



LUBRICANTS

Webinar Executive Summary

Lubricants for the Steel Industry

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This webinar is on lubricants for the steel industry. It covers the basics of the steelmaking process, the basic parts of a steel mill, and CITGO lubricants for steel mill applications.

Steelmaking is classified as primary or secondary processes. In primary steelmaking, iron ore is smelted with coke in a blast furnace to make pig iron. It is further processed in either an open hearth furnace (not many of those still operating today) or a basic oxygen furnace to reduce the carbon content and make steel. Another primary production involves the use of a direct reduction furnace followed by an electric arc furnace to make steel. Secondary production involves the use of scrap/recycled steel to make new steel. It is done using an electric arc furnace. Secondary production is much more energy efficient and less capital intensive compared to primary production, reducing the cost of the steel significantly. However, there is not sufficient recycled steel available to produce all of the steel needed. Approximately 75% of the steel produced today is through primary production. In the basic oxygen steelmaking process, pig iron (high carbon) and some steel scrap are charged to a basic oxygen furnace where in the molten form, it is blown with oxygen to reduce the carbon content and produce steel. Alloying elements can be added to produce specific grades of steel. An electric arc furnace is used to melt mainly scrap steel using an electric arc. The composition can be adjusted by the addition of pig iron or alloying elements. Continuous casting is the process by which the molten steel is transferred from the furnace using a ladle into the continuous casting machine. The molten steel flows first to a vessel called a tundish, which controls the flow into the next stage, then through a mold to produce mainly billets or slabs. The billets or slabs are then reheated in a reheat furnace, followed by passing through a series of rolls to reduce the size/diameter and produce the desired shape, typically resulting in an increase in length. Shapes such as rebar, angle, channel, and I-beam are produced in this way. Cold rolling involves passing sheet steel through rollers at or near room temperature, and often with a lubricant (rolling oil) applied to produce a thinner sheet of steel. Certain shapes can also be formed in this way. Both the hot and cold rolling operations typically produce a finer crystal structure in the steel. There are many types of mills used to produce different shapes, including plate, rod, pipe, structural shapes, rail, etc.

Since primary steelmaking requires coke for smelting, many primary steel mills have on-site coke ovens. Coal is heated in the absence of air/oxygen, producing a hard, gray, porous material that is almost pure carbon with very few impurities. The coke is then used in the smelting process to turn iron ore into pig iron that is used to make steel. A sinter plant is used to form nodules that are suitable for use in a blast furnace from iron ore fines. The fines cannot be charged to the blast furnace directly. Sintering the fines reduces waste and pollution and improves the steelmaking economics. The blast furnace is used in the process of smelting iron ore to make pig iron. The ore, coke, and flux (often limestone) are fed into the top of the furnace, and molten pig iron and slag are withdrawn at the bottom. An electric arc furnace heats scrap/recycled steel with an electric arc. The electrodes are made of high-purity graphite. The arc comes into direct contact with the scrap steel, causing it to melt. 100% recycled steel can be used to produce new steel products. Electric arc furnaces are used extensively in mini mills. Other parts of a steel mill include continuous casting, hot rolling mill, cold rolling mill, shear (to cut the steel to the desired length) and a cooling bed where the red-hot product can cool sufficiently for stacking and storage.



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CITGO offers a complete line of products for the steel industry. The EP Compounds, especially EP Compound 220, are used widely in the gearboxes in steel mills, such as the rolling mill stand gearboxes. For gearboxes that operate in more extreme conditions, especially higher temperature, CITGEAR Synthetic EP Gear Fluids are recommended. Those PAO-based fluids offer excellent thermal and oxidation stability and can provide extended service life. The CUTGEAR Synthetic HT Fluids are PAO-based non-EP fluids for use in worm gear drives and blowers. CITGEAR Synthetic PAG Gear Fluids offer improved energy efficiency compared to mineral oil or PAO based fluids. They are also recommended for the lubrication of worm gears. CITGEAR XCO Oils have excellent oil/water separation properties. They are used in the high speed rod mills made by Danielli and Morgan (Siemens AG). The Pacemaker SD oils exceed the requirements of the Siemens AG Morgoil® Advanced Bearing Lubricant “Super Demulsibility” specification. CITGO FR WG-40XD is a Factory Mutual (FM) approved water-glycol based fire-resistant hydraulic fluid. It has excellent fire resistance due to the product containing approximately 40% water. It is suitable for use at pressures up to 3500 psi. The product must be monitored and the water concentration adjusted to maintain the fire resistance property. Lithoplex ST 1 and 2 are mineral oil based lithium complex greases designed for the steel industry. The base oil viscosity is 440 cSt @ 40°C. The products are excellent general-purpose steel mill greases and are dyed green for easy identification. The SynDurance ST Synthetic Greases are offered in NLGI 1 and 2 grades with base fluid viscosities of ISO 220 or ISO 460 (four products in total). These smooth adhesive lithium complex greases containing PAO base fluids offer outstanding low-temperature pumpability for those cases where the grease must be pumped over long distances in cold climates. They are dyed purple for easy differentiation from other products. Charts are provided that list multiple process machinery applications in steel mills and the products that are typically recommended for them.