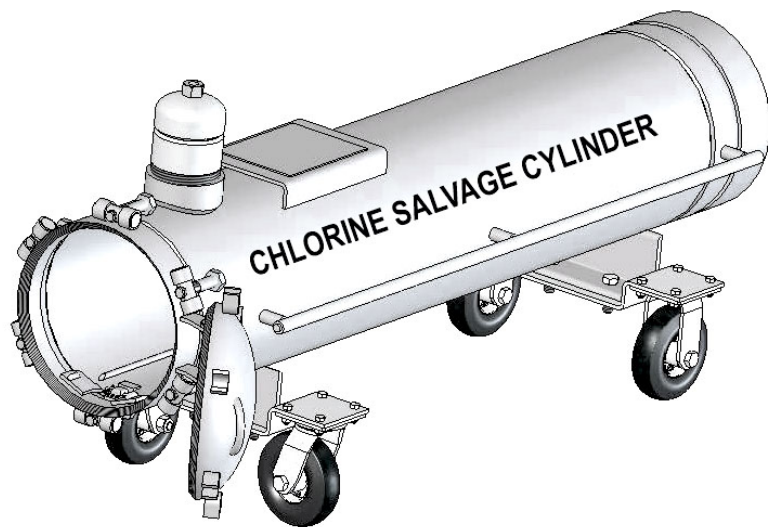


CHLORINE INSTITUTE RECOVERY VESSEL (SALVAGE CYLINDER) FOR 100-LB. & 150-LB. CHLORINE CYLINDERS

Edition 3

September 2021



INSTRUCTION BOOKLET

CHLORINE INSTITUTE IB/RV

The Chlorine Institute 1300 Wilson Boulevard, Suite 525, Arlington, VA 22209

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1. INTRODUCTION

Leaks in chlorine cylinders rarely occur. When they do occur, however, prompt corrective action is required by competent personnel with special equipment. The Chlorine Institute Recovery Vessel and the Chlorine Institute Emergency Kit “A” are two different types of such specialized equipment that can assist in the mitigation of any chlorine release from cylinders. The Recovery Vessel is an alternative to the Chlorine Institute's Kit “A” and does address some of the limitations that come with Kit “A”. Terminology used in regulations for the recovery vessel are “salvage cylinder” (U.S.) and “salvage container” (Canada). The terms “recovery vessel” and “salvage cylinder” may be used synonymously throughout this document.

1.1 SCOPE

This instruction manual provides information on the design and use of the Chlorine Institute Recovery Vessel.

1.2 CHLORINE INSTITUTE STEWARDSHIP PROGRAM

The Chlorine Institute exists to support the chlor-alkali industry in advancing safe, secure, environmentally compatible, and sustainable production, distribution, and use of its mission chemicals¹.

Chlorine Institute members are committed to adopting CI's safety and stewardship initiatives, including pamphlets, checklists, and incident sharing, that will assist members in achieving measurable improvement. For more information on the Institute's stewardship program, visit CI's website at www.chlorineinstitute.org.

1.3 DISCLAIMER

The information in this pamphlet is drawn from sources believed to be reliable. The Institute and its members, jointly and severally, make no guarantee, and assume no liability, in connection with any of this information. Moreover, it should not be assumed that every acceptable procedure is included, or that special circumstances may not warrant modified or additional procedures. The user should be aware that changing technology or regulations may require changes in the recommendations contained herein. Appropriate steps should be taken to ensure that the information is current when used. These recommendations should not be confused with federal, state, provincial, municipal, or insurance requirements, or with national safety codes.

1.4 APPROVAL

The Emergency Preparedness Issue Team approved Edition 3 of this instruction booklet on September 13, 2021.

1.5 REVISIONS

Suggestions for revision should be directed to the Secretary of the Institute in writing.

¹ CI's mission chemicals: chlorine, sodium and potassium hydroxides, sodium hypochlorite, the distribution of vinyl chloride monomer (VCM), and the distribution and use of hydrogen chloride.

1.5.1 Significant Revisions

Significant revisions in Edition 3 of this instruction booklet include:

- Noted the alternative terms “salvage cylinder” and “salvage container” used in U.S. and Canadian regulations (Section 1);
- Clarified regulatory authorization for transport (Section 2.1);
- Revised guidance on respiratory protection for clarity (Section 2.3);
- Included emphasis on gasket replacement and compatibility considerations (Section 2.5);
- Updated guidance on using aqua ammonia for leak detection (Section 2.6);
- Included awareness of requirements for reporting chlorine releases (Section 2.8);
- Included recommendation for users having an emergency plan (Section 2.9);
- Enhanced guidance for using the recovery vessel, including the addition of a QR code that links to an instructional video (Section 3);
- Included replacement recommendation for Viton® gasket (Section 6.3); and
- Minor editorial and formatting edits throughout.

1.6 REPRODUCTION

The contents of this pamphlet are not to be copied for publication, in whole or in part, without prior Institute permission. Please contact the Secretary of the Institute for further information (secretary@CL2.com).

2. **GENERAL DESCRIPTION**

The Chlorine Institute Recovery Vessel is designed for use with the standard U.S. Department of Transportation (DOT) 3A480 or 3AA480, 100- and 150-pound capacity cylinders in chlorine service only. The cylinders have outside diameters between 8 ¼ and 10 ¾ inches and overall height from 39 ½ to 59 inches. The vessel is designed for use with all configurations of standard chlorine cylinders. The empty weight of the Recovery Vessel is approximately 300 pounds. The weight of the vessel with a full 150-pound cylinder is approximately 525 to 575 pounds.

2.1 REGULATORY AUTHORIZATION

The DOT and Canadian Standards Association (CSA) establish certain requirements for the design, construction, and marking of salvage cylinders with reference to ASME standards. The Recovery Vessel is authorized for transport when used to move a damaged or leaking cylinder without the need for special regulatory exemptions. See Section 5 of this booklet, as well as 49 CFR 173.3(d) and CSA B340, for additional details.

2.2 TRAINING & SAFETY

Drivers and other personnel, who load, unload, or transport the Recovery Vessel must be trained in its use. Training must include the use of respiratory equipment and all other safety equipment. Knowledge of the properties of chlorine is a must.

Personnel safety is of primary importance. Emergency response should only be performed by authorized personnel who are trained in the procedures and are equipped with suitable respiratory and personal protective equipment.

See the current edition of CI Pamphlet 65 for guidance on appropriate personal protective equipment.

2.3 RESPIRATORY EQUIPMENT

The type of respiratory equipment required will be determined by the severity of the leak and the potential for exposure to chlorine. For further details, see the current edition of CI Pamphlet 65.

2.4 CHLORINE CYLINDER INSPECTION

Daily inspection of full cylinders is recommended whether or not they are connected to unloading lines. Through these means a leak usually can be detected in an early stage when it can be corrected or controlled by appropriate procedures. Inspection guidance can be found in CI Pamphlet 17.

2.5 GASKET CONSIDERATIONS

2.5.1 Replacement

The Viton® O-ring should be removed and replaced after each use and each hydrostatic test (see Section 6 for more details). For further guidelines concerning the Viton gaskets, consult the manufacturer or The Chlorine Institute.

2.5.2 Compatibility

Instructions in this booklet are intended for use with chlorine cylinders only. Contact the manufacturer before considering using the Recovery Vessel for other compressed gas cylinders, since other gasket materials may be required. When used with compressed gases other than chlorine, the Viton gasket included with the Recovery Vessel may result in rapid deterioration and continued release.

CAUTION

Using the Recovery Vessel with other compressed gas cylinders can result in a worsening incident due to incompatibility of gasket materials.

2.6 LEAK DETECTION

As soon as there is any indication of the presence of chlorine in the air, **authorized, trained personnel equipped with suitable personal protective equipment should investigate promptly.** All other persons should be kept away from the affected area.

The location of a leak in a chlorine-containing system can usually be detected by the reaction of ammonia vapor with the escaping chlorine. The reaction is a dense white cloud. The most convenient way is to use 5-30% aqua ammonia (10.3 – 61.7% ammonium hydroxide solution) in a squeeze bottle. Direct the vapors at the suspected leak. To avoid corrosion, the ammonia solution (liquid) should not be directly sprayed onto the cylinder or its connections. Efforts to detect the source of any leak should be carried out with an awareness of the potential hazards and use of necessary personal protective equipment. Note, a weaker solution such as household ammonia, which is typically less than 5%, may not be concentrated enough to detect minor leaks because the solution may degrade over time.

CAUTION

Once the leak is found and you can safely maneuver the container, rotate the container, if needed, so that the leak is coming out from the top of the container in vapor form (e.g., at the 12 o'clock position when the container is laying on its side). Because chlorine liquid vaporizes and expands into gas by 460 times its volume, it is more manageable to have gas leaking from the cylinder instead of liquid.

2.7 ASSISTANCE

Chlorine emergencies should be handled only by trained personnel. If assistance is required, promptly notify your supplier. If the supplier cannot be reached or respond immediately, then summon help by activating CHLOREP (The Chlorine Emergency Plan), an emergency response mutual aid network that can be accessed 24/7 for assistance. CHLOREP can be activated by calling CHEMTREC in the U.S. 1-800-424-9300 or CANUTEC in Canada 1-613-996-6666.

2.8 REPORTING REQUIREMENTS

There are federal, state, and local requirements for the reporting of chlorine releases that must be met.

2.9 EMERGENCY PLAN

It is recommended that users have an emergency plan that complies with federal, state, and local government requirements. For further detail on emergency response plans, refer to CI Pamphlet 155.

3. USING A RECOVERY VESSEL

If the leak is on the side or on the bottom of the chlorine cylinder, place the cylinder in the horizontal position with the leak in the uppermost position (vapor space). If the leak is in the valve or valve threads, leave the cylinder in the upright position until ready to place in the Recovery Vessel.

Refer to Drawing 188 (Appendix D) and the schematic showing the hinged closure (Appendix C). Take the Recovery Vessel to an area in close proximity to the leaking cylinder and perform the following preparatory work.



Instruction Video

- a. Alternately loosen the T-bolts that retain the hinged lid on the Recovery Vessel.
- b. Remove the valve protective cap from the vent valve on the Recovery Vessel.
- c. Remove the outlet cap and open the vent valve on the Recovery Vessel.
- d. Move the Recovery Vessel into position directly in front of the chlorine cylinder, lock or secure wheels to prevent movement, and loosen the T-bolts. Swing the T-bolts from the lugs of the hinged closure. Open the hinged closure. Inspect the O-ring gasket (Part RV-9) to make sure it is installed properly. Inspect the seating surface on the Recovery Vessel.
- e. Prior to placing the chlorine cylinder inside the Recovery Vessel, remove the cylinder valve bonnet, if possible. Also remove the net covering, if present, since it may react with the leaking chlorine within the Recovery Vessel and create additional challenges.
- f. Position the bottom of the chlorine cylinder on the slide rails on the inside of the Recovery Vessel.
- g. Slide the entire chlorine cylinder, bottom first, into the Recovery Vessel.
- h. Again, inspect the O-ring gasket and seating surfaces. Remove any foreign substances that might have gotten on the O-ring or seating surface. Close the hinged cover by positioning the lid evenly on the mating sealing surface to assure proper sealing.
- i. Swing the T-bolts into position and alternately tighten the bolts snugly until the lid is secure.
- j. Close the vent valve and install the outlet cap on the valve. Check for leaks with ammonia vapor. Install the valve protective cap.
- k. Check the hinged lid sealing joint for leaks with ammonia vapor.
- l. Allow time for the cylinder to come to ambient temperature/pressure (typically up to 30 minutes), then check for leaks again.

- m. If white smoke indicates leaking chlorine, tighten the T-bolts again in an alternating manner.

WARNING

Do not overtighten the T-bolts. Overtightening may damage the gasket.

- n. If tightening the T-bolts won't stop the leak, do the following:
- o. Follow the instruction for removing a cylinder from the Recovery Vessel.
- p. Clean sealing surfaces and install a new O-ring.
- q. Repeat earlier procedure for putting a cylinder in a Recovery Vessel.
- r. Consult with the chlorine cylinder supplier immediately and arrange for ultimate disposal.

NOTE

The Recovery Vessel with a full cylinder of chlorine will weigh approximately 525 to 575 lbs (238.14 to 260.82 kgs).

4. HANDLING OF CHLORINE REMAINING IN THE RECOVERY VESSEL

The containment of leaks by this emergency device is only an interim measure. **The chlorine must be emptied as soon as possible.**

CONSULT WITH THE CHLORINE SUPPLIER IMMEDIATELY AND ARRANGE FOR ULTIMATE DISPOSAL.

4.1 REMOVAL OF DAMAGED CYLINDER FROM THE RECOVERY VESSEL

WARNING

Do not attempt to open the hinged closure until the Recovery Vessel has been relieved of all internal pressure. Opening under pressure may result in injury to persons and damage to equipment.

- a. Put on suitable personal protective equipment before attempting to open the Recovery Vessel. See CI Pamphlet 65.
- b. Move the Recovery Vessel into position and lock or secure wheels to prevent movement.
- c. Before opening the hinged closure, remove the vent valve protective cap.
- d. Then remove the valve outlet cap.

- e. Open the vent valve and relieve the internal pressure into a suitable absorption system.
- f. Loosen the T-bolts alternately.
- g. Do not swing the bolts loose from the head lugs until it is certain that no pressure remains in the vessel. Continue to loosen the T-bolts. The presence or absence of pressure will become apparent and will indicate the rate at which opening can proceed.
- h. If evidence of chlorine remaining in the cylinder or Recovery Vessel is encountered, close the hinged closure and repeat the process of venting the contents.

5. TRANSPORTING THE RECOVERY VESSEL

When the Recovery Vessel is transported containing a damaged or leaking chlorine cylinder, certain regulatory requirements must be met:

- Bill of lading/shipping papers with the appropriate description (see 49 CFR Part 172 Subpart C or *Transportation of Dangerous Goods (TDG) Regulations*, Part 3).
- Proper marking and labeling (see 49 CFR Part 172 Subpart D, E, and F or *TDG Regulations*, Part 4).
- Properly secured in a motor vehicle (see 49 CFR 177.834 or *TDG Regulations*, Part 5).

The loaded Recovery Vessel must be delivered to the consignor or the consignee as soon as practical for proper disposal.

6. MAINTENANCE AND INSPECTIONS

6.1 CLEANING

Before cleaning the used Recovery Vessel, personnel should be wearing appropriate personal protective equipment, including splash protection. See CI Pamphlet 65.

The following steps are recommended to ensure proper cleaning of the Recovery Vessel:

- Remove the vent valve protective cap and the vent valve.
- Wash inside of the Recovery Vessel with approximately 5% solution of caustic soda or soda ash to neutralize any chlorine residual.
- After washing, rinse the Recovery Vessel with water until it is free of the cleaning solution.
- Dry the vessel thoroughly so it does not corrode. Consider repainting or passivation of the vessel to minimize corrosion.

6.2 INSPECTIONS

After any use, thoroughly inspect the interior and exterior surfaces of the Recovery Vessel and repair any damage which may have occurred to the paint finish or markings. The vessel is of welded construction and contains few removable parts. Welded repairs to the Recovery Vessel must be accomplished in accordance with 49 CFR 173.3(d) or CSA B340, as applicable.

Inspect any threads and sealing surface as follows:

- Apply a non-reactive thread sealant to a new or reconditioned chlorine ton container valve and insert it in the threaded opening on the side of the Recovery Vessel.
- Apply a non-reactive lubricant to the valve protective cap before screwing it into the half coupling.
- Carefully inspect the sealing gasket surface for nicks, cuts or gouges and repair if necessary.

See CI Pamphlet 164 for sealants and lubricants that are compatible with chlorine.

6.3 GASKET REPLACEMENT

Replace the Viton O-ring gasket after each use and after each hydrostatic test. Remove all foreign material from the O-ring gasket groove and seating surface before the Viton O-ring is installed. The O-ring should be coated with a non-reactive lubricant (see CI Pamphlet 164) before it is placed in position. The O-ring is intentionally smaller than the groove diameter and must be stretched to create a "snap-fit" when properly positioned. It is recommended that the O-ring be inserted into the groove at one 90-degree quadrant; then work the O-ring into the groove of the other three quadrants. Care should be taken not to "roll" the O-ring.

Viton gaskets have a four-year shelf life, at which time gaskets should be removed from emergency use. For further guidelines concerning Viton gaskets, consult the manufacturer or The Chlorine Institute.

6.4 BOLTS

Lubricate the bolts periodically with a non-reactive lubricant (see CI Pamphlet 164) in accordance with the frequency and severity of the service involved. Inspect the head bolts periodically for thread wear. Overtightening can cause excessive thread wear and should be avoided.

6.5 PAINTING

If the Recovery Vessel is to be painted, do so with the head in the closed position to prevent paint from being applied to the sealing surfaces. Paint on these surfaces may impede proper sealing. It is recommended that the seating surfaces and O-ring gasket be coated with non-reactive lubricant (see CI Pamphlet 164) before closing for painting. The bolt threads should be masked while painting.

If complete painting of the Recovery Vessel is needed, the following procedure is recommended:

- a. Surface preparation in accordance with SSPCSP-10, near white blast clean;
- b. 1st coat - 3 mils of inorganic zinc primer;
- c. 2nd coat - 5 mils of gray high build epoxy; and
- d. Finish coat - 2 mils of white aliphatic urethane.

7. TESTING

The Recovery Vessel must be periodically tested (every five years) in accordance with 49 CFR 173.3 (d) and CSA B340. Consult with the chlorine supplier or Recovery Vessel manufacturer to identify an appropriate testing facility.

8. REFERENCES

8.1 INSTITUTE PUBLICATIONS

The following publications are specifically referenced in this instruction booklet. The latest editions of CI publications may be obtained at www.chlorineinstitute.org.

<u>Pamphlet #</u>	<u>Title</u>
1	<i>Chlorine Basics</i> (Formerly <i>The Chlorine Manual</i>), ed. 8; Pamphlet 1; The Chlorine Institute: Arlington, VA, 2014 .
17	<i>Packaging Plant Safety and Operational Guidelines</i> , ed. 5; Pamphlet 17; The Chlorine Institute: Arlington, VA, 2017 .
65	<i>Personal Protective Equipment for Chlor-Alkali Chemicals</i> , ed. 7; Pamphlet 65; The Chlorine Institute: Arlington, VA, 2021 .
155	<i>Water and Wastewater Operators Chlorine Handbook</i> , ed. 3; Pamphlet 155; The Chlorine Institute: Arlington, VA, 2014 .
164	<i>Reactivity and Compatibility of Chlorine and Sodium Hydroxide with Various Materials</i> , ed. 3; Pamphlet 164; The Chlorine Institute: Arlington, VA, 2017 .

8.2 REGULATIONS

8.2.1 *Code of Federal Regulations*. Title 49. Chapter 1. Parts 190-192 & 195. Office of the Federal Register National Archives and Records Administration. U.S. Government Printing Office: Washington, DC, (revised annually).

8.2.2 *Canadian Transportation of Dangerous Goods Act and Regulations*; Transport Canada: Ottawa, Ontario, 2009. Website: <http://www.tc.gc.ca/tdg>.

APPENDIX A - PARTS LIST

PART NUMBER	DESCRIPTION	QUANTITY
RV-1	Recovery Vessel Proper	1
RV-2	Valve Protective Cap	1
RV-3	Ton Container Valve*	1
RV-4	Valve Outlet Cap*	1
RV-5	Hinge Bushing	2
RV-6	Hinge Bolt Washer	2
RV-7	Hinge Bolt	2
RV-8	Hinge Bolt Nut	2
RV-9	O-Ring, Viton® E*	1
RV-10	Head Bolt*	6
RV-11	Head Bolt Washer*	6
RV-12	Tapped Swing Nut*	6
RV-13	Wrench (for valve)*, 3/8 inch sq. box, 1 ¼ inch x 7 ¼ inch	1
RV-14	Wrench (for hinged closure nuts)*, straight open end, 1 ¼ inch x 15 ½ inch	1
RV-15	Instruction Booklet*	1
RV-16	Bill of Lading Blank*	1
RV-17	Pouch, Spare Parts	1

* Spare parts recommended.

Viton® is a registered trademark of The Chemours Company.

APPENDIX B - EMERGENCY CONTACTS

EMERGENCY CONTACTS	
Chlorine Supplier:	_____
Address:	_____
Phone:	_____
CHEMTREC*	800-424-9300
CANUTEC**	613-996-6666
Nearest Chlorine Producer or Packager:	_____
Address:	_____
Phone:	_____
Police Department:	_____
Fire Department:	_____
First Aid:	_____

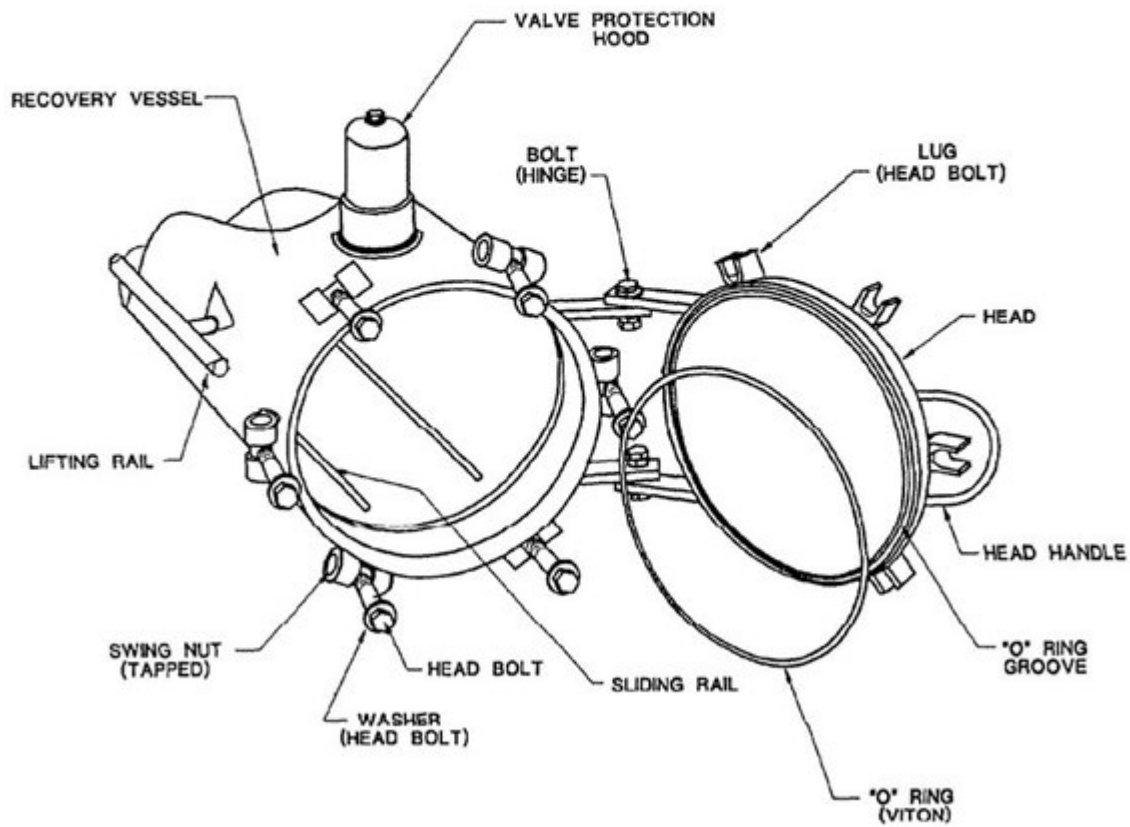
<p>* In the UNITED STATES, summon help through CHEMTREC, the Chemical Transportation Emergency Center at the American Chemistry Council in Falls Church, VA.</p>	
(Toll Free)	800-424-9300
<p>** In CANADA, summon help through CANUTEC, the Canadian Transport Emergency Centre in Ottawa.</p>	
CANADA, All provinces (Call Collect)	613-996-6666

APPENDIX C - RECOVERY VESSEL HINGED CLOSURE**Spare parts note:**

Stock two (2) extra "O" rings for each closure

Replace "O" ring after exposure to chlorine

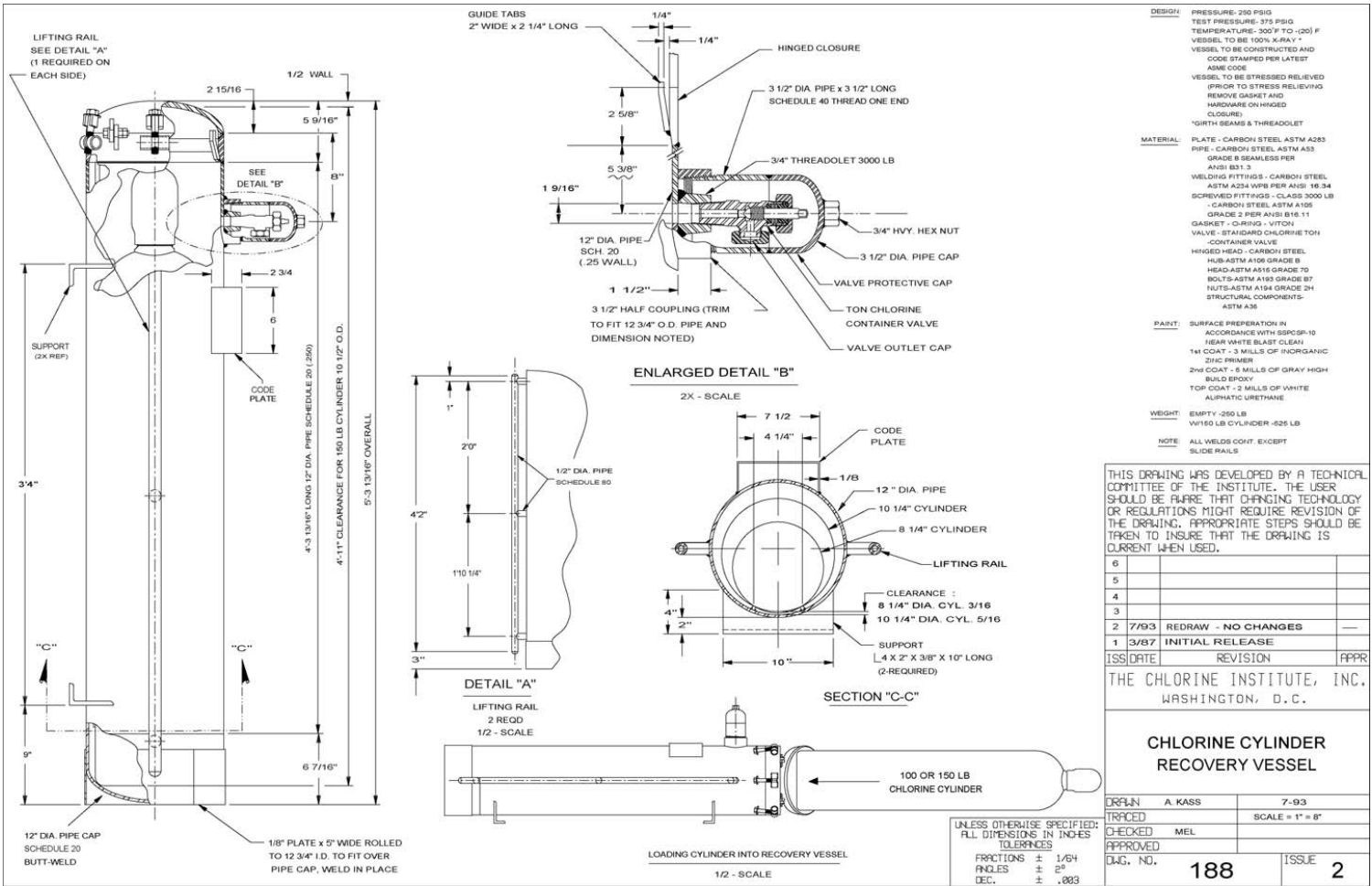
Replace "O" ring after shelf life expiration



DRAWINGS

APPENDIX D DRAWING 188 - CHLORINE CYLINDER RECOVERY VESSEL

DRAWING 188-2: CHLORINE CYLINDER RECOVERY VESSEL



DESIGN: PRESSURE- 250 PSIG
 TEST PRESSURE- 375 PSIG
 TEMPERATURE- 300 F TO -200 F
 VESSEL TO BE 100% X-RAY *
 VESSEL TO BE CONSTRUCTED AND
 CODE STAMPED PER LATEST
 ASME CODE
 VESSEL TO BE STRESSED RELIEVED
 (PRIOR TO STRESS RELIEVING
 REMOVE GASKET AND
 HARDWARE ON HINGED
 CLOSURE)
 *GIRTH SEAMS & THREADOLET

MATERIAL: PLATE- CARBON STEEL ASTM A525
 PIPE- CARBON STEEL ASTM A53
 GRADE B SEAMLESS PER
 ANSI B31.3
 WELDING FITTINGS- CARBON STEEL
 ASTM A234 WPB PER ANSI 16.34
 SCREWED FITTINGS- CLASS 3000 LB
 - CARBON STEEL ASTM A105
 GRADE 2 PER ANSI B16.11
 GASKET- O-RING- VITON
 VALVE- STANDARD CHLORINE TON
 CONTAINER VALVE
 HINGED HEAD- CARBON STEEL
 HUB-ASTM A105 GRADE B
 HEAD-ASTM A515 GRADE 70
 BOLTS-ASTM A193 GRADE B7
 NUTS-ASTM A194 GRADE 2H
 STRUCTURAL COMPONENTS-
 ASTM A36

PAINT: SURFACE PREPARATION IN
 ACCORDANCE WITH SSPC-SP-10
 SEAM WHITE BLAST CLEAN
 1M COAT - 3 MILLS OF INORGANIC
 ZINC PRIMER
 2ND COAT - 8 MILLS OF GRAY HIGH
 BUILD EPOXY
 TOP COAT - 2 MILLS OF WHITE
 ALIPHATIC URETHANE

WEIGHT: EMPTY -250 LB
 W/150 LB CYLINDER -525 LB

NOTE: ALL WELDS COHT. EXCEPT
 SLIDE RAILS

THIS DRAWING WAS DEVELOPED BY A TECHNICAL
 COMMITTEE OF THE INSTITUTE. THE USER
 SHOULD BE AWARE THAT CHANGING TECHNOLOGY
 OR REGULATIONS MIGHT REQUIRE REVISION OF
 THE DRAWING. APPROPRIATE STEPS SHOULD BE
 TAKEN TO INSURE THAT THE DRAWING IS
 CURRENT WHEN USED.

6			
5			
4			
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2	7/93	REDRAW - NO CHANGES	
1	3/87	INITIAL RELEASE	
ISS DATE		REVISION	APPR

THE CHLORINE INSTITUTE, INC.
 WASHINGTON, D.C.

CHLORINE CYLINDER
 RECOVERY VESSEL

DRW'N	A. KASS	7-93
TRACED		SCALE = 1" = 8"
CHECKED	MEL	
APPROVED		
DWG. NO.	188	ISSUE 2

UNLESS OTHERWISE SPECIFIED:
 ALL DIMENSIONS IN INCHES
 TOLERANCES

FRACTIONS ± 1/64
 INCHES ± .03
 DEC. ± .003