REVIEW OF RING -BAFFLE PRESSURE DISTRIBUTION PROCEDURES IN VERTICAL SYLINDRICAL TANKS

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ABSTRACT

In this article a review on the various pressure distribution procedures on the ring baffle in Storage tanks is investigated. In this research 5 most common procedures in determining pressure loads on ring baffles is investigated. Radial and circumferential distribution of pressure on ring baffles in a 284 cm tank is tested. Some effective parameters on pressure distribution are: nondimensional liquid velocity$U_{max}T/2W$, liquid amplitude ξ/r, baffle depth d/r, radial position on the baffle y/W,circumferential position β, and baffle spacing s/W.

The dependence of the pressure loads on each of these variables is illustrated with representative data obtained with one and two baffles mounted in the tank. These data are compared with available theories where applicable. Results suggest that pressure distributions can be determined from available theories for the design of single and multiple baffle configurations.

INTRODUCTION

Sloshing is defined as the periodic motion of the free surface of a liquid in a partially filled tanks. If the liquid is allowed to slosh freely, it can produce additional forces. High amplitude fluid sloshing is one of the widespread causes of steel oil storage tanks during strong earthquakes addressed as an important failure mode (NASA SP-8031, 1969). This phenomenon generates additional forces impacting the wall and roof of the tanks. Since the damping provided by the wiping action of the fluid against the tank wall is small, free oscillations may persist for long periods, and forced oscillations may produce long free-surface waves unless suitable damping device are provided (Hosseinzadeh et al., 2014).

The undesirable sloshing phenomenon may be controlled by the proper geometrical design of the tank and by the addition of baffles. Tank geometry influences the natural sloshing frequencies and sloshing modes, forced response, resultant pressure forces and moments acting on the tank. Baffles increase the effective fluid damping and thereby reduce the duration of free oscillation and the magnitude of forced oscillations (NASA SP-8009, 1968).

The selection and design of suppression systems require quantitative knowledge of the slosh characteristics. Anti-slosh baffles are usually required in liquid-propellant space vehicles to minimize propellant oscillations. The most common configuration consists of rigid rings fitted around the internal periphery of the tank. Annular ring baffles in cylindrical tanks have been designed as integral parts of the structure to provide structural stability for the thin tank shell (Structural baffles) and as separate devices that are independent of the primary tank structure (Non-structural baffles). Efficient design of both rigid and flexible baffles requires a detailed understanding of the hydrodynamic loads as well as the damping