# SERVICE BULLETIN

**Title:** **Refrigerant Volume Determination**
**Models Affected:**

**Number:** **C9315**
**Date:** **10/19/93**
**Supersedes:**
**Date:**

## Purpose:

To obtain a close estimate of the tank level that would contain the correct refrigerant charge calculated for the chiller.

**File: Refrigerant Volume**

**Prepared By:** Ted Libera

**Approved By:** Alan Johnson

## Background:

It is not practical to weigh a tanker truck at most jobsites and there is no accurate measuring device on refrigerant delivery tankers. This has resulted, at various times, in far too much or far too little refrigerant being delivered to a job site. This is an effort to rectify this annoying and costly occurrence.

It is a complicated process to calculate the volume of a liquid in a partially-filled horizontal tank, so we will use a table of % volume vs. liquid height as a percent of tank diameter.

## Method:

First, please note that although we will be using the tank capacity at 100% full as part of our calculations, the tank should NEVER be more than 90% full by volume, per ASHRAE standards. There must be room for the liquid to expand as its temperature increases.

**Step 1:** Find the tank radius in ft.

**Step 2:** Find the density of your refrigerant from a refrigerant table or choose the best value from the table below.

**Table 1 — HFC-134a liquid density in #/ft $^3$**

| | |
|---|---|
| **@ 40F** | = 80.0 |
| **@ 70F** | = 76.3 |
| **@ 80F** | = 75.2 |

**Table 2 — HCFC-22 liquid density in #/ft $^3$**

| | |
|---|---|
| **@40F** | = 79.25 |
| **@70F** | = 75.46 |
| **@80F** | = 74.11 |

**Step 3**: Calculate the tank capacity in pounds of refrigerant:

**Capacity = Density x 3.14 x (radius squared) x (length of tank in ft.)**

**Step 4:** Find the correct tank volume percent:

**( [Correct charge in lbs.] / Capacity) x 100**

**Step 5:** Determine the percent of total tank height that will be occupied by the charge by finding the capacity percent in the Capacity vs. Height table.

**Step 6:** Multiply the percent height found in Step 5 by the diameter of the tank in inches. The result is the correct height of refrigerant in the tank.

**Table 3 — Capacity % Vs. Height %**

| Height % | Capacity % | Height % | Capacity % | Height % | Capacity % |
|---|---|---|---|---|---|
| 0 | 0 | 40 | 37.75 | 80 | 85.75 |
| 5 | 2 | 45 | 43.5 | 85 | 90.5 |
| 10 | 5.5 | 50 | 50 | **VOLUME LIMIT** | |
| 15 | 9.5 | 55 | 56.5 | 90 | 94.6 |
| 20 | 14.5 | 60 | 62.5 | 95 | 98.2 |
| 25 | 19.75 | 65 | 68.5 | 100 | 100 |
| 30 | 25.5 | 70 | 74.75 | | |
| 35 | 31.5 | 75 | 80.5 | | |