MACHINE FOUNDATION

Functions of Machine Foundation:

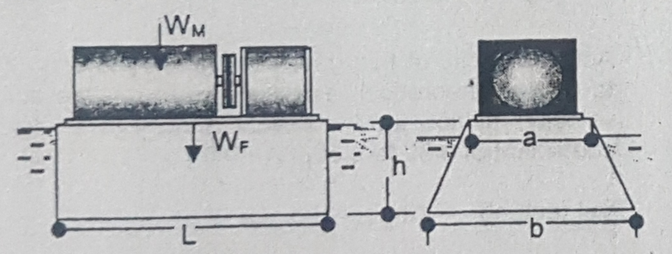
1. To support the weight of the machine, and to distribute the weight of the machine and its own over a safe sub-soil area.
2. To absorb the vibrations produced by the machine.
3. To maintain the alignment of the machine.

Monolithic Foundation - concrete foundation which is formed by pouring the entire concrete mixture continuously at one time and allowing the structure to harden as a whole unit.

Grouting - process of filling a small clearance between machine and foundation, after the machine is aligned and levelled, by using a special hardening mixture.

DESIGN PROCEDURE IN MACHINE FOUNDATION:

Manufacturer's manual supplies foundation drawings, but in the absence of such drawings, the following guide can be used.
Refer: PSME Code, pp 9-11; Morse, pp 108-113



1. Knowing the bedplate dimensions of the machine, determine the upper dimensions of the foundation "a" and "L". Allow a clearance from the edge of about one foot or about 10% of the length of the bedplate.

2. Knowing the weight of the machine, W_M, determine the required weight of the foundation, W_F, by any of the following methods:

a. W_F = 3 to 5 times the W_M (Sec. 2.4.1.2, PSME Code)

b. $W_F = e \times W_e \times \sqrt{N}$

where: W_F = weight of the foundation, kg
W_e = weight of the engine, kg
N = engine speed, rpm
e = an empirical coefficient, [Table 2.4.2.3(4), PSME Code]

c. Volume of foundation can be computed based on HP of the engine, [Table 2.4.2.3(4), PSME Code]

d. Weight of foundation can be computed based on the HP of the engine, [Morse, Table 4-5, p. 108]

3. Knowing the bearing capacity of the soil, solve for the base width "b". For machine foundation use only ½ of the given safe soil bearing capacity. The safe bearing capacity is computed using a factor of safety of 5.

$$\frac{S_b}{2} = \frac{W_M + W_F}{bL}$$

where: S_b = safe soil bearing capacity

Note: If "b" will come out less than "a", then make b = a, that is, the foundation has a rectangular cross-section.

4. Using a density of 2406 kg/m^3 for concrete, determine the volume of the foundation.

$$V_F = \frac{W_F}{2406} \quad m^3$$

5. Compute the depth of the foundation "h":

$$V_F = \left(\frac{a+b}{2}\right) h L$$

6. Finalize the design; make adjustments in the dimensions if necessary provided the required volume is maintained and without reducing the required base area.

Other data and information:

7. Use Class A (1 : 2 : 4) mixture, that is, 1 part cement, 2 parts sand and 4 parts stone.

8. Determine the quantity of cement, sand and stone using the following data:

To produce 1 cu yd of concrete using 1:2:4 mixture, the following are needed: 6 sacks cement, 0.44 cu yd sand and 0.88 cu yd stone.

9. Weight of steel bar reinforcements needed should be about ½% to 1% of the weight of the foundation.

10. Anchor bolts should be imbedded in the concrete at least 30 times the bolt diameter.

Machine Foundation General Requirements:

- all heavy machinery shall be supported on solid foundations of sufficient mass and base area to prevent or minimize the transmission of objectionable vibration to the building and occupied space and to maintain the supported machine at its proper elevation and alignment.
- foundation mass should be from 3 to 5 times the weight of the machinery it is supposed to support. If the unbalanced inertial forces produced by the machine shall be calculated, a mass of weight equal to 10 to 20 times the forces should be used to dampen vibration. For stability, the total combined engine, driven equipment, and foundation center of gravity must be kept below the foundation's top.
- the weight of the machine plus the weight of the foundation should be distributed over a sufficient soil area which is large enough to cause a bearing stress within the safe bearing capacity of the soil with a factor of safety of five (5).
- foundation should be isolated from floor slabs or building footings by at least 25 mm around its perimeter to eliminate transmission of vibration.
- foundations are preferably built of concrete in the proportion of
1 : 2 : 4. The machine should not be placed on the foundation until seven (7) days have elapsed or operated until another seven (7) days have passed.
- concrete foundations should have steel bar reinforcements placed both vertically and horizontally, to avoid thermal cracking. Weight of reinforced steel should be from ½ % to 1% of the weight of foundation.

- foundation bolts of specified size should be used and surrounded by a pipe sleeve with an inside diameter of at least (3) times the diameter of the anchor bolt and a length 18 times the diameter of the bolt. NO foundation bolts shall be less than 12 mm diameter.