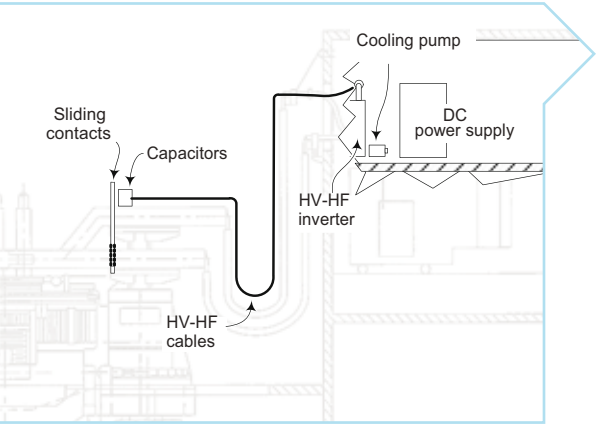
Arc Conditioner



Typical installation

Commonly used in the metals industry, especially for recycling metals, electric arc furnaces put high demands on the power grid. Their wide fluctuations in power draw cause disturbances that can impair power quality and damage equipment.

The arc conditioner is a practical, cost-effective solution to problems stemming from intensive use of arc furnaces: voltage fluctuations, inrush currents, excessive electrode consumption, equipment wear, harmonics, etc. It was initially designed by CITEQ[1] and then developed by Hydro-Québec's research institute, IREQ.

Improved performance and savings

Arc furnaces use the thermal energy of an electric arc produced between graphite electrodes to obtain very high temperatures particularly suitable for melting metal. For metallurgy operations with one or more such furnaces, the arc conditioner is a good way to cut costs.

Comprised of two cabinets and a number of passive components installed closer to the furnace (see layout), the arc conditioner helps the furnace run smoothly by stabilizing its electric arcs. This greatly improves furnace performance and reduces power system disturbances, resulting in major savings.

Stability is achieved by injecting a high-frequency current that keeps the arc alive under difficult conditions. Since arc extinctions are avoided, the furnace works much more smoothly and operating conditions are optimized. No changes are required to the furnace's main electric circuitry, so the furnace can continue working independently of the conditioner if the need arises.

This technology can be of benefit for all open- and submerged-arc furnaces operating on AC or DC, especially smelters and furnaces melting scrap steel.

[1] *Centre d'innovation sur le transport en énergie du Québec [Québec centre for innovation in energy transmission], a Hydro-Québec–Asea-Brown-Boveri joint venture*

Specifications

The arc conditioner consists of generic modules that can be cascaded as required by the specific characteristics of each furnace. A complete cascaded assembly could, for example, have the following specifications:

- Maximum output voltage: 5 to 7 kV
- Frequency: 50 to 200 kHz
- Inverter output: 100 kW (continuous), 350 kW (peak)

Advantages

- Improved productivity: A 10% increase in furnace power during the melting phase shortens the tap-to-tap time, resulting in increased annual tonnage. In addition, the more stable arc improves process control and production management.
- Improved process efficiency: Shorter tap-to-tap time means lower energy consumption per tonne and lower losses.
- Reduced electrode consumption: Operating the furnace at a higher voltage (lower current) results in about a 20% improvement.
- Reduced disturbances: Increased arc stability reduces flicker and harmonics.

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