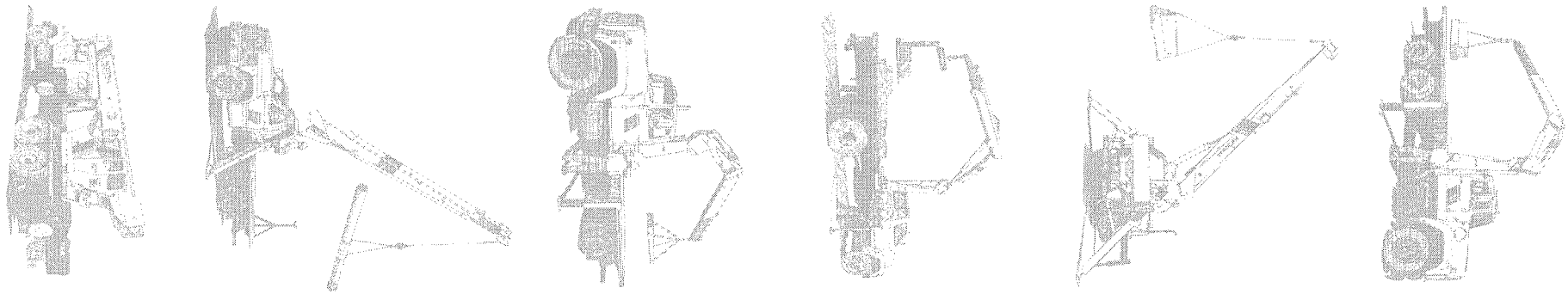


ARTICULATING AND TELESCOPING CRANES

SERIES 400B

SAFETY

SAFETY RESPONSIBILITIES

The single most important factor in the prevention of equipment failures and accidents is a positive attitude towards safety.

Failure to read this manual is a misuse of the equipment. Anyone who will supervise, operate, service or work around this crane shall first read this manual. Death or serious injury can result from improper use or maintenance of this machine.

Occupational safety is of prime concern to the National Crane Corporation in the design and production of this crane. This manual was written with the safety of the operator and others who work around this equipment as our goal.

It is your responsibility to know the specific requirements, governmental regulations, precautions and work hazards which exist. You shall make these known to all personnel working with the equipment or in the area, so that all of you may take the necessary and required safety precautions. Failure to heed these instructions can result in death or serious injury.

Safety is dependent upon all people who are associated with the machine. The condition of the equipment, the maintenance and inspection procedures and the operating procedures are all equally important.

It is your responsibility to operate and maintain your crane with skill, good judgment and caution. Following recognized safety procedures will help you avoid accidents. Modifications to any part of this crane can create a safety hazard and therefore shall not be made without the manufacturer's written approval. Use only factory approved parts to repair or maintain this equipment. If this equipment is rebuilt or remounted, mounting procedures, retesting and recertification is required in accordance with factory instructions.

MANAGEMENT/SUPERVISORY RESPONSIBILITIES

As an owner or employer, it is your responsibility to instruct the operator in the safe operation of your equipment and to provide the operator with properly maintained equipment. See that operators are properly trained, competent, physically fit and if required, licensed. Good vision, good judgment, coordination and mental ability are required. Any person who lacks any of these qualities must not be allowed to operate a crane.

Signalmen must have good vision and sound judgment, know standard crane signals and be able to give signals clearly. They must have enough experience to recognize hazards and signal the operator to avoid them.

Riggers must be trained to determine weights and distances and to select and properly use lifting tackle. It is management's responsibility to see that riggers are properly trained.

Crew members must be given specific safety responsibilities and instructed to report any unsafe conditions to the operator or their supervisors.

OPERATOR'S RESPONSIBILITIES

Safety must always be the operators most important concern. He must refuse to operate when he knows it's unsafe and consult his supervisor when safety is in doubt. He must read and understand the Operator's Manual and see that the machine is in proper working order before operating. He must understand the rating

boom to avoid two-blocking. Two-blocking can cause structural damage or failure to the boom or winch system, which can cause a load to drop. Do not rely on anti-two-block system to eliminate two blocking. Use the anti-two-block system as a backup device to safe operation.

15. Do not guide running rope onto sheaves or drums with hands. Broken wires or sticky surfaces can cause injury or hands to be pulled into pinch points.
16. Do not allow anyone to ride the loadline, hook, load or any device attached to the loadline. Use only National Crane approved personnel baskets attached to the boom or jib for personnel lifting.
17. When working with a pinned jib, refer to jib safety section in this manual for proper erecting and stowing procedures. Always be sure the jib is pinned properly and all pin keepers are in place. Do not exceed jib capacities even when main boom is retracted. Operate slowly and smoothly because the jib tip moves faster due to increased boom length.
18. Leaving the machine unattended can be very dangerous. Lower any suspended load. Place the boom in its support when practical. Set all brakes and disengage the pump or shut the engine off. Lock all switches and doors. Install vandal guards when necessary.
19. Do not exceed 80% of the crane rating when using clam bucket.

The following examples are for illustrative purposes only. The examples utilize the capacity chart shown. The load chart ratings, component weights and dimensional data may not be the same as the actual unit. Always use actual information from the crane and job site when planning a lift.

Example 1

A load is to be lifted from the ground and weighs 1,600 pounds (726 kg) at a radius of 10' (3.04 m). It will be placed on the roof of a building at a radius of 40' (12.19 m) and a height of 40' (12.19 m) above the ground on the opposite side of the truck.

Step 1. Determine the load.

Load =	1,600 lb	(726 kg)
1 Part Load Block =	90 lb	(41 kg)
Sling =	30 lb	(14 kg)
	1,720 lb	(780 kg)

Step 2. Starting Radius

Given = 10 ft (3.04 m)

Step 3. Ending Radius

Given = 40 ft (12.19 m)

Step 4. Refer to crane Capacity Chart.

Starting point: Assuming the boom is fully retracted [22' (6.71 m) boom length], the capacity at a 10' (3.04 m) radius is 9,800 pounds (4,445 kg).

In order to get the load on the roof, the load must be hoisted from the ground, swung around the rear of the truck (deadspot in rotation is over the cab), boom extended to 56' (17.07 m) extension, load hoisted to a height that will clear the top of the building, boom rotated to the point load is to be placed, boom tip lowered to 40' (12.19 m) radius and load lowered to building roof.

Ending Point: The load rating at the ending point is 1,950 pounds (885 kg). The boom will be at 56' (17.07 m) extension and the loaded radius is 40' (12.19 m).

The crane has enough capacity at each end of the lift to allow the lift to be made.

Step 5. Lastly refer to winch Capacity Chart.

- Crane is reeved for single part line.
- Allowable load for single part line is 5,840 pounds (2,649 kg) well above the 1,720 pounds (780 kg) to be lifted.

Operator should now proceed to lift the load as smoothly as possible.

Note: This load could not be lifted if the jib were being used on this machine as maximum capacity of the 18' jib at 40' (12.19 m) radius would only be 1,300 pounds (590 kg) at 59°. Note that the capacities remain the same even with the boom retracted. Also note this winch can lift 5,840 pounds (2,649 kg) while the boom is only able to withstand 1,950 pounds (885 kg) at 40' (12.19 m) radius. Therefore, one could easily damage crane by attempting to pull until winch stops with a heavier load.

Example 2

Assume a load of 7,000 pounds (3,175 kg) at 10' (3.04 m) radius on the ground beside the truck to be picked up, swung over and placed on the truck bed at an 6' (1.83 m) radius from the crane. Crane is reeved for single part.

Step 1. Weight of load and load handling equipment.

Load =	7,000 lb	(3,175 kg)
1 Part Line Block =	90 lb	(41 kg)
Slings =	50 lb	(22 kg)
	7,140 lb	(3,239 kg)

Step 2. Starting Radius

Given = 10 ft (3.04 m)

Step 3. Ending Radius

Given = 6 ft (1.83 m)

Step 4. Refer to crane Capacity Chart.

Using information in Example 1, Step 4, the crane capacity at the 10' (3.04 m) point is 9,800 pounds (4,445 kg). Of course, at the 6' (1.83 m) radius, the capacity would be substantially more. Therefore, the crane capacity is adequate.

Step 5. Refer to winch Capacity Chart.

The capacity of a 1 part line is 5,840 pounds (2,649 kg), which is less than load to be lifted. Crane must be reeved for 2 part to lift the 7,000 pound (3,175 kg) load.

Note: Two part winch capacity is 11,680 pounds (5,298 kg).

Actually when one puts on the 2 part block, the load block weighs approximately 100 pounds (45 kg) rather than the 90 pounds (41 kg) figured in Step 1 so actual load lifted is 7,150 pounds (3,243 kg). Load [7,000 pounds (3,175 kg)] + 2 part block [100 pounds (45 kg)] + slings [50 pounds (22.67 kg)].

14. Using winch function, unspool enough loadline to reeve loadline over jib sheave case. Keep slight tension on loadline to avoid bird caging of loadline on winch drum.
15. Route loadline over jib sheave and install keeper. Install line block to end of loadline.
16. Remove anti-two-block switch and weight/chain assembly and install on jib tip. Be certain to use keeper provided with switch.
17. Disconnect twist lock quick coupler on anti-two-block cord going to boom anti-two-block switch and attach to quick coupler on jib anti-two-block wire on rear of jib between the upper and lower jib ears.
18. Install pin B and keeper into jib ears.
19. Unwrap ATB cord on side of jib to allow manually extending jibs to be deployed without damage to the cord.
20. For manually extendable jibs, pull extension retention pin E, and extend second section out by pulling on sheave case. The second section jib, as it extends, will hit a mechanical stop that allows for extension pin E installation. Install pin and keeper.
21. Make ATB cord connections as required.

Stowing Procedure

1. Using lift function, lower boom so that jib tip is close to the ground .
2. For manually extendable jibs, pull extension retention pin and fully retract extendable 2nd section jib into the 1st section. Retraction of 2nd section may be facilitated by attaching loadline wedge socket to attachment point F on the jib sheave case. Slowly activate the winch up function until the 2nd section is fully retracted
3. Reinstall extension retention pin through the 1st and 2nd section jib assembly and install spring clip.
4. Remove loadline from jib sheave case. Place loadline in area to avoid possible damage from stow procedure.
5. Disconnect twist lock anti-two-block wire connector at rear of 1st section jib. Connect twist lock connector to anti-two-block switch connector on boom tip. Move anti-two-block switch and weight/chain assembly to boom tip.
6. Attach tag line to sheave case end of jib.
7. Remove spring clips from pins C2 on both upper and lower jib ears.
8. Remove pins C2 from upper and lower jib ears. Do not remove C1 pins at this time. C1 pins will be used as a pivot point to swing jib into stow position. A slight hammer strike may be necessary to remove pins. Always use proper eye protection during this step.
9. Using lift function, raise boom to a horizontal position.
10. Using extend function, extend boom approximately 1 foot.
11. Using tag line attached to jib sheave case, slowly swing jib into stow position (parallel with 1st section boom). Pins C1 are the jib pivot points during this operation.

⚠CAUTION

Use caution when swinging jib to avoid unnecessary impact with 1st section boom.

12. Install t-handle pin B through jib ear and boom sheave case holes. This pin will keep the jib assembly in line (parallel) with the 1st section boom. Pin B **does not** retain the jib in its stowed position on the 1st section boom.
13. Using boom telescope function, slowly retract boom. The ramp/bracket assembly on the side of the 1st section jib will engage the hook on the side of the 1st section boom, first lifting the jib and then engaging the jib stow bracket and the boom hook completely upon full retraction of the boom.
14. Install stow pin A with spring clip into the ramp/bracket assembly on the jib. Complete engagement of stow brackets and proper installation of pin A is critical for secure jib stow attachment.
15. Remove pins C1 from upper and lower jib ears. A slight hammer strike may be necessary to remove pins. Always use proper eye protection during this step.
16. Reinstall loadline over boom sheave case.

⚠CAUTION

Visually check all pin positions to assure jib is fully retracted into stow brackets, jib stow attachment is secure, and all pins and safety clips are in their proper locations.

Always have at least one, if not both of the following in place at all times:

- **Stow bracket completely engaged into stow hook with stow pin A properly in place.**
- **Both pins C1 in upper and lower jib holes properly in place through mating holes on boom tip.**

JIB MAINTENANCE

1. Lubricate sheave pin on jib with grease gun containing chassis grease weekly.
2. Check for free rotation of jib sheave daily when using jib.

LUBRICATION

LUBRICATION PROCEDURES AND CHARTS

Following the designated lubrication procedures is important in ensuring maximum crane lifetime and utilization. The procedures and lubrication charts in this section include information on the types of lubricants used, the location of the lubrication points, the frequency of lubrication, and other information. The information included in this section does not include lubrication requirements for the truck chassis. Refer to appropriate truck manufacturer's manual for this information.

The service intervals specified are for normal operation where moderate temperature, humidity and atmospheric conditions prevail. In areas of extreme conditions, the service periods and lubrication specifications should be altered to meet existing conditions. For information on extreme condition lubrication, contact your local service representative or the National Crane Product Support Department.

LUBRICANTS

Specific recommendations of brand and grade of lubricants are not made here due to regional availability, operating conditions, and the continual development of improved products. Where questions arise, refer to the component manufacturer's manual and a reliable supplier.

Chassis Grease. Lubricating grease of proper consistency is to be applied periodically at relatively frequent intervals with grease guns through grease fittings. Minimum apparent viscosity of 300 SUS (Saybolt Universal Seconds) at 100° F (38° C) is recommended.

Extreme Pressure Multipurpose Gear Lubricant (EPGL). This gear lubricant is compounded to achieve high load carrying capacity and meet the requirements of either API-GL-5 or MIL-L-2105C. Unless otherwise specified, SAE 80W-90 viscosity may be used for year round service. Low temperature usage is restricted as follows:

SAE VISCOSITY NUMBER	MINIMUM AMBIENT TEMPERATURE - °F (°C)
75W	- 40 (-40)
80W	- 15 (-26)
85W	+10 (-12)
90	+20 (-7)
140	+40 (+5)
250	+50 (+10)

Open Gear Lubricant. This is a special adhesive lubricant of heavy consistency for protection of wire rope and exposed gears where provision is not made for continuous lubricant replenishment. Select the viscosity that gives best protection and lubrication without peeling, scaling, or excessive throw off.

Chassis Grease Low Temp. This special grease for low temperature remains plastic at -60°F (-51°C) with melting point of 280°F (138°C). It is a heavy duty extreme pressure type lubricant (Lubriplate Low Temp or equal).

Coupling Lube Spline Lubricant. Coupling Lube Spline Lubricant is a synthetic-blend, heavy duty, antiwear, extreme pressure coupling grease recommended for the lubrication of pump shaft/PTO splines when the pump is mounted directly to the PTO. It exhibits excellent reduced wear characteristics and has exceptional serviceability over a wide range of temperatures. It is available from Schaeffer Manufacturing Company, 102 Barton Street, St. Louis, Missouri.

HYDRAULIC OIL

Oil in a hydraulic system serves as the power transmission medium, system lubricant and coolant. Selection of the proper oil is essential to ensure satisfactory system performance and life. The most important factors in selecting an oil for hydraulic service are viscosity and antiwear additives.

Viscosity. The oil must have proper viscosity to provide a lubricating film at system operating temperature.

Oil viscosity is important because it has a direct bearing on efficient transmission of power. An oil must flow readily through the system with a minimum of pressure and flow loss. Positive lubrication depends on viscosity. The oil must be sufficiently light to get between the components machined surfaces and maintain a lubricating film at system operating temperatures. Oil too light may cause the following conditions in the system.

1. Excessive leakage.
2. Lower volumetric efficiency of the pump.
3. Increased component wear.
4. Loss of system pressure.
5. Lack of positive hydraulic control.
6. Lower overall efficiency.

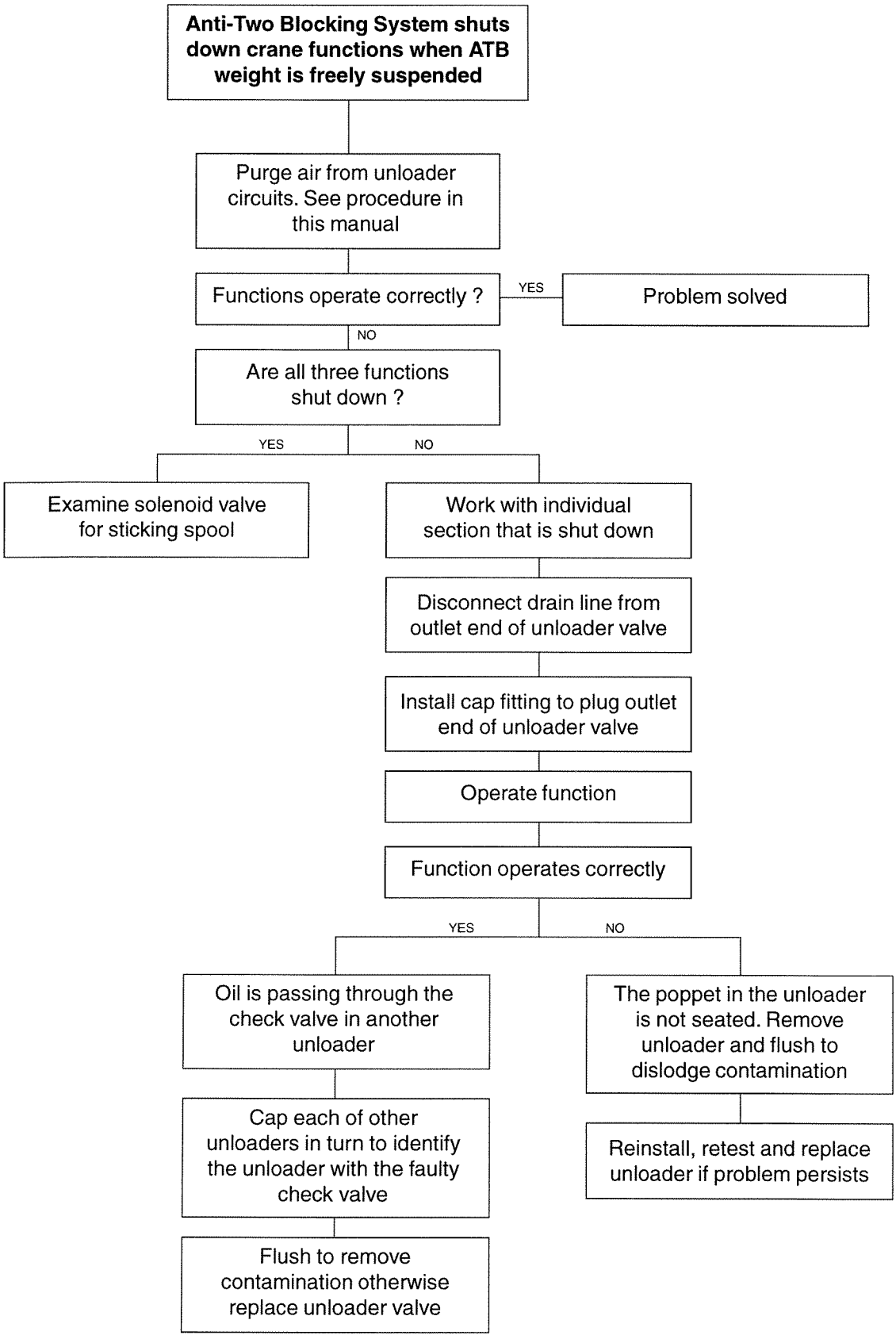
Oil too heavy may cause the following conditions in the system:

1. System pressure drop.
2. Increases system temperature.
3. Sluggish system operation.
4. Low mechanical efficiency.
5. Higher power consumption.

TROUBLE DIAGNOSIS (continued)

CONDITION	POSSIBLE CAUSE	POSSIBLE SOLUTION
Swing moves erratic or loosely (Standard system) (Cont'd)	• Brake not holding properly. • Brake releasing at wrong time or erratically.	• Check for no pressure in brake pilot line when turn is in neutral. • Replace worn brake parts or shim brake to proper torque. • Bleed air from brake with bleed screw on side of brake.
Swing will not turn (Standard System)	• Attempting to swing up too much of incline. • Turn circuit relief valves sticking. • Turntable bearing drag. • Brake not releasing properly.	• Level machine. • Clean and check circuit pressure. • Lubricate thoroughly as rotating boom. • Check for 200 + PSI brake pilot pressure. Clean pilot line or adjust motor counterbalance valves. • Adjust or clean brake for proper release.
Excessive pump noise during operation	• Excessive pump speed. • Low oil temperature. • Low hydraulic oil supply. • Suction line kinked, collapsed or blocked. • Hydraulic oil too thick. • Relief valve chattering. • Hydraulic tubing vibration. • Tank breather plugged.	• Adjust foot throttle or check for too high PTO ratio. • Allow unit to warm up. • Check and fill. • Clear blockage. • Warm oil or use oil more applicable to environment. • Dirt in relief valve or damaged relief. • Check for loose tubing. • Clean breather.
Cylinders drift	• Not getting oil to cylinders. • Worn or damaged piston seals. • Air in hydraulic oil. • Loose holding valve. • Dirt in holding or check valve.	• Clean and replace as required. • Replace as required. • Cycle operate crane cylinder to remove air. • Tighten valve. • Clean valve.
Winch will not lift or hold load	• Load too heavy. • Relief valve setting too low. • Motor worn excessively. • Counterbalance valve defective or leaking. • Anti-two-block system defective. • Brake worn out.	• Check load and change to applicable multipart reeving. • Check and adjust if required. • Replace motor. • Clean and replace as necessary. • Repair anti-two-block system. • Repair or replace brake.

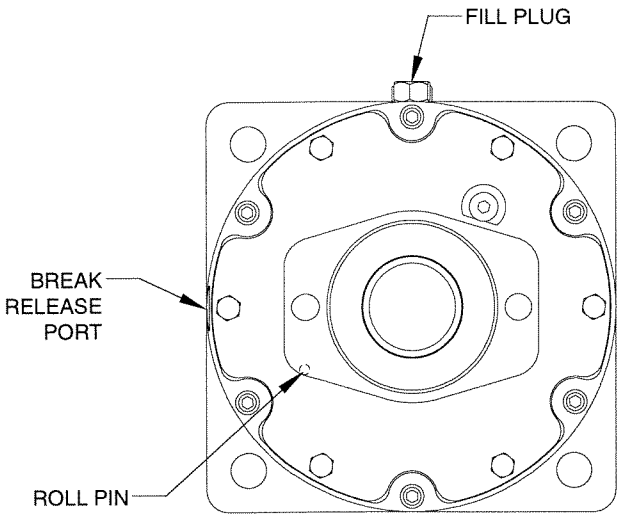
ANTI-TWO BLOCK TROUBLE DIAGNOSIS - HYDRAULIC (CONTINUED)



Note: None of the internal parts of the unloader valves are serviceable.

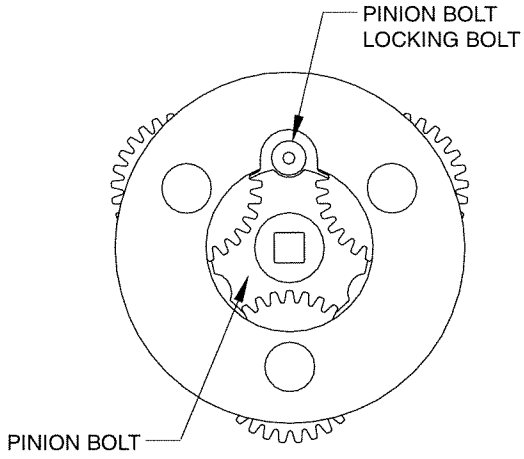
out under 2nd/3rd/cylinder to allow easy installation as the booms are assembled.

25. Slide 2nd/3rd / cylinder assembly into 1st section boom approx. 2 feet (60 cm). Use caution during this step to keep retract cables straight and on the correct side of the boom assembly as the sections are assembled.
26. Continue to slide 2nd/3rd/cylinder assembly into 1st until it is approximately halfway into 1st.
27. Assemble bottom front wear pads in 1st section, trapping ends of retract cables in slots on bottom of 1st section. Lift 2nd/3rd/cylinder assembly up to ease installation.
28. Slide boom together to within 12 inches (30 cm) of complete retraction. Install upper front spacer bar in 1st section and upper front wear bar and cable guide assembly to 2nd.
29. Retract boom completely, using proper hardware and spacers, connect extend cylinder butt plate to the winch mount. Hydraulic power source can be utilized at this time if slight cylinder length adjustment is necessary.
30. Slide extend cable anchor into position in winch mount. Push threaded ends of extend cables through holes in anchor and assemble hex nuts onto threaded ends.
31. Assemble top rear wear pads to the top of the 2nd and 3rd boom sections. Wear pads can be inserted from the winch mount end of the boom, and the cam plates dropped through the holes in the aligned boom top plates. Rotate cam plates with screwdriver to move wear pads against boom side plates. These cam plates function as rear side clearance adjustment.
32. Approximately 10 feet (300 cm) of anti-two-block cable will be available on the winch mount end of the boom to route and hookup to the control console wiring. Find the end of this cable and slide the cord grip/strain relief hookup onto it and slide it up the cable into approximate position inside the boom.
33. Assemble the extension spring and spade bolt to the cord grip. Assemble the spade bolt through the extend cylinder anchor with a hex nut. Adjust tension on anti-two-block cable by sliding cord grip down cable into the boom. Approximately 2 inches (5 cm) of spring extension should be adequate for proper boom operation.
34. Visually check each end of boom for proper extend, retract and anti-two-block cable routing and placement. Make certain anti-two-block cable is correctly on sheave. Inspect from sheave case end.
35. Adjust slack out of extend and retract cables at hex nut adjustment points. Slowly cycle boom in and out several times. Torque cables per procedure located elsewhere in this book.



ROLL PIN TO BRAKE
RELEASED PORT RELATIONSHIP

FIGURE 3



PLANETARY DRIVE KIT

FIGURE 4

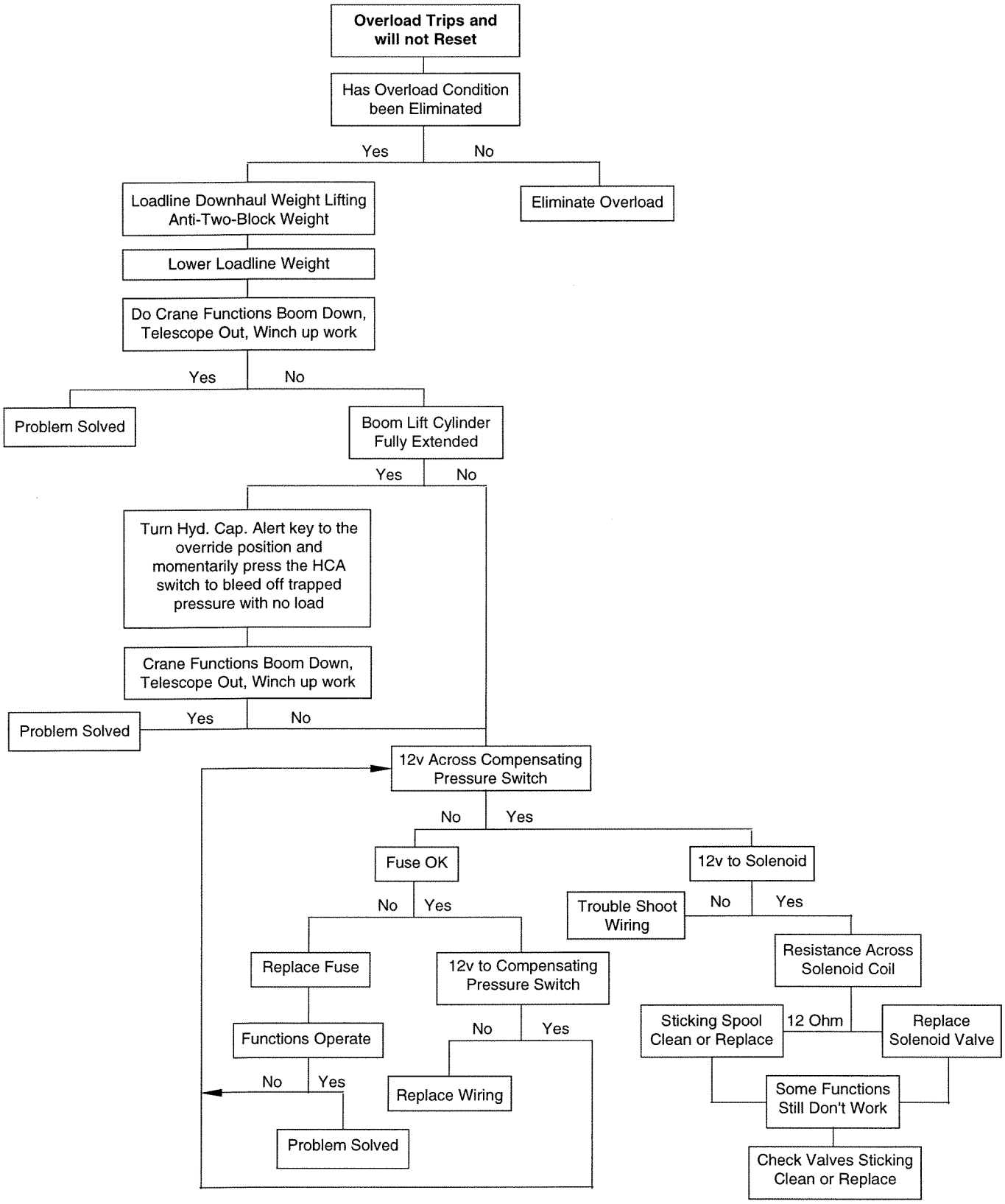
2. With the brake driver in place (8), install the stators (18) and the friction discs (17) into the piston. Install snap ring (33). Push the piston down by hand to lock the friction disc in place until the cover is installed. Make sure the brake driver (8) is centered in the piston.
3. Inspect the cover O-ring (24) and replace if necessary. Install the piston springs (15) in the cover (3). A small amount of a heavy grease will hold the springs in place for assembly. When installing the cover, note the position of the roll pin and install so that the pin will slide into the hole in the piston. Install the capscrew (28) and tighten in a sequence that pulls the cover down evenly. Reinstall on gear housing.

GEAR HOUSING DISASSEMBLY

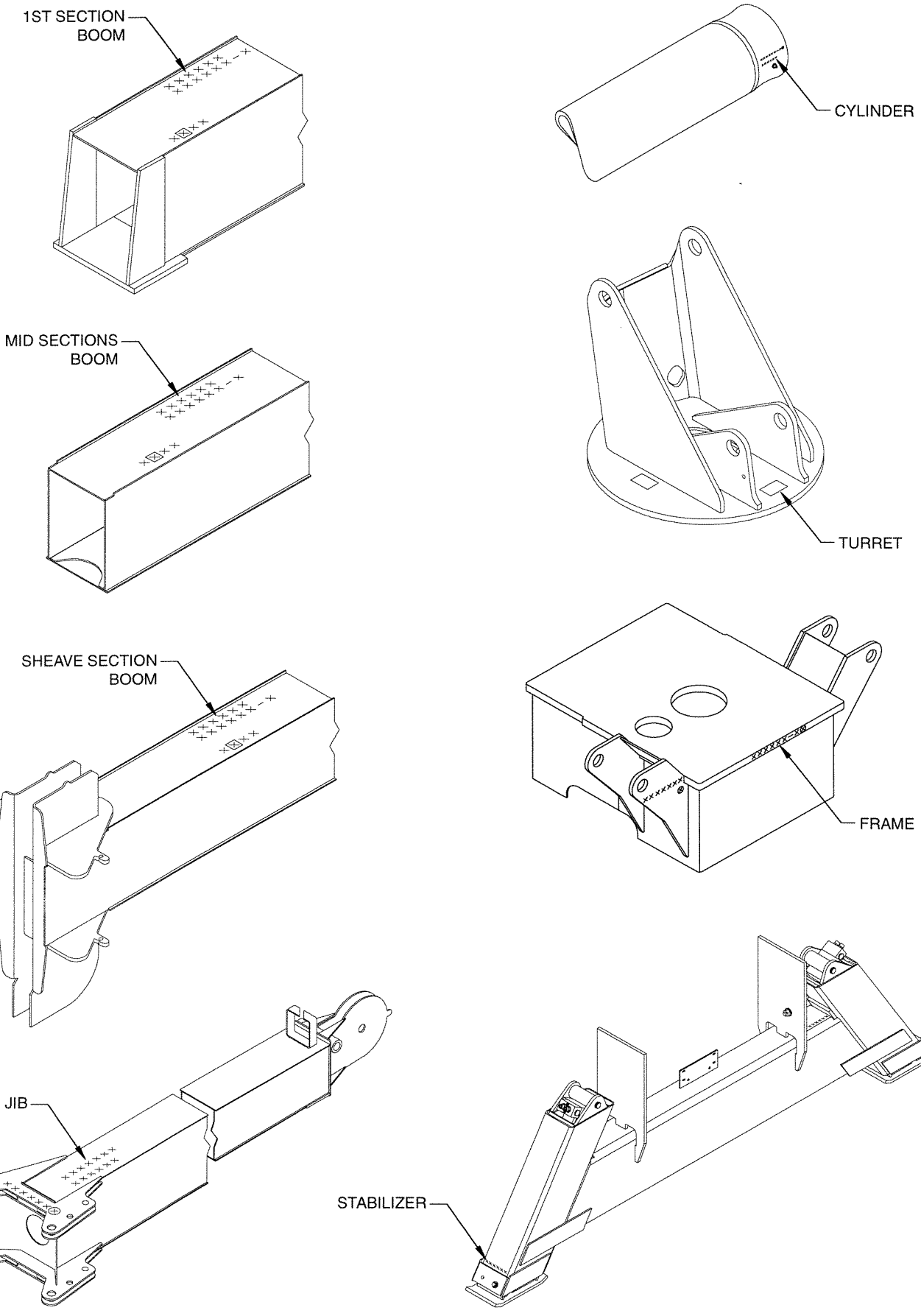
1. Remove brake section.
2. Remove input sun gear and thrust washer (7, 31) from the input planet set. Inspect for wear and replace if necessary.
3. Remove the input planet set (4) by pulling straight up and out of the housing.
4. Remove the pinion bolt retaining bolt (see figure 4). With a special tool remove the pinion bolt. Lift the output planet set (3) out of housing.
5. Remove the pinion (6) by pressing from the gear housing side of the box. The pinion has a slight press fit to the bearing. Remove the seal (10) and inspect the bearings for wear and replace if necessary.

GEAR HOUSING REASSEMBLY

1. Press new cup (12) into housing (1). Grease pack both cones (11) before installation. Install the cone and grease seal on the pinion side of the box.
2. Press pinion (6) into housing (1). Place the inside cone over the pinion shaft.
3. Apply Loctite to the pinion bolt and slide the output planet set into the housing. Using a special tool, tighten the bolt to 50 ft lbs then loosen and retighten to 25 ft lbs.
4. If the scallops in the side of the pinion retaining bolt do not align with the pinion locking bolt hole, tighten the pinion bolt until it does. Apply Loctite and install the pinion bolt locking bolt.
5. Install the input planet set, input sun gear and thrust washer.
6. Install brake housing.


Overload Trips and will not Reset
Has Overload Condition been Eliminated
Yes
No
Eliminate Overload
Loadline Downhaul Weight Lifting Anti-Two-Block Weight
Lower Loadline Weight
Do Crane Functions Boom Down, Telescope Out, Winch up work
Yes
No
Problem Solved
Boom Lift Cylinder Fully Extended
Yes
No
Turn Hyd. Cap. Alert key to the override position and momentarily press the HCA switch to bleed off trapped pressure with no load
Crane Functions Boom Down, Telescope Out, Winch up work
Problem Solved
Yes
No
12v Across Compensating Pressure Switch
No
Yes
Fuse OK
12v to Solenoid
No
Yes
Trouble Shoot Wiring
No
Yes
Replace Fuse
12v to Compensating Pressure Switch
Resistance Across Solenoid Coil
Functions Operate
No
Yes
Sticking Spool Clean or Replace
12 Ohm
Replace Solenoid Valve
No
Yes
Replace Wiring
Some Functions Still Don't Work
No
Yes
Problem Solved
Check Valves Sticking Clean or Replace

TYPICAL LOCATIONS / SERIAL NUMBER IDENTIFICATION



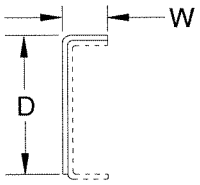


TABLE B

Section Modulus in³ (cm³)

THICKNESS 3/16 in. (4.76 mm)

D in.(mm) \ W in.(mm)	2 3/4 (70)	3 1/4 (83)	3 3/4 (95)	4 1/4 (108)
7 1/2 (191)	2.2 (36)	2.3 (38)	2.3 (38)	2.4 (39)
8 1/2 (216)	2.8 (46)	2.9 (48)	3.0 (49)	3.0 (49)
9 1/2 (241)	3.4 (56)	3.5 (57)	3.6 (59)	3.7 (61)
10 1/2 (267)	4.1 (67)	4.3 (70)	4.4 (72)	4.5 (74)
11 1/2 (292)	4.9 (80)	5.1 (84)	5.2 (85)	5.4 (88)
12 1/2 (318)	5.8 (95)	6.0 (98)	6.1 (100)	6.3 (103)
13 1/2 (343)	6.7 (110)	6.9 (113)	7.1 (116)	7.3 (120)
14 1/2 (368)	7.6 (124)	7.9 (129)	8.1 (133)	8.3 (136)

THICKNESS 1/4 in. (6.35 mm)

D in.(mm) \ W in.(mm)	2 3/4 (70)	3 1/4 (83)	3 3/4 (95)	4 1/4 (108)
7 1/2 (191)	2.9 (48)	3.0 (49)	3.1 (51)	3.2 (52)
8 1/2 (216)	3.7 (61)	3.8 (62)	3.9 (64)	4.0 (66)
9 1/2 (241)	4.5 (74)	4.7 (77)	4.8 (79)	5.0 (82)
10 1/2 (267)	5.5 (90)	5.7 (93)	5.8 (95)	6.0 (98)
11 1/2 (292)	6.5 (106)	6.7 (110)	6.9 (113)	7.1 (116)
12 1/2 (318)	7.6 (124)	7.9 (129)	8.1 (133)	8.3 (136)
13 1/2 (343)	8.8 (144)	9.1 (149)	9.4 (154)	9.6 (157)
14 1/2 (368)	10.1 (166)	10.5 (172)	10.7 (175)	11.0 (180)

THICKNESS 5/16 in. (7.94 mm)

D in.(mm) \ W in.(mm)	2 3/4 (70)	3 1/4 (83)	3 3/4 (95)	4 1/4 (108)
7 1/2 (191)	3.6 (59)	3.7 (61)	3.9 (64)	4.0 (66)
8 1/2 (216)	4.6 (75)	4.7 (77)	4.9 (80)	5.0 (82)
9 1/2 (241)	5.6 (92)	5.8 (95)	6.0 (98)	6.2 (102)
10 1/2 (267)	6.8 (111)	7.1 (116)	7.3 (120)	7.5 (123)
11 1/2 (292)	8.1 (133)	8.4 (138)	8.6 (141)	8.9 (146)
12 1/2 (318)	9.5 (156)	9.8 (161)	10.1 (166)	10.4 (170)
13 1/2 (343)	11.0 (180)	11.4 (187)	11.7 (192)	12.0 (197)
14 1/2 (368)	12.6 (206)	13.0 (213)	13.4 (220)	13.7 (224)

THICKNESS 3/8 in. (9.52 mm)

D in.(mm) \ W in.(mm)	2 3/4 (70)	3 1/4 (83)	3 3/4 (95)	4 1/4 (108)
7 1/2 (191)	4.3 (70)	4.5 (74)	4.6 (75)	4.8 (79)
8 1/2 (216)	5.5 (90)	5.7 (93)	5.9 (97)	6.0 (98)
9 1/2 (241)	6.7 (110)	7.0 (115)	7.2 (118)	7.4 (121)
10 1/2 (267)	8.1 (133)	8.4 (138)	8.7 (143)	8.9 (146)
11 1/2 (292)	9.7 (159)	10.0 (164)	10.3 (169)	10.6 (174)
12 1/2 (318)	11.3 (185)	11.7 (192)	12.1 (198)	12.4 (203)
13 1/2 (343)	13.1 (215)	13.6 (223)	14.0 (229)	14.3 (234)
14 1/2 (368)	15.1 (247)	15.5 (254)	16.0 (262)	16.4 (269)

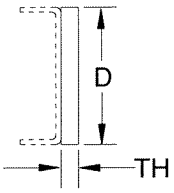


TABLE C

Section Modulus in³ (cm³)

TH in.(mm) \ D in.(mm)	8 (203)	9 (229)	10 (254)	11 (279)	12 (305)	13 (330)	14 (356)	15 (381)	16 (406)
3/16 (4.76)	2.0 (33)	2.51 (41)	3.10 (51)	3.75 (61)	4.46 (73)	5.24 (86)	6.08 (100)	6.98(114)	7.94 (130)
1/4 (6.35)	2.66 (44)	3.37 (55)	4.16 (68)	5.03 (82)	5.99 (98)	7.03 (115)	8.15 (134)	9.36(153)	10.5 (172)
5/16 (7.94)	3.33 (55)	4.21 (69)	5.20 (85)	6.29 (103)	7.49 (123)	8.79 (144)	10.19 (167)	11.7 (192)	13.31 (218)
3/8 (9.52)	4.0 (66)	5.06 (83)	6.25 (102)	7.56 (124)	9.00 (148)	10.56 (173)	12.25 (201)	14.06(230)	16.0 (262)
7/16 (11.11)	4.67 (76)	5.9 (97)	7.29 (119)	8.82 (144)	10.5 (172)	12.32 (202)	14.29 (234)	16.4 (269)	18.66 (306)

weld rear suspension reinforcing to forward reinforcing. Replace as much of the spring hanger cut out areas as possible and butt weld these pieces in.

If reinforcing angle is to be bolted on, drill hole pattern and install bolts according to Figure C. Reinforce spring hanger cut outs and the weld area, suspension reinforcing to forward reinforcing by adding bars under these areas. The bars should be of the same thickness, width and yield strength as the reinforcing angle lip, and should be long enough to extend at least 6 inches (152 mm) beyond either side of the weld or cut out areas. Weld these reinforcing bars to the underside of the reinforcing with length-wise welds. ***Do not weld across the flanges.*** Replace any equipment that had been removed.

6. If additional suspension reinforcing is required, as may be the case with a truck frame that tapers down to approximately 6 inches (15.24 cm) deep through the suspension, a channel may be fabricated through the suspension for additional strength. To do this, install the angle as described in the previous step, making sure that the long leg of the angle extends to the top of the truck frame. A bar of the same material strength, thickness, length and flange width as the reinforcing angle is then added to the top of the truck frame. The bar is butt welded to the top of the forward reinforcing, then skip-welded with 6 inches (15.24 cm) of weld, 6 inches (15.24 cm) no weld, etc., along both edges of the bar, front to back.

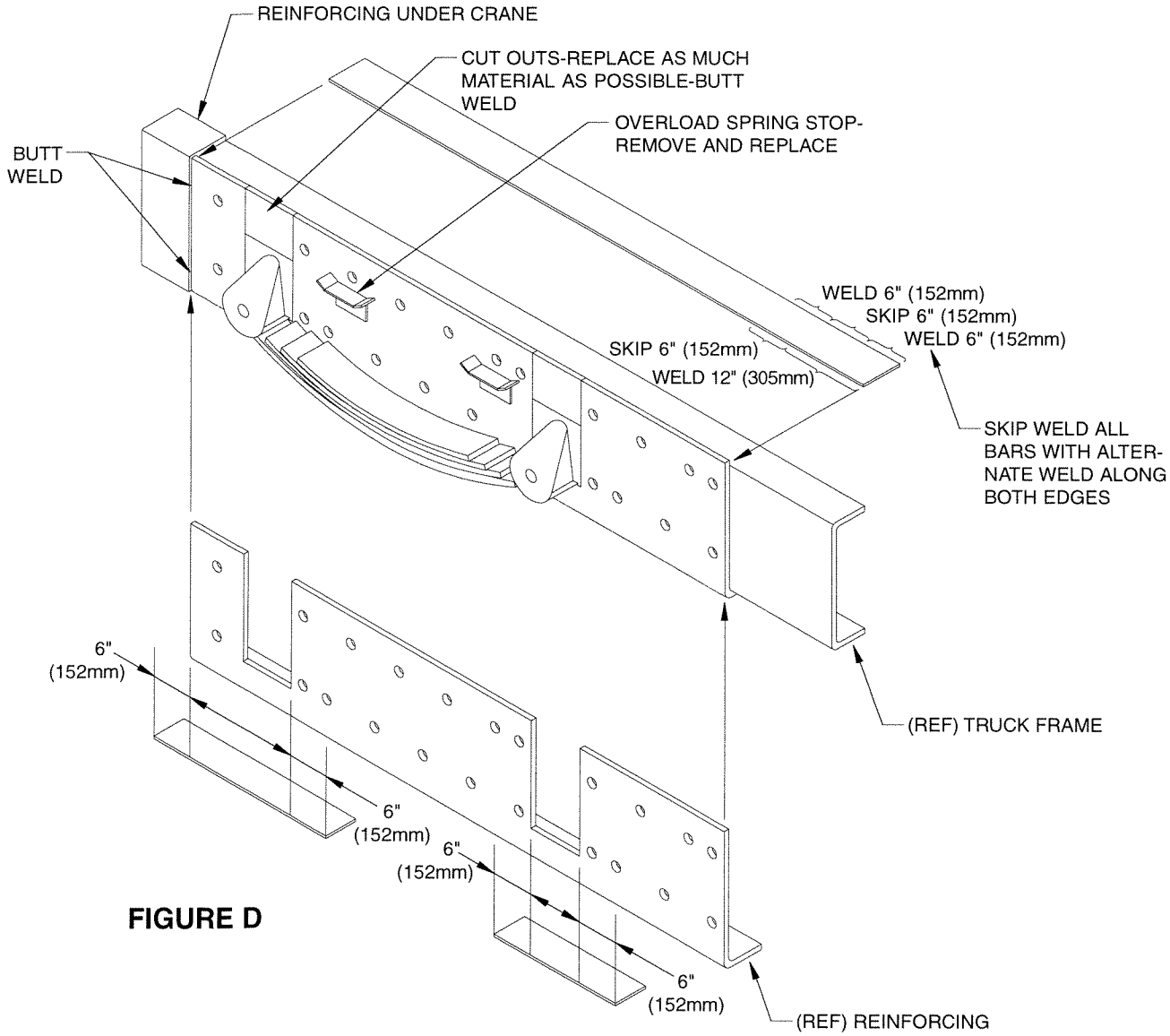


FIGURE D