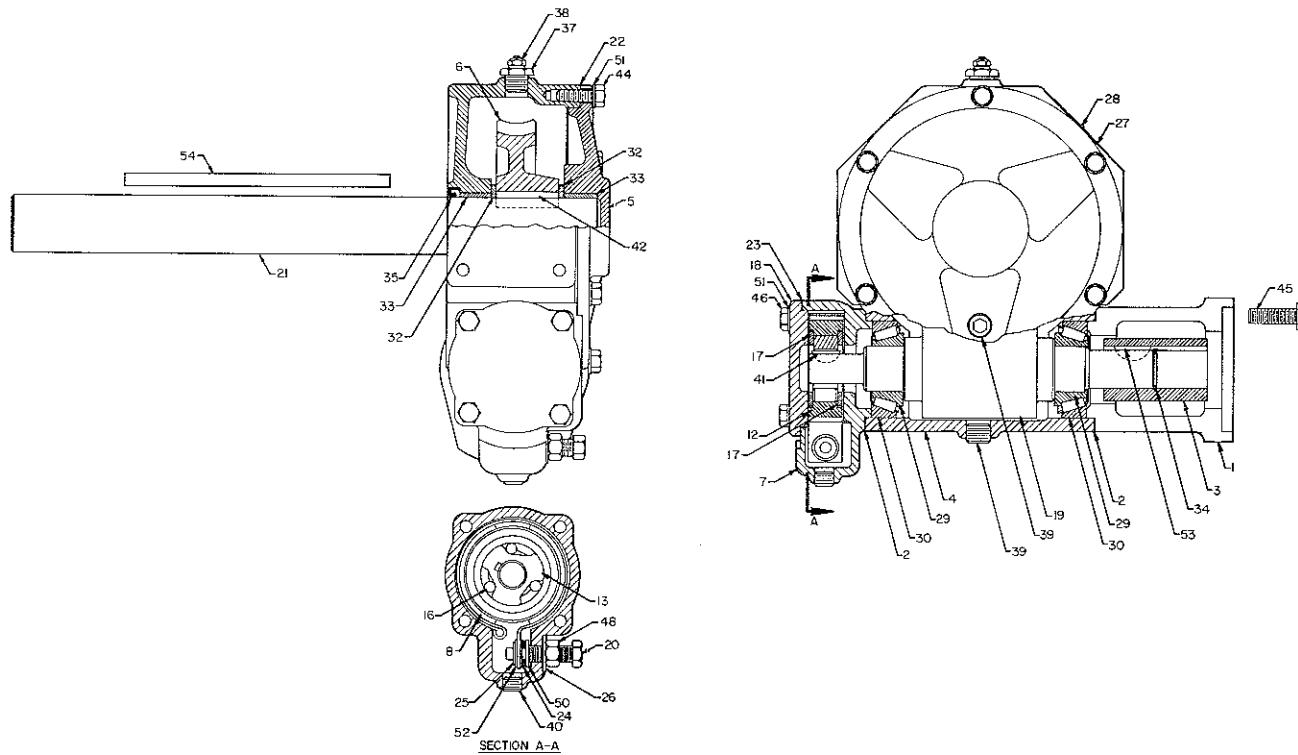


Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	51707867	DRUM, winch	1	21.	72060794	SCREW, soc. hd.; 1/2-13 x 1-1/4"	2
2.	52707730	PIN	2	22.	72060217	SCREW, hex hd.; 7/8-9 x 4"	1
3.	52707731	PIN	1	23.	72060247	SCREW, hex hd.; 1-8 x 4-1/2"	1
4.	52707932	BLOCK, snatch	1	24.	72060581	SCREW, set; 3/8-16 x 3/4"	1
5.	60030108	ROLLER, cable guide	1	25.	72062103	NUT, lock; 3/8-16	2
6.	60030136	SHEAVE	3	26.	72062080	NUT, lock; 1/2-13	4
7.	60102596	SPACER	2	27.	72062120	NUT, lock; 7/8-9	1
8.	60105538	STUD, cable guide	1	28.	72062137	NUT, lock; 1-8	1
9.	60105540	BAR, side, cable guide	2	29.	72063005	WASHER, wrt.; 1/2"	4
10.	51707928	CABLE assembly (includes items 14 & 15)	1	30.	72063051	WASHER, lock; 3/8"	4
11.	60109337	PLATE, pin retainer	3	31.	----	NOT USED	-
12.	70055185	BEARING, flange	1	32.	73051517	MOTOR, hydraulic	1
13.	71057752	WINCH	1	33.	----	NOT USED	-
14.	70058026	THIMBLE (part of item 10)	1	34.	72063054	WASHER, lock; 9/16"	4
15.	70058909	CLAMP (part of item 10)	2	35.	72601499	SCREW, hex hd.; 9/16-12 x 1-1/4"	4
16.	71073920	HOOK; 3-ton	1				
17.	72053508	ZERK; 1/8" npt	3				
18.	72060054	SCREW, hex hd.; 3/8-16 x 3"	2				
19.	72060046	SCREW, hex hd.; 3/8-16 x 1"	4				
20.	72060147	SCREW, hex hd.; 5/8-11 x 1"	3				

NOTE

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

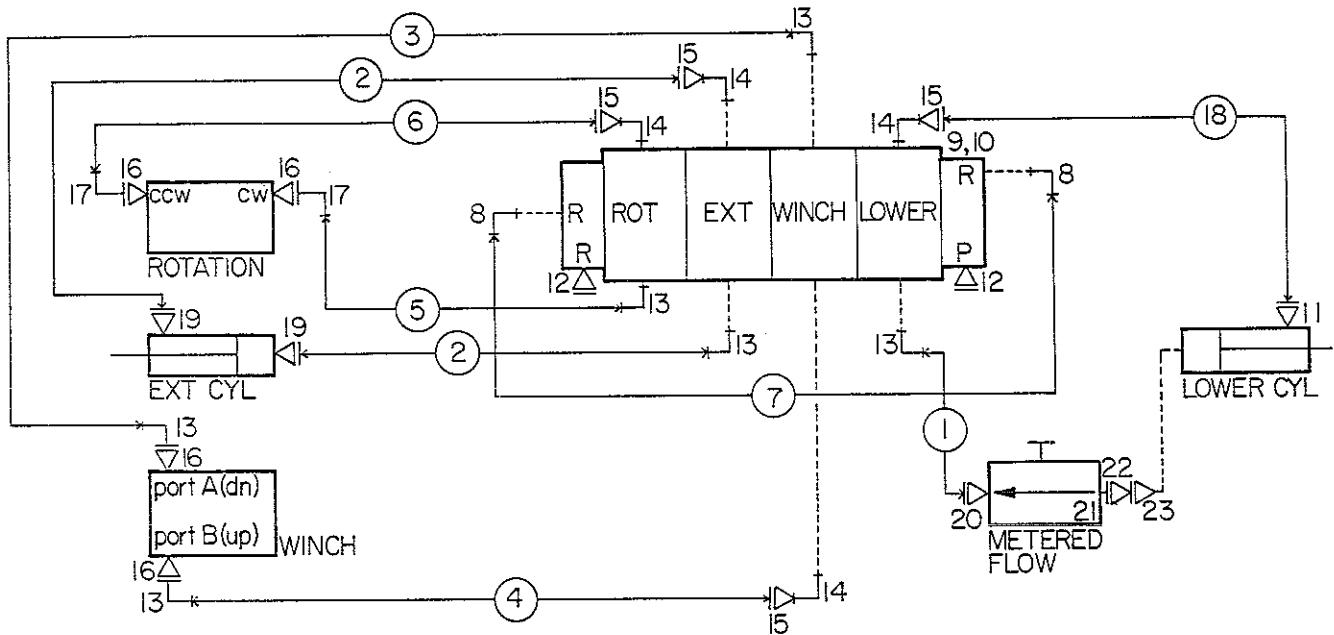
Figure D-13. Winch, Rope and Hook (Part Number 31707850)



Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	70143416	ADAPTER, motor	1	30..	70055193	BEARING, cup	2
2.	76392896	GASKET, bearing retainer	*	31..	--	NOT USED	-
3..	72533060	COUPLING	1	32..	70143429	WASHER, thrust	2
4..	70143417	HOUSING	1	33..	70055194	BEARING	2
5..	70143418	COVER	1	34..	72066024	RING, retaining	1
6..	70056403	GEAR, worm	1	35..	76392899	SEAL, oil	1
7..	70143419	HOUSING, brake	1	36..	--	NOT USED	-
8..	70732033	BAND/SHOE assembly	1	37..	72532844	BUSHING, reducer; 3/8" npt(m) x 1/8" npt(f)	1
9..	--	NOT USED	-	38..	72053613	PLUG, vent	1
10..	--	NOT USED	-	39..	72053242	PLUG; 3/8" npt	2
11..	70732034	ROTOR (includes items 12 thru 17)	1	40..	72053241	PLUG; 1/4" npt	1
12..	70143420	- RACE, brake (part of item 11)	1	41..	72661260	KEY, Woodruff; #15	1
13..	70143421	- DRIVER, brake (part of item 11)	1	42..	70143430	KEY; 5/16" x 7/16" x 1-5/8"	2
14..	70142237	- SPRING (part of item 11)	3	43..	72060022	SCREW, hex hd.; 5/16-18 x 5/8"	1
15..	70142238	- PLUNGER (part of item 11)	3	44..	72601516	SCREW, hex hd.; 5/16-18 x 7/8"	5
16..	70142240	- ROLLER (part of item 11)	3	45..	72060026	SCREW, hex hd.; 5/16-18 x 1-1/4"	4
17..	70143422	- WASHER, thrust (part of item 11)	2	46..	72060031	SCREW, hex hd.; 5/16-18 x 2-1/2"	4
18..	70143423	COVER, brake	1	47..	--	NOT USED	-
19..	70056404	GEAR, worm	1	48..	72062068	NUT, jam; 7/16-20	1
20..	70143424	BOLT, adjusting, hex hd.; 7/16-20	1	49..	--	NOI USED	-
21..	70143425	SHAFT, output	1	50..	72063178	WASHER, hardened; 5/16"	2
22..	76392897	GASKET, cover	3	51..	72063050	WASHER, lock; 5/16"	14
23..	76392898	GASKET, brake; .015" thick	1	52..	72063002	WASHER, wrt.; 5/16"	1
24..	70143426	SPRING, Belleville	2	53..	72661274	KEY, Woodruff; #9	1
25..	70143427	RETAINER, push-on	1	54..	70143431	KEY; 3/8" x 3/8" x 6-7/8"	1
26..	76392822	SEAL, thread	1				
27..	70143428	PLATE, name	1				
28..	70142375	SCREW, drive; #4 x 3/16"	2				
29..	70055192	BEARING, cone	2				

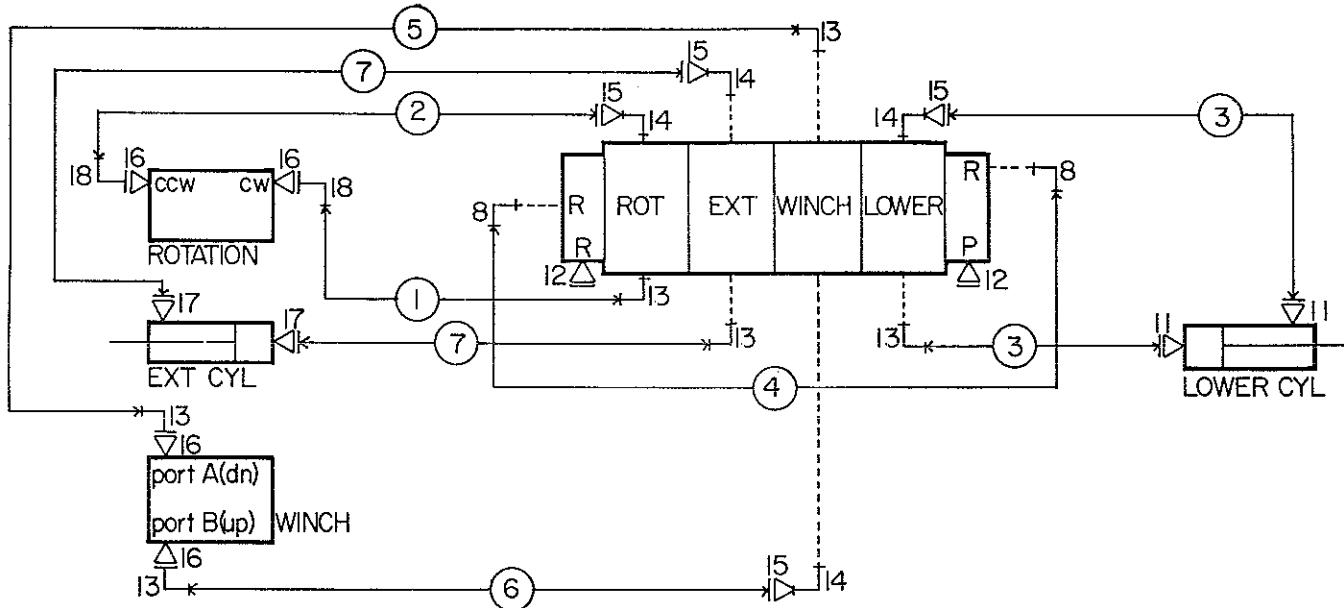
*As Required

Figure D-14. Winch (Part Number 71057752)



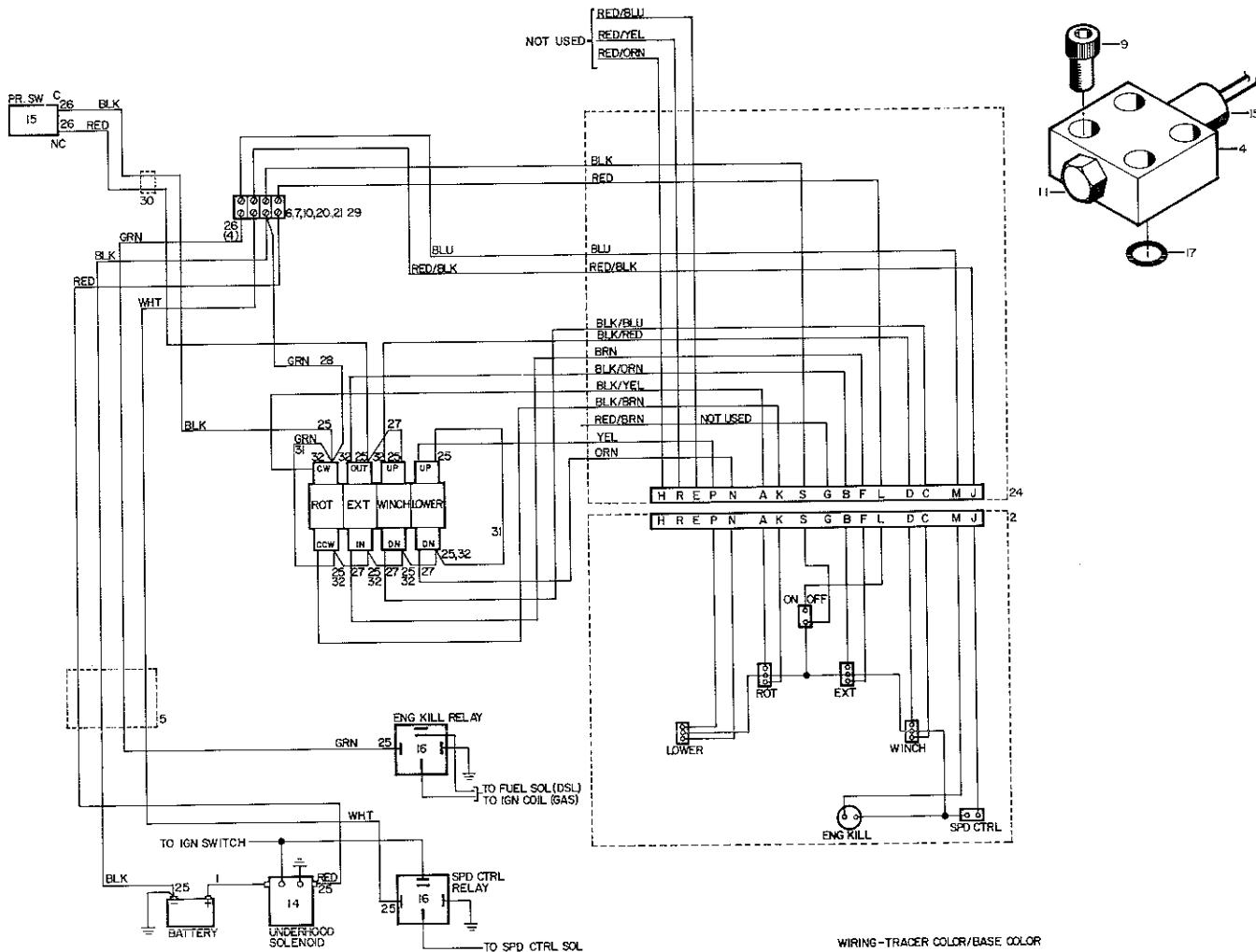
Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	51707965	HOSE; 1/4" ID x 25" lg.	1	14.	72532700	ELBOW, extra-long 90°; 9/16-18 str. thd.(m) x 9/16-18 JIC(m)	4
2.	51708153	HOSE; 1/4" ID x 24" lg.	2	15.	72532707	ADAPTER; 7/16-20 JIC(m) x 9/16-18 JIC(f)	4
3.	51708151	HOSE; 1/4" ID x 11" lg.	1	16.	72532722	ADAPTER; 7/8-14 str. thd. (m) x 9/16-18 str. thd.(f)	4
4.	51708152	HOSE; 1/4" ID x 12" lg.	1	17.	72532985	ELBOW, 45°; 9/16-18 str. thd.(m) x 7/16-20 JIC(m)	2
5.	51704624	HOSE; 1/4" ID x 32" lg.	1	18.	51706021	HOSE; 1/4" ID x 30" lg.	1
6.	51705970	HOSE; 1/4" ID x 33" lg.	1	19.	72532792	ADAPTER; 3/4-16 str. thd.(m) x 7/16-20 JIC(m)	2
7.	51707967	HOSE; 1/2" ID x 17" lg.	1	20.	72053499	ADAPTER; 1/4" npt(m) x 7/16-20 JIC(m)	1
8.	72053763	ELBOW, 90°; 3/4-16 str. thd.(m) x 3/4-16 JIC(m)	2	21.	73054034	VALVE, flow control	1
9.	72060000	SCREW; hex hd.; 1/4-20 x 1/2"	4	22.	72053640	ADAPTER, swivel; 1/4" npt(m x f)	1
10.	72063049	WASHER, lock; 1/4"	4	23.	72533013	ADAPTER; 7/16-20 str. thd.(m) x 1/4" npt(m)	1
11.	72532351	ADAPTER; 7/16-20 str. thd.(m) x 7/16-20 JIC(m)	1				
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)	6				

Figure D-15. Hydraulic Kit (Part Number 91708165)



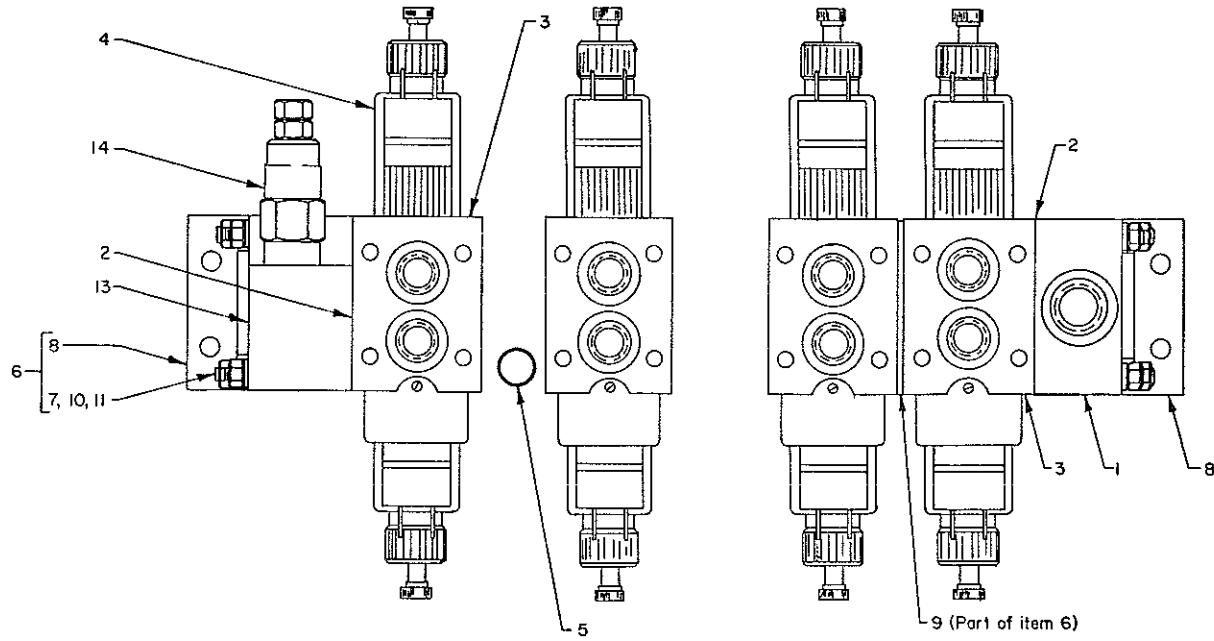
Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1..	51704624	HOSE; 1/4" ID x 32" lg.	1	13..	72532699	ELBOW, 90°; 9/16-18 str. thd.(m) x 7/16-20 JIC(m)	6
2..	51705970	HOSE; 1/4" ID x 33" lg.	1	14..	72532700	ELBOW, extra-long 90°; 9/16-18 str. thd.(m) x 9/16-18 JIC(m)	4
3..	51706021	HOSE; 1/4" ID x 30" lg.	2	15..	72532707	ADAPTER; 7/16-20 JIC(m) x 9/16-18 JIC(f)	4
4..	51707967	HOSE; 1/2" ID x 17" lg.	1	16..	72532722	ADAPTER; 7/8-14 str. thd.(m) x 9/16-18 str. thd.(f)	4
5..	51708151	HOSE; 1/4" ID x 11" lg.	1	17..	72532792	ADAPTER; 3/4-16 str. thd.(m) x 7/16-20 JIC(m)	2
6..	51708152	HOSE; 1/4" ID x 12" lg.	1	18..	72532985	ELBOW, 45°; 9/16-18 str. thd.(m) x 7/16-20 JIC(m)	2
7..	51708153	HOSE; 1/4" ID x 24" lg.	2	19..	72533013	ADAPTER; 7/16-20 str. thd.(m) x 1/4" npt(m)	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)	2				
12..	72532358	ADAPTER; 3/4-16 str. thd.(m) x 3/4-16 JIC(m)	2				

Figure D-16. Proportioning Hydraulic Kit (Part Number 91708429)



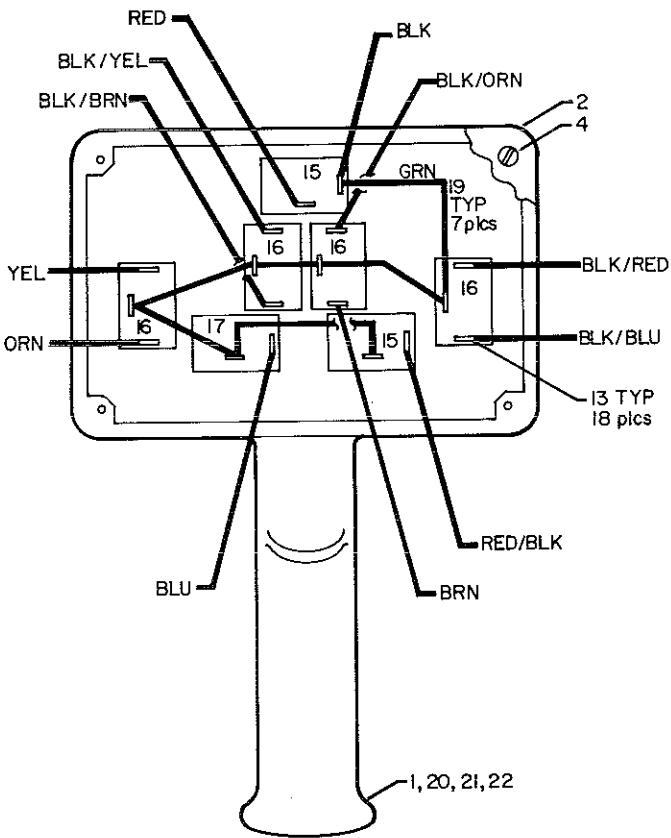
Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	51704784	CABLE, #1 Wire; 6" lg..	1	17.	7Q072015	O-RING	1
2.	51708154	HANDLE, control	1	18.	70392352	DECAL, electrocution hazard; large	1
3.	----	NOT USED	-	19.	----	NOT USED	-
4.	60025221	MANIFOLD, capacity alert	1	20.	60111833	SPACER; 3/8" tube x 1" lg..	2
5.	89044034	CABLE, 4-wire; 14 ga. x 35'	1	21.	72060006	SCREW, hex hd.; 1/4-20 x 1-1/2"	2
6.	77044341	BLOCK, terminal; 4-contact	1	22.	----	NOT USED	-
7.	60111832	PLATE, mounting	1	23.	----	NOT USED	-
8.	70034060	TIES, plastic	10	24.	51707980	CABLE, 16-wire; 18 ga. x 48"	1
9.	72060731	SCREW, soc. hd.; 5/16-18 x 3/4"	4	25.	77040186	TERMINAL, crimp on	11
10.	72061009	SCREW, pan hd.; #6 x 3/4"	2	26.	77040051	TERMINAL, crimp on	6
11.	72532140	PLUG; 9/16-18 str. thd..	1	27.	89044231	WIRE, green; 14 ga. x 3"	4
12.	----	NOT USED	-	28.	89044231	WIRE, green; 14 ga. x 36"	1
13.	----	NOT USED	-	29.	72063049	WASHER, lock; 1/4"	2
14.	77041003	SOLENOID; 12 VDC	1	30.	89044188	CABLE, 2-wire; 14 ga. x 35"	1
15.	77041283	SWITCH, pressure; 2800 PSI	1	31.	89044231	WIRE, green; 14 ga. x 10"	2
16.	77041251	RELAY, 12 VDC	2	32.	77040282	TERMINAL, crimp on	7

Figure D-17. Standard Control Kit (Part Number 90708164)



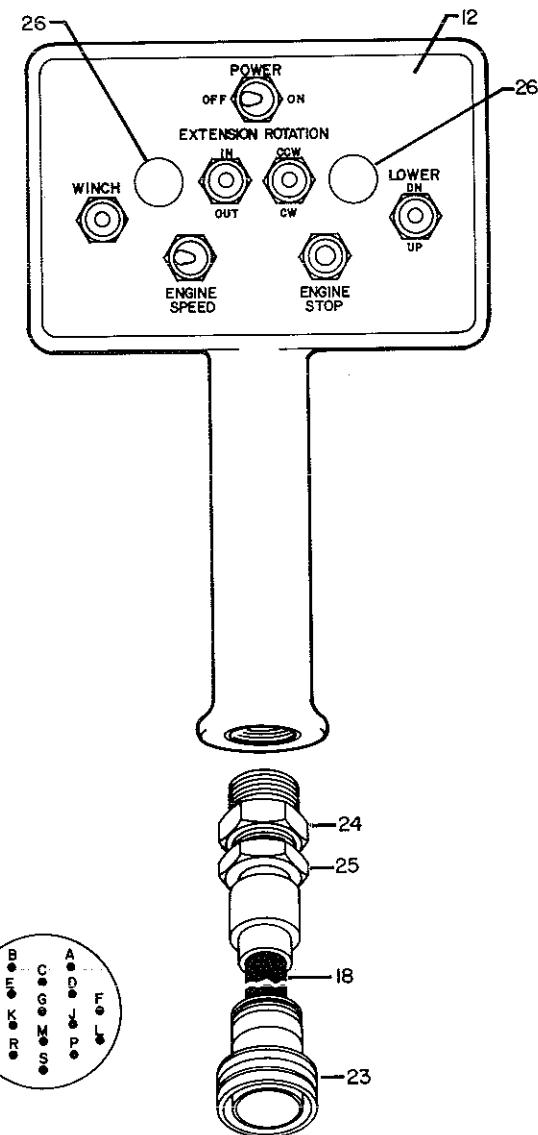
Item No.	Part No.	Description	Qty
1.	60025709	BLOCK, outlet	1
2.	7Q072205	O-RING	2
3.	73054636	SECTION, valve (includes item 4)	4
4.	77041361	- COIL, valve section	2/section
5.	76392808	O-RING	6
6.	94731957	KIT, tie rod (includes items 7 thru 11)	1
7.	70143335	- STUD, valve bank	4
8.	70143336	- FOOT, 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.	94731969	ASSEMBLY, inlet (includes items 13 thru 15)	1
13.	60025794	- BLOCK, inlet	1
14.	73054623	- VALVE, relief; 2500 PSI	1

Figure D-18. Standard Valve Bank (Part Number 73731910)



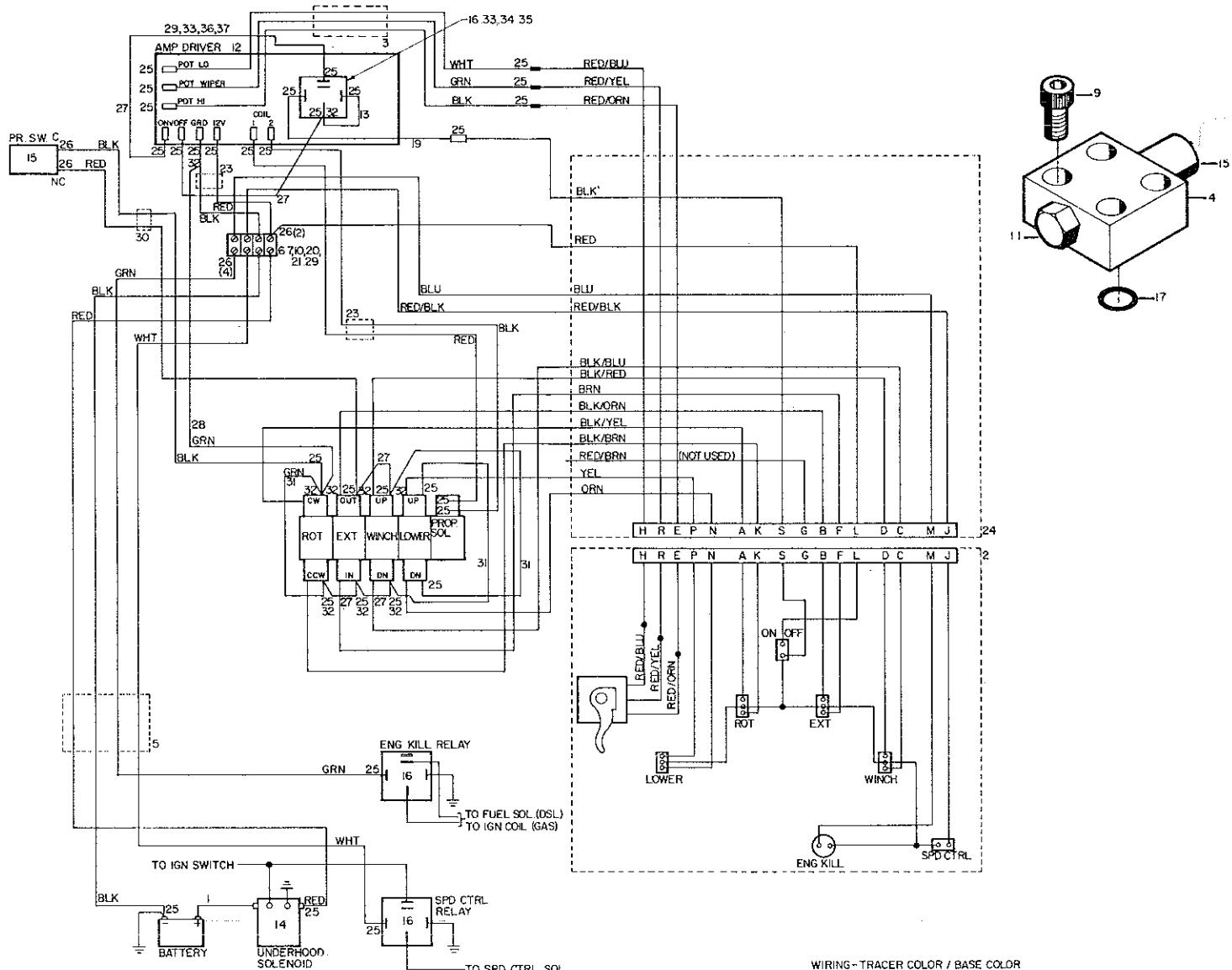
A	BLK/YEL	J	RED/BLK
B	BLK/ORN	K	BLK/BRN
C	BLK/BLU	L	RED
D	BLK/RED	M	BLU
E	RED/ORN	N	ORN
F	BRN	P	YEL
G	RED/BRN	R	RED/YEL
H	RED/BLU	S	BLK

WIRING-TRACER COLOR/BASE COLOR



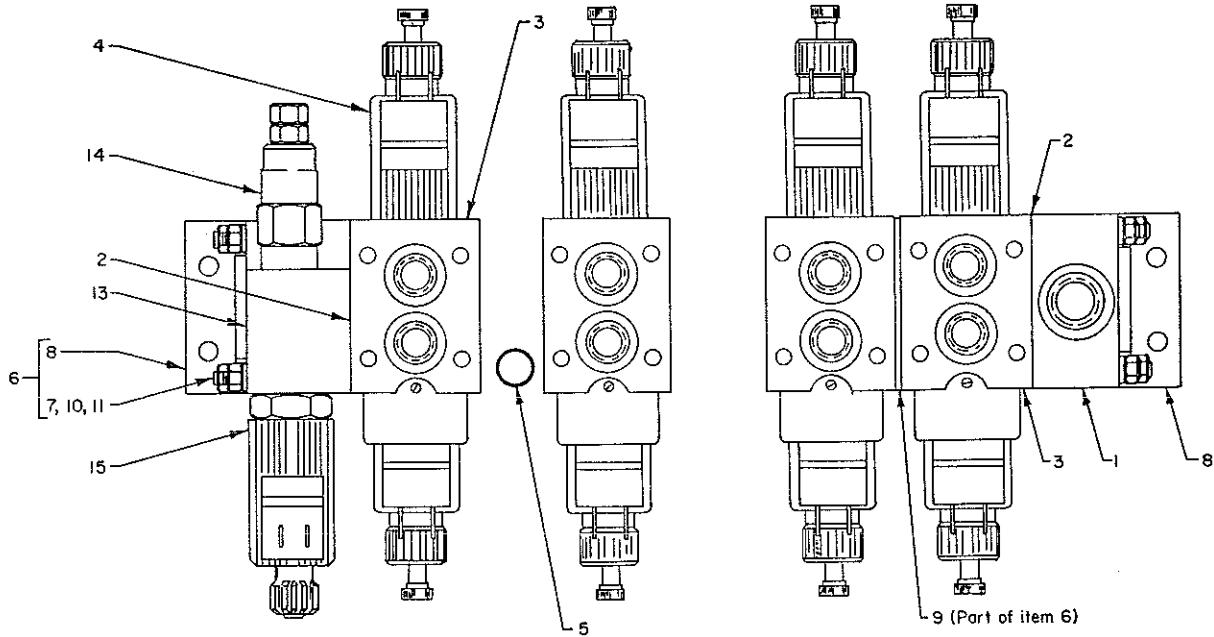
Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	60111140	HANDLE, control	1	15.	77041345	SWITCH, toggle, SPST	2
2.	70034306	BACK, control handle	1	16.	77041346	SWITCH, toggle, SPDT	4
3.	---	NOT USED	-	17.	77041347	SWITCH, momentary toggle, SPST	1
4.	72061009	SCREW, pan hd.; #6 x 3/4"	4	18.	89044116	CABLE, 16 wire; 18 ga x 360"	1
5.	----	NOT USED	-	19.	60045031	WIRE, green; 18 ga. x 4"	7
6.	----	NOT USED	-	20.	70392351	DECAL, electrocution hazard; small	1
7.	----	NOT USED	-	21.	70029119	PLACARD, ID	1
8.	----	NOT USED	-	22.	72066340	RIVET, pop; 1/8"	2
9.	----	NOT USED	-	23.	77044170	CONNECTOR; 16-pin	1
10.	----	NOT USED	-	24.	72531833	BUSHING, reducer; 3/4" npt(m) x 1/2" npt(f)	1
11.	----	NOT USED	-	25.	77044096	CORD, grip	1
12.	70392696	DECAL, remote control	1	26.	70392785	PLUG; 1/2"	2
13.	77040186	TERMINAL, crimp on	18				
14.	----	NOT USED	-				

Figure D-19. Standard Remote Control Handle (Part Number 51708154)



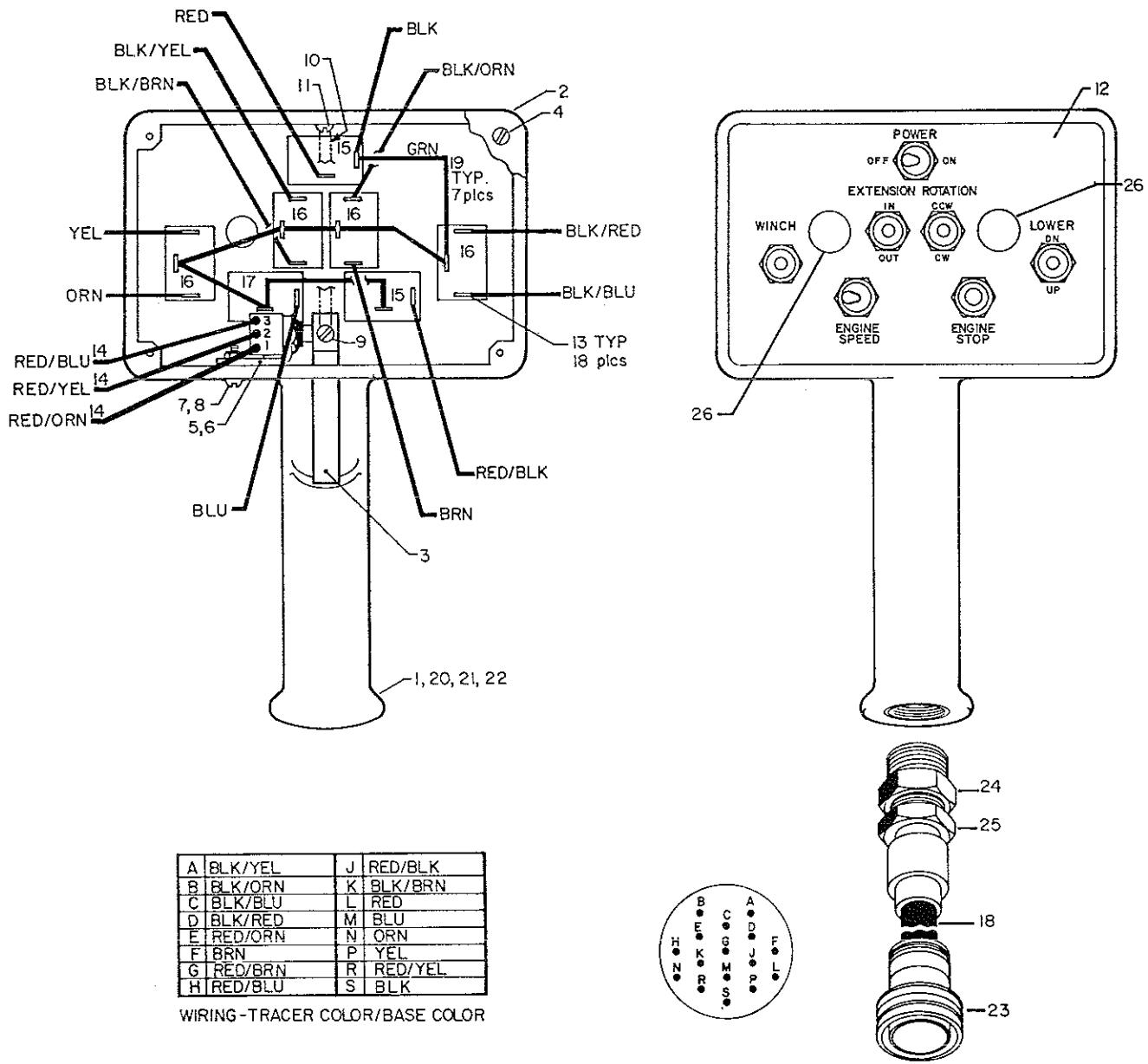
Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	51704784	CABLE; #1 wire x 6" lg..	1	20..	60111833	SPACER	2
2.	51707752	HANDLE, control	1	21..	72060006	SCREW, hex hd.; 1/4-20 x 1-1/2"	2
3.	89044039	CABLE, 14-ga., 3-wire, 25" lg..	1	22..	----	NOT USED	-
4.	60025221	MANIFOLD, capacity alert	1	23..	89044188	CABLE; 14-ga, 2-wire, 36" lg..	2
5.	89044034	CABLE, 14-ga., 4-wire, 35" lg..	1	24..	51707980	CABLE; 18-ga, 16-wire, 48" lg..	1
6.	77044341	BLOCK, terminal; 4-contact	1	25..	77040186	TERMINAL, female slip on	31
7.	60111832	PLATE, mounting, terminal strip	1	26..	77040051	TERMINAL, spring spade	8
8.	70034060	TIE, plastic; 6-3/4" lg..	10	27..	89044231	WIRE, green; 14-ga. x 3"	5
9.	72060731	SCREW, soc. hd.; 5/16-18 x 3/4"	4	28..	89044231	WIRE, green; 14-ga. x 36"	1
10.	72061009	SCREW, pan hd.; #6 x 3/4"	2	29..	72063049	WASHER, lock; 1/4"	6
11..	72532140	PLUG; 9/16-18 str. thd.	1	30..	89044188	CABLE; 14-ga., 2-wire, 33" lg..	1
12..	77041329	DRIVER, amp..	1	31..	89044231	WIRE, green; 14-ga. x 10"	3
13..	89044231	WIRE, green; 14-ga. x 1"	1	32..	77040282	TERMINAL, piggy-back	9
14..	77041003	SOLENOID; 12 VDC, 100 amp..	1	33..	72060002	SCREW, hex hd.; 1/4-20 x 3/4"	5
15..	77041283	SWITCH, pressure; 2800 PSI	1	34..	72063001	WASHER, wrt.; 1/4"	1
16..	77041251	RELAY, Bosch	3	35..	72062104	NUT, lock; 1/4-20	1
17..	7Q072015	O-RING	1	36..	77044201	NUI, electrical; 1/2" lock	1
18..	70392352	DECAL, electrocution danger	1	37..	77044018	CONNECTOR, strain relief	1
19..	89044231	WIRE, green; 14-ga..	25"				

Figure D-20. Proportioning Control Kit (Part Number 90707666)



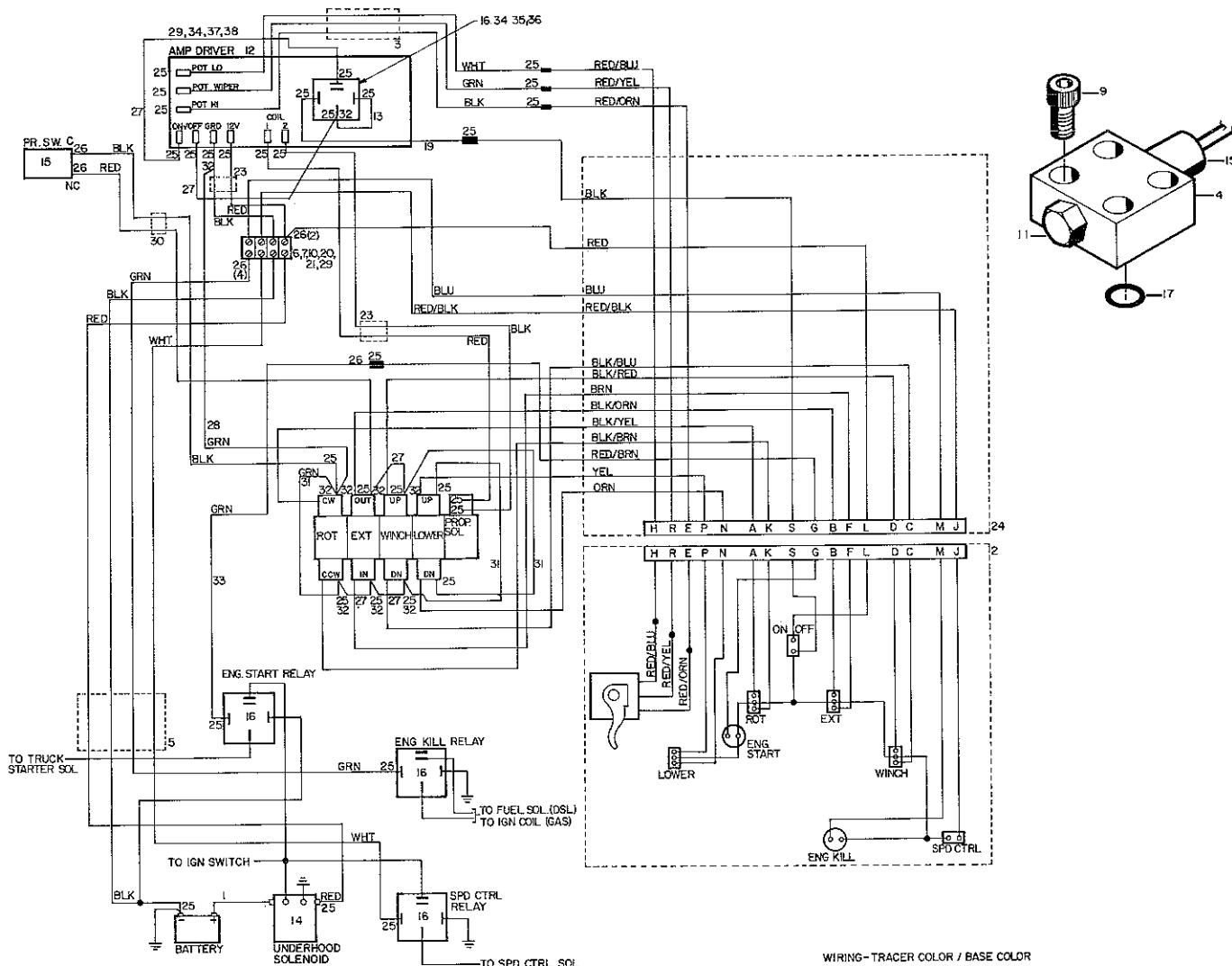
Item No.	Part No.	Description	Qty
1..	60025709	BLOCK, outlet	1
2..	7Q072205	O-RING	2
3..	73054636	SECTION, valve (includes item 4)	4
4..	77041361	- COIL, valve section 2/section	
5..	76392808	O-RING	6
6..	94731957	KIT, tie rod (includes items 7 thru 11)	1
7..	70143335	- STUD, valve bank	4
8..	70143336	- 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-21. Proportioning Valve Bank (Part Number 73731911)



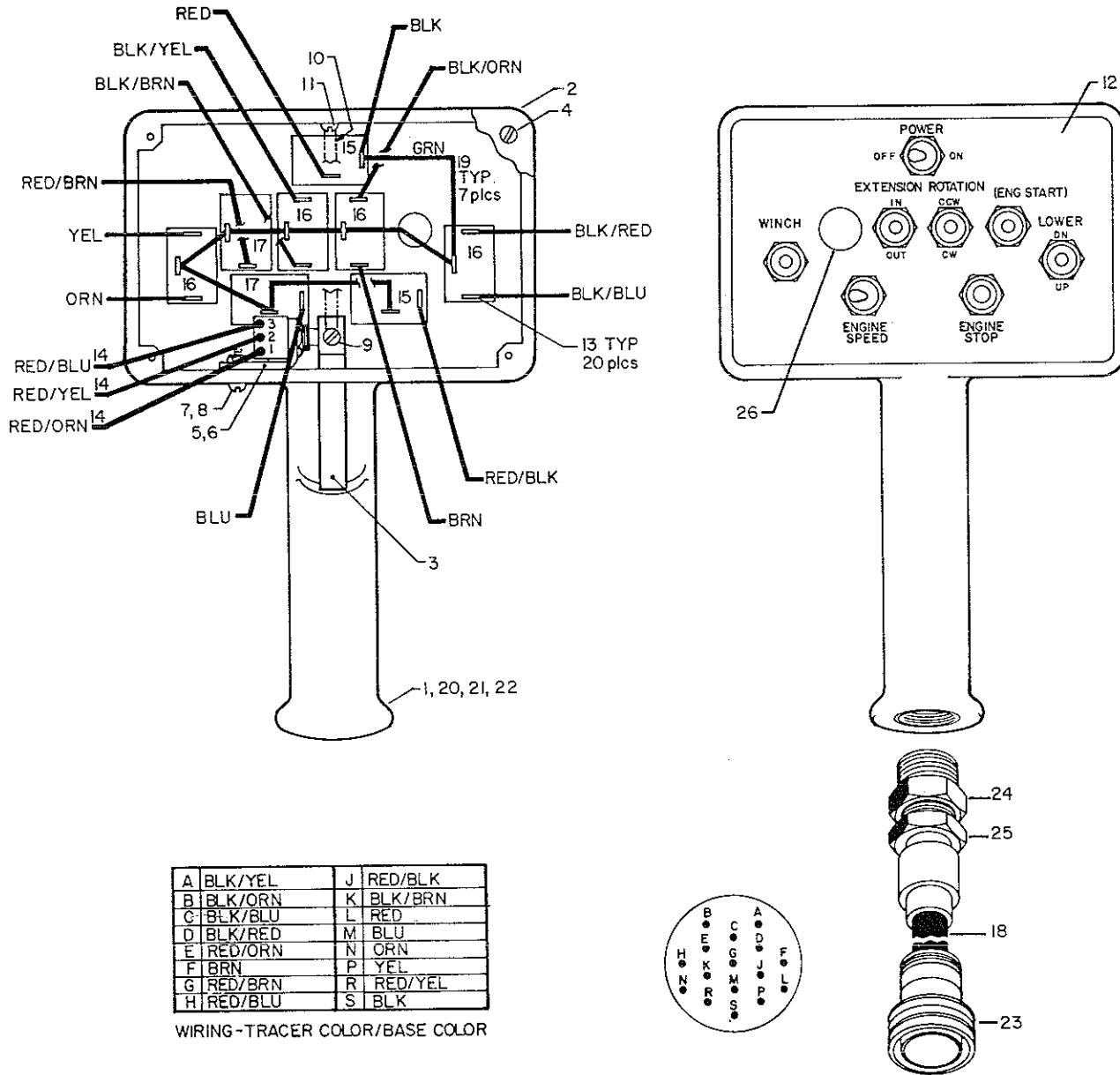
Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1..	60111140	HANDLE	1	15..	77041345	SWITCH, toggle, SPST	2
2..	70034306	BACK, control handle	1	16..	77041346	SWITCH, toggle, SPDT	4
3..	60111141	TRIGGER	1	17..	77041347	SWITCH, momentary contact	1
4..	72061009	SCREW, pan hd.; #6 x 3/4"	4	18..	89044116	CABLE; 18-ga., 16-wire	360"
5..	51707507	POTENTIOMETER, trigger	1	19..	60045031	WIRE, green; 18 ga. x 4"	7
6..	60111142	BRACKET, potentiometer mounting	1	20..	70392862	DECAL, electrocution, small	1
7..	72060670	SCREW, soc. hd.; #10-32 x 3/4"	2	21..	70029119	PLACARD, identification	1
8..	72062130	NUT, lock; #10-32	2	22..	72066340	RIVET, pop; 1/8"	2
9..	72060669	SCREW, soc. hd.; #10-32 x 5/8"	1	23..	77044170	CONNECTOR; 16-pin	1
10..	70143223	SPRING, tension	1	24..	72531833	BUSHING, reducer; 3/4" npt(m) x 1/2" npt(f)	1
11..	72061000	SCREW, pan hd.; #6 x 1/2"	1	25..	77044096	GRIP, cord	1
12..	70392696	DECAL, remote control	1	26..	70392785	PLUG, hole; 1/2"	2
13..	77040186	TERMINAL, female slip-on	18				
14..	77040047	TERMINAL, male slip-on	3				

**Figure D-22. Proportioning Remote Control Handle
(Part Number 51707752)**



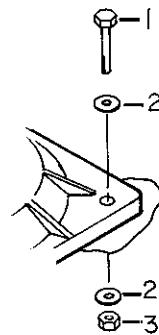
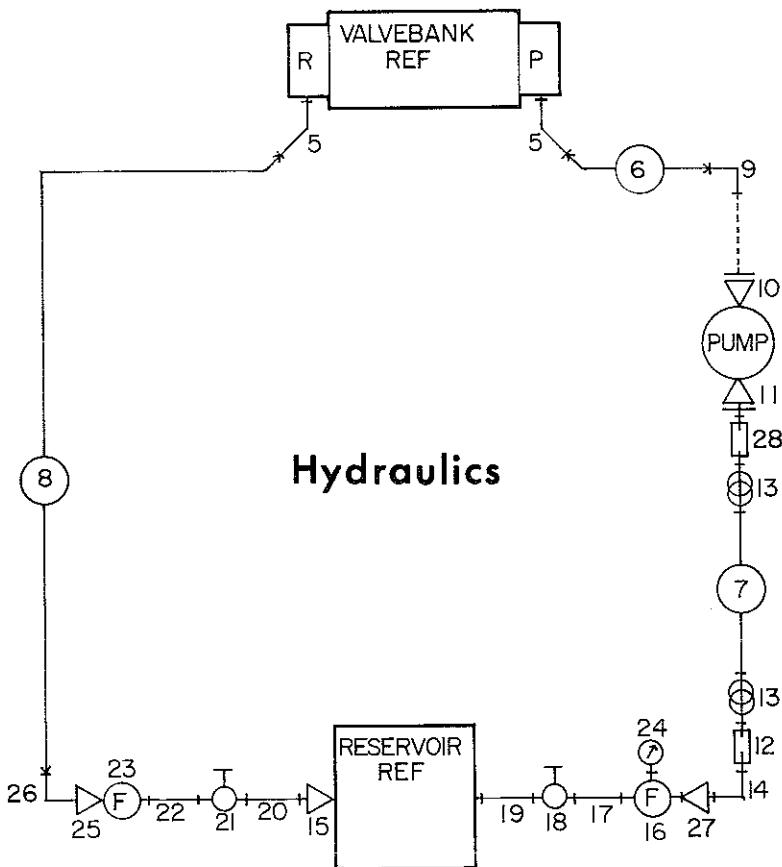
Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1..	51704784	CABLE; #1 wire x 6" lg.	1	20..	60111833	SPACER	2
2..	51707981	HANDLE, control	1	21..	72060006	SCREW, hex hd.; 1/4-20 x 1-1/2"	2
3..	89044039	CABLE, 14-ga., 3-wire, 25" lg.	1	22..	---	NOT USED	-
4..	60025221	MANIFOLD, capacity alert	1	23..	89044188	CABLE; 14-ga., 2-wire, 36" lg.	2
5..	89044034	CABLE, 14-ga., 4-wire, 35" lg.	1	24..	51707980	CABLE; 18-ga., 16-wire, 48" lg.	1
6..	77044341	BLOCK, terminal; 4-contact	1	25..	77040186	TERMINAL, female slip on	33
7..	60111832	PLATE, mounting, terminal strip	1	26..	77040051	TERMINAL, spring spade	9
8..	70034060	TIE, plastic; 6-3/4" lg.	10	27..	89044231	WIRE, green; 14-ga. x 3"	5
9..	72060731	SCREW, soc. hd.; 5/16-18 x 3/4"	4	28..	89044231	WIRE, green; 14-ga. x 36"	1
10..	72061009	SCREW, pan hd.; #6 x 3/4"	2	29..	72063049	WASHER, lock; 1/4"	6
11..	72523140	PLUG; 9/16-18 str. thd.	1	30..	89044188	CABLE; 14-ga., 2-wire, 33" lg.	1
12..	77041329	DRIVER, amp.	1	31..	89044231	WIRE, green; 14-ga. x 10"	3
13..	89044231	WIRE, green; 14-ga. x 1"	1	32..	77040282	TERMINAL, piggy-back	9
14..	77041003	SOLENOID; 12 VDC, 100 amp.	1	33..	89044231	WIRE, green; 14-ga. x 35'	1
15..	77041283	SWITCH, pressure; 2800 PSI	1	34..	72060002	SCREW, hex hd.; 1/4-20 x 3/4"	5
16..	77041251	RELAY, Bosch	4	35..	72063001	WASHER, wrt.; 1/4"	1
17..	7Q072015	O-RING	1	36..	72062104	NUT, lock; 1/4-20	1
18..	---	NOT USED	-	37..	77044018	CONNECTOR; 1/2" strain relief	1
19..	89044231	WIRE, green; 14-ga.	25"	38..	77044201	NUT, electrical; 1/2"	1

Figure D-23. Control Kit with Engine Start (Part Number 90707982)



Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	60111140	HANDLE	1	14.	77040047	TERMINAL, male slip-on	3
2.	70034306	BACK, control handle	1	15.	77041345	SWITCH, toggle, SPST	2
3.	60111141	TRIGGER	1	16.	77041346	SWITCH, toggle, SPDT	4
4.	72061009	SCREW, pan hd.; #6 x 3/4"	4	17.	77041347	SWITCH, momentary contact	2
5.	51707507	POTENTIOMETER, trigger	1	18.	89044116	CABLE; 18-ga., 16-wire	360"
6.	60111142	BRACKET, potentiometer mounting	1	19.	60045031	WIRE, green; 18 ga. x 4"	7
7.	72060670	SCREW, soc. hd.; #10-32 x 3/4"	2	20.	70392862	DECAL, electrocution, small	1
8.	72062130	NUT, lock; #10-32	2	21.	70029119	PLACARD, identification	1
9.	72060669	SCREW, soc. hd.; #10-32 x 5/8"	1	22.	72066340	RIVET, pop; 1/8"	2
10.	70143223	SPRING, tension	1	23.	77044170	CONNECTOR, 16-pin	1
11.	72061000	SCREW, pan hd.; #6 x 1/2"	1	24.	72531833	BUSHING, reducer; 3/4" npt(m) x 1/2" npt(f)	1
12.	70392696	DECAL, remote control	1	25.	77044096	GRIP, cord	1
13.	77040186	TERMINAL, female slip-on	20	26.	70392785	PLUG, hole; 1/2"	1

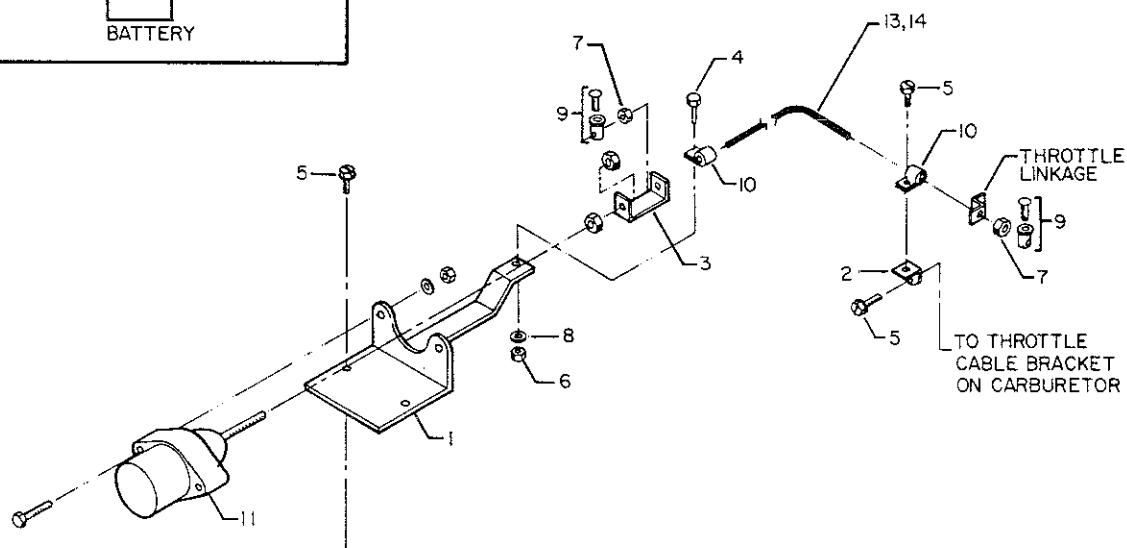
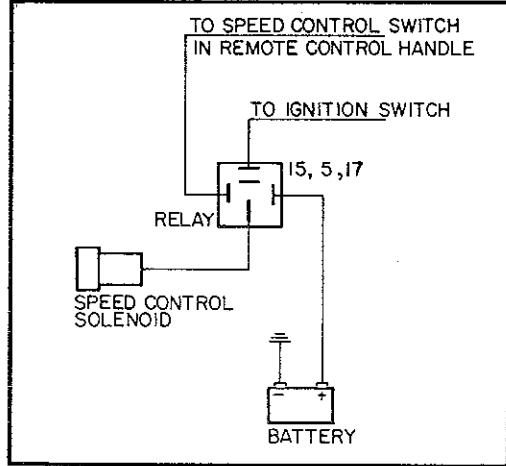
**Figure D-24. Remote Control Handle with Engine Start
(Part Number 51707981)**



Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	72060187	SCREW, hex hd.; 3/4-10 x 3"	4	16.	73052012	FILTER, suction	1
2.	72063008	WASHER; 3/4" wrt.	8	17.	72053211	NIPPLE, close; 1-1/4" npt	1
3.	72062140	NUT, lock; 3/4-10	4	18.	73054130	VALVE, gate; 1-1/4"	1
4.	95708162	KIT, decal (not shown)	1	19.	72053216	NIPPLE; 1-1/4" npt x 6" lg.	1
5.	72532670	ELBOW, 45°; 3/4-16 JIC(m) x 3/4-16 JIC(f)	2	20.	72053146	NIPPLE; 3/4" npt x 6" lg.	1
6.	51703725	HOSE; 3/8" ID x 252" lg.	1	21.	73054129	VALVE, gate; 3/4"	1
7.	89039481	HOSE; 1" ID	4 ft.	22.	72053141	NIPPLE, close; 3/4" npt	1
8.	51703613	HOSE; 1/2" ID x 192" lg.	1	23.	73052000	FILTER, return	1
9.	72053763	ELBOW, 90°; 3/4-16 str. thd.(m) x 3/4-16 JIC(m)	1	24.	70048031	GAUGE, vacuum	1
10.	----	ADAPTER (determined by pump)	1	25.	72531832	BUSHING, reducer; 3/4" npt(m) x 3/8" npt(f)	1
11.	----	ADAPTER (determined by pump)	1	26.	72531420	ELBOW, 90°; 3/8" npt x 3/4-16 JIC(m)	1
12.	72532470	NIPPLE, barbed; 1"	1	27.	72053377	BUSHING, reducer; 1-1/4" npt(m) x 1" npt(f)	1
13.	72066515	CLAMP, hose; 1"	2	28.	72531195	NIPPLE, barb; 45°; 1"	1
14.	72053286	ELBOW, street, 90°; 1" npt	1				
15.	72531836	BUSHING, reducer; 1-1/4" npt(m) x 3/4" npt(f)	1				

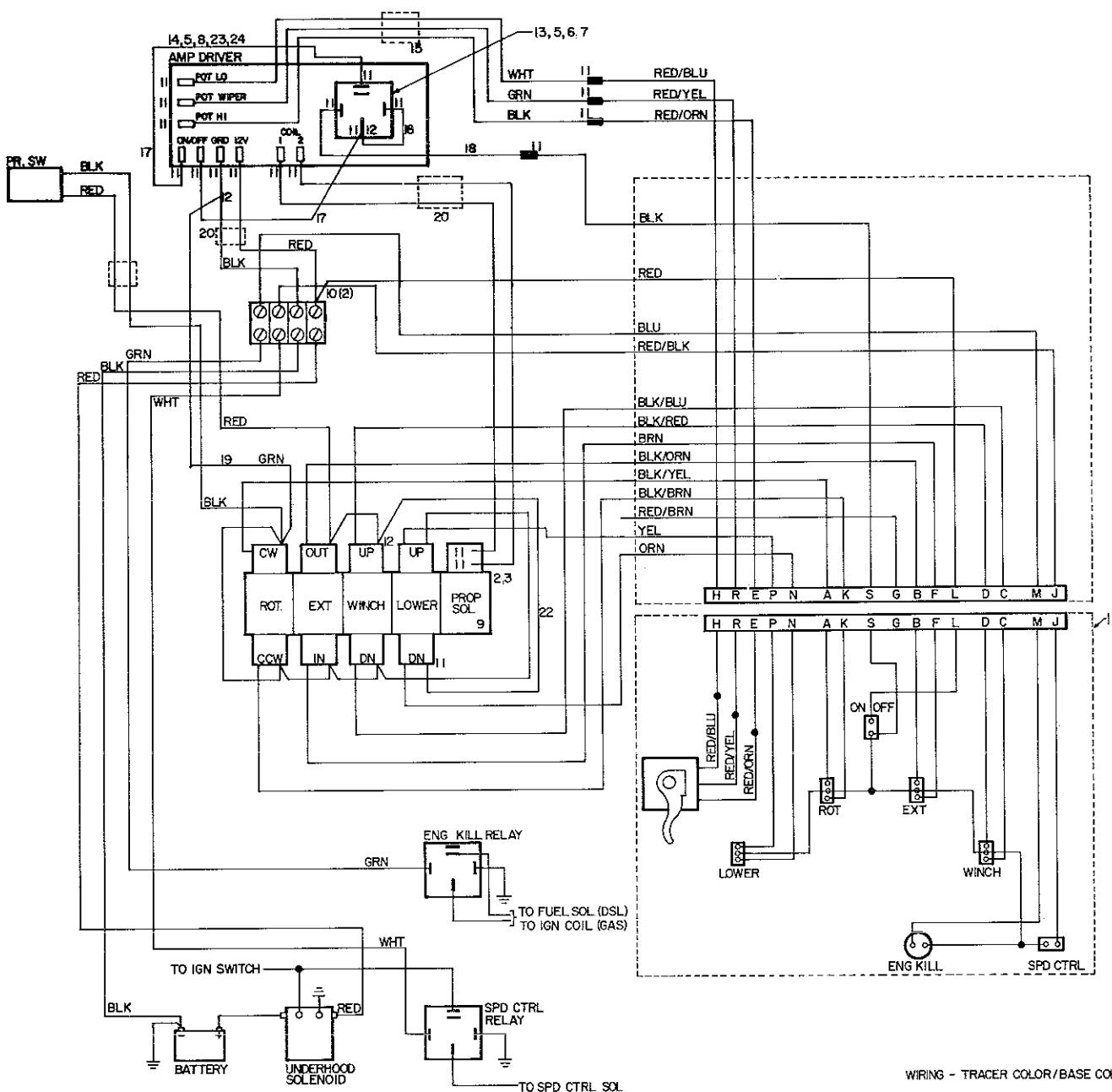
Figure D-25. Installation Kit (Part Number 93708163)

FOR CRANE INSTALLATIONS



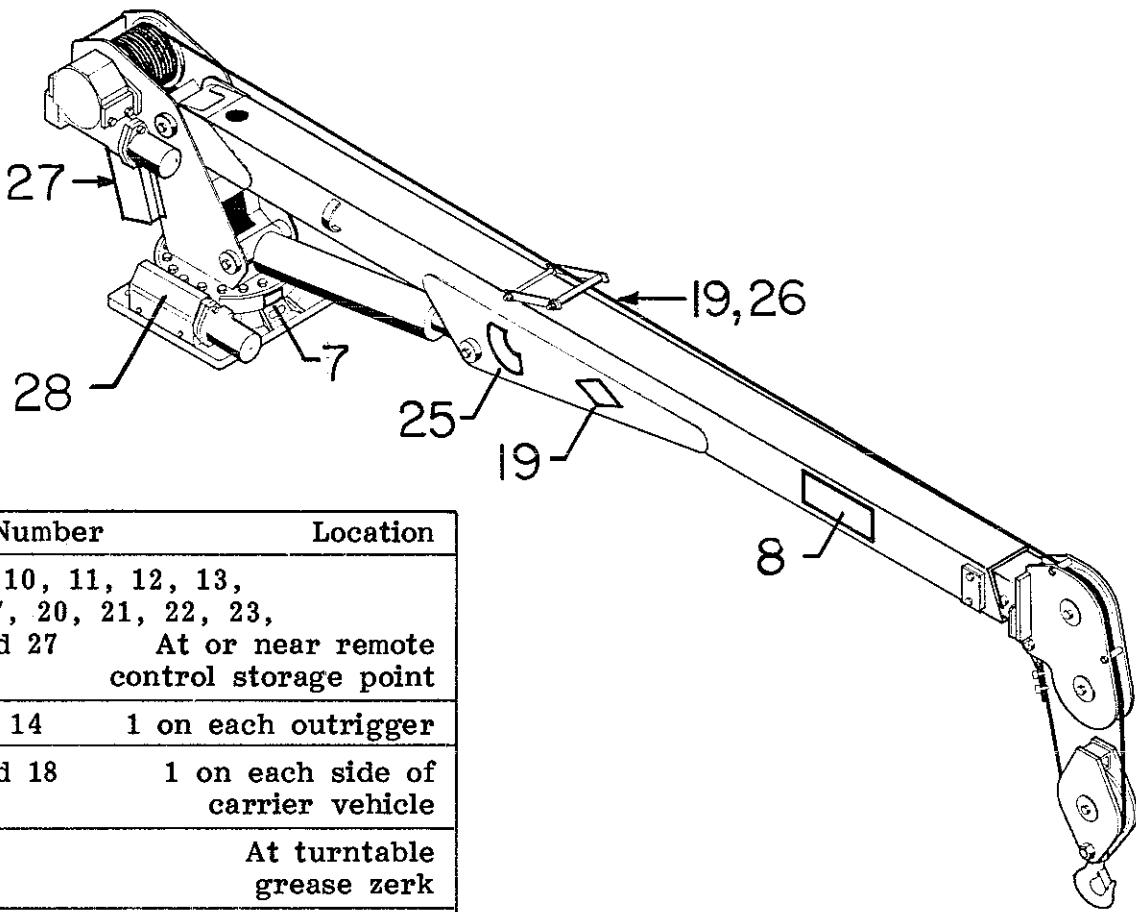
Item No.	Part No.	Description	Qty
1.	52705080	BRACKET, speed control	1
2.	60106760	BRACKET, linkage	1
3.	60108086	BRACKET, plunger adjustment	1
4.	72060002	SCREW, hex hd.; 1/4-20 x 3/4"	1
5.	72061004	SCREW, slotted hex; #14 x 3/4"	5
6.	72062000	NUT; 1/4-20	1
7.	72062093	NUT; #8-32	2
8.	72063049	WASHER, 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-26. Throttle Control Kit (Part Number 31705270)



Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	51707752	HANDLE, remote control	1	13.	77041251	RELAY, Bosch	1
2.	60025664	BLOCK, inlet	1	14.	77041329	DRIVER, amp	1
3.	7Q072205	O-RING	1	15.	89044039	CABLE, 14 ga. 3-wire; 25" lg.	1
4.	70034060	TIE, plastic	4	16.	89044231	WIRE, 14 ga green; 1" lg.	1
5.	72060002	SCREW, hex hd.; 1/4-20 x 3/4"	5	17.	89044231	WIRE, 14 ga. green; 3" lg.	2
6.	72062104	NUT, lock; 1/4-20	1	18.	89044231	WIRE, 14 ga. green; 25" lg.	1
7.	72063001	WASHER, wrt.; 1/4"	1	19.	89044231	WIRE, 14 ga. green; 36" lg.	1
8.	72063049	WASHER, lock; 1/4"	4	20.	89044188	CABLE, 14 ga. 2-wire; 36" lg.	2
9.	73054624	SOLENOID, proportional	1	21.	----	NOT USED	-
10.	77040051	TERMINAL, wire	2	22.	89044231	WIRE, 14 ga. green; 10" lg.	1
11.	77040186	TERMINAL, wire	20	23.	77044018	RELIEF, strain	1
12.	77040282	TERMINAL, wire	3	24.	77044201	NUT, electrical; 1/2" lock	1

Figure D-27. Standard Control to Proportioning Control Conversion Kit (Part Number 95708177)



Item Number	Location
6, 9, 10, 11, 12, 13, 16, 17, 20, 21, 22, 23, 24 and 27	At or near remote control storage point
1 and 14	1 on each outrigger
15 and 18	1 on each side of carrier vehicle
7	At turntable grease zerk
2 and 3	At grease zerks
4	On reservoir suction line port
5	On reservoir return line port

Item No.	Part No.	Description	Qty	Item No.	Part No.	Description	Qty
1.	70391598	DECAL, outrigger warning	1	15.	70392865	DECAL, electrocution	4
2.	70391612	DECAL, grease weekly, left	5	16.	70392866	DECAL, operating conditions	1
3.	70391613	DECAL, grease weekly, right	2	17.	70392867	DECAL, moving outrigger	1
4.	70392108	DECAL, suction line	1	18.	70392868	DECAL, loadline	4
5.	70392109	DECAL, return line	1	19.	70392887	DECAL, IMT diamond	2
6.	70392213	DECAL, don't wash or wax	1	20.	70392888	DECAL, operating restrictions	1
7.	70392524	DECAL, rotate while greasing	1	21.	70392889	DECAL, remote electrocution	1
8.	70392794	DECAL, 3016 ID	2	22.	70392891	DECAL, driveline	1
9.	70392813	DECAL, electrocution	1	23.	70392982	DECAL, contact IMT	1
10.	70392814	DECAL, operator training	1	24.	71039134	DECAL, oil level	1
11.	70392815	DECAL, operation	1	25.	71391522	DECAL, right hand angle chart	1
12.	70392861	DECAL, 2-blocking	1	26.	71391523	DECAL, left hand angle chart	1
13.	70392863	DECAL, hoisting personnel	1	27.	71392793	PLACARD, capacity	2
14.	70392864	DECAL, stand clear	2	28.	70392399	DECAL, lubricate worm	1

Figure D-28. Decal Kit (Part Number 95708162)

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 on the control handle operates a potentiometer which increases and decreases voltage depending on the trigger 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 proportional 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. No power to control valve. Pump failure. Proportioning solenoid Pressure build-up valve	Black lead on terminal board should be 12 VDC. If not check for blown fuse or broken wire. Check for manual control valve operation. Valve spools may be operated manually by pushing on the red-tipped spools. If crane operates manually, continue. Check pump for operation. Check proportioning solenoid for proper operation. Check for 3 - 9 VDC at coil. Valve bank spools do not shift. Check.
Crane operates too slow	Dirty filter Proportioning solenoid Proportioning solenoid	Check vacuum gauge. Change filter element if necessary Check voltage at proportioning solenoid coil. Should vary between 3 VDC and 9 VDC depending on position of trigger. Check that proportioning solenoid is providing sufficient flow to valve bank
Extension and Winch function inoperative.	Excessive load Defective pressure switch	Reduce load. Check pressure switch for proper operation. Bypass 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 Defective amp driver Defective trigger pot	Check proportioning solenoid for proper operation. Should be 3 to 9 VDC at the coil with trigger deflected. If present, replace flow control valve. Perform adjustments in Paragraph 5-3. Check for 12 VDC at Amp Driver. If present, replace amp driver. 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.

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 shown on this list correspond to those on the figure listed.

Figure No.	Item No.	Part No.	Description	Qty
D-4.	4.	60030116	BEARING, thrust	2
D-4.	7.	70055147	BEARING, roller	1
D-4.	8.	70055148	BEARING, roller	1
D-4.	9.	71056395	GEAR-BEARING, turntable	1
D-4.	16.	72062162	NUT; 9/16-12 gr. 8	23
D-4.	19.	72063117	WASHER; 9/16" gr. 8	23
D-4.	23.	72601510	SCREW, hex hd.; 9/16-12 x 3-3/4" gr. 8	23
D-4.	24.	73051482	MOTOR, hydraulic	1
D-4.	25.	70056397	GEAR, worm	1
D-5.	2.	72063117	WASHER; 9/16" gr. 8	18
D-5.	3.	72601144	SCREW, hex hd.; 9/16-12 x 2" gr. 8	18
D-6.	5.	60030007	PAD, wear	2
D-6.	6.	60030139	PAD, wear	1
D-7.	2.	7BF81015	BUSHING, cylinder case	4
D-7.	6.	7BF81215	BUSHING, cylinder rod	2
D-7.	12.	73054304	VALVE, counter-balance; 10-gpm	1
D-7.	13.	9C161823	SEAL KIT, lower cylinder	1
D-10.	3.	60030189	PAD, wear	1
D-11.	9.	73054004	VALVE, holding	1
D-11.	--	9B101220	SEAL KIT, extension cylinder	1
D-12.	3.	60030189	PAD, wear	1
D-13.	6.	60030136	SHEAVE	3
D-13.	10.	51707928	CABLE	1
D-13.	12.	70055185	BEARING, flange	1
D-13.	16.	71073920	HOOK; 3-ton	1
D-13.	32.	73051517	MOTOR, winch	1
D-15.	21.	73054034	VALVE, flow control	1
D-17.	14.	77041003	SOLENOID; 12 VDC	1
D-17.	15.	77041283	SWITCH, pressure; 2800 PSI	1
D-17.	16.	77041251	RELAY; 12 VDC	2
D-18.	3.	73054636	SECTION, control valve	1
D-19.	15.	77041345	SWITCH, toggle, SPST	1
D-19.	16.	77041346	SWITCH, toggle, SPDT	1
D-19.	17.	77041347	SWITCH, momentary contact, SPST	1
D-20.	12.	77041329	DRIVER, amp	1
D-20.	14.	77041003	SOLENOID; 12 VDC	1
D-20.	15.	77041283	SWITCH, pressure; 2800 PSI	1
D-20.	16.	77041251	RELAY; 12 VDC	2
D-21.	3.	73054636	SECTION, control valve	1
D-21.	15.	73054624	VALVE, solenoid proportioning	1
D-22.	5.	51707507	POTENTIOMETER	

Figure No.	Item No.	Part No.	Description	Qty
D-22.	15.	77041345	SWITCH, toggle, SPST	1
D-22.	16.	77041346	SWITCH, toggle, SPDT	1
D-22.	17.	77041347	SWITCH, momentary contact, SPST.	1
D-23.	12.	77041329	DRIVER, amp	1
D-23.	14.	77041003	SOLENOID; 12 VDC	1
D-23.	15.	77041283	SWITCH, pressure; 2800 PSI.	1
D-23.	16.	77041251	RELAY; 12 VDC	2
D-24.	15.	77041345	SWITCH, toggle, SPST	1
D-24.	16.	77041346	SWITCH, toggle, SPDT	1
D-24.	17.	77041347	SWITCH, momentary contact, SPST.	1
D-25.	24.	70048031	GAUGE, vacuum.	1
D-26.	11.	77041239	SOLENOID; 12 VDC	1

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.

