Forging operations:

Forging is a manufacturing process that shapes metal into a desired form by hammering, pressing, or rolling it. The process involves heating the metal to a specific temperature and then deforming it plastically with a hammer or die.

Types of forging processes:

- **Closed die forging**

The heated metal is placed in the bottom die, and the top die is moved towards it to form the part.

- **Open die forging**

The metal is compressed between two flat dies, allowing it to flow laterally. This process is often used to produce larger, simpler parts like bars, rings, and hollows.

- **Seamless rolled ring forging**

A hole is punched in a thick, round piece of metal, then it's rolled and squeezed into a ring. This process uses curved dies instead of flat dies.

- **Roll forging**

Also known as roll forming, this process uses opposing rolls to form the part.

Hazards in forging operation

The most common hazards of forging are burns and smoke/gas poisoning. Working in an industry where smoke or gas are in the surrounding atmosphere all day is damaging, but protective clothing and equipment can reduce this possible damage slightly. It is key to take frequent breaks in the fresh air.

Other possible hazards include:

- Cuts and scrapes
- Crushed fingers
- Sight or hearing damage

- Repetitive strain in the elbow
- Knee strain (due to standing for long hours)

Preventative maintenance of forging machines:

- **Follow manufacturer's specifications**: Use the type and amount of lubricant recommended by the manufacturer.
- **Change lubricants regularly**: Replace lubricants at the recommended intervals to ensure smooth operation.
- **Monitor for contaminants**: Dirt and other foreign particles can decrease the machinery's efficiency.
- **Stock key items**: Stock key items like main gears, eccentric shafts, and rams to avoid long lead times for replacement.
- **Schedule regular inspections**: Schedule and record regular inspections of guards and point of operation protection devices.
- **Train personnel**: Train personnel for the proper inspection and maintenance of forging machinery and equipment.
- **Fasten overhead parts**: Ensure that all overhead parts are fastened or protected so that they won't fall off or fly in the event of failure.

Safe work practices in forging operations:

- Properly maintain the hammer or press. Make sure all nuts and bolts are tight; Make sure you have proper lubrication.
- On a press, if you have leaks, fix them. Hydraulic oil is flammable.
- Make sure that any operator has proper training prior to using the machine.
- Wear proper eye protection & use ear protection.
- Wear safety shoes and proper clothing & verify the dies are tight before forging.

- Always have a clear path between the forge and the hammer and in the workspace around the hammer.
- Use the proper size tongs for holding hot steel.
- Never allow by standers to be close to the hammer when operating the hammer.
- Make sure they also have proper safety equipment as hot sparks can fly.
- Keep hands clear of the moving parts.
- Make sure the hammer is properly secured to the foundation.
- Keep belt guard and other safety guards attached to the hammer or press.
- Know where the shut-off switches or valves are.
- Never "cold forge" or hit the dies together without steel at forging temperature between them.
  Try to hold the work piece parallel with the die surface. If the work piece is at an angle, it can "kick up" and hurt you.
- Hold the tongs to your side, not pointing into your stomach when forging.
- Make sure your shop is properly ventilated.

Above all else, use common sense. Forging can be dangerous.

Safety in use, handling and storage of dies:

- **Remove blocks**: Always remove die storage blocks when using tooling.
- **Be careful with the handle**: Use caution when operating the handle and releasing it to engage the block.
- **Check placement**: Ensure the blocks are properly seated before setting down tooling.

- **Avoid crushing**: Be mindful of the risk of injury to your hands or feet when moving or setting down dies.
- **Clean**: Clean with a non-abrasive detergent.
- **Apply lithium grease**: Use lithium grease on the handle and sliding pins.

Safety on die changing:

When performing a die change on a press machine, safety measures include:

- locking out the machine power
- use appropriate personal protective equipment (PPE)
- Utilizing die safety blocks to support the heavy die during removal and installation.
- Carefully managing pinch points.
- Ensuring proper machine guarding

And following established lockout/ tagout procedures to prevent accidental activation while working in the die area; always prioritize proper training and awareness of potential hazards during the die change process.

Hot Rolling Mills Operation:

- The hot rolling process involves passing heated steel through a rolling mill to shape and reduce its thickness.
- The hot rolling process can:

✓ Increase the strength, toughness, ductility, formability, and weld ability of the metal.

✓ Produce new raw materials for other rolling or metal forming processes.

✓ Create uniform grain structures and volume in the final product.

Hazards in hot rolling operations:

Hot rolling mills are part of the steelmaking process and present several hazards to workers, including:

- **Burns**: The high temperatures of the rolling process can cause burns to workers who touch hot metal or surfaces.
- **Heat stroke**: The high temperatures of the furnace and working shed can cause heat stroke to workers.
- **Eye irritation**: The high temperatures of the furnace and working shed can cause eye irritation to workers.
- **Noise**: The machinery and equipment in steel production can generate high levels of noise, which can lead to hearing loss.
- **Exposure to dust**: Workers can be exposed to dust.
- **Slip and fall**: Workers can slip and fall.
- **Entanglement**: Workers can get entangled with moving stock.

Control measures for the hazards include in hot rolling:

- **Fire safety measures**

Fire suppression systems, fire extinguishers, and smoke detectors can help with fire safety. Employees should also be trained on fire safety protocols.

- **Hearing protection**

Earplugs or earmuffs can help reduce the impact of high noise levels on workers' hearing.

- **Noise assessments**

Regular noise assessments can help prevent noise-induced hearing loss.

- **Noise-reducing barriers**

Engineering controls like noise-reducing barriers can help prevent noise-induced hearing loss.

Safety in hot rolling mills:

- **Machine guarding**-Protect workers from moving parts, belts, pulleys, and other machinery with guards. Regularly inspect guards to ensure they are in good condition.
- **Personal protective equipment (PPE)**-Wear appropriate PPE, such as safety glasses, hard hats, gloves, and safety shoes.
- **Training**-Ensure workers are trained on how to safely operate and maintain the mill, including how to use PPE and emergency procedures.
- **Ventilation**-Ensure there is adequate ventilation to remove toxic fumes, dust, and gases produced by metal processing.
- **Fire safety**-Have fire suppression systems, fire extinguishers, and smoke detectors in place. Train employees on fire safety protocols.
- **Lockout procedures**-Ensure the mill is turned off and de-energized before maintenance, repair, or cleaning.
- **Material handling and storage**-Have clear procedures for material handling, lifting, and storage. Secure heavy loads properly during transportation.
- **Control settings**-Learn how to use the controls for temperature, speed, and pressure.
- **Check the material**-Look for irregularities in the material being rolled, such as cracks or surface defects.
- **Prevent slippage**-Use clamps or other securing mechanisms to keep the material in place.

Selection and use of PPE for hot work:

- **Eye and face protection**-Goggles, face shields, or helmets protect from sparks, molten particles, and intense light.
- **Hand protection**-Insulated gauntlet gloves protect from burns, sparks, heat, cuts, scratches, and electric shock.
- **Foot protection**-High-top boots or leggings protect feet from heat, burns, and electric shock.
- **Clothing**-Flame-resistant clothing and aprons protect exposed skin from heat, fires, and burns. Heavier materials like wool or heavy cotton are harder to ignite and resist wear and damage.
- **Ear protection**-Ear plugs protect ears from noise.