Process Overview

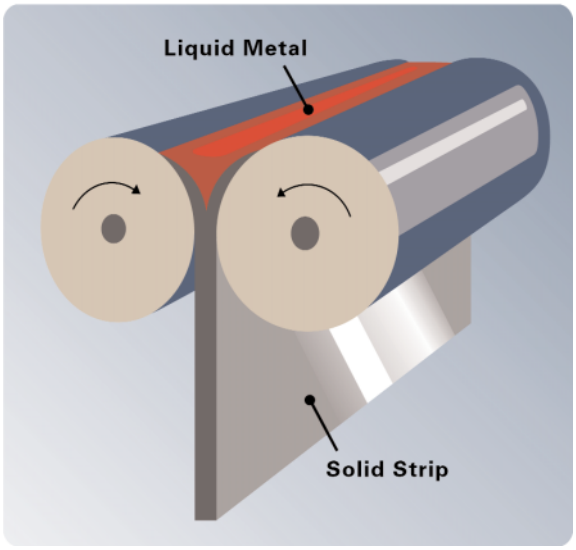
The Castrip® process is a major technological breakthrough for producing flat-rolled, carbon and stainless steel sheets at very thin gauges. The process is based on Sir Henry Bessemer's 1857 concept of twin roll casting, which has proven very difficult to bring to commercial reality...until now. Castrip technology allows steel makers to produce thin flat-rolled products in far fewer process steps, saving money on both capital outlay and operating expenses. And by casting steel at or near its final dimensions, tremendous savings of time and energy can be achieved.

Process Fundamentals

The twin roll casting process shown in Figure 1 uses two copper water-cooled, counter-rotating rolls. A refractory core nozzle (not shown) is positioned between the rolls to distribute molten steel into the melt pool. Side dams are positioned at each end of the rolls to contain the melt pool (also not shown).

Figure 1

Twin Roll Casting



Starting at the first point of contact between the rolls and the molten steel, solidification begins and continues as the rolls rotate downwards. Two individual steel shells are formed, one on each roll. The shells form one continuous sheet when they are brought together at the roll nip or kissing point. This steel strip is guided through pinch rolls and a hot rolling stand, where it is reduced to the desired dimensions, typically between 0.7 and 2.0 mm. (See Figure 2 for a complete diagram of the Castrip process. The typical layout of a Castrip plant is illustrated in Figure 3.) Water-spray cooling reduces the steel from its rolling temperature to a temperature suitable for coiling.

Figure 2

The Castrip® Process

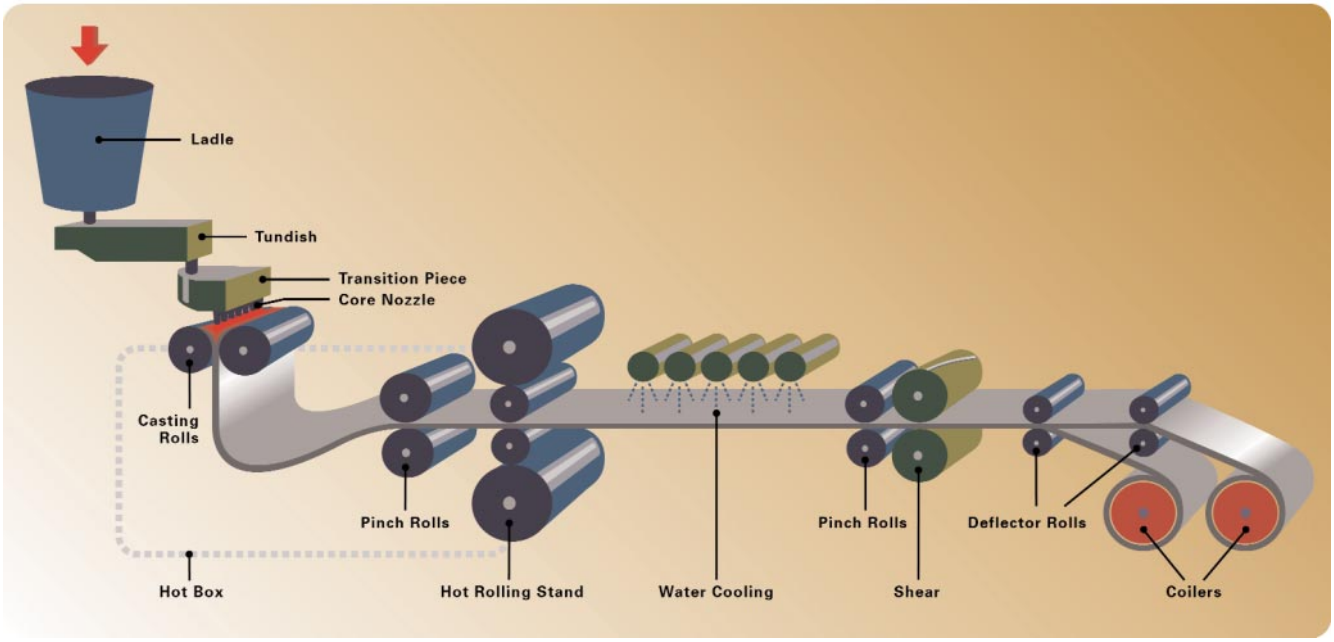
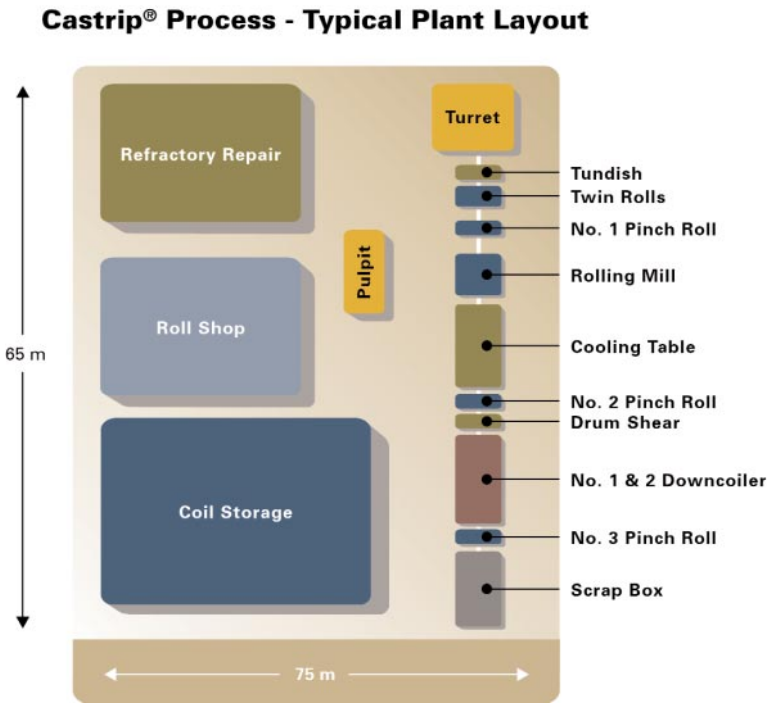


Figure 3



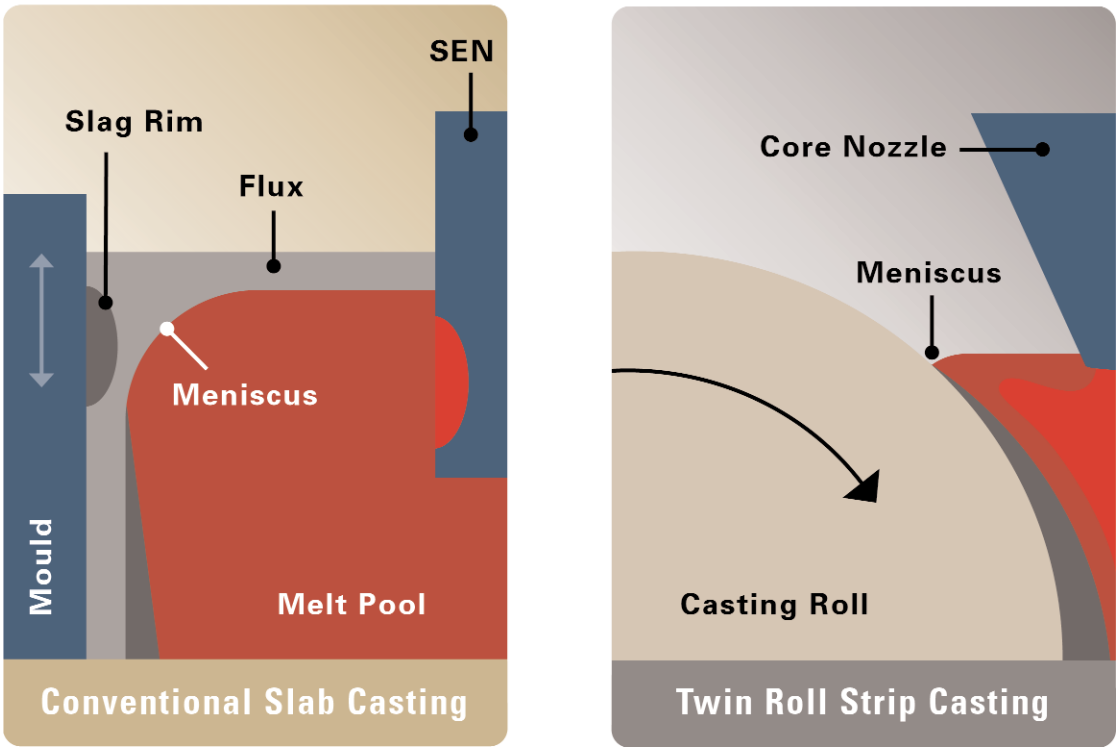
Process-to-Process Comparison

The Castrip® process represents a step-change over conventional thin slab casting of steel products in almost every aspect of operations - in fact, most characteristics are an order of magnitude different from comparable values from slab casting. The solidification event is completed in a shorter amount of time, the casting speed is much faster, heat fluxes are tremendously higher and the product is thinner.

Unlike slab casting, the Castrip process does not utilize any form of lubrication between the roll surface and the molten steel. Further, oscillation of the mold is not used and intimate contact is maintained between the solidifying shell and the roll. This allows for greater heat transfer, which dramatically reduces the solidification time to just 0.15 seconds, compared with 1070 seconds for conventional casting. (See Figures 4 and 5 for direct quantitative comparisons.)

Figure 4

Melt Pool Comparison



Castrip® Process Fundamentals

Figure 5

Parameter	Castrip	Thin Slab	Thick Slab
Cast Thickness (mm)	1.6	50	220
Casting Speed (m/min)	80	6	2
Ave. Mold Heat Flux (MW/m²)	14	2.5	1.0
Total Solidification Time (s)	0.15	45	1070
Ave. Shell Cooling Rate (°C/s)	1700	50	12

In addition to the differences in solidification, the subsequent processing of the strip is inherently different between the two processes. Whereas Castrip products are cast less than 2 mm thick and can be rolled to less than 1 mm in-line with one rolling stand, conventional processes require 5 to 7 stands in a hot mill plus a cold rolling mill to achieve the same product thickness. Hence, the Castrip process represents a huge savings in capital equipment.