The committee report gives design and construction requirements for concrete silos covered in “Recommended Practice for Design and Construction of Reinforced Concrete Bins, Silos, and Bunkers for Storing Granular Materials (ACI 313-77) and Commentary” when they are reinforced with prestressing steel. This document may be considered at some future date for inclusion as a chapter in ACI 313-77 and its commentary. For this reason it is written in a language similar to that of the standard.

Keywords: bins; circular prestressing; concrete construction; dynamic loads; earthquake resistant structures; formwork (construction); granular materials; lateral pressure; loads (forces); pressure; prestressed concrete; prestressing steels; quality control; reinforced concrete; reinforcing steels; shotcrete; shrinkage; silos; slipform construction; static loads; stresses; structural analysis; structural design; thermal stresses; thickness; walls.

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1 — NOTATION

Consistent units must be used in all equations. Except where noted, units may be either all U.S. customary or all metric (SI).

\[ A_{ps} = \text{area of prestressed reinforcement in tension zone} \]
\[ D = \text{inside diameter of silo} \]
\[ f'c = \text{ultimate compressive strength of concrete} \]
\[ f_{ci} = \text{compressive strength of concrete at time of initial prestress} \]
\[ f_{ps} = \text{stress in prestressed reinforcement at nominal strength} \]
\[ f_{pu} = \text{specified tensile strength of prestressing tendons} \]

\[ f_{yp} = \text{specified yield strength of prestressed tendons} \]
\[ f_{se} = \text{effective stress in prestressed reinforcement (after allowance for all prestress losses)} \]
\[ f_{si} = \text{average initial prestress (before long-term losses)} \]
\[ f_{y} = \text{yield strength of nonprestressed reinforcement} \]
\[ h = \text{wall thickness} \]
\[ h_i = \text{core wall thickness} \]
\[ K = \text{wobble friction coefficient per unit length of prestressing steel} \]
\[ l = \text{length of prestressing steel element from jacking end to any point} \]
\[ P_s = \text{prestressing tendon force at jacking end} \]
\[ P_e = \text{prestressing tendon force at any point} \]
\[ p_{dcs} = \text{horizontal unit design pressure due to stored material} \]
\[ p_{dcs} = p_{dcs} f_{pi}/f_{se} \text{ unit pressure due to initial circumferential prestress force} \]
\[ \alpha = \text{total angular change of prestressing steel profile in radians from jacking end to any point} \]
\[ \mu = \text{curvature friction coefficient (between tendon and duct)} \]
\[ q = \text{ratio of prestressed reinforcement, } A_{ps}/bh \]
\[ \phi = \text{capacity reduction factor} \]
\[ \nu = \text{Poisson's ratio (assumed to be 0.2)} \]

2 — SCOPE

Provisions in this report apply to silo walls prestressed with high-strength steel meeting the requirements for prestressing steels given by “Building Code Requirements for Reinforced Concrete (ACI 318-77).”

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