# Installation, Care and Operations Manual

NATIONAL OILWELL

# Blak-JAK™

## *LINER RETENTION SYSTEM*

## Type Pump

## *NATIONAL 12P-160*

NATIONAL OILWELL

**P.O Box 4638**
**Houston, Texas 77210-4638**

***12/08/2003***

***MANUAL: 80-501-200***
***Rev-B, 08/17/04***

# Foreword…

This manual is published as a guide for the normal operation of your **NATIONAL-OILWELL** equipment. Because of many factors which contribute to the function or malfunction of this machinery, and not having complete knowledge of each factor or combination of factors, we cannot detail all facets of this subject. We must therefore confine the scope of this presentation and when situations encountered are not fully encompassed by complete, understandable instructions, these situations must be referred to the manufacturer.

The dimension and tolerances specified in this publication are those desirable for the most efficient operations of the equipment. When components become worn or when new parts are introduced into a worn unit, it may not be possible or economically feasible to reestablish such strict alignment and correct all dimensional deviations.

Improvements in design, engineering, materials, production methods, etc., may necessitate changes in these products and result in inconsistencies between the content of this publication and the physical equipment. We reserve the right to make these changes without incurring any liability or obligation beyond that which is stipulated in the purchase contract.

*The pictures, photographs, charts, diagrams, drawings, verbal contents and specifications are not to be construed as giving rise to any warranty on the part of NATIONAL-OILWELL. National-Oilwell makes no warranty, either expressed or implied beyond that which is stipulated in the purchase contract.*

**NATIONAL-OILWELL** BLAK-JAK's are manufactured by National-Oilwell at the McAlester, Oklahoma plant.

## ⚠! CAUTION ! CAUTION ! CAUTION ! ⚠

EXERCISE SAFETY IN ALL PERFORMANCES: DO NOT IGNORE ANY WARNINGS, USE ONLY APPROVED METHODS, MATERIALS AND TOOLS. DO NOT PERMIT ANY FUNCTION OF QUESTIONABLE SAFETY; ACCIDENTS ARE CAUSED BY UNSAFE ACTS AND UNSAFE CONDITIONS. SAFETY IS YOUR BUSINESS AND YOU ARE INVOLVED.

## ⚠! WARNING ! WARNING ! WARNING ! ⚠

BEFORE PERFORMING ANY SERVICE FUNCTION, BE CERTAIN THAT THE UNIT IS SEPARATED FROM ITS POWER SOURCE OR THAT THE POWER SOURCE IS LOCKED-OUT TO PREVENT ANY FORM OF ENERGY FROM ENTERING THE EQUIPMENT. THIS WOULD INCLUDE ELECTRICAL OR MECHANICAL ENERGY INTO OR FROM THE PRIME MOVER(S), PNEUMATIC ENERGY FROM THE COMPRESSOR/AIR SYSTEM, ETC.

## ⚠! WARNING ! WARNING ! WARNING ! ⚠

FAILURE TO OBSERVE THE WARNINGS AND NOTES OF CAUTION IN THIS PUBLICATION CAN RESULT IN PROPERTY DAMAGE, SERIOUS BODILY INJURY, OR DEATH.

## ⚠! WARNING ! WARNING ! WARNING ! ⚠

DO NOT PROCEED WITH INSTALLATION UNTIL THE INSTALLER HAS READ THE MANUAL IN ITS ENTIRETY.

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## OPERATION

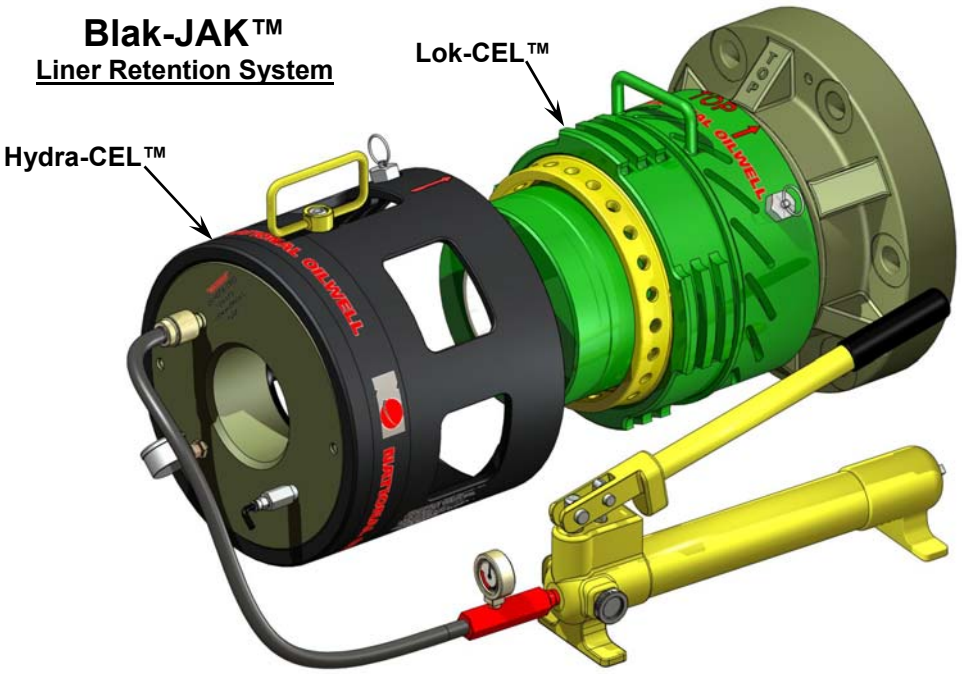
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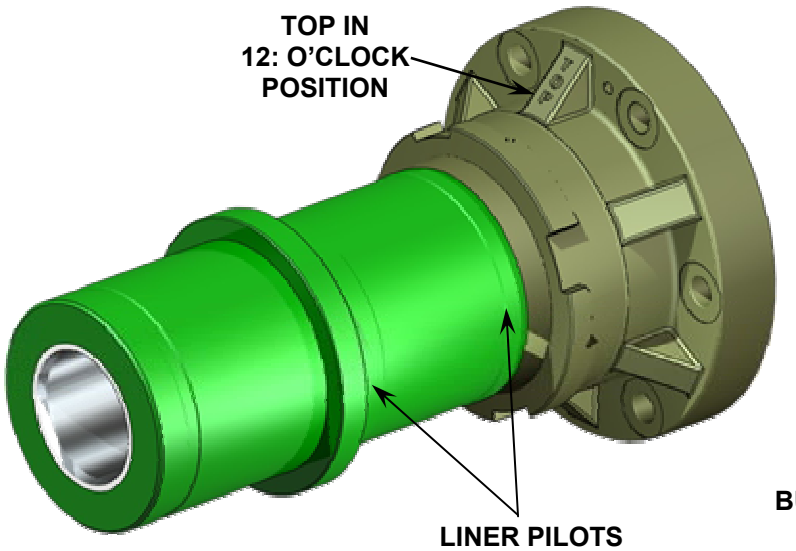
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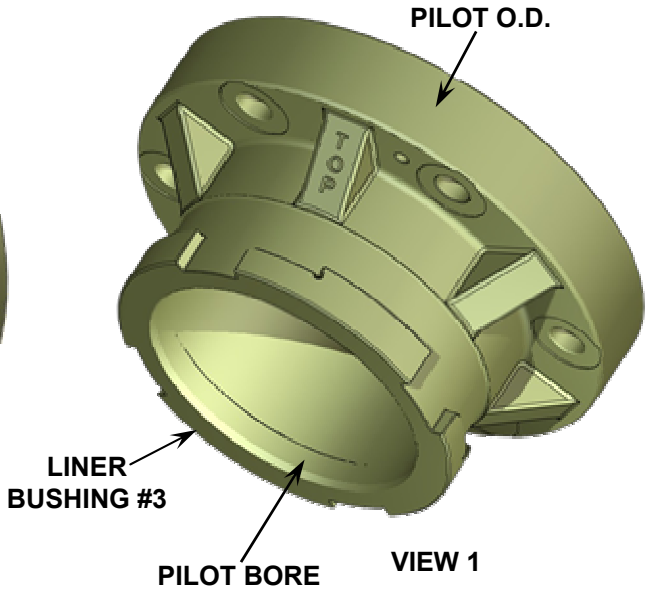
## Installation… (Liner Bushing and Liner)

**NOTE: ITEM NUMBERS SHOWN REFLECT ITEM NUMBERS ON PARTS LIST. (80-501-100 & 80-502-100) Pages 15 & 16 OF THIS MANUAL.**

1. REMOVE AND REPLACE OEM LINER BUSHING WITH **BLAK-JAK™ LINER BUSHING (#3) VIEW 1.** RE-USE OEM STUDS AND HEX NUTS, **TORQUE TO 780 (ft-lbs). NOTE:** FAILURE TO PROPERLY TORQUE STUDS CAN LEAD TO PREMATURE FAILURES. HEX NUTS SHOULD BE CHECKED PERIODICALLY FOR PROPER TORQUE.

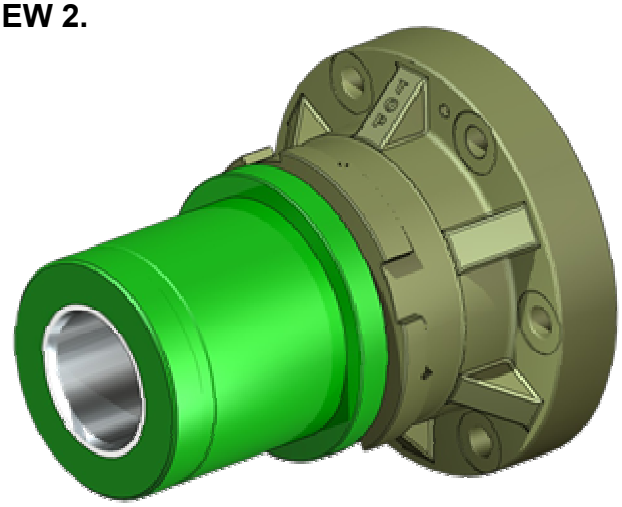



VIEW 2

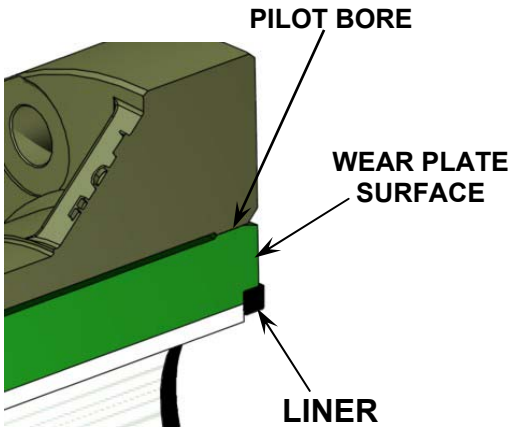



VIEW 1

2. WHEN INSTALLED CORRECTLY, TOP WILL BE IN THE 12:O'CLOCK POSITION. **VIEW 2.**



VIEW 2A



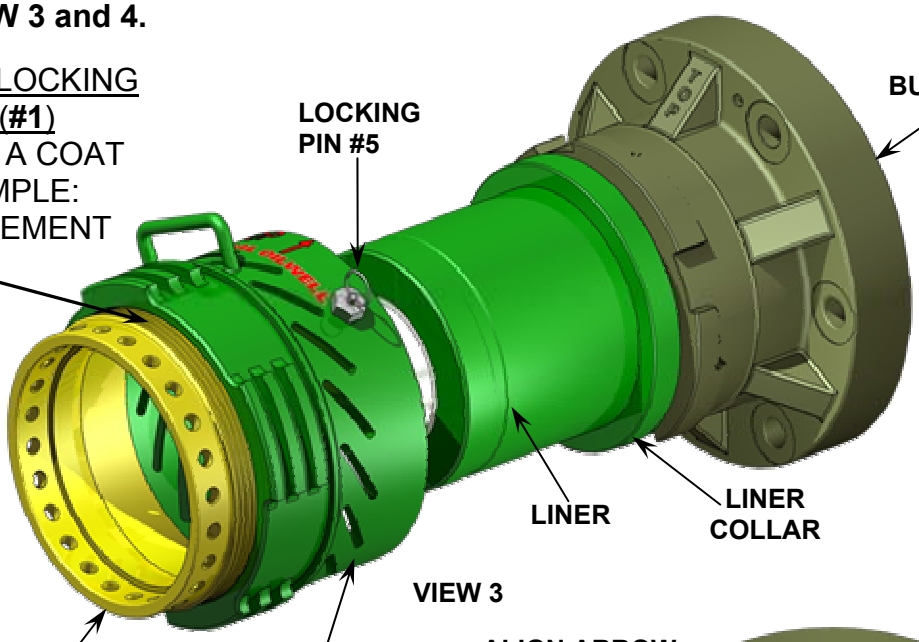

VIEW 2B

3. REMOVE PAINT FROM PILOTS OF LINER BUSHING **(#3)** AND LINER. **VIEW 1, 2 AND 2B.** APPLY LUBRICANT TO ALL PILOTS INCLUDING LINER GASKET COUNTER BORE. INSTALL LINER (WITH GASKET) SECURING GASKET AGAINST WEAR PLATE. **VIEW 2B.** (WEAR PLATE NOT SHOWN)

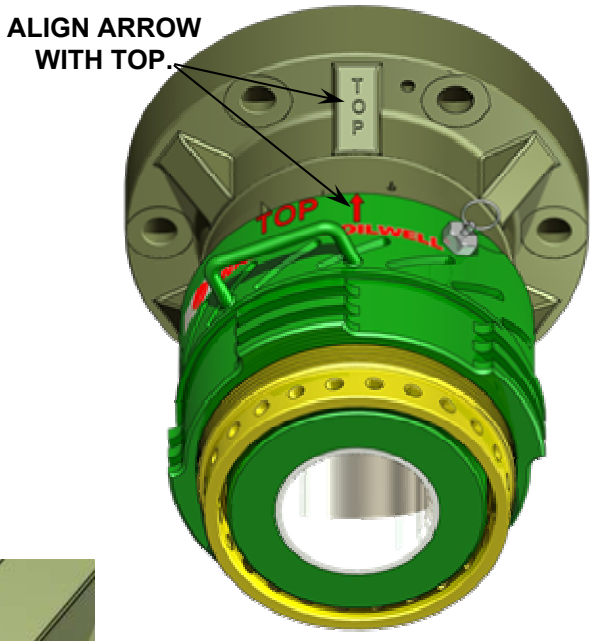
## Installation… (LOK-CEL)

4. INSTALL LOK-CEL BODY ASSEMBLY, ITEMS (**#1, #2, and #5)** OVER LINER AND UP TO LINER BUSHING (**#3)**. ALIGN ARROW ON LOK-CEL BODY (**#1)** WITH TOP ON LINER BUSHING (**#3)**. **VIEW 3 and 4.**

**NOTE:** THREADS ON LOCKING RING (**#2**) AND BODY (**#1**) MUST ALWAYS HAVE A COAT OF LUBRICANT. EXAMPLE: WHITE LEAD REPLACEMENT OR EQUIVALENT.




VIEW 3




VIEW 4

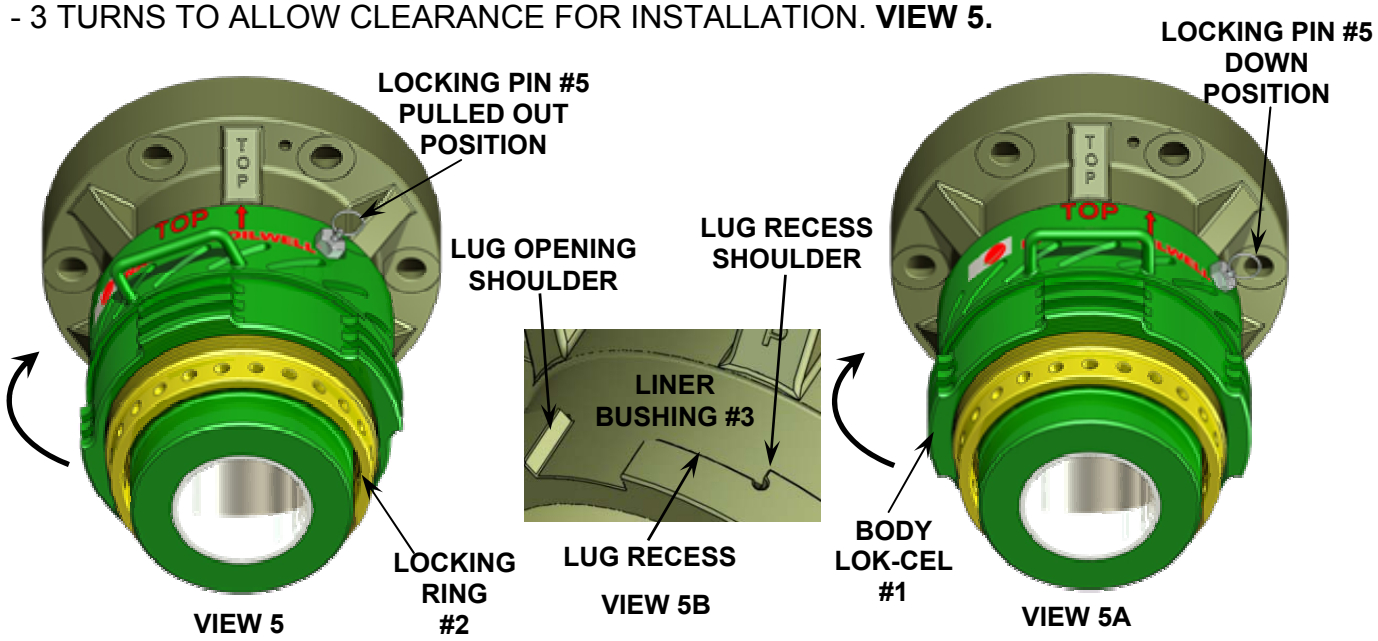
5. PULL LOCKING PIN (**#5**) OUT TO CLEAR LUGS ON LINER BUSHING (**#3**). **VIEW 4 and 4A.**




VIEW 4A

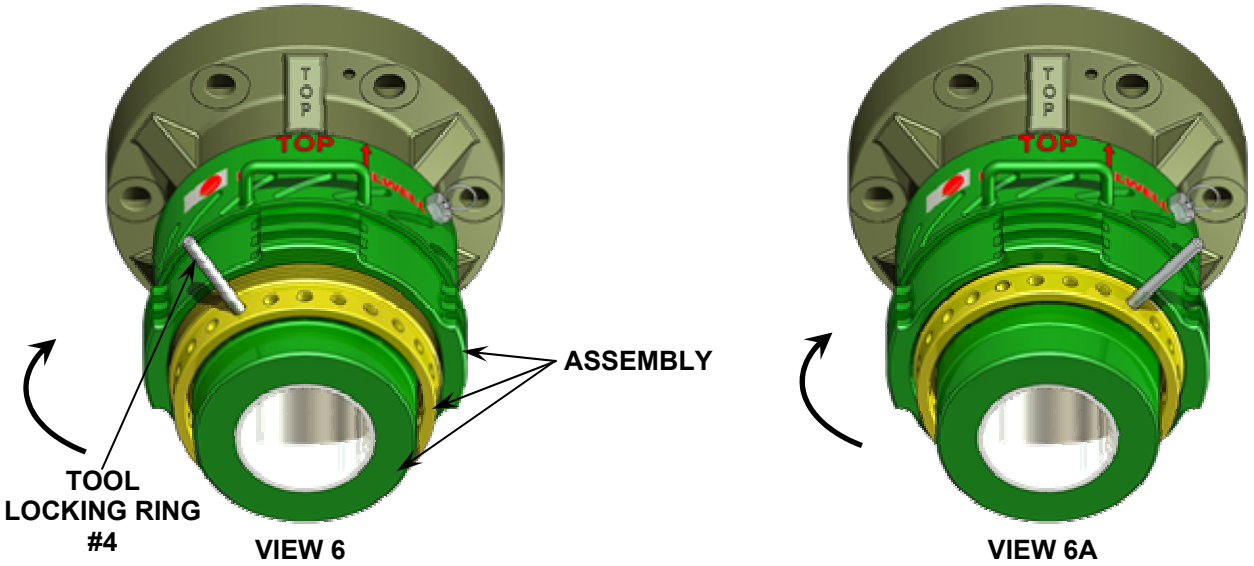
## Installation… (LOK-CEL)

6. CONTINUE TO PUSH LOK-CEL BODY (**#1**) FORWARD UNTIL LUGS CLEAR LUG RECESS. **VIEW 5 and 5B. NOTE:** LOCKING RING (**#2**) MUST BE BACKED OFF COUNTER CLOCKWISE 2 - 3 TURNS TO ALLOW CLEARANCE FOR INSTALLATION. **VIEW 5.**



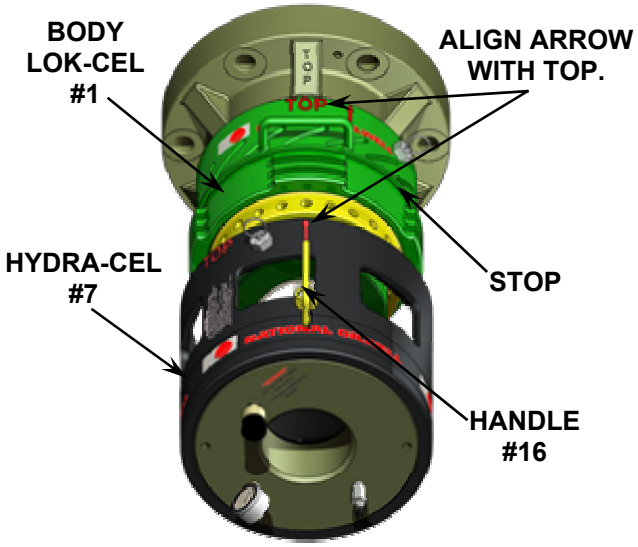

7. ROTATE LOK-CEL BODY (**#1**) CLOCKWISE UNTIL LUGS CONTACT LUG RECESS SHOULDER. **VIEW 5A and 5B**. **NOTE:** BOTH TOPS SHOULD NOW BE ALIGNED WITH ONE ANOTHER, AND LOCKING PIN (**#5**) SHOULD BE IN THE DOWN POSITION.

8. TURN LOCKING RING (**#2**) CLOCKWISE, USING LOCKING RING TOOL (**#4**) UNTIL CONTACT IS MADE WITH LINER COLLAR AND SLACK IN **ASSEMBLY** IS REMOVED. **VIEW 6 and 6A.**
**NOTE:** REMOVE LOCKING RING TOOL (**#4**) BEFORE PROCEEDING TO NEXT STEP.



## Installation… (HYDRA-CEL)

**9.** LIFT HYDRA-CEL (**#7**) WITH HANDLE (**#16**). PLACE HYDRA -CEL (**#7**) OVER LINER. ALIGN ARROW WITH TOP ON LOK-CEL BODY (**#1**), CONTINUE TO SLIDE FORWARD OVER LOK-CEL BODY (**#1**) UNTIL FRONT FACE OF HYDRA-CEL (**#7**) IS SECURE AGAINST STOP ON LOK-CEL BODY (**#1**) **VIEW 7 and 7B.**




VIEW 7

**NOTE:**
AN OPERATIONAL QUICK REFERENCE GUIDE DECAL IS ATTACHED TO HYDRA-CEL (**#7**). **VIEW 7A**



VIEW 7A

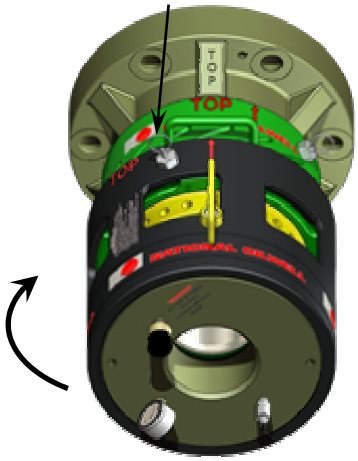


VIEW 7B

**10.** PULL LOCKING PIN (**#14**) OUT, **VIEW 8 and 8A**. ROTATE HYDRA-CEL (**#7**) CLOCKWISE UNTIL SECURE AGAINST ROLL PIN (**#13**), **VIEW 8B and 8C**. LOCKING PIN (**#14**) SHOULD NOW BE IN THE DOWN POSITION. **VIEW 8B**.



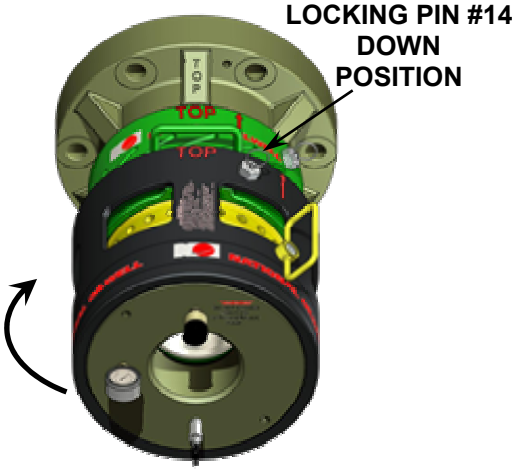

VIEW 8




VIEW 8A




VIEW 8C

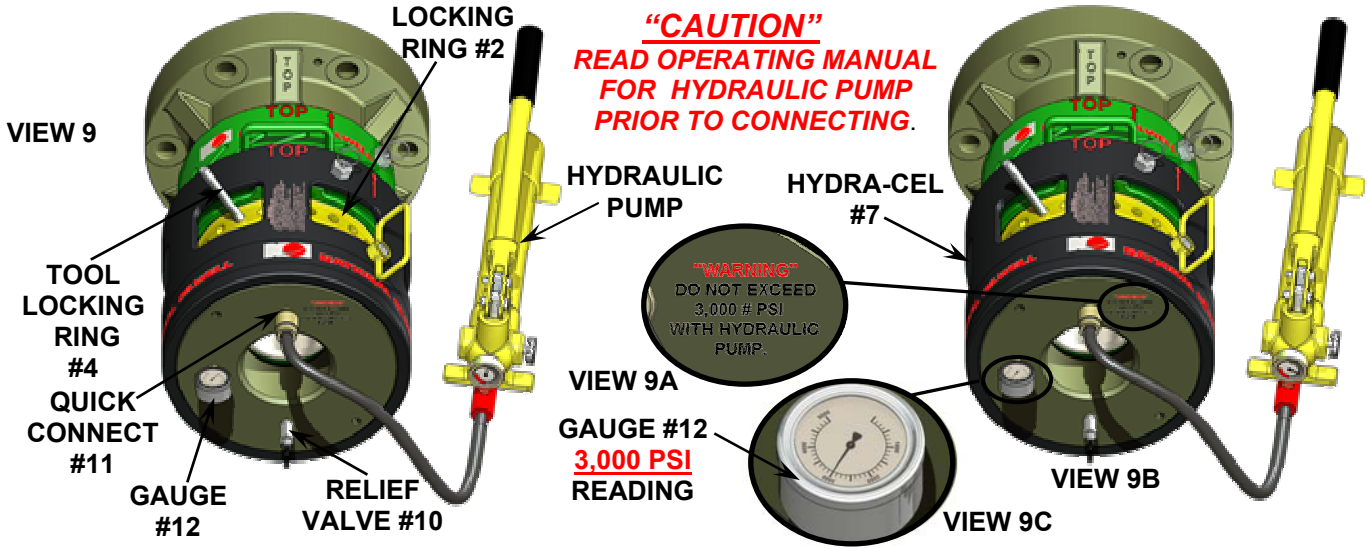



VIEW 8B

## Operation… (HYDRA-CEL / LOK-CEL)

**11.** CONNECT HYDRAULIC PUMP TO QUICK CONNECT (**#11**) **VIEW 9**. PRESSURE HYDRA-CEL (**#7**) USING HAND PUMP OR AIR ASSISTED HYDRAULIC PUMP TO A MAXIMUM OF 3,000 PSI. USE GAUGE (**#12**) **VIEW 9B & 9C,** FOR ACCURATE PRESSURE READING.

**NOTE: DO NOT EXCEED 3,000 PSI WITH HYDRAULIC PUMP**. **VIEW 9A.** RELIEF VALVE (**#10**) IS FACTORY SET TO RELIEVE PRESSURE IN EXCESS OF 3,000 PSI. IF PUMP PRESSURE EXCEEDS 3,000 PSI THERE MAY BE A SMALL AMOUNT OF HYDRAULIC FLUID VISIBLE FROM THE CONNECTED TUBE. THE RELIEF VALVE (**#10**) WILL RE-SET WHEN PRESSURE DROPS BELOW FACTORY SETTING. AFTER RELIEF VALVE HAS RE-SET, RE-APPLY HYDRAULIC PRESSURE TO 3,000 PSI.




**12.** WITH 3,000 PSI HYDRAULIC PRESSURE APPLIED, SECURE LOCKING RING (**#2**) USING LOCKING RING TOOL (**#4**). TURN CLOCKWISE UNTIL CONTACT IS MADE WITH THE LINER COLLAR AND THREADS ARE HAND TIGHT. **VIEW 9B and 10**. **NOTE: HAND TIGHT IS SUFFICIENT**. **DO NOT HAMMER** LOCKING RING TOOL (**#4**) TO SECURE LOCKING RING (**#2**). THE SAME FORCE USED TO SECURE LOCKING RING (**#2**) WILL HAVE TO BE APPLIED WHEN REMOVING LOCKING RING (**#2**). **HAND TIGHTEN ONLY.**

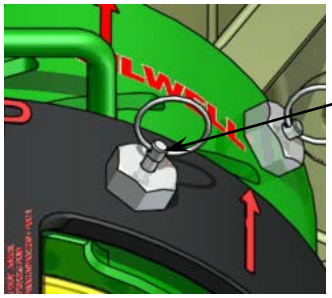
**13.** WITH LOCKING RING (**#2**) SECURED **VIEW 10**. RELEASE PRESSURE FROM HYDRAULIC PUMP. **VIEW 10 and 10A**.



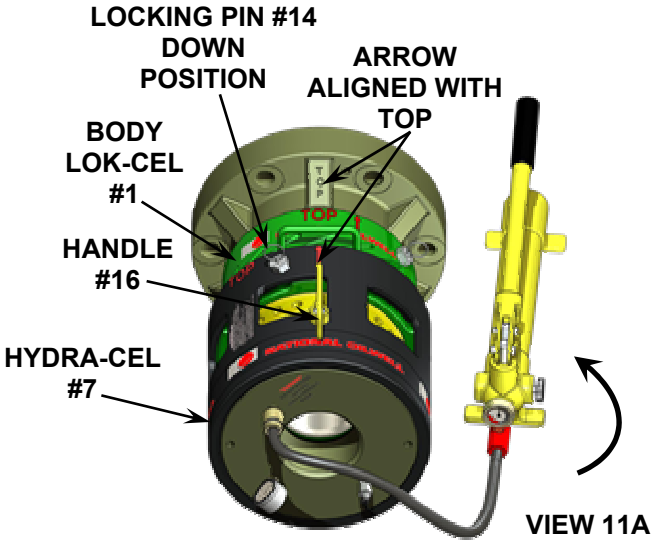
## Removal… (HYDRA-CEL)

**NOTE:** THE HYDRA-CEL (**#7**) **RAM #3** IS SPRING LOADED, AND WILL RETRACT WHEN HYDRAULIC PUMP PRESSURE IS RELEASED. **HYDRAULIC PUMP MUST REMAIN ATTACHED AND PRESSURE RELEASE VALVE OPENED** TO ALLOW SPRINGS **(#8)** TO PUSH RAM **(#3)** BACK FROM LINER FACE. (THIS SHOULD HAPPEN QUICKLY). HYDRA-CEL (#7) CAN NOW BE REMOVED WITH LITTLE EFFORT. FOR RAM (#3) TO COMPLETELY RETURN TO ITS RETRACTED POSITION REQUIRES CONTINUED ATTACHMENT TO **HYDRAULIC PUMP AND PRESSURE RELEASE VALVE TO REMAIN OPEN**. ***(IF RESERVOIR OF HYDRAULIC PUMP IS FULL, RAM (#3) MAY NOT RETRACT COMPLETELY)***

14. WITH HYDRAULIC PRESSURE RELEASED AND VALVE REMAINING OPEN. PULL LOCKING PIN (**#14**) OUT ON HYDRA-CEL (**#7**) **VIEW 11**, ROTATE HYDRA-CEL (**#7**) COUNTER-CLOCKWISE UNTIL ARROW ON HYDRA-CEL (**#7**) IS ALIGNED WITH TOP ON LOK-CEL BODY (**#1**). LOCKING PIN (**#14**) WILL NOW BE IN THE DOWN POSITION. **VIEW 11A**

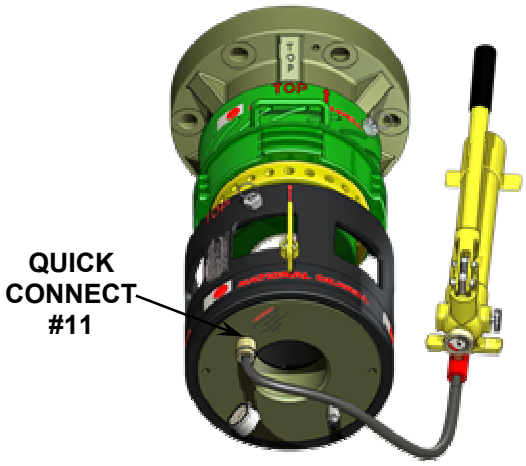



**VIEW 11**

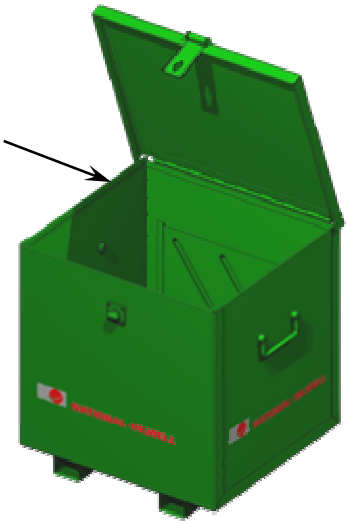



**VIEW 11A**

15. LIFT HYDRA-CEL (**#7**) USING HANDLE (**#16)** AND SLIDE BACK TO REMOVE. **VIEW 11B**. LEAVE HYDRAULIC PUMP ATTACHED IF RE-USING HYDRA -CEL (**#7**). **NOTE:** IF NO FURTHER USE OF HYDRA -CEL (**#7**) IS REQUIRED, REMOVE HYDRAULIC HOSE FROM QUICK CONNECT (**#11**) REPLACE DUST COVER AND STORE IN PROTECTIVE BOX.




**VIEW 11B**



# Removal … (LOK-CEL / Liner Change)

1. INSTALL HYDRA -CEL (**#7**) AS PER **STEPS 9 AND 10 ON PAGE 6**.

2. PRESSURIZE HYDRA -CEL (**#7**) AS PER **STEPS 11 AND 12 ON PAGE 7**.

3. RELEASE TENSION ON LOCKING RING (**#2**) THREADS. TURN COUNTER CLOCKWISE APPROXIMATELY ¼ REVOLUTION USING LOCKING RING TOOL (**#4**).

4. RELEASE PRESSURE FROM HYDRAULIC PUMP AND REMOVE HYDRA -CEL (#7) AS PER **STEPS 13 – 15 PAGES 7 AND 8**.

5. TO REMOVE LOK-CEL BODY ASSEMBLY, PULL LOCKING PIN (**#5**) **VIEW 4A PAGE 4**. ROTATE LOK-CEL BODY (**#1**) COUNTER CLOCKWISE UNTIL LUGS CONTACT LUG OPENING SHOULDER OF LINER BUSHING (**#3**) **VIEW 5 AND 5B PAGE 5**. **NOTE:** ARROW SHOULD NOW BE ALIGNED WITH **"TOP"** ON LINER BUSHING (**#3**) **VIEW4 PAGE 4**. SLIDE LOK-CEL BODY (**#1**) BACK AND REMOVE.

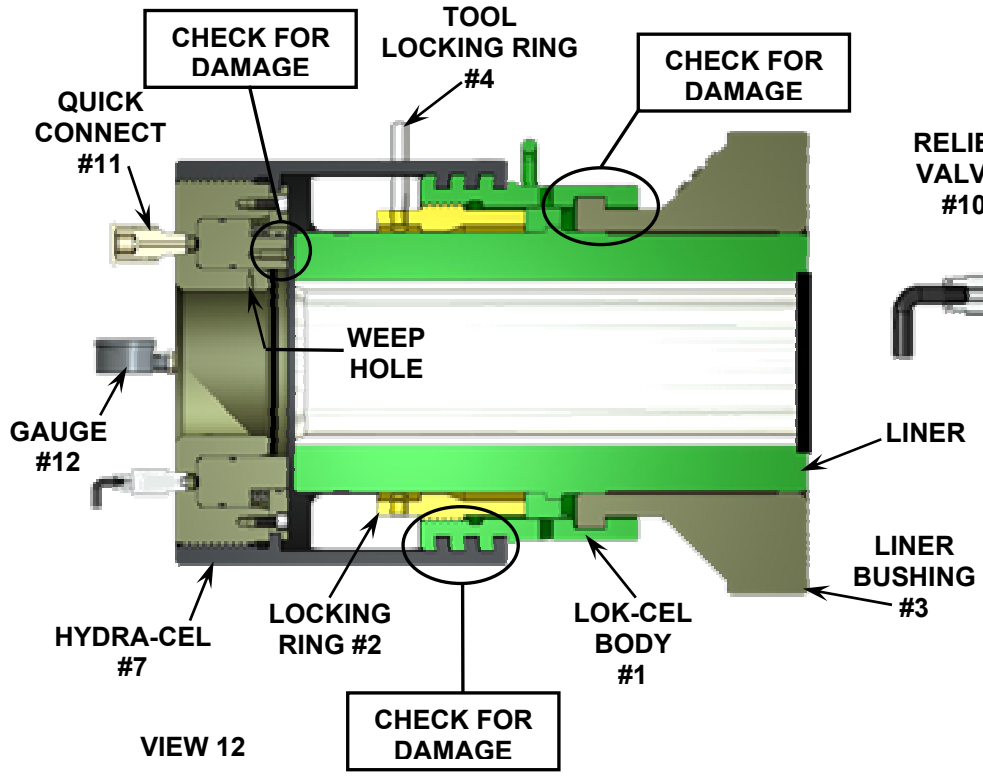
6. REMOVE LINER AND REPLACE.

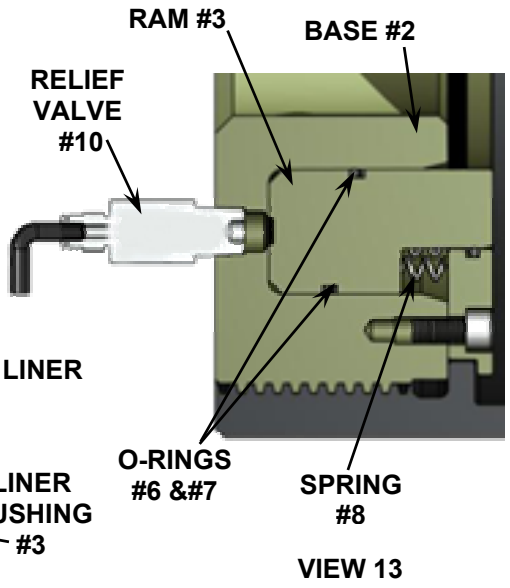
**⚠WARNING⚠**

***DO NOT PRESSURE HYDRA-CEL #7 ABOVE 3,000 PSI, AND OR WITHOUT HAVING RELIEF VALVE #10 INSTALLED. DOING SO WILL RESULT IN COMPONENT FAILURE. WHICH COULD RESULT IN PERSONAL INJURY.***

## ...Care & Maintenance...

1. **HYDRA-CEL #7**: USE HYDRAULIC FLUID ONLY. AIR MUST BE PURGED FROM SYSTEM BEFORE USE, AFTER DISASSEMBLY AND / OR SEAL CHANGE.
2. AVOID APPLYING HYDRAULIC PRESSURE TO **HYDRA -CEL #7** WHEN NOT INSTALLED ON THE **LOK-CEL BODY #1**. PUMPING **RAM #3** O-RINGS PAST THE WEEP HOLE VIEW 12 COULD DAMAGE **THE RETURN SPRINGS #8 AND O-RINGS (#6, #7)**. VIEW 13
3. CARE MUST BE GIVEN TO MATING SURFACES, CHECK FOR DAMAGE AS PER VIEW 12. KEEP SURFACES FREE OF DEBRIS AND FOREIGN MATTER. INSPECT ALL WEAR AREAS EVERY 3 MONTH'S, OR SOONER IF NEEDED.
4. IF DAMAGE OCCURS OF A MINOR NATURE, (EXAMPLE NICKS, DINGS) REPAIR SURFACES PRIOR TO USE. IF DAMAGE IS ANYTHING MORE THAN MINOR, PARTS MUST BE REPLACED. USE OF **HYDRA -CEL#7** AND OR **LOK-CEL #1** WITH DAMAGED COMPONENTS MAY RESULT IN FAILURE OF ASSEMBLY, COMPONENTS, AND PERSONAL INJURY. **DO NOT USE HYDRA-CEL #7 OR LOK-CEL #1 IF COMPONENTS ARE DAMAGED**. SEE PARTS LIST FOR REPLACEMENT PART NUMBERS. (Pg.'s 15 & 16)
5. **LOK-CEL BODY #1**: CARE MUST BE GIVEN TO MATING SURFACES, CHECK FOR DAMAGE AS PER VIEW 12 . KEEP SURFACES FREE OF DEBRIS AND FOREIGN MATTER. INSPECT ALL WEAR AND CONTACT AREAS PRIOR TO EACH USAGE.
6. **LOCKING RING #2**: LUBRICATE THREADS WITH WHITE LEAD REPLACEMENT OR EQUIVALENT. THREADS MUST TURN FREELY WITHOUT BINDING. INSPECT FOR DAMAGE AS DESCRIBED IN STEP 5. IF DAMAGE IS MORE THAN MINOR COMPONENTS MUST BE REPLACED. **( SEE STEP 4 )**
7. **LINER BUSHING #3:** CHECK FOR DAMAGE PER STEP 4. RE-TORQUE HEX NUTS AND STUDS EVERY THREE MONTHS. SEE STEP 1 PAGE 3.

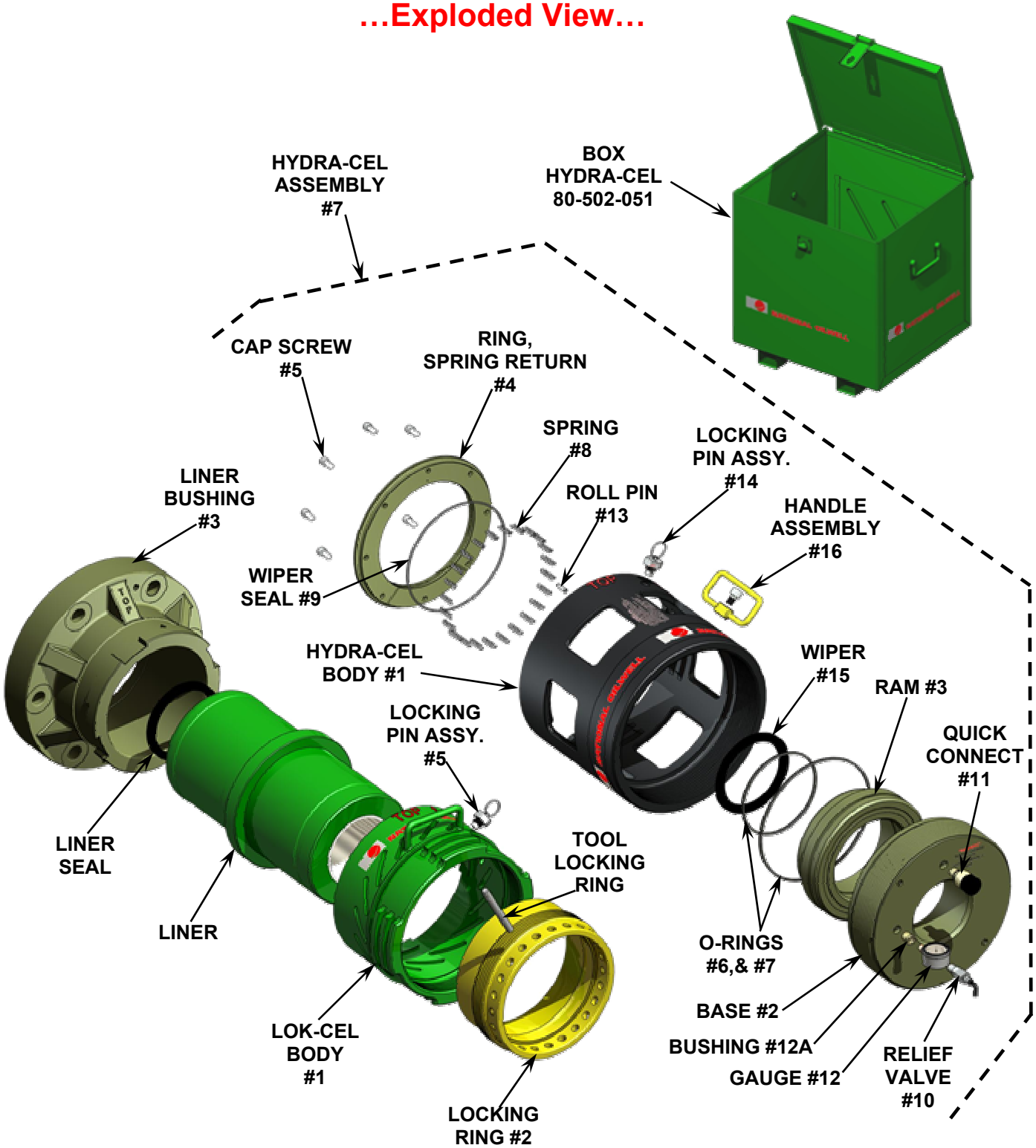


# …Trouble Shooting Guide…

| | PROBLEM | PROBABLE CAUSE | SOLUTION |
|---|---|---|---|
| *1* | LOK-CEL BODY #1 WILL NOT INSTALL OVER LINER BUSHING #3 | **1**. DAMAGE ON MATING SURFACES. **2**.LOCKING RING #2 INTERFERENCE. | **1**. DEBURR DAMAGED AREAS. **2**. UNSCREW LOCKING RING #2 C.C.W. 2-3 TURNS. |
| **2** | LOCKING RING #2 IS HARD TO TURN OR WILL NOT TURN AT ALL. | **1**. ASSEMBLY STILL IN TENSION. **2**. THREADS HAVE NOT BEEN LUBRICATED. **3**. DAMAGED COMPONENTS. | **1**. RELEASE TENSION PER STEP 13 OF PG. 7. **2** APPLY LUBRICANT TO THREAD PER NOTE PG. 4. **3**. REPLACE DAMAGED COMPONENTS. |
| **3** | LOCKING RING #2 RELEASES AT A LOWER PRESSURE THAN SPECIFIED (3,000 PSI). | **1**. LINER BUSHING #3 HEX NUTS AND STUDS HAVE LOOSENED. **2**. LOK-CEL PARTS ARE DAMAGED. | **1**. RE-APPLY TORQUE PER STEP 1 OF PG. 3. **2**. REPLACED DAMAGED PARTS. |
| **4** | LOK-CEL BODY #1 WILL NOT ROTATE ON LINER BUSHING #3 | **1**. ASSEMBLY IS STILL UNDER TENSION. **2**. LOCKING PIN #5 HAS NOT BEEN RETRACTED. | **1**. RELEASE TENSION PER STEP 13 OF PG. 7. **2** PULL LOCKING PIN #5 OUT PER VIEW 4A PG. 4. |
| **5** | HYDRA-CEL #7 WILL NOT INSTALL OVER LOK-CEL BODY #1 | **1**. DAMAGE ON MATING SURFACES. **2**.HYDRA-CEL #7 RAM #3 IS EXTENDED. **3**. IMPROPER LINER DIMENSION. | **1**. DEBURR DAMAGED AREAS. **2**. RELEASE PRESSURE, STEP 13 Pg 7. **3**. REPLACE LINER. |
| **6** | HYDRA-CEL #7 WILL NOT HOLD HYDRAULIC PRESSURE. | **1**. HYDRAULIC LEAKS.(RAM#3 EXTENDS PAST WEEP HOLE) **2**. HYDRAULIC PUMP IS DAMAGED OR RELEASE VALVE OPEN. **3**. RELIEF VALVE #10 OPENS A LOW PSI. | **1**. TIGHTEN ALL CONNECTIONS. REPLACE O-RINGS #6 & 7 IF NECESSARY. **2**. REPLACE PUMP, CLOSE RELEASE VALVE. **3**. REPLACE RELIEF VALVE #10. |
| **7** | HYDRA-CEL #7 WILL NOT RELEASE FROM LOK-CEL #1. | **1**. STILL IN TENSION. **2**. LOCKING PIN #14 HAS NOT BEEN EXTENDED. **3**. HYDRAULIC PUMP IS DAMAGED. | **1**. RELEASE TENSION PER STEPS 13 & 14 OF PG. 7 & 8. **2** PULL LOCKING PIN #14 OUT PER VIEW 11 PG. 8. **3**. REPLACE HYDRAULIC PUMP. |
| **8** | RAM #2 WILL NOT RETRACT. | **1**. ASSEMBLY STILL IN TENSION **2**. RELEASE VALVE ON HYDRAULIC PUMP NOT OPENED. **3**. DAMAGED SPRINGS #8. | **1** & **2**. RELEASE TENSION PER STEPS 13 & 14 OF PG. 7 & 8. **3** REPLACE SPRING #8. |
| **9** | RAM WILL NOT MOVE WHEN HYDRAULIC PRESSURE IS APPLIED. | **1**. HYDRAULIC LEAKS. **2**. HYDRAULIC PUMP IS DAMAGED. **3**. RAM IS ALREADY FULLY EXTENDED. | **1**. CHECK ALL CONNECTIONS. REPLACE O-RINGS #6 & 7 IF NECESSARY. **2**. REPLACE PUMP. **3**. REPLACE SPRINGS #8. |
| **10** | RELIEF VALVE #10 LEAKS HYDRAULIC FLUID FROM CONNECTED TUBE. | **1**. HYDRAULIC PRESSURE EXCEEDS FACTORY SETTINGS. FAULTY GAUGE. **2**. RELIEF VALVE #10 NEEDS TO BE CALIBRATED OR IS DAMAGED. | **1**. DO NOT EXCEED MAXIMUM HYDRAULIC PRESSURE 3,000 PSI. REPLACE GAUGE #12 **2**. REPLACE RELIEF VALVE #10. |
| **11** | HYDRAULIC FLUID LEAKS FROM INSIDE OF THE HYDRA-CEL #7 | **1**. DAMAGED O-RINGS #6 & #7. **2**. DAMAGED BASE # 2, OR RAM #3. | **1**. REPLACE O-RING PER PG.13. **2**. REPLACE DAMAGED PARTS. SEE PARTS LIST FOR REPLACEMENT PART NUMBERS. |
| **12** | HYDRAULIC FLUID LEAKS FROM THREADED COMPONENTS ATTACHED TO HYDRA-CEL #7. | **1**. LOOSE COMPONENTS . **2** NO THREAD SEALANT USED. **3**. DAMAGED THREADS. | **1**. CHECK ALL COMPONENTS.. **2**. REMOVE COMPONENTS, APPLY THREAD SEALANT AND RE-INSTALL. **3**. REPLACE DAMAGED COMPONENTS. |
| **13** | LINER IS DIFFICULT TO REMOVE FROM LINER BUSHING #3. . | **1**. NO LUBRICANT WAS APPLIED TO LINER PILOTS WHEN INSTALLED. **2**. PAINT WAS NOT REMOVED FROM PILOTS ON LINER AND OR LINER BUSHING #3. | **1**. ALWAYS LUBRICATE PILOTS. **2**. REMOVE PAINT FROM PILOTS THEN LUBRICATE. STEP 3 OF PG 3. |
| **14** | LINER IS DIFFICULT TO INSTALL INTO LINER BUSHING #3. | **1**. LUBRICANT NOT APPLIED TO LINER PILOTS. **2**. PAINT WAS NOT REMOVED FROM PILOTS ON LINER AND OR LINER BUSHING #3. **3**. DIMENSIONAL ERROR. | **1**. ALWAYS LUBRICATE PILOTS. **2**. REMOVE PAINT FROM PILOTS THEN LUBRICATE STEP 3 OF PG 3. **3**. REPLACE ANY PARTS THAT HAVE DIMENSIONAL ERRORS. |
| **15** | LINER GASKET LEAKS FREQUENTLY. LINER GASKET HAS SHORT LIFE. | **1**. TENSION IS NOT BEING APPLIED CORRECTLY. **2**. TENSION IS BEING LOST. **3**. DAMAGED COMPONENTS. | **1**. APPLY TENSION TO LOK-CEL #1 AS PER STEPS 11 & 12 OF PG 7. **2**. SEE PROBLEM 3. **3**. REPLACE DAMAGED COMPONENTS. |

## …Exploded View…

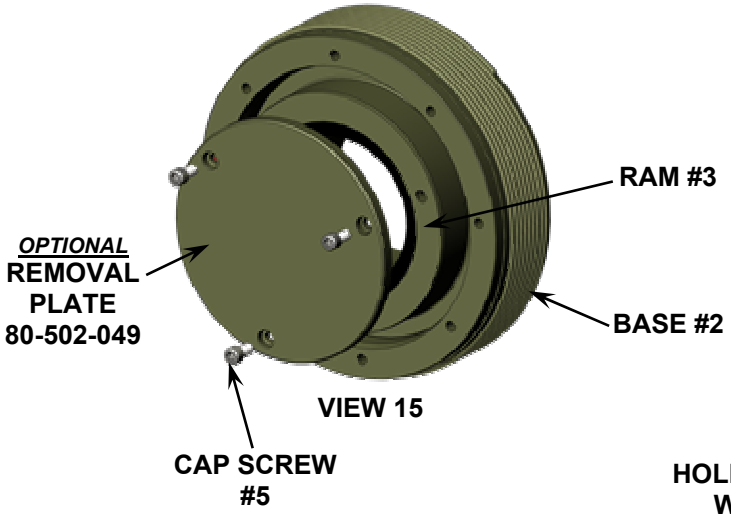



VIEW 14

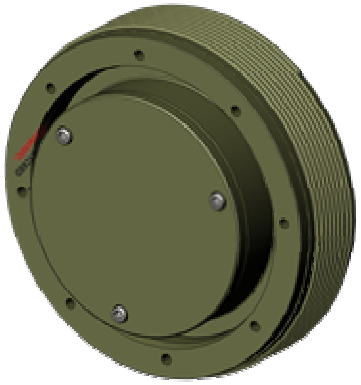
## Overhaul & Repair… (Hydra-CEL Seal Replacement)

1. LOOSEN AND REMOVE THE 8 **CAP SCREWS #5**, REMOVE **RING SPRING RETURN #4**, **WIPER SEAL #9, AND RETURN SPRINGS #8**. VIEW 14.
2. INSTALL TWO ½ -13 BOLTS (NOT SUPPLIED) IN THE ½-13 TAPED HOLES OF **BASE #2** VIEW 17. TURN BOLTS CLOCKWISE UNTIL BOTTOMED OUT.
3. USING A PRY BAR, TURN THE **BASE #2** WITH THE INSTALLED ½-13 BOLTS COUNTER CLOCKWISE TO REMOVE THE **BASE #2** FROM THE **HYDRA-CEL BODY #1**.
4. REMOVE THE **QUICK CONNECT #11**, **RELIEF VALVE #10**, AND **GAUGE #12** FROM THE **BASE #2**. DRAIN THE REMAINING HYDRAULIC FLUID FROM THE **BASE #2**. VIEW 17.
5. INSTALL **REMOVAL PLATE** (**80-502-049** ***OPTIONAL***) USING THE REMOVED **CAP SCREWS #5**. VIEW 15 AND 15A. TIGHTEN UNTIL SECURE AGAINST THE **RAM #3**.
6. REMOVE **RAM #3** FROM **BASE #2** USE A NON-METALLIC OBJECT AGAINST BACK SIDE OF REMOVAL PLATE. VIEW 15B. TAP NON-METALLIC OBJECT WITH HAMMER TO REMOVE **RAM #3**. ***(TIP) PLACE A BLOCK OF WOOD ( 4"X4"X12") ON A BENCH TOP. GRABBING THE BASE WITH BOTH HANDS, PLACE OVER THE BLOCK OF WOOD AND APPLY A DOWNWARD FORCE TO REMOVE THE RAM #3.***
7. REMOVE SEALS, CLEAN AND INSPECT FOR ANY DAMAGE. IF **RAM #3** AND **BASE #2** ARE IN GOOD CONDITION, REPLACE SEALS VIEW 16. COAT SEAL AREA OF **RAM #3** AND **BASE #2** WITH CLEAN LIGHT OIL.
8. INSTALL **RAM #3 WITH O-RINGS #6 AND #7** INTO THE **BASE #2** VIEW 15B UNTIL RESISTANCE IS FELT FROM THE **O-RINGS**.
9. USING A SOFT FACE HAMMER, TAP **RAM #3** INTO THE SEATED POSITION. VIEW 15B. ***(TIP) GRABBING THE BASE WITH BOTH HANDS HOLDING THE RAM #3 IN PLACE VIEW 15B, WITH RAM #3 FACING DOWNWARD. THRUST BASE ON (WOODEN) BENCH TOP A FEW TIMES UNTIL RAM #3 IS SEATED INTO THE BASE #2 VIEW 15B.***
10. INSTALL **BASE #2** INTO **HYDRA-CEL BODY #1** BY REVERSING THE PROCEDURE IN STEPS 2 AND 3. LUBRICATE THREADS (*WHITE LEAD REPLACEMENT OR EQUIVALENT*)
11. INSTALL INTO THE **BASE #2** THE **QUICK CONNECT #11**, **RELIEF VALVE #10**. APPLY A THREAD SEALANT TO THREADS BEFORE INSTALLING. TURN CLOCKWISE TO INSTALL. APPROXIMATELY 35 ft-lbs. TORQUE. ATTACH HYDRAULIC PUMP TO THE **QUICK CONNECT #11**. PUMP UNTIL HYDRAULIC FLUID IS VISIBLE FROM THE **GAUGE #12** PORT AND ALL AIR IS PURGED. INSTALL **GAUGE #12** PER ABOVE. DISCONNECT HYDRAULIC PUMP.
12. INSTALL NEW **RETURN SPRINGS #8** INTO THE **RAM #3.**
13. INSTALL THE **RING SPRING RETURN #4,** WITH **WIPER SEAL #9** USING THE EIGHT **CAP SCREWS #5**. APPROXIMATELY 35 ft-lbs. TORQUE. ***(TIP) LUBRICATE WIPER SEAL #9 AND MATING AREA OF RAM #3 USING WHITE LEAD REPLACEMENT, THEN INSTALL APPLY EVEN FORCE TO THE CAP SCREWS #5. IT WORKS BEST TO USE 4 CAP SCREWS 90 DEG APART WORKING THEM DOWN TOGETHER. THEN INSTALL THE REMAINING CAP SCREWS. #5. THEN TORQUE.***

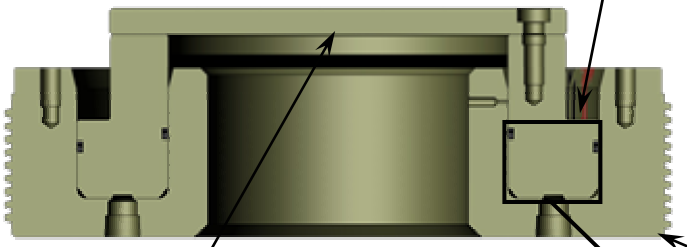
## Overhaul & Repair… (Seal Replacement)



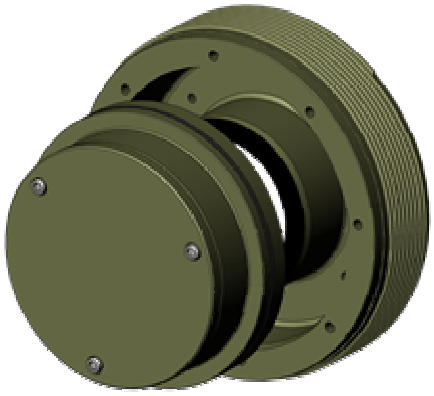

VIEW 15



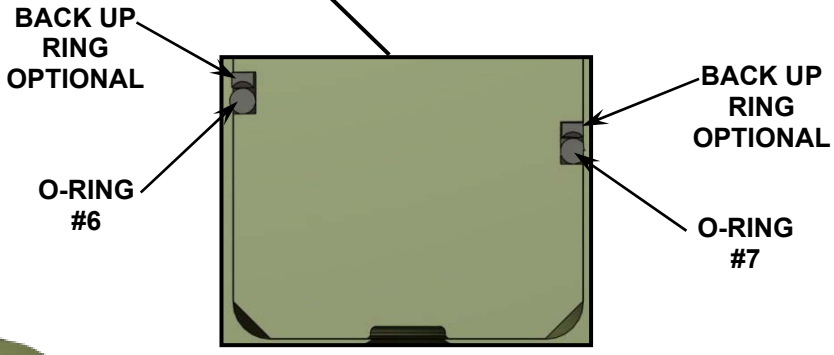
VIEW 15A



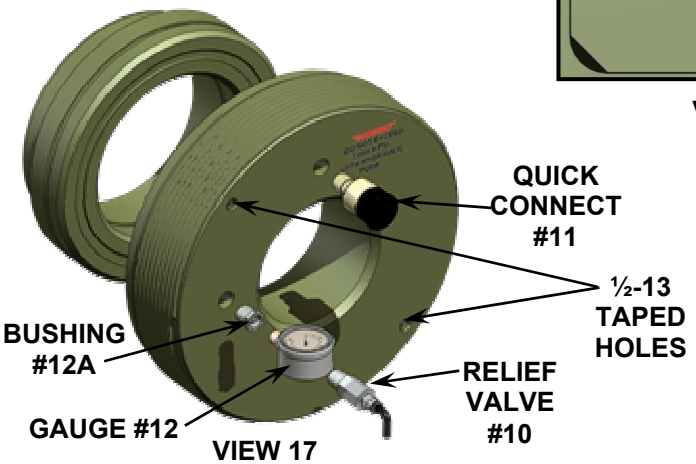

VIEW 15B



VIEW 15C




VIEW 16



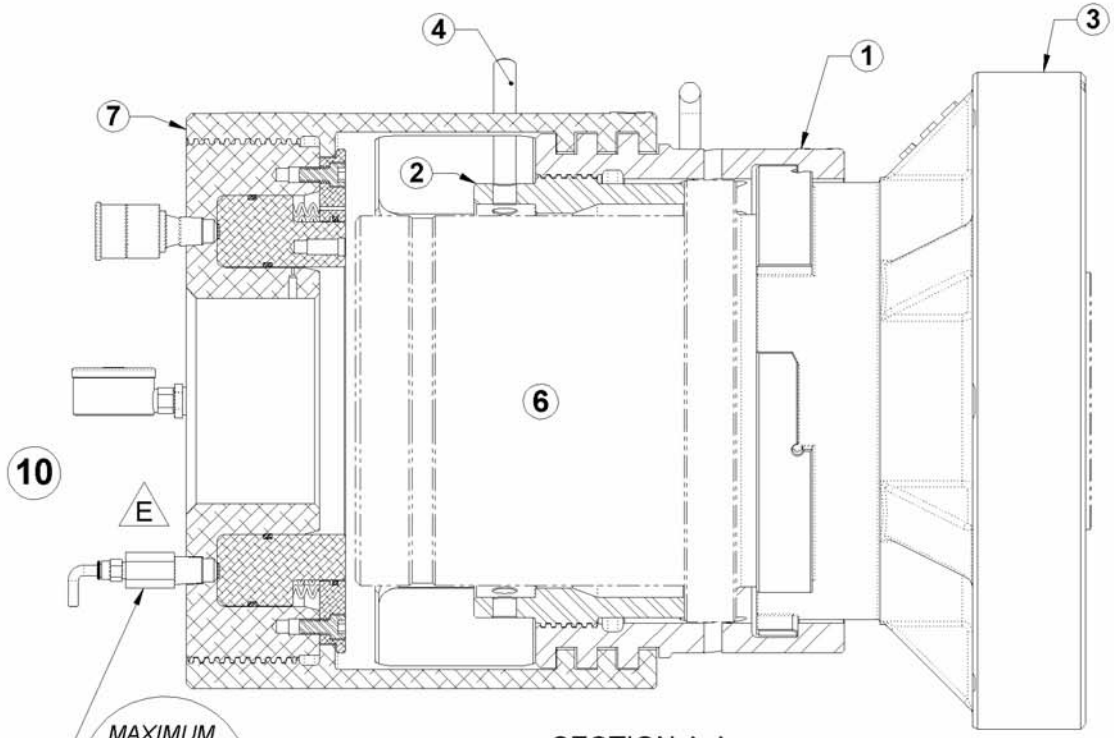

VIEW 17

**⚠WARNING⚠**

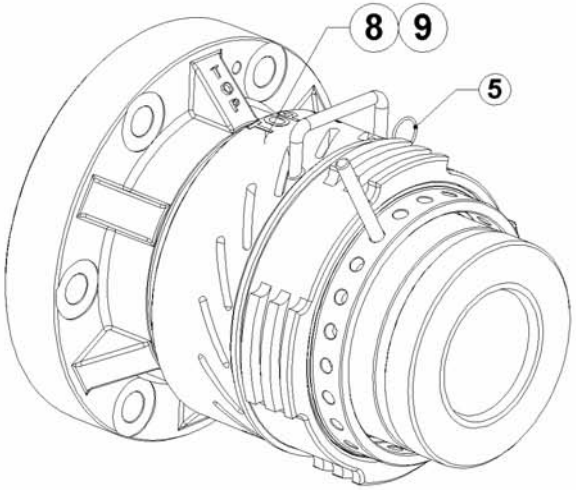
***DO NOT PRESSURE HYDRA-CEL #7 ABOVE 3,000 PSI, AND OR WITHOUT HAVING RELIEF VALVE #10 INSTALLED. DOING SO WILL RESULT IN COMPONENT FAILURE. WHICH COULD RESULT IN PERSONAL INJURY.***

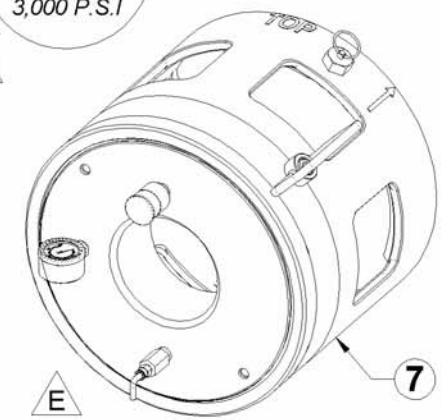
| 1 | 80-502-016 | ASSEMBLY, AIR TURBO II ENERPAC (PATG-1102N) | |
|---|---|---|---|
| 1 | 80-500-112 | ASSEMBLY, HAND PUMP INCLUDES ITEMS A,B,& C | |
| 1 | 80-500-040 | GAGE, PRESSURE 10,000# (GP-10S) | C |
| 1 | 45-804-097 | HOSE, 1/4" I.D X 15' LG. W 3/8" NPT (M) ENDS | B |
| 1 | 80-500-039 | HAND PUMP, HYDRAULIC 10,000# (P-392) | A |
| QTY. | PART NO. | DESCRIPTION / MATERIAL / SPECIFICATION | ITEM NO. |
| | | REF:B/M (NOT SHOWN) | |

| LTR | DESCRIPTION OF CHANGE | MADE | CHKD | DATE | APPD |
|---|---|---|---|---|---|
| A | REDRAWN WITH CHANGES | RFW | | 25-Jun-03 | |
| B | ADDED MAX. P.S.I .NOTE | RFW | | 29-Jul-03 | |
| C | REVISED BILL OF MATERIAL | RFW | | 27-Aug-03 | |
| D | REVISED NOMENCLATURE | RFW | | 11-Nov-03 | |
| E | UPDATED HYDRA-CELL IMAGES | RFW | | 03-Dec-03 | |




SECTION A-A




| 1 | 80-501-100C | BLAK-JAK 12P-160 COMPLETE INCLUDES ITEMS 1-5, & 7 | 10 | 278.7 |
|---|---|---|---|---|
| 1 | 80-501-100S | LOK-CEL 12P-160 - INCLUDES ITEMS 1, 2, 4, & 5 | 9 | 71.1 |
| 1 | 80-501-100 | LOK-CEL 12P-160 - INCLUDES ITEMS 1-5 | 8 | 218.1 |
| | | | | |
| 1 | 80-502-100 | HYDRA-CEL, LOAD CELL ASSEMBLY | 7 | 60.6 |
| | | | | |
| REF | REF. | LINER, W / SEAL, (REF.) | 6 | 227.0 |
| 1 | 80-502-015 | LOCKING PIN, ASSEMBLY, S.S | 5 | 0.2 |
| 1 | 80-501-016 | LOCKING RING TOOL, PIN 1/2" DIA. X8" 300 SERIES S.S | 4 | 0.3 |
| 1 | 80-500-003 | ADAPTER BUSHING, LINER | 3 | 147.0 |
| 1 | 80-501-002 | LOCKING RING | 2 | 26.3 |
| 1 | 80-501-000 | LOK-CEL BODY, 12P-160 | 1 | 44.3 |
| QTY | PART NO. | DESCRIPTION - B/M | ITEM NO. | WEIGHT |

C D

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APPLICABLE SPECS

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES | DIMENSIONAL TOL.
BREAK SHARP CORNERS | FRACTIONS ±
FILLET RADII | X.XXX ±
CONCENTRICITY | X.XX ±
SQUARENESS | X.X ±
PARALLELISM (EXCEPT WHEN (M) MODIFIED) | ANGLE ± .50 DEGREE
SURFACE RMS
SIMILAR TO | SUPERSEDES
NEXT ASSY | SUPERSEDED BY
LAYOUT No.

MATERIAL SPEC: SEE LIST - B/M

DESIGNED BY | DATE
DRAWN BY: RFW | DATE: 05/17/03
CHECKED BY: ADR | DATE: 05/17/03
P.E. APPROVAL | DATE
Q.A. REVIEW | DATE

NATIONAL OILWELL

TITLE: BLAK-JAK, LINER RETENTION ASSEMBLY, 12P-160

SIZE: C | REFERENCE No. | DRAWING No.: 80-501-100 | REV: E
SCALE | EST WT | SHEET

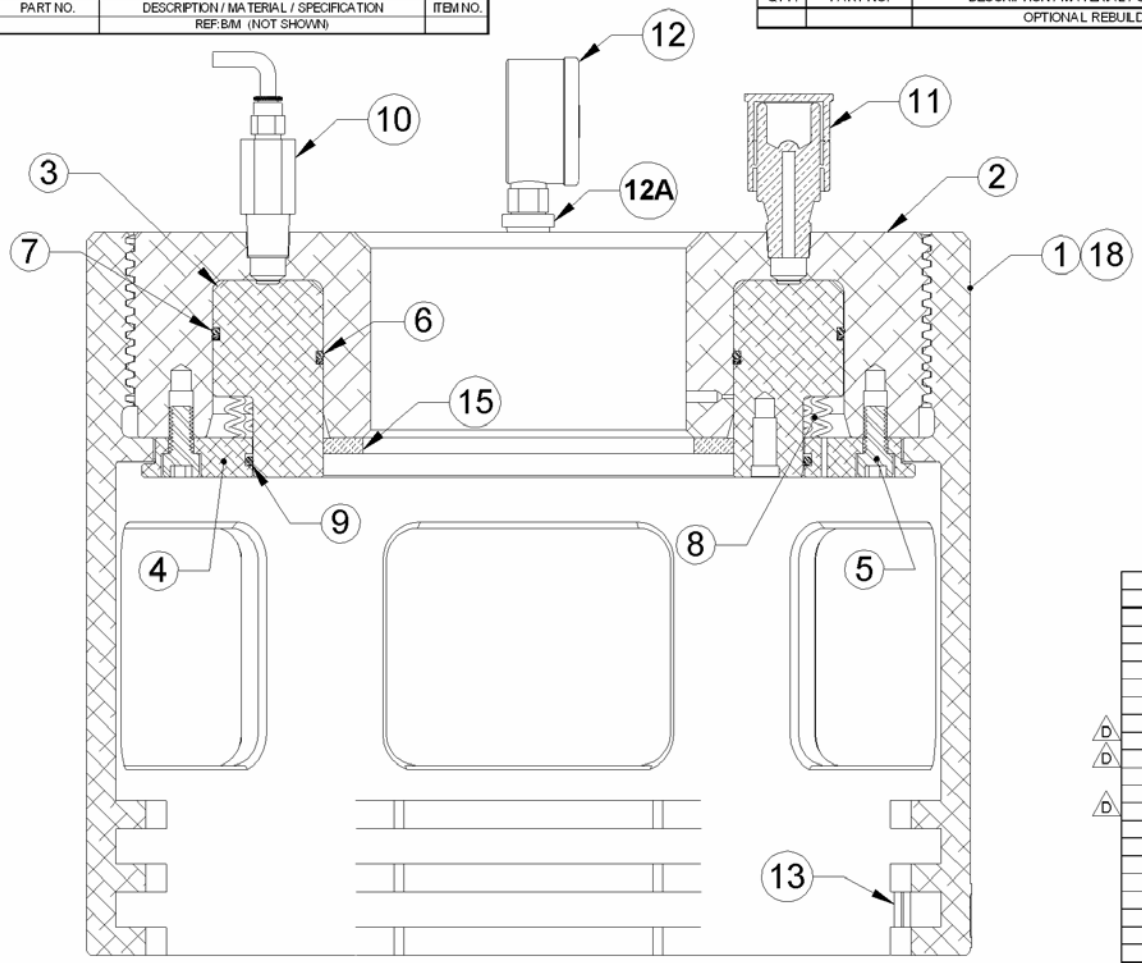
DWG NO 80-501-100 SHT

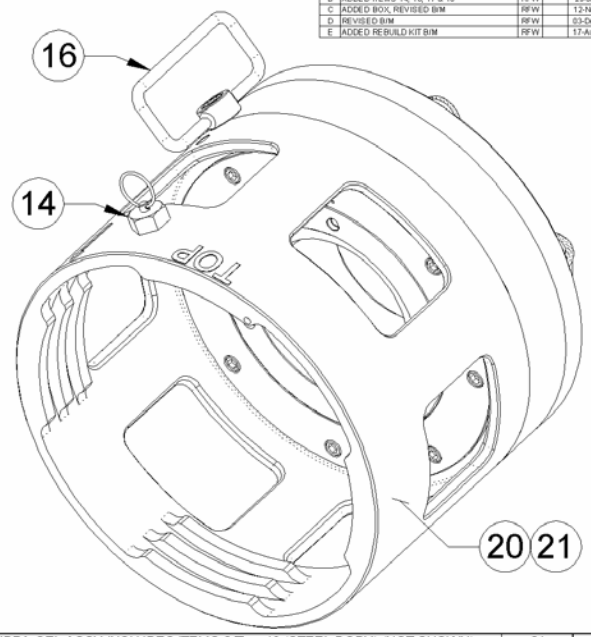
DWG NO 80-502-100 SHT

| | | | |
|---|---|---|---|
| 1 | 80-502-016 | ASSEMBLY, AIR TURBO II ENERPAC (PATG-1102N) | |
| 1 | 80-500-112 | ASSEMBLY, HAND PUMP INCLUDES ITEMS A,B,& C | |
| 1 | 80-500-040 | GAGE, PRESSURE 10,000# (GP-10S) | C |
| 1 | 45-804-097 | HOSE, 1/4" I.D X 15' LG. W 3/8" NPT (M) ENDS | B |
| 1 | 80-500-039 | HAND PUMP, HYDRAULIC 10,000# (P-392) | A |
| QTY. | PART NO. | DESCRIPTION / MATERIAL / SPECIFICATION | ITEM NO. |
| | | REF: B/M (NOT SHOWN) | |

| | | |
|---|---|---|
| 1 | 80-502-049 | REMOVAL PLATE (RAM) |
| 1 | 80-502-007K | KIT, SPRING RETURN, (Item 8), set of 24 |
| 1 | 80-502-006K | KIT, SEAL HYDRA-CEL: (Includes Items 6, 7, 9, & 15) |
| 1 | 80-502-004K | KIT, CAPSCREW PLATE SPRING (Item 5), set of 8 |
| QTY. | PART NO. | DESCRIPTION / MATERIAL / SPECIFICATION |
| | | OPTIONAL REBUILD KITS |

| LTR | DESCRIPTION OF CHANGE | MADE | CHKD | DATE | APPD |
|---|---|---|---|---|---|
| A | REDRAWN WITH CHANGES | RFW | | 25-Jun-03 | |
| B | ADDED ITEMS 14, 16, 17 & 18 | RFW | | 29-Jul-03 | |
| C | ADDED BOX, REVISED B/M | RFW | | 12-Nov-03 | |
| D | REVISED B/M | RFW | | 03-Dec-03 | |
| E | ADDED REBUILD KIT B/M | RFW | | 17-Aug-04 | |




| | | | | |
|---|---|---|---|---|
| 1 | 80-502-101 | HYDRA-CEL ASSY INCLUDES ITEMS 2 Thru 18 (STEEL-BODY) (NOT SHOWN) | 21 | 142.0 |
| 1 | 80-502-100 | HYDRA-CEL ASSY INCLUDES ITEMS 1 Thru 17 (ALUM-BODY) | 20 | 101.0 |
| 1 | 80-502-010 | LIFTING EYE, 1/2-13 UNC X 3/4" (OPTIONAL) NOT SHOWN | 19 | 0.4 |
| 1 | 80-502-014 | BODY, HYDRA-CEL (STEEL) | 18 | 63.2 |
| 1 | 80-502-051 | BOX, ASSEMBLY (NOT SHOWN) | 17 | 40.0 |
| 1 | 80-502-017 | HANDLE ASSEMBLY | 16 | 0.4 |
| 1 | 80-502-033 | WIPER GASKET, SELF ADHESIVE, FOAM RUBBER | 15 | N/A |
| 1 | 80-502-015 | LOCKING PIN, ASSEMBLY S.S | 14 | 0.2 |
| 1 | 80-502-009 | ROLL PIN, 1/4" DIA. X 1" LONG | 13 | 0.0 |
| 1 | 80-502-047 | HEX HD. BUSHING, 304 S.S, 3/8" / 1/4" (FASTENAL 0464097) | 12A | 0.0 |
| 1 | 80-502-055 | GAUGE, WIKA, 2" O.D, 1/4" MPT, (GAUGESTORE.COM, STK # 38121, PN # 4312040) | 12 | 0.3 |
| 1 | 64-226-200 | QUICK HOSE COUPLING 3/8" NPT | 11 | 0.5 |
| 1 | 80-502-013 | RELIEF VALVE ASSEMBLY | 10 | 0.4 |
| 1 | 99-609-564 | WIPER SEAL, O-RING 1/8" DIA. SECTION, 90 DURO - PARKER 2-269 | 9 | N/A |
| 24 | 80-502-007 | SPRING, .36 O.D x 1 1/5" LONG 10.5 COILS, .063 WIRE, 100#/1") | 8 | 0.1 |
| 1 | 80-502-006 | SEAL KIT OUTER ( O-RING W/ BACKUP- VITON 1/8" 90 DURO) 2-273 | 7 | N/A |
| 1 | 80-502-005 | SEAL KIT INNER ( O-RING W/ BACKUP- VITON 1/8" 90 DURO) 2-260 | 6 | N/A |
| 8 | 80-502-004 | S.H.C.S- 3/8"-16 X 3/4" LONG 300 SERIES S.S | 5 | 0.3 |
| 1 | 80-502-003 | RING, SPRING RETURN | 4 | 3.0 |
| 1 | 80-502-002 | RAM, HYDRA-CEL | 3 | 11.0 |
| 1 | 80-502-001 | BASE, HYDRA-CEL | 2 | 22.6 |
| 1 | 80-502-000 | BODY, HYDRA-CEL (ALUMINUM) | 1 | 22.2 |
| QTY | PART NO. | DESCRIPTION - B/M | ITEM NO. | WEIGHT |


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APPLICABLE SPECS

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES 1/8" | DIMENSIONAL TOL.
BREAK SHARP CORNERS 1/8" | FRACTIONS ± 1/16"
FILLET RADII 1/8" | X.XXX ±
CONCENTRICITY 1/16" | X.XX ±
SQUARENESS 1/16" | X.X ±
PARALLELISM 1/16" | ANGLE ± .50 DEGREE
RFS EXCEPT WHEN (M) MODIFIED | SURFACE RMS 500

SIMILAR TO | SUPERSEDES
NEXT ASS'Y | SUPERSEDED BY
LAYOUT No.

MATERIAL SPEC: SEE LIST

| | | |
|---|---|---|
| DESIGNED BY | | DATE |
| DRAWN BY | RFW | DATE 05/17/03 |
| CHECKED BY | | DATE |
| P.E. APPROVAL | | DATE |
| Q.A. REVIEW | | DATE |

NATIONAL OILWELL

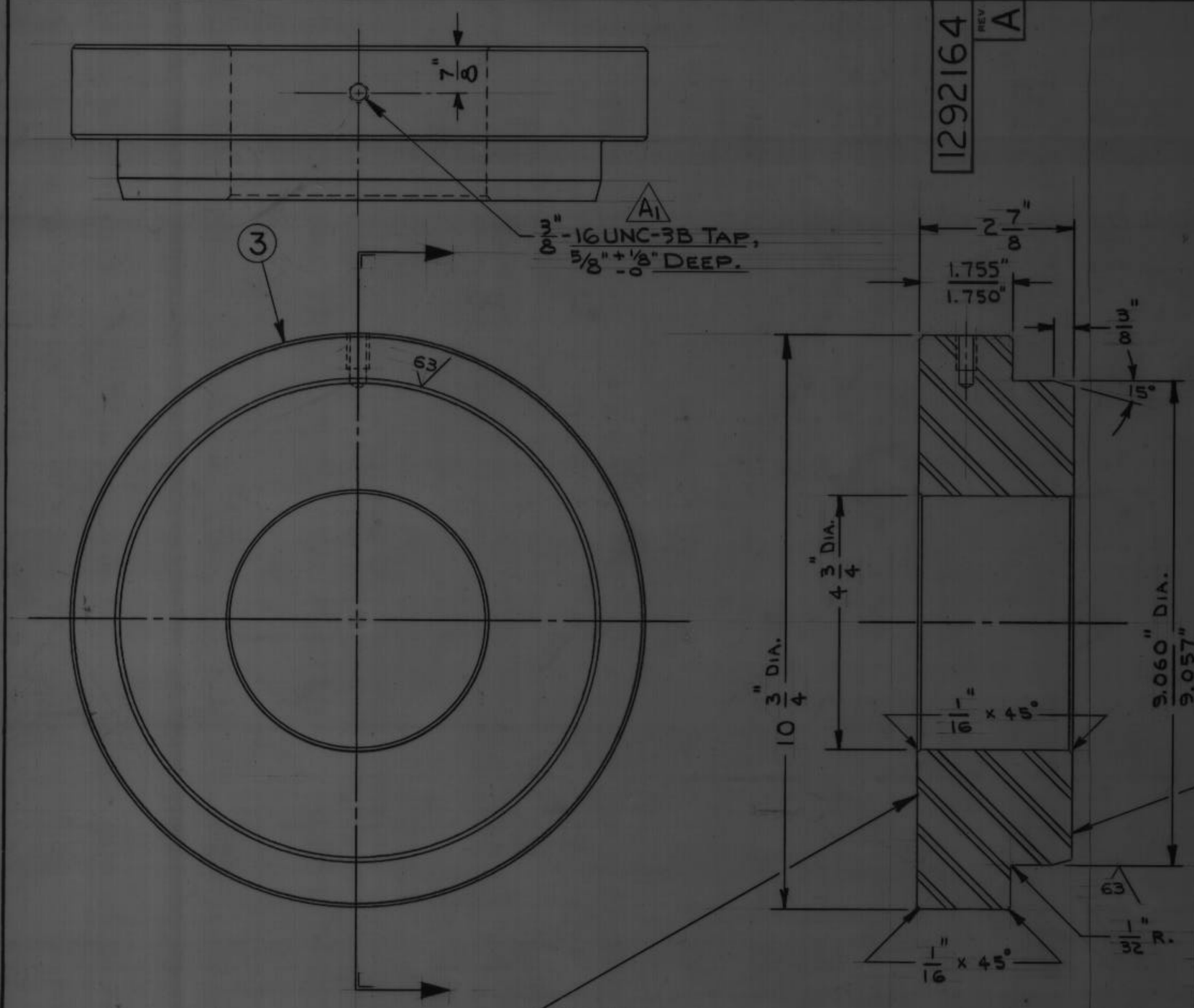
TITLE: HYDRA-CEL ASSEMBLY, BLAK-JAK LINER RETAINER

| SIZE | REFERENCE No. | DRAWING No. | REV |
|---|---|---|---|
| B | | 80-502-100 | E |

SCALE | EST WT SEE-LIST | SHEET

1292164 REV A

| REV. | DESCRIPTION | CHK'D BY | DATE | C.N. |
|---|---|---|---|---|
| | NEW PART | [illegible] | 3-20-72 | 8205 |
| A1 | 3/8" TAP & 7/8" DIM. ADDED. | ABS | 11-18-75 | 75-239 |




NOTE:-
PLACE LABELS (ITEMS ① & ②) ON THIS SIDE AFTER PAINTING.

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FINISH ALL OVER.

BREAK SHARP CORNERS.

STAMP ON PART NUMBER.

| ITEM | QTY. | PART NUMBER OR SIZE | DESCRIPTION | REQ'D |
|---|---|---|---|---|
| 3 | - | 3139000 | PLATE, STEEL 3" 10 3/4" x 0'-10 3/4" Lg. | 1 |
| 2 | D | 1292163 | LABEL, INSTRUCTION | |
| 1 | - | 1292162 | LABEL, OUTLINE | 1 |

DRAWN 2-21-72 BY HPP
CHECKED 3-20-72 BY [illegible]

PLATE, LINER BUSHING PULLER :-
FOR 12-P-160 TRIPLEX PUMP

SIZE C PART NUMBER 1292164

ALLOWABLE MACHINE TOOL RANGES, UNLESS OTHERWISE SPECIFIED: SURFACE FINISH 250

SCALE 6" = 1'-0"

ASSEMBLY NUMBER 1292000

SUPERSEDES

MATERIAL

HARDNESS

VENDOR

Armco National Supply Division