

**GENERAL:**

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The scope of this document is to provide instruction for the installation of concrete formwork for exterior underground steam and condensate lines.

**DESIGN GUIDELINES:**

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**A. General**

1. Exposed Concrete: Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faces or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.
2. Unexposed Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material.
3. Steel forms, if used, shall be flat and smooth, without dents, free of rust and shall be tight fitting for all exposed surfaces.
4. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
5. Form ties shall be adjustable length, such that when forms are removed, ties leave no metal within 1" of finished surface. Tie holes shall leave holes not less than 1/2" nor more than 1" in depth.
6. All formwork shall be designed for the loads, lateral pressures, and allowable stresses outlined in ACI 347, "Recommended Practice for Concrete Formwork" and for design considerations, wind loads, allowable stresses and other applicable requirements of the controlling local building code.
7. Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be of a suitable commercially manufactured type.
8. Forms shall be constructed sufficiently tight to prevent loss of mortar from the concrete.
9. Positive means of adjustment (wedges or jacks) of shores and struts shall be provided and all settlement shall be taken up during the concrete placing operations. Forms shall be securely braced to prevent lateral deflections.
10. Forms shall be constructed so that they can be removed without hammering or prying against the concrete.
11. All footings and foundations shall be formed. Pouring concrete against soil on the sides of the excavation will not be permitted.
12. Formwork shall be constructed such that the finished concrete surfaces are free of any abrupt dimensional changes requiring extensive corrective work such as patching or grinding and that formed concrete will conform to dimensional tolerances as follows:
 

12.1. Variation from plumb	1/4" in 10'; 3/4" in 40' or more
12.2. Variation from level	1/4" in 10'; 3/4" in 40' or more
12.3. Variation of concrete lines from theoretical position indicated on drawings	1/2" in 20'; 1" in 40' or more

- 12.4. Variation in size and location of sleeves  
And openings Plus or minus 1/4"
- 12.5. Variation in the thickness of walls and  
structural slabs Plus 1/2" to minus 1/4"
13. Above tolerances do not relieve installer from responsibility of adhering to closer tolerances where required to coordinate concrete work with work of various trades or to achieve special architectural details.
14. Surfaces of plywood or other wood forms shall be sealed to prevent absorption of moisture from the concrete either by a factory applied non-absorbent liner or by a field application of an approved non-staining form oil or sealer. Where finished concrete surfaces are to be painted the form coating material shall be compatible with the type of paint to be used.
15. Oiling or sealing of forms shall be done prior to placing of the reinforcing steel. Excess coating material shall not be allowed to stand in puddles in the forms nor allowed to come in contact with concrete against which fresh concrete will be placed.
16. All forms shall be thoroughly cleaned and re-oiled or sealed before re-use.
17. All embedded items, such as sleeves, inserts, anchors, etc., shall be accurately located and securely fastened prior to placing concrete.
18. Voids in sleeves, inserts, anchor slots, etc., shall be filled temporarily with readily removable material to prevent entry of concrete into the voids.
19. All embedded items shall be clean and free of oil and other foreign matter such as loose coatings of rust, paint, and scale. The embedding of wood in concrete shall be avoided.
20. Formwork not supporting weight of concrete, such as on walls, and similar parts of the work, may be removed as soon as concrete is sufficiently hard to not be damaged by form removal operations, but not sooner than 24 hours.
21. Do not strip any formwork or remove any covering from concrete placed in freezing weather until so permitted by proper attainment of strength.
22. Time during which temperature falls below 40°F shall not be counted in computing time for removal of forms, unless ambient temperature is kept above 40°F by artificial heating.
23. Whenever the formwork is removed during the required curing period, the exposed concrete shall be cured by one of the methods specified.

## REFERENCES