LOW TEMPERATURE AND CRYOGENIC STORAGE

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INTRODUCTION

Changes in concepts for designing and constructing cities, methods of transportation, and industry itself are necessary as countries become more industrialized. Industrialization in turn results in increased demand for energy and the chemical building materials required to produce plastics and similar sophisticated chemical products. Low temperature and cryogenic storage facilities for such materials as ammonia, propylene, ethylene, and LNG fulfill this need.

Thirty years ago, insulated and refrigerated storage containers of 380 cubic meters up to the current 100,000 cubic meters capacities were unheard of, although they might have been under consideration by engineers with foresight. Within the last twenty years, such facilities for products like liquid nitrogen, oxygen, natural gas, propane, and ammonia have become relatively commonplace. In the South Pacific area there are several examples of projects of this nature being considered or constructed. Examples are the two 60,000 cubic meter LNG storage tanks at Brunei, Borneo which will store product at -162°C; the storage Korea Oil Corporation has built at Wulsan, Korea for 8000 cubic meters of ethylene at -103°C and 5250 cubic meters of propylene at -48°C; and the storage of 5000-metric tons of ammonia at -33°C under consideration by Pusri for installation at Palembang, Sumatra, Indonesia.

ECONOMICS

The use of low temperature and cryogenic storage is based on the lower vessel weights and costs possible when storing large volumes as liquids at low pressures and under refrigeration. As the volume of product to be stored increases at ambient temperatures, the steel weight requirements of pressure vessel liquid-storage expand prohibitively. For cryogenic gases where the critical temperature is below ambient, pressure storage at ambient temperature cannot maintain cryogenic gases in a liquid phase and refrigeration is necessary.

Table 1 summarizes the approximate comparison of pressure storage costs versus fully refrigerated storage for three products of interest. Fully refrigerated storage requires a refrigeration system to maintain the tank.

This chart does not include the cost of refrigeration equipment to go with the refrigerated storage; however, its cost is usually considerably less than the additional costs due to pressure storage. The savings in weight of storage vessel versus weight of contained product, for refrigerated storage versus pressure storage clearly shows why more products are being shipped in the refrigerated condition. Beyond the economic advantage, fully refrigerated storage offers the following:

SAFETY
a) Less gas pressure in storage.
b) Less flash of product in the event of a spill.

STORAGE SAVINGS
a) Truck and rail transport of refrigerate products to inland storage terminals is less expensive.
b) Fully refrigerated inland terminals are less expensive.
c) Less loss of product (or requirement for fill refrigeration) upon transfer of refrigerated liquids to inland storage facilities.

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