Chlorine Tank Car Unloading Facilities:
Guidelines for British Columbia’s Provincial Industrial Railways

Guidelines Respecting the Design, Location, Construction, Operation and Maintenance of Chlorine Tank Car Unloading Facilities

SHORT TITLE
1. These Guidelines may be cited as the Chlorine Tank Car Unloading Facilities Guidelines

INTERPRETATION
2. In these Guidelines,
   “BCSA” means British Columbia Safety Authority;
   “chlorine” means the chemical element Cl2 in liquid or gaseous form and containing not more than 150 parts per million of water;
   “dangerous commodity” means any substance subject to the Regulations for the Transportation of Dangerous Commodities by Rail or subject to any other regulation or order issued by MOTI to control its hazard;
   “main track” is a track extending through yards and between railway stations where trains are operated by timetable, train order, block signals, or some other approved method of control;
   “MOTI” means the provincial Ministry of Transportation and Infrastructure;
   “owning or operating company” means the person or company owning or operating the chlorine unloading facility;
   “railway right-of-way” means any lands that are owned or leased by a railway subject to the jurisdiction of the MOTI and are contiguous to that railway’s tracks;
   “railway station” means any location where passenger and/or freight trains may stop in accordance with the current railway timetable;
   “railway station-dwelling” means a railway station building, part of which is used as a dwelling;
   “serving track” means the track serving the chlorine facility and upon which the chlorine tank cars are located for unloading purposes;
   “shall” is used to indicate mandatory provisions;
“should” is used to indicate recommendatory [provisions];

“tank car” means any vessel described as a tank car in the Regulations for the Transportation of Dangerous Commodities by Rail and is approved by the MOTI for chlorine service, but does not include multi-unit tank cars such as the ICC 106A500-X tank car.

APPLICATION

3. These Guidelines apply to chlorine tank car unloading facilities located on the right-of-way owned or leased by any railway company subject to the jurisdiction of the MOTI.

4. A chlorine tank car unloading facility approved by an order of the MOTI prior to July 31, 1965 shall be operated and maintained in accordance with these Guidelines but unless otherwise ordered by the MOTI, it need not conform to those provisions of these Guidelines pertaining to location, construction and design.

5. These Guidelines do not apply to chlorine stationary bulk storage facilities; the erection of such facilities on the railway right-of-way is prohibited.

PART I

APPLICATIONS TO THE MOTI

6. (1) Except as provided in subsection (2), no chlorine unloading facility or part thereof shall be constructed until the MOTI has approved the proposed location by an order.

   (2) If the proposed facility complies in all respects with Parts II, III, IV and V, approval of the location need not be obtained before construction is undertaken, but shall be obtained before the facility is used.

7. (1) Application for approval to locate a chlorine unloading facility on the railway right-of-way shall be submitted through the railway company concerned to the MOTI.

   (2) Applications shall be accompanied by four copies of all drawings, prepared in compliance with the requirements of sections 8 to 13.

8. (1) A plan of the chlorine facilities and of other structures on the same site shall be drawn to a minimum scale of one inch to 50 feet.

   (2) A plot plan showing the location of the chlorine facilities in relation to off-site structures shall be drawn to a minimum scale of one inch to 200 feet.

   (3) A section as described in section 11 shall be drawn to a minimum scale of one inch to 20 feet.

9. All drawings shall be dated, bear an identification number and the name of the applicant, and be signed by the Chief Engineer or other official of the applicant or consulting company responsible for them.

10. Except as provided in paragraph 13(g), the plan shall show the location of the chlorine unloading rack and of the tank car, when it is in position for unloading, in relation to the following buildings, structures and boundary lines:
(a) within 2,000 feet, any building mentioned in paragraph 16(a);
(b) within 1,000 feet, any building mentioned in paragraph 16(b);
(c) within 500 feet, any building mentioned in paragraph 16(c);
(d) within 75 feet, any building or structure mentioned in section 15;
(e) all buildings and other structures occupying the same site as the chlorine unloading facility;
(f) railway right-of-way boundaries;
(g) boundary lines of the property on which the chlorine unloading facilities are located;
(h) the nearest fire hydrant;
(i) the gauge side of the nearest rail of the track serving the facility;
(j) within 50 feet, the gauge side of the nearest rail of any main track or the curb line of any main road or street; and
(k) within 20 feet, the gauge side of the nearest rail of any track other than a main track or the track serving the facility.

11. A section shall be provided to show the elevation of the unloading facilities in relation to other structures on the same site and any track within 50 feet.

12. In addition to the structures previously referred to in this Part, the plan shall show the location of dikes, pipelines, power lines, sewers, ditches, watercourses and other similar major structures located on the same site or immediately adjacent thereto.

13. The notes or legend on the drawing shall include the following information:
   (a) evidence that the Provincial Fire Commissioner, or local fire authority, having jurisdiction in the area adjacent to the railway right-of-way, has no objection to the proposed facilities; this evidence may take the form of a plan signature by the authority concerned, or of a letter addressed to the owning or operating company by such authority;
   (b) a statement to the effect that the proposed facilities will comply in all respects with these Guidelines, unless there are exceptions, in which case, the exceptions shall be listed;
   (c) the size, type of construction and purpose of all buildings, tanks or structures located on the same site as the chlorine unloading facilities;
   (d) location of the unloading site by reference to the name of the railway company serving the site, name of the railway subdivision, the railway mileage of the location and the name of the nearest town or city;
   (e) the direction from which the prevailing winds blow;
   (f) locations of the nearest available self-contained breathing apparatus and tank car emergency repair kit; and
   (g) if there are no buildings within the restricted distance referred to in either paragraph 10(a), (b), (c) or (d), a statement to this effect shall appear in the drawing notes or legend.

13.1 Where the MOTI has approved, pursuant to subsection 6(1), the proposed location of the chlorine unloading facility, a copy of each drawing referred to in subsection 7(2) shall be kept by the railway company for the life of the facility and retained for at least two years thereafter.
PART II

DISTANCES

14. The location of a chlorine unloading site with respect to occupied buildings shall take into account the direction of the prevailing winds and where practicable it shall be located down wind from such buildings.

15. Except as provided in section 17, the horizontal distance between the centre point of a chlorine unloading rack or of a tank car, when it is at the unloading position, and the nearest point of any railway freight station, warehouse, storage tank or any other storage or transfer facility used for a combustible or a dangerous commodity shall not be less than 75 feet.

16. Except as provided in section 17, the horizontal distance between the centre point of a chlorine unloading rack or of a tank car, when it is at the unloading position, and the nearest point of any occupied building shall be in accordance with the following:
   (a) not less than 2,000 feet from any school, hospital, hotel, motel, church, theatre, auditorium, sports arena, multi-store shopping centre, apartment or other multi-unit residential building, office building or department store or merchandise building of more than one storey in height, or any other building or enclosure considered by the BCSA to belong to this category;
   (b) not less than 1,000 feet from any single family dwelling, railway passenger station, railway station-dwelling, one storey office building, department store, merchandise building or restaurant, or other easily evacuated or low occupancy building or enclosure considered by the BCSA to belong to this category; and
   (c) not less than 500 feet from any factory, railway shop or other building used primarily for manufacturing or processing or for maintenance or repair work.

17. Notwithstanding sections 15 and 16, the BCSA, at its discretion, may authorize lesser distances between a chlorine unloading rack or tank car and any building, storage tank or other structure located on the same site as the chlorine facilities and used exclusively by the company or person owning or operating the chlorine facilities.

18. The horizontal distance between the centre point of a chlorine unloading rack or of the tank car, when it is at the unloading position, and the nearest point of the line of any adjoining property which has been or may be built upon shall not be less than 50 feet.

19. The horizontal distance between the track side of a chlorine unloading rack and the gauge side of the nearest rail of the track serving the facility shall not be less than prescribed in Schedule I.

20. The horizontal distance between the centre point of the chlorine unloading rack or of the tank car, when it is at the unloading position, and a main roadway or street or the gauge side of the nearest rail of any track other than a track serving the facility shall not be less than prescribed in the following paragraphs:
   (a) not less than 50 feet from a main track or from the curb line of a main roadway or street; and
   (b) not less than 20 feet from a passing track or any track other than a main track or a track serving the facility.
PART III

PIPING AND TRANSFER EQUIPMENT

21. (1) Except as provided in section 22, only steel pipe, fittings and valves shall be used. They shall not be less than 3/4 inch nominal diameter and shall comply with the standards prescribed in Tables I and II of Schedule II, or other standards recommended by The Chlorine Institute and approved by the MOTI.

(2) All joints exceeding a nominal diameter of 1 1/4 inches shall be welded.

(3) Gaskets, joint compound and valve packing shall comply with the recommendations of The Chlorine Institute as contained in its Pamphlet No. 6, dated January 18, 1962, and amendments thereto.

(4) All welding operations shall be performed by a welder approved by the MOTI for the type of welding to be done.

22. Notwithstanding section 21, the flexible connection between the unloading rack and the tank car shall comply with The Chlorine Institute Drawing No. 118, as shown in Schedule III, or other arrangement recommended by The Chlorine Institute and approved by the MOTI.

23. A shut-off valve shall be installed in the discharge line near the discharge side of the flexible connection prescribed in section 22. It shall not be used for throttling purposes and shall either be fully open or fully closed. A second shut-off valve shall be installed in the discharge line near the process tank or other receiving vessel.

24. (1) Prior to being placed in service for the first time and prior to being returned to service after a repair, the piping system shall receive a hydrostatic and a pneumatic test as prescribed in subsections (2) and (3).

(2) The piping system shall be tested at a hydrostatic pressure of 300 psig. It shall be able to withstand this test for 30 minutes without leakage or a failure of any kind.

(3) After the hydrostatic test, the piping system shall be thoroughly dried and cleaned, then tested for leaks with dry air at 150 psig, as recommended by The Chlorine Institute in its Pamphlet No. 6, dated January 18, 1962, and amendments thereto.

(4) A dated and signed record of the latest hydrostatic and dry air tests shall be retained on the owner’s or operating company’s file for examination by a Railway Safety Inspector of BCSA when so requested.

25. An expansion chamber shall be provided between shut-off valves or other locations where liquid chlorine may become trapped. The capacity of the expansion chamber shall not be less than 20 per cent of the capacity of the pipeline it is intended to protect.

26. (1) If the normal tank car pressure is not adequate for unloading purposes, it may be increased by means of clean dry air by a procedure commonly known as “Air Padding” in accordance with the recommendations contained in The Chlorine Institute Pamphlet No. 4, dated May 17, 1961, and amendments thereto, and with the requirements prescribed in subsections (3) and (4).

(2) Clean, dry, inert gas may be used for “Padding” if the written consent of the chlorine supplier is obtained.

(3) The total pressure of air or inert gas padding plus chlorine vapour in the tank car at the maximum temperature attained during unloading shall not exceed the following:

(a) 125 psig, for tank cars equipped with safety valves set to discharge at 225 psig; and
(b) 200 psig, for tank cars equipped with safety valves set to discharge at 375 psig.

(4) The air or inert gas used for padding shall be free from oil and other foreign substances and shall be dried to a dew point, measured at atmospheric pressure, of minus 40°F or below.

27. (1) Piping shall be carried on permanent supports of steel or concrete or on some other supporting system approved by the MOTI.

(2) Ground-based supports for pipelines more than four feet above ground shall be mounted on footings which extend below the frost line or which rest on bedrock.

(3) Pipelines exposed to damage by vehicular traffic shall be protected by guard rails or curbs of concrete or metal.

(4) Provision shall be made in pipelines for expansion, contraction, jarring, vibration and settling.

(5) Ground-based, steel supports for pipelines more than four feet above ground should be coated or otherwise protected against fire damage by a method recommended by the National Fire Protection Association to provide the support with a fire resistance rating of not less than two hours.

28. (1) Pipelines running parallel to a track shall not be closer than 10 feet to the gauge side of the nearest rail of that track and shall comply with subsection (2).

(2) Except as provided in section 29, pipelines located on the railway right-of-way within 20 feet of a track shall be installed in accordance with any one of the following paragraphs:

(a) pipelines may be enclosed in a reinforced concrete or steel trench fitted with a recessed removable cover flush with the ground; the trench shall be provided with a drain to prevent water from collecting;

(b) pipelines may be carried on an overhead pipe bridge fabricated from steel or concrete and providing a minimum clearance of not less than 13 feet above ground, except that the installation of pipelines over tracks shall not be undertaken without the express approval of the MOTI in writing;

(c) that portion of a pipeline between the unloading rack and a process or similar building located on the unloading site may be enclosed by a chain link fence not less than five feet high.

29. (1) Notwithstanding subsection 28(2), pipelines under railway tracks shall comply with Pipe Crossings Under Industrial Railways Guidelines.

(2) Notwithstanding subsection 28(2), pipelines under roadways on the railway right-of-way shall be enclosed in a vented encasing pipe. The top of which shall be below the frost line and in no case less than three feet below the surface of the roadway. It shall be capable of supporting all overhead traffic without deformation or a failure of any kind.

30. Unloading racks shall be constructed of concrete or steel and their footings shall extend below frost line or to solid bedrock.

31. Vaporizers shall be designed, constructed, operated and maintained in accordance with the recommendations of The Chlorine Institute as contained in its Pamphlet No. 9, dated November 7, 1962, and amendments thereto.
PART IV

UNLOADING OPERATIONS

32. The company or person to whom the chlorine tank car is consigned for unloading shall comply with all of the requirements prescribed in this Part.

33. At least one unloading operator or other person trained in the handling of chlorine and familiar with its hazards, (see Schedule IV), shall be in attendance on the unloading site during the entire period that chlorine is being discharged from the tank car for the purpose of ensuring that the unloading operations are performed safely and in accordance with these Guidelines.

34. During the entire period that the tank car is connected to the unloading pipelines it shall be protected on the connected end or ends of the unloading track by a locked derail or switch located at least one car length from the tank car.

35. (1) During the entire period that the tank car is connected to the unloading pipelines, it shall be protected on the connected end or ends of the unloading track by a weatherproof sign or signs, measuring 12 inches by 15 inches and reading “STOP — TANK CAR CONNECTED”. The word “STOP” shall be in letters at least four inches high and the other words in letters at least two inches high. The letters shall be white on a blue background.

(2) The “STOP — TANK CAR CONNECTED” sign or signs, shall be placed on the tank car, or the unloading track in a manner that will ensure its visibility to the crew of an engine approaching the tank car on the same track.

36. The tank car hand brakes shall be applied and the wheels shall be blocked at both ends of the car during the entire period that the tank car is connected to the unloading lines.

37. (1) Except as provided in subsection (2), the shut-off valves shall be closed and the unloading pipelines disconnected from the tank car immediately after the completion of unloading operations.

(2) Pipelines need not be disconnected from the tank car if all shut-off valves on the tank car and in the discharge lines are closed, the tank car is protected as provided in sections 34 to 36 and the period during which operations are suspended does not exceed 72 hours.

38. Tank cars shall not be unloaded after sundown unless the unloading rack, tank car dome and other areas of activity on the unloading site are adequately lighted by permanent flood lights, installed and otherwise in conformity with the provisions of the Canadian Electrical Code, Part I, Eighth Edition and amendments thereto, or in accordance with any other higher standard prescribed by the local authority. Any electrical facilities within 20 feet of the unloading rack or tank car connection shall be suitable for a corrosive atmosphere.

39. At least one 20 pound ABC, dry chemical fire extinguisher or its equivalent shall be located at the unloading site and be readily available to the unloading operator during unloading operations.

40. (1) At least one respirator of the self-contained type and approved for use in chlorine atmospheres by the United States Bureau of Mines, together with a person trained in its use, shall be available on the site on not more than 20 minutes notice.

(2) At least two respirators of the absorbing canister type and approved for use in chlorine atmospheres by the United States Bureau of Mines, together with a person trained in their use, shall be readily available on the site during unloading operations.
41. (1) A chlorine emergency repair kit of a type recommended by The Chlorine Institute for the repair of tank cars, together with a man qualified to use it, shall be available on the site on short notice.

(2) Instruction cards, which provide information essential to the emergency handling of chlorine leaks, such as the location of respirators and the phone numbers listed hereunder, shall be posted in a conspicuous place outside near the unloading rack or inside near the unloading site telephone:
   (a) the phone number of at least one senior officer of the company owning or operating the unloading facility;
   (b) the phone numbers of the nearest police department, fire department and hospital;
   (c) the phone numbers of the principal public and institutional buildings within 2,000 feet of the unloading rack;
   (d) the phone number of at least one person who is available on short notice and is competent in handling chlorine leaks and similar emergencies;
   (e) the phone numbers of at least two persons who are available on short notice and are competent in the use of chlorine emergency repair kits; and
   (f) the phone number of the nearest agent or officer of the railway company serving the facility.

(3) The owning or operating company shall have at least one person available on short notice during unloading operations who has been trained in the handling of major chlorine leaks and other similar emergencies and that person shall participate in periodic safety drills, which shall include practice in the proper use of respirators, and other safety equipment.

42. The deliberate venting of chlorine to the atmosphere in quantities sufficient to cause injury to a person on the unloading site or in quantities sufficient to escape the boundaries of the unloading site is prohibited.

43. A weatherproof sign measuring not less than 12 inches by 12 inches and bearing the word “CHLORINE” in black letters at least four inches high on a yellow background shall be attached in a conspicuous place to the unloading rack or to a post near the rack.

44. The exterior of the piping system shall be painted or otherwise protected from atmospheric corrosion.

45. (1) All piping and other parts of the unloading system shall be inspected at least once every three months by a competent inspector for leaks and other evidence of deterioration.

(2) Leaking or defective pipes, fittings, valves or other parts of the unloading system shall be repaired or replaced by a qualified person and this work shall be undertaken immediately or with the minimum of delay that is consistent with good safety practice. That portion of the system to be repaired or replaced shall be isolated from the rest of the system and purged of chlorine in a manner that will not violate section 42.
PART V

GENERAL

46. (1) The unloading site shall be kept free of debris. Grass and weed growth shall not be permitted to exceed six inches in height.

(2) No combustible or other dangerous commodity, except chlorine, shall be stored or handled on the unloading site unless that commodity is mentioned in the approved application or is otherwise sanctioned by the approving order.

47. All chlorine unloading facilities subject to these Guidelines may be inspected at any time by an officer of the MOTI.

48. The owning or operating company shall report immediately to the railway company concerned and to the Railway Safety Manager of BCSA in New Westminster BC, every fire, explosion, pipeline rupture, or any occurrence that results in the accidental release of chlorine from the system in quantities sufficient to escape the boundaries of the unloading site or causes injury to a person on the site to the extent that medical attention is required.

49. Violations of any provision of these Guidelines are subject to such penalty as may be provided in the Railway Safety Act (BC).

50. The principal hazards associated with the unloading of tank cars of chlorine are discussed in Schedule IV.
**SCHEDULE I**

**Table I**

Minimum Clearance Distances Measured Horizontally between the Track Side of a Chlorine Unloading Rack and the Gauge Side of the Nearest Rail of the Track Serving the Storage Facility

<table>
<thead>
<tr>
<th>STRAIGHT TRACK</th>
<th>Minimum Distance from gauge side of nearest rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) That portion of a rack or structure more than 4 feet above the top of the rail</td>
<td>6 feet</td>
</tr>
<tr>
<td>(b) Except as provided in (c), that portion of a rack or structure 4 feet or less above the top of the rail</td>
<td>3 feet 7 3/4 inches</td>
</tr>
<tr>
<td>(c) Loading, unloading racks or terminals of an overall height of 4 feet or less above the top of the rail</td>
<td>6 feet</td>
</tr>
</tbody>
</table>

**CURVED TRACK**

All distances prescribed for straight track shall be increased by 1 inch per degree of track curvature.
# SCHEDULE II

## Table I

DESIGN AND RATINGS FOR STEEL PIPE, FITTINGS AND VALVES

FOR GASEOUS OR LIQUID CHLORINE AT PRESSURES UP TO 300 PSIG AND TEMPS. FROM -150°F TO 300°F

<table>
<thead>
<tr>
<th>SIZE</th>
<th>( \frac{3}{4}&quot; - 1\frac{1}{2}&quot; )</th>
<th>2&quot; - 4&quot;</th>
<th>6&quot; UP</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIPE</td>
<td>SCH. 80, SEAMLESS (See Note 1)</td>
<td>SCH. 80, SEAMLESS</td>
<td>Sch. 40, SEAMLESS</td>
</tr>
<tr>
<td>FITTINGS</td>
<td>BUTT WELD - SCH. 80, SEAMLESS</td>
<td>BUTT WELD - SEAMLESS, THICKNESS TO MATCH PIPE</td>
<td>BUTT WELD - SEAMLESS, THICKNESS TO MATCH PIPE</td>
</tr>
<tr>
<td></td>
<td>FLANGED - 300# ASA, FORGINGS</td>
<td>FLANGED - 300# ASA, CASTINGS OR FORGINGS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCREWED - 2000# CWP, FORGINGS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SOCKET WELD - 3000# CWP, FORGINGS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FORGED</td>
<td>RATING - 300# ASA</td>
<td>RATING - 300# ASA</td>
<td>RATING - 300# ASA</td>
</tr>
<tr>
<td>FLANGES</td>
<td>TYPE - SCREWED, SOCKET WELD OR WELD NECK</td>
<td>TYPE - SCREWED</td>
<td>TYPE - WELD NECK</td>
</tr>
<tr>
<td></td>
<td>SIZES ( \frac{3}{4}&quot; - 1&quot; ) ONLY</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FORGED, 2 BOLT - OVAL FLANGE UNIONS FACED TO MANUFACTURER'S STANDARD</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RATING - 1500# CWP</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TYPE - SCREWED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VALVES</td>
<td>PATTERN - GLOBE OR ANGLE</td>
<td>PATTERN - GLOBE OR ANGLE</td>
<td>PATTERN - GLOBE OR ANGLE</td>
</tr>
<tr>
<td></td>
<td>RATING - 600# ASA</td>
<td>RATING - 300# ASA</td>
<td>RATING - 300# ASA</td>
</tr>
<tr>
<td></td>
<td>DESIGN - OS &amp; Y., FORGED BODY &amp; BONNET, BOLTED BONNET &amp; GLAND, RENEWABLE OR HARD-FACED SEAT</td>
<td>DESIGN - OS &amp; Y., FORGED OR CAST BODY &amp; BONNET, BOLTED BONNET &amp; GLAND, RENEWABLE OR HARD-FACED SEAT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ENDS - SCREWED, SOCKET WELD OR FLANGED</td>
<td>ENDS - FLANGED</td>
<td></td>
</tr>
</tbody>
</table>
**VALVES FOR CHLORINE GAS ONLY**

<table>
<thead>
<tr>
<th></th>
<th>PATTERN - PLUG</th>
<th>PATTERN - PLUG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RATING - 300# ASA</td>
<td>RATING - 300# ASA</td>
</tr>
<tr>
<td></td>
<td>DESIGN - LUBRICATED NON-LIFTING PLUG</td>
<td>DESIGN - LUBRICATED, NON-LIFTING PLUG</td>
</tr>
<tr>
<td></td>
<td>ENDS - SCREWED OR FLANGED</td>
<td>ENDS - FLANGED</td>
</tr>
</tbody>
</table>

**BOLTING**

<table>
<thead>
<tr>
<th></th>
<th>DIMENSIONS PER ASA B18.2, THREADS PER ASA B1.1 (thru 1&quot; - UNC SERIES):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1⅛&quot; UP - 8N SERIES)</td>
</tr>
<tr>
<td></td>
<td>BOLT STUDS - THREADED FULL LENGTH</td>
</tr>
<tr>
<td></td>
<td>BOLTS - HEAVY PATTERN</td>
</tr>
<tr>
<td></td>
<td>NUTS - SEMI-FINISHED, HEAVY SERIES</td>
</tr>
</tbody>
</table>

**ABBREVIATIONS** — See Note 4.

**NOTE 1** ALLOY STEEL TO ASTM A333 Gr. 3 MAY BE SCHEDULE 40.

**NOTE 2** RAISED FACE FLANGES MAY BE USED IN GAS SERVICE. LARGE OR SMALL TONGUE AND GROOVE FACINGS AS PER ASA B 16.5 MAY BE USED IN BOTH LIQUID AND GAS SERVICE.

**NOTE 3** THE DISC, SEAT AND STEM OF MANUAL VALVES SHALL BE MONEL OR HASTELLOY C, EXCEPT HARD-FACED SEATS WHICH SHALL BE COLMONOY #5 OR ITS EQUIVALENT.

**NOTE 4** ABBREVIATIONS

- **ASA** — AMERICAN STANDARDS ASSOCIATION INC.
- **ASTM** — AMERICAN SOCIETY FOR TESTING MATERIALS
- **CWP** — COLD WORKING PRESSURE
- **SCH** — SCHEDULE
- **OS&Y** — OUTSIDE SCREW AND YOKE
TABLE II
MATERIALS OF CONSTRUCTION FOR STEEL PIPE AND FITTINGS (A.S.T.M. DESIGNATIONS)

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pipe* and Seamless Fittings</th>
<th>Castings</th>
<th>Forgings</th>
<th>Studs</th>
<th>Nuts</th>
</tr>
</thead>
<tbody>
<tr>
<td>-150º to -20ºF</td>
<td>A333 Gr 3</td>
<td>A352 Gr LC3</td>
<td>A350 Gr LF3</td>
<td>A320 Gr L7</td>
<td>A194 Gr 4</td>
</tr>
<tr>
<td>-50º to -20ºF</td>
<td>A333 Gr C</td>
<td>A352 Gr LCB</td>
<td>A350 Gr LFI</td>
<td>A320 Gr L7</td>
<td>A194 Gr 4</td>
</tr>
<tr>
<td>-20º to +300ºF</td>
<td>A53 Gr A</td>
<td>A216 Gr WCB</td>
<td>A105 Gr I or II A193 Gr B7 A194 Gr 1.2 or 2H</td>
<td>A354 Gr BC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A106 Gr A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fittings only A234 Gr WPA WPB A181 Gr I or II A354 Gr BC

Note: Cold bent carbon steel pipe shall not be used in Chlorine service unless it is stress relieved.
SCHEDULE IV

CHLORINE HAZARDS

1. It is believed that compliance with the requirements prescribed in these Guidelines will provide a high degree of safety in the unloading of tank cars of chlorine. Effective implementation of these requirements is most likely to be realized if the persons involved in the unloading operations have a good knowledge and understanding of the properties and hazards of chlorine.

2. The principal properties and hazards of chlorine are as follows:
   (a) chlorine is normally transported under pressure in liquid form in tank cars and cylinders. Under atmospheric conditions, such as would be obtained in the event of a leak, liquid chlorine is rapidly converted to a gas in the ratio of approximately one volume of liquid to 460 volumes of gas. For this reason a relatively small leak of liquid chlorine is capable of polluting a large volume of air;
   (b) chlorine gas is about 2 1/2 times as heavy as air. It therefore tends to accumulate in low places and is not readily diluted or dispersed unless it is subjected to strong air currents;
   (c) chlorine is not flammable, but at ordinary temperatures it will support the combustion of some combustible, organic substances such as finely divided cork. At elevated temperatures it will support the combustion of steel and for this reason may cause the rapid deterioration of steel piping or other steel equipment that is exposed to a fire;
   (d) although insulated chlorine tank cars of the ICC 105A type provide good thermal protection for the lading, they should be removed from the scene of a fire as soon as possible;
   (e) dry chlorine is compatible with a wide variety of metals including mild steel, but chlorine containing more than about 150 parts per million of water is highly corrosive to mild steel and other metals with poor resistance to dilute hydrochloric acid. It is, therefore, essential that all piping and equipment be thoroughly dried before it is placed in service and that water be prevented from entering the system by other means; chlorine leaks should not be sprayed with water;
   (f) the maximum concentration of chlorine in air that most adult persons can breathe for one hour without serious effects is four parts per million; this is about the minimum concentration that is detectable by odour;
   (g) chlorine in concentrations of about 35 parts per million is considered dangerous if breathed for periods longer than about 30 minutes, but because concentrations of chlorine above 15 parts per million are extremely irritating to the throat and respiratory tract it is unlikely that any one would intentionally expose himself for more than a few minutes to such concentrations;
   (h) even a few breaths of air which contain more than 1,000 parts per million of chlorine are likely to be fatal;
   (i) respirators of the absorbing canister type are not suitable for use in atmospheres containing more than about one per cent of chlorine by volume; self-contained breathing apparatus must be used in such atmospheres;
   (j) in addition to the respirators referred to in paragraph (i), persons repairing leaks, or who otherwise may be exposed to liquid chlorine or high concentrations of gaseous chlorine, should wear gloves and other suitable protective clothing; the action of chlorine on the skin and other body tissues is similar to that of acids and other corrosive substances; and
   (k) for additional information on this subject the reader is referred to The Chlorine Institute Inc., 342 Madison Avenue, New York City, New York 10017 or to the nearest chlorine producer.