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BRODERSON MFG. CORP.  
LENEXA, KANSAS 66215

# OPERATION AND MAINTENANCE MANUAL IC-400-3B

OWNER: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

SOLD AND SERVICED BY: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

MODEL NO. \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

# **BRODERSON MANUFACTURING CORP.**

## **STATEMENT OF WARRANTY FOR MOBILE CRANES**

Broderson Manufacturing Corp. ("BMC") warrants its products to be free from defects in material or workmanship at the date of shipment from BMC. This warranty shall be effective only when validated by the return to BMC of its standard form of Warranty Validation Certificate (Attachment A), duly completed and signed by the original purchaser from BMC and any subsequent purchaser who buys a BMC product as a new product, and then only as to defects reported to BMC in writing within 1 year or 2000 hours, whichever occurs first, from the date a product is placed in service, as evidenced by such warranty validation certificate. **THIS WARRANTY APPLIES TO ALL PARTS OF BMC'S PRODUCTS EXCEPT ENGINES, DRIVE TRAINS, HYDRAULIC SYSTEM COMPONENTS, TIRES, OR ACCESSORY EQUIPMENT, WITH RESPECT TO WHICH BMC MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND NO OTHER WARRANTY OF ANY KIND, EXPRESS OR IMPLIED;** the sole warranties, if any, with respect thereto being those made by the respective manufacturers thereof.

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THE FOREGOING DISCLAIMERS OF WARRANTIES AND DISCLAIMER OF LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES SHALL BE EFFECTIVE REGARDLESS OF WHETHER THE EXPRESS WARRANTY CONTAINED HEREIN BECOMES EFFECTIVE AS PROVIDED IN THE FIRST PARAGRAPH HEREOF.

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# **BRODERSON MANUFACTURING CORPORATION**

## **IC-400-B INDUSTRIAL CRANE**

### **INTRODUCTION**

The BroderSON IC-400-B was designed and built to provide safe, dependable, and efficient crane service. This we warrant by our testing and quality control procedures. To properly utilize the full potential of the equipment, the following customer controlled conditions must exist:

1. The operator must understand the equipment.
2. The operator must know the operating characteristics.
3. The operator must observe the safety rules.
4. The equipment must be given proper maintenance.

This manual was written to provide information required for these conditions. The recommendations for periodic inspection, test, and maintenance are minimum standards for safe and economical performance.

When ordering parts: the unit serial number, unit model number, part number, part description and quantity must be provided.

This unit must not be altered or modified without written factory approval.

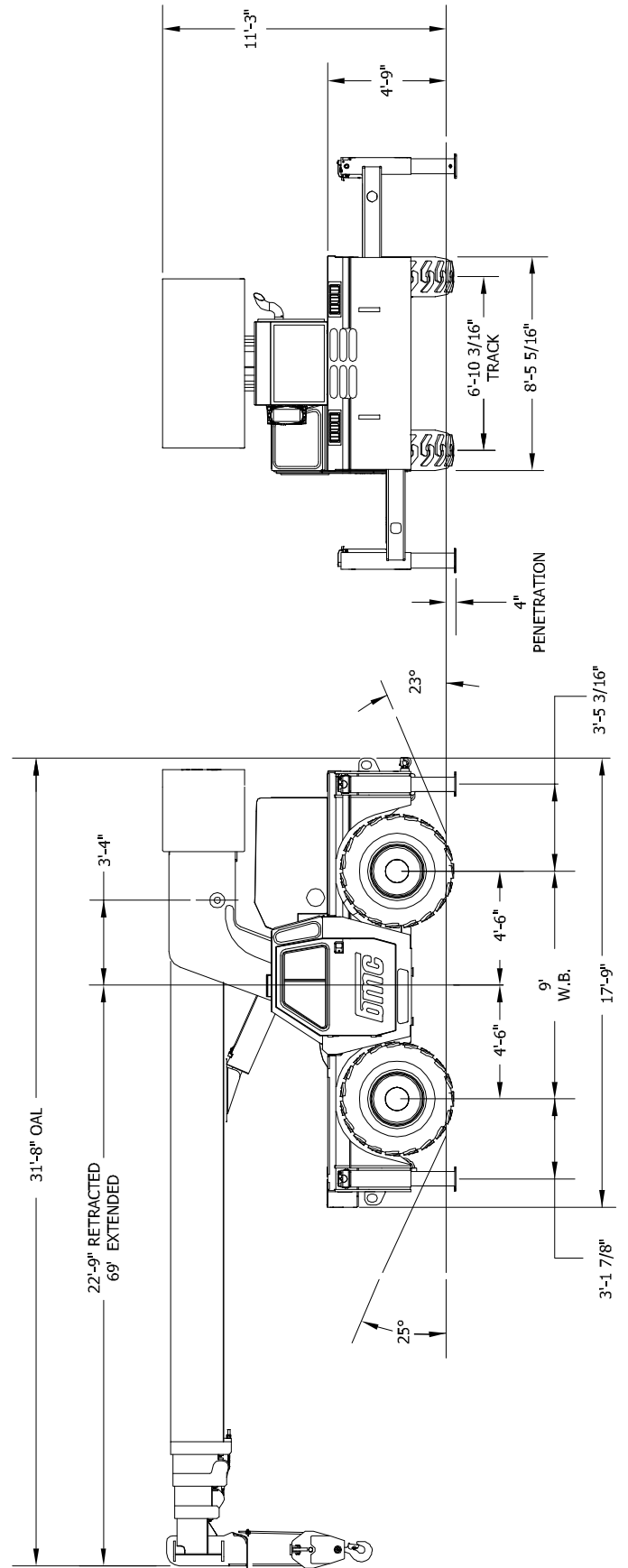
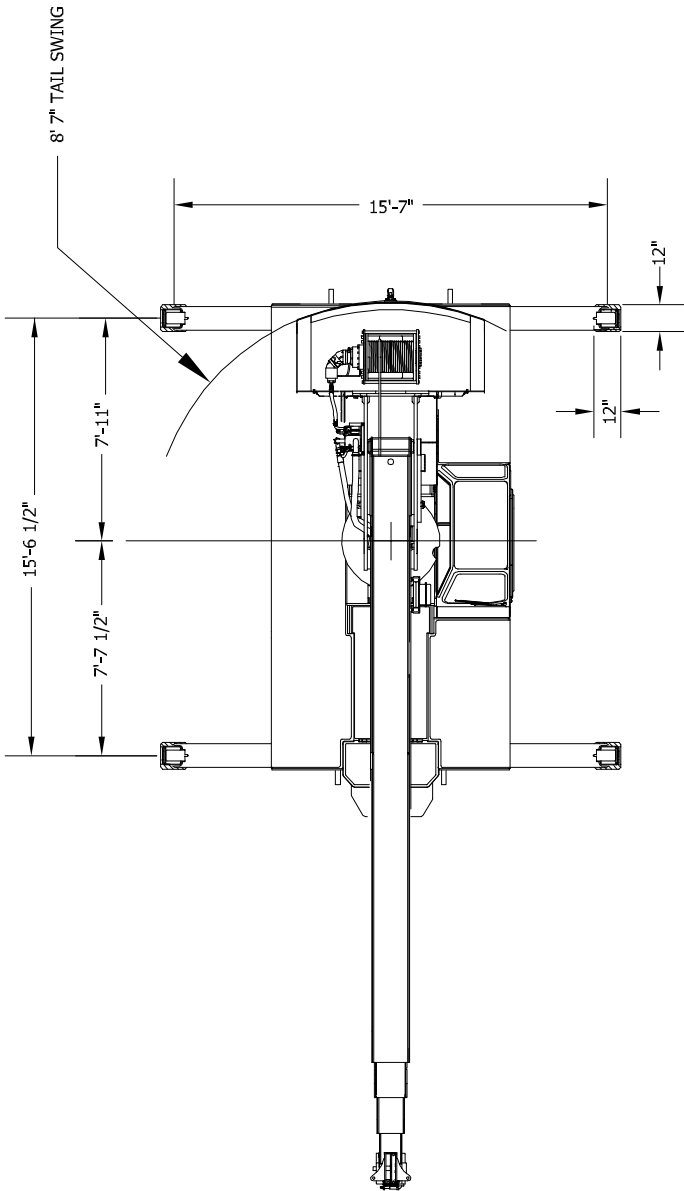
To reorder this manual, ask for IC-400-B Operation and Maintenance Manual, Part Number 990-30259. Contact your BroderSON Service Representative at:

BroderSON Manufacturing Corp.  
14741 W. 106<sup>th</sup> Street  
Lenexa, Kansas, 66215 U.S.A.  
913-888-0606

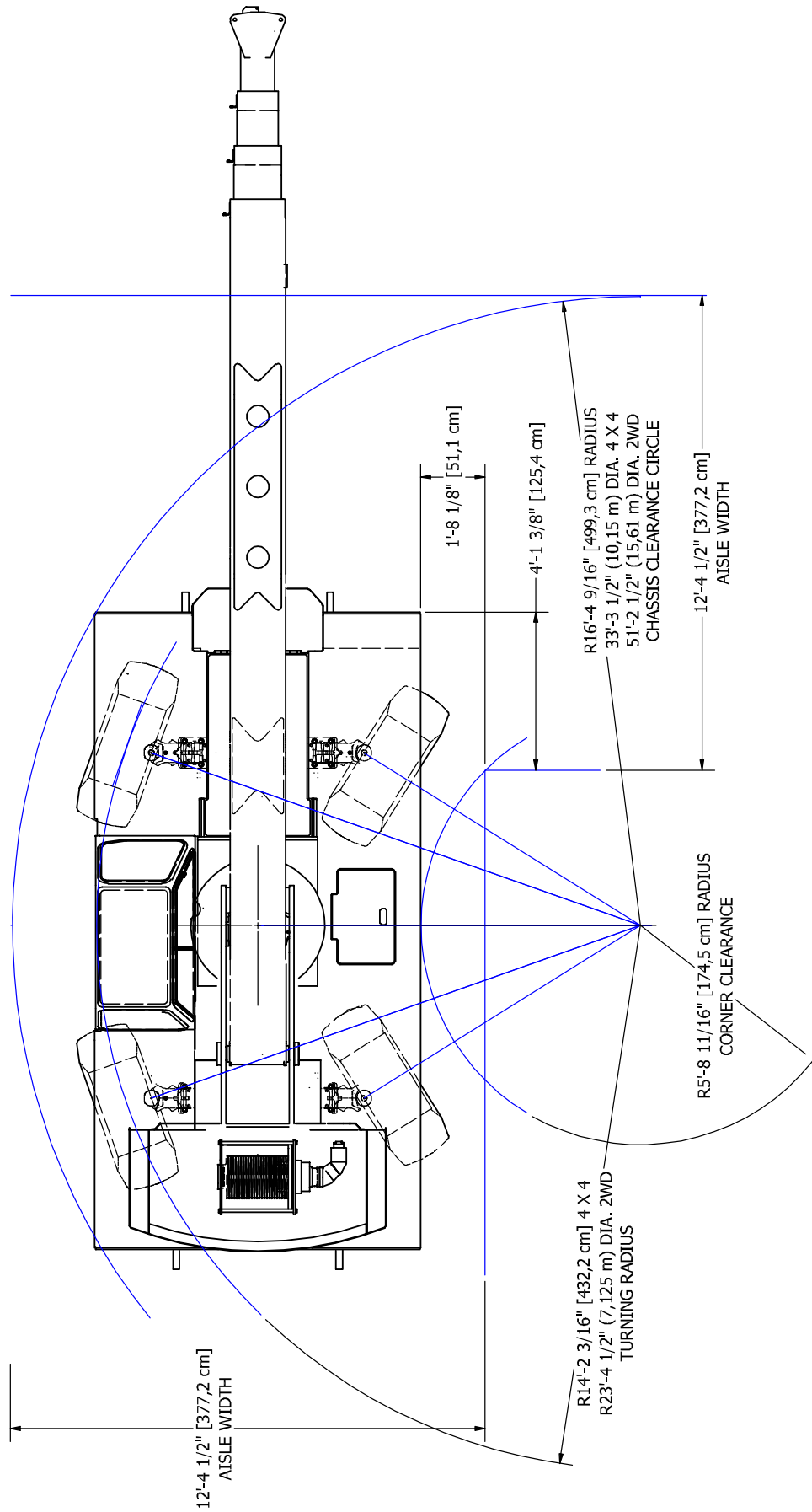
### **NOTICE**

If this crane becomes involved in an accident, please call BroderSON Manufacturing Corp. at 913-888-0606, and ask for the Service Manager. Also, please notify your BroderSON dealer.

# IC-400-B DIMENSIONS



# IC-400-B TURNING DIMENSIONS



## SECTION 1

### DESCRIPTION AND SPECIFICATIONS

The IC-400-B is a self-propelled Industrial Crane designed for lifting and material handling, with special features of self-loading cargo decks, 4-wheel steer, and 4-wheel drive. The basic unit consists of a chassis and hydraulic boom assembly. The chassis includes a frame, four hydraulic independently controlled outriggers, engine, 6-speed transmission, front steering-driving axle & rear steering-driving axle, fuel tank, hydraulic oil tank, control station, 3-mode full-power steering, power brakes, all weather cab, and lighting package. The boom assembly includes a hydraulic powered continuous rotation turret, 4-section telescopic boom, hydraulic boom elevation cylinder, hydraulic boom telescope cylinder, and hydraulic powered planetary gear hoist. Rated Capacity Limiter (RCL) is standard.

#### **IC-400-B:**

4-section hydraulically extended boom with capacity of 50,000 pounds (22,680 kg) at an 8-foot (2.4 m) load radius. Horizontal reach of 69 feet (21.03 m) and vertical reach of 80 feet (24.37 m).

#### **General:**

##### **Length:**

Overall	31 feet 8 inches (9.65 m)
Chassis	17 feet 9 inches (5.41 m)

<b>Width:</b>	8 feet 6 inches (2.59 m)
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##### **Height:**

Overall	11 feet 3 inches (3.43 m)
Deck	56 inches (1.42 m)

<b>Wheelbase:</b>	108 inches (2.74 m)
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##### **Ground Clearance:**

Chassis	16.6 inches (42 cm)
Minimum (Tailpipe)	13.8 inches (35 cm)

<b>Angle of Approach:</b>	25 degrees
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<b>Angle of Departure:</b>	23 degrees
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##### **Outriggers:**

Spread	15 feet 7 inches (4.75 m)
Penetration	4.5 inches (114 mm)

##### **Boom Movement:**

Rotation	Continuous
Elevation	0 to 75 degrees
Telescope	47 feet (14.33 m)

##### **Boom Speeds:**

Rotation	0.53 RPM
Elevation	41 seconds
Telescope	18 ft/min

##### **Hoist Line Speeds:**

Low-Speed Mode:	144 ft/min (43.9 m/min)
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**General: (continued)**

<b>Extension:</b>	<b><u>W/O Boom Extension</u></b>	<b><u>With Boom Extension</u></b>
Sheave Height (Nominal):	80 feet (24.37 m)	99 feet (30.18 m)
Horizontal Reach:	69 feet (21.03 m)	90 feet (27.43 m)
<b>Weight:</b>		
Total	55,200 pounds (25,038 kg)	
Front Axle	31,154 pounds (14,131 kg)	
Rear Axle	24,046 pounds (10,907 kg)	
<b>Turning Radius: (4-Wheel Steering)</b>	14 feet 2 inches (4.32 m)	
<b>Aisle Width for 90° Turn</b>	12 feet 4 inches (3.76 m)	
<b>Steering Modes</b>	Rear Steer, Round Steer, Crab Steer	
<b>Road Speed</b>	25 MPH (40.2km/h)	
<b>Drawbar Pull</b>	29,300 pounds* (13,290 kg)	
<b>Gradeability</b>	70 percent* (34 degrees)	
*Calculated, Wheels spin below these values in 2-wheel drive.		
<b>Grade Limit</b>	19 percent (11 degrees)	

**Engine:****Standard:****Cummins - QSB4.5 Turbo EPA Tier 4 Final:**

Cummins Model QSB4.5 diesel engine, turbocharged, charge air cooled, 4-cylinder, 4.5-liter (275 CID). U.S. EPA Tier 4 Final certified. Rated 163 hp (122 kw) at 2600 RPM. 460 foot-pounds (624 Nm) maximum torque at 1500 RPM. 120-amp alternator. Oil capacity, 11.6 quarts (11 L). Coolant capacity, 33.6 quarts (31.8 L). Electronic controls for 3 engine speeds during crane operation – 850, 1200, or 1800 RPM, as well as incremental RPM steps, at 100 RPM steps, between those set points. Protection system shuts down engine when coolant is too hot or oil pressure is too low. Charge air cooler, grid heater and engine block heater (which plugs into 120-volt AC extension cord) are included. Tier 4 Final engines require the use of Ultra Low Sulfur Diesel (ULSD) that meets the EPA defined sulfur content of 15 parts-per-million (ppm). Tier 4 Final engines also use Diesel Exhaust Fluid (DEF), and DEF must be added as needed to maintain proper engine performance. A 5-gallon DEF bottle is located in the fuel tank for easy access and filling.

**Transmission:****Standard:**

Powershift transmission with 2 ranges and 3 speeds in FORWARD and REVERSE. Provides full powershifts between the 3 FORWARD and REVERSE gears at maximum engine speed. Provides a low range and a high range that can be selected when the machine is at a STOP. All shifting is done with an electric push button operator interface in the operator compartment. The transmission includes a front axle disconnect for 2-wheel drive when commanded by the operator through the electric push button interface in the operator compartment. The machine must be placed in park before changing from 2-wheel drive or 4-wheel drive. The control system will not allow a change in drive state without being in PARK. A torque converter with a stall torque ratio of 2.73:1 attaches directly to engine flywheel to drive transmission. Equipped with oil cooler and filter.

Forward gear ratios and speeds:

<u>GEAR RATIO</u>	<u>SPEED</u>
1 <sup>st</sup> 8.93	2.1 mph (3.4 km/h)
2 <sup>nd</sup> 4.63	4.0 mph (6.4 km/h)
3 <sup>rd</sup> 1.70	10.5 mph (16.9 km/h)
4 <sup>th</sup> 3.75	4.9 mph (7.9 km/h)
5 <sup>th</sup> 1.94	9.2 mph (14.8 km/h)
6 <sup>th</sup> 0.71	23.6 mph (38 km/h)

Reverse gear ratios and speeds:

<u>GEAR RATIO</u>	<u>SPEED</u>
1 <sup>st</sup> 8.93	2.7 mph (4.3 km/h)
2 <sup>nd</sup> 4.63	6.3 mph (10.1 km/h)
3 <sup>rd</sup> 1.70	15 mph (25.4 km/h)
4 <sup>th</sup> 3.75	4.9 mph (7.9 km/h)
5 <sup>th</sup> 1.94	9.2 mph (14.8 km/h)
6 <sup>th</sup> 0.71	23.6 mph (38 km/h)

**Front Axle:**

**Standard:**

Planetary driving-steering axle with 19.333 to 1 ratio. Front axle is rigid-mounted. Axle has a 30% limited-slip differential.

**Rear Axle:**

**Standard:**

Dana Corporation planetary driving-steering axle with 19.333 to 1 ratio. Rear axle is rigid mounted. Axle has a 30% limited-slip differential.

**Brakes:**

**Standard:**

Service brakes are 4-wheel hydraulic, internal wet-disc brakes. System includes two, 0.5-gallon (1.9 L) accumulators, unloading valve, and brake malfunction warning light. Parking brake is internal wet-disc, spring-applied & hydraulically released, and integral to the rear axle.

**Steering:**

**Standard:**

Hydraulic steering unit with a 4.0-inch (10.1 cm) cylinder attached to each axle. Allows limited steering when engine is not running. Selecting front-wheel steering, 4-wheel steering, or crab steering is done through electronic push button operator interface in the operator compartment. Electronic sensors and control module automatically sense when the steering is centered upon the selection of a new mode. Steering wheel and electronically-controlled selector valve control 3-mode steering.

**Tires:**

**Standard:**

17.5 x 25, 20-ply rating, mud lug

**Optional Tires:**

**Spare Wheel and Tire:**

Standard Size: Extra wheel with 17.5 x 25, 20-ply rating tire mounted, ready for service. Order left hand or right hand. Net Weight: 530 pounds (240 kg)

**Chassis:**

**Standard:**

**Cargo Deck:**

Total Deck Area: 74 square feet (6.94 m<sup>2</sup>). Front deck: 102" (2.6 m) X 57.8" (1.5 m), RH side deck 198.3" (5.04 m) X 32" (.81 m). A maximum of 25,000 pounds (11,340 kg) may be carried on the deck when centered over or between axles. Five stake pockets are provided along edges of deck for 1-inch (25mm) pipe stakes. Stakes furnished. Cargo decks have skid resistant coating.

**Headlight and Taillight Grilles:**

Steel protective grilles for headlights and taillights. Easily removable for replacement .

**Outriggers:**

Four hydraulic out-and-down outriggers of box-beam construction. Independent controls for each outrigger. Hydraulic cylinders are equipped with direct-connected holding valves. Pad dimensions: 11.5 inches (29cm) x 11.5 inches (29cm).

**Pulling Eyes:**

Two heavy duty lugs on front bumper provide for attachment of hook block so main winch line can be used for pulling loads at or near floor level; also for anchoring tag lines from load on hook. Two heavy duty eyes on rear bumper allow dragging or towing a load.

**Tie Downs:**

Pulling eyes also provide tie down locations for transporting crane by truck or cargo container.

**Accessory Storage Box:**

Consists of a hinged rear deck plate cover, and front box for carrying downhaul weight and other items. Storage box is 13.88" (35cm) deep x 40.3" (102.4 cm) long x 18" (45.7 m) wide.

**Sheave Block Storage Box:**

Recessed area in front deck for stowing sheave block. Sheave block is stored on the side, using eye bolt for easy lifting and lowering into storage box. Includes pin assembly for securing sheave block.

**Lifting Rings:**

Consists of four rings, one at each corner of the load deck, so sling can be attached for lifting crane. Rings hang below deck surface when not in use.

**Engine Hood:**

Side door and removeable side panels allow improved access to engine with boom centered over the front of machine. Engine fluid levels can be checked without starting engine and swinging boom.

**Chassis Options and Accessories:****Auxiliary Winch:**

Optional planetary gear winch, mounted on front outrigger bumper, with a single-lever control in the operator compartment. Hydraulic-powered to provide bare drum line pull of 15,000 lbs (6800 kg) and 40 ft/min (9 m/min) line speed on the 4<sup>th</sup> layer. Winch drum is 4.75 inches (12 cm) diameter by 9 inches (23 cm) long. Includes 125 feet (38.1 m) of 9/16-inch (14 mm) diameter 6x36 EIP-RRL-IWRC wire rope, minimum breaking force 33,600 pounds (150 kN). Also includes 10,000 lb (4500 kg) eye hook. A pintle hook is recommended for two-parting the line with a sheave block (pintle hook and sheave block not included). Winch is mounted to heavy-duty bracket with hook storage feature. Net weight: 580 pounds (265 kg)

**Pintle Hook - Rear:**

T-60-AOL Holland pintle hook mounted on rear frame member, provides capacity for 6000-pound (2700 kg) tongue weight and 30,000-pound (13600kg) trailer weight. Net Weight: 15 pounds (7kg)

**Pintle Hook - Front:**

T-60-AOL Holland pintle hook mounted on front frame member, provides same capacity as rear pintle hook. Net Weight: 15 pounds (7kg)

**Rearview Mirrors:**

One right-hand and one left-hand mirror, 6" (152mm) wide x 16" (406mm) high, mounted on deck stakes. Pivot out of way when contacted by obstacle at side of deck. Net Weight: 12 pounds (5kg)

### **Operator Compartment:**

#### **Standard:**

Operator control station provides one-position access to all chassis and crane functions. Includes adjustable operator's seat and seat belt, arm rests, and tilt steering column. Also includes access point to J1939 CAN Bus System.

#### **All Weather Cab:**

Consists of rigid-mounted canopy section with safety glass and removable hinged door. Door is equipped with a keyed lock to protect operator's station. Includes defroster fan, dome light, heater with 2-speed fan, 12V electric windshield wiper, electric windshield washer, 12V power outlet. There are sliding windows in the door and RH side. Emergency Exit through rear window.

#### **Air Conditioning:**

Provides factory system using R134a refrigerant. Compact AC unit mounted in operator area, fan-cooled condenser mounted on hood, and belt-driven compressor with magnetic clutch driven by engine.

#### **Electronic Controls:**

Dual, two-axis joysticks provide control of boom motions and hoist. Triggers prevent inadvertent boom motion. Arming command push-button on panel, along with RH joystick, enable or disable the functions of joysticks in conjunction with seat switch or dead man switch. Push-button switch on LH panel separates boom function from outrigger functions.

### **Operator Compartment Options and Accessories:**

#### **Floor Mat:**

Vinyl mat with foam backing covers floor, front wall, and under seat compartment of operator's compartment. Net Weight: 5 pounds (2kg)

#### **Noise Reduction Kit - Cab:**

Includes vinyl floor mats and side panels of foam-backed, perforated vinyl for noise reduction. Net Weight: 15 pounds (7kg)

#### **Sun Visor (Or Roller Shade):**

Adjustable sun visor (or roller shade option) for reducing glare mounted in roof of cab.

### **Electrical System:**

#### **Standard 12-Volt DC:**

##### **Battery:**

Dual Batteries; Group 49 with 950 CCA rating.

##### **Lighting Group:**

Consists of: two 12V-LED, with high & low beams for driving, tail, brake & turn signal lights, and backup lights in rear. Front turn signals and emergency flasher switch at operator's station. 12V horn actuated by button located on turn signal lever.

##### **Dash Display:**

In-dash LCD screen shows engine data including RPMs, coolant temperature, battery voltage, fuel level, engine oil pressure, DEF fluid level percent. Display also shows engine hourmeter. Display also shows engine fault codes and control system faults. Screen indicates hydraulic oil temperature. Also included are lights for engine warning & engine shutdown, in addition to a diagnostics page to aid with trouble shooting and fuse/relay failure identification.

**Back-Up Alarm:**

Provides pulsating sound from a 102 dB alarm when ignition is on and transmission is in reverse. Conforms to SAE J994B.

**Outrigger Alarm System:**

102 dB alarm with alternating 2-tone sound is actuated when the OUTRIGGER DOWN, OUTRIGGER BEAMS OUT or OUTRIGGER BEAMS IN controls are operated.

**Emergency Stop Switch:**

A two-position push button switch located on the LH side of the dash panel. Designed to stop the engine and shut down the hydraulic system.

**Optional Electrical Accessories:****Strobe Lights:**

Two yellow strobe lights, one on each side of counterweight, for high visibility all around crane. Flashes 60-120 times per minute. Includes operator-controlled switch. Net Weight: 15 pounds (7kg)

**Boom Work Lights:**

Two LED work lights, one on left side of boom to light boom tip, and one on right side of the turret to light ground, under boom tip. Includes switch at operator's station. Net Weight: 10 pounds (5kg)

**Hydraulic System:****Standard:**

Two piston pumps, mounted on and driven by the main transmission, delivers a combined flow of 103 GPM (390 L/min) at 4000 PSI (275.8 bar) and 2600 RPM engine speed. System protected by relief valves, suction-line strainers, and a 150 GPM, 10-micron return-line filter.

**Hydraulic Reservoir:**

156-gallon (509 L) capacity, equipped with 10-micron breather on top and oil level gauge on side.

**Boom:****Standard:**

Four-section, high strength steel construction, equipped with lubricant-filled bearing pads for efficient support and extension. Hydraulic cylinder coupled with double runs of high-strength leaf chain, extends and retracts the second, third, and fourth stages proportionally. The telescope cylinder and the boom elevation cylinder are equipped with cylinder-mounted holding valves. Boom angle indicator is provided on the left side of the boom.

**Boom Rotation:**

Heavy-duty bearing rotation gear with external teeth supports boom. Rotation is powered by hydraulic motor and worm gear drive. Rotation gearbox may be adjusted as wear occurs, to minimize backlash. Boom is attached by steel turret weldment.

**Main Hoist:**

Hydraulically-powered, turret-mounted hoist to provide a bare-drum line pull of 13,800 lbs (6520 kg) and a speed of 144 feet-per-minute (43.9 m/min). Hoist drum is a grooved 10.94-inch (27.79 cm) diameter by 17.14 inches (43.54 cm) long.

**Main Hoist Rope:**

Main hoist rope is 5/8" (15.87 mm) in diameter, Warrington-Seale construction, 6x36 ' classification, EEIP grade, IWRC core, RRL lay, minimum breaking strength 43,750 lbs (194 kN), 425' (129.5 m) long. Weight per foot is 1.13 lbs (1.68 kg per m). Note that rope weight is not included in load calculations.

**Downhaul Weight and Hook:**

Downhaul weight and 14,000-pound (6350 kg) rated swivel hook to use with wedge socket on 5/8-inch (16 mm) load line. Specially designed to work with the anti-two-block system and to clamp the dead end of the rope. Weighs 180 pounds (82 kg)

**Anti-Two-Block Device:**

Prevents damage to hoist rope and/or machine components from accidentally pulling sheave block or downhaul weight against boom tip. Consists of trip arm at boom tip, which is moved upward by sheave block or downhaul weight as hook approaches boom tip. Trip arm actuates electric switch, which is connected through cable reel mounted on boom to solenoid dump valve control system. This system will stop HOIST RAISE, TELESCOPE EXTEND, BOOM LOWER, SWING LEFT and SWING RIGHT circuits. No other circuits are affected. These circuits are returned to normal operation by operating the HOIST LOWER or TELESCOPE RETRACT control.

**Rated Capacity Limiter:**

Operational aid that warns operator of impending overload with audible and visual signals. Has read-outs for load, boom angle, boom length and load radius. In the event of an overload, it blocks the following boom functions: HOIST RAISE, TELESCOPE EXTEND, BOOM LOWER, SWING LEFT and SWING RIGHT. These circuits are returned to normal by lowering load to a safe resting place with hoist, or by retracting or raising boom to a shorter load radius. There is an override system on the display of the RCL System in the Operator's Compartment.

**Four-Part-Line Sheave Block:**

Double sheave block for 4-part-line requirements. 12-inch (305 mm) OD sheaves for 5/8-inch (16 mm) diameter wire rope. Swivel hook with safety latch. 470-pound (214 kg) weight provides positive overhaul. Includes bar on top to actuate trip arm of Anti-Two-Block Device.

**Optional Boom Attachments:****Boom Extension: 20-foot (6.1 m) Offset:**

Provides 20 feet (6.1 m) of additional length for lifting loads with load line. Boom extension may be stowed alongside base boom section when not in use. Tip sheave, attaching brackets and pins are included. Deduct 500 pounds (220kg) from Capacity Chart when boom extension is in the stowed position. Includes trip arm for Anti-Two-Block Device. Boom extension will tilt through 3 positions: in-line, 15 degree offset and 30 degree offset. Net Weight: 775 pounds (350 kg)

**\*\*\* Specifications subject to change without notice \*\*\***

## OPERATION SECTION

### SAFETY RULES

#### GENERAL:

1. Since the manufacturer has no direct control over machine application and operation, conformance with good safety practice is the responsibility of the owner and operator.

2.



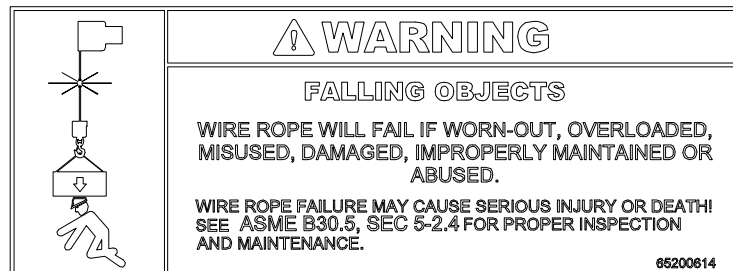
3.



4. The operator shall be responsible for those operations under his direct control. Whenever there is any doubt as to safety, the operator shall have the authority to stop and refuse to handle loads until safety has been assured.
5. The operator shall not engage in any practice which will divert his attention while actually operating the crane.
6. Do not run the engine in an enclosed area or indoors without adequate ventilation.
7. Do not use ether for starting. Ether is highly flammable and can be ignited by the intake manifold heater grid, causing engine damage or operator injury.
8. This list of rules is only a supplement to all federal, state, and local safety rules that may apply.

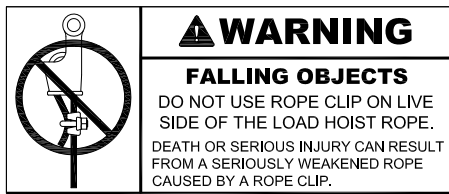
#### CRANE CONDITION:

1. Before beginning operation each day, thoroughly inspect the entire crane to be sure it is in good operating condition.
2. Inspect load hoist rope and wedge socket daily. We recommend rope inspection, replacement and maintenance in accordance with ASME B30.5, Sec. 5-2.4.

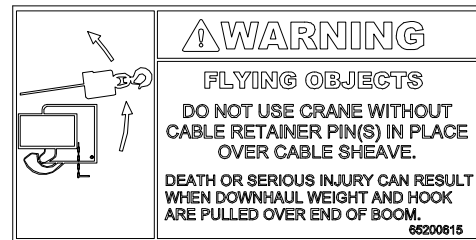


3. Keep operator's compartment and decks free of mud and grease.
4. Keep all window glass clean. Keep gauges and displays clean.
5. Tools, lubricants, or rags on the crane should be kept in a secured toolbox.

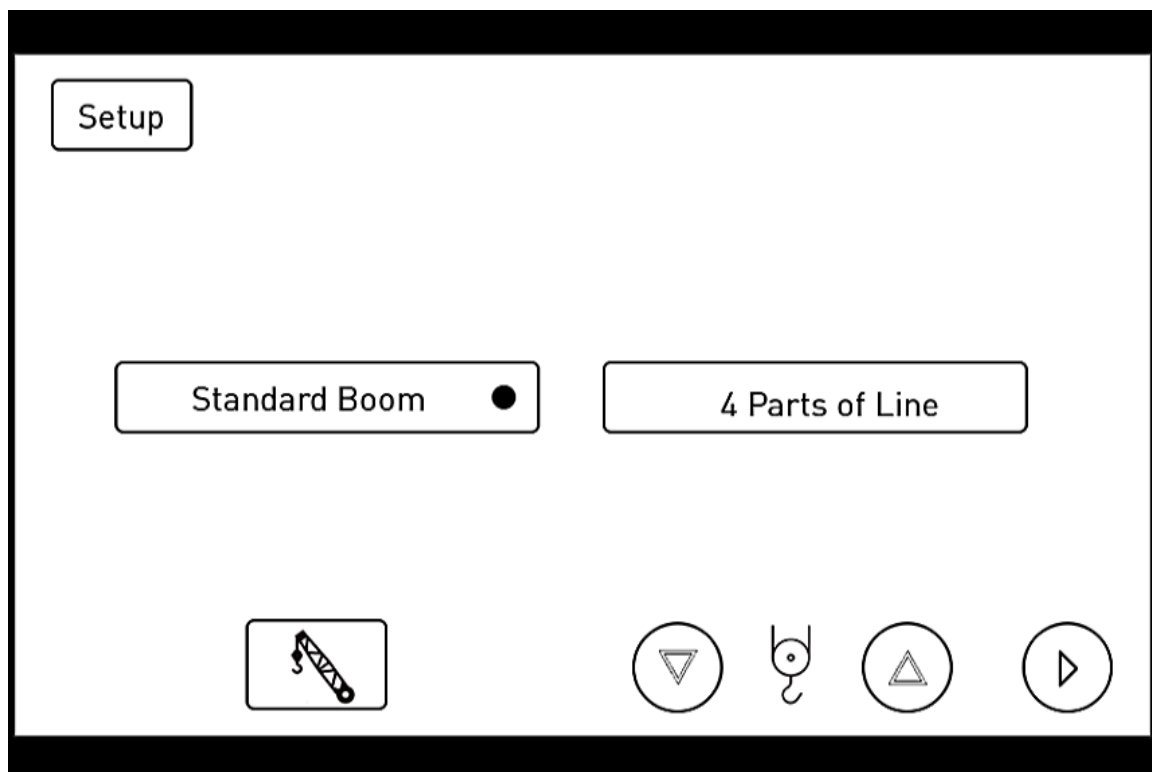
6.



7.

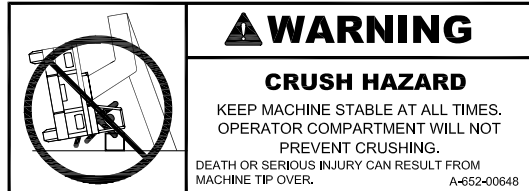


8. The Rated Capacity Limiter must be checked after each setup for the proper operating configuration on the display.



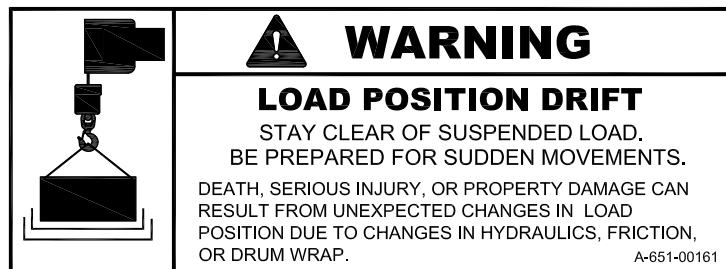
## LIFTING:

1. Always refer to Crane Capacity Chart in operator's compartment before handling load. Do not exceed load ratings. Under some conditions, the standard capacity ratings cannot be recommended and must be adjusted downward to compensate for special hazards, such as weak supporting ground, wind, hazardous surroundings, operator inexperience, etc. The weight of the load should always be known.



2. Rated Capacity Limiter components must be inspected for damage at the beginning of each shift. The Rated Capacity Limiter must be tested with a known load at least once a month.
3. Be careful to prevent load swinging. A swinging load can cause instability or loss of control of the load. Be aware that the Anti-Two-Block System and the Rated Capacity Limiter can cause sudden stopping of boom movement, which can cause the load to swing. Swing the boom slowly whenever these systems might stop the boom.

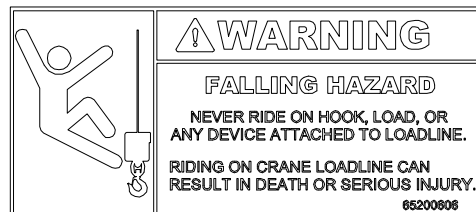
4. Do not allow anyone to put any part of his body under a load. The load may lower or fall if there are damaged parts on the crane. Also, the load may drop a short distance due to thermal contraction of the hydraulic oil in the cylinders.



5. Do not use crane to drag loads sideways. Do not use crane to raise grounded or fixed load by using Boom Raise function.

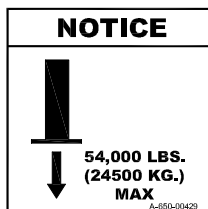


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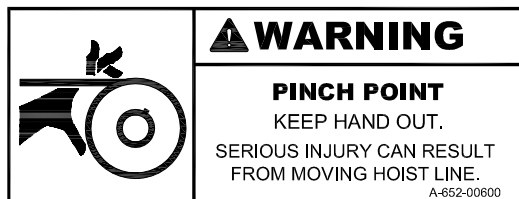


8. Level the crane before lifting. A small incline will significantly reduce the capacity. Use appropriate cribbing under the outriggers for leveling. All outrigger beams must be fully extended and tires must clear the ground to use the OUTRIGGERS OUT & DOWN ratings. The machine will know and function accordingly, when the transducers sense a minimum pressure rating of 2000 PSI.

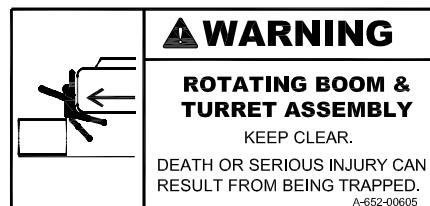
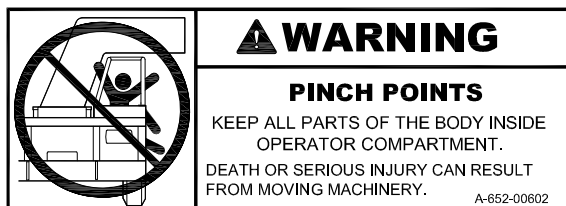
9. Always use outriggers if possible. If you must lift on rubber, keep the load as close to the ground as possible to prevent tip-over. Move the load very slowly and use tag lines to prevent load swinging.
10. Crane may tip at less than rated loads if the surface is uncompacted, has wet dirt or soft soil with frozen crust, thin or cracked pavement, or surface near a hole or ledge. Always use adequate outrigger floats and/or cribbing. See page 2-22



11. The operator shall not leave the controls while the load is suspended.
12. Always use adequate parts of load hoist line for lifting heavy loads.
13. Always be sure the rope is properly seated and wound evenly on hoist drum.
14. Keep hands away from load hoist rope when hoist is being operated.



15. Be sure at least three wraps of rope are left on the hoist drum to ensure against rope pulling out of its anchor.
16. Never wrap the hoist rope around a load. Always use approved rigging.
17. Avoid pinch points such as between a rotating turret and the cab, or in access holes of a telescoping boom, or between the two-block mechanism.



### CAUTION

Keep hands out of Anti-Two-Block mechanism. Serious injury can result from moving parts.

18. Avoid two-blocking.

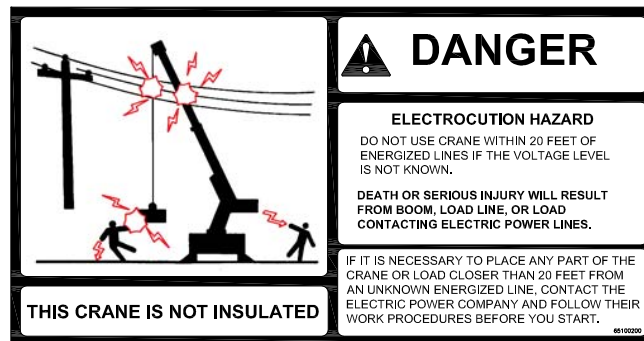
- A. Stop raising hoist line before downhaul or hook block strikes boom tip plates.
- B. Pay out hoist line while extending boom.
- C. Maintain clearance between downhaul weight or hook block and boom tip while booming down.

### DANGER

Two-blocking will abruptly stop boom lowering and boom swing, as well as hoist and extend. If the boom is moving fast, this will cause the load to bounce or swing, which could cause loss of control of load or tipping.

19. The amount of counterweight supplied with this crane should never be changed. Unauthorized addition of counterweight in the field to increase lifting ability constitutes a safety hazard.

20. Always keep crane boom at least 20 feet (6 m) away from any electric power lines of unknown voltage. If voltage is known, use chart on side of turntable to determine required clearance distance. When in doubt, contact local power authority.



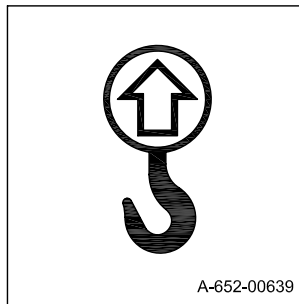
REQUIRED CLEARANCE FOR NORMAL VOLTAGE TABLE	
NORMAL VOLTAGE, KV (PHASE TO PHASE)	MINIMUM REQUIRED CLEARANCE, FEET (METERS)
<b>OPERATION NEAR HIGH VOLTAGE POWER LINES</b>	
TO 50 .....	10 (3)
OVER 50 TO 200 .....	15 (4 1/2)
OVER 200 TO 350 .....	20 (6)
OVER 350 TO 500 .....	25 (7 1/2)
OVER 500 TO 750 .....	35 (10)
OVER 750 TO 1000 .....	45 (14)
<b>OPERATION IN TRANSIT WITH NO LOAD AND BOOM LOWERED</b>	
TO 1 .....	4 (1 1/2)
OVER 1 TO 50 .....	6 (2)
OVER 50 TO 345 .....	10 (3)
OVER 345 TO 750 .....	16 (5)
OVER 750 TO 1000 .....	20 (6)

REF. ASME B30.5 - 2011 65100163

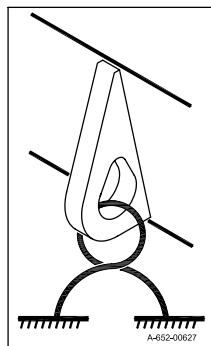
21. If boom should accidentally contact a power line, keep ground personnel away from crane. Stay in the crane until the power source is de-energized. Move the crane away from electrical hazard if this does not cause new hazards. If it is absolutely necessary to leave the crane, **jump** clear of the crane with both feet together. Hop away from the crane keeping feet together. The ground surface may be energized.

22. Do not operate outside during thunderstorms. Avoid all lightning strike opportunities. Consult local weather reports during inclement weather conditions.

23. Crane has four lifting rings, one at each corner of load deck, for lifting the crane. Use proper slings and rigging methods to keep the load balanced during the lift. Do not lift by the boom. Proper lifting and securing practices are the responsibility of the rigger in charge.



24. When transporting the crane, be sure it is properly secured to the vehicle. Utilize the tie-down anchors, as indicated on the crane, to stabilize the load and prevent shifting during transport. Use caution to not over-tighten the chains and binders when securing the crane to the transport vehicle. Proper securement and prudent shipping practices are the responsibility of the carrier.



## TRAVEL:

1. For Pick and Carry operation: Traveling with suspended loads involves so many variables, such as ground conditions, boom length, and vehicle acceleration, that it is impossible to devise a single standard rating procedure with any assurance of safety. For such operations, the user must evaluate prevailing conditions and determine safe practices using precautions, such as the following:
  - A. The boom shall be centered over front axle.
  - B. Use shortest boom practical.
  - C. Carry load as close to ground as practical.
  - D. Reduce travel speed to suit conditions [2 MPH (3 km/h) maximum].
  - E. Maintain specified tire pressures and lug nut torques.
  - F. Avoid sudden starts and stops.
  - G. Provide tag or restraint lines to restrict the swinging of the load.
  - H. Hand-held tag lines should be nonconductive.
  - I. Do not carry heavy boom loads and deck loads at the same time.
  - J. Do not pick and carry with boom extension installed.
  - K. Do not exceed the OVER FRONT, ON RUBBER capacity.
2. When raising the boom or moving the unit with boom elevated, be sure there is adequate overhead clearance for boom.
3. For carrying loads on decks:
  - A. Boom must be retracted, centered and lowered as close as possible.
  - B. 2 MPH (3km/h) maximum road speed. Reduce speed below 2 MPH (3km/h) to
  - C. Remove load hook from load before traveling.
4. Cranes with rear steering require close watch because of "tail swing" when the chassis is turned in tight quarters.
- 5.



6. Every effort has been made to make the BMC Industrial Crane a stable vehicle. However, with the rigid front axle and rear axle, the operator must take care to control the vehicle speed to be compatible with conditions of rough roads or uneven terrain.
7. When this crane is to be parked on a grade, set parking brake and block wheels, or extend outriggers fully.

### **CAUTION**

**Driving the unit in four-wheel-drive on hard surfaces, such as concrete or asphalt, may damage the differential.**

8. Do not drive the unit in four-wheel-drive on hard surfaces such as concrete or asphalt.

### **CAUTION**

**Do not allow fuel tank to become empty. The engine will be difficult to restart and may require "bleeding" of diesel injectors. Keep fuel tank full when idle to prevent condensation in tank.**

9. Shut off engine before refueling, and remove fuel cap slowly. Vapor pressure in tank can cause a burst of fuel and vapor when the cap is removed. Always refuel with proper fuel and into proper tank.
10. Know your visibility limitations. Loads being carried on the deck or hanging on the hook can add further limitations to visibility during travel. Always use a signal person when in doubt.

## INSTRUMENTS AND CONTROLS

The IC-400 instrument panel is equipped with a monitor display that includes warning lights and push buttons to change display screens. The display includes:

- Engine Hour Meter
- Engine RPM Tachometer
- Engine Coolant
- Engine Oil Pressure
- Engine DEF Level
- Engine After-treatment Manual Regeneration Button
- Regeneration Disable Button
- Engine RPM Set-Points
- Engine RPM Incremental Adjust
- Machine Fuel Level
- Machine Hydraulic Temperature
- System Voltage
- Transmission Gear Indicator
- Seat Switch Indicator
- Parking Brake Indicator
- Brakes Charging Indicator
- Low Brake Pressure

There are other display screens that are accessible on the main display. They are:



**Outrigger Page** - Shows the hydraulic pressure on each outrigger. This page can be accessed through pressing the icon or the physical button below the icon on the 15-button panel. This page has a digital level that represents the machine level, as measured by the angle in diameter, mounted to the underside of the bearing plate.



**Steering Page** - Shows the current steer mode that is being operated; or the steer mode that has been requested. This page can be accessed through pressing the icon or the physical button below the icon on the 15-button panel.



**Diagnostics Page** - Shows a full set of system diagnostics, which includes but is not limited to:

- a) Status for Analog and Digital Inputs and outputs to aid with trouble shooting.
- b) A fuse relay diagram that will show the operator when a fuse or relay has an issue, and highlight which fuse or relay it is for easy locating.

This page can be accessed through pressing the icon or the physical button below the icon on the 15-button panel.



**Climate Page** – Provides controls for the heating and cooling in the operator compartment. This page can be accessed through pressing the icon or the physical button below the icon on the 15-button panel.



**Home Page** – Selecting this icon or the associated physical button below the icon on the 15 button panel will return the operator to the main page of the system.

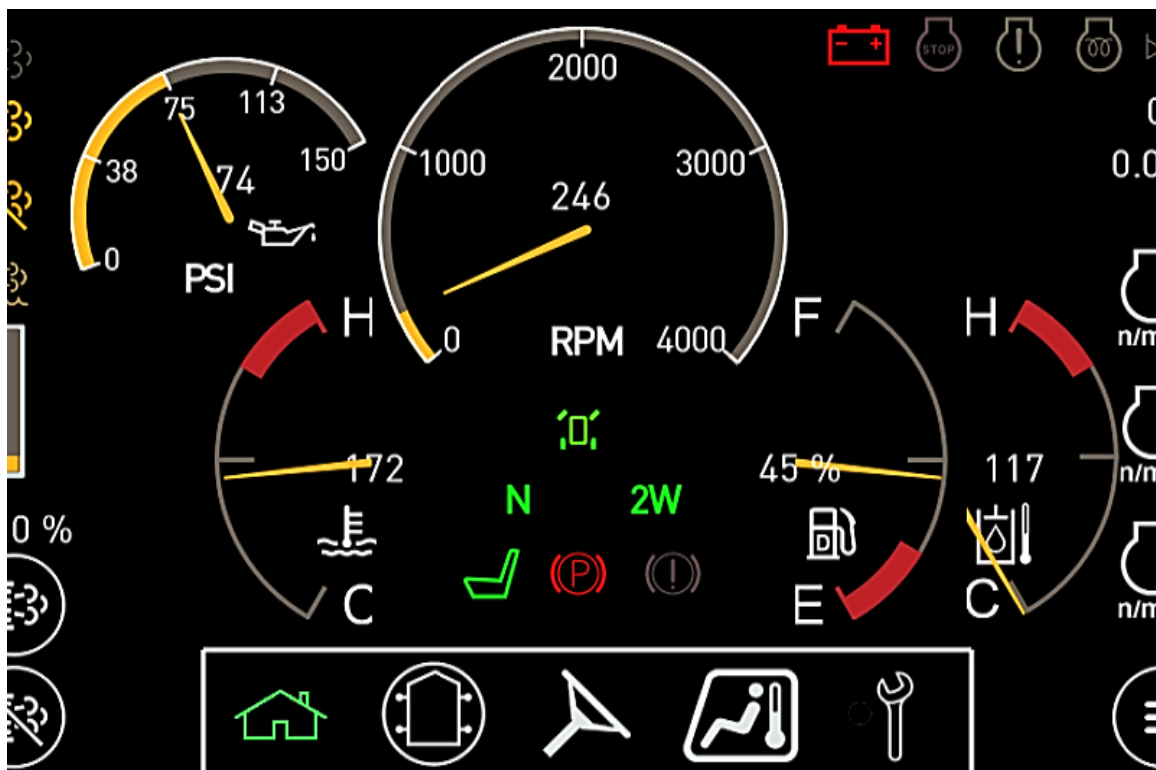
The ignition switch is key-operated and has OFF, RUN and START positions. The ignition switch should always be turned off and the key removed when the vehicle is left unattended.

The BMC IC-400 is equipped with a standard lighting package. The controls for the lights are located on the 15-button panel located below the main display screen. Stop lights are controlled by operating the foot brakes. The turn signal control is also located on the 15-button panel located below the main display screen. The emergency flasher lights are actuated by engaging the left and right turn signal buttons simultaneously. Repeating this will disengage the emergency flasher lights.

The steering column provides tilting and telescope features, and each have a hold lever on the side of the column to hold the column in the preferred position for the operator.

The park brake switch is located on the 12-button panel located to the right of the operator. To apply, ensure that the machine is stopped and push the N/P (NEUTRAL/PARK) side of the rocker switch and the switch itself will light up. Once the N/P button has been engaged, the gear display on the main display will show N and the parking brake light will illuminate below the neutral indicator. The foot brake and accelerator pedals are located and operated as they are in other vehicles already familiar to the operator.

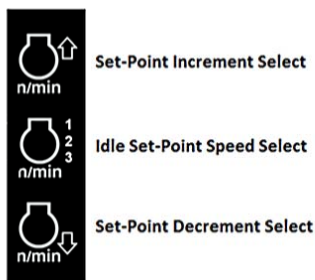
*Example of Home Page*



The powershift transmission is controlled through the series of buttons on the 12-button panel to the right of the operator. There are two ranges for this transmission and 3 gears in each range for FORWARD and REVERSE. The shifting is electronically-controlled. Although it is possible that the transmission and drivetrain components can be damaged by shifting from FORWARD to REVERSE (or vice versa while the unit is in motion), or while the engine speed is above 1000 RPM, the system is set up in such a way that the program will not allow these outcomes to occur.

Also, it is possible that the transmission and drivetrain components can be damaged by changing range from Low to High, or vice versa while the machine is in motion; however, the system will prevent such damage, as well. To shift the range of the transmission, the machine must be at a complete STOP. An electronic interlock built into the control system will only allow the range to shift if the machine is in N/P. The control system will default the transmission to the N/P state when the engine is started. The parking brake switch prevents driving with the brake on and engages the transmission to NEUTRAL.

Normal engine speed control uses the foot accelerator pedal. A three-position switch on the main display screen provides preset engine speeds. In addition, there are buttons on the main display screen to increment and decrement the engine speed once the preset engine speed has been engaged. Parking brake must be set to activate system. Press the preset button once to engage the low idle state of the engine, a second time to engage the mid-range set point of 1200 RPM, and a third time to engage the high idle set point of 1800 RPM.



Four-wheel or 2-wheel-drive is selected from the 12-button powertrain panel located to the right of the operator. The transmission and drivetrain components can be damaged if attempting to shift from 2-wheel-drive to 4-wheel-drive, or vice versa, while the machine is in motion. To shift from 2-wheel-drive to 4-wheel-drive, or vice versa, the machine must be at a complete STOP. An electronic interlock built into the control system, which will only allow the operator to change from 2-wheel-drive and 4-wheel-drive if the machine is in N/P. Avoid 4-wheel-drive operation on pavement except for short distances.

### THREE-MODE STEERING FUNCTIONS

The IC-400 is equipped with 3-mode steering: Four-wheel round steering can be used for making tight turns; 2-wheel, front steering should be used for traveling long distances; crab steering can be used for maneuvering in tight places. Switches on the 12-button panel to the right of the operator provide the mode selection. Electronic sensors and controls automatically sense when the wheels are centered, as they steer past the centered position, once a new mode is selected. The steering wheel is directly mounted to the steering control unit of the all-hydraulic power steering system. The steering system will provide limited steering even if the engine should stop running.

## CONTROL VALVE FUNCTIONS

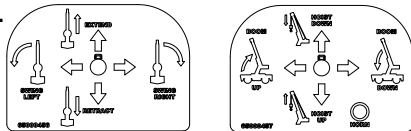
The control valves for the IC-400-B utilize an electronic/ hydraulic system, whereas the valves are not mounted in the cab.

### Boom Function:

Controls for operating boom rotation, boom elevation, boom extension and hoist are actuated by two, dual-axis joysticks with one mounted to each arm rest of the operator compartment. The joystick handles are electronically connected to the remote-mounted hydraulic control valves. An arming button (ARM) is located in the RH joystick, or electronically in the 15-button panel below the main display to serve as the handle interlock for the control system. The seat switch and the arming button must be active to enable functionality of the pilot control joysticks. Boom functions will not operate unless the arm button is engaged before moving the joysticks out of center. Disengaging the ARM button or releasing the seat switch while the handle is not centered, will result in an abrupt stop. The placards located at the base of the joystick handles identify the function and direction resulting from each handle movement.

## BOOM ENABLE CONTROLS

- 1. Swing or Slewing:** Moving right on the LH joystick lever will rotate the boom to the operator's right; moving left will rotate it to the operator's left.
- 2. Telescope:** Pushing forward on the LH joystick located at the operator's left, will extend the boom; pulling back will retract the boom.
- 3. Boom Lift or Topping:** Moving the RH joystick to the left, will raise the boom; moving the RH joystick to the right will lower the boom.
- 4. Hoist:** Pushing the RH joystick forward will lower the load line; pulling back will raise the load line. Included in this joystick is a drum rotation indicator that will vibrate as the Hoist Drum rotates. Holding a finger over the top of the lever will give the operator the strongest feel for the vibration.



**NOTE:** Joysticks may be used together for simultaneous operation, to achieve combinations of movements. Some controls must be used together. For instance, the boom telescope and the hoist controls must be used together to maintain clearance between boom and load line hook. Full speed operation of all boom functions is allowed when the crane is set up on outriggers, leveled to  $\pm 3^\circ$ , and the RCL is running in the normal mode.

### Outriggers:

A 12-button pad is mounted to the left-hand dash panel for controlling the direction of outriggers on each corner of the machine. There are two function buttons on top (F1 & F2) to select an operation, based off the task at hand. The two modes of selection include *IN & OUT*, or *IN & DOWN*. Eight buttons are paired together giving two directions for each outrigger. Engaging the lower side of the button will deploy the associated outrigger while engaging the upper side of the button will stow the associated outrigger. All four outrigger button pairs may be operated simultaneously or individually. Outrigger alarms will sound when deploying any of the outriggers.

### CAUTION

Special attention must be given to avoid hitting personnel or obstacles. Also, in either mode of operation, make sure to deploy the beams first, then the jacks. On stow operation, make sure *Jacks* is selected first.

### NOTICE

Avoid holding a joystick lever or outrigger button in the activated position after the function has reached the end of its travel. This will impose unnecessary stresses on the hydraulic components and heat the hydraulic system.

## **SEQUENCE OF OPERATION**

### **DRIVING THE VEHICLE**

The following procedure is recommended for driving the vehicle:

1. Perform the daily inspection and test. (See Page 3-4)
2. Start engine and allow a warming period.
3. While warming the engine, set up the Rated Capacity Limiter (RCL) configuration.
4. Stow boom over front.
5. Pull hoist line snug.
6. Stow the outriggers.
7. Step on the brake pedal.
8. Release park brake switch by selecting the desired range, direction (FORWARD or REVERSE), and the desired gear to operate the machine in.
9. Release brake pedal and press on accelerator pedal.
10. Slow down when making turns.
11. When parking the vehicle, set park brake and lower outriggers, or chock wheels.

### **W A R N I N G**

**Engine exhaust contains carbon monoxide, a poisonous gas that is invisible and odorless. Breathing engine exhaust fumes can cause death or serious illness. Do not run the engine in enclosed areas without adequate ventilation.**

### **OPERATING THE CRANE**

The following procedure is recommended for placing the crane in operation:

1. Perform daily inspection and test. (See Page 3-4)
2. Drive crane to lifting location. Take the time to survey the location for obstacles, and solid footing. Check if crane is spotted within the lifting radius for the load being lifted.
3. Start engine and allow a warming period at low RPM (if not already running).
4. Apply park brake, which also places the transmission in NEUTRAL.
5. Set all outriggers fully down on firm, level surface. Use appropriate cribbing under outrigger shoes as needed on soft ground. Outriggers should remain set during all crane operations except for pick and carry.
6. Set up the Rated Capacity Limiter (RCL) configuration for the boom and outrigger conditions.
7. Enable the ARM button on the 15-button panel to activate the joysticks. Meter the controls when beginning or ending any movement. This prevents suddenly starting or stopping, which causes unsafe load swinging and shock loads on the equipment. The control should be slightly actuated to begin movement and then slowly increased to desired speed. Metering can be improved by coordinating with the accelerator pedal.
8. You may use the throttle control switch to set the engine speed to one of the preset RPM options when the park brake is on. Return to idle by cycling through set points to return to low idle, or by using the decrement speed buttons.
9. Release accelerator when crane is not in use and shut off engine, if practical.

### **NOTICE**

**Any change in outrigger position, when in the working mode, will cause the crane to default to the lowest chart level. The system senses a configuration has changed even if temporarily.**

## NORMAL GAUGE READINGS

The IC-400 is equipped with two, full color touch screen displays. The main display is on the right side of the cab. This display is programmed to be the primary controller for the machine. It will monitor engine information directly off the SAE J1939 CAN bus network provided by the engine manufacturer. The display is also connected to other inputs, such as the fuel tank sender and hydraulic tank temperature sensor, to provide a wide variety of valuable information to the operator. Much of the run-time information is combined together in the main screen where the operator will find many common vehicle parameters. Other screens with specific information can be scrolled to as needed, including: outrigger screen, steering screen, HVAC controls screen, and a diagnostics screen. Five buttons are provided below the display to serve as redundant buttons, to the touch screen icons, for navigation to these various screens as needed.

### Main Screen vehicle parameters:

- Engine Hour Meter
- Engine RPM Tachometer
- Engine Coolant
- Engine Oil Pressure
- Engine DEF Level
- Engine-After-Treatment Manual Regeneration Button
- Engine-After-Treatment Regeneration Delay Button
- Engine RPM Set Points
- Engine RPM Incremental Adjust
- Machine Fuel Level
- Machine Hydraulic Oil Temperature
- System Voltage
- Transmission Gear Indicator
- Seat Switch Indicator
- Parking Brake Indicator
- Brakes Charging Indicator

This display is considered the 'home' screen and displays real-time data for each parameter. Engine and system fault codes will display on the 'home' screen as a pop-up window when those events occur. It also has warning and shutdown icons that will turn on when a critical threshold has been exceeded. These icons include the following:

- Battery Charging System Error
- Engine Warning Light
- Engine Shutdown Light
- Engine Grid Heater / Wait to Start Light
- Engine Coolant Level Indicator Light
- DEF Level Indicator
- DEF Level Warning Light
- After-treatment Regeneration Active
- After-treatment Regeneration Disable
- After-treatment System Temperature/Regeneration Underway Indicator Light

### **WARNING**

Vapors can be formed inside fuel tank and cause build-up of pressure that can result in sudden expulsion of fuel and fuel vapors from the filler neck when the fuel cap is removed from a hot tank. Remove cap slowly. Fuel spray may cause injury.

Any time there is a control system fault detected, there will be a pop-up window identifying what the fault is. The various diagnostics screens will help identify the issue that needs to be resolved.

If there is an engine warning or engine stop signal, either the amber (warning) or red (stop) icons on the main display will be lit until resolved. An audible alarm will also sound. A pop-up window identifying what the engine fault(s) is will also appear on the screen alerting the operator of the issue. There may be several to scroll through.

### **WARNING**

**The crane will not operate if it is not level.**

**Level Guide Screen:** Within the outrigger display screen there is a bubble level that provides feedback to the operator on the current status of the cranes level. This screen will assist in leveling the crane during setup. The number of degrees the crane is off of true level appears on the side of each axis on the level display.

## **RATED CAPACITY LIMITER (RCL)**

A rated capacity limiter (RCL) is installed on the crane to assist the operator in estimating loads and measuring load radii. Following are some operating tips.

Always be aware that the RCL can stop boom movement at capacity load conditions and in two-blocking conditions. Use good judgment in controlling the speed of boom movements to prevent shock loads and swinging loads.

If the RCL system stops the crane movement, there are various remedies that may be used to restart operation. If the hook is two-blocked, it should be lowered using HOIST DOWN, if safe to do so. BOOM RAISE or TELESCOPE RETRACT may be used if this is safer.

If the load is the maximum for the load line or attachment, the load should be set down in a safe place using the HOIST DOWN control and the load or attachment changed. TELESCOPE RETRACT, SWING LEFT, or SWING RIGHT may also be used, if safe. DO NOT USE THE BOOM RAISE CONTROL as this may increase the overload.

If the load is at the maximum allowable load radius, the boom can be raised or retracted to a safe radius, or the load may be lowered to a safe place using HOIST LOWER. If the boom extension is at its lower angle limit, the boom must be raised or the load hoisted down.

If there is a malfunction of the RCL or Anti-Two-Block system that causes loss of boom movement and cannot be remedied by the procedures above, the override button on the RCL display may be required to move the boom. The override button will provide an amount of time (and a countdown for that time), to the operator, to get the load into a SAFE POSITION.

### **W A R N I N G**

**We recommend the emergency override button be used with discretion. Improper or careless use of this button can cause damage to the crane and endanger people and property. The operator who uses this override in an emergency should use good judgment.**

## CRANE CAPACITY

Before lifting loads, the operator must read the **Crane Capacity Chart** and adhere to the load capacities and radii of handling stated in the chart. The information provided on this chart is based on stability, structural strength and hydraulic capacity.

To operate the crane safely, the operator must know the weight of the load and handling devices, and the radius of the lifting operation. The crane must not be loaded beyond the specifications of the capacity chart, except for test purposes, as provided in ASME B30.5. The person responsible for the lift must be sure that the load does not exceed the crane ratings at any radius or position at which the load may travel during the entire lifting operation. The weights of the hooks, blocks, downhaul weights, slings, and other handling devices must be added with the load.

Be aware that one outrigger may lift off the ground while operating on outriggers at less than Rated Capacity. This is considered normal if the load is mainly over the opposite corner at the time. The loading on the outrigger closest to the hook load will increase substantially. Loading on the outrigger in the opposite corner will decrease. Flexing in the chassis can cause the opposite corner to lift slightly.

The **Rated Capacity Limiter** on the crane is intended to assist the operator in estimating loads, measuring load radii, and to alert the operator to impending overload conditions. The use of the Rated Capacity Limiter does not replace the requirements of the preceding section. Verified weights and measured radii must take precedence over the Rated Capacity Limiter readings.

The Rated Capacity Limiter displays a load, load radius, and boom angle that are obtained from electronic calculations using readings from pressure, length, and angle sensors. These readings cannot be exact and should be treated as estimates.

Be aware that the electronic and mechanical components cannot be 100% fail-safe. Do not consider the system as a substitute for good judgment, training, experience or accepted safe operating practices. The operator is solely responsible for operation of the crane.

Setting the Rated Capacity Limiter for the proper configuration of the crane is necessary before starting a lift. If incorrectly set, the system will not alert the operator to an impending overload, possibly resulting in the loss of life or destruction of property. If the Rated Capacity Limiter is inoperative or malfunctioning, repair or recalibration of the unit must be done as soon as reasonably possible. The person responsible for lifts must establish procedures for determining load weights and radii, and conduct the lifts according to safe operating practices.

The Rated Capacity Limiter is designed to stop some crane functions at the limitations of the capacity chart. These are: BOOM LOWER, TELESCOPE EXTEND, and HOIST RAISE. Great care must be exercised when handling a load near capacity or near a two-blocking condition. If the boom is being lowered or swung, the load will tend to swing if the Rated Capacity Limiter stops the boom movement. If the load is moving too fast, the sudden stopping by the system can cause dangerous load swinging, which can cause death or injury to personnel or property damage by impact with the load, or by the crane tipping.

### **WARNING**

The Rated Capacity Limiter can suddenly stop the BOOM LOWER, TELESCOPE EXTEND, and HOIST RAISE functions, causing the load to bounce or swing. Use great care when handling a load near capacity limits or near a two-blocking condition.

### **NOTICE**

**The system will automatically detect the outrigger position; therefore, the outriggers can be set any time. All detection is automatic.**

The IC-400 is equipped with transducers that detect when all the outriggers are completely deployed. These transducer inputs are fed to the RCL, which allows it to decide which chart to work with: Outriggers or Rubber.

Once the RCL is in run mode, the IC-400 continues to detect when outrigger positions change. The outriggers cannot be lifted without a stability warning or a capacity warning. **NOTE:** If this occurs with a load that is more than a Rubber Chart allows, the RCL will go into FKO (Function Knock Out), limiting functions, until it is rectified.

## **CRANE CAPACITY CHART, DEFINITIONS, AND RULES:**

The load radius is the horizontal distance from the centerline of boom rotation (the center of the turntable when it is level), to the vertical load line with the load suspended. Because of deflections of the boom and carrier, the load radius increases when a load is hoisted from its resting place. The load radius may be measured with a measuring tape. If the desired load radius falls between two load radii on the chart, use the load radius with the lower capacity. Interpolating between the numbers is not recommended.

Load capacity ratings on this equipment are given on the basis that operations are to be conducted on firm and level terrain and in a safe environment. A level sensor and a screen on the *Dash Display* have been provided to aid the operator in leveling the crane. These capacity ratings are to be reduced in proportion to any deviation from the prescribed conditions. Any unfavorable environmental condition, such as soft, sloping or uneven terrain, high wind, or hazardous surroundings constitutes a deviation.

The main boom capacities are given in relation to the load radius at which the load is being handled. Boom extension capacities depend on the boom angle, the boom extension angle, and load radius. The capacities shown on the capacity chart are the maximum allowable at the indicated radius. The greatest load that may be handled by the BMC IC-400 is 50,000 pounds (22,680 kg), but only at an 8-foot (2.4 m) radius, on outriggers. All load ratings, operating radii, work areas, boom extension offsets, and outrigger conditions are shown on the capacity chart. A laminated chart is attached near the operator's seat, as well as in the literature compartment. An electronic version of the chart may also be accessed through the *Dash Display*. These charts are for the express purpose of informing the operator when a load can or cannot be safely handled.

The capacities shown in the 360° ROTATION and ON RUBBER 360° columns of the capacity chart apply to the entire 360 degree rotation of the boom. The capacities are maximum allowable at the indicated radius. The capacities ON OUTRIGGERS OVER FRONT and ON RUBBER FRONT are limited to the work area sectors shown on the chart.

Note that the ON RUBBER 360° capacities are much less than the ON RUBBER FRONT capacities. The least stable position of the boom is over the sides of the crane. Use great care when swinging a load from the front or rear of the crane toward the sides of the crane. The load must be known in order to assure that the crane will not tip.

### **NOTICE**

**Under certain load conditions, torsion induced in the chassis can cause it to twist. This may result in an opposite-side outrigger or tire lifting free from the supporting surface. This is most likely to occur when the boom is positioned over one corner of the machine. The condition does not indicate a loss of stability when working within the limits of the capacity chart. Provided the crane capacity has not been exceeded, operation may continue without restriction.**

# CAPACITY CHART

CAPACITIES APPLY TO OPERATION ON FIRM LEVEL SURFACE										
LOAD RADIUS FEET	MAIN BOOM OR EXTENSION CAPACITIES IN POUNDS									
	360° ROTATION						OVER FRONT			
	ON RUBBER	OUTRIGGERS OUT & DOWN	OUTRIGGERS MID & DOWN	OUTRIGGERS IN & DOWN	ON RUBBER	ON OUTRIGGERS				
MAIN BOOM	8	17000	50000	47500	42000	24400	50000			
	10	13200	42000	38000	28300	20300	42000			
	12	10500	36000	31800	20600	17200	36000			
	14	8500	35100	27300	16000	14700	35100			
	16	6900	30100	23500	12800	12700	30100			
	18	5600	23600	20300	10600	11100	23600			
	20	4600	21100	17200	8800	9400	21100			
	22	3700	19000	14400	7400	7900	19000			
	24	3000	17100	11800	6300	6600	17100			
	26	2300	15400	10600	5300	5600	14800			
	28	1800	13300	8700	4600	4800	12900			
	30	1300	12200	7600	3900	4100	11800			
	32	1100	11200	7000	3300	3600	11200			
	36	700	9100	5400	2300	2800	8900			
	40	----	7400	4300	1600	2200	7400			
	42	----	6800	3900	1300	2000	6800			
	44	----	6200	3400	1100	1800	6100			
	48	----	5400	2900	700	1400	5300			
	52	----	4700	2600	----	1100	4700			
	54	----	4400	2400	----	1000	4400			
	56	----	4400	2400	----	900	4400			
	60	----	4100	2000	----	----	4000			
	64	----	3600	1600	----	----	3600			
	68	----	3200	1300	----	----	3200			
EXT	72	----	2800	----	----	----	2700			
	76	----	2400	----	----	----	2300			
	80	----	2100	----	----	----	2100			
	84	----	1900	----	----	----	1900			
	88	----	1500	----	----	----	1500			
	BOOM EXT.	BOOM EXT. OFFSET ANGLE	20-FOOT BOOM EXTENSION CAPACITIES							
MAIN BOOM ANGLE										
0°			15°	30°	40°	50°	60°	70°	75°	
0°			2600	2750	3000	3400	4100	5100	6200	7000
15°			----	2500	2600	2700	2900	3300	4300	4800
30°	----	----	2300	2400	2500	2700	3200	3400		

# CAPACITY CHART, METRIC

CAPACITIES APPLY TO OPERATION ON FIRM LEVEL SURFACE									
	LOAD RADIUS M	MAIN BOOM OR EXTENSION CAPACITIES IN KILOGRAMS							
		360° ROTATION						OVER FRONT	
		ON RUBBER	OUTRIGGERS OUT & DOWN	OUTRIGGERS MID & DOWN	OUTRIGGERS IN & DOWN	ON RUBBER	ON OUTRIGGERS		
MAIN BOOM	2.4	7711	22,680	21,546	19,051	11,068	22,680		
	3.0	5,987	19,051	17,237	12,837	9,208	19,051		
	3.7	4,763	16,329	14,424	9,344	7,802	16,329		
	4.3	3,856	15,921	12,383	7,257	6,668	15,921		
	4.9	3,130	13,653	10,659	5,806	5,761	13,653		
	5.5	2,540	10,705	9,208	4,808	5,035	10,705		
	6.1	2,087	9,571	7,802	3,992	4,264	9,571		
	6.7	1,678	8,618	6,532	3,357	3,583	8,618		
	7.3	1,361	7,756	5,352	2,858	2,994	7,756		
	7.9	1,043	6,985	4,808	2,404	2,540	6,713		
	8.5	816	6,033	3,946	2,087	2,177	5,851		
	9.1	589	5,534	3,447	1,769	1,860	5,352		
	9.6	499	5,080	3,175	1,497	1,633	5,080		
	11	317	4,128	2,449	1,043	1,270	4,037		
	12.2	----	3,357	1,950	725	997	3,357		
	12.8	----	3,084	1,769	589	907	3,084		
	13.4	----	2,812	1,542	499	816	2,767		
	14.6	----	2,449	1,315	317	635	2,404		
	15.9	----	2,132	1,179	----	499	2,132		
	16.5	----	1,996	1,089	----	453	1,996		
	17.1	----	1,996	1,089	----	408	1,996		
	18.3	----	1,860	907	----	----	1,814		
19.5	----	1,633	725	----	----	1,633			
20.7	----	1,451	589	----	----	1,451			
EXT	22	----	1,270	----	----	----	1,225		
	23.2	----	1,089	----	----	----	1,043		
	24.4	----	952	----	----	----	952		
	25.6	----	861	----	----	----	861		
	26.8	----	680	----	----	----	680		
	BOOM EXT.	BOOM EXT. OFFSET ANGLE	9-METER BOOM EXTENSION CAPACITIES						
MAIN BOOM ANGLE									
0°		15°	30°	40°	50°	60°	70°	75°	
0°		1,089	1,247	1,361	1,542	1,860	2,313	2,812	3,175
15°		----	1,247	1,179	1,225	1,315	1,497	2,812	2,177
30°		----	----	1,043	1,089	1,134	1,225	1,451	1,542

### **CAUTION**

The **ON OUTRIGGERS** capacities of this crane are based on all outriggers being **FULLY DEPLOYED** to a **FIRM** surface with no load on the tires. The crane may tip at less than capacity loads if operated in the following manner:

- A. Outriggers only partially deployed or tires carrying some load.
- B. Crane operated on a hill or sloping surface. Crane will tip at less than rated capacity if crane is not level.
- C. Outriggers extended to a surface that appears to be firm, but is unable to support the outrigger pad at full rated loads. Examples of this type of surface are:
  - 1. Thin or cracked blacktop or concrete.
  - 2. Dirt that appears dry and firm on top, but is moist or unpacked beneath the surface.
  - 3. Dirt with a frozen but thin crust.

### **CAPACITY EXAMPLE** (Also See Boom Extension Capacity Example Page 2-29)

Refer to the IC-400 capacity chart on the preceding page. A load 6' X 6' X 6' (1.5 m x 1.5 m x 1.5 m) and weighing 16,000 pounds (5750 kg) is to be lifted to a new location. The load is on a roof 64' (20 m) high. The center of the load is 24' (7.3 m) from the center of rotation of the crane.

The chart shows that 12,500 pounds (5670 kg) is the maximum load on one-part line, so the sheave block is required. The chart also shows the weight of the standard sheave block to be 470 pounds (213 kg). The rigger indicates that two slings are required, weighing a total of 50 pounds (23kg). The total load is  $16,000 + 470 + 50 = 16,520$  lbs ( $5670 + 213 + 23 = 5906$  kg).

The 360° ROTATION, ON RUBBER column of the chart allows lifting up to 17,000 pounds (7711 kg) at a 8-foot (2.4 m) load radius. However, this radius is less than the distance from the center of rotation to the center of the load, so the load cannot be lifted in this configuration. This lift will require the ON OUTRIGGERS columns to be used. Outriggers should always be used whenever possible.

The boom will need to be fully extended to reach the desired height. ON OUTRIGGERS 360° with a fully extended boom at a 24' (7.3 m) load radius, the capacity is 17,100 pounds (7756 kg) which is more than the total load. The load can be lifted over the front on outriggers or over the side on outriggers. If possible, position the crane to lift the load over the front with the outriggers deployed. This is the best position for stability.

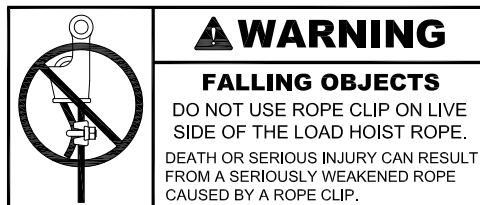
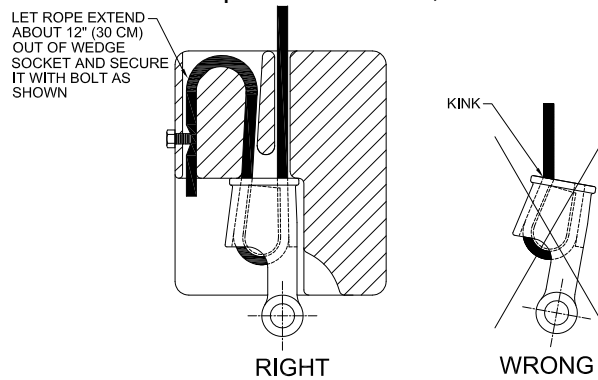
### **NOTICE**

**As the boom is loaded, deflection of the boom, tires, etc. will increase the load radius. Be conservative in your capacity estimate.**

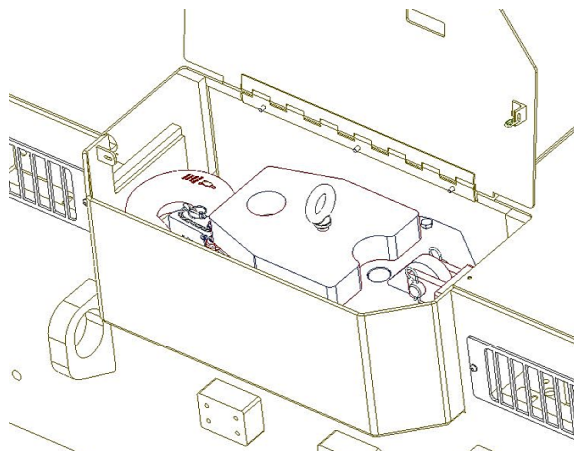
## SHEAVE BLOCK AND DOWNHAUL WEIGHT

The Capacity Chart shows the approved hoist rope arrangements. The downhaul weight and sheave blocks supplied by Broderick are specially designed to operate the BMC Anti-Two-Block system. Other blocks or downhauls may bypass this system and create a dangerous condition. All retaining pins that pass through the sheave plates must be locked in place with cotters to hold the hoist rope (also called the load line) on the sheaves. Notice the load limit for each hoist rope arrangement.

For single part reeving, the load line must pass through the center of the downhaul, through the wedge socket, and the dead end clamped in the block, as shown in the figure below.



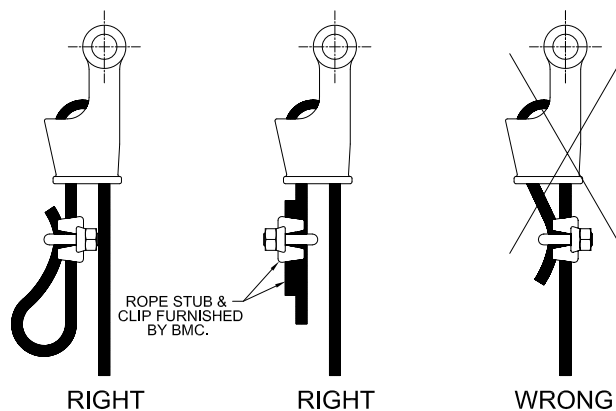
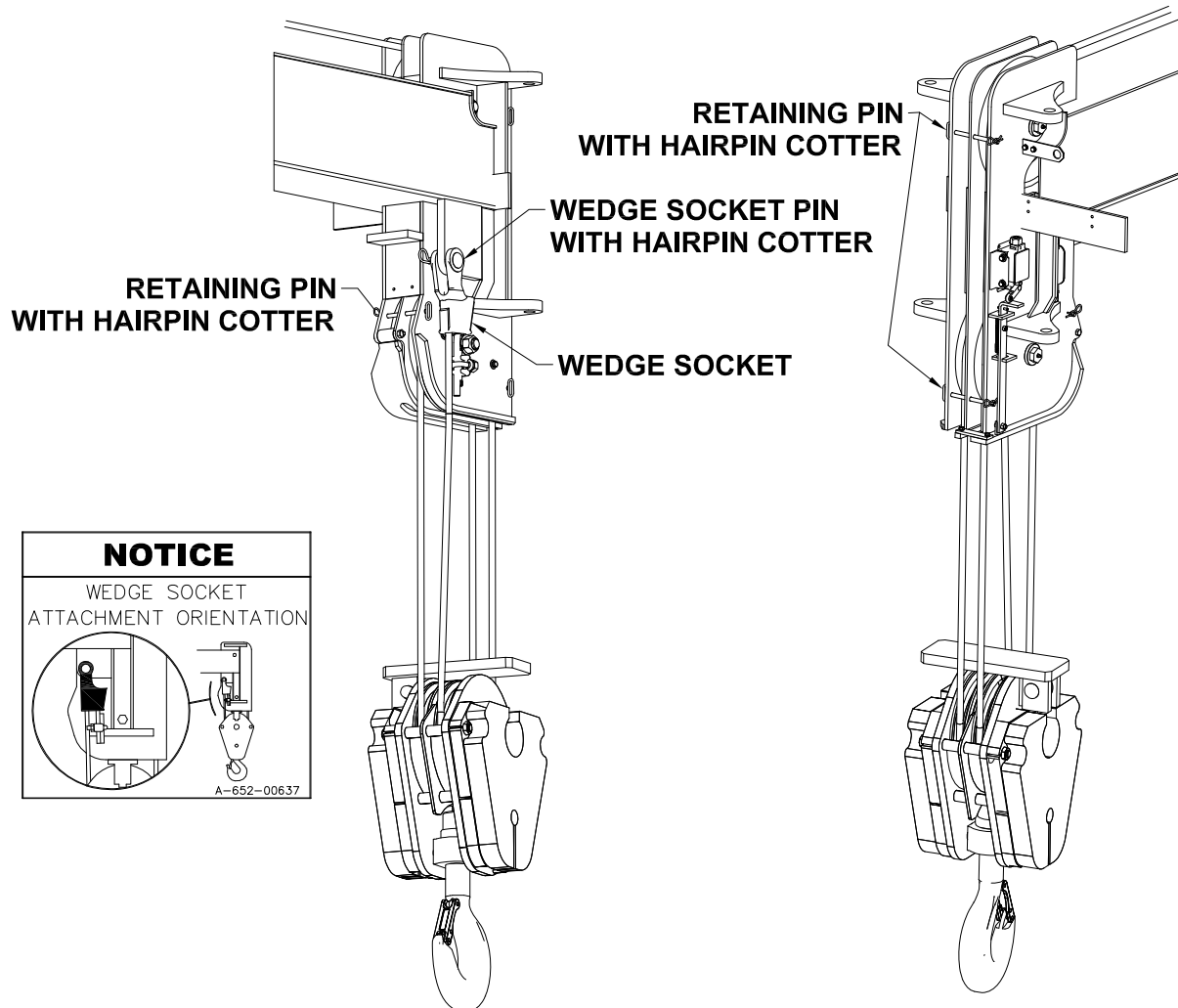
When resting the downhaul or sheave block on the ground for changing it, use the following procedure to prevent fouling the load line on the hoist. Raise the boom about 5 feet (1.5 m) and lower the hoist until the hook nearly touches the ground. Then lay the hook on the ground by lowering the boom, not the hoist.



To stow the sheave block, pull the sheave block, lift the block into the storage compartment by the hook. See the figure above.

## MULTI-PART LINE REEVING

For loads above 12,500 pounds (5670 kg) the sheave block must be used. The 4-part-line sheave block can be used for loads up to 50,000 pounds (22,680 kg). The wedge socket should be pinned to the wedge socket anchor at the boom tip, as shown in the figure. The dead end of the rope in the wedge socket should be clamped, as shown in the figure below. **The clamp must not be used on the live part of the rope.** This will seriously weaken the rope. The sheave block should hang straight, and the top of the block should meet the boom sheave plates squarely when pulled up snug.



## **SAFETY DEVICES**

There are certain safety devices on the IC-400 that are designed to maintain control of a load even if power or hydraulic line failure occurs. The operator should understand the function and operation of these devices so that a continual check on their performance can be made. There are other safety devices on the IC-400 designed to assist in the safe operation of the crane. These devices work with the control system, hydraulic system or engine to avert potential hazards. The operator should also understand how these devices work and how to routinely check if the device is functioning properly.

### **OUTRIGGER CYLINDER CHECK VALVES:**

Holding valves are mounted to each of the outrigger cylinders. These valves hold the outrigger in the extended position, should power or hydraulic line failure occur. If an outrigger creeps up while supporting a load, there is an internal leak in the valve or in the outrigger cylinder piston seal. In either case, maintenance is required.

### **BOOM ELEVATION CYLINDER HOLDING VALVE:**

A single-acting holding valve is mounted into the cylinder barrel. This valve holds the boom in the elevated position if power or hydraulic pressure line failure occur. This valve is adjustable to hold the desired load. If the boom creeps down with loads up through maximum capacity, valve should be adjusted. If adjustment fails to correct the problem, there is an internal leak in the holding valve or the hydraulic cylinder. Refer to the maintenance instructions.

### **BOOM TELESCOPE CYLINDER HOLDING VALVE:**

A single-acting holding valve is mounted to the telescoping cylinder. This valve holds the cylinder in the extended position, if power or hydraulic pressure line failure occurs. If the boom creeps in under load, there is an internal leak in the holding valve or the hydraulic cylinder. Refer to the maintenance instructions.

### **HOIST BRAKE AND HOLDING VALVE:**

The hoist has an automatic brake in the gearbox and a holding valve mounted directly on the hoist motor to hold the load. A clutch in the gearbox allows the winch to turn freely in the RAISE direction. The brake is pilot released in the LOWER direction and should allow smooth stops of a load on the hoist.

### **ANTI-TWO-BLOCK SYSTEM:**

This system prevents damage to the hoist rope and machine components from accidentally pulling the load hook against the boom tip. A pivot arm-actuated electric switch is connected through a cable reel, mounted on the boom to the control system, to stop the hydraulic circuit. This system will block the HOIST RAISE, TELESCOPE EXTEND and BOOM LOWER. No other circuits are affected. These circuits are returned to normal operation by operating the HOIST LOWER or TELESCOPE RETRACT control. An emergency over-ride is provided so the boom can be operated in case of system failure. This button is located on the RCL Display. When the over-ride is selected, a countdown timer is displayed, indicating how long the over-ride will be active.

### **WARNING**

**We recommend the emergency override button be used with discretion. Improper or careless use of this operation can cause damage to the crane and endanger people and property. The operator who uses this button in an emergency should use good judgment.**

**EMERGENCY STOP SWITCH:**

A two-position push button switch located on the top left-hand side of the dash panel is designed to stop the engine and shutdown the control system. Push switch in to disconnect power to the engine run circuit and control system circuit. Twist and pull to restore power.

**ARM FUNCTION BUTTON:**

On the 15-button panel there is an ARM button that must be engaged before the pilot joysticks will function. This protects against inadvertent movement of the joystick while not intending to move the crane. The crane will not move if the ARM function button is not activated. The seat switch must be engaged to arm the machine.

**OPERATOR-PRESENT SEAT SWITCH:**

An embedded switch inside seat bottom cushion designed to shutdown the hydraulic system when the operator has left the seat. The engine will stay running.

**BATTERY DISCONNECT SWITCH:**

A two-position rotary switch designed to disconnect the battery “positive” terminal from the electrical circuit. It is located inside the right side engine compartment cover. Locking tabs allow the use of ‘lock-out/ tag-out’ if needed for maintenance or repair. **NOTE:** There is an indicator light that will signal when it is safe to kill the power, after the machine is shut OFF.

**BRAKE PRESSURE WARNING ICON:**

An indicator icon is included in the main display to alert the operator when the hydraulic pressure is low in the accumulators. This system should be checked daily. See *Driving the Vehicle* section on page 2-13. If the warning icon shows on the display during normal operations, stop work and repair the system immediately.

**EMERGENCY EXIT:**

In the event that the main access to the operator’s station is blocked or otherwise hazardous, use the rear window, as marked. Pull ripcord ring until completely removed! Push the window out until it is completely open, and carefully climb out onto the rear deck. If unable to use provided emergency exit, use the horn and flashers to summon help.

**W A R N I N G**

**Do not bypass safety devices! Each device has a specific purpose and should not be tampered with. Death, serious injury, or property damage could result from a safety device that is not functioning.**

**LOCKING FEATURES:**

The IC-400 has several locking features for various covers and compartments. The cab door can be locked to protect the operator’s compartment. The master battery disconnect switch can be locked to prevent operation of the machine during maintenance work.

## OPTIONAL EQUIPMENT

### NOTICE

**Use appropriate ladders/steps to gain access to the boom tip and deck to perform this installation.**

#### **INSTALLING AND STOWING BOOM EXTENSION:**

1. Set the outriggers.
2. Raise and extend the boom about 30 feet (9 m) above the ground, paying out load line until hook is just above ground.
3. Position boom over front, lower and retract boom, leaving the load line on the ground.
4. If the sheave block is installed, remove it.
5. Remove load line from tip sheaves and lay over side of boom opposite of the stowed boom extension.
6. Make sure the front stow pin is in place and the attach pins are removed from the lugs on the boom tip, and the mating lugs on the boom extension.
7. Remove the rear hairpin cotter pin and swing the boom extension away from the rear end of the boom until the attaching lugs mesh on the right-hand side of the boom.
8. Insert the attach pins in the right-hand lugs and retain them with the hairpin cotters.
9. Remove the front stow pin and swing the boom extension around to the front until the left hand lugs mesh. Boom must be extended until the boom extension comes off of the stow bracket/ramp.
10. Insert the attach pins in their outer lugs and retain them with hairpin cotters. To insert the fourth pin, it may be necessary to rock boom extension side to side, or up and down.
11. Replace the front stow pin in its brackets for storage and insert their hairpin cotters.
12. Lay the load line over the main boom and extension tip sheaves, and insert the cable retainer pins and cotters.
13. Install the downhaul weight, wedge socket, and swivel hook on the load line if they are not already installed.
14. Disconnect the Anti-Two-Block wiring cable from the switch on the main boom tip and connect it to the cable connector on the boom extension base.
15. Check the Anti-Two-Block system for proper operation and Set Rated Capacity Limiter.
16. Stow the Boom Extension by performing steps 1-3 and by reversing steps 14-7; Next, follow steps 17-20.
17. Lay the load line back in the main boom tip sheaves and insert both retainer pins & cotters.

18. Replace all of the pins in their lugs for storage and insert their hairpin cotters.
19. Install the sheave block on the load line, if desired.
20. Check the Anti-Two-Block system for proper operation, and set Rated Capacity Limiter configuration.

#### **SETTING THE OFFSET ANGLE ON THE OFFSETTABLE BOOM EXTENSION:**

1. The boom extension must be installed on the main boom tip and the load line, downhaul weight and wedge socket installed on the boom extension, and secured with all of the retainer pins.
2. Draw the load line taut with the hoist by pulling the downhaul weight against the bottom of the tip sheave plates, while operating the Anti-Two-Block over-ride button on the RCL Display.

#### **WARNING**

**Be careful not to operate the TELESCOPE EXTEND while overriding the Anti-Two-Block system. This may break the load line and allow the boom extension and downhaul weight to fall, causing death or serious injury to personnel.**

3. Remove the offset index pin from the boom extension knuckle. To loosen the pin, it may be necessary to rock the boom extension tip up and down manually while maintaining the proper tension in the load line.
4. Lower or raise the load line with the hoist until the 0, 15, or 30 degree offset holes align in the knuckle.
5. Insert the index pin in the knuckle and retain it with the hairpin cotter.
6. Set Rated Capacity Limiter configuration.

#### **STOWING THE BOOM EXTENSION:**

1. If the boom extension is offset to 15 or 30 degrees, return it to the zero offset position, as described above.
2. Perform steps 16-20 of the boom extension installation and stowing procedure.
3. Set Rated Capacity Limiter configuration.

## CAPACITY EXAMPLES FOR BOOM EXTENSION

The boom extension may lift loads in any swing position when the outriggers are OUT & DOWN. The boom extension may lift loads over the front on IN & DOWN outriggers. The LOAD RADIUS and BOOM EXTENSION ANGLE capacity charts must both be considered when using the boom extension. The smaller capacity specified by the two charts must be used. Radii below the double lines on the capacity chart require an installed boom extension to reach them. Refer to the capacity chart on page 2-20 for the following examples:

**EXAMPLE #1:** The boom is elevated over the side of the crane. The boom extension is offset to 15°, and the load radius is 44 feet (13 m). The outrigger beams and jacks are fully extended on concrete pavement and the crane is level. The column for OUT & DOWN, 360° ROTATION, or OVER FRONT shows the capacity is at the 44-foot (13-m) load radius to be 8050 pounds (3650 kg). The column for BOOM EXTENSION, MAIN BOOM ANGLE 50° shows the capacity for the 15° boom extension offset to be 2900 pounds (1300 kg). Since 2900 pounds (1300 kg) is less than 8050 pounds (3650 kg), the load (including the downhaul weight and slings) must be limited to 2900 pounds (1300 kg).

**EXAMPLE #2:** The boom is elevated to 15° over the side of the crane. The boom extension is offset to 0°, and the load radius is 88 feet (26.8 m). The boom is fully extended. The outrigger beams and jacks are fully extended on concrete pavement and the crane is level. The column for OUT & DOWN, 360° ROTATION, or OVER FRONT shows the capacity at the 88-foot (26.8 m) load radius to be 2000 pounds (910 kg). The column for BOOM EXTENSION, MAIN BOOM ANGLE 15° shows the capacity at the 0° boom extension offset to be 2750 pounds (1200 kg). Since 2000 pounds (910 kg) is less than 2750 pounds (1200 kg), the load must be limited to 2000 pounds (910 kg).



## FRONT AUXILIARY WINCH:

The front auxiliary winch is mounted to the front bumper and is controlled from the operator compartment. The winch has 125' (38 m) of 9/16" (14 mm)-6x36 EIP-RRL-IWRC wire rope with a 33,600-pound (150 kN) minimum breaking force and a 5-ton (4.5-metric ton) rated hook. The winch is capable of pulling 20,000 pounds (6800 kg) on the bare drum. The winch can pull 13,400 pounds (6100 kg) on the 4<sup>th</sup> layer. Do not exceed the working strength of the hook and rope. Limit pulls to 10,000 pounds (4.5 metric ton).



NOTICE
<b>AUXILIARY WINCH ROPE</b> 9/16" (14mm), 6 X 36 RRL, EIP, IWRC, 125' (38 M) MINIMUM STRENGTH > 33,600 LB. (149 kN)
WORKING STRENGTH = 10,000 LB. (44 kN) A-650-00430

Included with this option is a pivoting roller guide and a shut-off limit switch. The switch is designed to block any further pulling-in of the rope, once the hook nearly reaches the rollers. Paying-out the rope will not be affected. A pivot link is provided above the winch mounting to store the hook while not in use.

The front auxiliary winch is designed for the following uses:

1. As a tag line for restraining loads on the boom load line during pick-and-carry operation.
2. To drag loads on the ground to a position where they may be safely lifted with the boom.
3. To pull the crane out of mud or other obstacles.
4. To pull a smaller vehicle that is stuck.

## **WARNING**

**The front winch is not designed for lifting personnel or loads. Observe the following safety rules:**

1. Never lift or carry personnel with the winch and wire rope.
2. Do not allow anyone to stand near or under the load being moved.
3. Be sure the cable is securely anchored in the drum and that at least 5 wraps of rope remain on the drum to insure against the rope pulling out of its anchor.
4. Stand clear of a loaded winch cable. If it breaks, it can be very dangerous.
5. Keep hands clear of the winch and any sheaves that the cable passes over when the winch is being operated.
6. Do not over-stow the hook into the roller guide. This may damage the hook, rope, or the roller guide
7. Do not use the drivetrain to pull a load that is too heavy for the winch to pull. The drawbar pull of the IC-400 can easily exceed the working strength of a single part of line for the front winch.

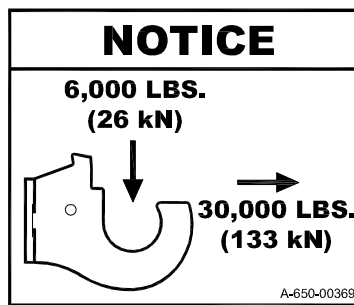
## PINTLE HOOKS:

Available Pintle Hooks allow the crane to tow other disabled vehicles and trailers, and drag loads.

1. Observe the capacity ratings marked near the hook when towing.
2. Exceeding the capacities can damage the drivetrain.
3. Use slow and smooth motions to avoid shock loads or overrunning loads. Make sure vehicle being towed is occupied to steer and brake.




















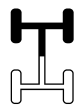




Pintle Hooks also allow the crane to be towed.





























1. Use appropriately sized straps or chains.
2. Place transmission in NEUTRAL. Utilize an operator to activate brakes as needed, and steer the crane while being towed.
3. Do not exceed a towing speed of 5 mph (8 kph).



## SWITCH AND INDICATOR SYMBOLS ON BMC CRANES

The following list shows the symbols used to label switches and indicators on BMC cranes. Most symbols are derived from the ISO 3767-1:1998(E) standard. Not all symbols will be included on your BMC crane.

	On/Start		Windshield washer switch
	Off/Stop		Windshield defroster switch
	Battery not charging		Heater switch
	Hour meter		Air conditioner switch
	Read operator's manual		Ventilation fan switch
	Sound level notification		Parking brake is set
	Headlights (main/high beam)		4-wheel (round) steer
	Work light		Rear-wheel steer
	Hazard lights		Crab steer
	Rotating beacon or strobe lights		2-wheel drive
	Turn signals left/right		4-wheel drive
	Windshield wiper switch		Steering wheel tilt

	Tire pressure		Engine oil pressure low
	Lift point		Engine coolant fill location
	Tie-down point		Engine coolant temperature high
	Transmission oil fill location		Engine coolant low level mark
	Transmission oil pressure		Engine air filter restriction indicator
	Transmission oil temperature		Engine start
	Brake fluid fill location		Engine idle set
	Hydraulic oil low-level mark		Check engine
	Hydraulic oil filter restriction indicator		Stop engine
	Hydraulic temperature gauge		Wait to start/ engine preheat/ grid heater/ glow plug switch
	Hydraulic oil temperature high		Gas fuel only
	Hydraulic oil pressure gauge OR hydraulic oil pressure low		Diesel fuel only
	Positive polarity		Fuel level gauge
	Negative polarity		Drain

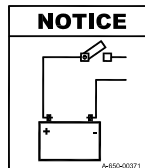


## MAINTENANCE

### SAFETY RULES

Before doing maintenance, lower load, lower boom and retract boom, move to a safe place, shutdown engine, and remove key. Place warnings on the ignition switch and crane controls to prevent unauthorized starting or movement during maintenance. Disconnect battery using Battery Disconnect Switch, inside the RH side of the engine compartment.

1. mounted on front hood cover, and lockout if needed.

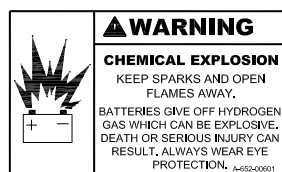


2. Relieve hydraulic pressure when working on hydraulic parts. See instructions on page 3-41.
3. Allow fluids and parts to cool before working on them.
4. Read maintenance instructions before beginning work.
5. Do not check for hydraulic leaks with hands. If a mist of hydraulic oil is noticed around a line or component, use cardboard or other material to check for location of leaks. High pressure fluid leaking from a small hole, can be almost invisible, yet have enough force to penetrate the skin. If injured by escaping fluid, see a doctor at once. Serious reaction or infection can occur.
6. Wear safety glasses and safety shoes.
7. Do not wear loose-fitting or torn clothing.
8. Remove rings and other jewelry.
9. Wear heavy leather gloves when working with wire rope.
10. Keep fingers, clothing, and hair away from moving parts.
11. To prevent falls, clean areas of crane that are stepped on for access to crane parts. Wear slip resistant footwear. Use appropriate ladders/steps to gain access to boom tip and deck.
12. Avoid placing body parts in pinch points. Use tools that extend through the pinch points when possible. Block the moving parts securely when it is necessary to work in pinch point areas.
13. When inflating or adding air to a tire that is not mounted on a machine, place the tire in a tire cage and use a clip-on air chuck with an extension hose that will permit standing behind the tire tread at a safe distance when inflating.
14. Do not work on any machine that is supported only by jacks or a hoist. Always use adequate blocks or jack stands.

15. If it is necessary to work on the boom in an unstowed condition, block it to prevent it from dropping unexpectedly.
16. Use a hoist when lifting components that weigh 50 pounds (22 kg) or more. Follow all hoist and rigging safety rules.
17. Do not use lower grade fasteners if replacements are necessary.
18. When reinstalling wiring or plumbing after repairs, be sure that it will not be damaged by rubbing against sharp edges or objects, or rough or hot surfaces.
19. Never use a rope clip on live side of the load hoist rope. This will seriously weaken the rope. Death or serious injury can result from the misuse of a rope clip on the hoist rope.
20. Replace any instruction or warning placards that are lost or damaged or not readable.
21. Always replace all guards and covers after working on the crane.
22. After working on the hydraulic system, remove air from the lines and cylinders involved by cycling them full stroke with the engine running until the functions operate smoothly.
23. When welding on the crane, or on anything connected to the crane by wire rope or other conducting link, disconnect the battery, the Rated Capacity Limiter components, controls system (and its computer), transmission shifter, main VEC, optional camera monitor, lower control valve, and the engine electronic control module. When welding on the boom or turn-table assembly, disconnect the cable reel, cylinder transducers, boom control valve, and any other electronic components connected above the slinging.
24. When using pressure spray to clean the crane, cover all electronic components with sheets of plastic to protect them from spray.
25. Do not allow antifreeze to contact skin. Rinse off spills immediately with plenty of water. Antifreeze is highly toxic if ingested.
26. Always disconnect negative cable first and refasten last to prevent accidental short through chassis components.
27. Dispose of all hazardous substances properly by following local regulations.

### **CAUTION**

**Even with low voltage electrical systems, severe arcing can occur. Electrical shock or component damage can result from contact with energized conductors. Use caution when working with any electrical device.**



## **MAINTENANCE**

The Broderson IC-400 Industrial Crane will perform better and live longer if a program of inspection, lubrication, adjustment and general preventive maintenance is followed. We recommend the following schedule:

### **NEW UNIT INSPECTION AND TEST**

The following inspection and test should be made before placing the unit on the job. This will insure that no damage or loss of operating capability occurred during shipment.

1. Check for physical damage.
2. Check for leaks at fittings and drips under chassis.
3. Check radiator coolant level.
4. Check engine oil level.
5. Check hydraulic oil reservoir level.
6. Check transmission oil level. The transmission oil is checked at the transmission petcock. (There is no dipstick involved.)
7. Check fuel tank level.
8. Check tire pressure.
9. Check for loose pins, bolts, and retainers.
10. Start engine.
11. Check for operation of foot brake.
12. Check for operation of parking brake.
13. Check for operation of accelerator pedal.
14. Check power steering for operation.
15. Check operation of transmission gear selector lever.
16. Check lights for operation.
17. Test-drive unit and check for normal operation.
18. Check operation of hydraulic outriggers.
19. Check boom rotation.
20. Check boom elevation.
21. Check boom extension functions & sequencing (pay out hoist cable while extending the boom).
22. Check boom chains and chain sheaves.
23. Perform hoist cable break-in procedure, as described on page 3-24.
24. Check anti-two-block system for proper operation and cutout of boom functions.
25. Perform a load test, with a know load to test the Rated Capacity Limiter.
26. Check the outrigger modes on display for proper operation.
27. Check emergency stop switch and seat switch operation.
28. Check lubrication points and condition of wire rope.

### **WARNING**

**When the Rated Capacity Limiter is inoperative or malfunctioning, it must be repaired as soon as reasonably possible. When a lift must be made without a properly functioning load indicator or RCL, the designated lift supervisor must establish procedures for determining load weights and load radii, and conducting the lift safely.**

## OPERATOR INSPECTION AND TEST

An operator, in the course of normal operation, should make certain observations, inspections, and tests to assure that the unit is ready to perform safely.

### Daily:

1. Check levels of engine oil, coolant, and transmission fluid.
2. Check air cleaner intake system for cracks or loose connections.
3. Check general condition of tires.
4. Visually inspect for loose pins, bolts, physical damage, and leaks.
5. Check hydraulic hoses, particularly those that flex during crane operation.
6. Check hydraulic oil level.
7. Check fuel level.
8. Check foot brake operation. Check for warning icon operation, as shown in brake maintenance section.
9. Check parking brake operation. Put transmission in the NUETRAL position. This action will apply the parking brake.
10. Check power steering operation.
11. Observe chassis for normal driving operation.
12. Observe boom operation for normal power, speed, and sequencing.
13. Check load line and hooks for damage.
14. Check condition of sheaves and load line retainers.
15. Check anti-two-block system for proper operation.
16. Check back-up alarm for proper operation.
17. Check operation of all transmission gears, forward, and reverse.
18. Clean all glass and check for cracks.
19. Check operation of all warning and safety devices.
20. Check operation of Rated Capacity Limiter according to the RCL Operation Manual.
21. Check the outrigger modes on display for proper operation.
22. Check seat switch and emergency stop operation.
23. Check Drum Rotation Indicator.
24. Cummins Diesel Engine, per engine manual:
25. Maintenance Procedures at Daily Interval are as follows. Check:
  - ✓ Diesel Exhaust Fluid (DEF) Level
  - ✓ Crankcase Breather Tube
  - ✓ Fuel-Water Separator (drain)
  - ✓ Air Cleaner Restriction
  - ✓ Lubricating Oil Level
  - ✓ Fan, Cooling (inspect for re-use)
  - ✓ Coolant Level
  - ✓ Aftertreatment Exhaust Piping
  - ✓ Air Intake Piping
  - ✓ Dust Ejection Valve

**Weekly:**

1. Check tire pressure: 100 PSI (690 kPa).
  2. Check for loose wheel nuts. 475 foot-pounds (645 Nm) torque required.
  3. Check lights and turn signals.
  4. Check power steering lines for damage.
  5. Check brake lines for damage.
  6. Check operation of horn.
  7. Check operation of hoist brake for smoothness.
  8. Check outrigger holding valves for operation.
  9. Check boom topping holding valves for operation.
  10. Check rotation gears for looseness or backlash.
  11. Check boom extension cylinder for proper operation and holding valve performance.
  12. Check operation of windshield wipers.
  13. Boom extension (if equipped) to ensure it is properly pinned with all retainers in place.
  14. Check boom chains and chain sheaves.
- .

**Monthly:**

1. Check accumulator pre-charge, as shown in *brake maintenance* section.

**NOTE:** Change the transmission fluid on a new machine after the first 20 hours.

## IC-400-B MAINTENANCE CHECKLIST

Refer to the *component maintenance* section of this manual and to the Engine Operator's Manual for complete instructions.

### 50-HOUR INTERVAL:

1. 50-hour lubrication, as shown on lube schedule.
2. Inspect wire rope thoroughly.
3. Inspect for physical damage and leaks.
4. Clean radiator fins and check coolant level.
5. Check tire pressure and condition. Inflate tires to 100 PSI (690 kPa).
6. Check fluid levels in engine, transmission, & hydraulic tank.
7. Check air filter restriction indicator.
8. Inspect air intake and exhaust systems for cracks, leaks, loose bolts, & loose connections.
9. Change engine oil and filter after first 50 hours. Replace at intervals specified by engine manufacturer thereafter.
10. Change the hydraulic filter after first 100 hours and at 500 hours thereafter.
11. Check rotation gear and pinion fit, and gear train backlash.
12. Check rotation bearing bolt and nut torques (1200-1300 ft-lbs for bolts or 900-1000 ft-lbs for nuts. For gearbox bolt torques refer to the *Torque Data Chart* at the back of the Operation & Maintenance Manual.
13. Check axle mounting bolts 682 foot-pounds (925 Nm).
14. Torque wheel mounting nuts. 475 foot-pounds (645 Nm) torque.
15. Check for loose pins or pin retainers.
16. Check brake lines and steering lines for damage and leaks.
17. Inspect sheaves and hooks for damage or excessive wear.
18. Visually inspect welds on boom, turret, and outriggers.
19. Perform a load test, as described on page 3-3.
20. Check outrigger modes on the display for proper operation.
21. Check horn, outrigger alarm, and backup alarm.
22. Change filter, with the fluid above 100°F (38°C), every 200 hours or 6 months, whichever is sooner.
23. Measure boom extension & retraction chain sag and adjust if as necessary. See page 3-38.

### 250-HOUR OR 3-MONTH INTERVAL:

1. 50-hour maintenance.
2. 50 and 250-hour lubrication.
3. Clean engine and battery.
4. Check engine mounts and radiator mounts.
5. Adjust and lubricate boom chains and chain sheaves.
6. Inspect all bolts on the machine for tightness.
7. Visually inspect all welds for cracks.
8. Check hydraulic hoses, fittings, cylinders, and centerpost for leaks.
9. Perform all maintenance required by engine manual.

**500-HOUR OR 6-MONTH INTERVAL:**

1. 250-hour maintenance.
2. 50, 250, and 500-hour lubrication.
3. Check antifreeze for protection level and cleanliness.
4. Change hydraulic filter element, if not changed in the last 250 hours and inspect oil from element.
5. Change transmission filter element and inspect oil from element.
6. Check condition of all operational and warning placards.
7. Torque mounting bolts on rotation bearing and gearbox, winch, and axles. Torque spec shown on 50-hour interval.
8. Inspect boom sections for signs of overload, excessive wear, or other damage.
9. Perform all maintenance required by engine manual.

**1000-HOUR OR 12-MONTH INTERVAL:**

1. 500-hour maintenance.
2. 50, 250, 1000-hour and 12-month lubrication.
3. Perform engine maintenance specified in Engine Manual.
4. Change hydraulic fluid & filter, and clean breather and reservoir.
5. Change transmission fluid & filter, and clean strainer.

**24-MONTH INTERVAL:**

1. 12-month maintenance.
2. Pressure test engine cooling system.
3. Flush cooling system.
4. Change engine thermostat.
5. Fill with new coolant and distilled water.
6. Perform all maintenance required by Engine Manual.

S/N: \_\_\_\_\_ HOURS: \_\_\_\_\_ DATE: \_\_\_\_\_ BY: \_\_\_\_\_

COMMENTS & PARTS REQUIRED: \_\_\_\_\_

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## FLUID VOLUME

Hydraulic Reservoir – 156 gallons (509 L)

Fuel Tank – 80 gallons (303 L)

Planetary Hoist – 6.5 quarts (6.2 L)

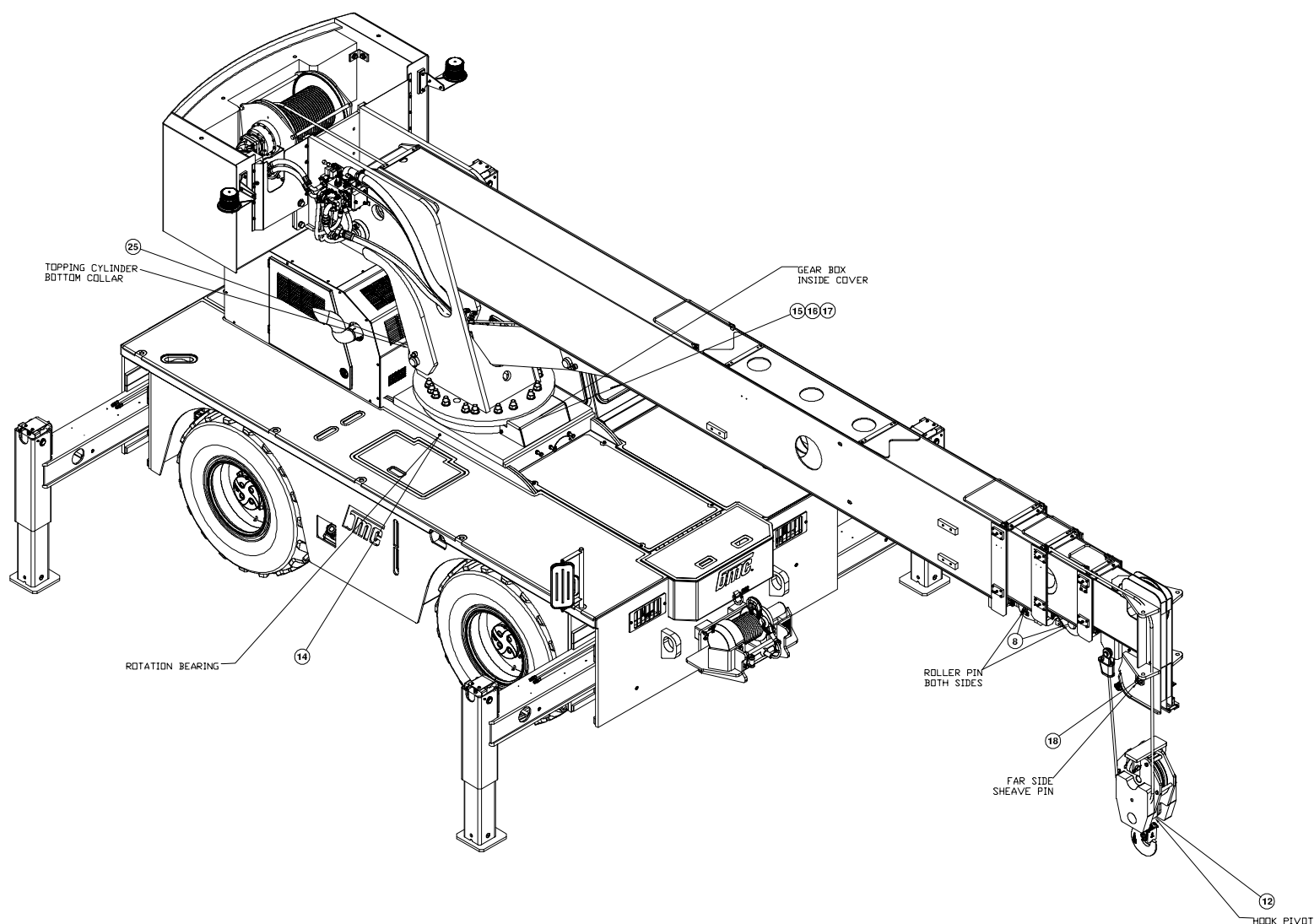
Axle – Differential Housing – 5.4 gallons (20.5 L), Hubs – .5 gallons (1.85 L)

Transmission – 5 gallons (19 L)—Not including oil cooler and lines.

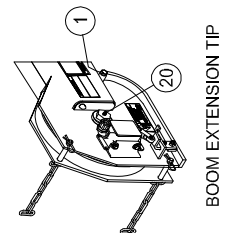
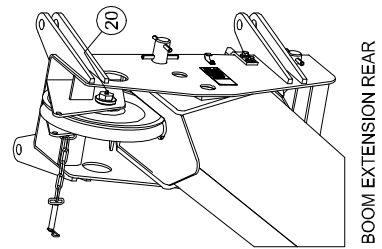
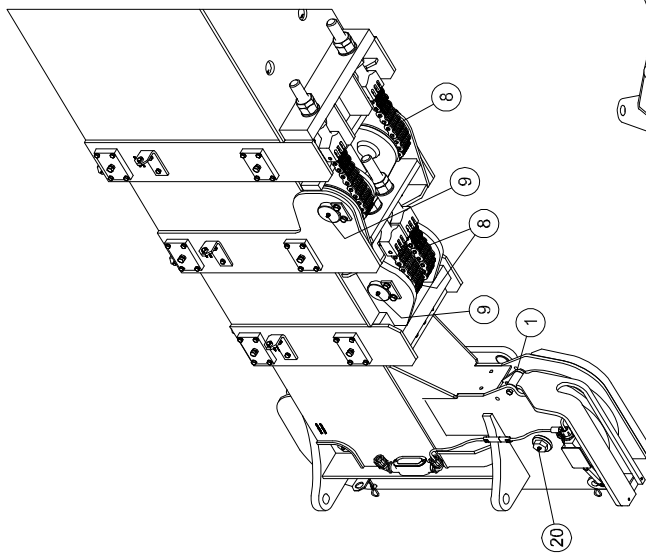
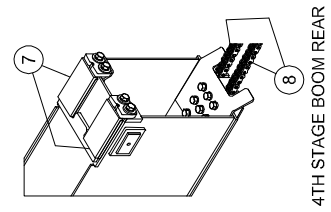
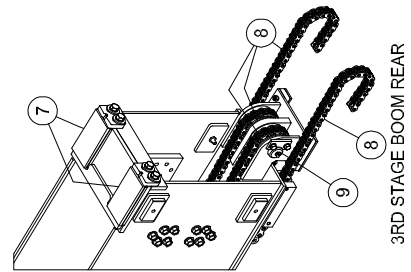
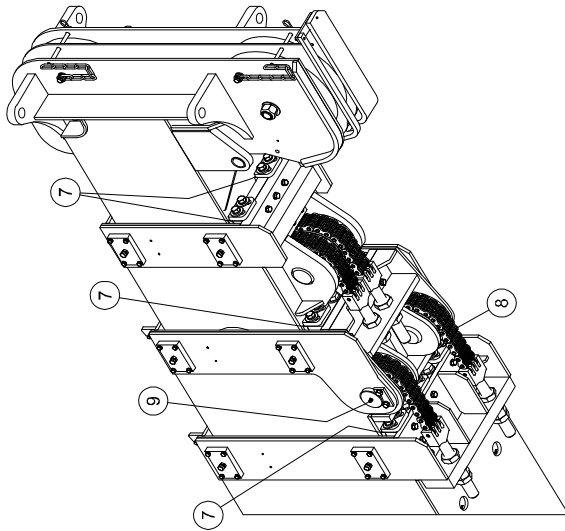
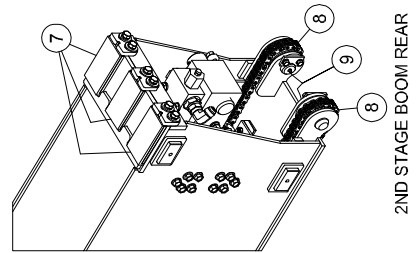
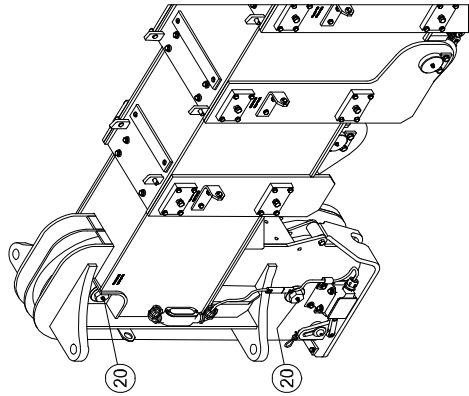
Engine Oil Capacity – 10.5 quarts (10 L)

Engine Cooling System – 14 quarts (13.2 L) fill to bottom of fill neck in surge tank.

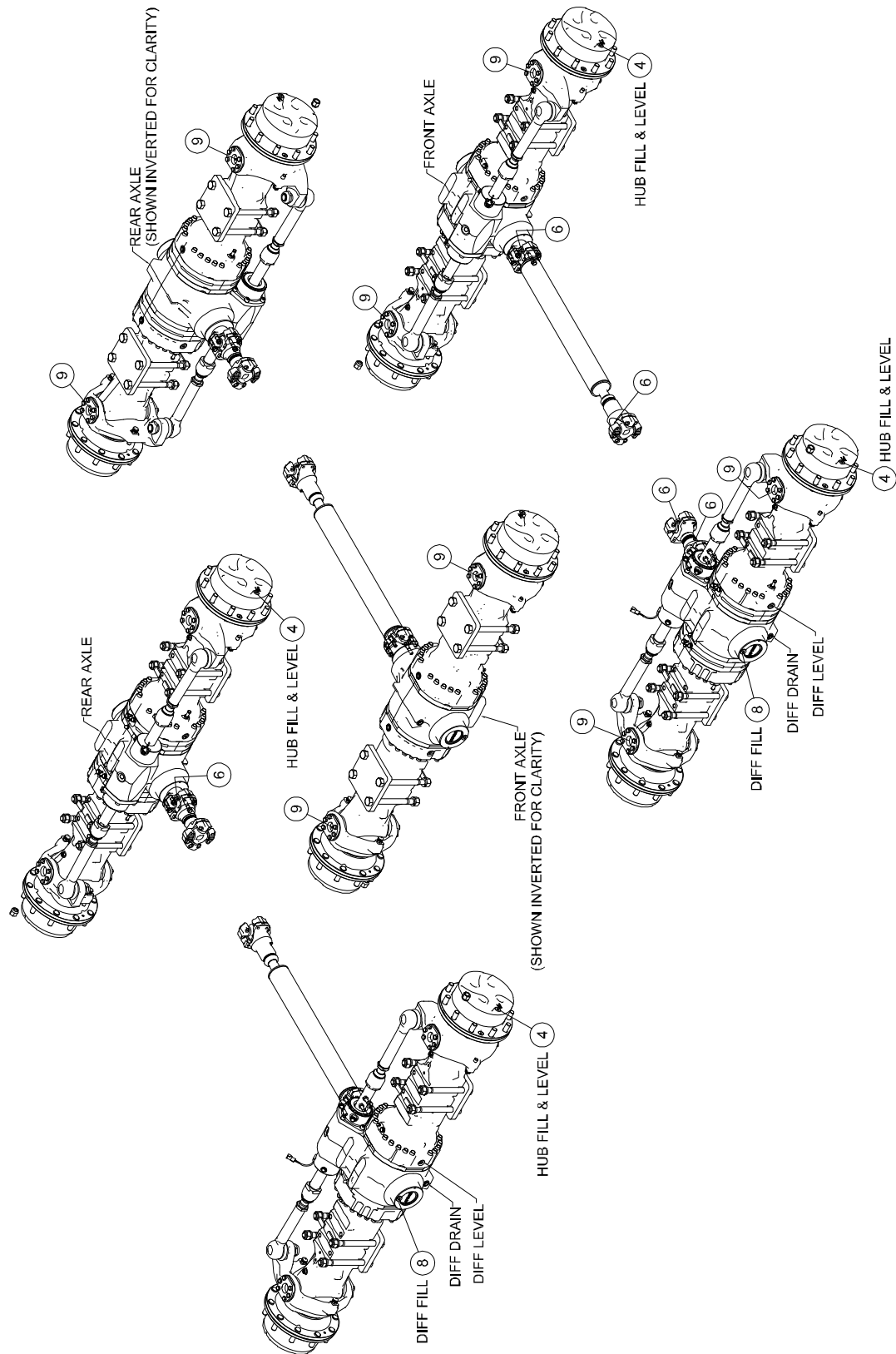
## IC-400-3B LUBRICATION CHART



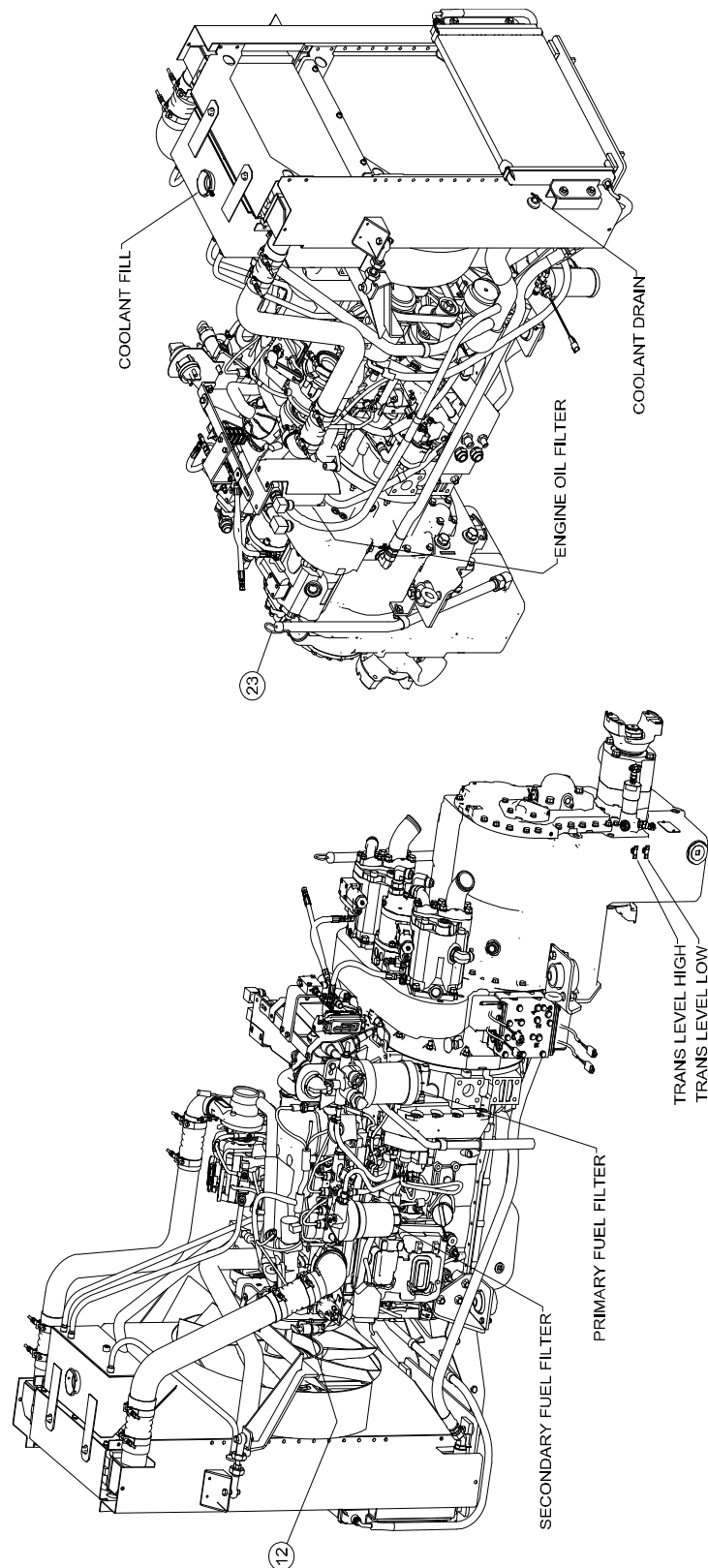
# IC-400-3B LUBRICATION CHART



# IC-400-3B LUBRICATION CHART



## IC-400-3B LUBRICATION CHART



## IC-400-3B LUBRICATION SCHEDULE

ITEM	DESCRIPTION	LUBE SYMBOL	LUBRICATION INTERVALS					NOTES
			50 HOUR	250 HOUR	500 HOUR	1000 HOUR	MONTHS	
1	Anti-Two-Block Arm	SIL	X					2 Points
2	Axle Differential	MPL	X				12	Check @50, Change @12 Mo.
3	Axle Kingpins	MPG	X					8 Zerks
4	Axle Hubs	MPL	X				12	Check @50, Change @12 Mo.
5	Boom Extension Pins	MPG	X					Wipe on.
6	Boom Rub Pads	SIL	X					Spray or Wipe on Boom.
7	Boom Chains	EO		X				Spray or Wipe*
8	Boom Chain Sheaves	MPG		X				6 Zerks
9	Cab Hinges & Latches	SIL		X				
10	Drive Shaft Joints	MPG	X					4 Zerks
11	Engine Oil	EO	X	X			3 Max.	Check Daily, Change @50 hours, then @250 or 3-mo. Max.
12	Hook Swivel & Pin	SIL	X					Sheave Block & Single Part Line
13	Hydraulic Oil	HO	X			X	12 Max.	Check Daily, Change @1000 hours, then @250 or 12-mo. Max.
14	Rotation Bearing	MPG	X					1 Zerk
15	Rotation Gear Teeth	OGG	X					Brush On*
16	Rotation Pinion Bearing	MPG	X					1 Zerk
17	Rotation Gearbox	WGO		X			24	Check @250, Change @24 Mo.
18	Sheave Pins	MPG			X			2 Zerks Std, 2 On Boom Ext.
19	Transmission	ATF		X			12 Max.	Check Weekly, Change @600 hours; Change Filter @200 hours.*
20	Hoist	MPL		X			12	1 Zerk*
21	Wire Rope	2-X	X					Spray, Brush, or Soak*
22	Wire Rope Retainers	SIL	X					
23	Sheave Block Sheave Pin	MPG	X	X	X			2 Zerk
24	Sheave Block Trunnion	MPG	X	X				1 Zerk
25	Boom Topping Cylinder	MPG				X		2 Zerk

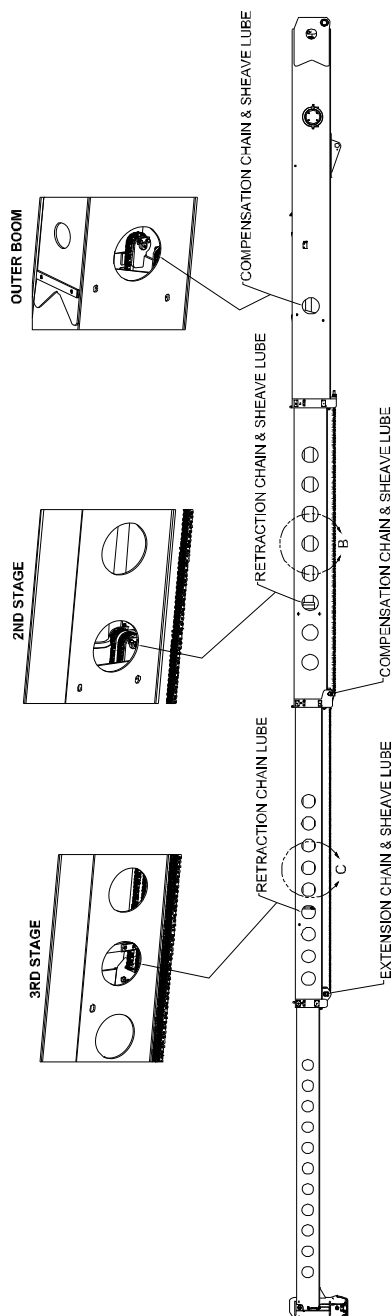
\* See Procedures in the Manual

### LUBE SYMBOLS

EO - Engine Oil - See Specs in Engine Manual  
 HO - Approved Hydraulic Fluids - See Specs in Hydraulics Section  
 MPG - Multi-Purpose Gun Grease  
 MPL - Multi-Purpose Gear Lube - SAE 80W-90  
 OGG - Open Gear Grease, Such as Mobilkote S  
 SIL - Silicone Lube - Aerosol with Concentrating Tube  
 2-X - AMOVIS #2-x  
 ATF - Mobil ATF D/M or equivalent

## BOOM CHAIN LUBRICATION

Put the crane on outriggers before beginning. The machine may tip in other configurations. Extend the boom fully and lower to horizontal. Turn off the engine. Using appropriate ladders or steps, lubricate inner chains and chain sheaves through windows. There are grease fittings on chain sheave shafts both inside and outside the boom. Reach in through boom windows with a long tipped oil can, spray chains generously, and grease sheave fittings. Do not attempt to grease chain shafts or oil chains inside boom with engine running, as boom may move while your hands are inside.



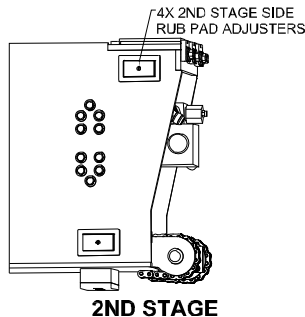
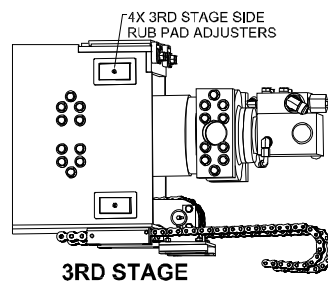
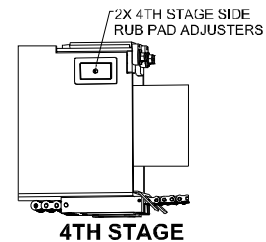
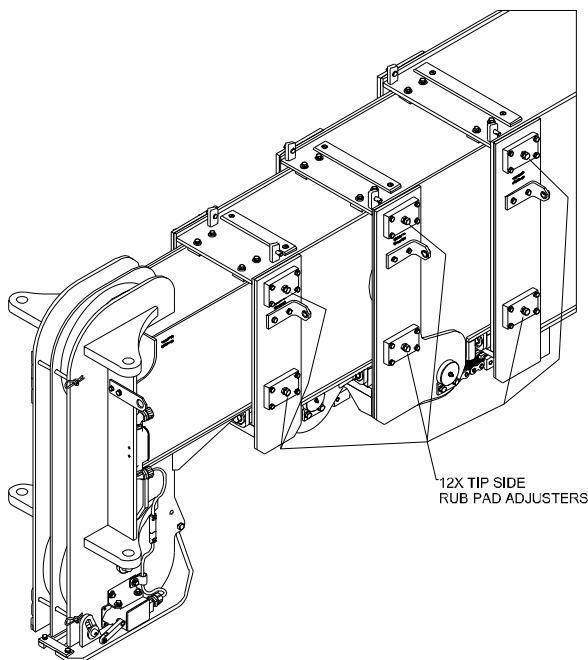
## RUB PAD ADJUSTMENT

The rub pads on the sides of the boom may require adjustments as they wear. Adjustable rub pads are located at the tips of the outer boom, second stage, and third stage. Adjustable rub pads are also located at the bases of the second stage, third stage, and fourth stage.

To determine if adjustment is required:

1. Set the outriggers.
2. EXTEND and RAISE the boom fully.
3. RAISE or LOWER the hook so that the wire rope is coming off the extreme left side of the hoist.
4. Check to make sure the wire rope does not contact the mounts for the wire rope retainers.
5. LOWER the boom and check to make sure the rope does not slip off the sides of the rub pads, mounted on the top of the boom.
6. Repeat steps 2-5 with the wire rope at the extreme right side of the hoist.
7. EXTEND and RAISE the boom fully.
8. Lift a 5000-10,000-pound (2250-4500 kg) load, in this position, just off the ground.
9. Check that the boom appears visually straight, and that stages are not leaning in alternating directions. For example, the second and fourth stages lean left, while the third stage leans right.

Rub pads can be tightened as necessary using a 9/16-wrench.



## ROTATION BEARING LUBRICATION

There is one grease zerk remote mounted in on the right side of the chassis pedestal. It is located just above the battery compartment. This should be used to lubricate the bearing every 50 hours. Rotate the turntable at least one revolution while pumping grease into the zerk. Use about 8 ounces (230 cc) of grease each time the bearing is lubricated.

Also, lubricate the gear teeth of the rotation bearing at the 50-hour interval. Remove the pinion cover. Brush open gear grease, such as Mobilkote-S, on the teeth on each side of the pinion, at four places around the bearing. Rotate the turntable several times and check the coverage of the grease on all of the teeth. Replace the pinion cover.

## BRAKE SYSTEM MAINTENANCE

### WARNING

**The brake system of the IC-400 requires routine maintenance to ensure proper operation. Failure to properly maintain the brake system may result in property damage, injury, or death.**

**Brake Malfunction Icon:** Located on the dash display. If the icon is present during normal crane operation, driving the crane, or operating the brakes, discontinue operating the crane and take out of service. This icon indicates that the pressures in the brake accumulators are too low for reliable brake operation. The problem must be found and fixed before driving the crane any further.

To check that the brake malfunction icon is operating correctly, turn the ignition key to the ON position, but do not start the engine. Pump the brake pedal several times to discharge the accumulators. If the icon does not turn on, there is a malfunction in the sensor or wiring. The problem must be found and fixed before driving the crane.

### CAUTION

**Brake dust may be hazardous. Observe precautions to prevent breathing large amounts of brake dust.**

**Brake Pads and Rotors:** Remember that the steering system on the IC-400 is non-load reactive. The operator will not be able to “feel” pad or rotor problems in the steering wheel. On a weekly basis, check to see if the rotors appear worn, grooved, warped, or otherwise damaged. When applying the brakes, listen for squeaking. Observe the wheels for any vibration or unusual motion during braking. If any of these conditions are present, a thorough inspection is required to find and fix the source of the problem.

Regardless of other indications, a thorough inspection of the pads and rotors must be performed at least every 1000 hours. Remove the tire and wheel assemblies. Note that proper tire handling equipment must be used when removing tires of this size. Inspect the pads, and replace them if they are cracked or worn. Replace pads if the lining without metal back plate is less than 0.125” thick (3.2 mm). Inspect the rotors, and replace them if they are grooved or warped. Replace rotors if they are less than 0.5” (13 mm) thick.

**Brake Unloading Valve:** Mounted under the floorboard of the operator’s compartment. Also called an accumulator charging valve. The brake unloading valve sends pressure to the accumulators if low pressure is detected. No routine maintenance is needed on the brake unloading valve.

The operator can hear the accumulators charge. If the accumulators charge frequently without depressing the brake pedal, the brake unloading valve, accumulators, or brake hoses may be leaking. If no leaks can be found, check accumulator pre-charge pressure. If pre-charge pressure is adequate, it may be necessary to repair or replace the brake unloading valve. If the accumulators do not charge, take a long time to charge, or cycle very rapidly, it may be necessary to repair or replace the brake unloading valve.

Relief pressure for the brake circuit is located in the unloading valve. It is set at 2925 PSI (202 bar) at the factory. The relief pressure cannot be adjusted. The relief pressure can be checked by installing a pressure gauge at the P port of the valve.

**Brake Modulating Valve:** Directly connected to the brake pedal. This valve sends pressure and flow to the brake calipers when the brake pedal is depressed. Lubricate the pedal hinges with a silicone lubricant. No other routine maintenance is required. If the brakes do not apply and the *Brake Malfunction Light* is not illuminated, the brake modulating valve may need repair or replacement. If the brakes do not fully release and the brake calipers are functioning properly, the brake modulating valve may need repair or replacement.

**Brake Accumulators:** Mounted under the floorboard of the operator's compartment. The brake accumulators store hydraulic oil under pressure for use at the brake calipers. They are bladder-type accumulators, and require a pre-charge pressure in the gas bladder. The brake accumulator pre-charge pressure must be maintained on a monthly basis as follows:

1. Set park brake or put machine on outriggers. Turn off engine.
2. Pump the brake pedal several times to discharge stored oil pressure.
3. Remove protective cap from the accumulator.
4. Connect a pressure gauge to the accumulator valve stem.

### **WARNING**

**Accumulator pressure gauges will not detect accumulator pre-charge pressure if improperly used. Carefully review pressure gauge and pre-charging instructions included with commercially available gauge kits.**

5. Measure accumulator gas pre-charge pressure. Nominal pressure is 1000 ± 100 PSI (69 ± 6.8 bar).

### **WARNING**

**NEVER use shop air or oxygen to pre-charge accumulators. ONLY use inert dry nitrogen (N<sub>2</sub>) gas. Failure to use proper gas can cause accumulator damage or failure, leading to property damage, injury, or death.**

6. If necessary, add only dry nitrogen gas (N<sub>2</sub>).
7. Disconnect all gauges. Replace valve caps.

If the accumulators are unable to hold a pre-charge pressure, or if the brakes fail to operate properly, they may be damaged. The accumulator pressures should cycle between 2175 PSI (150 bar) and 2675 PSI (184 bar). Accumulator bladder replacement instructions and accumulator replacement instructions ship with replacement parts. In the event that instructions are not included, contact BMC. Proper procedure is necessary to prevent damage or premature failure of replacement parts.

## **TRANSMISSION MAINTENANCE**

The transmission is a 3-speed-forward, three-speed-reverse, 2-range Dana 32000 series powershift transmission. The transmission is bolted directly to the flywheel housing of the engine and is connected by drive shafts to the front and rear axles. A torque converter transmits power from the flywheel to the transmission. The transmission gears are all constantly in mesh, and there are a series of clutches that control the direction and speed of the output.

### **TRANSMISSION OIL:**

The oil used in this transmission is Mobil ATF D/M automatic transmission fluid, with the Allison C-3 rating. See the recommendations below. Other oils can cause shortened transmission life due to material incompatibility and inadequate frictional properties for clutch discs. The refill capacity is about 4 to 5 gallons (15 L to 19 L).

#### **AMBIENT TEMPERATURE**

Between -10°F and 32°F  
(-23°C to 0°C)

Below -10°F (-23°C)

Above 32°F (0°C)

#### **TRANSMISSION FLUID SPECIFICATIONS**

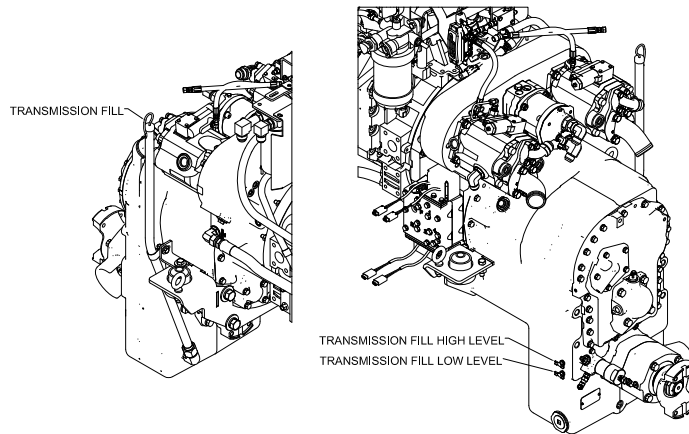
Hydraulic Transmission Fluid Type C-3 or C-4, except Grade 30

Type C-3 or C-4, except Grade 30  
Auxiliary preheat required to raise oil temperature above -10°F.

Type C-3 or C-4 or C-3 Grade 30

### **CAUTION**

**Do not use any oil with an EP (Extreme Pressure) additive.**



Check the oil level weekly by removing the ADD plug on the transmission. The ADD plug is located near the left-hand side of the transmission, near the engine. Make sure the area around the plug is clean before removing. Check the oil level in NEUTRAL at idle speed, with the oil warm. If oil weeps out of the hole, the oil level is sufficient. If no oil is present, stop the engine and install the ADD plug. Remove the FILL plug. With engine off, add oil through the dipstick tube or FILL plug hole, until oil weeps out of the FILL plug hole.

**TRANSMISSION FILTER CHANGE:** (Note--The transmission filter may be found in the Parts Manual under *Transmission Service Parts*.)

The transmission utilizes a cooler that is part of the radiator package. The filter is located on the side of the chassis, behind the right rear wheel. Change the filter on a new machine after the first 20 hours. Thereafter, the filter should be changed every 200 hours or 6 months, whichever is sooner. Use the following procedure:

1. Clean the filter housing, element, and nearby hoses.
2. Remove the used filter element and catch the oil in a clean bucket.
3. Empty the element into the bucket and examine the oil for foam, water, and excessive particles. By checking the oil at every filter change, trends may be observed, which could help in troubleshooting, if problems develop.
4. Lubricate the seal on the new element and thread it onto the housing.
5. Tighten the element 3/4 of a turn after the seal contacts housing.
6. Run the engine at low idle and check for leaks.
7. Check the oil level as described previously and top off as needed.

## **TRANSMISSION FLUID CHANGE:**

Change the transmission fluid on a new machine after the first 20 hours. If the filter is changed every 200 hours, change the fluid every 600 hours. If the filter has been changed more frequently, change the fluid every other filter change. Use the following procedure:

1. Operate the transmission long enough to warm the oil above 100°F (40°C).
2. Remove the transmission drain plug and drain the oil. Check for water, foam, or excessive particles in the oil.
3. Change the filter element as described previously.
4. Remove the transmission breather, wash it in clean solvent, blow it dry, and re-install.
6. Clean and install the transmission drain plug.
7. Fill the transmission through the dipstick tube or ADD plug with 4 gallons (15 L) of Mobil ATF D/M or equivalent.
8. Run the engine at low idle and check for leaks.
9. Check the oil level as described previously.

A pump in the transmission provides hydraulic power for operating the range shift solenoid and 4X4 disconnect solenoid.

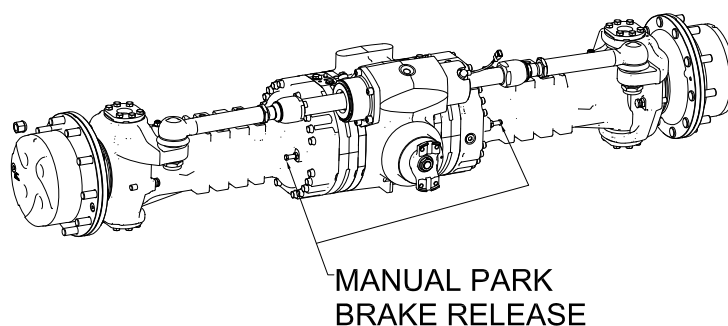


### **BLEEDING THE PARKING BRAKE:**

If the parking brake hydraulic lines are disconnected for any reason, the lines will have to be bled. This is done by using the bleed ports for the parking brakes located on the top of the rear axle. Before working on the parking brake system, set the outriggers or chock the wheels, to prevent rolling. The bleeding must be done with the engine running and the parking brake switch in the OFF position. It may require several repetitions to remove all of the air. In between each repetition, turn the brake ON for about 30 seconds.

### **MANUAL PARKING BRAKE RELEASE:**

Before working on the parking brake, set the outriggers or chock the wheels, to prevent rolling. Find the manual park brake release bolts on the axle. There are two bolts on each side of the axle differential. Turn the release bolts clockwise until fully seated. Do NOT use an impact wrench to run these bolts in. Once the bolts are fully run in, the parking brake will be released. To reset the parking brake to normal operation, be sure to fully back the release bolts out to their original location.



## **TRANSMISSION TROUBLESHOOTING**

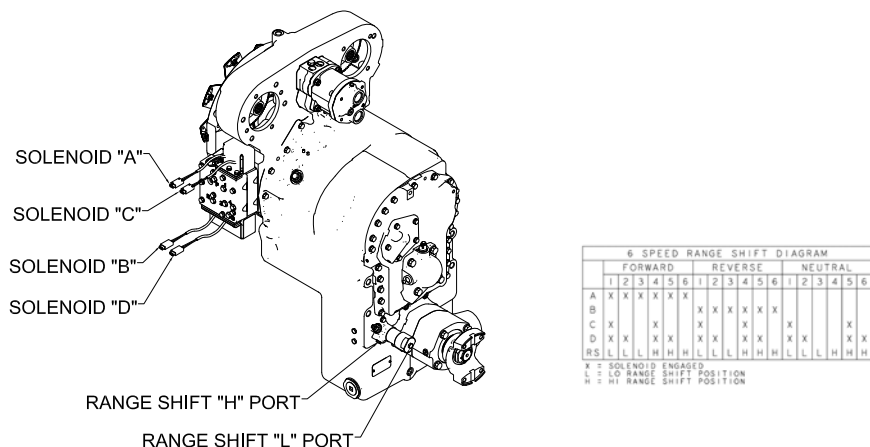
If the transmission does not function properly, there are several simple checks that may reveal the cause. Try these checks first, before making a service call.

### **NOTICE**

**For transmission service or overhaul, which is beyond the scope of this manual, please call your Broderson dealer or the Broderson Service Department to have a Dana service representative contact you.**

1. If transmission feels like it is slipping, check the transmission oil level. High or low level can cause problems. If air bubbles are in the oil and the oil level is not too high, there may be a leak in the suction line of the transmission pump.
2. If the transmission fluid is overheating, it may be caused by plugged radiator fins, dirty fluid, or using too high a gear. Drain the transmission, remove the filter and suction screen, check them for excessive contamination, and save the contaminants for further examination.
3. Check the electrical connectors on the transmission solenoids. The solenoids are located on the side of the transmission in a valve body, which is on the machine (to the right of transmission).

4. If the shift panel is not working and the wiring appears to be sound, check the solenoids on the transmission control valve. The coils of two of the solenoids should be magnetized whenever a state other than NEUTRAL is selected and the ignition switch is on. The following chart shows the solenoids that are energized as each gear is selected:



If abnormal contamination is found or a problem cannot be diagnosed and fixed by the above steps, please call your Broderson dealer or the Broderson Service Department to have a Dana service representative contact you.

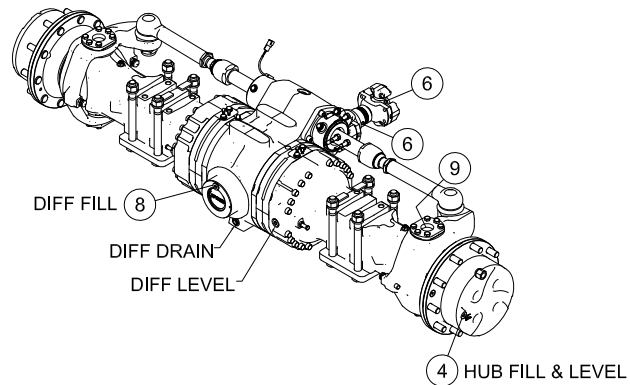
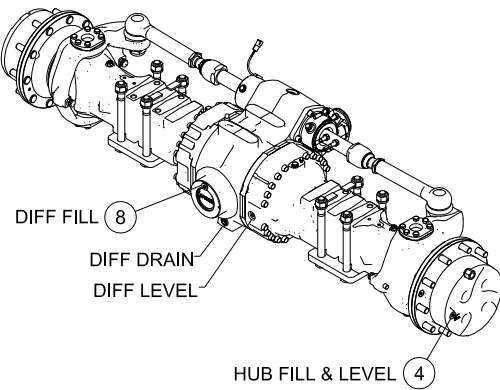
## TOWING

If the crane must be towed, run the engine at low idle to release the parking brake and lubricate the transmission. Do not exceed 10 mph (16 km/hr). If the engine cannot be run, release the parking brake by following the manual parking brake release procedure on page 3-21. Do not exceed 3 mph (5 km/hr) and one mile (1.6 km) total distance while towing. It is recommended by the axle and transmission manufacturer to remove both drive shafts, prior to towing. Afterward, reset the park brake by the procedure on page 3-21.

## WHEEL ALIGNMENT

### DRIVE AXLES--HUBS AND DIFFERENTIALS:

Maintain fluid levels, as shown in the figures below. If necessary, add 80W-90 gear lube. Check every 50 hours and change every 12 months.



## HOIST CABLE LUBRICATION

The hoist cable is a wire rope and should be cleaned & lubricated every 50 hours of normal operation, and more frequently when used in dirty or corrosive environments. Whenever the rope is dirty or dry, it should be serviced. The rope should be cleaned with solvent and compressed air, or solvent and rags. A wire brush may be used for difficult areas.

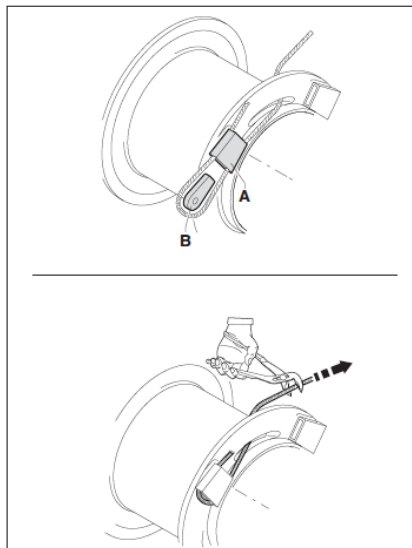
The recommended lubricant is AMOVIS #2-X. It should be sprayed or dripped onto the rope where it is bent, as it passes over the tip sheave, as it is spooling onto the hoist. Use an appropriate ladder or steps to access the tip sheave. Wrap rags around the wire rope behind the sheave and swab the excess oil that is carried along on the rope. Always wear heavy leather gloves when handling wire rope.

## CABLE WEDGE (FLANGE MOUNT) INSTALLATION & INSPECTION

The following steps will assure that the wire rope (*i.e.* hoist rope, hoist cable, or load line) winds smoothly and evenly on the hoist, and will yield greater safety and longer rope life.

If the cable is not sufficiently compact during the initial assembly phase when it is loaded, it may become caught up in the turns below, and damaged.

1. Position rope spool such that rope will wind from the top of the spool, to the top of the hoist drum. Winding from the bottom of the spool will introduce a reverse bend and may introduce torque into the rope.
2. Never pull loops through, as this will introduce a kink in the rope and severely shorten effective service life. If excess rope accumulates on the floor, straighten it to remove loops & eliminate tension without introducing torque or a kink.
3. Introduce the cable end into slot positioned on the drum, and then into pocket "A."
4. Fold the cable around wedge "B."
5. Secure the cable and wedge in the slot by pulling firmly.



### **CAUTION**

**For a correct assembly, it is necessary to have a minimum pre-load of 5% of the cable breaking force. The cable breaking force depends on the diameter and of the cable type, and it must be indicated on the cable certificate.**

6. Slowly rotate the hoist while applying tension on the cable in front of the boom. Wear heavy leather gloves and wrap rags around the cable to wipe off any dirt from the cable. Keep hands away from the sheaves and hoist drum while the cable is moving.
7. After two turns of the drum, stop the hoist and push the cable into the drum groove if it has come out.
8. Slowly rotate the drum until the first layer of cable is on the drum. If any gaps between the rope appear, back up the hoist and rewind. There must be no gaps in the first layer.
9. After the first layer is on the drum, the hoist may be turned a little faster until the remainder of the cable is installed.
10. Leave about 40 feet (12 m) of cable on the ground to install the sheave block. The sheave block must be used for cable preloading to ensure enough rope can be spooled off the hoist drum. See the *Operation Section* for instructions on reeving and wedge socket attachment.
11. Install the cable retainer pins and cotters in the tip sheave plates.
12. For the cable preloading, set the outriggers and attach a load of about 3000 pounds (1300 kg). EXTEND the boom fully. Position the load at a 10-foot (3 m) load radius over the side of the crane. HOIST UP and LOWER the load 3 times, and check winding of the rope on the hoist.
13. Attach about 8000 pounds (3600 kg) and repeat. Be sure that the cable winds evenly.
14. Never lift more than the rated load on the Capacity Chart for the parts-of-line and type of wire rope being used.
15. Lubricate the cable as recommended in the *Wire Rope Lubrication* section. Inspect, maintain, and replace the cable in accordance with ASME B30.5, Section 5-2.4.

## CONTROL AND HYDRAULIC SYSTEM

The IC-400 control system is a pilot-actuated hydraulic system that is supplied with flow by two variable displacement pumps. The pumps are mounted on and driven by the transmission and supply flow on demand. The control joysticks are single axis levers mounted on each side of the operator seat. The pilot joysticks will only be provided with pilot pressure and be able to transmit that pilot pressure to the control valves when the seat switch and the ARM command are activated.

The pump on the curb side of the machine, **P1**, supplies the three-spool upper control valve mounted on the turntable. This valve controls the hoist, boom extension, and the boom topping functions.

The pump on the road side of the machine, **P2**, supplies the outrigger control valve, lower control valve, braking, and steering circuits. The lower control valve is located below the operator station mounted to the chassis. The outrigger control valve is mounted inside the chassis on the road side of the machine. The braking and steering circuits are sourced through the priority manifold, which is mounted inside the chassis on the curb side of the machine.

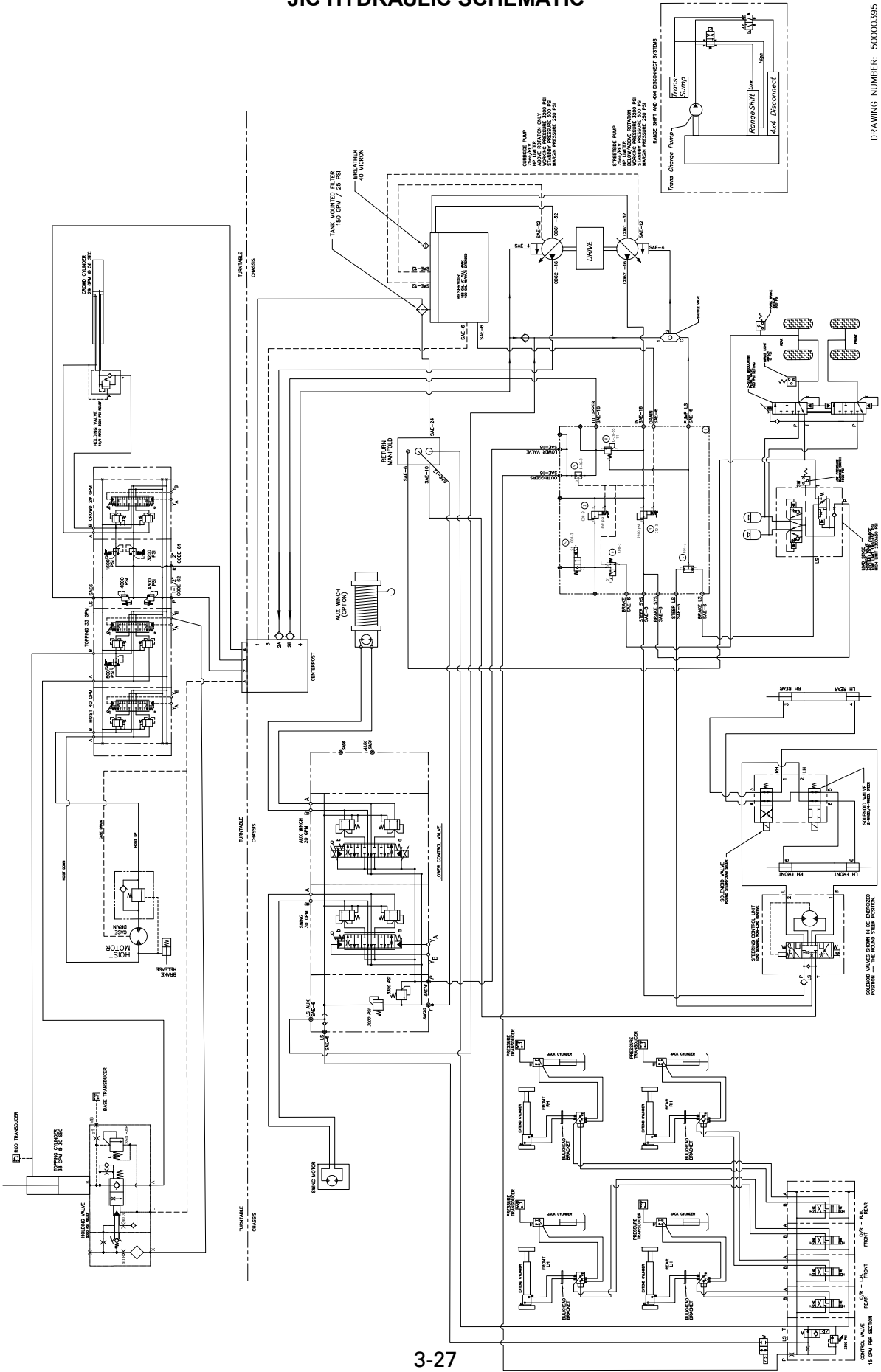
The **P2** pump flow is also passed through the hydraulic swivel and combined with the flow from **P1** to supply the upper control valve.

If the brake system pressures are low, the unloading valve shifts and allows flow into the brake system accumulators. The two accumulators are separated in a front/back split, such that each provides fluid either to the front or rear brakes. Flow and pressure to the wet disc brakes is controlled by a valve directly connected to the foot pedal in the cab.

The schematic of the hydraulic system is shown on the following page.

JIC HYDRAULIC SCHEMATIC

IC-400-B J.I.C. HYDRAULIC SCHEMATIC



DRAWING NUMBER: 50000395

## ELECTRICAL AND CONTROL SYSTEM

The electrical and machine control system of the IC-400 is built utilizing *J1939 CAN* technology and consists of three major wiring harnesses that connect the machine's sensors, modules, and devices together.

Located in the operator's compartment are two display units; the main machine display and the RCL display. Also in the cab are the vehicle fuse and relay box. There is a single wiring harness that connects the devices within the operator's compartment to two electrical bulk head connectors that are located at the RH side of the operator's compartment. These two bulk head connectors are the interface point for the electrical system between the operator's compartment and the rest of the machine.

The harness that runs the length of the chassis connects sensors and modules to the CAN network of the machine. At the front and rear of the machine, the harness connects to pressure transducers attached to each outrigger cylinder. In the center of the machine there is one control module that is mounted on the curb side of the turntable; this I/O module controls the solenoids, lights, and the other electrical components of the machine *below rotation*. On the top of these control modules are status indicator lights that can aid in troubleshooting. Other electrical components that are located below rotation, and under the dash of the operator's compartment include:

1. **Brake Light Switch** – attached to the brake pedal modulating valve; supplies current to the brake light, when the brake pedal is engaged
2. **Brake System Pressure Switch** – attached to the brake accumulator charging valve; monitors the brake system pressure, and when necessary, demands pressure from hydraulic system to change the brake system
3. **Machine Level Sensor** – located below the slewing bearing; monitors the machine's level status
4. **Steer Position Sensors** – located in each steer cylinder, integral to the axles; used to indicate when the wheels are straight, to allow for steer-mode change of state
5. **Outrigger Enable Valve** – located in the outrigger control valve; diverts the load sense signal to the pump through common shuttle valve at the inlet of the lower control valve, when outrigger function is demanded
6. **Park Brake and Arming Valves** – located in the priority manifold on the curb side of the chassis; solenoid-operated valves that allow hydraulic pressure to be transmitted to the Park Brake; equipped with pilot-controlled valves (when these function are desired)
7. **Range Shift and 4x4 Disconnect Solenoids** – located on the curb side of the chassis; controls the hydraulic logic to operate the range shift and 4x4 state of the drivetrain.
8. **Electrical Interface with the Slipring** – transmits electrical communication to/from above rotation
9. **Dump Valve** – located on the curb side of the chassis; blocks the pilot supply pressure for the HOIST UP, boom TOPPING UP, and boom EXTEND functions when an FKO (Function Kick Out) or A2B condition is identified by the machine's RCL system
10. **Outrigger Cylinder Pressure Transducers** – one mounted on each O/R cylinder; transmits pressure readings to the central system of the machine
11. **Steer Mode Control Valves** – located inside the left frame rail; controls the hydraulic flow path for the three modes of steering operations
12. **Horn** – located in the chassis, on the front, right-hand side of the machine; creates an audible blast when the horn button is actuated by the operator
13. **Back-Up Alarm/ Outrigger Alarm** – located on the rear plate of the chassis; contains two different tones of audible alarming: 1) when the machine is put into REVERSE, and 2) when the outriggers are being deployed

Finally, the below rotation harness connects to the engine for communication to and from the engine through the use of *J1939 CAN* communication protocol.

The harness that connects to the electrical slipring above rotation connects the sensors, modules, and lighting above rotation to the CAN network of the machine. At the top of the turntable is a third control module for the machine. This I/O module collects and transmits the signals and communication for the above rotation components, including the components for the RCL system. Electrical components' connects above rotation include:

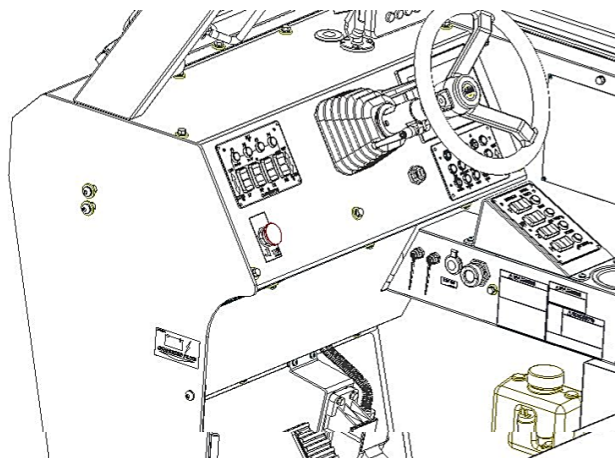
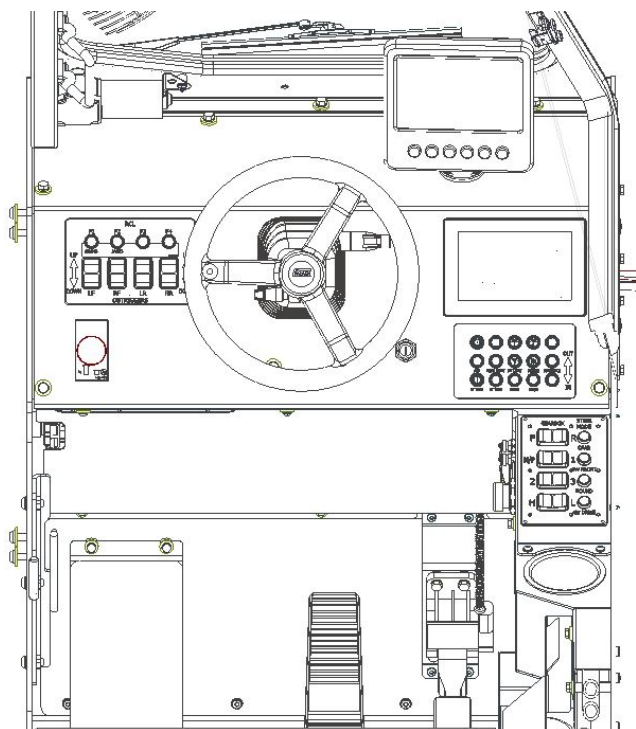
1. **Swing Position Sensor** – located in the slipring itself; transmits data to the above rotation control module on the CANOPEN network for swing angular position of the boom
2. **Cable Reel** – mounted on the side of the boom; transmits data for boom angle and reel rotations, which is used for computing boom length/load radius
3. **Anti-Two-Block Switch** – located on the boom tip; provides feedback when the load is two-blocked
4. **Above Rotation Lighting** – optional lighting for strobe lights and work lights
5. **Drum Rotation Sensor** – located as part of the hoist; provides rotational feedback to the control system and joystick-mounted thumper, that is integral to the hoist control joystick
6. **Boom Angle Inclinometer** – located integral to the cable reel; transmits the measured angle of the boom

## CONTROL SYSTEM AND ENGINE FAULTS

The control system of the IC-400 routinely checks itself and the rest of the system for potential problems at start-up and during operation. When a fault is detected within the control system or within the engine operation, an error code message will be displayed on the main display, as well as the RCL display in the operator's compartment. These faults are often a connection issue, calibration issue, or fault-related to the engine operation.

Prior to attempting to trace or troubleshoot, the system/machine should be shut off and re-started several times, as the faults may clear themselves if they are related to a start-up issue. If the fault persists, troubleshooting steps should be taken based off of the direction provided by the fault(s) that are being displayed.

The level sensor is calibrated at the factory and should not need recalibration in the field. If the level sensor is replaced in the field, then a recalibration will need to take place. See the instructions that come with the sensor.



## STEERING SYSTEM

The steering system is also shown in the hydraulic schematic. The IC-400 steering system is a load-sensing, demand-type system that takes only as much flow as needed when steering, and directs the excess flow to the control valve for boom and outrigger functions.

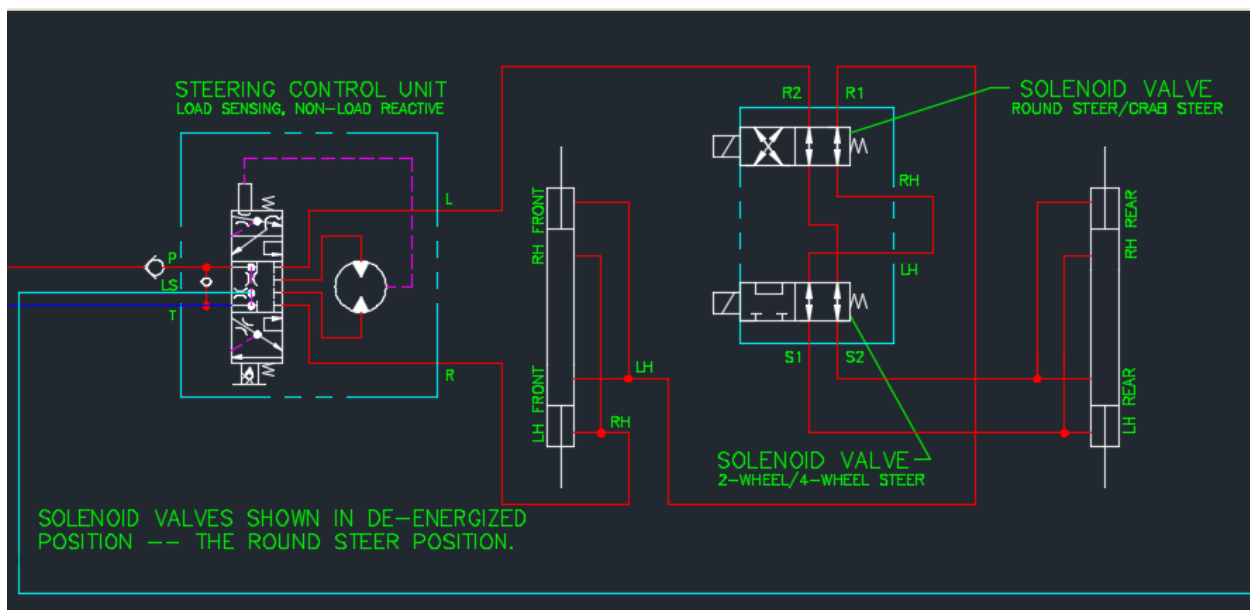
Oil from pump **P2** goes into the priority valve at port **P**. When no steering is required, the entire flow goes through the priority valve and leaves through other ports, to the outrigger control valve or the lower control valve, based on the load-sense driven requirement for flow.

When the steering wheel is turned, the load-sensing line signals the priority valve to divert the required amount of oil to the steering control unit to meet the steering system requirements. Since the amount of oil required for steering is usually a small portion of the pump output, the lower control valve is always operational while the unit is being steered. Crane operation speed is reduced such a slight amount, it is usually not noticed.

The steering control unit is non-load reactive. This means that bumps, curbs, and obstacles cannot change the steering angle and are not felt in the steering wheel. It also means that the wheels do not recenter when the steering wheel is released. The steering wheel must be turned back to center at the end of a turn.

The steering system pressure was set at 2060 PSI (142 bar) at the factory, and should not need adjustment.

The three steering modes are selected by switches on the drivetrain control panel and activate the automatic alignment system. Electronic proximity sensors and logic controls delay the switching of the steering mode until the wheels are centered.



## CARE OF HYDRAULIC OIL

The hydraulic system contains many highly pressurized, precision components. To protect the system, it is very important to keep the hydraulic oil clean, within proper temperature range for the oil specification, and to the proper fill level.

The IC-400 is equipped with a suction strainer, a breather filter, a single 10-micron return-line filter and a 156-gallon tank (590 L). The filter must be changed 500 hours or 6 months maximum.

The filter is accessible on the top of the hydraulic tank. Clean the filter and the surrounding parts before changing, to prevent dirt from getting into the open filter housing.

### **NOTICE**

**Machine damage or oil spills are possible. Internal damage can occur if pump is starved of fluid.**

Remove the filter element and catch any hydraulic oil in a clean container. Pour the remaining oil out of the old elements into the clean container. Inspect the oil for water and excessive contaminants. If water is found, the oil should be changed in the reservoir and purged out of the cylinders. If excessive particles are found, the source should be located and fixed, and the oil should be purged.

Lubricate the new element seal and install the new element. Run the engine and check for any leaking around the seal.

The hydraulic oil should be changed every 1000 hours or once a year, whichever is sooner. Retract the telescope, boom and outrigger cylinders. Remove the oil and dispose of it properly.

Remove the breather from the top of the tank. Clean the element with solvent and compressed air. Open clean-out cover on the tank. Clean the tank with solvent and compressed air.

The suction strainer is located at the bottom of each of the two suction hoses. These can be accessed by removing the clean out cover on the top of the tank and then pulling each suction hose, from the inside, up and out of the tank. The strainer has a reusable element. To service, remove the suction hose from the fitting connected to the suction hoses. Clean with compressed air. Reassemble the strainer and fittings to the suction hoses and return them to the bottom of the tank.

Replace the filter, as described previously, and refill the tank with new hydraulic oil that meets the specifications in the table below. Start the engine and run it at low idle for 15 minutes to filter the new oil. Then cycle all of the hydraulic cylinders at low idle and low pressure. Retract all cylinders. Add hydraulic oil until the level on the tank sight gage is just below the **FULL** mark.

### **HYDRAULIC OILS FOR IC-400**

<b>AMBIENT TEMP RANGE:</b>	<u>-40° to 75°F</u> (40° to 24°C)	<u>-15° to 110°F</u> (26° to 43°C)	<u>50° to 130°F</u> (10° to 54°C)
<b>POUR POINT:</b>	-40°F MAX (-40°C)	-15°F MAX (-26°C)	0°F MAX (-18°C)
<b>VISCOSITY INDEX:</b>	140 MIN	95 to 100	95 to 100
<b>VISC. SSU @ 100°F:</b>	200 MAX	230 MAX	340 MAX
<b>SSU @ 210°F:</b>	44 MIN	47 MIN	53 MIN
<b>EXAMPLES:</b>	MOBIL DTE-13 MOBIL UNIV.-ATF TEXAMATIC TYPE F TEXACO HD 46	MOBIL AW-46 MOBIL DTE-25 CONOCO SUPER 46 TEXACO HD 68	MOBIL AW-68 MOBIL DTE-26 CONOCO SUPER 68

**OTHER REQUIREMENTS:** Must contain rust and oxidation inhibitor, and antifoam & antiwear agents. Must pass Vickers Vane Pump Test.

The IC-400 is factory-filled with hydraulic oil for the -15° to 110°F (-26° TO 43°C) range. If significant portions of run time are spent operating below 20°F (-7°c) or above 100°F (43°C), the oil should be replaced with an extreme temperature oil.

#### **CAUTION**

**Never add kerosene or other thinners to hydraulic oil. These fluids have low aniline points and consequently will cause rapid deterioration of certain packings and seals in the hydraulic system.**

#### **CAUTION**

**Serious damage to the pumps will result if it is run with insufficient oil level in the reservoir or if the pumps are allowed to cavitate.**

Observe the operation of the machine. If the oil is too cold (below 40°F (5°C)), the machine will operate at slower speeds due to the increased viscosity of the fluid. It should be warmed up further to prevent damage to hydraulic components before sustained hard work is attempted. If the oil is too hot (above 210°F (99° C)), bleed-by leakage will increase, pump efficiency will go down, and moving parts may not be properly lubricated. If operating temperature continues to be excessive, rapid deterioration of the oil will result, and moving parts & seals will wear more quickly. The cause of the excess heat should be determined and corrected. The hydraulic temperature in the tank can be monitored on the dash display.

## REMOVAL OF AIR FROM HYDRAULIC CIRCUITS

To remove air from hydraulic circuits, perform the following steps:

1. Start the engine.
2. Raise and lower the boom, minimum five times. Ensure that the cylinder travels full stroke.
3. With the boom retracted and elevated to at least 65°, raise and lower the hook at least once with the hoist.
4. Extend and retract the boom, minimum five times.
5. Swing the turret left, one full revolution. Swing the turret right, one full revolution.
6. Extend and retract each outrigger a minimum of five times.
7. With the crane on outriggers, steer the crane wheels fully left and right three times in each steering mode.
8. Check the level of oil in the hydraulic reservoir and add more if necessary.
9. Set the crane on outriggers. With the boom about halfway extended and about 45° elevated, lift a load near maximum capacity using the hoist. Raise the boom an additional 10-15°. Extend the boom. Check for “spongy” operation.
10. If necessary, cycle functions again to remove remaining air.

## HYDRAULIC SEALS

### W A R N I N G

**Do not check for hydraulic leaks with hands. If a mist of hydraulic oil is noticed around a line or component, use cardboard or other material to check for location of leak. High pressure fluid leaking from a small hole, can be almost invisible, yet have enough force to penetrate the skin. If injured by escaping fluid, see a doctor at once. Serious reaction or infection can occur.**

All hydraulic fittings and hose connections should be kept tight to prevent loss of fluid from the system and unnecessary dripping from the machine. Some hydraulic fittings on the IC-400 crane use o-ring seals, and if tightening the fitting fails to stop the leak, the o-ring should be replaced.

#### **Notes:**

1. When installing an o-ring fitting with an adjustable nut and washer, be sure to back off the nut, washer, and o-ring as far as possible, before threading the fitting into the port. Then turn the fitting into the port as far as possible with fingers, and turn it backward until it is oriented properly. Torque the nut with a wrench, while holding the fitting with another wrench.
2. Lubricate all seals before assembling.
3. Take care not to over-tighten pipe threads.
4. Do not use Teflon tape to seal pipe threads. Loctite-type (anaerobic) sealant is preferred.

Leaks in component parts, such as pumps, valves, and motors that cannot be stopped by tightening bolts, can usually be stopped by replacing the seals in the component. Seal and packing replacement is the only maintenance which owners should attempt on component parts, unless they have a well-equipped shop with mechanics trained in hydraulic component overhaul.

Leakage in the pump suction line may not cause oil to appear externally, but may allow air to enter the line during operation. The air entrained in the oil will cause pumps to be noisy, and if allowed to continue, can damage the pump. If a pump becomes noisy, immediately check the fluid level in the reservoir and be sure all suction fittings are tight. If noise continues, squirt hydraulic fluid on the suction connections. Listen for a change in the noise and watch for oil being sucked into a small opening in the connection. When the reservoir is full and all suction connections are tight, most pump noises will disappear. If they do not, a worn or faulty pump is indicated. On a routine basis, all hoses should be checked for wear, deterioration, and physical damage. Defective hoses should be replaced to provide maximum economy for the user.

## PRESSURE SETTINGS:

The hydraulic system is divided into three pressure circuits, each having its own protective relief valve. The functions operated by the control valve sections require different pressures for different functions. These are covered in sections below:

1. **Hoist, Boom, & Swing Circuit** -- 4000 PSI (276 bar) at full flow
2. **Outrigger Circuit** -- 3000 PSI (207 bar) at full flow
3. **Brake Circuit** -- 2925 PSI (202 bar) at full flow (Non-adjustable, see *Brake Maintenance* section)

## BRAKE SYSTEM CIRCUIT:

The pressure is set at the factory and should not require adjustment. The pressure can be checked as described in the *Brake Maintenance* section.

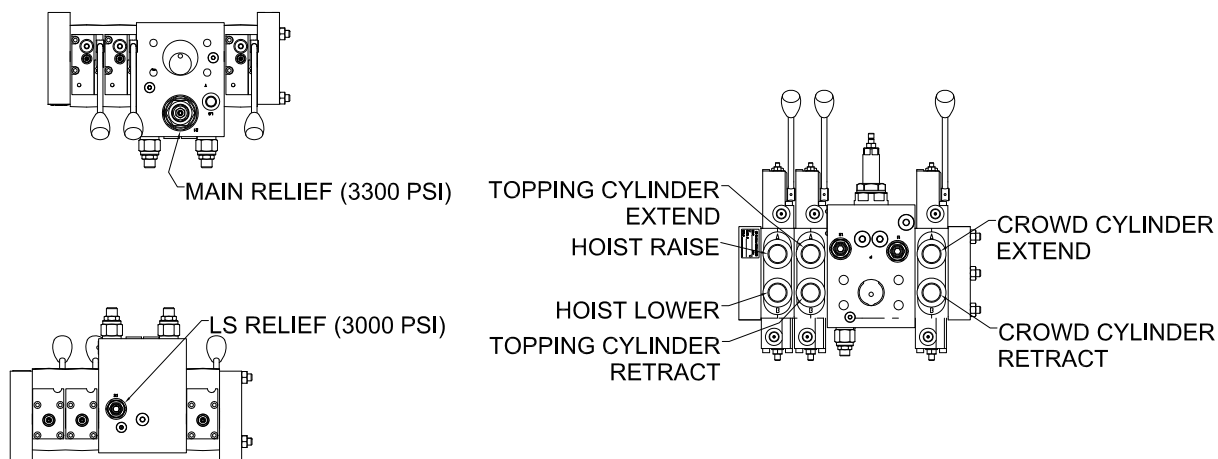
## BOOM LIFT CYLINDER HOLDING VALVES:

A holding valve is mounted into the base of the boom lift cylinder barrel. This valve is designed to hold the boom in position should loss of power or pressure line failure occur.

To check the boom lift cylinder holding valve, set the outriggers, place the boom in the horizontal position over the front of the crane, and raise rated load about 6 inches (15 cm) above the ground using the boom lift cylinder (not the hoist). The best load for this test is the rated load at the 20-foot (6 m) load radius, with outriggers extended and the boom over the front. Turn the engine OFF and put the key in the ON position. Actuate the BOOM DOWN valve spool on the upper control valve. If the boom moves down, a holding valve may be malfunctioning or a boom lift cylinder may have leakage past the piston seal.

## WARNING

**Before working on the holding valves or plumbing to the boom lift cylinders, always relieve trapped pressure. Lower the boom fully, turn off the engine, turn on the key and cycle the BOOM control.**



## **TELESCOPE CYLINDER HOLDING VALVE:**

There is a single telescoping cylinder on the IC-400 and it has its own holding valve. This valve is designed to hold the boom in position, should loss of power or pressure line failure occur.

The holding valve should be checked with the boom elevated to the maximum angle and the boom extended to a 10-foot (3 m) load radius. The boom should be about 50 feet (15.24 m) long in this configuration. A 36,000-pound (6300 kg) load on a 4-part line is required for this test. Use the hoist to lift this load about 6 inches (15 cm) above the ground. The radius of the test load should be within the rating on the capacity chart. Use great care to prevent the load from hitting the crane.

Turn the engine OFF, put the key ON, and pull the TELESCOPE RETRACT valve spool, on the upper control valve. If the boom retracts, the valve should be adjusted.

To adjust the holding valve, loosen the lock nut on the adjusting screw and tighten screw until unpowered movement stops. Retighten the lock nut to hold the proper adjustment. The boom will have to be lowered to make adjustments.

## BOOM SEQUENCE

The IC-400 uses a single extension cylinder to extend all three moving stages. The cylinder is a multi-stage design, and uses a chain system to proportionally extend and retract the second, third, & fourth stages together.

### BOOM CHAIN ADJUSTMENT

Study Illustrations 1, 2, and 3 on the following page, to understand the chain adjustment procedure. Proper adjustment is critical at time of boom assembly or scheduled maintenance.

**Initial adjustment:** Retract boom completely. The 4<sup>th</sup> stage extension and retraction chains determine the position of the 4<sup>th</sup> stage, relative to the 3<sup>rd</sup> stage. As shown in **Illustration 1**, ½" (13 mm)-clearance must be held between the 4<sup>th</sup> stage tip and 3<sup>rd</sup> stage tip. To increase this distance, loosen the retraction adjustment and tighten the extension adjustment. To decrease this distance, loosen the extension adjustment and tighten the retraction adjustment.

**Final adjustment:** Extend boom completely while horizontal, then slightly retract the boom to let the chains relax. Measure the inside chain drape at the center of the rear 3<sup>rd</sup> stage and 2<sup>nd</sup> stage windows, as shown in **Illustration 3**. See arrows in the windows for measuring locations. Measure the outside chains at midspan. Snug the 4<sup>th</sup> stage extension and retraction chains until the chain tightness allows the dimensions of approximately 1" (25 mm) and 5" (127 mm), as shown in **Illustration 3**. Also snug the 3<sup>rd</sup> stage compensation chains to the dimensions of 1 1/8" (29 mm) and 3 7/8" (98 mm), as shown. Assure that the drape in each pair of chains is matched so each chain carries its share of the load. Run boom in and out a few times and recheck all of the above dimensions. After proper settings attained, retighten the adjustment lock nuts.

The number "3" shown in the small windows on the bottom of the 2<sup>nd</sup> stage and base boom, show the adjustment is about midrange. These numbers run from 1 to 6, in 1" (25 mm)-increments. Numbers in these windows are approximate adjustments and cannot be used for final adjustments. Please note the importance of the dimensions stated above, taken at the large side windows.

# BOOM CHAIN ADJUSTMENT

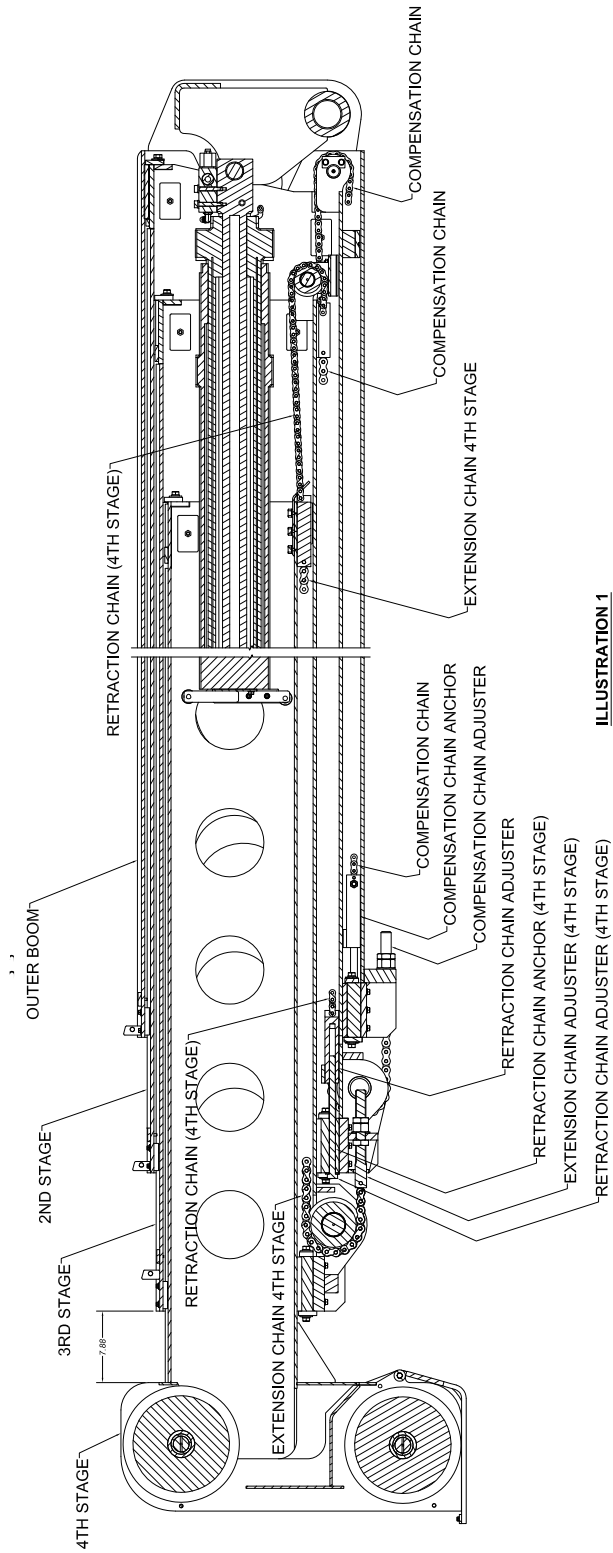


ILLUSTRATION 1

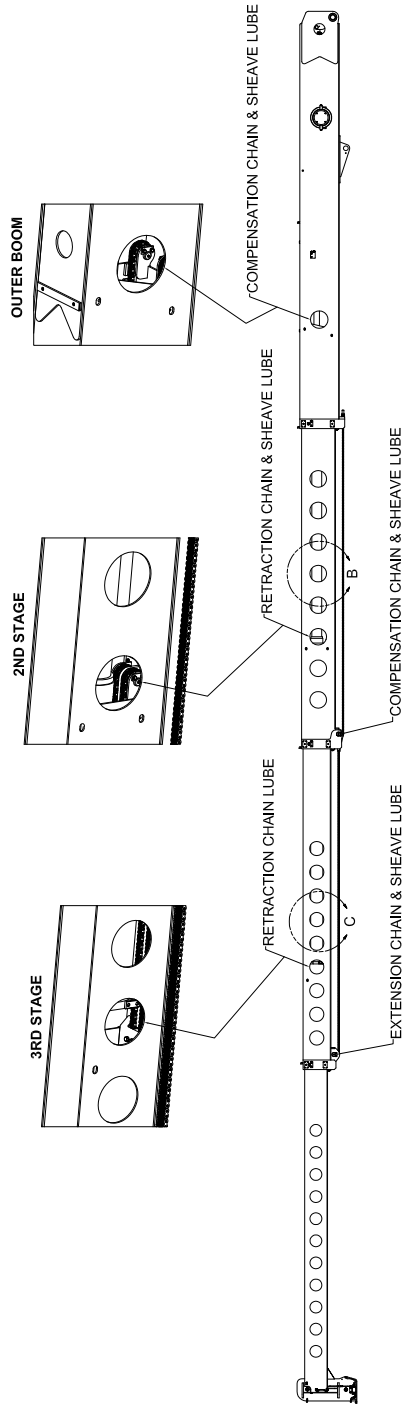


ILLUSTRATION 2

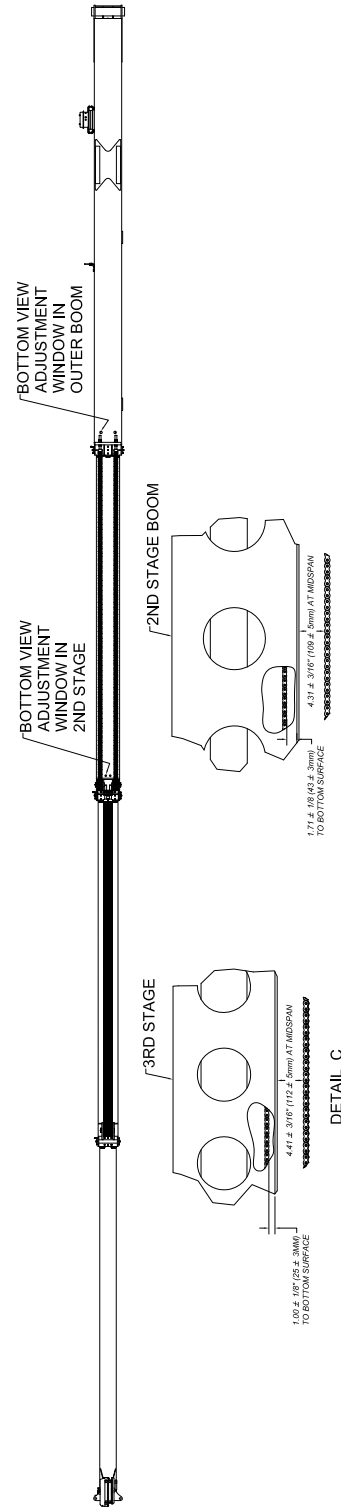


ILLUSTRATION 3

DETAIL B SCALE 125

DETAIL C SCALE 125

## ENGINE MAINTENANCE

Refer to the Engine Manual for additional engine maintenance. The air filter can be accessed outside of the engine compartment on the left-hand side of the machine. The oil dip stick can be accessed inside the engine compartment on the right-hand side of the machine. Access to the engine oil filter can be found inside the engine compartment on the right-side of the machine. The primary and secondary fuel filters can be accessed inside the engine compartment from the left-side of the machine. For additional engine maintenance, each panel on the engine enclosure can be removed for easy access. The turntable may need to be rotated to access the top-side of the after-treatment, and top-side engine for maintenance or repairs.

### AIR CLEANER SERVICE:

Check the air filter restriction visual indicator weekly with the engine running. If the indicator is in the *Replace Zone*, replace the primary and secondary filter. If the filter has not been changed for over 1000 hours, replace the filter regardless of the restriction indicator reading or dash icon.

### COOLING SYSTEM:

Check the level of coolant in the radiator overflow tank daily. Add a mixture of antifreeze and distilled water to the overflow tank, as required, to maintain the coolant level. Check the radiator fins for dirt or debris daily and wash the fins with a pressure or steam cleaner every 50 hours, or as required. Check the antifreeze protection level every 500 hours. Every 2 years, flush the cooling system and replace the thermostat and coolant. Pressure-test the system as specified by the engine manufacturer.

### SPARE PARTS LIST:

A spare parts list (including oil filter, fuel filter, etc) may be found in the Parts Manual, under *Engine and Transmission Installation*.

### MAJOR ENGINE SERVICING OR OVERHAUL:

Major servicing or overhaul is beyond the scope of this manual. Consult authorized engine service manual or rely on an authorized engine service center.

## MECHANICAL ADJUSTMENTS

### FASTENERS:

All fasteners on the IC-400 should be checked and retightened if required, as a part of the preventive maintenance program. Particular attention should be given to the drive axle mounting bolts, pump mounting bolts, rotation bearing bolts, rotation gearbox bolts, winch bolts, bolts holding extension cylinder to 2<sup>nd</sup> stage and 3<sup>rd</sup> stage. All bolts used in assembly are heat-treated **Grade 5** or better. Torque the wheel nuts to 475 ft-lbs (645 Nm). Torque the rotation bearing nuts to 900-1000 ft-lbs (1220-1355 Nm) while holding the bolts stationary. Alternatively, torque the rotation bearing bolts to 1200-1300 ft-lbs (1625-1760 Nm) while holding the nuts stationary. Note, these inspection torques are less than installation torques. See the *Turret Sub-assembly* and *Turret Installation* in the Parts Manual for installation torques.

### ROTATION GEARBOX:

The rotation gearbox assembly is attached to the chassis top plate by four cap screws. It is held in proper engagement with the external teeth on the bull gear by three setscrews. It is further restrained from torsional movement by three bolts on each side of the gearbox mounting flange. The gearbox should be adjusted with the boom centered over front of the chassis. This centers the gearbox pinion on the "high side" of the bearing gear teeth. Adjust the gearbox inward until there is light contact (.008/.013-inch clearance) between pinion and bull gear teeth. Metal shavings will occur if too tight. Swing function will appear loose if too much gap. Retighten the four mounting bolts and the six side bolts.

## RELIEVING HYDRAULIC PRESSURE

### **WARNING**

**Failure to relieve trapped hydraulic pressure may result in high-pressure fluid penetration of the skin. If injured by escaping fluid, see a doctor at once. Serious reaction or infection can occur.**

Relieve all trapped hydraulic pressure before disconnecting lines to hydraulic parts. Note that cycling the button pad or joystick controls with engine off will not release trapped pressure. The hydraulic system requires pilot pressure to move the valve spools.

1. For steering system, turn steering wheel a few degrees each direction with engine off. This may require a great deal of force.
2. For brake system, pump the brake pedal with the engine off and the key on. Pump the brakes even after the brake warning icon appears on the dash display.
3. For outriggers, manually move the spools in the control valve using the override ports at the ends of the solenoids and the master override simultaneously.
4. For the boom swing, topping/luffing, telescope, and hoist functions, an override handle is provided. The boom swing spool is located on the chassis control valve. The other boom functions are located at the upper control valve mounted to the side of the turntable. Use the provided emergency handle or a screwdriver to manually cycle the valve spools, using the shaft at the end of each spool.

### **WARNING**

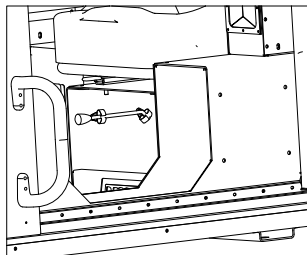
**Failure to relieve trapped pressure in the brake circuit, prior to disconnecting brake hoses (or load sensing hoses), may result in the brake system accumulators discharging pressure, which may result in injury due to escaping fluid.**

## MANUAL OVERRIDE OF HYDRAULIC FUNCTIONS

### **WARNING**

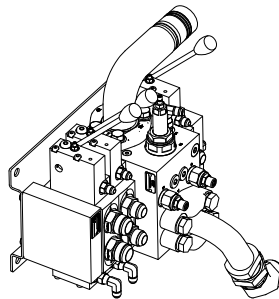
The Rated Capacity Limiter, anti-two-block system, outrigger alarm, and other systems will not function while using the manual overrides. Use manual overrides with extreme caution. In the event of a controls system fault, the following procedures may be used to lower a load, stow the boom, and retract the outriggers.

1. Turn off the ignition key.
2. To override the HOIST, TELESCOPE, and TOPPING/LUFFING functions:
  - a. Locate the override handle under the operator's seat. It looks like the figure below. If the handle is missing, an adjustable wrench may be used.



**Override Handle**

- b. Start the engine.
    - c. Using a ladder or steps, access the Upper Control Valve on the right side of the turret.
    - d. Put the handle on the small protruding shaft from a valve section, indicated in the figure below.

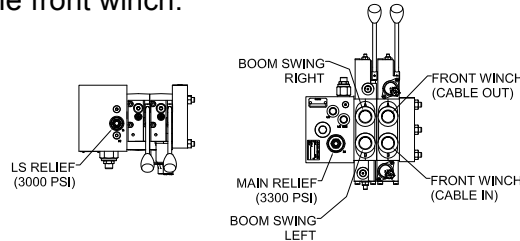


**Upper Control Valve**

- e. From left to right, the sections control the HOIST, TELESCOPE, and TOPPING/LUFFING functions. Each function must be ran independently.
      - f. If a load is on the hook, lower the hoist, retract the boom, or raise the boom to put the load in a safe location on the ground. Use extreme caution. The RCL will not stop the boom motion, and the anti-two-block system will not function.
      - g. Stow the boom by retracting the boom, raising the hook, and lowering the boom.
      - h. Turn off the crane.

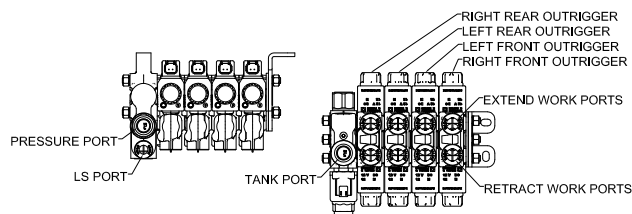
3. To override the boom swing/slewing:

- a. The Chassis Control Valve is located within the chassis under the operator compartment. If your unit has a front winch option, the other section on the lower control valve operates the front winch.

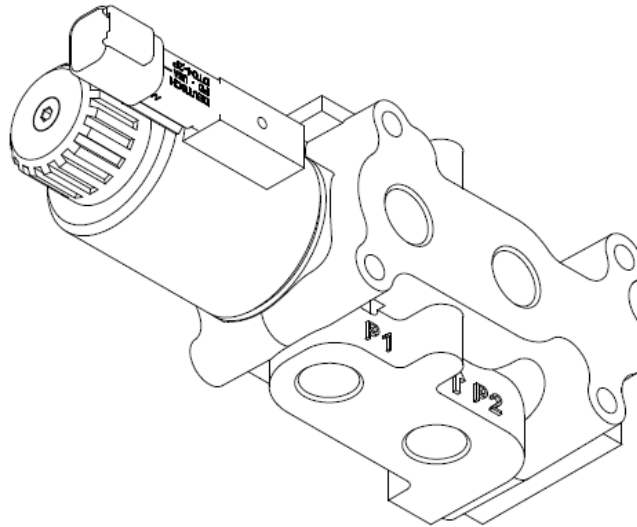


### **Chassis Control Valve**

- b. Locate the override handle under the operator's seat. If the handle is missing, an adjustable wrench may be used.
  - c. Start the engine.
  - d. Ensure that the park brake is set. Chock the wheels or put the machine on outriggers.
  - e. Put the handle on the small shaft protruding from the lower control valve. It will look similar to the overrides on the Upper Control Valve.
  - f. Swing the boom over the front of the crane. Use extreme caution. The RCL will not stop boom motion. Do not swing the boom from the front to the side, especially with a load on the hook or while on rubber. This may overload the crane.
  - g. Turn off the crane.
4. To override the outrigger functions:
- a. Locate the enable solenoid valve on the outrigger control valve. The outrigger control valve is located within the chassis on the inside of the left frame rail. The enable-solenoid-valve is indicated in the figure below.






- b. Disconnect the 2-pin electrical connector on the enable-solenoid-valve. Apply 12V to the pin with the white wire. Ground the pin with the black wire. This valve must remain powered to build pressure, to operate the outriggers.
- c. Each outrigger has a solenoid valve. Each valve section has 2 solenoids. Each solenoid has a 2-pin electrical connector. The white wires are 12V, and the black wires are ground.
- d. Ensure the parking brake is set.
- e. Start the engine.
- f. To raise outriggers, apply 12V and ground to each solenoid on the lower side of the outrigger control valve. From left to right, the valve sections control the right rear, left rear, left front, and right front outriggers.
- g. Turn off the crane.



### **Diverter Valve**

- h. Disconnect the 2-pin electrical connector on a Diverter Valve. Apply 12V to the pin with the white wire. Ground the pin with the black wire.
- i. On the Lower Control Valve, locate the outrigger valve section that corresponds to the Diverter Valve. From top to bottom, the valve sections control the right rear, right front, left front, and left rear outriggers.
- j. Start the crane.
- k. On the cab-side of the Lower Control Valve, apply power and ground to the solenoid corresponding to the Diverter Valve. The outrigger beam should now retract. Use extreme caution. The outrigger alarm will not sound.
- l. Turn off the crane.
- m. Repeat steps i – n for each outrigger beam.

## TORQUE DATA

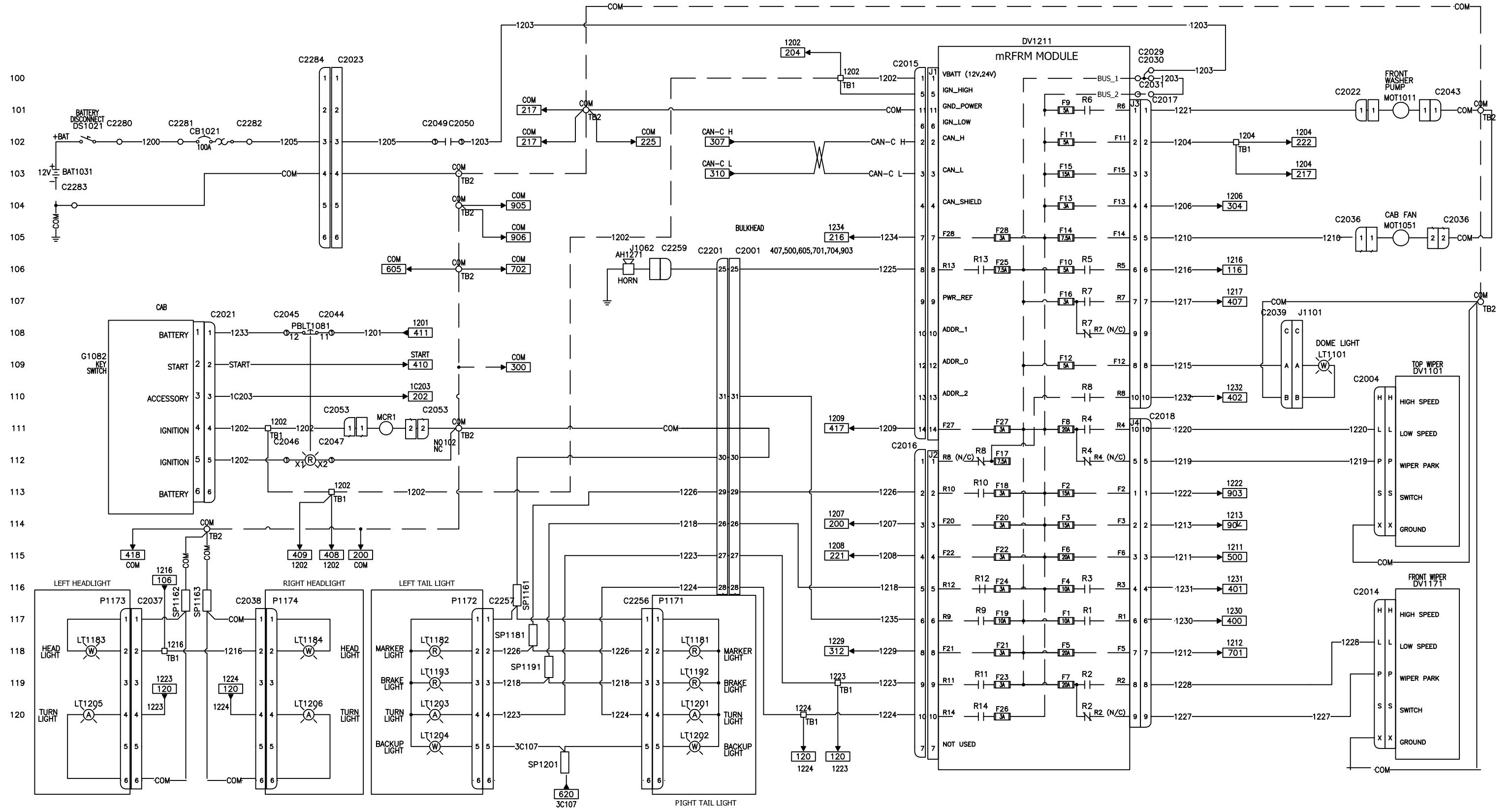
BOLT GRADE	SAE GRADE 1 OR 2	SAE GRADE 5	SAE GRADE 8
MARKING			
MATERIAL	LOW CARBON	MEDIUM CARBON STEEL Q & T	MEDIUM CARBON ALLOY STEEL Q & T
MINIMUM TENSILE STRENGTH	64,000 PSI (441 MPa)	120,000 PSI (827 MPa)	150,000 PSI (1034 MPa)
BOLT SIZE	RECOMMENDED TORQUE VALUES FT-LBS (N·m)		
1/4	5 (7)	7 (10)	10.5 (14)
5/16	9 (12)	14 (19)	22 (30)
3/8	15 (20)	25 (34)	37 (50)
7/16	24 (32)	40 (54)	60 (81)
1/2	37 (50)	60 (81)	92 (125)
9/16	53 (72)	88 (119)	132 (179)
5/8	74 (100)	120 (163)	180 (244)
3/4	120 (163)	200 (271)	296 (401)
7/8	190 (258)	302 (409)	473 (641)
1	282 (382)	466 (632)	714 (968)



### THE FOLLOWING RULES APPLY TO THE CHART:

1. Consult manufacturers' specific recommendations when available.
2. The chart may be used with coarse and fine thread fasteners lightly lubricated.
3. Increase torque by 20% when multiple tooth (shakeproof) lockwashers are used.
4. The torque values are given in foot-pounds (N·m).
5. Inch-pounds equivalent may be obtained by multiplying by 12.

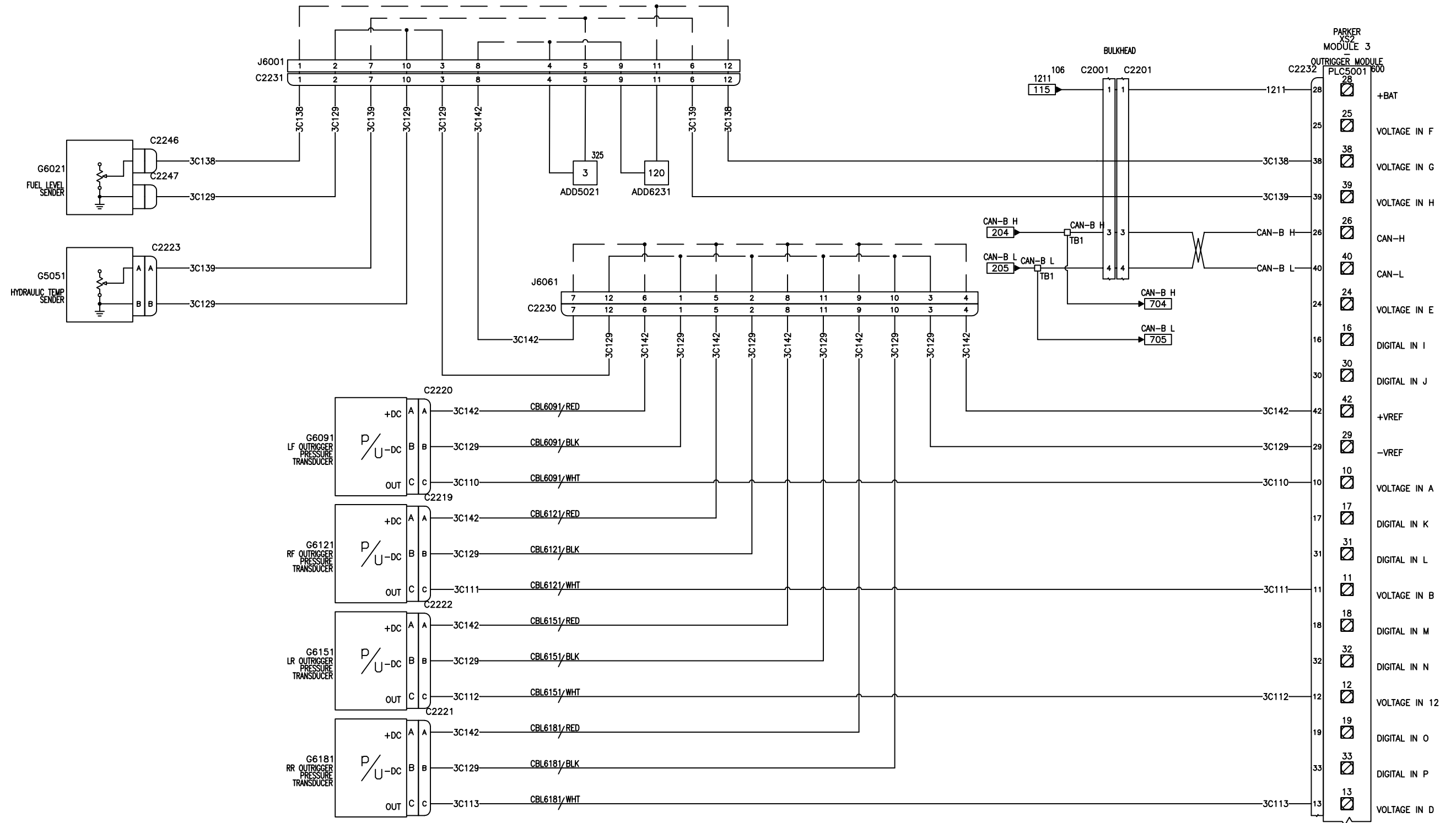
# IC-400-B WIRING DIAGRAM

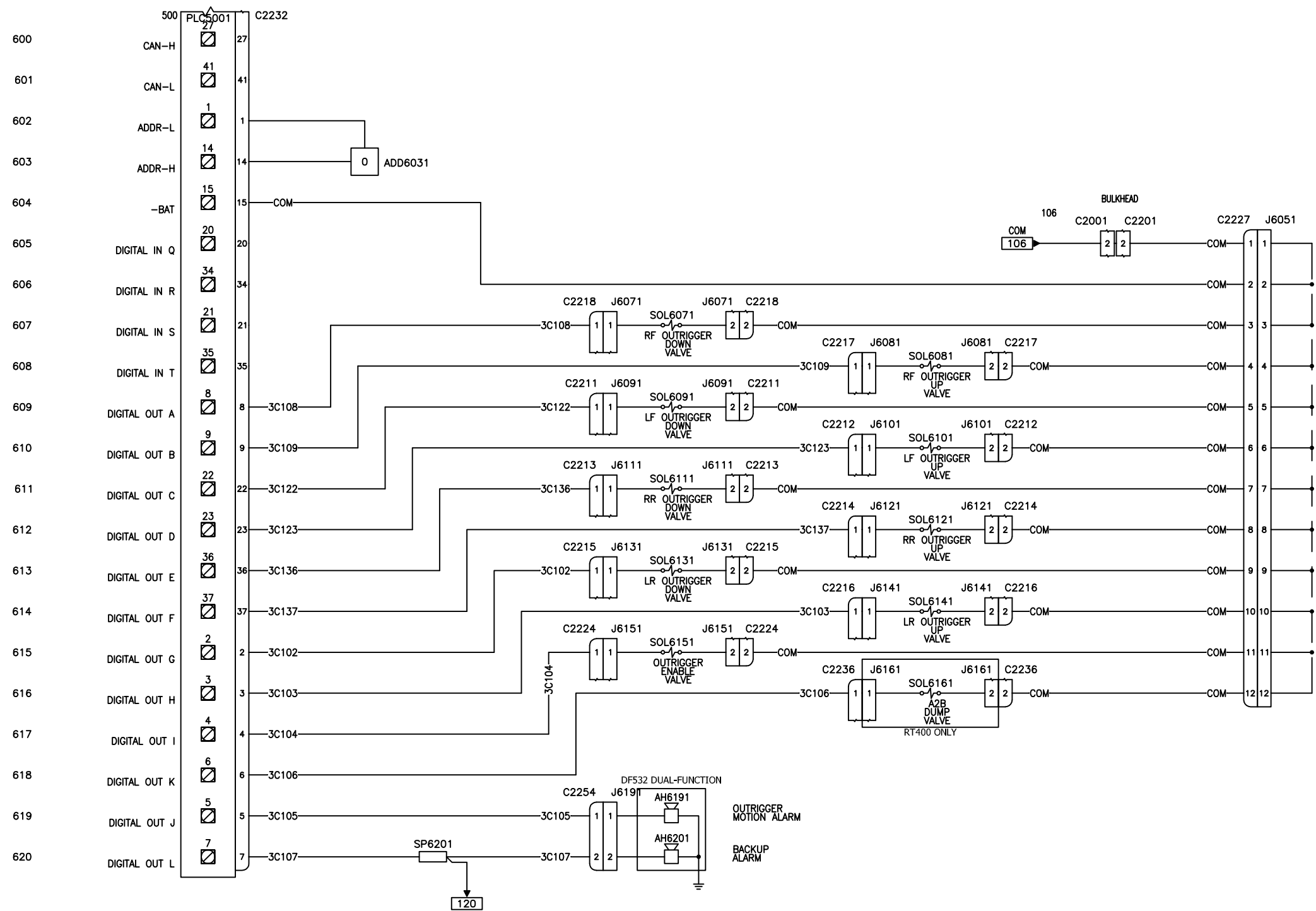


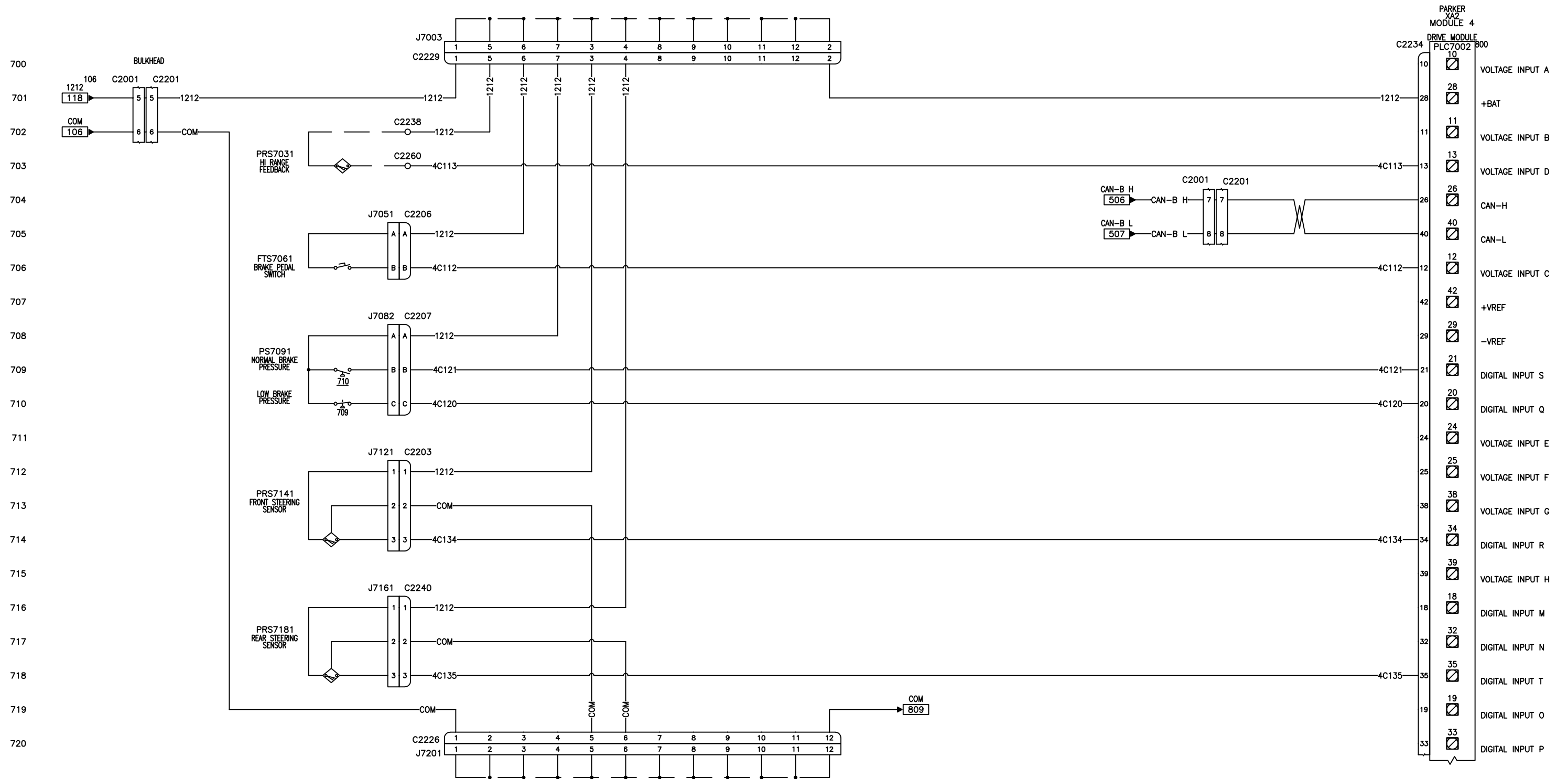


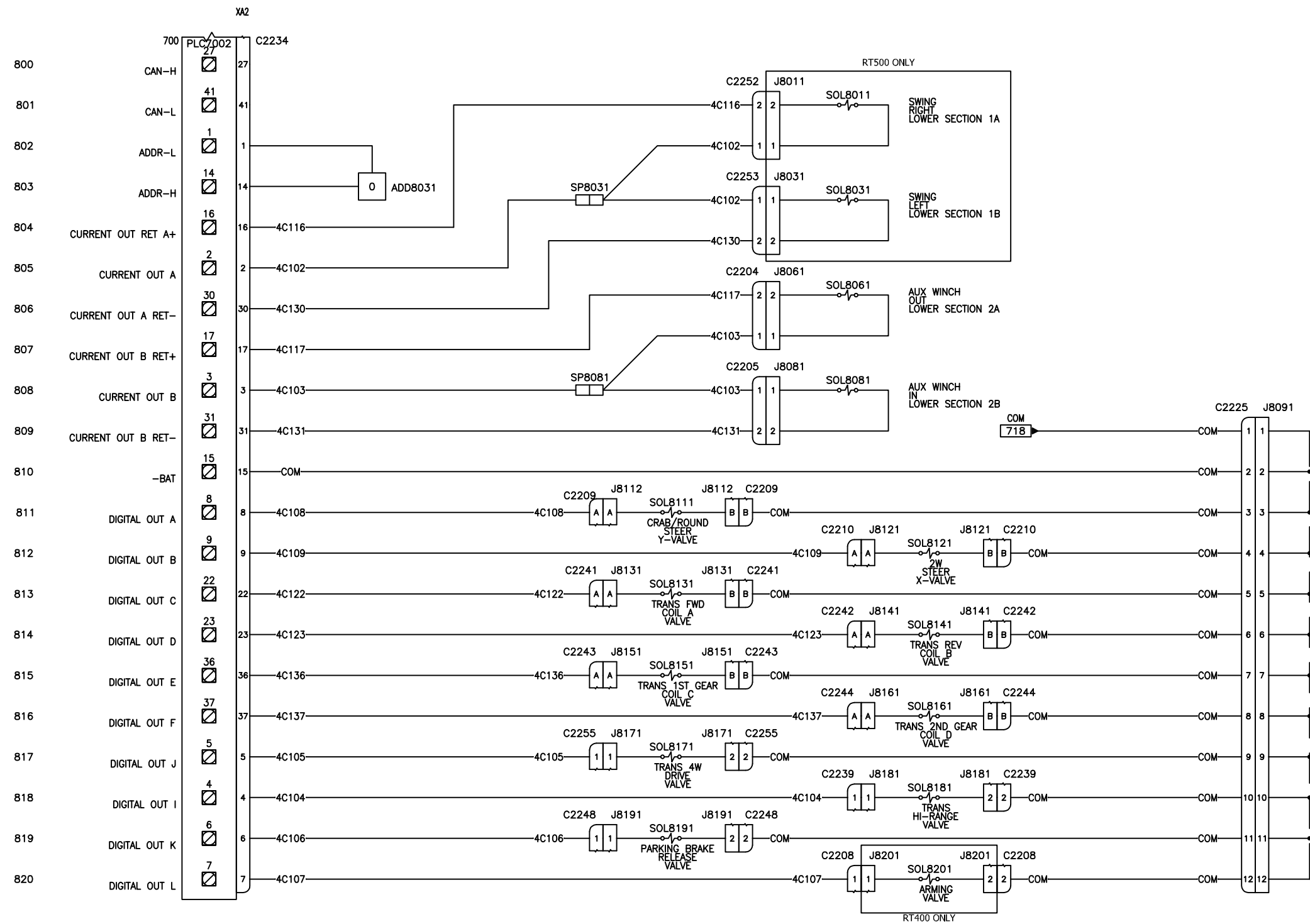




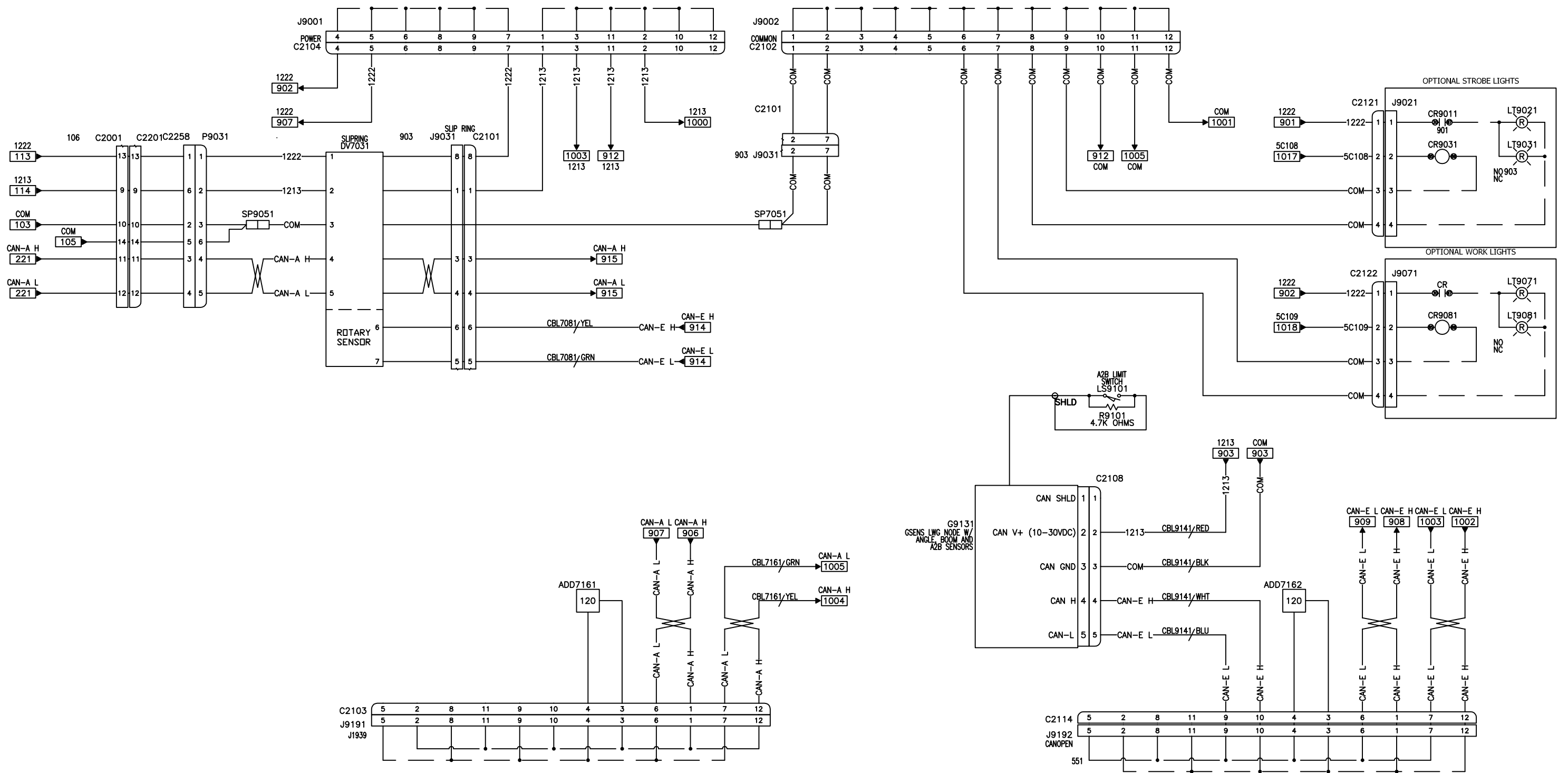






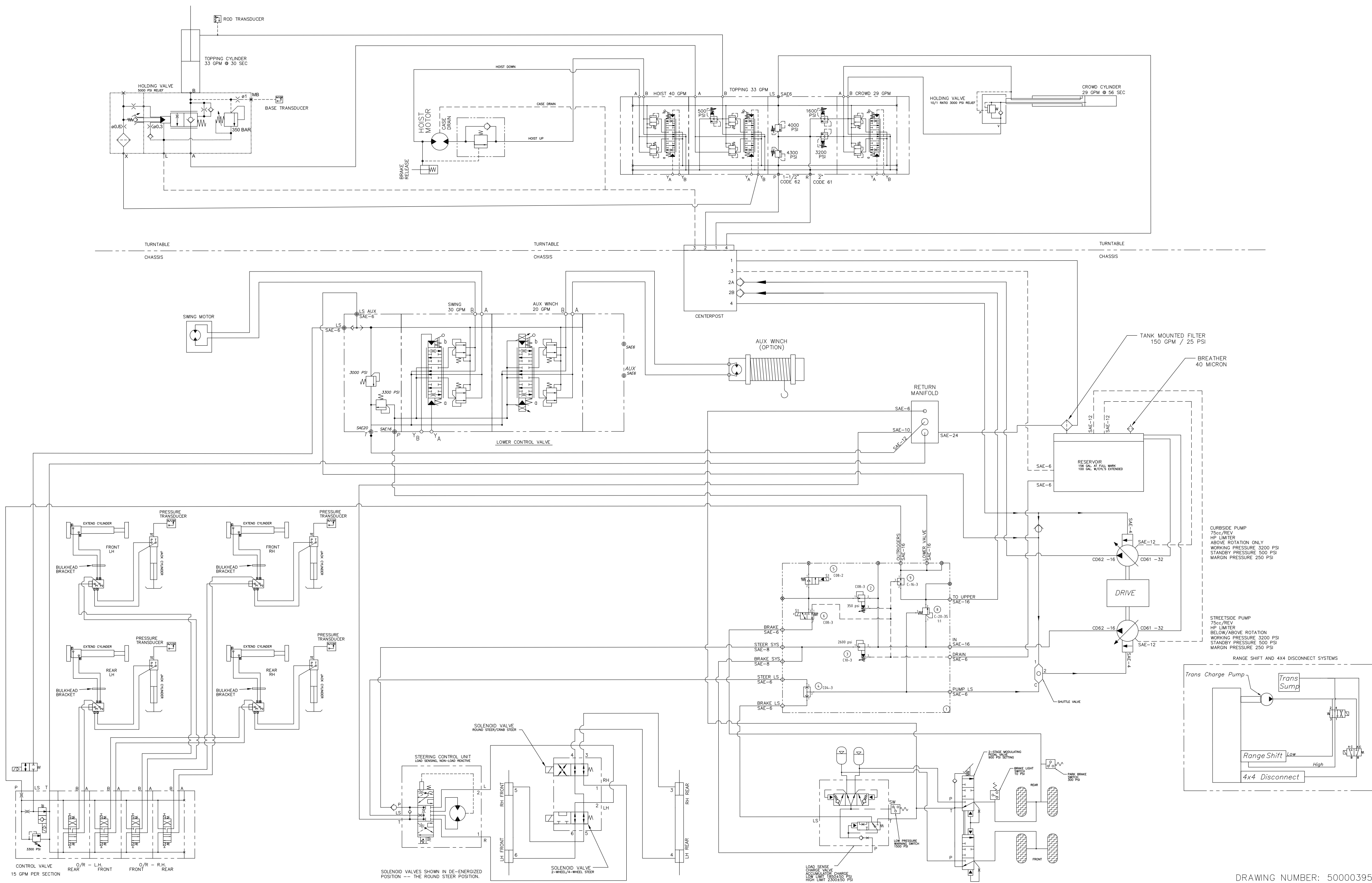


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## IC-400-B J.I.C. HYDRAULIC SCHEMATIC



DRAWING NUMBER: 50000395