**Table 4—Summary of Minimum Requirements—Continued**

<table>
<thead>
<tr>
<th>Cargo name</th>
<th>Ship type</th>
<th>Independent tank type C required</th>
<th>Control of cargo tank vapor space</th>
<th>Vapor detection</th>
<th>Gauging</th>
<th>Electrical hazard class and group</th>
<th>Special requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur dioxide</td>
<td>IG IIG</td>
<td>Yes</td>
<td>Dry</td>
<td>T</td>
<td>C</td>
<td></td>
<td>154.660 (b) (3), 154.1345 (c), (d), 154.1400 (c), 154.1405, 154.1410, 154.1705, 154.1715, 154.1720, 154.1870 (a), (b), 154.1405, 154.1410, 154.1702 (a) (b) (d) (f), 154.1710, 154.1740, 154.1745, 154.1750, 154.1818, 154.1830 (f), 154.1830 (f), 154.1870.</td>
</tr>
<tr>
<td>Vinyl chloride</td>
<td>IIG/IIPG</td>
<td></td>
<td>I &amp; T</td>
<td>C</td>
<td>I-D</td>
<td></td>
<td>154.1405, 154.1410, 154.1702 (a) (b) (d) (f), 154.1710, 154.1740, 154.1745, 154.1750, 154.1818, 154.1830 (f), 154.1870.</td>
</tr>
</tbody>
</table>

1. Refrigerant gases include non-toxic, non-flammable gases such as: dichlorodifluoromethane, dichloromonofluoromethane, dichlorotetrafluoroethane, monochlorodifluoromethane, monochlorotetrafluoroethane, and monochlorotrifluoromethane.

2. As used in this column: "I" stands for flammable vapor detection; "T" stands for toxic vapor detection; "O" stands for oxygen detection; and see §§ 154.1345 thru 154.1360.

3. As used in this column: "C" stands for closed gauging; "R" stands for restricted gauging; and see § 154.1300.

4. The designations used in this column are from the National Electrical Code.

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**APPENDIX A TO PART 154—EQUIVALENT STRESS**

I. Equivalent stress \((\sigma_c)\) is calculated by the following formula or another formula specially approved by the Commandant (CG–522) as equivalent to the following:

\[
\sigma_c = \sqrt{\sigma_x^2 + \sigma_y^2 - \sigma_x \sigma_y + 3 \tau_{xy}^2}
\]

where:
- \(\sigma_x\) = total normal stress in “\(x\)” direction.
- \(\sigma_y\) = total normal stress in “\(y\)” direction.
- \(\tau_{xy}\) = total shear stress in “\(xy\)” plane.

II. When the static and dynamic stresses are calculated separately, the total stresses in paragraph I are calculated from the following formulae or another formulae specially approved by the Commandant (CG–522) as equivalent to the following:

\[
\sigma_x = \sigma_x^{\text{(static)}} \pm \sqrt{\sum (\sigma_x^{\text{(dynamic)}})^2}
\]

\[
\sigma_y = \sigma_y^{\text{(static)}} \pm \sqrt{\sum (\sigma_y^{\text{(dynamic)}})^2}
\]

\[
\tau_{xy} = \tau_{xy}^{\text{(static)}} \pm \sqrt{\sum (\tau_{xy}^{\text{(dynamic)}})^2}
\]

III. Each dynamic and static stress is determined from its acceleration component and its hull strain component from hull deflection and torsion.

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**APPENDIX B TO PART 154—STRESS ANALYSES DEFINITIONS**

The following are the standard definitions of stresses for the analysis of an independent tank type B:

**Normal stress** means the component of stress normal to the plane of reference.

**Membrane stress** means the component of normal stress that is uniformly distributed and equal to the average value of the stress across the thickness of the section under consideration.

**Bending stress** means the variable stress across the thickness of the section under consideration, after the subtraction of the membrane stress.

**Shear stress** means the component of the stress acting in the plane of reference.