14.2.3.2.4 Reinforcement for Metal-Cased Concrete Piles (SDC D through F) Reinforcement requirements are the same as for uncased concrete piles.

EXCEPTION: Spiral-welded metal casing of a thickness not less than No. 14 gauge can be considered as providing concrete confinement equivalent to the closed ties or equivalent spirals required in an uncased concrete pile, provided that the metal casing is adequately protected against possible deleterious action due to soil constituents, changing water levels, or other factors indicated by boring records of site conditions.

14.2.3.2.5 Reinforcement for Precast Concrete Piles (SDC D through F) Transverse confinement reinforcement consisting of closed ties or equivalent spirals shall be provided in accordance with Sections 21.6.4.2 through 21.6.4.4 of ACI 318 for the full length of the pile.

EXCEPTION: In other than Site Classes E or F, the specified transverse confinement reinforcement shall be provided within three pile diameters below the bottom of the pile cap, but it is permitted to use a transverse reinforcing ratio of not less than one-half of that required in Section 21.6.4.4(a) of ACI 318 throughout the remainder of the pile length.

14.2.3.2.6 Reinforcement for Precast Prestressed Piles (SDC D through F) In addition to the requirements for Seismic Design Category C, the following requirements shall be met:

1. Requirements of ACI 318, Chapter 21, need not apply.
2. Where the total pile length in the soil is 35 ft (10,668 mm) or less, the ductile pile region shall be taken as the entire length of the pile. Where the pile length exceeds 35 ft (10,668 mm), the ductile pile region shall be taken as the greater of 35 ft (10,668 mm) or the distance from the underside of the pile cap to the point of zero curvature plus three times the least pile dimension.
3. In the ductile pile region, the center to center spacing of the spirals or hoop reinforcement shall not exceed one-fifth of the least pile dimension, six times the diameter of the longitudinal strand, or 8 in. (203 mm), whichever is smaller.
4. Spiral reinforcement shall be spliced by lapping one full turn, by welding, or by the use of a mechanical connector. Where spiral reinforcement is lap spliced, the ends of the spiral shall terminate in a seismic hook in accordance with ACI 318, except that the bend shall be not less than 135°. Welded splices and mechanical connectors shall comply with Section 12.14.3 of ACI 318.
5. Where the transverse reinforcement consists of spirals or circular hoops, the volumetric ratio of spiral transverse reinforcement in the ductile pile region shall comply with

$$\rho_s = 0.25\left(\frac{f_c'}{f_{yh}}\right)\left(\frac{A_g}{A_{ch}} - 1.0\right)\left[0.5 + \frac{1.4P}{f_c'A_g}\right]$$

but not less than

$$\rho_s = 0.12\left(\frac{f_c'}{f_{yh}}\right)\left[0.5 + \frac{1.4P}{f_c'A_g}\right]$$

and ρ_s need not exceed 0.021 where

ρ_s = volumetric ratio (vol. of spiral/vol. of core)
$f_c' \le 6{,}000$ psi (41.4 MPa)
f_{yh} = yield strength of spiral reinforcement ≤ 85 ksi (586 MPa)
A_g = pile cross-sectional area, in.^{2} (mm^2)
A_{ch} = core area defined by spiral outside diameter, in.^{2} (mm^2)
P = axial load on pile resulting from the load combination $1.2D + 0.5L + 1.0E$, lb (kN)

This required amount of spiral reinforcement is permitted to be obtained by providing an inner and outer spiral.

6. Where transverse reinforcement consists of rectangular hoops and cross ties, the total cross-sectional area of lateral transverse reinforcement in the ductile region with spacing, s, and perpendicular to dimension, h_c, shall conform to

$$A_{sh} = 0.3sh_c\left(\frac{f_c'}{f_{yh}}\right)\left(\frac{A_g}{A_{ch}} - 1.0\right)\left[0.5 + \frac{1.4P}{f_c'A_g}\right]$$

but not less than

$$A_{sh} = 0.12sh_c\left(\frac{f_c'}{f_{yh}}\right)\left[0.5 + \frac{1.4P}{f_c'A_g}\right]$$

where

s = spacing of transverse reinforcement measured along length of pile, in. (mm)
h_c = cross-sectional dimension of pile core measured center to center of hoop reinforcement, in. (mm)
$f_{yh} \le 70$ ksi (483 MPa)

The hoops and cross ties shall be equivalent to deformed bars not less than No. 3 in size. Rectangular hoop ends shall terminate at a corner with seismic hooks.