

Design Documents Referenced

 aci American Concrete Institute®	<p><u>ACI 351.3R-04</u> (Reapproved 2011)</p>	<p>Recommended Practices for Machinery Installation and Installation Design</p>
	<p>Foundations for Dynamic Equipment</p>	<p>Chapter 4—Foundations</p>
	<p>Reported by ACI Committee 351</p>	<p>Manufacturing, Distribution and Marketing Department API RECOMMENDED PRACTICE 686 PIP REIE 686 FIRST EDITION, APRIL 1996</p>
	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <p>ACI 351.3R-04</p> </div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <p>API PIP 686</p> </div>
	 PIP Process Industry Practices	 American Petroleum Institute

Above are two design documents for equipment and generator pads.

The design manuals contain lots of details, but below are a list of bullet point items to keep in mind when designing concrete under vibrating/oscillating equipment.

The current (03/13/2017) location of these files on the LJA network is:

Z:\STRUCTURAL_GROUP\Design Codes and Specifications\ACI 318, ACI 330, ACI 224-3R

Generator/Equipment Pad Design Bullet Points

Weight of Foundation to Weight of Equipment Ratio

ACI 351.3R-04 “Rule of Thumb Method”

Section 4.1.2.1

A long-established rule-of-thumb for machinery on block-type foundations is to make the weight of the foundation block at least three times the weight of a rotating machine and at least five times the weight of a reciprocating machine. For pile-supported foundations, these ratios are sometimes reduced so that the foundation block weight, including pile cap, is at least 2-1/2 times the weight of a rotating machine and at least four times the weight of a reciprocating machine. These ratios are machine weights inclusive of moving and stationary parts as compared with the weight of the concrete foundation block. Additionally, many designers require the foundation to be of such weight that the resultant of lateral and vertical loads falls within the middle third of the foundation base. That is, the net effect of lateral and vertical loads or the eccentricity of the vertical load should not cause uplift.

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2.4.2 A machinery block foundation supported on soil should have a minimum mass ratio of three times the mass of the machinery for centrifugal machines and five times the mass for reciprocating machines, unless analysis demonstrates that a lesser value will perform adequately. A block foundation subject to vibrations may require a dynamic analysis to ensure that the provisions of 2.2.11 are met.

Note: The minimum mass ratios 3:1 and 5:1 are traditional empirical values for foundation mass to equipment mass that should be used unless a lesser amount can be demonstrated to perform adequately. Although the 3-to-5 mass ratio has been a good rule of thumb, in certain installations a dynamic analysis of the rectangular concrete foundation may be necessary to adequately predict its behavior.

Foundation Pad Size

ACI 351.3R-04 “Rule of Thumb Method”

Section 4.1.2.1

The shape of the foundation should adequately accommodate the equipment, including maintenance space if required. Minimum width should be 1.5 times the vertical distance from the machine centerline to the bottom of the foundation block. The designer should

Foundation Thickness

ACI 351.3R-04 “Rule of Thumb Method”

Section 4.1.2.1

One rule-of thumb criterion for thickness is that the minimum thickness of the foundation block should be $1/5$ of its width (short side), $1/10$ of its length (long side), or 2 ft (0.6 m), whichever is greatest. Another criterion is given in Section 4.3 as $1/30$ of the length plus 2 ft (0.6 m).

Soil Bearing

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2.3.3 The maximum soil pressure due to static and dynamic load combinations should not exceed 75 percent of the allowable soil bearing capacity. When wind or earthquake loading is included in the load conditions, the allowable capacity can be increased by one-third. Uplift of the foundation shall be avoided.

Embedment

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2.4.9 Block foundations for reciprocating machines (compressors, and so forth) should have a minimum of 50 percent of the block thickness embedded in the soil, unless otherwise specified by the equipment user.

Note: It is desirable to have at least 50 percent of the total depth of the foundation embedded in the soil to increase the lateral restraint and the damping ratios for all modes of vibration.

Concrete Strength

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2.8.2 All concrete shall have a minimum compressive strength of 28 newtons per square millimeter (4000 pounds per square inch) at 28 days, unless otherwise specified by the user.