You said: spring relief valve

A **spring relief valve** (also known as a spring-loaded pressure relief valve) is a mechanical safety device designed to automatically protect piping systems, pressure vessels, and boilers from catastrophic overpressure events. It remains closed during normal operations and opens only when system pressure exceeds a predefined limit, safely venting fluid, gas, or steam. [1, 2, 3, 4, 5]

Working Principle

The valve operates on a simple balance of forces between fluid pressure and a mechanical spring: [1, 2]

1. **Normal State**: A compressed helical spring pushes downward on a spindle and disc (or poppet), keeping the valve tightly sealed against the seat. [1]
2. **Cracking Pressure**: As system pressure rises, it pushes upward against the bottom of the disc. When this upward force exactly equals the downward spring force, the valve reaches its "cracking pressure" and begins to crack open. [1, 2, 3]
3. **Full Discharge**: If pressure continues to increase, the spring compresses further, allowing the valve to open completely and discharge excess media at maximum flow capacity. [1, 2]
4. **Reseating**: Once the excess pressure is successfully vented and system pressure drops below the spring's force, the spring expands and pushes the disc back down to reseat and seal the valve. [1, 2]

Main Types of Spring-Loaded Valves

- **Conventional Spring-Loaded Valve**: The simplest design where the bonnet, spring, and guide are exposed to the vented fluid. Performance can be affected by back pressure in the discharge line. [1, 2, 3, 4, 5]
- **Balanced Bellows Valve**: Features a metallic bellows that isolates the spring and upper components from the fluid. It is used when back pressure is variable or high, ensuring the valve still opens at its exact set point. [1, 2, 3, 4, 5]
- **Safety Valve vs. Relief Valve**: A *relief valve* opens gradually and proportionally to the pressure increase (ideal for liquids), whereas a *safety valve* opens rapidly or "pops" fully open immediately upon reaching the set point (ideal for gases and steam). [1, 2, 3]