INTRODUCTION
Fire hazards are a constant presence in the steel
industry, and steel producers continuously look for
ways to lower these risks in their plants. In terms of
using fire-resistant lubricants to lower the chance
of fire, efforts have always concentrated on utilizing
hydraulic fluids; however, recently these efforts have
shifted towards fire-resistant grease. In the past, there
were various reasons for why the focus was not on
grease as a way to reduce fire-hazards:
» Minimal fire incidents with grease
» No intention to go public with fire risk issues
» No standardized measures or definition of
fire-resistance for grease

CHOOSING THE RIGHT GREASE FOR THE
APPLICATIONS CAN LEAD TO A MORE PRODUCTIVE
WORK ENVIRONMENT
An integrated steel plant can be split into four major
groups:
1. Iron Making
2. Steel Making
3. Rolling and Finishing
4. Auxiliary Units
With these major groups comes various equipment
and operating conditions, which include extreme
loads; low and high speeds; severe temperature
changes; and dusty, humid (often acidic)
environments. Because of these variables, the
lubrication needs can be a major challenge, and
require a wide range of lubricants.

The iron making section of the mill includes a raw
material blending, blending yard, beneficial plant,
sinter plant, coke ovens, and blast furnaces. The
equipment used in this area works under high
temperatures, and in a corrosive and dusty (abrasive)
environment. Additionally, crushing and screening
equipment are also present. Although this equipment
operates at slower speeds than the other operations
involved in iron making, they are still subjected to
heavy shock loads.

The steel making area includes blast furnaces,
continuous casters, and a lime plant. The typical
operating conditions are very similar to the iron
making process, but water ingress is an additional
parameter.

The rolling and finishing processes are done in the
hot strip mill, cold rolling mill, primary boom bar mill,
bar and wire rod mill and merchant mill. In this area,
heavy shock loads, water and scale ingress, high
temperatures and higher speeds are the dominating
operating conditions.

Lastly, the auxiliary units in an integrated mill, such
as a deslagging device, scrap disposal device,
ladle demolition stand, and maintenance stands
for ladles, are found in all the major areas, and can
be subjected to the various operating conditions
previously mentioned.

The variety of lubricants needed to cover the areas
of an integrated mill all consist of mineral and/or
synthetic base oils. The lubricants are considered
flammable, as they do not contain any water.
Fire-Resistant Greases: Introducing QUINTOPLEX™
By Josef Barreto-Pohlen, Grease Technology Manager

Approximately three quarters of the lubricating grease in an integrated steel plant are used in the continuous caster and the hot mill. The main function of the grease is to protect the bearings by sealing against water and dust ingress. To do this, a constant flow of grease is needed to ensure the forming of a grease collar outside the bearings. Without the collar, there is a risk of grease dropping onto a flammable surface, which increases the risk of fire.

As mentioned previously, using a fire-resistant hydraulic fluid to reduce the risk of fire is a preventative measure already done in a steel mill. However, the use of a fire-resistant grease as a preventative measure against fire is a new initiative. Quaker Chemical Corporation (“Quaker”) already offers a full line of fire-resistant hydraulic fluids, under the QUINTOLUBRIC® brand name.

The proprietary technology of the base fluids used to formulate QUINTOLUBRIC® fire-resistant hydraulic fluids has now been successfully transferred into a lubricating grease. This new fire-resistant grease line is marketed under the brand name QUINTOPLEX™.

HOW DOES QUINTOPLEX™ WORK?
For a fire to start and evolve, it must have four elements present known as the Fire Tetrahedron:
1. Heat
2. Fuel
3. Oxygen
4. Uninhibited chain reaction

Once a fire has started, it can spread in three different ways (National Fire Protection Agency, 2008):
1. Conduction: The passage of heat energy through or within a material because of direct contact
2. Convection: The flow of fluid or gas from hot areas to cooler areas
3. Radiation: Heat traveling without objects or gases carrying it along
Once the fire has spread, there are four ways to put it out:

1. Cool the burning material
2. Exclude oxygen
3. Remove the fuel
4. Break the chemical reaction

You may be wondering where QUINTOPLEX™ grease fits into this.

QUINTOPLEX™ fire-resistant grease has a very low vapor pressure, which means it removes fuel, one of the elements needed to start a fire based on the “Fire Tetrahedron”. By removing the fuel element, the risk of a fire starting is reduced.

Grease suppliers may use different terms to describe a grease that stops the perpetuation of fire. Commonly used terms are fire-resistant, flame retardant, noninflammable, self-extinguishing, and heat-resistant. All of these terms have similar meanings, which are described in more detail below.

- **Fire-resistant**: The grease is difficult to ignite and burns only at very high temperatures and needs an additional energy source to keep burning
- **Flame-retardant**: The same as fire-resistant
- **Noninflammable**: The grease does not burn under normal conditions; noninflammable greases are only those based on perfluor-compounds. All other products can and will burn when heated up to a certain temperature
- **Self-extinguishing**: The grease starts to burn, but doesn’t continue to do so for several reasons. It does not produce enough energy to keep the temperature at a burning point, and the reduced fuel means as low volatility as possible, with the removal of oxygen and the production of inert gases such as carbon dioxide
- **Heat-resistant**: This indicates whether a grease can withstand oxidation (ageing); not every fire-resistant grease is also heat resistant and vice-versa
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Unlike hydraulic fluid, there is no standardized test available to determine the fire-resistance of a grease. However, to demonstrate the level of the QUINTOLPLEX™ fire-resistant grease, Quaker uses two in-house tests detailed below.

1. A torch flame is held to the grease to see if it will ignite

2. The grease is placed on a hot ceramic disc (815°C/1,499°F)

In addition to being fire-resistant, QUINTOPLEX™ grease offers a number of benefits that also make it an option for any application in a steel plant.

» Wide operating temperature range
» Various viscosity grades available
» With and without solid lubricants
» Biodegradable

CASE HISTORY: ONE STEEL PRODUCER’S APPROACH TO FIRE SAFETY

In the hot mill at one major North American steel producer, slag was falling off the 2,300°F (1,260°C) steel bars as they exited the hot strip walk beam furnaces, causing excess grease on the bearings to catch on fire. The steel producer, who was always looking for ways to improve their operations and employee safety, contacted Quaker to develop a fire-resistant grease that could be used on the roller bearings to reduce the amount of slag fires.

Quaker first leveraged our technology that was originally developed for a mining application, and proposed QUINTOPLEX™ LXS 1002-EP grease for use on the hot mill. Before introducing QUINTOPLEX™ into their operation, the steel producer challenged the fire-resistant properties of the grease by exposing it to open flames and extremely hot metals. QUINTOPLEX™ passed all of the tests that were performed, resulting in its introduction into the hot mill lubrication system.
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Since running their system with the fire resistant grease, the mill has realized the following benefits:

» 90% reduction in fires
» Removal of the continuous water supply
» Reduced corrosion on the roller bearings

KEEPING OPERATIONS RUNNING SMOOTHLY
Mill operators should work with a grease supplier who has the expertise to offer technical advice to help evaluate situations, and who can offer realistic solutions to solve problems ranging from production efficiency to worker safety. At a minimum, grease manufacturers need to provide sustainable product solutions that require less volume and reduce energy during use, in order to bring real value to the customer.