

DANIELI DIGIMELTER Q-ONE TECHNOLOGY

Efficient energy source
for electric furnaces through
Hi-performance power unit

DANIELI AUTOMATION



QONE

A TECHNOLOGICAL BREAKTHROUGH IN THE EAF PROCESS AREA

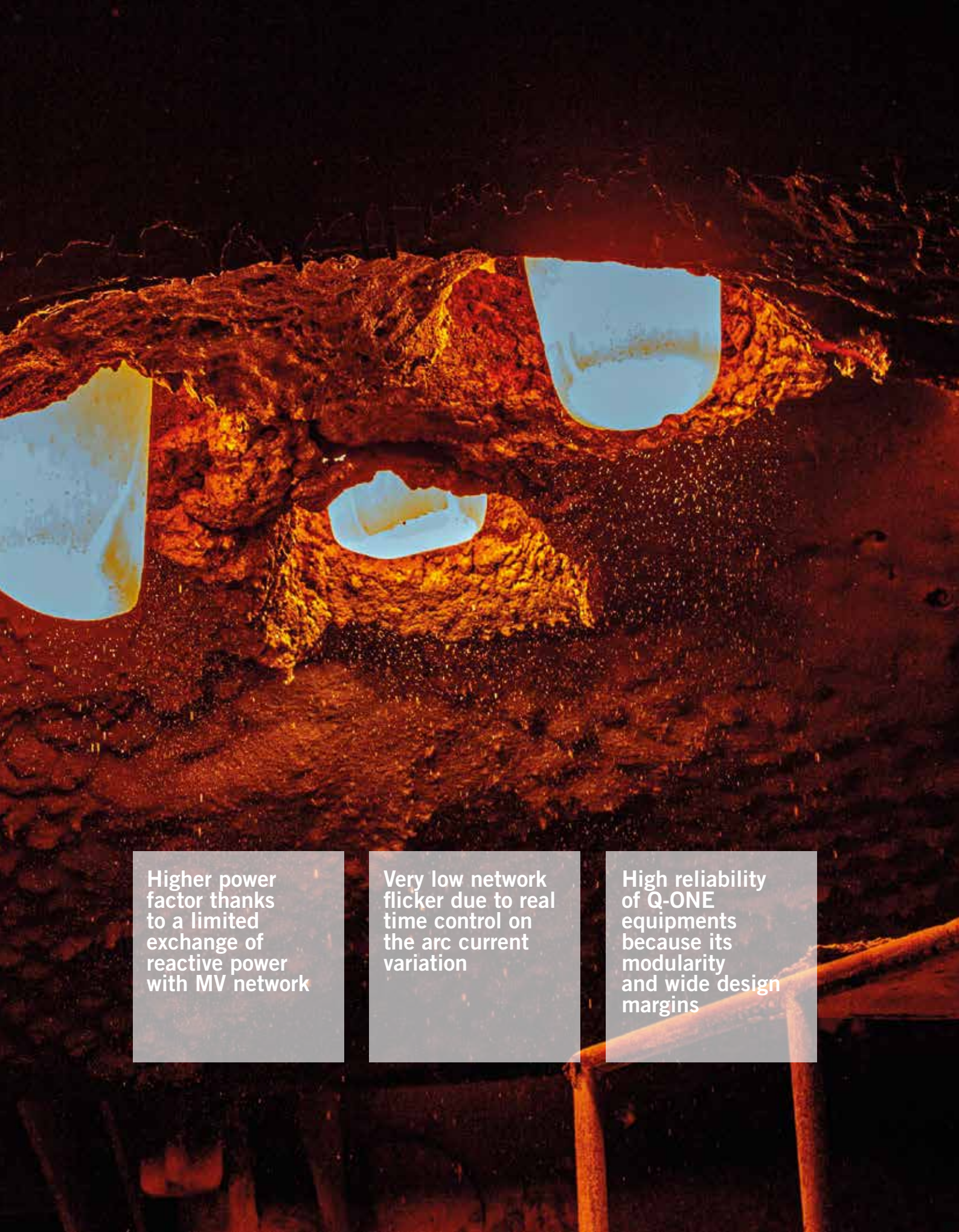
Electric Arc Furnace represents one of the most intensive disturbing loads in the electric power transmission systems, it is featured by rapid changes in absorbed power that occurs especially in the initial phase of melting, during which the critical condition of an interrupted arc may become a short circuit or a open circuit.

Actual furnaces design provides very large input ratings and due to nature of both, electrical arc and meltdown process, these equipment can generate large power quality problems on grid as non symmetric current & voltage, harmonics, flickers, voltage imbalances and drops, over voltages.

Conceived as innovative solution to supply the AC Electric Arc Furnaces, **Q-ONE** is a Danieli Automation's designed and patented equipment that uses latest power electronics technology to handle irregular loads in a more flexible and reliable way, and values of power factor close to unity. **Q-ONE** extends the Power System products range to the high-power systems used for EAF steel melting, where well-known challenges have to be addressed:

- > Hi-levels of active & reactive power absorbed from the electrical supply network in an unbalanced and untimely manner, causing huge disturbances (harmonics and flicker) affecting the proper functioning and operation of other connected loads;
- > Efficient use of energy through process optimization with great room for improvements and savings;
- > Suitability for existing EAF modernization projects, with a flexible power and control configuration to meet existing arc ratings and physical furnace shape.

The **Q-ONE** family of special power converters minimizes network disturbances, handle large load unbalances, and virtually absorb almost all active power in a balanced manner from the supply network. A specifically designed patented control system and configuration makes it possible to reduce the transients that are known to wear out the EAF components during the melting cycles, significantly reducing maintenance stops and the cost of wearable parts, and at the same time optimizing the melting process.



Higher power factor thanks to a limited exchange of reactive power with MV network

Very low network flicker due to real time control on the arc current variation

High reliability of Q-ONE equipments because its modularity and wide design margins

QONE

Impact onto the feeding network

Differently to a static var compensation system, the Q-ONE system acts onto the source of the conducted disturbances and not on their effect onto the network. The basic concept of Q-ONE is to separate the furnace working environment from the dedicated feeding network

Q-ONE flexibility

- > Extremely high speed control of voltage and current in the furnace
- > Real time control of the supply voltage of EAF
- > Real time control of the arc current thus of short circuit phenomena
- > Possibility to run the furnace with two phases only, with zero impact to network
- > Possibility to act onto the output frequency (typical 30 to 70 Hz)

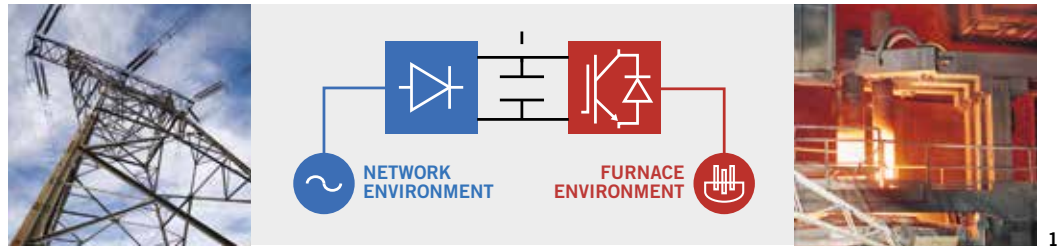
Q-ONE reliability

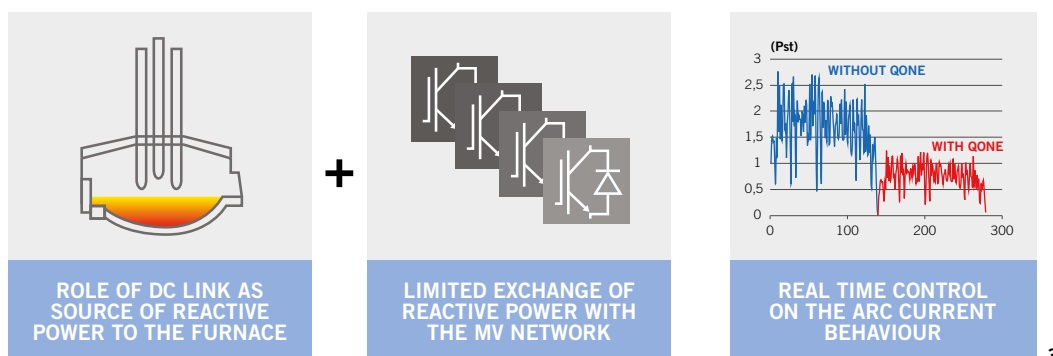
- > Rated voltage of Q-ONE equipment chosen with wide design margins;
- > Possibility to easily exclude three-phase modules in case of fault;
- > Possibility to easily exclude single units aboard Q-ONE modules in case of fault;
- > Remote control via WEB for maintenance and data monitoring.

Q-ONE layout

On request, the Q-ONE system installation can be designed with the possibility to easily switch between the existing furnace feeding system and the new one.

The existing furnace transformer can be disconnected from the secondary and moved backwards, whilst the primary side can be isolated





- 1 The Q-ONE basic concept
- 2 Q-ONE equipment and modules design (*) upgrade to 5KA under study
- 3 Impact onto the feeding network

3

by acting onto the copper bars of the feeding line
The layout of the new Q-ONE feeding system is chosen and designed to limit the impact onto the existing electrical and mechanical equipment.

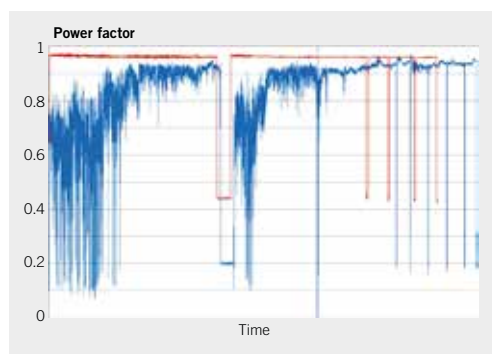
Thanks to a less installed apparent power, a consistent process energy saving is easily achievable (estimated in about 10%) with remarkable and substantial economical benefits.

Q-ONE equipment features

- > Reduced global power with respect to the equivalent furnace transformer;
- > Suitable arrangement of vector groups to highly compensate harmonics;
- > High flexibility by handling unbalanced loads.
- > Solution studied to keep AC furnace in operation with existing mechanical part;
- > High modularity inside a single phase-module and within the whole valve;
- > Suitable current redundancy;
- > Hi flexibility by settling the output voltage;
- > Easy maintenance and component replaceability (equipment components available on the market)
- > High level of safety by disconnecting and grounding the furnace load during maintenance;
- > High flexibility by disconnecting single modules of Q-ONE in case of fault.

Return of investment

In the light of the above, the ROI for a complete economical feedback is variable from country to country and can be estimated to be between 9 to 24 months.



- 4 Power factor
- Q-ONE EAF Power factor
- Transformer EAF Power factor

4

Q-ONE maintenance

The Q-ONE system with its installation was designed with utmost care to ensure simple removal of the inverter and converter units, thus guaranteeing easy inspection and maintenance of the main components.

Q-ONE savings

With the adoption of Q-ONE power converters to feed an Electric Arc Furnace, a consistent reduction in electrode consumption can be expected, estimated to be around 20%, as well as a drastic reduction in power on time, about 10%.



QONE benefits & savings

PERFORMANCE SAVINGS



>10%
OVERALL
PROCESS
ENERGY
SAVINGS



>20%
ELECTRODE
CONSUMPTION



>10%
POWER-ON
TIME



>10%
NOISE
REDUCTION
(AT CONSTANT
LEVEL)

OPERATIONAL BENEFITS



HI-SPEED
CONTROL
OF VOLTAGE
& CURRENT



HIGHER
FURNACE
POWER
FACTOR



VERY LOW
NETWORK
FLICKER



TOP
RELIABILITY
DESIGN
MODULARITY

INSTALLATION SAVINGS (due to unrequired equipment)



SERIES
REACTORS



EAF
TRANSFORMERS



SVC
STATIC VAR
COMPENSATOR



FURNACE
BREAKER

MAINTENANCE AND INSTALLATION BENEFITS



LOW IMPACT
ON EXISTING
ELECTRICAL
EQUIPMENT



HIGH LEVEL
OF SAFETY

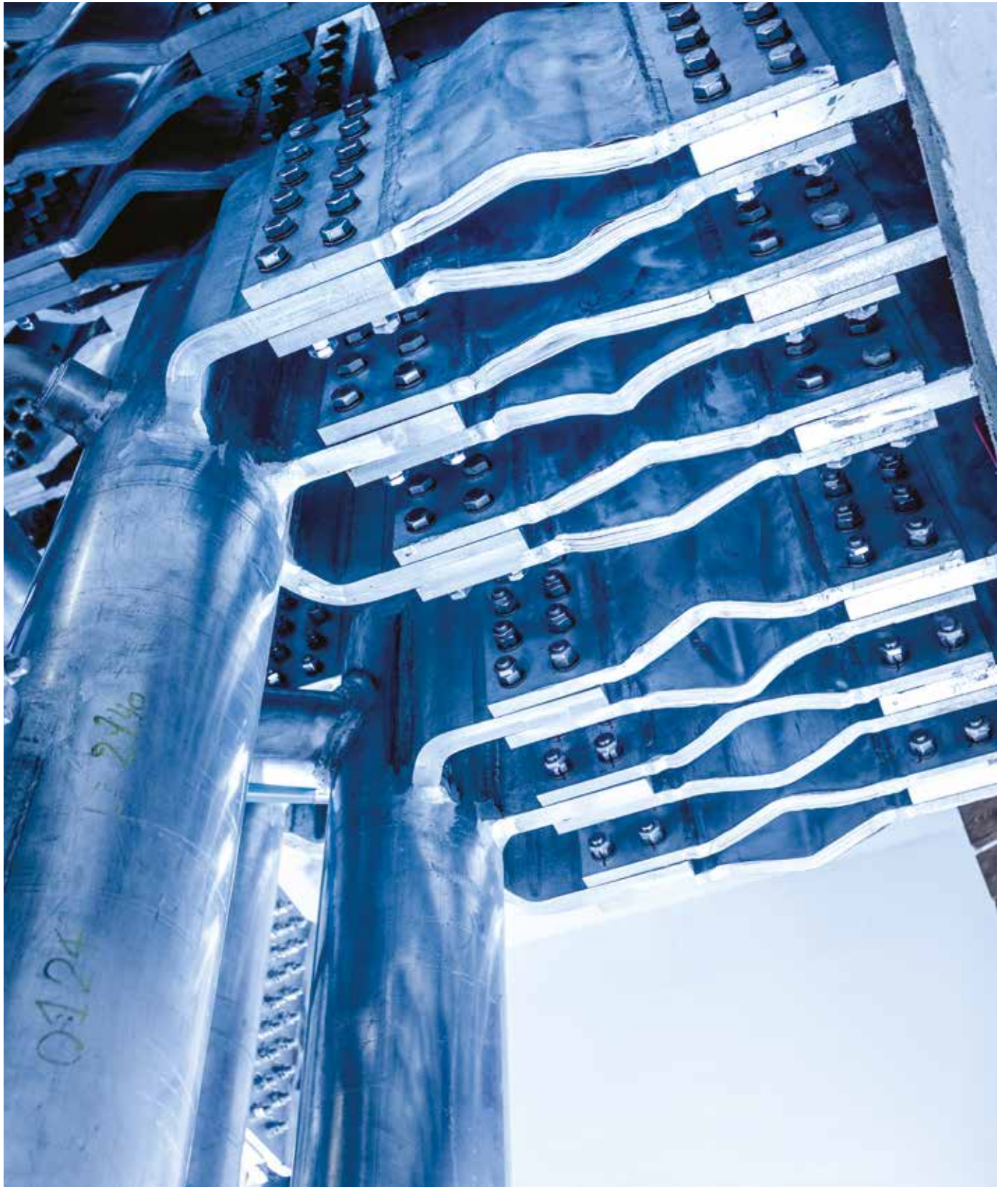


EASY
MAINTENANCE
OPERATIONS



REMOTE
CONTROL
VIA WEB





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