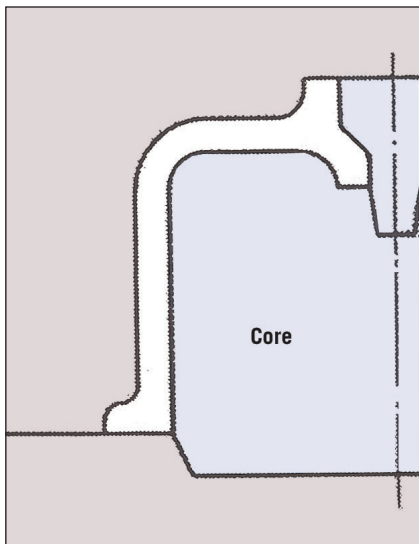


## Understanding Pattern Draft

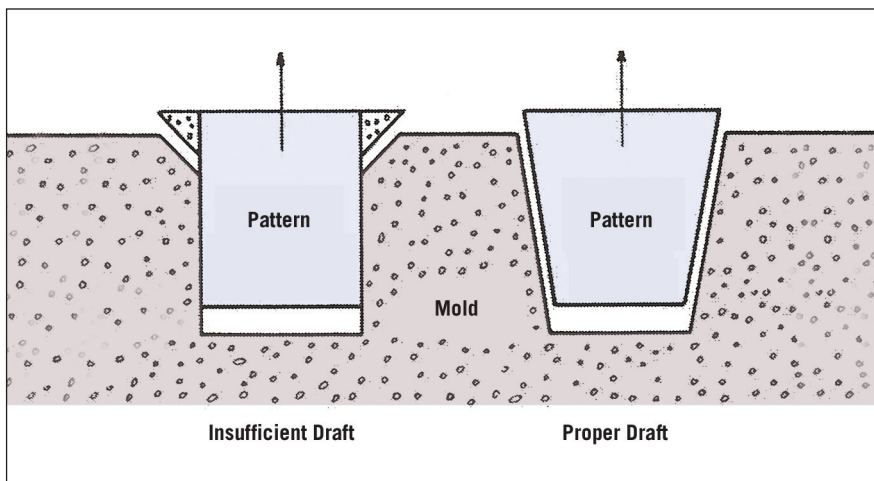
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Except for molds made with expendable patterns, such as lost foam and investment casting, all molds are separated into two or more parts, which allows the pattern to be removed from a sand mold without damaging the mold and castings to be removed from a reusable permanent mold without damaging either the casting or the mold. Draft allowance or taper enables the pattern to be removed from the mold more easily. But if this is not practical to the part's function, cores or loose pattern pieces commonly are incorporated into a mold design to enable pattern withdrawal. These shaping accessories will increase the cost of making the part, but it is possible to achieve a balance between end-use requirements and process requirements to determine a cost-effective casting design.

Draft is the taper on casting surfaces perpendicular to the parting plane of a pattern (Fig. 1). The designer does not have to be concerned with parting lines or draft when establishing the concept of a casting, but before the pattern is constructed, he or she may give input in how to position the casting in the mold.



**Fig. 2.** A core allows casting sections to be made without draft.



**Fig. 1.** Pattern draft is the slight taper on surfaces perpendicular to the parting plane that allows the pattern to be withdrawn without damaging the mold.

Often, the taper or draft can be advantageously incorporated into the part's design. In general, the position of the casting in the mold and where the parting line will be are determined before the details of another draft of the part design are developed. This way, the parting line and draft can be incor-

porated in a way that may improve the overall design of the part for reduced cost or better functionality.

If improper draft is provided, production problems can arise. In sand casting, too little draft on surfaces perpendicular to the parting line makes it difficult to compact the sand properly against the pattern and remove the pattern from the mold. This can result in a rough casting surface or mold damage. Adequate draft or taper is necessary on surfaces perpendicular to the parting line, especially in an interior pocket.

Pattern engineers always add pattern draft—typically of 0.5-2 degrees) to the drawing dimensions unless specific instructions are given to the contrary. Polished metal matters and automatic molding require less draft than wood patterns and hand molding.

Any surface can be cast without a draft through the use of cores, although this will increase the cost to make the part (Fig. 2). If it is possible to design a casting with a minimum of vertical surface load taper on side walls and ribs, then neither extra draft nor cores are needed (Fig. 3).

**ECS**