ISSUE 3

Know Where You Stand When Designing Grout Installations

THE Foundation Report ©

Technology from the Leaders in Foundation Repair and Regrouting

The four common methods of installing compressors in the order of increasing foundation load requirements are shown in **Table 1**. Static load ranges shown in the first column are relatively low compared with the strength of the supporting concrete. What complicates the situation is the combination of additional anchor bolt load and dynamic load, the progressive lowering in the strength of epoxy grout as temperatures rise, and the loss of load-bearing area due to rising of entrained air in the grout.

Skid mounting is the result of an equipment-packaging concept where partial erection of the compressor and its related equipment can be carried out under shop conditions where quality control can be closely monitored. This concept is ideal for equipment destined for offshore or remote locations where accessibility and accommodations are limited or where skilled manpower is not available. Packaging works well on portable units in the lower horsepower range.

Job-site skid installation is progressively more difficult with increasing compressor size because of the number of structural members required. Most packagers do not provide access holes to permit grouting of internal structural members. Those internal "I" beams, anchored to the equipment above, are critical. Consequently, with typical factory design, grout placement must be accomplished from the edges of the skid. Placement of grout prepared to the proper consistency is difficult, and often the critical members are left unsupported. When this occurs, a suspension-bridge effect is created, allowing excessive vibration to occur when the equipment is operating. The obvious solution to this grouting problem is to cut access holes in the field.

Most compressors leak oil. Oil degradation of cement grouts and concrete has long been recognized. With this in mind, skids which are to be permanently installed, should be installed with epoxy grout. Bond strength of epoxy grout helps to anchor internal structural members which have no anchor bolts in the concrete.

The embedment method of installing machinery is by far the oldest method. For short-crankshaft gas-engine compressors in the middle horsepower range, this method is preferred because it provides a "key" to resist lateral movement. On long-crankshaft equipment in the higher horsepower range, thermal expansion of the foundation may cause crankshaft distortion problems. Foundation expansion is uneven due to heat losses around the outer periphery of the foundation and results in center humping. Some authorities feel the effects of humping can be avoided by installing the equipment on rails or sole plates.

Exercise caution when installing equipment on sole plates — grout properties are taxed to the absolute maximum when sole plates are designed for static loads in the 200 psi range and then installed under equipment with high oil temperatures. This is particularly true during the first few hours of operation until the grout passes through its period of secondary curing.

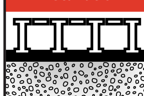
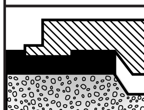
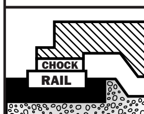
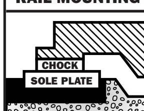
Rails should be as short as possible and all rails and sole plate corners should be rounded to a 2-inch radius to minimize stress risers in the grout. In recent years there has been a concerted effort to replace steel chocks with epoxy chocks. This involves the use of liquid epoxy grout which is poured in place and, after curing, forms a non-metallic chock. One of the alleged advantages of this method of installing machinery is that it is not necessary to have a machined surface on the engine base in contact with the chock.

In integral gas-engine compressors, cyclic lateral forces, created primarily by the compressor stages, are involved. On some compressors, the lateral forces are so great that the engine base is fretted by steel chocks. It stands to reason that epoxy chocks would be much less abrasion resistant than steel chocks.

Physical properties of epoxy mortars change dramatically as temperatures rise. Of particular importance is the lowering in compressive strength and modulus of elasticity.

Table 1:

Typical loadings for the various methods of installing compressors

Type of installation	Typical static load from equipment weight on load-bearing surface[1]	Typical total load on load-bearing surfaces[2]	Minimum comprehensive strength of epoxy grout at operating temperature necessary to prevent creep
 SKID MOUNTING (equipment not shown)	5-10 psi	50-100 psi	300 psi
 BASE EMBEDMENT MOUNTING	20-40 psi	200-400 psi	1200 psi
 RAIL MOUNTING	50-100 psi	500-1000 psi	3000 psi
 SOLE PLATE MOUNTING	100-200 psi	1000-2000 psi	6000 psi

[1] *Data are calculated from weight of equipment and do not include additional load due to anchor bolts.*

[2] *Total load estimate is the sum of static load + dynamic load + anchor bolt load.*

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