Packing

Components are placed in a steel box with a spacing of approximately 25 mm (1.0 in.) between the components. The box can be sealed with clay to contain the liberated gas. Intimate contact between compound and workpiece is not necessary; however, when properly packed, the compound will provide good support for the workpiece. The layer of compound surrounding the work must be heavy enough to allow for shrinkage and to maintain a high carbon potential during the entire cycle, but not so heavy as to unduly retard heating of the workpiece to carburizing temperature. If the container can be designed to conform to the shape of the workpiece, the compound will be of both uniform and minimum thickness.

Work-load density —that is, net weight (piece weight) divided by gross weight (weight of the carburizing container, compound, and workpieces)—is an important factor in the efficiency of pack carburizing, because it affects heating and cooling time. The smaller this percentage, the lower the relative efficiency of the process. Table 3 shows work-load densities for three different carburized parts.

Table 3 Work-load densities in pack carburizing

Part	Dimensions[(a)]				Weight per piece				Net weight, % of gross weight
	OD		OA		Net		Total[(b)]		
	mm	in.	mm	in.	kg	lb	kg	lb	
Roll	75	3	1220	48	37	82	72	159	51
Crane wheel	560	22	125	5	130	287	150	331	87
Gear	660	26	205	8	285	628	440	970	65

(a) OD, outside diameter; OA, overall (axial) dimension.

(b) Total weight of work plus packing material plus container, divided by number of pieces in pack

Procedure. Packing of the workpieces in a compound is a dusty and disagreeable operation (one of the reasons this process is losing favor in industry). For this reason, grouping of boxes, workpieces, and compound should be carefully planned so as to minimize handling of the compound. If possible, workpieces should come to the packer already stacked and sorted, preferably on open trays or in pans.

First, a layer of compound from 13 to 50 mm (½ to 2 in.) deep is placed in the empty box. The part or parts are then stacked in the container, and, if necessary, metal or ceramic supports or spacers are applied and internal container supports are inserted.

Whenever possible, workpieces should be packed with the longest dimension vertical to the base of the container. This is extremely important in processing long parts such as shafts and rolls because it minimizes the tendency of these parts to sag. Suspension of the work within the container or within the furnace is useful in minimizing distortion in relatively thin or delicate parts. For applications where small teeth or small holes are to be uniformly carburized, a 6- or 8-mesh material should be used to ensure good filling.

After the compound is sufficiently tamped, a final layer is placed on top of the parts. The thickness of the top layer varies according to the type of work, depth of case, type of container, and shrinkage rate of the compound, but it should be adequate to ensure that the work will be covered after shrinkage and other movements have occurred. A minimum depth of 50 mm (2 in.) is recommended. In the final step, the lid is put in place.

Process-Control Specimens. To control and evaluate the carburizing process, test pins or shims normally are included in the charge. To provide valid results, section sizes and locations of test specimens must closely approximate those of the workpieces. Placing a test pin close to a workpiece often will produce a thermal history identical to that of the workpiece.

For control purposes, many containers are equipped with a test-pin section that can be removed from the load during the carburizing cycle. After the pins have been quenched and fractured, case-depth readings made on them aid in evaluating whether satisfactory carburizing results are being obtained and in determining when the prescribed case depth has been attained.