

# SERVICE MANUAL

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

## 600E2 Telescoping Crane

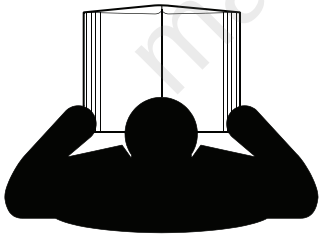
This Manual is Divided into the following Sections:

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| SECTION 3  | ELECTRICAL SYSTEM  |
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### 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.

3. If offset is positioned at right angles to the torque wrench, then the offset will not change the effective

length. Therefore, TW-wrench setting and  $T_a$ -applied torque, will be the same value as if no offset were used.

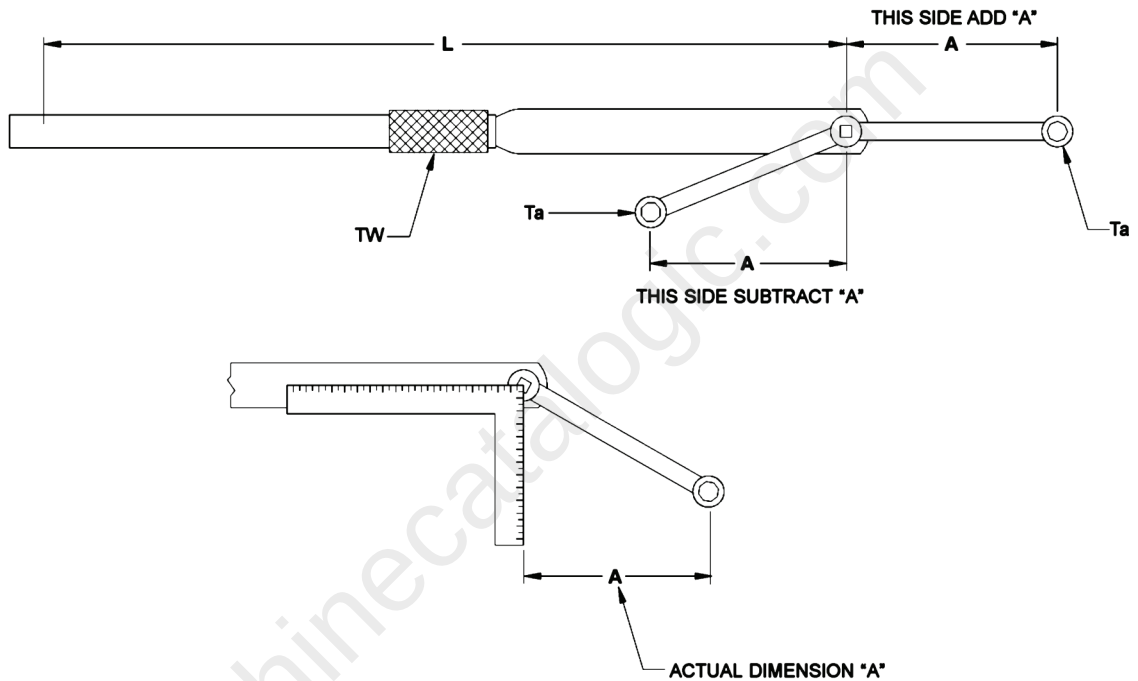
$$TW = \frac{T_a \times L}{L + A} \text{ or } \frac{T_a \times L}{L - A}$$

$T_a$  = Torque required (specified)

TW = Wrench scale reading or limit setting of torque wrench

$L$  = Length of torque wrench in inches (center of drive tang to handle pivot pin or center of hand grip extension handles are considered part of wrench length, when used).

$A$  = Length of adapter extensions in inches



20. Cut off the excess wire from the new wire that is sticking out of the first section leaving a length of about 24 inches (61 cm). This will allow a short amount of wire to use to apply tension and for the installation of the cable stop and shrink tube without dealing with a lot of extra wire.
21. Slide the cable stop onto the end of the wire sticking out of the end of the first section and run it up against the spacer bar. While pulling on the steel cable with a tension of about 15-25 lb (7-11 kg), tighten the screw in the cable stop.
22. Slide a new piece of shrink tube onto the end of the wire, run it up against the cable stop, and apply heat to shrink the tube. This will prevent the end of the wire from fraying.
23. Cut off the excess wire leaving about 1 inch (25 mm) of wire with shrink tube sticking out of the cable stop.
24. Slowly operate the boom to make sure the sheaves turn and the cable runs correctly.

## HYDRAULIC CAPACITY ALERT SYSTEM

This hydraulic capacity alert system uses the work port unloader solenoids in the anti-two-block system as the hydraulic system dump circuit.

The hydraulic capacity alert system has an override switch and button located on the operator's console that momentarily overrides the hydraulic capacity alert and anti-two-block systems and restores power to crane functions.

When trip pressure is reached, the pressure sensing switch breaks electrical continuity to the work port unloader solenoid in the main control valve. When power is removed from this solenoid, the unloader valves allow the oil flowing to winch up, telescope out and boom down to flow to tank. This path to tank will prevent further operation of these functions. When the overload condition is corrected by winching down, retracting the boom, or raising the boom, the pressure sensing switch allows the work port unloader solenoids to be powered thereby allowing the crane to function normally.

## HCA Maintenance & Repair

The following step-by-step analysis will be helpful in isolating and correcting almost every service problem if followed in a step-by-step systematic manner. Use this information with the Hydraulic Schematic and the Illustrated Parts Catalog to identify parts and follow flow paths. Start at top box and work downward step by step. Do not try to start in the middle or skip steps.

1. Refer to Hydraulic Schematic and System Description to gain a thorough understanding of the capacity alert system before proceeding with any maintenance.
2. System adjustment must be checked every three months for accuracy. Refer to the preceding section on System Adjustment.
3. Always be sure the boom is adequately supported and no hydraulic pressure remains in the lines before the pilot pressure line fittings are loosened.

## HCA System Adjustment

The hydraulic capacity alert system should be checked for proper adjustment during initial crane start-up and quarterly thereafter. The procedure for proper adjustment should be performed as follows:

**NOTE:** Trapped air must be bled from the system before adjustments are made.

1. Remove the console cover on the operators console.



### WARNING

Before loosening any fittings, support the boom.

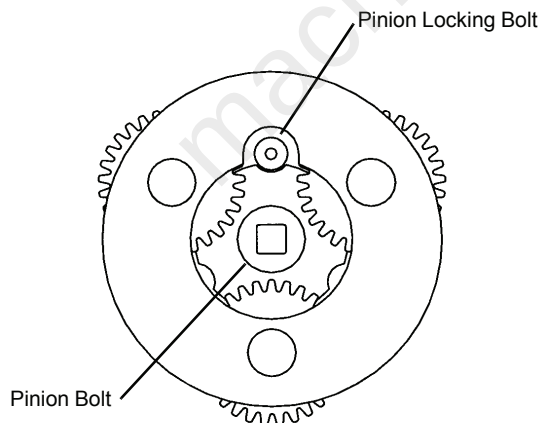
2. Start the truck and set the crane up for operation as prescribed in the Operators Manual.
3. Select a test weight that is equal to crane capacity at an intermediate boom length and radius.
4. Work with loads which have loaded boom angles near 30°. Starting with the boom at the chosen reference angle and a radius less than the chosen radius, pick the weight up with the winch and begin extending the boom.
5. As the boom is extending, lower the load with the winch to keep the load near the ground.
6. Monitor the load range gage located in the console as the boom is extending. The gage is plumbed directly into the lift cylinder pilot line and the pressure reading should increase to what is defined as capacity load pressure as the selected intermediate boom length and radius is reached.
7. The intermediate boom length is determined by a line and corresponding dimension decal on the side of the second section boom. The chosen radius is measured from the centerline of rotation to the loadline.

| Item | Component        |
|------|------------------|
| 1    | Gear Housing     |
| 2    | Brake Housing    |
| 3    | Motor Adapter    |
| 4    | Gear Set         |
| 5    | Brake Piston     |
| 6    | Pinion Shaft     |
| 7    | Outboard Bearing |
| 8    | Brake Driver     |
| 9    | Thrust Plate     |
| 10   | Seal             |
| 11   | Inboard Bearing  |
| 12   | Bearing Cup      |
| 15   | Spring           |

| Item | Component            |
|------|----------------------|
| 16   | Stator Plates        |
| 17   | Friction Plates      |
| 19   | Back-up Ring         |
| 20   | O-ring               |
| 21   | O-ring               |
| 22   | Back-up Ring         |
| 23   | O-ring               |
| 24   | Fill Plug            |
| 26   | Drain Plug           |
| 27   | Socket Head Capscrew |
| 28   | Socket Head Capscrew |
| 32   | Breather             |
| 34   | Thrust Washer        |
| 35   | Grease Fitting       |

| Item | Component             |
|------|-----------------------|
| 36   | Snap Ring             |
| 37   | Retaining Ring        |
| 41   | Sun Gear              |
| 43   | Retaining Ring        |
| 44   | Input Carrier         |
| 45   | Sun Gear              |
| 46   | Locking Bolt          |
| 47   | Output Planet Carrier |
| 48   | Retaining Rings       |
| 49   | Pinion Bolt           |
| 51   | Planet Gear           |
| 52   | Needle Bearings       |
| 53   | Planet Pin            |

14. Remove the retaining ring (43) from the input carrier (44), remove the output sun gear (45), and inspect for wear and replace as necessary.
15. Remove retaining rings (48), press out the planet pin (53), remove the planet gear (51), and needle bearings (52), inspect for unusual wear. Replace as required.
16. Remove the pinion locking bolt (46) from the out put planet carrier (47). Loosen the pinion bolt (49).
18. Remove the inboard bearing (11) and inspect for wear.
19. Remove the pinion shaft (6) from the housing (1) and inspect the pinion shaft, seal, and bearing for wear.
20. Remove outboard bearing (7) and seal (10). Inspect for wear and replace if necessary.



17. Remove the retaining rings (48). Lift output planet set out of the housing (1). Press out the planet pin (57); remove the planet gear (55) and needle bearings (54). Inspect for unusual wear. Replace as required.

## Tulsa Swing Drive Assembly Procedure

1. Press the inboard and outboard bearing cup (12) into the gear housing (1) if replaced.
2. Grease pack the bearing cones items (7) with EP 2 before installation.
3. Install the outboard cone (7) into the outboard cup (12). Press the seal (10) into the gear housing(1) from the outboard side.
4. Slide the output pinion (6) into the housing (1) from the outside.
5. Install the inboard bearing cone (11).
6. Separate the gear set (4) into sections.
7. Apply Loctite to the threads of the pinion bolt (49). Install the output carrier (47) into the gear housing (1).
  - a. Tighten the pinion bolt halfway, check the alignment of the output carrier (47) with the spline on the pinion shaft (6), and then tighten the pinion bolt the rest of the way.
  - b. Torque the pinion bolt to 50 ft-lb (68 Nm), loosen and re-torque until the pinion locking bolt aligns with

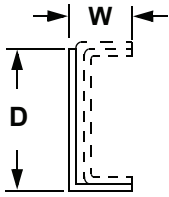


**TABLE D**  
**Section Modulus in<sup>3</sup> (cm<sup>3</sup>)**

| Thickness 3/16 in. (4.76 mm) |            |            |            |            |
|------------------------------|------------|------------|------------|------------|
| D in. (mm)                   | W in. (mm) |            |            |            |
|                              | 3 (76)     | 3.5 (89)   | 4 (102)    | 4.5 (114)  |
| <b>8.5 (216)</b>             | 5.7 (93)   | 6.4 (105)  | 7.0 (115)  | 7.7 (126)  |
| <b>9.5 (241)</b>             | 6.7 (110)  | 7.4 (121)  | 8.1 (133)  | 8.9 (146)  |
| <b>10.5 (267)</b>            | 7.7 (126)  | 8.5 (139)  | 9.3 (152)  | 10.1 (166) |
| <b>11.5 (292)</b>            | 8.8 (144)  | 9.7 (159)  | 10.6 (174) | 11.4 (187) |
| <b>12.5 (318)</b>            | 10.0 (164) | 10.9 (179) | 11.9 (195) | 12.8 (210) |
| <b>13.5 (343)</b>            | 11.2 (184) | 12.2 (200) | 13.2 (216) | 14.3 (234) |
| <b>14.5 (368)</b>            | 12.5 (205) | 13.6 (223) | 14.6 (239) | 15.7 (257) |
| <b>15.5 (394)</b>            | 13.8 (226) | 15.0 (246) | 16.1 (264) | 17.3 (284) |

| Thickness 1/4 in. (6.35 mm) |            |            |            |            |
|-----------------------------|------------|------------|------------|------------|
| D in. (mm)                  | W in. (mm) |            |            |            |
|                             | 3 (76)     | 3.5 (89)   | 4 (102)    | 4.5 (114)  |
| <b>8.5 (216)</b>            | 7.7 (126)  | 8.6 (141)  | 9.4 (154)  | 10.3 (169) |
| <b>9.5 (241)</b>            | 9.1 (149)  | 10.0 (164) | 10.9 (179) | 11.9 (195) |
| <b>10.5 (267)</b>           | 10.5 (172) | 11.5 (188) | 12.5 (205) | 13.6 (223) |
| <b>11.5 (292)</b>           | 11.9 (195) | 13.1 (215) | 14.2 (233) | 15.4 (252) |
| <b>12.5 (318)</b>           | 13.5 (221) | 14.7 (241) | 16.0 (262) | 17.2 (282) |
| <b>13.5 (343)</b>           | 15.2 (249) | 16.5 (270) | 17.8 (292) | 19.2 (315) |
| <b>14.5 (368)</b>           | 16.9 (277) | 18.3 (300) | 19.7 (323) | 21.2 (347) |
| <b>15.5 (394)</b>           | 18.7 (306) | 20.2 (331) | 21.7 (356) | 23.3 (382) |

| Thickness 5/16 in. (7.94 mm) |            |            |            |            |
|------------------------------|------------|------------|------------|------------|
| D in. (mm)                   | W in. (mm) |            |            |            |
|                              | 3 (76)     | 3.5 (89)   | 4 (102)    | 4.5 (114)  |
| <b>8.5 (216)</b>             | 9.8 (161)  | 10.8 (177) | 11.9 (195) | 12.9 (211) |
| <b>9.5 (241)</b>             | 11.5 (188) | 12.6 (206) | 13.8 (226) | 15.0 (246) |
| <b>10.5 (267)</b>            | 13.3 (218) | 14.5 (238) | 15.8 (259) | 17.1 (280) |
| <b>11.5 (292)</b>            | 15.1 (247) | 16.5 (271) | 18.0 (295) | 19.4 (318) |
| <b>12.5 (318)</b>            | 17.1 (280) | 18.6 (305) | 20.2 (331) | 21.7 (356) |
| <b>13.5 (343)</b>            | 19.2 (315) | 20.8 (341) | 22.5 (369) | 24.2 (397) |
| <b>14.5 (368)</b>            | 21.4 (351) | 23.1 (379) | 24.9 (408) | 26.7 (438) |
| <b>15.5 (394)</b>            | 23.7 (388) | 25.5 (418) | 27.4 (449) | 29.4 (482) |

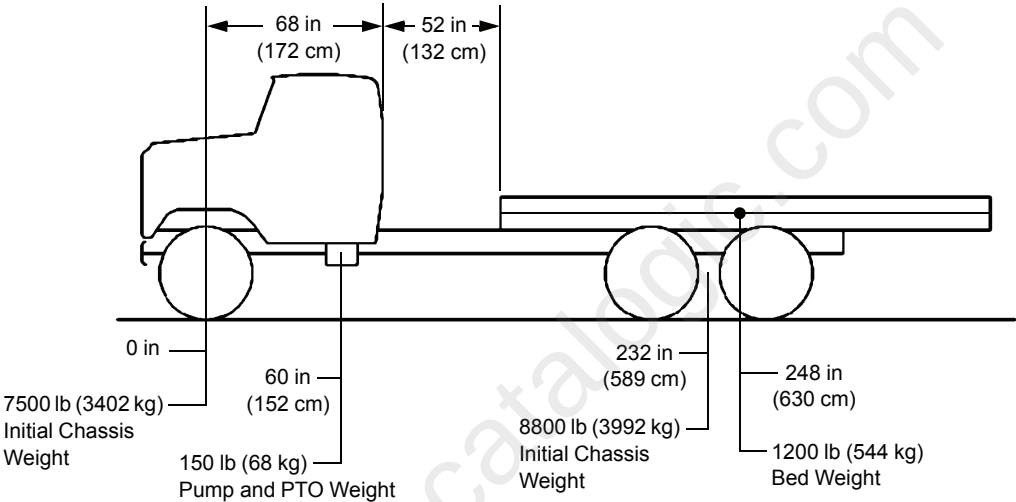
| Thickness 3/8 in. (9.52 mm) |            |            |            |            |
|-----------------------------|------------|------------|------------|------------|
| D in. (mm)                  | W in. (mm) |            |            |            |
|                             | 3 (76)     | 3.5 (89)   | 4 (102)    | 4.5 (114)  |
| <b>8.5 (216)</b>            | 11.9 (195) | 13.2 (216) | 14.4 (236) | 15.6 (256) |
| <b>9.5 (241)</b>            | 14.0 (229) | 15.3 (251) | 16.7 (274) | 18.1 (297) |
| <b>10.5 (267)</b>           | 16.2 (266) | 17.7 (290) | 19.2 (315) | 20.7 (339) |
| <b>11.5 (292)</b>           | 18.4 (302) | 20.1 (329) | 21.8 (357) | 23.5 (385) |
| <b>12.5 (318)</b>           | 20.9 (342) | 22.6 (370) | 24.5 (402) | 26.3 (431) |
| <b>13.5 (343)</b>           | 23.4 (384) | 25.3 (415) | 27.3 (447) | 29.3 (480) |
| <b>14.5 (368)</b>           | 26.0 (426) | 28.1 (461) | 30.2 (495) | 32.4 (531) |
| <b>15.5 (394)</b>           | 28.8 (472) | 31.0 (508) | 33.3 (546) | 35.6 (583) |

The 85% tipping factor as outlined in OSHA and ANSI specifications means that when lifting the full capacity loads most likely to cause the truck (with outriggers and stabilizer set) to overturn, the unit is at 85% of tipping over. Increasing this full capacity load by 117.6% (overloading) will cause the unit to tip over.

In order to determine the amount of counterweight required, it is necessary to add up the weight that each permanently attached piece of equipment will place on the front and rear axles of the truck along with the initial truck chassis weight and then compare the total front and rear axle weights with the weights listed on the “Mounting Configuration” (Installation Section) pages to determine the amount and location of counterweight required.

Counterweighting Determination Example

A typical truck is shown below with all the permanently attached equipment also shown. A series 690E crane will be mounted on this truck and a 180° stability working area around the rear of the truck is desired as in “Configuration 1” See “Mounting Configuration” in Installation Section.



$$\frac{(Wt) \times (Dist \text{ from Front Axle})}{Wheel \text{ Base}} = \text{Rear Axle Wt} \qquad Wt - \text{Rear Axle Wt} = \text{Front Axle Wt}$$

|                                                                                   | Rear                                              |                                                   | Front                                   |         |
|-----------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------|-----------------------------------------|---------|
|                                                                                   | Rear Axle Weight                                  |                                                   | Front Axle Weight                       |         |
| Initial Front Axle Weight                                                         | $\frac{(7500) \times 0}{232} = 0 \text{ lb}$      | $\frac{(3402) \times 0}{589} = 0 \text{ kg}$      | 7500 - 0 = 7500 lb 3402 - 0 = 3402 kg   |         |
| Pump and PTO Weight                                                               | $\frac{(150) \times 60}{232} = 39 \text{ lb}$     | $\frac{(68) \times 152}{589} = 18 \text{ kg}$     | 150 - 39 = 111 lb 68 - 18 = 50 kg       |         |
| Initial Rear Axle Weight                                                          | $\frac{(8800) \times 232}{232} = 8800 \text{ lb}$ | $\frac{(3922) \times 589}{589} = 3922 \text{ kg}$ | 8800 - 8800 = 0 lb 3922 - 3922 = 0 kg   |         |
| Bed Weight                                                                        | $\frac{(1200) \times 248}{232} = 1283 \text{ lb}$ | $\frac{(544) \times 630}{589} = 582 \text{ kg}$   | 1200 - 1283 = -83 lb 544 - 582 = -38 kg |         |
| Add the front and rear axle weights                                               | 10122 lb                                          | 4592 kg                                           | 7528 lb                                 | 3414 kg |
| Compare with weight required for this type of mount from Mounting Configuration 1 | 10500 lb                                          | 4763 kg                                           | 8000 lb                                 | 3629 kg |
| Difference                                                                        | 378 lb                                            | 171 kg                                            | 472 lb                                  | 215 kg  |

# Full Version Available

## National Crane 600E2 Boom Truck Service Manual

National Crane 600E2 boom truck service manual with repair procedures, adjustments and troubleshooting for the main systems. Instant PDF download.

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