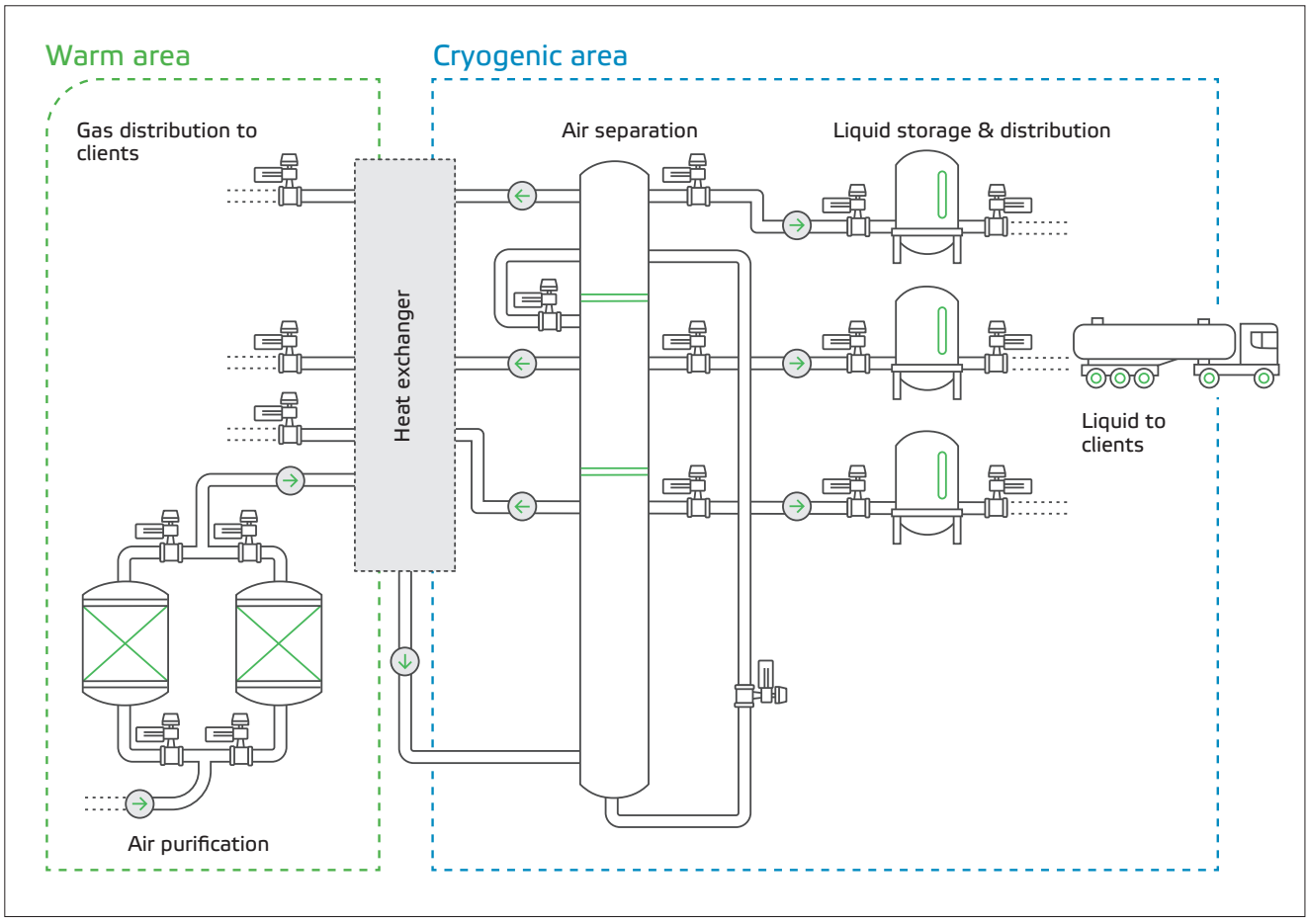
Air separation



Process overview

Air is mainly composed of nitrogen, oxygen, and argon, while also containing trace amounts of CO2, water vapor, and some noble gases. Air Separation Units (ASUs) are industrial facilities designed to split atmospheric air into its different elements. Components such as oxygen are then stored or utilized in various applications like healthcare, metal manufacturing, aerospace, and many more.

The process of an ASU relies on cryogenics and extreme cold temperatures to extract the different components. Each target element has its own boiling point, allowing separation at different temperatures throughout the process. Before reaching the ASU part of the process, the air is captured and pushed through a purification system. A molsieve or dryer-type setup is used to remove any impurities and water vapor from the air (application report reference 2723_01_01 for molsieve & 2730_01_01 for swing adsorption). Once cleared, the air is cooled to temperatures close to -184°C (-300°F), where it becomes a liquid.

The process forces the liquid through a distillation column, causing the temperature to change based on the stage in the column. Due to the differing boiling points, the target elements start to separate. Nitrogen, with a slightly lower boiling point, splits off at the top of the column, oxygen boils off next in the middle, and argon, having the highest boiling point, is collected at the bottom. Once all the separate elements are collected, they can be stored for transportation or pushed through the plant, ready for use.

Air Separation challenges / solutions

Challenges

1. Low temperature requirements – The temperature limit is often -184°C (-300°F) or lower, requiring specific constructions to withstand extreme temperature changes.
2. Material selection & compatibility – Due to the process media and temperature, both standard soft and metal materials must be compatible with the feed air and elements, carry any necessary approvals/testing, and adhere to differences in process temperatures.
3. Cleaning – Elements like oxygen often require specific cleaning procedures to ensure no external contamination enters the process.
4. Tight sealing – Both emissions and seat leakage must meet industry standards. A tight shut-off is often required for the seat, and low emission packing is needed.

Solutions

1. Valmet's standard cryogenic design – Provides a compact body that allows for rapid cooling of the media. With variable extension lengths and seal boot constructions available, the valves can be installed inside a cold box without issues.
2. Material selection – All air separation or cryogenic valves offered will be made of stainless steel and Monel materials. The soft material for sealing and emissions will be selected according to the needed temperature limitations. All materials offered will be suitable for media containing oxygen, argon, nitrogen, and CO2. Cryogenic constructions will contain approved and tested materials by BAM/WHA.
3. Special oxygen cleaning – Can be selected as an option for the valve construction. Valmet utilizes state-of-the-art clean rooms to ensure full compliance with special service cleaning requirements.
4. Cryogenic valve solutions – Come equipped with specially designed seats to allow for tight sealing under extreme temperatures. The valve's emissions are also in line with industry standards (ISO-15848).

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