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BRODERSON MFG. CORP.
LENEXA, KANSAS 66215

OPERATION AND MAINTENANCE MANUAL IC-20-1K

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 warranty herein made is extended only to the original purchaser from BMC and any subsequent purchaser who buys a BMC product as a new product. **WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, BMC EXPRESSLY DISCLAIMS THAT THE WARRANTY MADE HEREIN EXTENDS TO A PERSON WHO RENTS OR LEASES ANY BMC PRODUCT OR WHO PURCHASES ANY BMC PRODUCT AS A USED PRODUCT.** For purposes hereof, a BMC product shall conclusively be deemed "used" after the expiration of twelve (12) months from its placement in service, as evidenced by a duly completed and signed warranty validation certificate actually received by Broderson, or after such earlier time as it has been operated for more than one hundred (100) hours. This warranty shall not apply to ordinary wear and tear; negligence; acts of God; vandalism; abuse; misuse; neglect; accident or causes beyond the reasonable control of BMC, including without limitation fires, freezing, floods and other natural disasters; overloading; unauthorized altered, modified or changed products or parts; products or parts that have been improperly adjusted; or the Purchaser's neglect, negligence or willful damage; any products or parts not provided by BMC; any products or parts which have been repaired outside of BMC or an authorized distributor facility ; unless authorized in writing by BMC; or damages caused by failure to follow the maintenance procedures outlined in the applicable service manual or in technical bulletins issued by BMC.

BMC does not warrant any of its products to meet any state, local or municipal law, ordinance, code, rule or regulation. The purchaser must assume the responsibility for maintaining and operating the products which are the subject of this warranty in compliance with such of the foregoing as may be applicable, and BMC shall not be liable for the purchaser's failure to meet such responsibility.

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IN NO EVENT SHALL BMC BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER. THIS EXCLUSION OF INCIDENTAL AND CONSEQUENTIAL DAMAGES IS INTENDED TO BE INDEPENDENT OF ALL OTHER PROVISIONS OF THIS STATEMENT OF WARRANTY AND SHALL BE GIVEN FULL EFFECT NOTWITHSTANDING THE UNENFORCEABILITY OR FAILURE OF THE ESSENTIAL PURPOSE OF ANY OTHER PROVISION OF THIS STATEMENT OF WARRANTY.

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 CORP.

IC-20 INDUSTRIAL CRANE

INTRODUCTION

The Broderson IC-20 was designed and built to provide safe, dependable and efficient crane service. This, we assure, 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-20-1K** *Operation and Maintenance Manual* part number **990-30221**. Contact your Broderson service representative at:

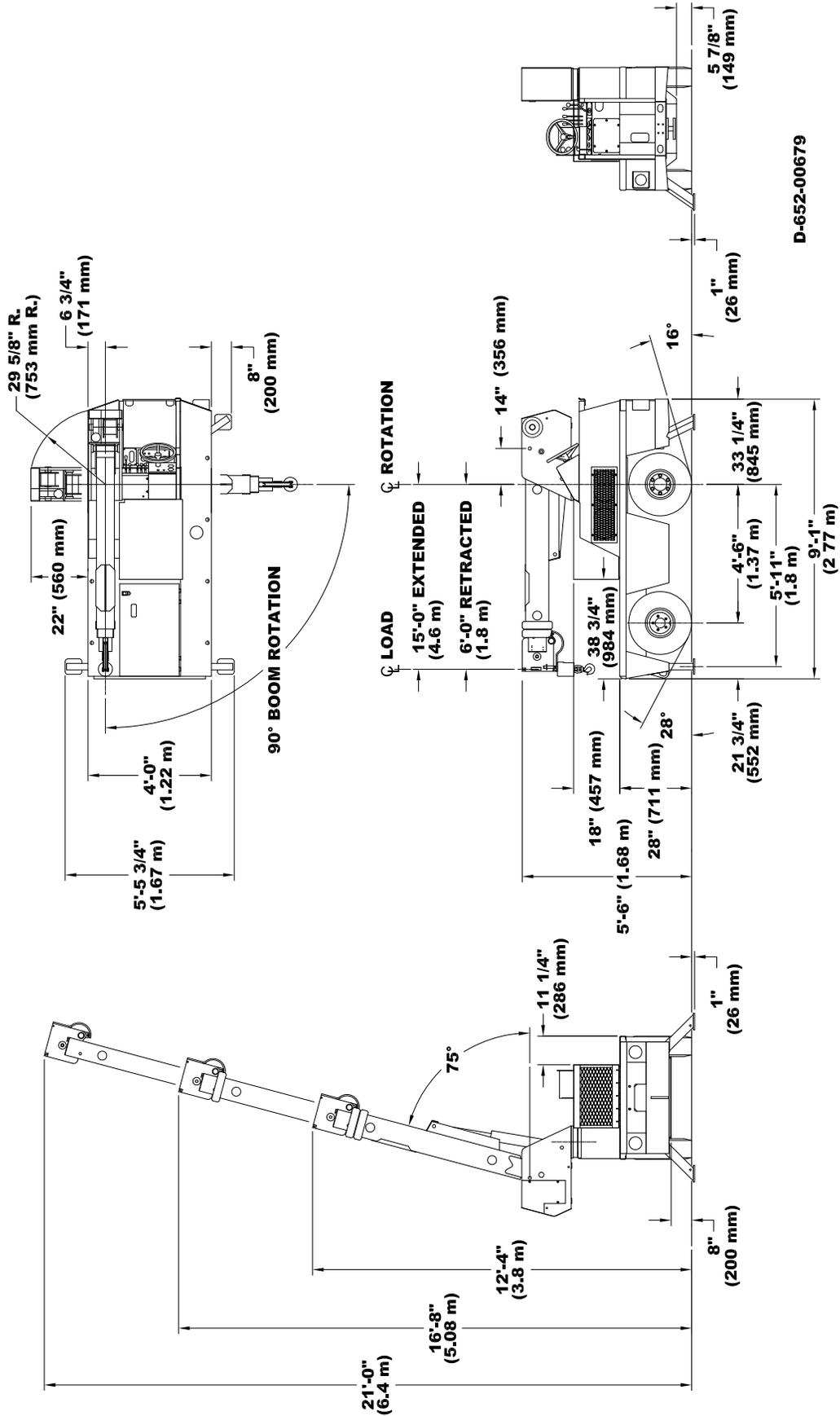
Broderson Manufacturing Corp.
14741 W. 106th Street
Lenexa, KS 66215 USA

NOTICE

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

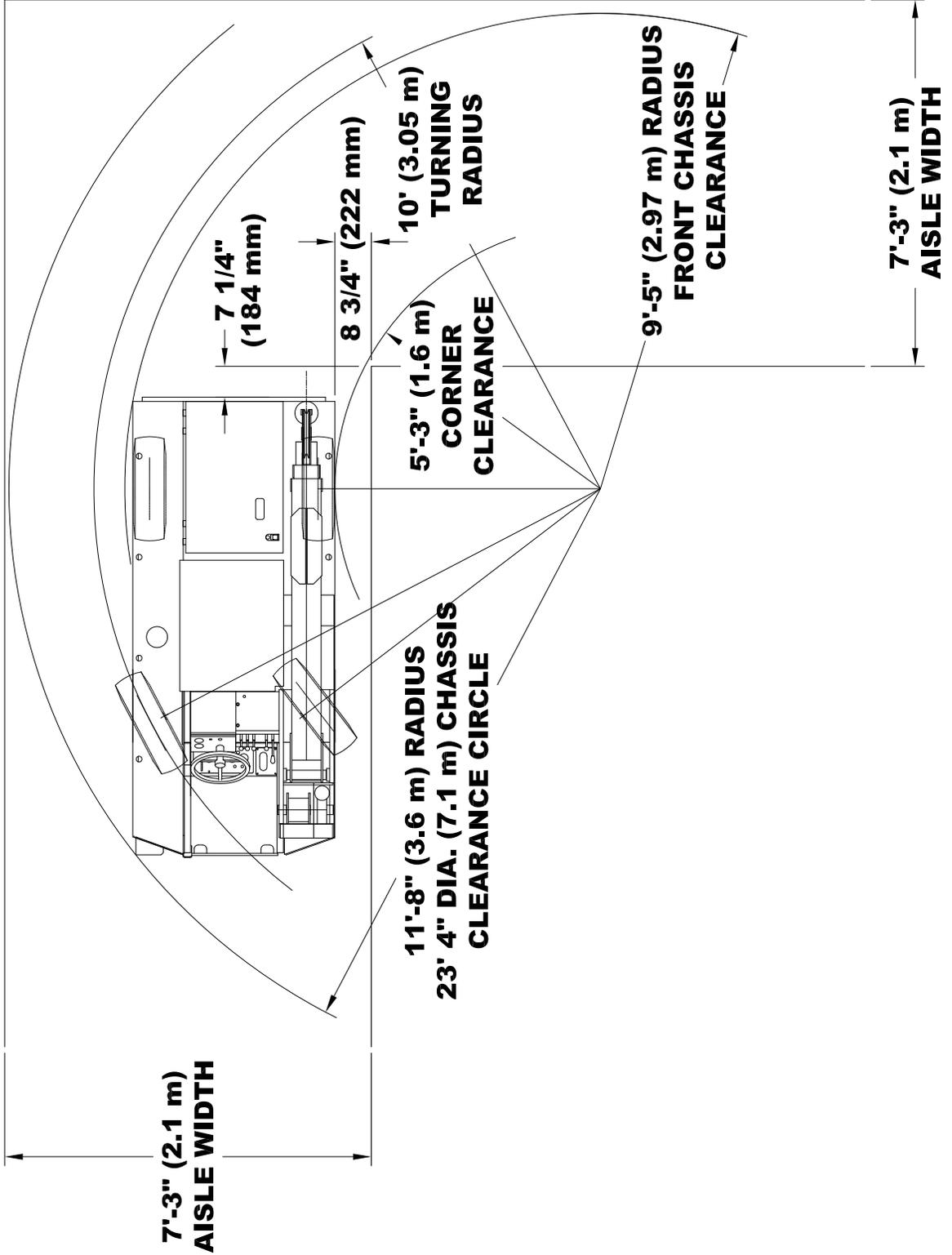
Specifications subject to change without notice.

DIMENSIONS AND ORIENTATION IC-20-1K



D-652-00679

TURNING DIMENSIONS



SECTION I

DESCRIPTION AND SPECIFICATIONS

The IC-20-1K is a self-propelled industrial crane designed for in-plant lifting and material handling applications. It is powered by either a dual fuel (gasoline/LPG) or diesel engine. The IC-20 has special features of low height, narrow width, short length, cargo deck, rear wheel steer and front wheel drive. The basic unit consists of a chassis and hydraulic boom assembly. The chassis includes a frame, three hydraulic outriggers, oil tank, control station, and full power steering. The boom assembly includes a hydraulic powered 90°-swing turret, 3-section telescopic boom, hydraulic boom elevating cylinder, and hydraulic powered hoist.

General:

Length:	
Chassis	9 feet 1 inch (2.77 m)
Overall	9 feet 1 inch (2.77 m)
Width:	4 feet (1.22 m)
Height:	
Deck	28 inches (711 mm)
Overall	5 feet 6 inches (1.68 m)
Wheelbase:	4 feet 6 inches (1.37 m)
Ground Clearance:	
Chassis	8 inches (200 mm)
Rear Axle (Minimum)	5 7/8 inches (149 mm)
Angle of Approach:	28 degrees
Angle of Departure:	16 degrees
Turning Radius: (Minimum)	10 feet (3.05 m)
Aisle Width for 90-degree Turn: (Minimum)	7 feet 3 inches (2.2 m)
Travel Speed: (Maximum)	5.5 mph (8.8 km/h)
Weight:	6380 pounds (2900 kg)
Weight Distribution:	
Left-Hand Front Wheel	1150 pounds (525 kg)
Right-Hand Front Wheel	1150 pounds (525 kg)
Left-Hand Rear Wheel	1260 pounds (570 kg)
Right-Hand Rear Wheel	2820 pounds (1280 kg)
Tire Footprint:	46 square inches (297 cm ²) each
Outrigger Footprint:	39 square inches (252 cm ²) each

DESCRIPTION AND SPECIFICATIONS (CONTINUED)

	Drawbar Pull:	3000 pounds (1360 kg)
	Gradeability:	53% (28 degrees)
	Wheels may spin before these calculated values are reached.	
	Grade Limit:	
	Forward and backward	15%
	Sideways with no load	10%
	Boom Movement:	
	Rotation	90 degrees
	Elevation	75 degrees
	Telescope	9 feet (2.74 m)
	Tailswing	2 feet 5 5/8 inches (753 mm)
	Boom Speed:	
	Rotation	10 seconds
	Elevation	9 seconds
	Telescope	25 seconds
	Sheave Height:	
	Without Jib	21 feet (6.4 m)
	With Jib	27 feet 9 inches (8.46 m)
	Horizontal Reach:	
	Without Jib	15 feet (4.57 m) C/L
Rotation		8 feet 8 inches (2.64m) Front of frame
	With Jib	22 feet (6.71 m) C/L
Rotation		15 feet 8 inches (4.78 m) Front of frame

ENGINE:

Standard:

Kubota 1.6L, EFI Dual Fuel, EPA Tier 2 Certified:

Kubota WG1605-GL-E3 gasoline engine complete with multi-port electronic fuel injection, dual fuel, and engine management system. Water-cooled, 4-cylinder, 94 CID (1.6 L), 3.11-inch (79 mm) bore, 3.09-inch (78.4 mm) stroke, 57.0 HP (32.6 kW) at governed speed of 2600 rpm. Maximum torque, 88.7 foot pounds (120.2 Nm) at 2400 rpm. 70-amp alternator, 13.5-gallon (51 L) gas tank, and 33-lb (15 kg) LPG tank.

Optional Engines and Accessories:

Kubota 1.8L, EPA Tier 4 Final Certified:

Kubota D1803-CR-TIE4B diesel engine. Water-cooled, 3-cylinder, turbocharged and inter-cooled, 111 CID (1.8 L), 3.43-inch (87 mm) bore, 4.04-inch (102 mm) stroke. 49.6 HP (37.0 kW) at governed speed of 2700 rpm. Maximum torque 111.0 ft-lbs (150.5 N-m) at 1600 rpm. 12V, 60-amp alternator. Net weight: 432 pounds (196 kg).

Hydrostatic Transmission Pump:

Standard:

Sauer-Danfoss piston type, 2.8 CID (45 mL) per revolution, direct driven from engine crankshaft. Maximum flow 31.2 gpm (114 L/min), maximum pressure 3,000 psi (207 bar).

Axle:

Standard:

Front Axle:

Channel shaped structure houses torque hubs, brakes and hydraulic drive motors. Front axle oscillates a total of 1.5 inches (38 mm) to minimize wheel spin on uneven surfaces.

Rear Axle:

Fixed rigidly to frame. Box beam crossmember and thrust bearing supported wheel hubs.

Steering:

Standard:

Full hydraulic unit controls 2.5-inch (63.5 mm) steering cylinder attached to rear axle. Limited steering if engine dies.

Brakes:

Standard:

Primary braking from hydrostatic transmission. Foot-actuated hydraulic disc brake for additional braking. Spring-applied, hydraulic-released park brake, actuated from a toggle switch on control panel. All braking is on front wheels.

Tires:

Standard:

7.50 x 10 pneumatic tires, 16-ply. Pressurized to 145 psi (1000 kPa) for crane rated loads.

Optional Tires:

Solid Rubber Tires:

For applications where hazardous ground conditions exist. These tires do not change the overall height or ground clearance.

Net Weight: 240 pounds (109 kg)

Solid Rubber Tires Non-Marking:

Same as solid rubber tires except non-marking.

Net Weight: 240 pounds (109 kg)

Foam Filling of Tires:

Standard tires; foam filled to prevent flats.

Net Weight: 312 pounds (142 kg)

Spare Tire & Wheel:

7.50 x 10 pneumatic tires, 16-ply. Front or rear axle must be specified.

Net Weight: 80 pounds (37 kg)

Chassis:

Standard:

Cargo Deck:

19-square-foot (1.77 m²) area. A maximum of 5000 pounds (2270 kg) may be carried on the deck when centered over front axle. Six stake pockets are provided in deck and six, 1.3-inch (34 mm) diameter pipe stakes.

Optional Deck Mats:

Deck Mats:

Rubber mats, ¼-inch (6 mm) thick, covering the 3 deck sections. Protects delicate loads from scratching and reduces sliding of heavy loads during travel.

Net Weight: 40 pounds (18 kg)

Outriggers:

Three hydraulic outriggers with box beam construction. Hydraulic cylinders are equipped with direct-connected holding valves. Pad dimensions are 6 inches (152 mm) x 6.5 inches (165 mm). Pulsating alarm sounds when outriggers are being lowered.

Lifting Sling Brackets:

Two lift rings in front deck and lug on turntable for attaching lifting sling.

Optional Chassis Accessories:

Auxiliary Winch:

Optional worm-gear-winch, mounted behind front bumper, with a selector valve and single lever control at the operator's console. Hydraulic powered to provide bare-drum line pull of 2500 pounds (1100 kg) at 20-ft/min (6m/min). Winch drum is 3.5 inches (89 mm) diameter by 6.25 inches (159 mm) long. The winch

includes 80 feet (24.3 m) of 5/16-inch (7.94 mm) wire rope, hook and 4-way roller guide. (Also, see page 2-17.) Net Weight: 130 pounds (59 kg)

Pintle Hook:

T-60-A Holland 5-ton pintle hook mounted on rear frame member.
Net Weight: 7 pounds (3 kg)

Lifting Sling :

Three-leg hitch consisting of heavy-duty pear link and 3 wire ropes with swaged-on clevis ends for attaching to lift points on crane chassis and turntable.
Net Weight 10 pounds (5 kg)

Rear View Mirrors:

One right-hand and one left-hand mirror, 6-inch (152 mm) diameter, mounted on deck stakes. Pivot out of way when contacted by obstacle at side of deck.
Net Weight: 12 pounds (6 kg)

Operator's Compartment:

Standard:

Operator control station provides 1-position access to all chassis & crane functions.

Operator's Compartment Accessories:

Operator Guard:

Tubular steel weldment with heavy expanded steel mesh top section, bolts over operator's compartment. Overall height with guard installed is 90 inches (2.3 m).
Net Weight: 60 pounds (27 kg)

Floor mat:

Ribbed vinyl mat with foam backing for operator comfort.

Electrical System:

Standard:

Back-Up Alarm:

Provides pulsating 97-dB sound from solid-state alarm when ignition is on and transmission is in reverse.

Electrical Group:

12 Volt DC

Battery:

Group 24 with 550 CCA rating.

Lighting Group:

Consists of two headlights & taillight, and 12-volt horn activated by button on instrument panel.

Display:

Located at operator's station and includes fuel gauge, volt meter, oil pressure, water temperature, and hydraulic oil temperature gauges. Hour meter records hours only during actual engine operation.

Optional Electrical Accessories:

Strobe Light:

One yellow strobe light mounted on operator guard for high visibility. Flashes 60-120 times per minute. Draws 1/2 amp. Includes operator-controlled switch. When the operator guard is not ordered, the strobe light is mounted outside the operator's compartment on the left side.

Boom Work Light:

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

Hydraulic System:

Standard:

Tandem pump mounted to rear of hydrostatic piston pump, which is driven by the engine crankshaft. Delivers 6 gpm (23 L/min) at 2500 psi (172 bar) for boom circuits, and 16 gpm (60 L/min) at 2500 psi (172 bar) for hoist & outrigger circuits. System protected by relief valves and two, 10-micron filters. Hydraulic reservoir has 9.5-gallon (36 L) capacity.

Boom Assembly:

Standard:

Three section, high strength steel construction, equipped with bearing pads for efficient support and extension. Double-acting hydraulic cylinders extend boom sections. The primary extension cylinder and the double-acting boom elevation cylinder are equipped with direct connected holding valves. Boom angle indicator provided on left side of boom.

Boom Swing:

Standard:

Two double-acting hydraulic cylinders are connected to turntable torque tube to provide 90 degrees of swing. Heavy-duty rotation bearing supports boom.

Optional Boom Swing Lock:

Boom Swing Lock:

Welds to back of frame and engages lug under turntable to hold boom in OVER FRONT position, and prevent boom from being swung in normal 90-degree arc.
Net Weight: 12 pounds (6 kg)

Boom Main Hoist:

Standard:

Turret-mounted, worm gear hoist is hydraulically powered to provide baredrum line pull of 3100 pounds (1400 kg). The IC-20 has a line speed of 63 ft/min (19 m/min). Hoist drum is 5 5/8-inch (143 mm) diameter by 4 7/8 inches (124 mm) long, and provides even pull and long cable life. Hoist includes 80 feet (24 m) of 5/16-inch (8 mm) wire rope, downhaul weight, and swivel hook.

Main Hoist Rope:

Main hoist rope is 5/16-inch (8 mm) diameter, Warrington-Seale construction, 6x36 classification, IPS grade, IWRC core, RRL lay, minimum breaking strength 9160 lbs (4155 kg), 80' (24 m) long. Weight per foot is 0.2 lbs (.3 kg per m). Note that rope weight is not included in load calculations.

Boom Attachments:**Standard:****Anti-Two-Block Device:**

Has electric solenoid dump valve, which prevents damage to hoist rope and machine components from accidentally pulling load hook against boom tip. This valve will dump the HOIST RAISE, TELESCOPE EXTEND, and BOOM LOWER circuits. No other circuits are affected. These circuits are returned to normal operations by operating the HOIST LOWER or TELESCOPE RETRACT control. This system uses a trip arm to activate switch.

Downhaul and Sheave Block:

Includes downhaul weight and hook for single part line. Downhaul and hook assembly weight is 40 pounds (18 kg). Downhaul is designed to clamp dead end of rope. Also includes single sheave block for two-part line requirements. Six-inch O.D. sheave for 5/16-inch (8 mm) diameter wire rope. Swivel hook with safety latch. Fifty pounds of weight provides positive overhaul. Includes bar on top, to actuate anti-two-block system.

Optional Boom Attachments:**7-Foot (2 m) Pin-On Jib:**

Consists of jib with pair of tension bars, tip sheave, cable keeper, pins, and jib attaching pins. Tension bars provide two positions, in-line and 30 degree offset. Net Weight: 97 pounds (44 kg)

Rated Capacity Limiter:

Operator's 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, the following boom functions will have hydraulic flow dumped: HOIST RAISE, TELESCOPE EXTEND, and BOOM LOWER. 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 also an override button on the RCL control panel and an override switch on the upper dash panel. Net Weight: 30 pounds (14 kg)

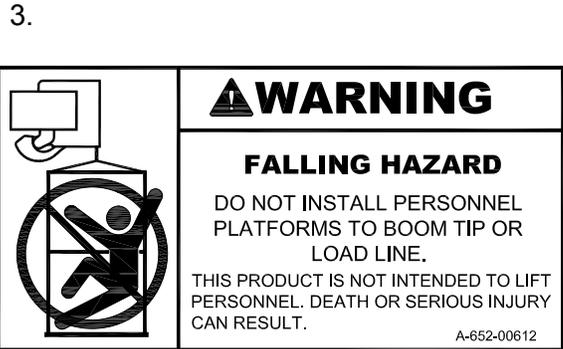
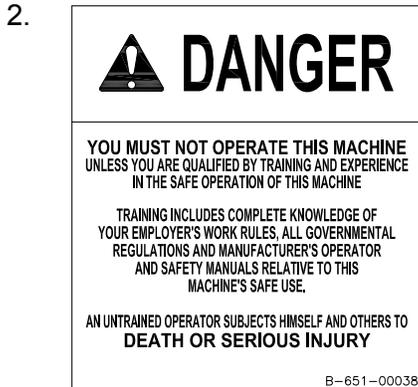
Rated Light Bar:

Tri-color Light Bar indicating percentage of rated capacity utilized. Includes audible alarm for overload or two-blocking. Requires RCL option.

OPERATION
SAFETY RULES

GENERAL:

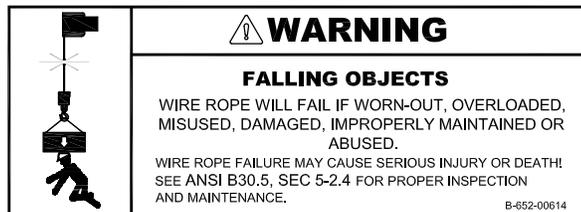
1. Since the manufacturer has no direct control over machine application and operation, conformance with good safety practice is the responsibility of the user and his operating personnel.



4. The operator shall be responsible for those operations under his direct control. Whenever there is any doubt regarding 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. This list of rules is only a supplement to all federal, state, and local safety rules that may apply.
7. Do not run the engine in an enclosed area without adequate ventilation.

CRANE CONDITION:

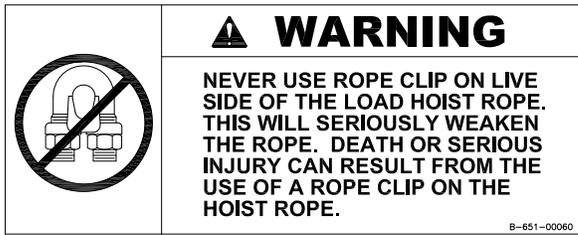
1. Before beginning operation each day, thoroughly inspect the entire crane to be sure it is in good operating condition.
2. Inspect load hoist rope and wedge socket, daily. We recommend rope inspection, replacement and maintenance in accordance with American National Standard *ASME B30.5, Sec. 5-2.4*.



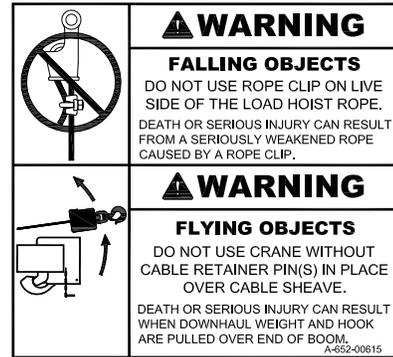
3. Keep operator's compartment and decks free of mud and grease.
4. Keep gauges clean.

5. Tools, lubricants, or rags on the crane should be kept in a secured toolbox.

6.



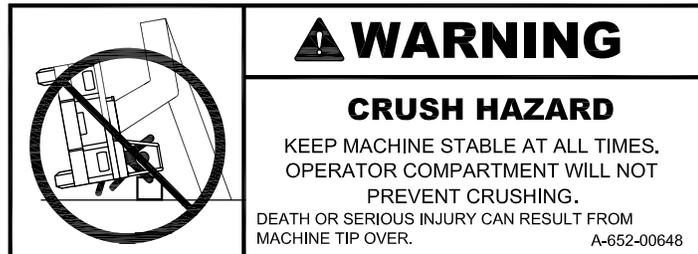
7.



8. If the crane is equipped with a Rated Capacity Limiter, it must be checked before each shift and after each setup for the proper operating configuration on the display. It must be inspected before each shift and tested with a known load at least once a month as described in the RCL Operation Manual.

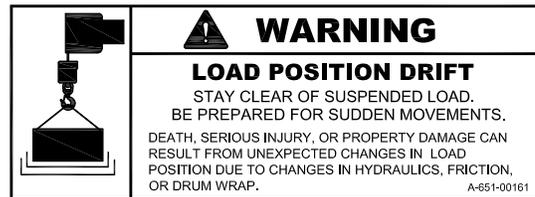
LIFTING:

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. 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. Move the boom slowly whenever these systems might stop the boom.

3. 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 in the crane. Also, the load may drop a short distance due to thermal contraction of the hydraulic oil in the cylinders.

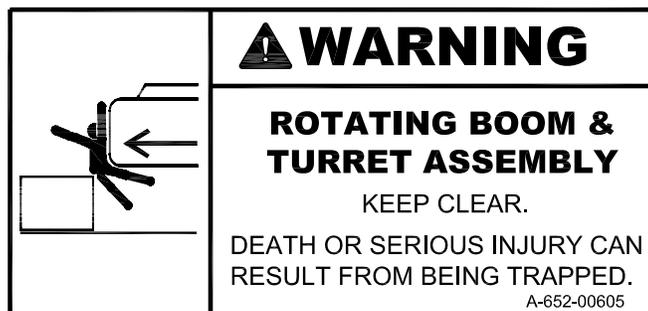


4. Do not use crane to drag loads sideways. 5.



7. Level the crane before lifting. A small incline will significantly reduce the capacity. Use appropriate cribbing under the outriggers for leveling. All outriggers must be fully extended to use the ON OUTRIGGERS ratings.
8. Always use outriggers if possible. If you must lift on rubber, keep the load as close to the ground as possible to prevent tipover. Move the load very slowly and use tag lines to prevent load swinging.

9. Crane may tip at less than rated loads if the surface is uncompacted, or if there is wet dirt, 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 2-13.
10. The operator shall not leave the controls while the load is suspended.
11. Always use adequate parts of load hoist line for lifting heavy loads.
12. Always be sure the rope is properly seated and wound level on hoist drum.
13. Keep hands away from load hoist rope when hoist is being operated.
14. Be sure at least five wraps of rope are left on the hoist drum to insure against rope pulling out of its anchor.
15. Never wrap the hoist rope around a load. Always use approved rigging.
16. Avoid pinch points such as between a rotating turret & the cab or operator guard , or in access holes of a telescoping boom.



17. 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.

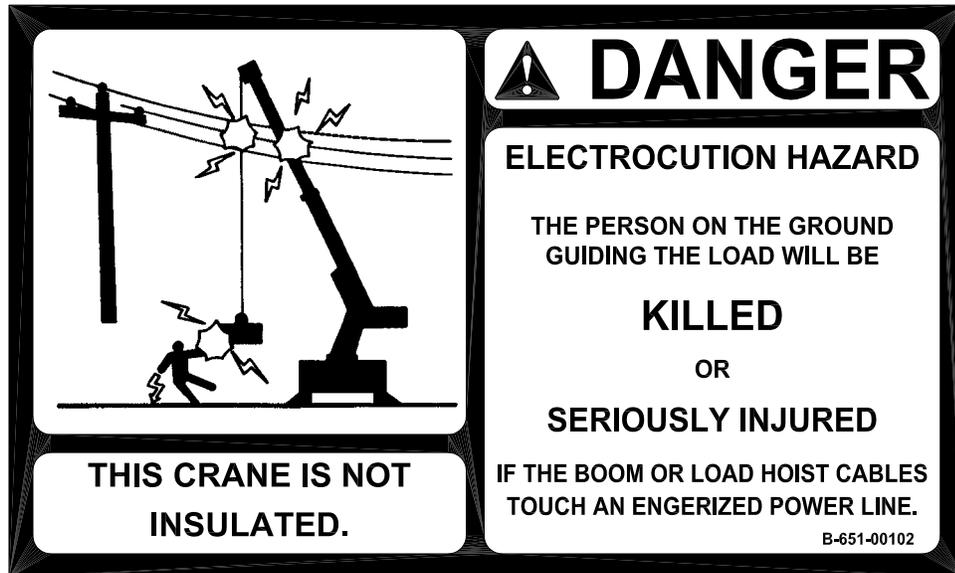
CAUTION

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

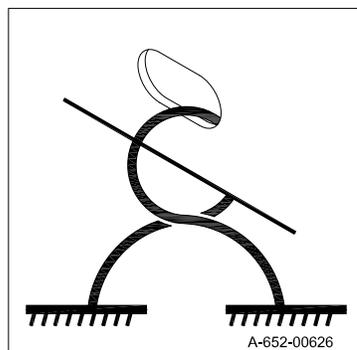
DANGER

Two-blocking will abruptly stop boom lowering, 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.

18. Always keep crane boom at least 10 feet (3 m) away from electric power lines. See chart on side of turntable for boom clearance.
19. 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 with feet together. The ground surface may be energized.



20. 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.
21. Do not operate outside during thunderstorms. Avoid all lightening stike conditions.
22. 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 [3 mph (4.8 km/h) (maximum)].
 - E. Maintain specified tire pressures.
 - F. Avoid sudden starts and stops.
 - G. Provide tag or restraint lines to snub 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 jib 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. 3 mph (4.8 km/h) maximum road speed. Reduce speed below 3 mph (4.8 km/h) to properly match condition of road surface and deck load.
 - 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. A warning sign with a black border. On the left is a circular icon with a diagonal slash over a drawing of a person's hand being caught between two moving parts of a crane. To the right of the icon, the word "WARNING" is written in large, bold, black letters. Below it, "PINCH POINTS" is written in bold. Underneath, the text reads: "KEEP ALL PARTS OF THE BODY INSIDE OPERATOR COMPARTMENT. DEATH OR SERIOUS INJURY CAN RESULT FROM MOVING MACHINERY." In the bottom right corner of the sign, the code "A-652-00602" is printed.

6. Every effort has been made to make the BMC Industrial Crane a stable vehicle. However, with the center of gravity higher than some vehicles, the rigid rear axle and the unsprung oscillating front axle suspension, the operator must take care to control the vehicle speed on rough roads, uneven terrain or slopes.
7. When this crane is to be parked on a grade, set parking brake and block wheels or extend outriggers fully.
8. 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.

INSTRUMENTS AND CONTROLS

The IC-20-1K has a lower and upper instrument panel. The lower panel consists of the standard engine display screen and controls. The display shows the electrical system voltage, water temperature, oil pressure, hydraulic oil temperature, and fuel level. There are controls for the gas/LPG functions, throttle, headlight switch, key switch horn button, and transmission. A bubble level is mounted to the left of the panel for leveling the crane. The ignition switch is key-operated and has START, RUN and OFF positions. The ignition switch should always be turned off and the key removed when the vehicle is left unattended.

At the top of the upper instrument panel, is the anti-two-block override key switch, and below that is the hour meter.

A pedal-activated service brake is provided to assist slowing down on slopes. The foot pedal activates hydraulic disc brakes mounted on each torque hub. The parking brake is applied by actuating a toggle switch located on the lower right side of the transmission control lever panel, and above it is the parking brake indicator light.

The hydrostatic transmission control lever is located to the right of the steering wheel. Wait for boot-up, before starting the engine. Engine RPM is controlled on the display. After the engine is started and the throttle is set, release the parking brake and move the control lever smoothly until the desired speed is reached. Always operate this transmission control lever smoothly. If lever is released while moving, the crane will stop suddenly and may cause loss of control of load.

For maneuvering in tight quarters, the throttle should be set for low speed. For traveling longer distances, the throttle may be set to full speed. The vehicle speed is controlled by the transmission lever.

The hydrostatic transmission will normally stop the crane on a grade, but some oil will slip through the wheel drive motors and allow the crane to creep. ALWAYS apply parking brake when operating the crane, or leaving the crane unattended. Remember the hydrostatic transmission is NOT a parking brake.

Be sure to release parking brake before moving the transmission control lever toward forward or reverse.

The crane will “coast” on some downhill ramps when the surface is uneven, and one wheel is raised off the ramp. The forward motion of the crane may not always be satisfactorily controlled by the hydrostatic wheel drive motors under these conditions. The foot brake can be applied if the operator feels the machine is traveling faster than desired.

On other surfaces the crane may slow down or stop because one drive wheel is spinning. The engine speed and/or transmission speed may be increased gradually to resume motion.

A neutral safety switch in starter circuit prevents starting engine with the transmission engaged. The control lever must be in NEUTRAL to start engine.

The steering wheel is directly mounted on the steering control unit of the power steering system. The steering system will provide limited steering even if the engine should stop running.

The controls for operating the boom swing, boom elevation, boom telescope, hoist, and outriggers are located along the forward control station area. These handles are directly connected to the hydraulic control valve. The placard located adjacent to these handles identifies the function controlled and movement resulting from each handle actuation.

 CAUTION				
THE LOAD HOIST LINE ON THIS UNIT MUST BE 5/16" DIA. 6 X 36-IPS - RRL - IWRC WIRE ROPE (OR EQUIVALENT) WITH A MINIMUM BREAKING STRENGTH OF 9,160 LBS. WITH ROPE IN GOOD CONDITION. THE MAXIMUM LOAD WITH SINGLE PART LINE IS 2,500 LBS.				
RIGHT  SWING  LEFT	EXTEND  TELESCOPE  RETRACT	LOWER  BOOM  RAISE	LOWER  HOIST  RAISE	UP  OUTRIGGER  DOWN
<small>C-650-00358</small>				

Swing: Pulling back on the lever will rotate the boom to the operator's left; pushing forward will rotate it to the operator's right.

Boom: Pulling back will raise the boom; pushing forward will lower it.

Telescope: Pulling back on the lever will retract the boom; pushing forward will extend the boom.

Hoist: Pulling back on the lever will raise the load line; pushing forward will lower the load line.

Outriggers: The three outriggers must be operated simultaneously. Special attention must be given to avoid hitting personnel or obstacles. Pads or cribbing should be used for leveling, but the outriggers must be fully extended.

All controls may be used 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.

Avoid holding a control lever in the open position after the function has reached the end of its travel. This will impose unnecessary stresses on the components and heat up the hydraulic system.

SEQUENCE OF OPERATION

DRIVING THE VEHICLE

The following procedure is recommended for driving the vehicle:

CAUTION

Be sure the backrest bar is lowered behind you before operating the crane.

1. Apply parking brake.
2. Ensure that the hydrostatic transmission control lever is in NEUTRAL.
3. Start engine and allow a warming period.
4. Check to see that boom is retracted.
5. Check to see that boom is over the front.
6. Check to see that boom is lowered.
7. Check to see that hoist line is snug.
8. Check to see that outriggers are retracted.
9. Release parking brake.
10. Set desired engine speed on engine display---from slow for maneuvering, to fast for longer travel.
11. Move hydrostatic transmission lever to control direction and speed.
12. Slow down when making sharp turns on slopes.

OPERATING THE CRANE

WARNING

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 crane in enclosed areas without adequate ventilation.

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

1. Apply parking brake.
2. Start engine and allow warming period.
3. The outriggers must be extended firmly to ground at all times before operation is conducted, and remain extended until work operation is completed & boom is restored to road travel position, except for ON RUBBER operation.
4. During operations, the controls should always be metered when beginning or ending movement to prevent sudden starting or stopping, which imposes undue shock loads on the equipment, especially when handling heavy loads. The control should be slightly actuated to begin movement and then slowly increased to the desired operating speed. The results obtained from metering the control levers can be improved by reducing the engine speed with the engine display. High engine speed is not required to operate the crane controls.

Avoid holding a control lever in the open position after the function has reached the end of its travel. This will impose unnecessary stress on the components and heat up the hydraulic system.

CRANE CAPACITY CHART

Before lifting loads, the operator must read the capacity placard and adhere to the load capacities and radii of handling given. The information provided on this placard is based on stability, structural strength, and hydraulic capacity.

To operate the crane safely, the operator must know the weight of the load & handling devices, and the radius of the lifting operation. The best way to find the weight is to weigh it with a scale or load indicator that has been recently tested. The person responsible for the lift must be sure that the load does not exceed the crane ratings at any radius at which the load may be during the entire lifting operation. The weights of the hooks, blocks, downhaul weights, slings, and other handling devices must be added with the load.

The load radius is the horizontal distance from the centerline of boom rotation (the center of the unloaded turntable), to the vertical load line with the load suspended. The load radius may be measured with a measuring tape.

Load capacity ratings on this equipment are given on the basis that operations are to be conducted on firm and level terrain with outriggers extended fully and firmly to the ground. These capacity ratings are reduced in proportion to the deviation from the prescribed conditions. Any unfavorable environmental condition, such as soft, sloping or uneven terrain, constitutes a deviation.

The main boom capacities are given in direct relation to the radius at which the load is being handled. 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-20-1K is 5000 pounds (2268 kg), but only at a 4-foot (1.2 m) radius, and on outriggers. All variances of loads and radii of handling are shown on the crane capacity chart. A metal chart is attached near the operator's seat and a laminated chart is included in the literature compartment for the express purpose of informing the operator when a load can or cannot be safely handled. The boom on the IC-20 rotates 90 degrees from straight over the front right tire, to 90 degrees over the left side.

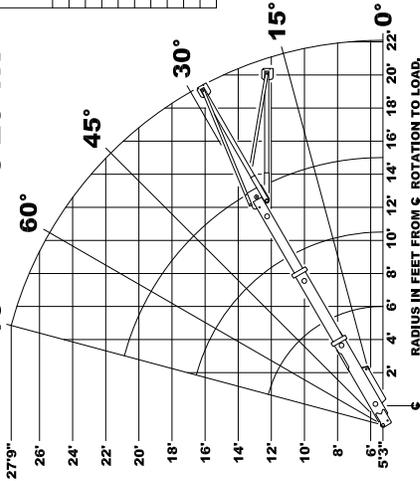
The capacity chart on the IC-20-1K is divided between **FRONT ON RUBBER, FRONT ON OUTRIGGERS, LEFT SIDE ON RUBBER, LEFT SIDE ON OUTRIGGERS** and **7-FT (2.1 m) JIB ON RUBBER OR OUTRIGGERS**. The least stable operating position of the boom is over the left side of the crane. Use great care when swinging a load. The load must be known 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.

The following page shows a copy of the capacity chart for the IC-20-1K.

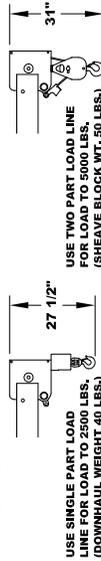
CRANE CAPACITY CHART IC-20-1K



CAPACITIES IN LBS FOR OPERATION ON FIRM LEVEL SURFACE

LOAD RADIUS FEET	3-SECTION BOOM			7-FT. JIB	
	FRONT ON RUBBER	LEFT SIDE ON RUBBER	RIGHT SIDE ON RUBBER	ON RUBBER	OR OUTRIGGERS
4	2500	5000	3800	5000	1300
5	2000	4000	3100	4000	1100
6	1500	3300	2500	3300	750
8	1400	2500	1500	2500	650
10	1300	2000	1000	2000	550
12	1200	1600	750	1400	500
15	1100	1200	500	1000	500
17					425
19					325
22					225

EXCEEDING CAPACITY RATINGS OR APPLYING SIDE LOADS TO THE BOOM OR JIB IS MISUSE, IS HAZARDOUS, AND Voids WARRANTY.
CAPACITIES ON OUTRIGGERS ARE 85% OF TIPPING LOADS. CAPACITIES ON RUBBER ARE 75% OF TIPPING LOADS. CAPACITIES BELOW BOLD LINES ARE LIMITED BY TIPPING. OTHER CAPACITIES ARE LIMITED BY STRUCTURAL OR HYDRAULIC CAPACITY.
BOOM ANGLE MUST NOT BE LESS THAN 30° EXCEPT WHILE RIGGING IF THE JIB IS IN THE 30° OFFSET POSITION.



LOAD RADIUS IS THE HORIZONTAL DISTANCE FROM THE CENTER OF ROTATION OF THE UNLOADED CRANE TO THE VERTICAL LOAD LINE WITH THE LOAD APPLIED.
LOAD HOOK, DOWNHAUL WEIGHT, HOOK BLOCKS, AND OTHER LOAD HANDLING DEVICES SHALL BE CONSIDERED PART OF THE LOAD EXCEPT FOR HOIST ROPE.
DECK LOAD CAPACITY 5000 LBS. (CENTERED OVER AXLE). CARRY SPEED 3 MPH MAX.
THE BOOMS ON THIS UNIT ARE ALL STEEL AND HAVE NO LINE VOLTAGE RAYINGS.
ALL CAPACITIES APPLY TO FIRM LEVEL SURFACES.
REMOVAL OF THE BLOCK SWITCH IS FUNCTIONAL AFTER INSTALLING OR REMOVING JIB.
MAXIMUM HYDRAULIC PRESSURE 2500 PSI
OPERATION:

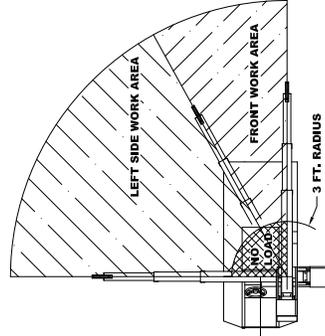
1. BEFORE OPERATING THIS CRANE.
2. CHECK LEVEL OF ENGINE OIL AND HYDRAULIC OIL DAILY.
3. SET VEHICLE PARK BRAKE SECURELY.
4. START ENGINE.
5. SET HYDRAULIC PRESSURE TO 2500 PSI.
6. READ AND UNDERSTAND THE OPERATION AND MAINTENANCE MANUAL.
7. OPERATE ALL HYDRAULIC CONTROLS SLOWLY AND SMOOTHLY. AVOID SUDDEN STARTS AND STOPS.
8. SHARP TURNS ON SLOPES.
9. WIRE ROPE WITH A MINIMUM BREAKING STRENGTH OF 9160 LBS. 40 FEET LONG.
10. TORQUE FRONT WHEEL NUTS TO 145 FT. LBS. REAR WHEEL NUTS TO 200 FT. LBS. (THESE CONDITIONS MUST BE MAINTAINED TO HANDLE RATED LOADS ON THIS CRANE).

MODEL NO. SERIAL NO. DATE OF MFR.

IC-20-1K

**BRODERSON MANUFACTURING CORP.
LENEXA, KANSAS**

65407019



WORK AREA DIAGRAM

NOTE: DO NOT OPERATE INSIDE 3 FOOT LOAD RADIUS. JIB MAY BE OPERATED IN ALL WORKING AREAS.

PICK AND CARRY WITH THE SHORTEST PRACTICAL BOOM, CENTERED OVER THE FRONT AXLE. OPERATE WITH THE BOOM AS LOW AS POSSIBLE, WITH THE LOAD CLOSE TO THE GROUND. PICK AND CARRY CAPACITIES ARE FOR SMOOTH, LEVEL, PAVED SURFACES.

CRANE CAPACITY CHART

IC-20-1K

METRIC

LOAD RADIUS METERS	3-SECTION BOOM			2.1 m JIB		
	FRONT ON RUBBER	LEFT SIDE OUTRIGGERS	LEFT SIDE ON RUBBER	LEFT SIDE ON OUTRIGGERS	ON RUBBER	ON OUTRIGGERS
1.2	1130	2270	1720	2270	590	590
1.5	920	1840	1430	1840	510	510
2.0	670	1370	980	1370	310	310
2.5	630	1110	650	1110	290	290
3.0	590	920	460	920	250	250
3.5	550	770	370	700	230	230
4.0	520	660	290	530	220	220
4.5	500	550	230	460	200	200
5.0					170	170
5.5					130	130
6.0					100	100

EXCEEDING CAPACITY RATINGS OR APPLYING SIDE LOADS TO THE BOOM OR JIB IS MISUSE, IS HAZARDOUS, AND VOIDS WARRANTY.
 CAPACITIES ON OUTRIGGERS ARE 85% OF TIPPING LOADS. CAPACITIES ON RUBBER ARE 75% OF TIPPING LOADS. CAPACITIES BELOW BOLD LINES ARE LIMITED BY TIPPING. OTHER CAPACITIES ARE LIMITED BY STRUCTURAL OR HYDRAULIC CAPACITY.
 BOOM ANGLE MUST NOT BE LESS THAN 30° EXCEPT WHILE RIGGING IF THE JIB IS IN THE 30° OFFSET POSITION.



LOAD RADIUS IS THE HORIZONTAL DISTANCE FROM THE CENTER OF THE UNLOADED CRANE TO THE VERTICAL LOAD LINE WITH THE LOAD APPLIED.
 LOAD HOOK, DOWNHAUL WEIGHT, HOOK BLOCKS, AND OTHER LOAD HANDLING DEVICES SHALL BE CONSIDERED PART OF THE LOAD EXCEPT FOR HOIST ROPE.
 DECK LOAD CAPACITY 2270 kg (CENTERED OVER AXLE), CARRY SPEED 5 km/hr. MAX.
 THE BOOMS ON THIS UNIT ARE ALL STEEL AND HAVE NO LINE VOLTAGE.
 ALL CAPACITIES APPLY TO FIRM LEVEL SURFACES.
 ENSURE ANTI-TWO BLOCK SWITCH IS FUNCTIONAL AFTER INSTALLING OR REMOVING JIB.
 MAXIMUM HYDRAULIC PRESSURE 172 bar

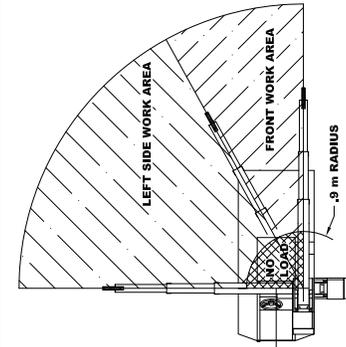
- OPERATION:
1. READ AND UNDERSTAND THE OPERATION AND MAINTENANCE MANUAL.
 2. CHECK LEVEL OF ENGINE OIL AND HYDRAULIC OIL DAILY.
 3. CHECK UNIT FOR VISIBLE DEFECTS AND LOOSE PARTS DAILY.
 4. START ENGINE.
 5. EXTEND OUTRIGGERS TO SOLID FOOTING.
 6. OPERATE ALL HYDRAULIC CONTROLS SLOWLY AND SMOOTHLY. AVOID DRIVE SLOWLY WHEN MAKING SHARP TURNS ON SLOPES.
 7. OPERATE ALL HYDRAULIC CONTROLS SLOWLY AND SMOOTHLY. AVOID DRIVE SLOWLY WHEN MAKING SHARP TURNS ON SLOPES.
 8. DRIVE SLOWLY WHEN MAKING SHARP TURNS ON SLOPES.

THE LOAD HOIST LINE ON THIS UNIT MUST BE 7.9 mm DIA. 6X36-IPS-NRCC WIRE ROPE WITH A MINIMUM BREAKING STRENGTH OF 4155 kg-24m LONG. TIRE PRESSURE 1000 kPa FOR 7.50-10 16PR TORQUE FRONT WHEEL NUTS TO 80 Nm, REAR WHEEL NUTS TO 270 Nm (THESE CONDITIONS MUST BE MAINTAINED TO HANDLE RATED LOADS ON THIS CRANE).

MODEL NO. SERIAL NO. DATE OF MFR.

IC-20-1K

BRODERSON MANUFACTURING CORP.
 LENEXA, KANSAS 65401013



WORK AREA DIAGRAM

NOTE: DO NOT OPERATE INSIDE .9 METER LOAD RADIUS. JIBS MAY BE OPERATED IN ALL WORKING AREAS.

PICK AND CARRY WITH THE SHORTEST PRACTICAL BOOM, CENTERED OVER THE FRONT AXLE. OPERATE WITH THE BOOM AS LOW AS POSSIBLE, WITH THE LOAD CLOSE TO THE GROUND. PICK AND CARRY CAPACITIES ARE FOR SMOOTH, LEVEL, PAVED SURFACES.

CAUTION

A capacity load may be carried on the boom, or a capacity load may be carried on the deck, but not at the same time. The total of the percent of deck load and the percent of boom load must not exceed 100%. For example, if the boom load is 100% of its capacity at its current load radius, the deck load capacity is 0%. If the boom load is 60% of the load rating for its load radius, the deck load capacity is 40% of maximum.

CAUTION

The capacities of this crane are based on all outriggers being FULLY EXTENDED to a FIRM, LEVEL surface. The crane may tip at less than capacity loads if operated in the following manner:

- A. Outriggers only partially extended and resting on curbing, shoring, etc. If the outriggers are not all the way DOWN, or if they are not all the way OUT.
- B. 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 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.
- C. Crane operated on a hill or slopping surface. Crane can tip at less than rated capacity when load is lifted on downhill side.

CAPACITY EXAMPLE (See 7-foot (2.1 m) Jib Capacity Example Page 2-17)

Refer to the IC-20-1K capacity chart on the preceding page. A load that is 4 feet (1.2m) wide and weighs 2800 pounds (1270 kg) is to be lifted from the side and loaded onto the deck of the crane for transport to a new location. We see on the chart that 2500 pounds (1135 kg) is the maximum load on 1-part line, so the sheave block is required. The charts show the weight of the standard sheave block to be 45 pounds (20 kg). The rigger says that two slings are required, weighing a total of 40 pounds (18 kg). The total load is 2800 (1270 kg)+45 (20 kg) +40 (18 kg)=2885 lbs (1309 kg). A 6-foot (1.8 m) load radius is required to clear the side of the crane.

Looking at the Left Side, ON RUBBER column, we see that the load is too large and heavy for this condition. This leaves the ON OUTRIGGERS column. The outriggers should always be used whenever possible anyway. We see that we can lift up to 3300 pounds (1370 kg) at a 6-foot (2.0 m) load radius, either over the front or over the side. Checking the chart again, we see that the load is within the deck load limit of 5000 pounds (2270 kg) and that the travel speed with the load must be limited to 3 mph (5 km/h) -- or less if conditions dictate.

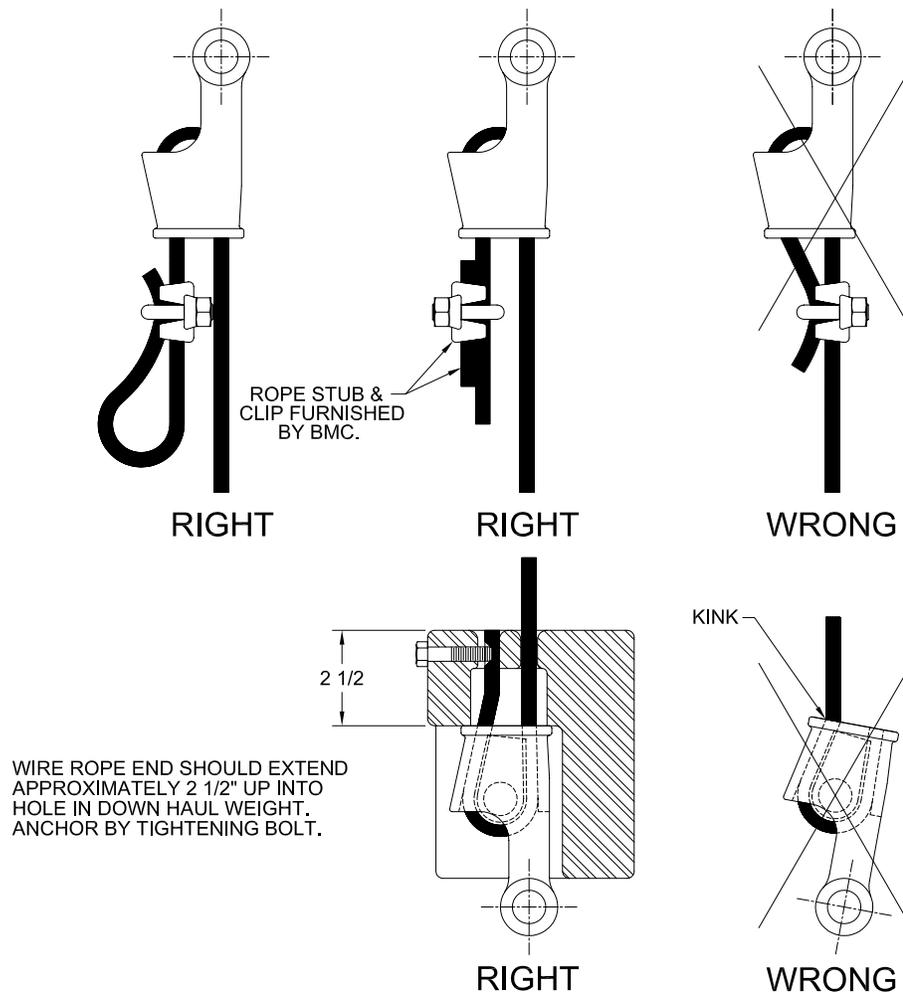
REMEMBER THAT AS THE BOOM IS LOADED, DEFLECTION OF THE BOOM, TIRES, ETC., WILL INCREASE THE LOAD RADIUS. SO BE CONSERVATIVE IN YOUR CAPACITY ESTIMATE.

SHEAVE BLOCK AND DOWNHAUL WEIGHT

The capacity chart shows the approved hoist rope arrangements. The downhaul weight and sheave blocks supplied by Broderson are specially designed to operate the Anti-Two-Block system. Other blocks or downhauls may bypass this system and create a dangerous condition. Notice the load limit for each hoist rope arrangement.

The keeper pins that pass through the sheave plates must be locked in place with cotters to hold the line on the sheaves. 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.

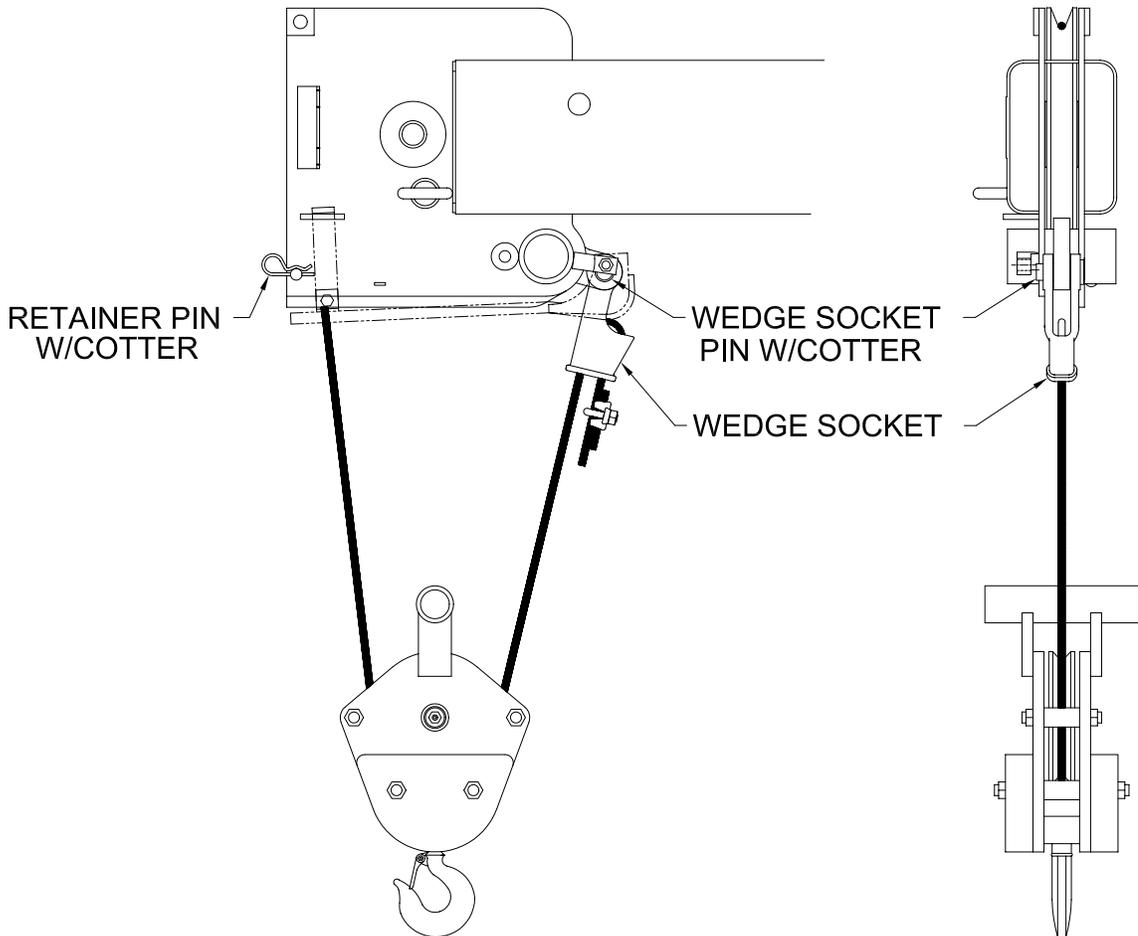
WIRE ROPE INSTALLATION



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.

TWO-PART LINE REEVING

For loads above 2500 pounds (1135 kg) the sheave block must be used. The wedge socket should be pinned to the 2-part line lug, as shown in the figure. The dead end of the rope in the wedge socket should be clamped, as shown in the figure. The clamp must not be used on the live part of the rope. This will seriously weaken the rope by metal fatigue over a number of cycles. The sheave block should hang straight, and the top of the block should meet the boom sheave plates squarely when pulled up snugly.



	▲ WARNING
	NEVER USE ROPE CLIP ON LIVE SIDE OF THE LOAD HOIST ROPE. THIS WILL SERIOUSLY WEAKEN THE ROPE. DEATH OR SERIOUS INJURY CAN RESULT FROM THE USE OF A ROPE CLIP ON THE HOIST ROPE.

B-651-00060

SAFETY DEVICES

There are certain safety devices on the IC-20 that are designed to maintain control of a load in case of power or hydraulic line failure. The operator should understand the function and operation of these devices so that a continual check on their performance can be made.

OUTRIGGER CYLINDER CHECK VALVE:

A double-acting check valve is flange-mounted on each of the outrigger cylinders. This valve holds the outrigger in the extended position should power or hydraulic line failure occur. This valve has no adjustment. 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 flange-mounted on the cylinder barrel. This valve holds the boom in the elevated position should 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, this 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 EXTENSION CYLINDER HOLDING VALVE:

A single-acting holding valve is flange-mounted to the cylinder rod end. This valve holds the cylinder in the extended position should power or hydraulic pressure line failure occur. This valve is adjustable to hold the desired load. If the boom creeps in under load, this 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.

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 a solenoid dump valve in the hydraulic circuit. This valve will dump the HOIST RAISE, TELESCOPE EXTEND and BOOM LOWER circuits. No other circuits are affected. These circuits are returned to normal operation by operating the HOIST LOWER or TELESCOPE RETRACT control. An emergency override switch is provided for the Anti-Two-Block System, on the upper instrument panel, in case of system failure. Holding this switch will allow the operator to override the system dump valve.

WARNING

We recommend the emergency override switch be used with discretion. Improper or careless use of this switch can cause damage to the crane and endanger people and property.

WARNING

Even though the crane is equipped with an anti-two-block device, we strongly recommend that the operator always watch the downhaul weight and stop movement before two-blocking occurs. Two-blocking can cause sudden stopping of boom movement or can break the load hoist rope and let the load fall. This could cause death or serious injury.

OPTIONAL EQUIPMENT

7-FOOT (2.1 m) JIB:

CAPACITY EXAMPLES FOR 7-FOOT (2.1 m) JIB (SEE CAPACITY CHART PAGE 2-11)

The 7-foot (2.1 m) jib has bail bars that allow positioning in-line with the main boom or 30 degrees offset from the main boom. The jib rating, either offset or in-line, is by load radius only.

Example #1-- Boom and jib are in-line at about a 60 degree boom angle. Boom is fully extended and boom & jib load radius is 10 feet (3.0 m). Capacity is 550 pounds (250 kg).

Example #2-- Jib is offset 30 degrees from main boom. Boom is partly retracted and set at about 45 degrees. Boom and jib load radius is 17 feet (5.0 m). Capacity is 425 pounds (200 kg).

CAUTION

Do not pick and carry with the 7-foot (2.1 m) jib installed.

FRONT AUXILIARY WINCH:

The front auxiliary winch is mounted behind the front bumper and is controlled from the operator compartment. The winch, with 80 feet (24.4 m) of 5/16-inch (7.9 mm) diameter 6X36-IWRC-IPS wire rope (9160 pound (4155 kg) breaking strength) and 2-ton hook, has a single-part-line capacity of 2500 pounds (1100 kg) on the first wrap.

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.

OPTIONAL EQUIPMENT

RATED CAPACITY LIMITER:

A Rated Capacity Limiter (RCL) may be installed on the crane to assist the operator in estimating loads and measuring load radii. Please read the RCL Operation Manual and the following information for complete instructions on operation of the system.

After starting the engine, always set up the correct Rated Capacity Limiter configuration. The operation of the RCL functions should be checked at the beginning of each shift of operation, and it should be tested with a known load at least once a month as described in the RCL Operation Manual.

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 the hoist control, if safe. The boom raise and telescope retract may also be used if this is safer. In some unusual circumstances it may be necessary to swing the boom before lowering the load. If you are sure this will not cause an overload, you can swing the boom to a safer position.

If the load is the maximum for the loadline or attachment, the load should be set down in a safe place using the hoist lower control, and the load or attachment changed. TELESCOPE RETRACT may also be used, and swing may be used, if safe, as described in the preceding paragraph. 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 the hoist control.

If the boom is fully lowered until it stops, (about 0°) the RCL will show an overload condition because the boom lift pressure sensors cannot read a useful pressure in this condition. To remedy this, raise the boom slightly. On the other hand, if the boom is fully raised, (about 75°) the RCL may show an overload condition because the pressure in the boom lift cylinder is sensed to be an overload. To correct this condition, the override key may be turned and held and the boom lowered just slightly. Then check for other conditions before lowering further.

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 key on the dashboard may be required to move the boom.

WARNING

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

The Rated Capacity Limiter on the crane is intended to assist the operator in estimating loads and measuring load radii and to alert the operator to impending overload conditions. The use of the Rated Capacity Limiter does not relieve the operator of the responsibility of operating the crane safely by existing regulations. 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. In general, the smaller the load and the higher the boom angle, the larger the percent of error. 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 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 & radii, and conduct the lifts according to the Crane Capacity Chart section of this manual.

The Rated Capacity Limiter is designed to stop crane functions that could cause an overload or two-blocking. 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, 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

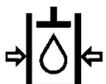
The Rated Capacity Limiter can suddenly stop the boom lower function, causing the load to bounce or swing. Use great care when handling a load near capacity limits or near a two-blocking condition.

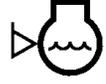


SWITCH AND INDICATOR SYMBOLS ON BMC CRANES

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
	Lift point
	Tie-down point
	Transmission oil fill location
	Transmission oil pressure
	Transmission oil temperature
	Brake fluid fill location
	Hydraulic oil low-level mark
	Hydraulic oil filter restriction indicator
	Hydraulic temperature gauge
	Hydraulic oil temperature high
	Hydraulic oil pressure gauge OR hydraulic oil pressure low
	Positive polarity
	Negative polarity

	Engine oil pressure low
	Engine coolant fill location
	Engine coolant temperature high
	Engine coolant low level mark
	Engine air filter restriction indicator
	Engine start
	Engine idle set
	Check engine
	Stop engine
	Wait to start/ engine preheat/ grid heater/ glow plug switch
	Gas fuel only
	Diesel fuel only
	Fuel level gauge
	Drain

MAINTENANCE

SAFETY RULES

1. Lower load and boom, shut down engine, remove key, and put it in a safe place. Place warnings on the ignition switch and crane controls to prevent unauthorized starting or movement during maintenance.
2. Disconnect battery when disabling crane or when welding on crane.
3. Relieve hydraulic pressure when working on hydraulic parts by cycling the controls with the engine shut down.
4. Allow fluids and parts to cool before working on them.
5. Read maintenance instructions before beginning work.
6. 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.
7. Wear safety glasses and shoes.
8. Do not wear loose-fitting or torn clothing.
9. Remove rings and other jewelry.
10. Wear heavy leather gloves when working on wire rope.
11. Keep clothing and hair away from moving parts.
12. To prevent falls, clean areas of crane that are stepped on for access to crane parts. Wear slip resistant footwear.
13. 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 points.

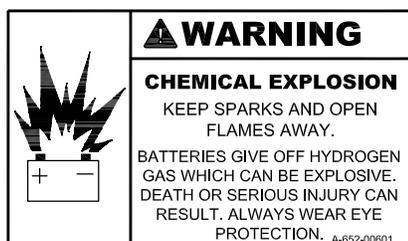


14. When inflating or adding air to a tire, place a tire cage over the tire and use a clip-on inflater chuck with an extension hose that will permit standing behind the tire tread when inflating.

15. Do not work on any machine that is supported only by jacks or a hoist. Always use adequate blocks or jack stands.
16. If it is necessary to work on the boom or outriggers in an unstowed condition, block them to prevent them from dropping unexpectedly.
17. Use a hoist when lifting components that weigh 50 pounds or more. Follow all hoist and rigging safety rules.
18. Do not use lower grade fasteners if replacements are necessary.
19. When reinstalling wiring or plumbing after repairs, be sure that it will not be damaged by rubbing against sharp, rough or hot surfaces, or edges.
20. 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 use of a rope clip on the hoist rope.
21. Replace any instruction or warning placards that are lost or damaged.
22. Always replace all guards and covers after working on the crane.
23. 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.
24. 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 display, computer, and the engine electronic control module. When welding on the boom or turntable assembly, remove the cable reel and any other electronic components bolted to these assemblies.
25. When using pressure spray to clean the crane, cover all electronic components with sheets of plastic to protect them from spray.
26. Do not allow anti-freeze to contact skin. Rinse off spills immediately with plenty of water. Anti-freeze is highly toxic if ingested.
27. Always disconnect negative cable first and refasten last to prevent an accidental short through chassis components.

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-20-1K Industrial Crane will perform better and 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 ensure 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 fuel tank level.
7. Check torque hub oil level.
8. Check tire pressure.
9. Check for loose pins, bolts, and retainers.
10. Check brake fluid reservoir for appropriate fluid level.
11. Operate foot brake. Check for operation.
12. Operate park brake. Check for operation and warning light.
13. Operate throttle. Check for operation.
14. Start engine.
15. Check oil pressure.
16. Check voltmeter.
17. Check power steering for operation.
18. Check anti-two-block system for proper operation.
19. Check transmission control switch and accelerator pedal for operation.
20. Check lights for operation.
21. Test drive unit and check for normal operation.
22. Check operation of hydraulic outriggers.
23. Check boom rotation.
24. Check boom elevation.
25. Check boom extension (pay out hoist cable during power extension).
26. Perform cable break-in procedure, page 3-11.
27. If equipped with an RCL, perform a load test according to the Rated Capacity Limiter Operation Manual.

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 and able to perform safely.

Daily:

1. Check radiator coolant level.
2. Check engine oil level.
3. Check general condition of tires.
4. Visually inspect for loose pins and physical damage.
5. Check fuel level.
6. Check engine coolant temperature.
7. Check battery voltage.
8. Check hydrostatic transmission control switch and accelerator operation.
9. Check parking brake operation.
10. Check power steering operation.
11. Observe chassis for normal driving operation.
12. Observe boom operation for normal power and speed.
13. Check load line and hooks for damage.
14. Check condition of sheaves and load line retainers.
15. Check hydraulic oil level.
16. Check anti-two-block system for proper operation.
17. Check back-up alarm for proper operation.
18. Check hydraulic hoses, particularly those that flex during crane operation.
19. Check horn, back-up alarm, and outrigger alarms (if equipped) for proper operation.

Weekly:

1. Check tire pressure - 145 psi (1000 kPa).
2. Visually inspect wheel nuts.
3. Check lights.
4. Check brake lines and power steering lines for damage.
5. Check brake fluid level.
6. Check operation of hoist brake for smoothness.
7. Check outrigger holding valves for operation.
8. Check boom topping holding valve for operation.
9. Check boom extension cylinder holding valve for operation.
10. Check that BoomJib (if equipped) is properly pinned with retainers in place.
11. Check Drain Water Separator (Kubota D1803 Only).

IC-20 MAINTENANCE CHECKLIST

Refer to the component maintenance section of this manual and to the engine operator's manual for complete instructions.

50-HOUR INTERVALS:

1. 50-hour lubrication, as shown on lube schedule.
2. Inspect wire rope thoroughly.
3. Inspect for physical damage and leaks.
4. Check tire pressure and condition (145 psi (1000 kPa)).
5. Clean radiator fins.
6. Change engine oil and filter after first 50 hours and at every 400 hours thereafter.
7. Change the hydraulic filters after the first 100 hours and at 500 hours thereafter.
8. Check rotation cylinders.
9. Check rotation bearing bolt tightness.
10. Check axle mounting bolts and pins.
11. Torque wheel mounting nuts. (60 ft-lbs (80 N-m) front, 200 ft-lbs (270 N-m) rear)
12. Check for loose pins or pin retainers.
13. Check steering lines for damage.
14. Inspect sheaves and hooks for damage or excessive wear.
15. Visually inspect welds on boom, turret, and outriggers.
16. Clean air cleaner inlet, dustcap, and dust cup.

250-HOUR INTERVALS:

1. 50-hour maintenance; 50 and 250-hour lubrication.
2. Adjust fan belt tension
3. Check tension of fan and alternator belts.
4. Clean battery.
5. Inspect all bolts for tightness.
6. Visually inspect all welds for cracks.
7. Clean or change air filter (every 100 hours if used in dusty conditions).
8. Check hydraulic fittings for leaks.
9. Inspect air intake system for cracks and leaks.
10. Check brake cable adjustment.
11. Check engine and radiator mounts.

500-HOUR INTERVALS:

1. 50 and 250-hour maintenance; 50, 250 and 500-hour lubrication.
2. Change fuel filter element and clean water separator.
3. Check antifreeze for protection level and cleanliness.
4. Inspect engine fan and replace fan belt.
5. Clean crankcase vent.
6. Remove any sediment in fuel tank.
7. Change hydraulic filter elements and inspect oil from elements for water or excessive contamination.
8. Check condition of all operational and warning placards.
9. Torque mounting bolts on rotation bearing and gearbox, winch, and axles.
10. Inspect boom sections for signs of overload, excessive wear, or other damage.
11. Replace air filter element.
12. Check water pump for leaks and clean water jacket.
13. Check fuel lines for leaks.

1000-HOUR INTERVALS:

1. 50, 250 and 500-hour maintenance.
2. 50, 250, 500 and 1000-hour lubrication.
3. Adjust engine valve clearance per engine manual.
4. Change hydraulic fluid and filters and clean breather and reservoir.

1500-HOUR INTERVALS:

1. 50, 250, and 500-hour maintenance.
2. 50, 250, and 500-hour lubrication.
3. Check injector tip per engine manual.
4. Check EGR cooler per engine manual (D1803 only).
5. Change oil separator element per engine manual.

3000 HOUR INTERVALS:

1. Inspect turbocharger per engine manual.
2. 50, 250, 500 and 1000-hour lubrication.
3. 50, 250, 500 and 1000-hour maintenance.

6-MONTH INTERVAL: (For usage less than 250 hours in 6 months)

1. Perform 250 hour maintenance and lubrication.
2. Change hydraulic filter elements and inspect oil.

12-MONTH INTERVAL: (For usage less than 500 hours per year)

1. Perform 6 month maintenance.
2. Perform 500 hour maintenance.
3. Change hydraulic fluid and filters and clean breather and reservoir.
4. Check EGR piping per engine manual (D1803 only).
5. Check intake air line per engine manual.
6. Check exhaust manifold for cracks, gas leaks, looseness, or damage per engine manual.

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 engine maintenance specified in engine manual for 24-month interval.

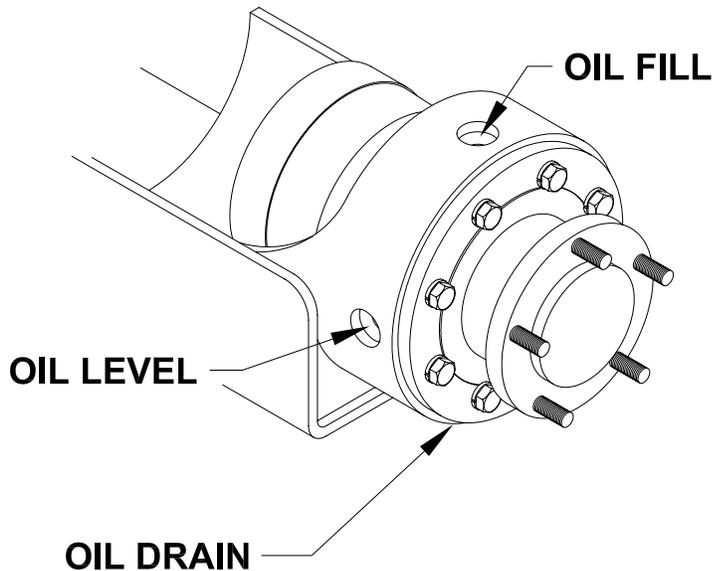
S/N: _____ HOURS: _____ DATE: _____

BY: _____

ROTATION SYSTEM LUBRICATION

There is one grease fitting on the right-hand side of the rotation bearing. This should be used to lubricate the bearing every 50 hours. Rotate the turntable 90 degrees while pumping grease into the fitting. Use about 3 ounces (89 mL) of grease each time the bearing is lubricated.

Also, lubricate the four grease fittings on each end of the two swing cylinders.



TORQUE HUBS

Use Mobilube HD 80W-90 gear lube or equivalent SAE 80W-90.

On new cranes, drain oil after first 50 hours of use and refill.

Check oil level every 50 hours.

Drain and refill after 1,000 hours of operation or after one year of service, whichever comes first.

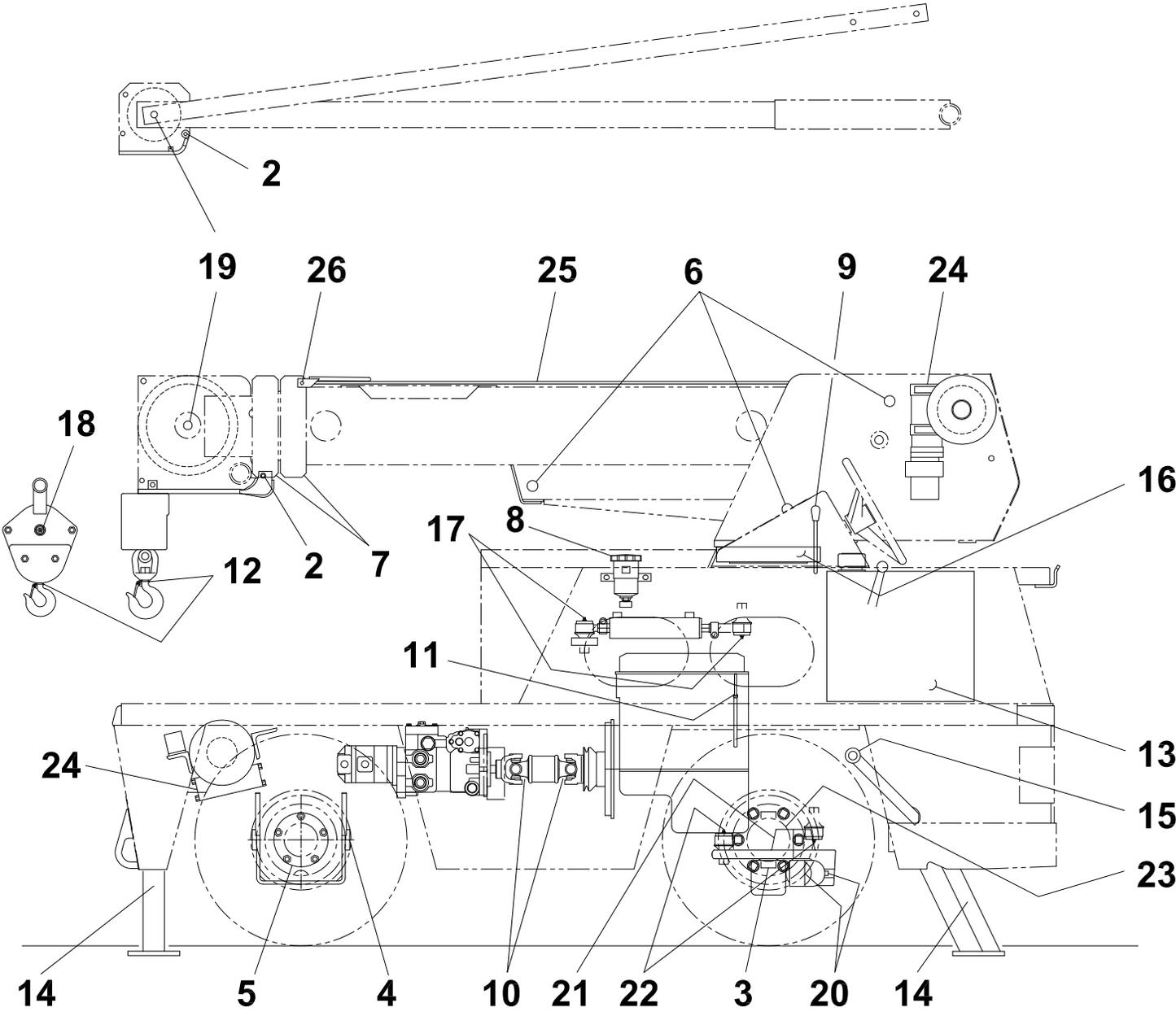
WIRE ROPE LUBRICATION

The wire rope should be cleaned and 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. 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.

IC-20 LUBRICATION CHART



IC-20 LUBRICATION SCHEDULE

ITEM	DESCRIPTION	LUBE SYMBOL	LUBRICATION INTERVALS				MONTHS	NOTES
			50 HOUR	250 HOUR	500 HOUR	1000 HOUR		
1								
2	Anti-Two-Block Arm	SIL	X				2 Points	
3	Axle Kingpins	MPG			X		4 Zerks	
4	Axle Pivot Pin	MPG			X		1 Zerk	
5	Axle Planetary Hubs	MPL	X			12	Check @50, Change @12 Mo.*	
6	Boom Extension Pins	MPG		X			6 Pins - Wipe	
7	Boom Rub Pads	SIL	X				Spray or Wipe	
8	Brakes	HO	X				Check @50, Bleed @12 Mo.*	
9	Control Valve Links	SIL		X			12 Points	
10	Drive Shaft Joints	MPG			X		2 Zerks	
11	Engine Oil	EO	X	X		6 Max.	Check Daily, Change @250 Hrs. or 6 Mo. Max.	
12	Hook Swivel & Pin	MPG	X				Wipe	
13	Hydraulic Oil	HO	X		X	12 Max.	Check Daily, Change @1000 Hours or 12 Mo. Max.	
14	Outrigger Legs	SIL	X				Wipe Upper & Lower Sides	
15	Pedal Hinges	SIL			X		2 Points	
16	Rotation Bearing	MPG	X				1 Zerk*	
17	Rotation Cylinders	MPG	X				4 Zerks*	
18	Sheave Block	MPG	X				2 Zerks	
19	Sheave Pins	MPG	X				1 Zerk Std, 1 On Boom Ext.	
20	Steering Cylinder Ends	MPG	X				2 Zerks	
21	Steering Sector	MPG	X				1 Zerk	
22	Steering Tie rod End	MPG	X				4 Zerks	
23	Wheel Bearings, Rear	WBG				12	Clean & Repack	
24	Winch(es)	MPL		X		12	Check @250, Change @12 Mo.	
25	Wire Rope	2-X	X				Spray, Brush or Soak*	
26	Wire Rope Retainers	SIL	X					

* See Procedures in the Manual

LUBE SYMBOLS

HO - Approved Hydraulic Fluids - See Page 3-20
 EO - Engine Oil - See Specs in Engine Manual
 MPG - Multi-Purpose Gun Grease
 MPL - Multi-Purpose Gear Lube - SAE 80W-90
 SIL - Silicone Lube - Aerosol with Concentrating Tube
 WBG - Wheel Bearing Grease
 2-X - AMOVIS #2-x

FLUID VOLUME

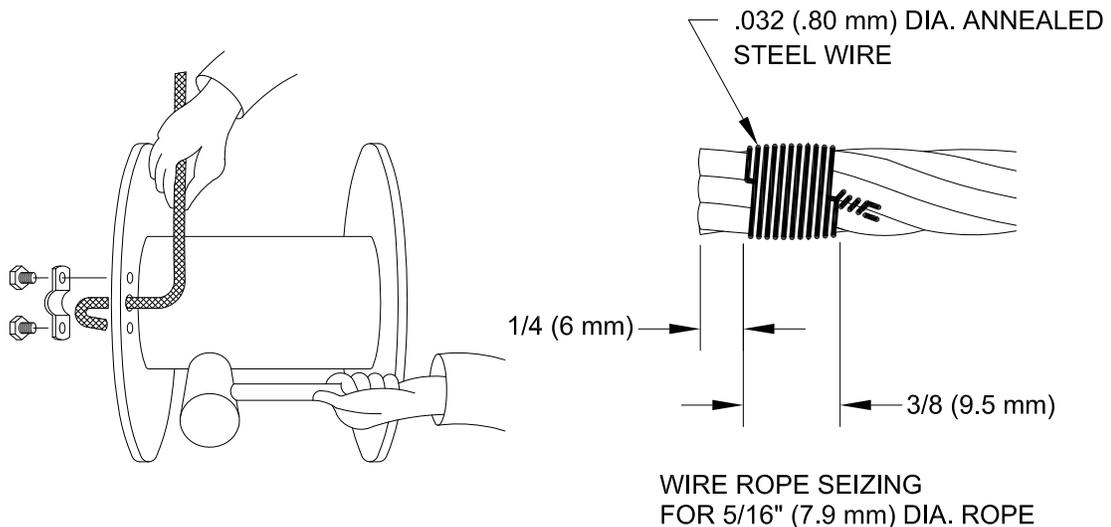
Hyd Res. - 9.5 Gal. (36 L)
 Fuel Tank - 13.5 Gal. (51 L)
 Hoist - 14 Oz. (414 ml)
 Torque Hubs - 2 Pts. (1 L)
 Hyd Sys. Total- 12.5 Gal. (47 L)
 Engine Cooling - 12 Qts. (11 L)
 Front Aux. Winch- 8oz. (236 ml)
 Brake Reservoir - 1Pt. (.50 L)

HOIST CABLE INSTALLATION AND INSPECTION

The following steps will assure that the wire rope winds smoothly and evenly on the hoist and will yield greater safety and longer cable life:

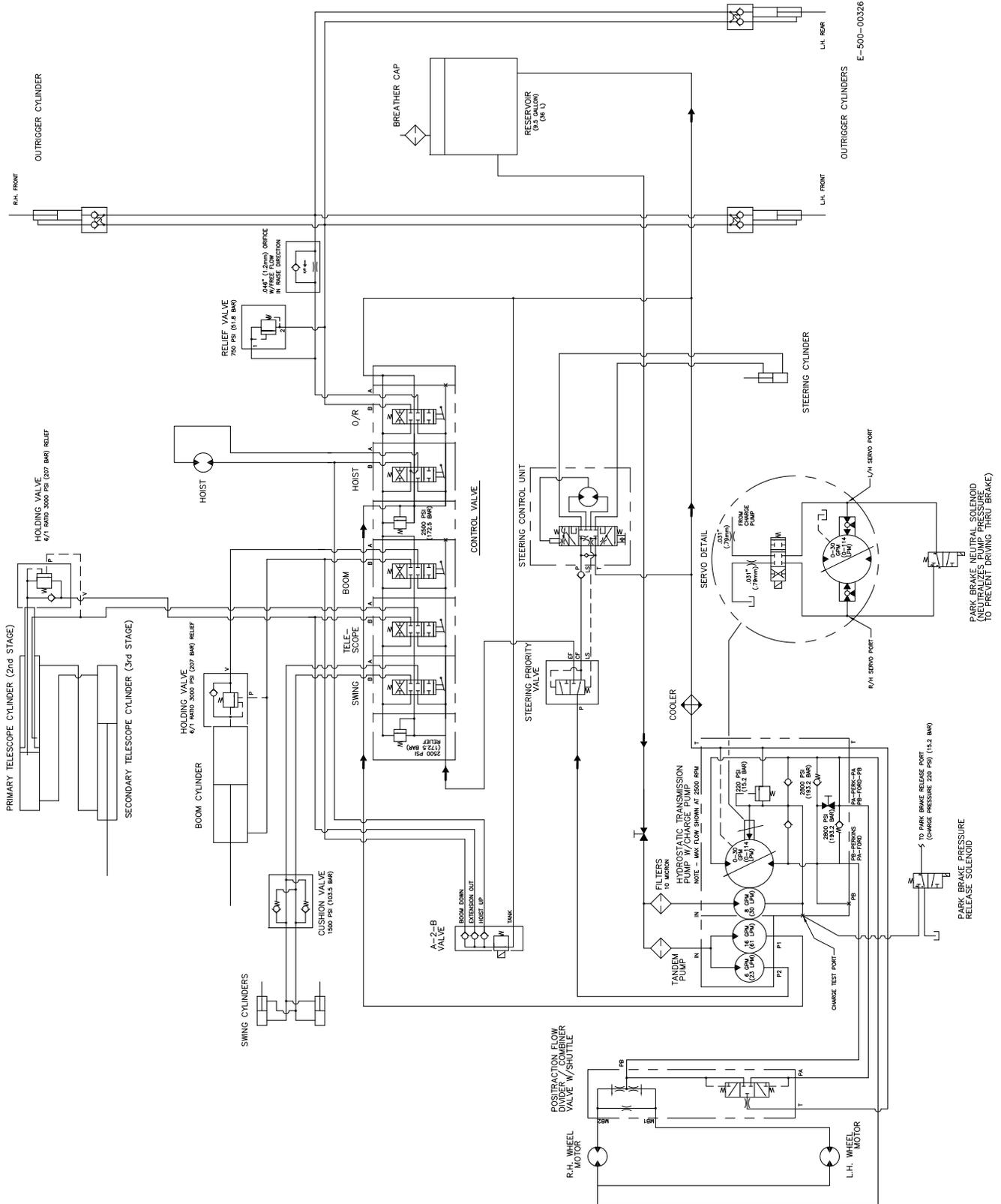
Refer to **Section 1** of this manual for complete replacement rope specifications.

1. If possible, the cable should be rolled off a storage spool and straightened out on the ground in line with the boom. If the ground is not clean or the space is too limited, the cable can be wound directly from the storage spool onto the hoist, but the spool must rotate in the same direction as the hoist.
2. Check the seizings on the ends of the cable, and replace them if they are missing or damaged.
3. Install the cable over the boom tip sheave and route it through the cable retainer loops, to the hoist drum.
4. Position the hoist drum with the cable clamp on top.
5. Insert the cable through the anchor slot and under cable clamp. The end of the cable should extend past the clamp as much as possible.
6. Force the rope to the left side of the drum.



7. 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.
8. After two turns of the hoist drum, stop the hoist and push the cable tightly against the flange of the drum with a wooden or rubber mallet.
9. Slowly rotate the drum until the first layer of cable is on the drum. If any gaps between the rope appear, stop the hoist and tap the cable toward the flange. There must be no gaps.
10. After the first layer is on the drum, the hoist may be turned a little faster until the remainder of the cable is installed.
11. Leave about 15 feet (4.6 m) of cable on the ground to install the sheave block. See the *Operation Section* for instructions on reeving and wedge socket attachment.
12. Install the cable retainer pins and cotters in the tip sheave plates.
13. For the cable break in, lower the outriggers and attach a load of about 1000 pounds (450 kg). Extend the boom fully. Position the load at a 6-foot (2.0 m) load radius over the left-hand side of the crane. Hoist and lower the load three times, and check winding of the rope on the hoist.
14. Attach about 2500 pounds (1100 kg) and repeat. Be sure that the cable winds evenly on the hoist.
15. If the cable appears to twist too much, remove the sheave block and rewind the cable on the drum as in Steps 7-11.
16. Never lift more than the rated load on the Capacity Chart for the parts of line and type of wire rope being used.
17. 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.

JIC SCHEMATIC



E-500-00326

HYDRAULIC SYSTEM

The IC-20 hydraulic system consists of three sub-systems, driven by a triple pump. The 30-gpm (114 L/min) piston pump powers the propulsion system. The 6-gpm (23 L/min) gear pump supplies the hydrostatic steering function and the boom functions. The hoist, outriggers, and optional front winch are powered by the 16-gpm (61 L/min) pump.

The boom, outriggers and hoist functions are controlled by a single valve assembly with two inlet ports. The 6-gpm (23 L/min) pump flow enters the left-hand port and supplies the swing, boom, and telescope. The 16-gpm (61 L/min) pump flow enters the mid-inlet port to supply the hoist and outriggers. Adjustment procedures for the crane hydraulic functions are given on page 3-22.

The schematic of the hydraulic system is shown on the previous page. The steering system and propulsion systems are also shown in diagrams on the following pages.

STEERING SYSTEM

The IC-20 steering system is a load-sensing, demand-type system that takes only as much flow as is needed when steering and directs the excess flow to the control valve for boom functions. The priority flow-control valve is in the line between the 6-gpm (23 L/min) pump section and control valve.

Oil from the 6-gpm (23 L/min) section of the pump goes into the priority valve at port "P." When no steering is required, the entire flow goes through the priority valve and leaves through port "EF" to the crane valve. The crane operating speed is not affected, since there is no loss of volume passing through the priority valve.

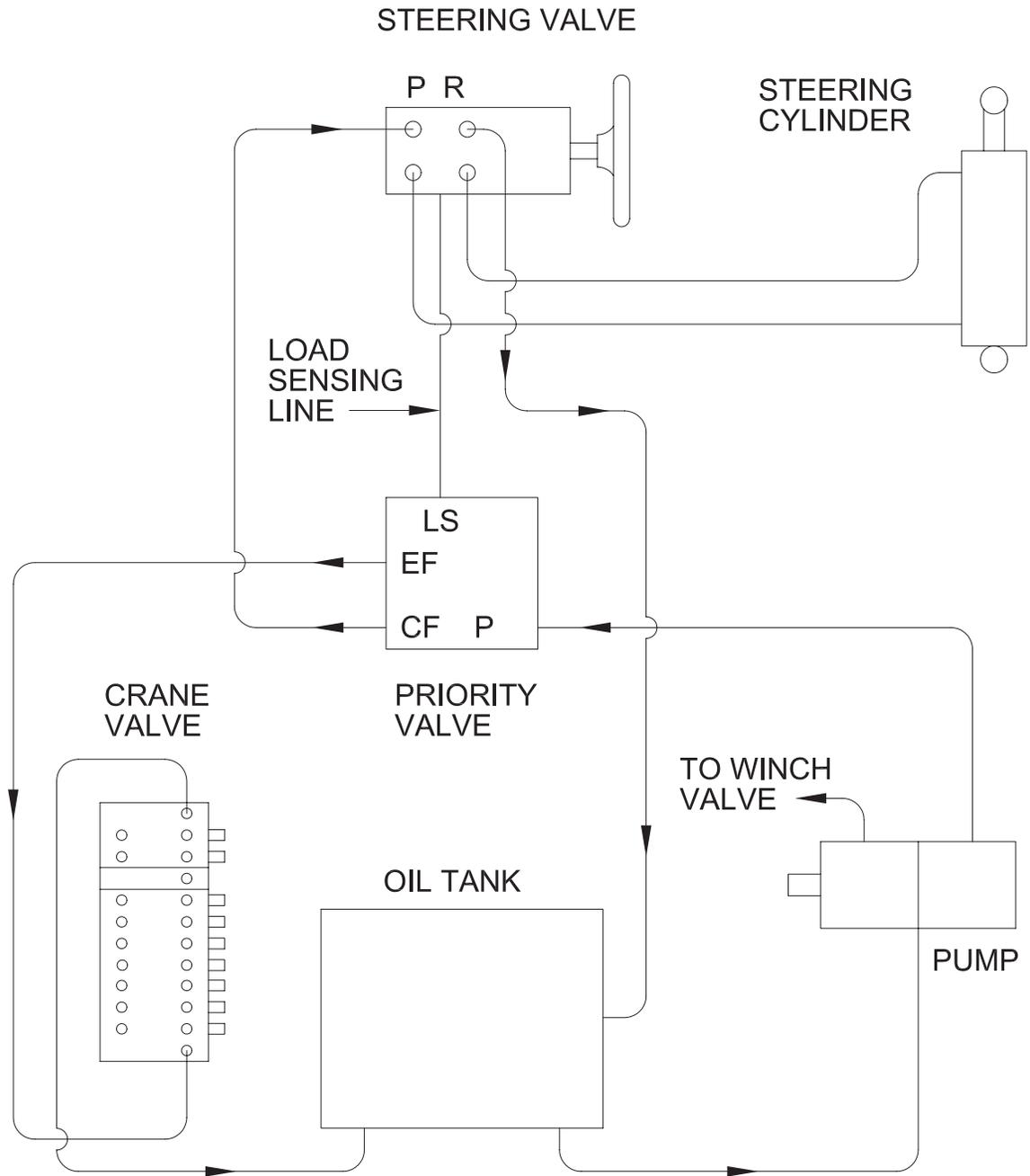
When the steering wheel is turned, the load-sensing line signals the priority valve to divert the required amount of oil to the steering control unit to meet the steering system requirements. The excess oil, not required for steering, flows to the crane control valve as usual. Since the amount of oil required for steering is usually a small portion of the pump output, the crane 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.

There is a check valve inside the pressure port of the steering control unit. This prevents pressure in the steering cylinders from venting back into the pressure line when the pressure is low. This eliminates steering wheel kickback when the steering wheel is released.

The steering system pressure relief valve inside the steering control unit is set at 1500 psi (103 bar) at the factory and should not need adjustment.

STEERING SYSTEM



PROPULSION SYSTEM

The propulsion system is a closed-loop hydrostatic transmission. The variable volume piston pump is driveline driven from the engine crank shaft. The pump can deliver up to 30-gpm (114 L/min) or 3000 psi (207 bar) to the wheel drive motors. The flow from the wheel drive motors returns directly to the pump inlet, not the reservoir. The built-in charge pump maintains approximately 220 psi (15 bar) pressure to the intake side of the piston pump whenever the engine is running. Excess flow from the 8-gpm (30 L/min) charge pump combines with case drain flow and goes through the cooler, and returns to tank.

When the transmission control lever in the operator compartment is pushed forward, the pump starts delivering oil to the wheel drive motors for forward travel. When the transmission control lever is released, the pump blocks the flow and the wheel drive motors stop. If this is done on level ground, the crane will stop and stand still. If this is done on an incline, the crane will stop, but then creep down the incline, due to oil leaking through the wheel drive motors. ALWAYS apply the parking brake when the crane is stopped. When parking on a slope, also set the outriggers or place wheel chocks on the downhill side of the wheels.

A positraction flow divider is located in the line between the pump and drive motors. When a wheel is lifted off the ground, is on ice, or for any reason starts to spin, it will momentarily take more oil than the wheel that has traction. When this happens, a spool inside the positraction valve will shift and restrict the high flow to the spinning wheel, forcing flow to the wheel with traction. If the unit stops moving, the engine speed will have to be increased to resume travel.

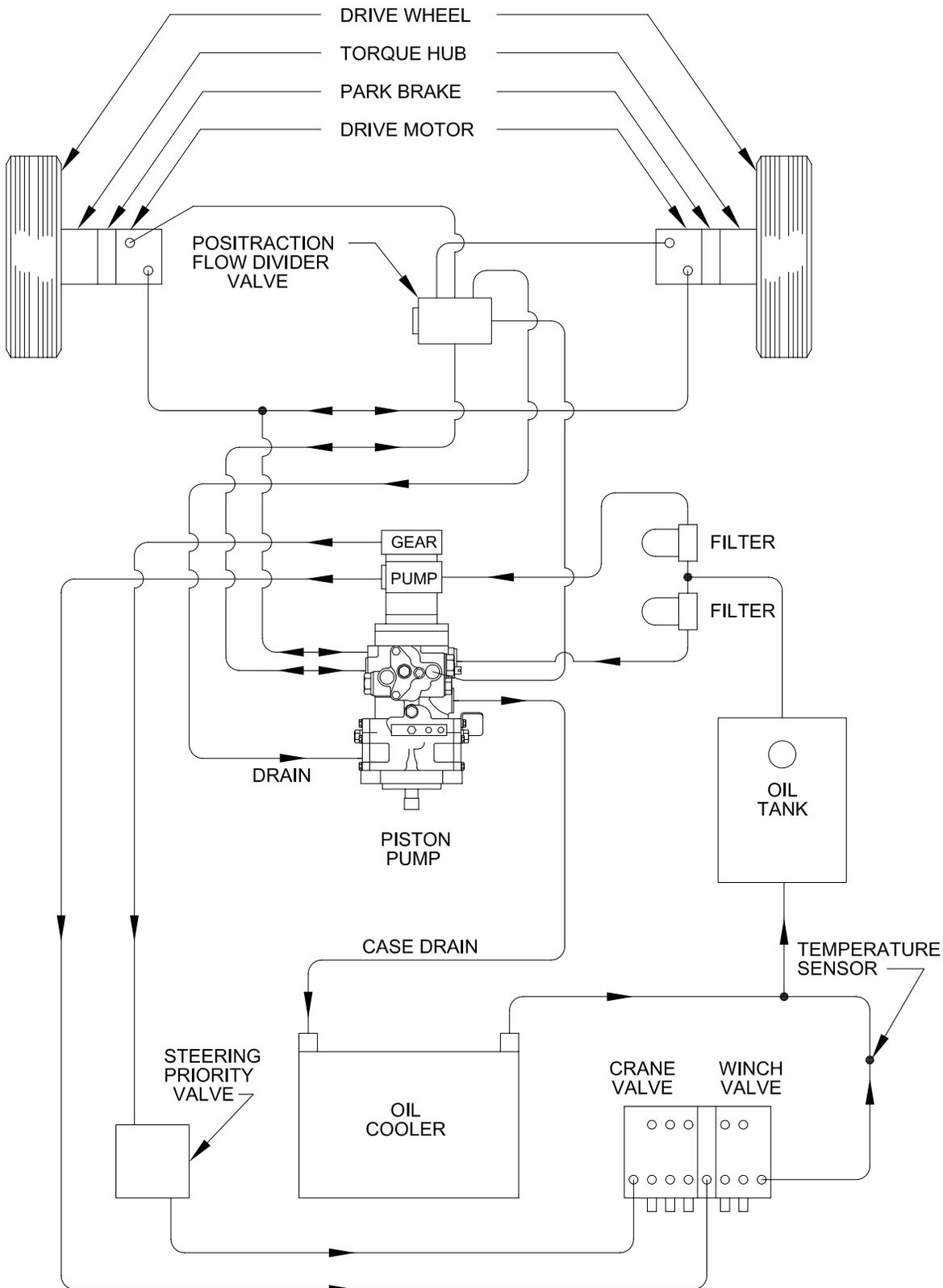
The crane is equipped with an oil cooler that will allow it to operate properly when the ambient temperature is over 100°F (38°C). An oil temperature gauge is located on the screen, along with the sensor. If this gauge reads above 200°F (93°C), the unit should be shut down and the reason for the excessive temperature located and corrected. The fins on the oil cooler and engine radiator may be dirty and need cleaning.

For maneuvering in tight quarters, the throttle should be set for low speed. For traveling longer distances the throttle may be set to full speed. The vehicle speed is controlled by the transmission lever.

A manual bypass valve is built into the piston pump. It appears like a shaft with a cross hole in it on the side of the pump. If the machine cannot run under its own power, it can be towed for very short distances at 3 mph (5 km/h) or less by turning the bypass valve counterclockwise 4 turns. It must be turned back again as far as possible to run normally.

CAUTION: The crane will roll freely down inclines with the bypass valve open. Keep the valve closed except when towing and the crane is secured to the tow vehicle. An operator must be in the crane to operate the brakes.

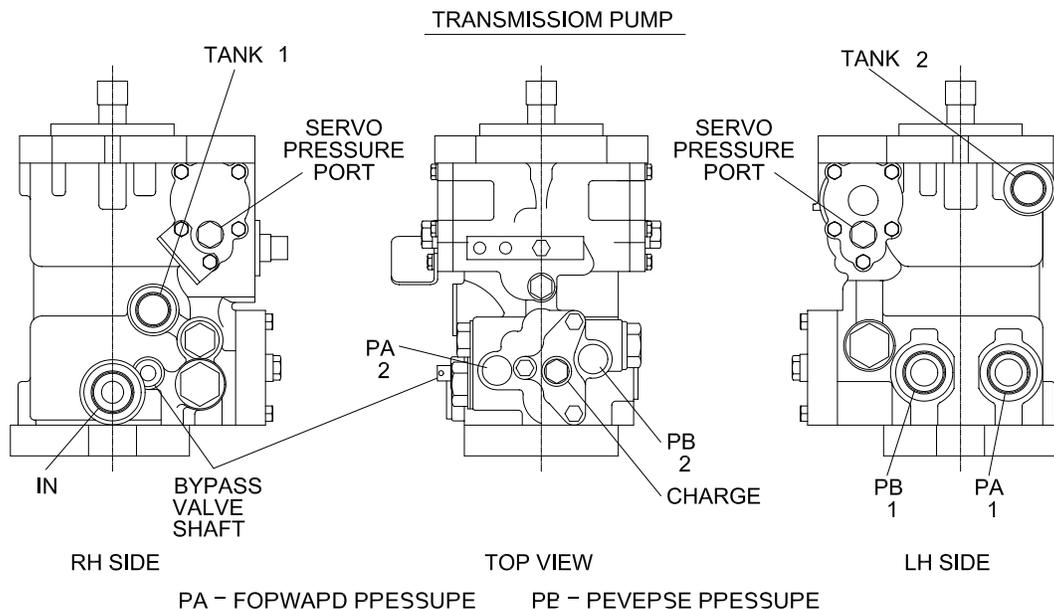
IC-20 PROPULSION SYSTEM



START-UP PROCEDURE -- PISTON PUMP

When initially starting a new or rebuilt transmission pump, it is extremely important that the start-up procedure be followed. It prevents damage to the unit that might occur if the system is not properly purged and charged with oil before start-up.

1. After the propulsion components have been properly installed, fill pump housing at least half full with new hydraulic fluid as specified on page 3-20. Connect all hydraulic lines and check to be sure they are tight.
2. Check the wiring connections to the pump control.
3. Fill the reservoir with approved hydraulic fluid that is new and clean. Install a 0 to 300 psi (0 to 21 bar) gauge in the charge pressure port. The port is the highest port on top of the pump and has a #6 elbow with a ¼-inch (6 mm) hose that connects with the brake release valve. This may be disconnected, or a tee may be inserted. See figure below.
4. Start the engine at the lowest speed and shut it off again after running 5 seconds. Repeat this twice. This procedure enables the charge pump to draw in the oil before running the pump continuously.
5. Keep the transmission control in the neutral position, start the engine, and run it at a low idle. The charge pump should immediately pick up oil and fill the system. If there is no indication of fill in 30 seconds (gauge in charge pressure port of the pump should register about 220 psi (15 bar)), stop engine and determine the cause.
6. After the system shows signs of filling, run it in NEUTRAL and low idle for 5 minutes. Extend the outriggers so that drive wheels can spin freely. The outriggers must be blocked up to raise the machine. At low engine speed, slowly push the transmission lever forward until the wheels turn slowly. Run for 5 minutes and repeat in REVERSE direction. Then increase to full throttle for one minute in each direction.
7. Check fluid level in the reservoir and fill to the proper level. Check all line connections for leaks and tighten if necessary.



IC-20 PISTON PUMP TROUBLESHOOTING

TROUBLE	CAUSES	REMEDIES
1. System will not operate in either direction.	<ul style="list-style-type: none"> A. Brake switch tripped B. Oil supply low C. Oil filter clogged D. Oil too heavy E. Bypass valve open F. Neutral solenoid valve is open G. Brake solenoid valve is open H. Low charge pressure--below 200 PSI I. Charge pump relief valve damaged J. Damaged internal charge check valve K. Charge pump key sheared L. Charge pump worn or scored or damaged M. Drive coupling broken N. Forward or reverse relief valve stuck open 	<ul style="list-style-type: none"> Release brake switch. Check oil level, fill. Replace filter element. Use proper viscosity oil. Close bypass valve. Repair valve or circuit. Repair valve or circuit. See below. Remove relief valve parts. Examine parts and seat. Replace damaged parts. Disassemble and determine if check valve is faulty. Inspect charge pump for damage & replace key. Remove parts and examine. Replace defective parts. If severe scoring is indicated, remove complete pump unit, disassemble and inspect for damage.* Inspect coupling for sheared spline. Remove relief valve. Clean or replace.
2. Pump is noisy.	<ul style="list-style-type: none"> A. Air in system B. Clogged filter C. Internal pump or motor wear or damage 	<ul style="list-style-type: none"> Fill oil reservoir. Check and fix suction line leaks. Replace filter element. Disassemble, inspect and repair.*
3. Sluggish response to acceleration or deceleration.	<ul style="list-style-type: none"> A. Air in system B. Low charge pressure C. Loose bypass valve D. Park brake on E. Relief valve dirty or damaged F. Internal pump or motor wear or damage 	<ul style="list-style-type: none"> See Steps 1-B, 1-D, 2-A. See Step 1-H. Close bypass valve. Repair park brake or brake solenoid. Remove, clean or replace. Disassemble, inspect and repair.*

* Pump should be disassembled only by experienced hydraulic pump repair personnel, preferably at a Sundstrand Service Center.

CARE OF HYDRAULIC OIL

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

The IC-20 is equipped with a 100-mesh fill strainer, two, 10-micron suction filters, a breather filter, and a 9.5-gallon (36 L) tank. The filters must be changed after the first 100 engine hours to eliminate the contaminants generated during run-in. Thereafter, they should be changed at every 500-hour maintenance interval.

The filters are located between the right hand tires. To minimize oil loss, close the shutoff valves under the tank. **Be sure shutoff valves are fully opened before starting engine.**

Remove the filter elements and catch the hydraulic oil in a clean container. Pour the remaining oil out of the old elements into the clean container and 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 each new element seal and install the new elements. Open the shutoff valves. Run the engine and check for any leaking around the seals.

The hydraulic oil should be changed every 1000 hours or once a year, whichever is sooner. Wash the oil tank and filters before changing the oil. Retract the telescope, topping, and outrigger cylinders. Leave the shutoff valves open and remove the drain plug. Catch the oil and dispose of it properly. Clean the breather element in the fill cap with solvent and compressed air. Clean out the tank with solvent and compressed air.

Replace the filters, as described previously, and refill the tank with new hydraulic oil that meets the specifications in the table. 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. Add hydraulic oil to the dipstick level mark, if necessary, with cylinders retracted.

APPROVED HYDRAULIC FLUIDS

WARM CLIMATE:

MOBIL ATF D/M*
CASTROL HEAVY DUTY MULTI-PURPOSE ATF
D-A LUBE AUTOTRANS SUPER PLUS
TOTAL FLUIDMATIC AV

COOL CLIMATE:

MOBIL MULTI-VEHICLE ATF
DEXRON VI

*Total Fluidmatic MV was used at the factory to fill the hydraulic system of your IC-20. Please see BMC drawing 210-00004 for approved alternatives.

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 they are run with the shutoff valve closed or with insufficient oil level in the reservoir.

Observe the operation of the machine. If the oil is too cold, the machine will be sluggish and should be warmed up further before sustained work is attempted. If the oil is too hot, internal leakage will increase, pump efficiency will go down, and moving parts will not be properly lubricated. If operating temperature is excessive, rapid deterioration of the oil will result and moving parts and seals will wear more quickly. The cause of the excess heat should be determined and corrected. Oil temperature should never exceed 200°F (93°C).

CONTROL VALVE ADJUSTMENTS

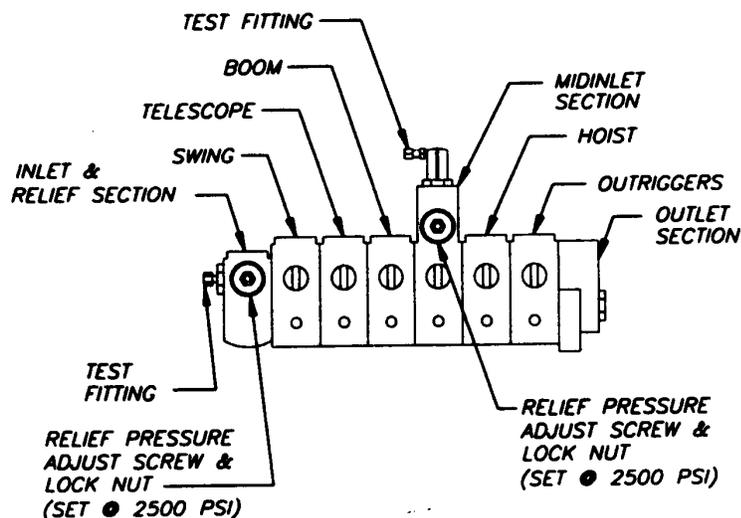
The crane control valve has two relief valves to protect the hydraulic components. The relief valves are adjustable and should be checked and set as follows:

1. Boom circuits -- 2500 psi (172 bar) at full flow.
2. Hoist and outrigger circuits -- 2500 psi (172 bar) at full flow.

BOOM CIRCUITS:

Remove the 3/8-inch tube cap from the test fitting on the left-hand side of the control valve and install a 3000-psi (200 bar) test gauge. To obtain full-flow reading, run pump at full speed, actuate boom control lever to LOWER position, and hold until maximum reading is made. If a pressure of 2500 psi (172 bar) is not possible, check the following:

1. Broken mechanical connection to the pump shaft.
2. Low oil level in the reservoir.
3. Clogged suction filter or shut-off valve not fully opened.
4. Valve spool linkage not allowing control valve to fully open. Valve spool should move 5/16 inch (8 mm) each way from neutral.
5. Adjust relief valve by removing cap on end of relief cartridge, and turning socket head screw clockwise to increase pressure, or counter-clockwise to lower pressure.
6. Foreign particle in pilot-operated relief.
7. Worn or defective hydraulic pump.



HOIST AND OUTRIGGER CIRCUITS:

The relief pressure for the hoist valve can be adjusted similarly to the boom circuit. Connect a 3000 psi (200 bar) gauge to the test fitting on the mid-inlet section of the valve. Disconnect both hoses at hoist motor and install plugs. Do not connect hoses together. Operate hoist control in either direction. Run engine at full throttle. Adjust relief valve to 2500 psi (172 bar) at full flow.

BOOM CYLINDER HOLDING VALVE

A holding valve is directly connected to the base of the boom lift cylinder barrel and to the base of the primary extension cylinder rod. These valves are 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 one foot above the ground, using the boom lift cylinder (not the hoist). An example of rated load for the IC-20 is 2500 pounds (1110 kg) at an 8-foot (2.5 m) load radius, with outriggers extended, and the boom over the front. Turn the engine off and move the boom lever to the LOWER position. If the boom moves down, adjust the holding valve.

WARNING

Before working on the holding valves or plumbing to the boom lift cylinders, always relieve trapped pressure by lowering the boom fully, turning off the engine, and cycling the BOOM lever.

To adjust the holding valve, loosen the jam nuts on the adjusting screw and tighten the screw until unpowered boom movement stops. Retighten the jam nuts. If adjusting the valve does not help, the cylinder may have internal leakage, or the valve may be malfunctioning.

EXTENSION CYLINDER HOLDING VALVE

A holding valve is directly connected to the base of the primary telescope cylinder rod. The 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 the correct radius. A 4000 to 5000 pound (1810 to 2270 kg) load on a 2-part line is required for this test. Use the hoist to lift this load about 6 inches (150 mm) 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 and pull the TELESCOPE lever to the RETRACT position. 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.

ENGINE MAINTENANCE

AIR CLEANER SERVICE:

Clean out the dust cup every 50 hours. Loosen the clamps around the cup and housing and remove the cup. Dump dust out of cup. Clean gasket and sealing surfaces with a damp cloth. Replace cup gasket if it shows signs of damage. Replace cup with arrows pointing up and tighten clamp.

Clean the intake cap screen every 50 hours, and perform a thorough inspection of the air intake pipes and joints.

Clean the filter element every 250 hours or every 3 months, whichever comes sooner and replace the element every 500 hours or 6 months. Remove and clean the dust cup and gasket, and the intake cap. Remove the wing nut on the element and gently remove the element. Bumping the element during removal may cause dirt to fall into the clean air tube. Clean the inside of the housing carefully with a damp cloth. To clean the element, use a compressed air blower nozzle with less than 100 psi (690 kPa) and blow air from the inside of the element. Shake dust off of the outside of the element. Make sure the gaskets and element fit properly and reassemble, being careful not to allow any dust into the intake pipe.

Do not remove an element just for inspection. This may do more harm than good. You cannot judge the element condition by its appearance. If you think the filter may need service, remove it and replace or clean it before reassembling air cleaner.

Conditions where more dirt than usual is in the air, especially soot, will make more frequent service necessary. If there is a significant amount of dust in the dust cup when it is cleaned every 50 hours, clean the element every 100 hours and replace it every 200 hours--or more frequently in extremely dusty conditions. Excessive exhaust smoke or loss of power may indicate a plugged filter.

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 two 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 Installation*. Replace engine parts only with genuine OEM parts as required by EPA regulations.

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 in the IC-20 should be checked, and retightened if required, as a part of the preventive maintenance program. Particular attention should be given to the axle, wheel and hub mounting bolts, pump mounting bolts, rotation bearing bolts, and hoist bolts. All bolts used in assembly are heat-treated **Grade 5**, except the bolts attaching the rotation bearing to the mainframe and turret, which are **Grade 8**. The torque chart on the next page can be used on all bolts.

WHEEL BEARING ADJUSTMENTS:

Wheel bearing adjustment must be maintained at all times. Adjustment is made each time the bearings are repacked (annually). Wheel bearings are adjusted by the adjusting nut. This nut should be tightened until only a slight drag is felt when rotating the wheel.

WHEEL ALIGNMENT:

Toe-in, which is the setting of the steering wheels so they are closer together at the front than at the rear, is adjusted by lengthening or shortening the tie rods. Proper toe-in for the rear wheels is zero.

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 (6.7)	7 (9.5)	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.

J.I.C. SCHEMATIC

