



OPERATION AND SERVICE MANUAL

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

N160 Series Articulating Crane

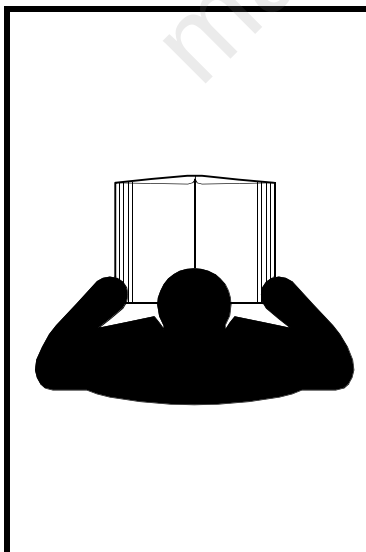
This Manual is Divided into the following Sections:

SAFETY AND OPERATION
SERVICE AND MAINTENANCE
SPECIFICATIONS
CRANE INSTALLATION

NOTICE

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

The crane serial number is identified on the builder's decal attached to the crane frame. **Always furnish crane serial number** when ordering parts or communicating service problems with your distributor or the factory.



WARNING

To prevent death or serious injury:

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

INTRODUCTION

This manual has been compiled to assist you in properly operating and maintaining your National crane.

Before placing the crane in service, all operators and persons working around the crane must thoroughly read and understand the contents of the manual pertaining to **Safety, Operation and Maintenance**. Before moving a vehicle equipped with the crane, information relating to transporting the vehicle must be read and observed.

This manual must be retained with the machine for use by subsequent operating personnel.

Information in this manual does not replace federal, state or local regulations, safety codes or insurance requirements.

DANGER

Failure to observe all the instructions contained in this manual will result in death or serious injury to the operator or bystanders or damage to the equipment.

Supplemental information regarding Safety & Operation, Specifications, Service & Maintenance, Installation, and parts for options such as Remote Controls, Augers, varying control of configurations, baskets, grapples, etc. is included in the Option Section at the rear of this manual.

Whenever a question arises regarding your National product or this publication, please consult your National dealer for latest information. Also, he is equipped with proper tools, necessary National parts and trained service personnel to properly maintain and service your crane.

A VHS Safety Video which includes sections on Operation, Safety and Maintenance for National crane operators and owners is supplied when warranty registration is complete. Additional copies are available from your local distributor or National Crane.

DANGER

**AN UNTRAINED OPERATOR
SUBJECTS HIMSELF AND
OTHERS TO**

DEATH OR SERIOUS INJURY

**YOU MUST NOT OPERATE
THIS CRANE UNLESS**

- You have been trained in the safe operating of this crane.
- You read, understand and follow the safety and operating recommendations contained in the crane manufacturer's manuals, your employers work rules and applicable government regulations.
- You are sure that all safety signs, guards and other safety features are in place and in proper condition.

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⚠ CAUTION

The Capacity Alert System is intended to be used as an aid to prevent most overload conditions. **Do not use the Capacity Alert System as a substitute for safe operating practices as outlined in the "SAFETY AND OPERATION" section of this manual.**

Do not expect the Capacity Alert System to detect all possible overload conditions. It will not prevent structural or stability overloads to the crane or winch caused by:

1. Freely swinging loads or operating in an out-of-level condition which will result in excessive side loading.
2. Side loading due to pulling sideways on the boom with boom rotation or load hoist. Load must always be directly under boom tip.
3. Sudden load movements from erratic operation of the crane functions which will result in excessive shock loading.
4. Improper loadline reeving for loads larger than single line pull capacity.
5. Extending the boom without first paying out the loadline which can result in deadheading (two blocking) the loadline against the boom tip.
6. Loads in excess of capacity when operating with a jib deployed.
7. Loads with lift cylinder fully retracted.
8. Excessive induced loading during auger system operation.
9. Operation without outriggers and stabilizers fully deployed or inadequate footing for the outriggers and stabilizers.

⚠ DANGER

JIB OPERATIONS

The Capacity Alert System does not provide accurate indication of overload conditions when operating with a jib deployed. Reliance upon the system to warn of overload with the jib deployed (or other excepted overload conditions) can result in structural damage, instability, injury and death. The operator must always know the weight of the load to be lifted, insure that the loadline reeving is correct for the size of the load, and operate the machine within its rated capacity in a safe, smooth manner according to the instructions outlined in the "SAFETY AND OPERATION" section of this manual.

SERVICE

SERVICE AND REPAIR

The information supplied in this section of the manual is designed to assist you in service and repair of your National Crane. Inspection, lubrication and general maintenance information are found in two previous sections of this manual. Before attempting to perform any service work, the machine must be shut down as outlined under Maintenance Procedure in the Maintenance section of this book.

Generally, a study of the hydraulic schematics in conjunction with a systematic procedure to locate and correct the problem will enable a skilled mechanic to determine the problem and correct it. If at any time you cannot find or correct the problem, contact your local distributor or National Crane Service Department. ***Be sure you have your parts and service book, model number and serial number at hand when you call.*** This information is on the serial number placard located on the crane frame.

The following general suggestions should be helpful in analyzing and servicing your crane. Use the following systematic approach should be helpful in finding and fixing problems:

1. Determine the problem.
2. List possible causes.
3. Devise checks.
4. Conduct checks in a logical order to determine the cause.
5. Consider the remaining service life of components against the cost of parts and labor necessary to replace them.
6. Make the necessary repair.
7. Recheck to ensure that nothing has been overlooked.
8. Functionally test the new part in its system.

NOTE: Your safety and that of others is always the number one consideration when working around cranes. Safety is a matter of thoroughly understanding the job to be done and the application of good common sense. It is not just a matter of "Do's" and "Don'ts". Stay clear of all moving parts.

CLEANLINESS

An important item in preserving the long life of the crane is keeping dirt out of working parts. Enclosed compartments, seals, and filters have been provided to keep the supply of air, fuel and lubricants clean. It is important that these enclosures be maintained.

Whenever hydraulic, fuel, lubricating oil lines are disconnected, clean the adjacent area as well as the point of disconnect. As soon as the disconnection is made, cap, plug or tape each line or opening to prevent entry of foreign material. The same recommendation for clean-

ing and covering apply when access covers or inspection plates are removed.

Clean and inspect all parts. Be sure all passages and holes are open. Cover all parts to keep them clean. Be sure parts are clean when they are installed. Leave new parts in their containers until ready for assembly.

HYDRAULIC SYSTEMS

Contaminants in a hydraulic system affect operation and will result in serious damage to the system components. Dirty hydraulic systems are a major cause of component failures.

If evidence of foreign particles is found in the hydraulic system, flush the system.

Disassemble and assemble hydraulic components on a clean surface.

Clean all metal parts in a nonflammable cleaning fluid. Then lubricate all components to aid in assembly.

Inspect all sealing elements (O-ring, gaskets, etc.) when disassembling and assembling the hydraulic system components. Installation of new elements is always recommended.

When installing metal hydraulic tubes, tighten all bolts finger tight. Then, in order, tighten the bolts at the rigid end, the adjustable end, and the mounting brackets. After tubes are mounted, install the hoses. Connect both ends of the hose with all bolts finger tight. Position the hose so it does not rub the machine or another hose and has a minimum of bending and twisting. Tighten bolts in both couplings.

Due to manufacturing methods, there is a natural curvature to a hydraulic hose. The hose should be installed so any bend is with this curvature.

In case of replacement hoses with angled stem reusable fittings, the hose curvature must be taken into consideration when assembling and positioning the angled stem.

FASTENERS AND TORQUE VALUES

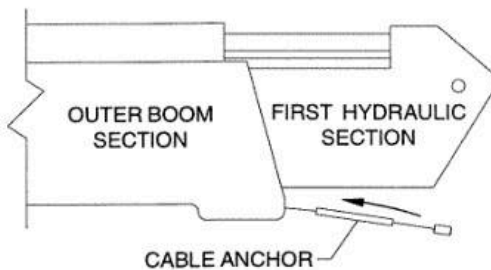
Use bolts of the correct length. A bolt which is too long may bottom before the head is tight against the part it is to hold. If a bolt is too short, there may not be enough threads engaged to hold the part securely. Threads can be damaged. Inspect them and replace fasteners as necessary. (See Maintenance Section for Torque Chart.)

Torque values must correspond to the type bolts, studs, and nuts being used.

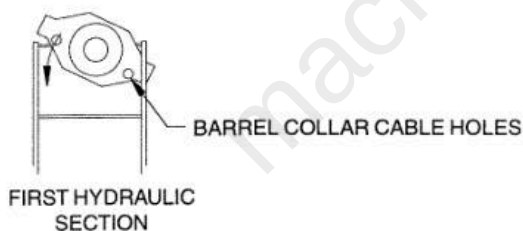
The torque tables are provided in the Maintenance Section for reference when performing maintenance.

Use of proper torque values is extremely important. Improper torquing can seriously affect performance and reliability.

16. Install the first hydraulic section (with the second and third hydraulic sections) into the outer boom section. Leave approximately 15 inches (380 mm) sticking out. Do not allow the cables to become pinched or crushed.
17. Install the two wear pads with plugs to the two cable anchors which bolt to the inside bottom front of the outer boom section. Lift up on the front end of the first hydraulic section. Remove the tape from the extend/retract cables and slide the cable anchor/wear pad assemblies over the cables and into the boom sections. Be sure the extend/retract cables install completely into the cable anchor grooves. Loctite, install and torque the cable anchor to the Grade 8 value for a 3/8-16 UNC capscrew listed in this manual.



18. Install the four side wear pads with shims to the inside front of the outer boom section.
19. Install the wear pad to the extend cylinder barrel butt plate. With the extend cylinder fully retracted, rotate the collar at the end of the extend cylinder barrel into the slots at the top front of the first hydraulic section. Be sure the butt plate wear pad and barrel collar cable holes are towards the boom section top plates.



20. Loctite and install the extend cylinder barrel collar retaining plate capscrews with the retaining plates at the top end of the first hydraulic section. Torque the capscrews to the Grade 8 value for a 3/8 - 16 UNC capscrew listed in this manual.
21. Pull the threaded ends of the 1/2/3 extend/retract cables through the holes in the extend cylinder barrel collar and install one nut per cable.
22. Pull the threaded ends of the 0/1/2 extend/retract cables through the tubes on the top front of the outer boom and install one nut per cable.
23. Using a hydraulic porta power or crane hydraulics extend the extend cylinder rod threaded end through the hole in the top end of the second hydraulic section. Install the washer and 1 1/4-12 UNF lock nut and torque to 600 ft lbs (800 N.m).
24. Torque the 1/2/3 extend/retract cables to 35 ft lbs (47 N.m).
25. Torque the 0/1/2 extend/retract cables to 35 ft lbs (47 N.m)
26. Run several short cycles on the boom and recheck the cable torque with the boom slightly extended. Install the second nut on each extend/retract cable and lock the two nuts together.
27. Extend the boom out and install the spacer pads to the inside tops of the outer boom, first hydraulic and second hydraulic sections.
28. If the outer boom section was removed during disassembly, reverse the order of the "Boom Removal" section to reinstall the boom assembly onto the crane.

Hydraulic System

Flow Rate _____	17 GPM (64.3 LPM)
Pump-System Pressure _____	4050 ± 50 psi (27.9 MPa)
Pump-Standby Pressure _____	300 ± 25 psi (2.1 MPa)
Main Relief _____	4100 + 200/-0 psi (28.3 MPa)
Optional Stabilizer Section - "A" & "B" Port Relief _____	2100 ± 100 psi (14.5 MPa)
Spool #1 O/R Section - "A" & "B" Port Relief _____	2100 ± 100 psi (14.5 MPa)
Spool #2 Lift Section - "B" Port Relief (15 GPM Max) _____	2100 ± 100 psi (14.5 MPa)
Spool #3 Fold Section - (15 GPM Max) _____	
Spool #4 Turn Section - "A" & "B" Port Relief (10 GPM Max) _____	2100 ± 100 psi (14.5 MPa)
Spool #5 Extend Section - "A" Port Relief (10 GPM Max) _____	2950 ± 100 psi (20.3 MPa)
Optional Acc. Sections "A" & "B" Port Reliefs _____	3000 ± 100 psi (20.7 MPa)
Optional Fly Jib Section "A" Port Relief _____	3250 ± 100 psi (22.4 MPa)
Optional Fly Jib Section "B" Port Relief _____	2200 ± 100 psi (15.2 MPa)
Oil Reservoir Capacity (Crane Frame Mount) _____	20.0 gallon (75.7 L)
Oil Reservoir Capacity (Truck Frame Mount) _____	34.0 gallon (128.7 L)

* Torsion Box length is defined as the bed length in a rear mount configuration

** Other options may require additional space.

Winch add 7" (178mm)

Fly Jib add 8" (203mm)

*** Requires additional 3" (76mm) from back of cab to front edge of crane and clearance from back edge of crane to bulkhead if required.

**** Based on 40 in. (1016mm) truck frame height

Operational Speeds

NOTE: Speeds are nominal and may vary.

Inner Boom Lift from Stow to Maximum Height _____	22 sec.
Inner Boom Lift from Maximum Height to Stow _____	29 sec.
Fold Outer Boom from Stow to Maximum Reach _____	25 sec.
Fold Outer Boom from Maximum Reach to Stow _____	21 sec.
Boom Rotation 360° _____	24 sec.
Boom Hydraulic Extension 5 & 4 Section Boom _____	40 sec.
3 & 2 Section Boom _____	30 sec.
Boom Hydraulic Retraction 5 & 4 Section Boom _____	29 sec.
3 & 2 Section Boom _____	22 sec.

Winch System

Wire Rope _____ 185 ft. (41.5m) of 7/16" (11.2mm) diameter rotation resistant nominal breaking strength of 22,400 lbs. (10,161 kg).

Winch Performance _____ with 1 part of line

Layer	Winch Pull* (lbs) (kg)	Winch Speed (FPM) (MPM)
1	5873 (2664)	77 (23.5)
2	5290 (2400)	85 (25.9)
3	4812 (2183)	94 (28.6)
4	4413 (2002)	102 (31.1)

All ratings based on 17 GPM (64 LPM) at 3000 psi (20.7 MPa)

*Single line rating is limited to 4400 lbs. (1996 kg)

SECTION MODULUS TABLES

Use Table E and Table F below along with Tables A through D in the preceding section of this manual for determining the section modulus of the truck frame.

Always measure the truck frame and check the tables to be sure that any truck factory listed section modulus is correct. It is also necessary to measure the frame and check the section modulus wherever the depth and/or flange width changes.

1. **Channel** (Table E). Table E supplements Table A for narrower truck frame flanges. Use the width of the narrow flanges for "W" to find the section modulus from Table E.

2. **Angle** (Table F). Use Table F for an angle

section such as when a flange and part of the web of a truck frame channel is removed.

Where thickness, depth or flange width vary, interpolation between tables or variables within a given table will provide the strength for the section.

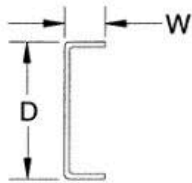
If you have any questions concerning frame strength or reinforcing, contact National Crane before proceeding.

Where thickness, depth or flange width vary, interpolation between tables or variables within a given table will provide the strength for the section.

If you have any questions concerning frame strength or reinforcing, contact National crane before proceeding.

TABLE E

Section Modulus in³ (cm³)



THICKNESS 3/16 in. (4.76 mm)			
W in.(mm) D in.(mm)	1 (25)	1 1/2 (38)	2 (51)
8 (203)	3.2 (52)	3.9 (64)	4.6 (75)
9 (229)	3.8 (62)	4.7 (77)	5.5 (90)
10 (254)	4.6 (75)	5.5 (90)	6.4 (105)
11 (279)	5.4 (88)	6.4 (105)	7.4 (121)
12 (305)	6.3 (103)	7.4 (121)	8.5 (139)
13 (330)	7.2 (118)	8.4 (138)	9.6 (157)
14 (356)	8.2 (134)	9.5 (156)	10.8 (177)
15 (381)	9.3 (152)	10.6 (174)	12.0 (197)

THICKNESS 1/4 in. (6.35 mm)			
W in.(mm) D in.(mm)	1 (25)	1 1/2 (38)	2 (51)
8 (203)	4.1 (67)	5.0 (82)	5.9 (97)
9 (229)	5.0 (82)	6.0 (98)	7.1 (116)
10 (254)	5.9 (97)	7.1 (116)	8.3 (136)
11 (279)	7.0 (115)	8.3 (136)	9.6 (157)
12 (305)	8.2 (134)	9.6 (157)	11.0 (180)
13 (330)	9.4 (154)	10.9 (179)	12.5 (205)
14 (356)	10.7 (175)	12.4 (203)	14.1 (231)
15 (381)	12.1 (198)	13.9 (228)	15.7 (257)

THICKNESS 5/16 in. (7.94 mm)			
W in.(mm) D in.(mm)	1 (25)	1 1/2 (38)	2 (51)
8 (203)	4.9 (80)	6.1 (100)	7.2 (118)
9 (229)	6.0 (98)	7.3 (120)	8.6 (141)
10 (254)	7.2 (118)	8.7 (142)	10.1 (166)
11 (279)	8.5 (139)	10.1 (166)	11.8 (193)
12 (305)	9.9 (162)	11.7 (192)	13.5 (221)
13 (330)	11.5 (188)	13.4 (220)	15.3 (251)
14 (356)	13.1 (215)	15.2 (249)	17.3 (284)
15 (381)	14.8 (242)	17.1 (280)	19.3 (316)

THICKNESS 3/8 in. (9.52 mm)			
W in.(mm) D in.(mm)	1 (25)	1 1/2 (38)	2 (51)
8 (203)	5.7 (93)	7.1 (116)	8.4 (138)
9 (229)	7.0 (115)	8.6 (141)	10.1 (166)
10 (254)	8.4 (138)	10.2 (167)	12.0 (197)
11 (279)	10.0 (164)	11.9 (195)	13.8 (226)
12 (305)	11.6 (190)	13.8 (226)	15.9 (261)
13 (330)	13.4 (220)	15.7 (257)	18.0 (295)
14 (356)	15.4 (252)	17.8 (292)	20.3 (333)
15 (381)	17.4 (285)	20.1 (329)	22.8 (374)

Full Version Available

National Crane N160 Articulating Crane Service Manual

National Crane N160 articulating crane service manual with repair procedures, adjustments and troubleshooting for the main systems. Instant PDF download.

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