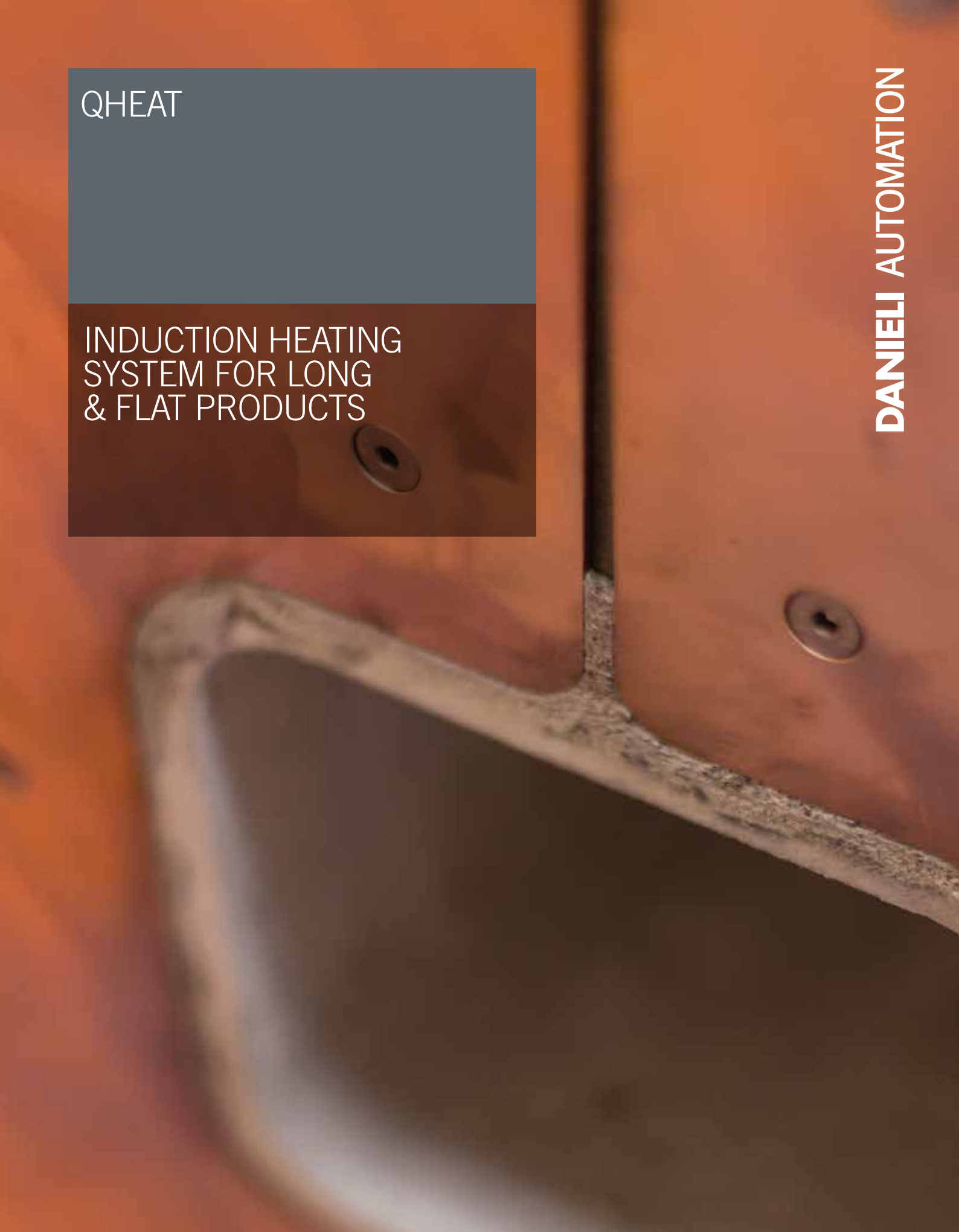
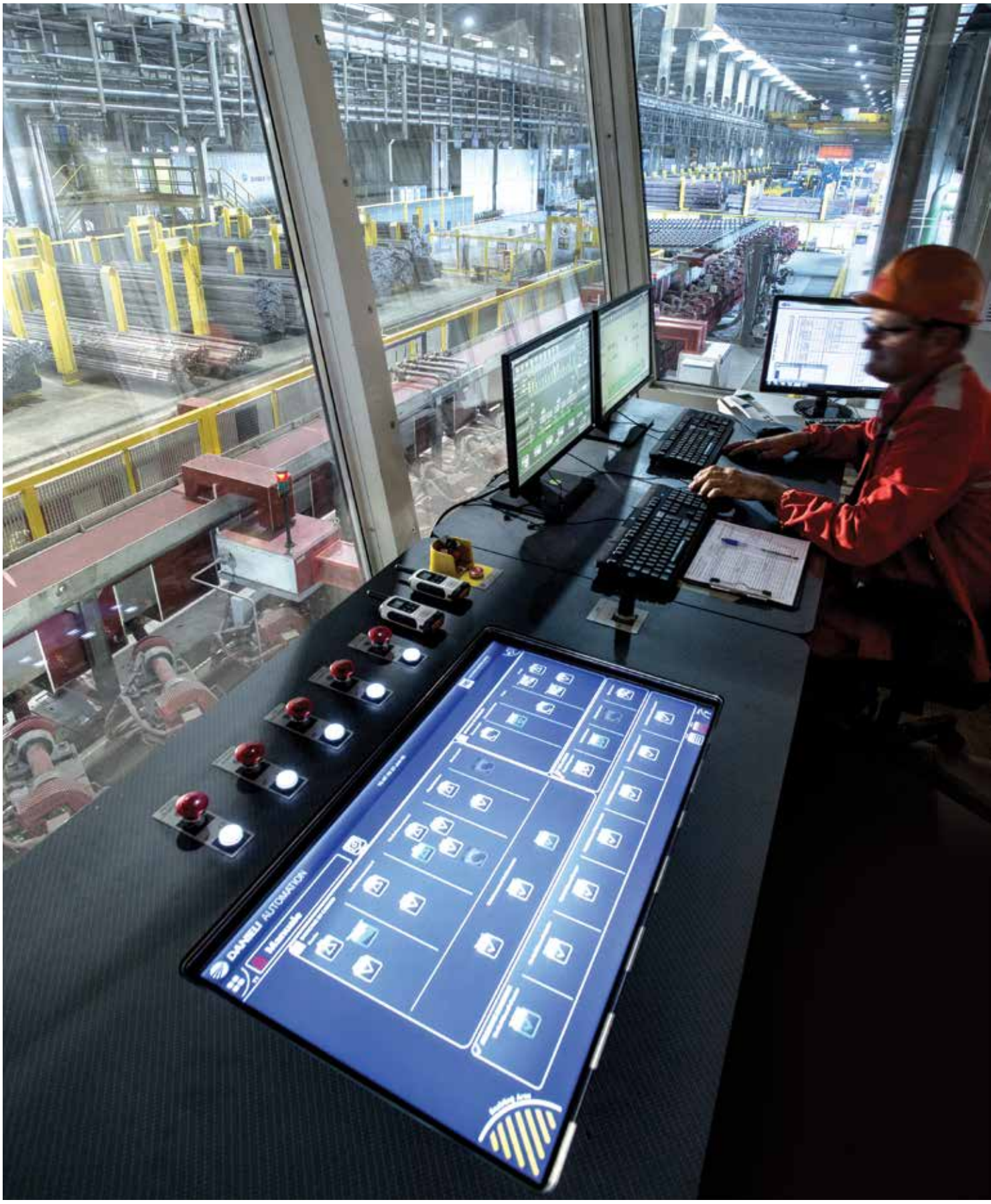


QHEAT

INDUCTION HEATING SYSTEM FOR LONG & FLAT PRODUCTS

DANIELI AUTOMATION


DANIELI AUTOMATION

DANIELI AUTOMATION QHEAT INDUCTION HEATING SYSTEM FOR LONG & FLAT PRODUCTS

Based on the experience of endless and hot charging process and the know-how in converters units, Danieli Automation has developed a new induction heating system, called QHEAT. The induction heating furnace is the most environmentally friendly solution for reaching the required rolling temperature without using gas or smoke emissions, and drastically reducing scale formation. Additionally, the induction heating furnace is ready in real time: no need for long start or stop sequences, as with traditional reheating furnaces.

QHEAT

MAIN BENEFITS
> Improved material quality
> System modularity
> Easy maintenance
> Diagnostic tools
> Remote Assistance

Operational principles
Induction heating is the process of heating an electrically conducting object by electromagnetic induction, where eddy currents are generated within the metal and its resistance leads to Joule heating.
So it is possible to heat a metal without direct contact and without open flames or other heat sources (like IR).
An induction heater consists of an electromagnet (coil), through which a high-frequency alternating current (AC) is passed.
The frequency of AC used depends on the object size, material type, coupling (between the work coil and the object to be heated) and the penetration depth.
An induction heating system is composed by an inductor (to generate the magnetic field) and a converter (to supply the inductor with a time-varying electrical current).

Advantages of Induction Heating
> Improved final product quality since the parts to be heated have no contact with direct flames, eliminating any quality issue related to open flame treatment;
> Very low scale formation due to shorter heating time than traditional gas furnace heat treatment;
> High productivity because heat is developed instantly inside the workpiece;
> Environmental friendly: induction heating does not burn traditional fossil fuels;
> Safer process thanks to the elimination of smoke, waste heat, emissions and loud noise;
> Reduced energy consumption due to a more efficient process with immediate heating availability.

Highlights of Danieli Automation QHEAT
> Independent control of each inductor to obtain a perfect temperature control and equalization between head and tail of treated material;
> Increased efficiency;
> Power factor compensation not required, due to the used converter's characteristics;
> Modularity;
> Easy maintenance and service operations;
> Remote assistance.
> Fast furnace start up and stop


DANIELI AUTOMATION

QHEAT

Highlights

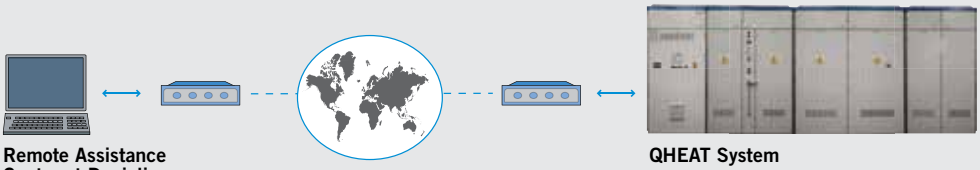
The innovative Danieli Automation induction furnace is comprised of a converter cabinet based on the most modern IGBT technology that feeds the induction coils using the capacitors' matching circuit to generate high-frequency current.

Increased Efficiency
Danieli Automation's special coil design and care to select the best materials allow for a high electrical efficiency of the heating coils. In particular, the use of premium grade copper guarantees a high quality and the best efficiency.
Particular attention is also paid to the design of low power-loss electrical connections between converters, resonating capacitor banks and heating coils. Each single coil is controlled independently in order to achieve a better tail-to-head material temperature equalization.

Modularity
A very important design detail to be highlighted is the modularity and extendibility of power equipment, and the independent power control of each power inverter to optimize material temperature equalization.
In case of failure, thanks to the system's flexibility, the inductors can be excluded one by one without stopping the process; the automation control will automatically reroute the lost power to other active power inductors.

Maintenance
As usual, all power equipment incorporates a simple and fast maintenance concept: through a detailed fault report of the entire system, maintenance workers can easily identify the cause of the failure.

All power equipment is designed for quick-change operations; for example, by using the inverter power module with wheeled frames, power capacitors are exchangeable, one by one, without involving bus bar, each internal water connection having a quick coupling or dedicated tap.



Remote Assistance Center at Danieli Headquarters

QHEAT System

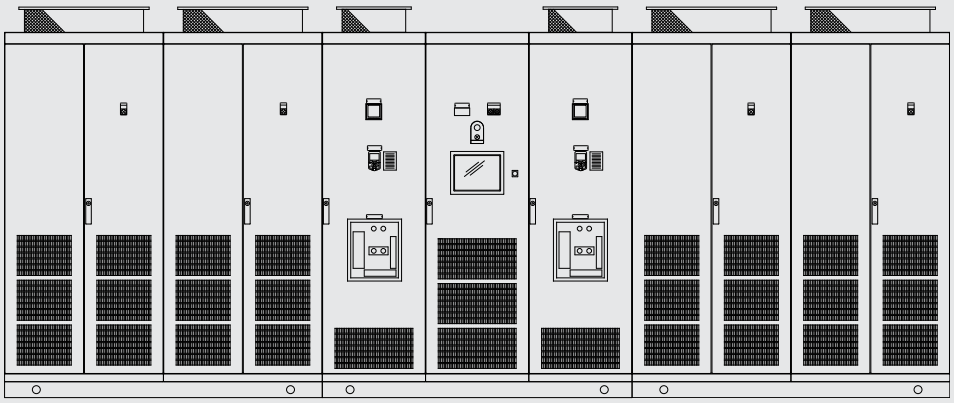
Remote Teleservice
Danieli Automation provides the Remote Teleservice, a flexible, effective service solution to reduce assistance costs and optimize intervention time.
The Teleservice is designed for connection of the QHEAT control unit with the remote assistance stations located at Danieli headquarters in Italy, troubleshooting and monitoring of the QHEAT system.

The Teleservice provides a remote non-stop service and a reliable support to quickly solve unexpected malfunctions, with the following benefits:

> Immediate intervention of a specialist at any time.
> Reduction or elimination of the specialist's travelling time and costs.
> Increased power of the internal team by accessing a virtually unlimited remote resource for problem solving.

QHEAT

Typical Cabinet layout



INVERTER UNIT #1 | INVERTER UNIT #2 | INCOMING LINE #1 | CONTROL SECTION | INCOMING LINE #2 | INVERTER UNIT #3 | INVERTER UNIT #4


DANIELI AUTOMATION

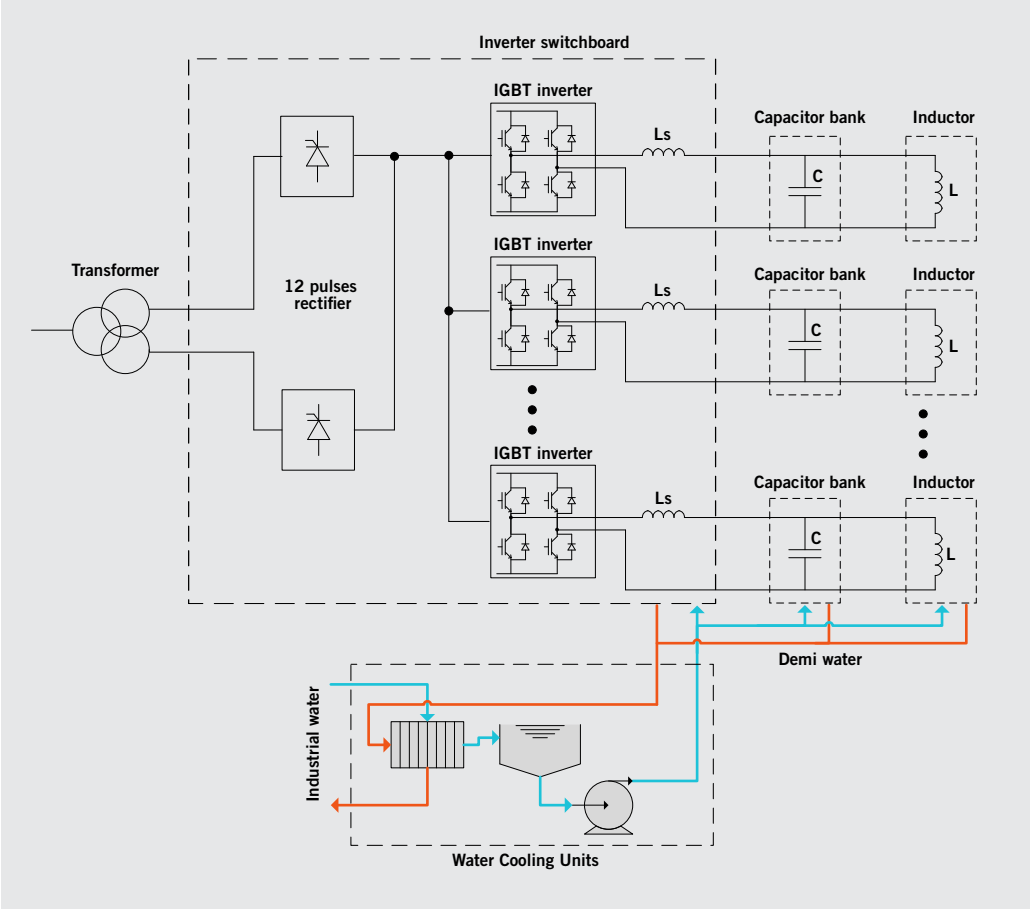
QHEAT

Power configurations & control architecture

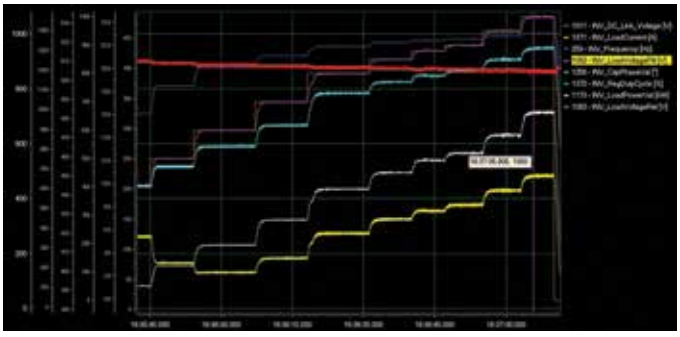
Control architecture
The control structure is based on a powerful, state-of-the-art Danieli Automation Process Automation Controller (DA-PAC) that communicates with the power part (modulator boards) through the Ethercat optical fiber hi-speed link to ensure trouble-free operation in the worst EMI environment.

Level 1 plant automation ensures a perfect control of material temperature thanks to smart controls based on signals from pyrometers and an accurate material tracking system.

The fastest and best-performing Danieli Automation Controller DA-PAC perfectly controls the high-frequency system.



QHEAT Operator Panel
The QHeat system is equipped with a dedicated touch-screen operator panel for each switchboard, located on the control unit door, in order to provide local command, fault management, and alarm monitoring and parameterization.



QHEAT Configuration tool
The main interface of Danieli Automation Power Equipment is the Configurator software, a powerful and user-friendly tool application for commissioning and maintenance.
It is supplied with an advanced graphical HMI to check status and quickly identify fault causes, allow system parameterization, tuning, accurate and fast signal tracing, graphic status indication and fault/alarm monitoring.

A normal Ethernet network connects the QHeat Power Equipment and the PC to allow easy remote support by Danieli personnel.

QHEAT

Water Cooling Unit

In order to ensure long equipment life, it is important to provide clean, low-conductivity water to cool down these parts.

Power converters, capacitor boxes and heating coils are therefore cooled by a closed circuit running demineralized water, with a plate water-to-water heat exchanger to extract heat from the closed circuit to the industrial raw water circuit. The temperature and water flow is continuously monitored to ensure optimal working conditions. A conductivity meter controls water quality, and the circuit includes a resin filter to maintain good quality over time.

The cooling system also includes a tank, pumps (one is redundant) and two separate circuits for electrical devices and heating inductors.
The inductor circuit requires emergency water in case of electricity black-out while the hot material is inside the heating coils. This solution keeps the converter circuit and electrical devices always clean.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MORGÅRDSHAMMAR

QHEAT

Typical configurations

INDUCTION HEATING FOR BILLETS

Material section	up to 350 mm
Material length	from 3 m
Plant productivity	up to 250 tph
Working frequency	up to 1 kHz
Single coil power	1000 kW
Total power	up to 30 MW
Material temperature in/out	750 / 1150 °C
Optional	Twin special coils to reheat two billets simultaneously

INDUCTION HEATING FOR BARS

Material section	from 12 mm to 130 mm
Material length	from 3 m
Plant productivity	up to 10 tph
Working frequency	up to 15 kHz
Single coil power	up to 200 kW
Total power	up to 5 MW
Material temperature in/out	20 / 1000 °C
Field of application (example)	Hardening and tempering line for alloyed steel

TRANSVERSE FLUX HEATING (TFH) FOR FLAT

Material width	up to 2000 mm
Material thickness	from 1 mm to 50 mm
Material length	from 3 m
Plant productivity	up to 2000 tph
Working frequency	up to 1 kHz
Single coil power	up to 5000 kW
Total power	up to 50 MW
Material temperature in/out	850 / 1150 °C

LONGITUDINAL FLUX HEATING (LFH) FOR FLAT

Material width	up to 2000 mm
Material thickness	from 20 mm to 250 mm
Material length	from 3 m
Plant productivity	up to 2000 tph
Working frequency	up to 8 kHz
Single coil power	up to 6000 kW
Total power	up to 60 MW
Material temperature in/out	750 / 1150 °C

HEADQUARTERS

DANIELI
Via Nazionale, 41
33042 Buttrio (UD) Italy
Phone +39 0432 195 8111
Fax +39 0432 195 82 89
www.danieli.com
info@danieli.com

DANIELI AUTOMATION
Via Bonaldo Stringher, 4
33042 Buttrio (UD) Italy
Phone +39 0432 518 111
Fax +39 0432 673 177
www.dca.it
info@dca.it

WORLDWIDE DANIELI COMPANIES

GERMANY
Brunshofstrasse, 12
D-45470 Mülheim - Ruhr
Phone (49) 208.3780000
info@germany.danieli.com

UNITED KINGDOM
722 Prince of Wales Road
Sheffield S9 4EU
Phone (44) 114.2800300
info@uk.danieli.com

SWEDEN
Nya Ågatan, 23
S-77782 Smedjebacken
Phone (46) 240.668500
info@sweden.danieli.com

SPAIN
Poligono Sondikalde
Calle Portu Bidea, 2
48150 Sondika - Vizcaya
Phone (34) 94.4872800
info@spain.danieli.com

AUSTRIA
Max Planck Strasse, 5
A - 9100 Völkermarkt
Phone (43) 4232.51440.6101
info@austria.danieli.com

FRANCE
Les Mercuriales
F-93176 Bagnolet Cedex
Phone (33) 1.49722269
info@france.danieli.com

USA
600 Cranberry Woods Drive
Suite 200
Cranberry Township, PA 16066
Phone (1) 724.7785400
info@usa.danieli.com

CHINA
Jingyuan Street, 8, BDA
Beijing, 100176
Phone (86) 10.58082828
infodme@china.danieli.com

CHINA
No. 19, Xing Gang Road, CEDZ
Changshu, Jiangsu 215513
Phone (86) 512 52267088
infodcs@china.danieli.com

INDIA
Technopolis Building
Plot 4, Block - BP, 5th Floor
Wing - B, Sector - V, Salt Lake
700 091 Kolkata - West Bengal
Phone (91) 33.39847777
info@india.danieli.com

THAILAND
Land Plot N. K11
The Eastern Seaboard Ind. Estate
Tambol Pluakdaeng, Amphur
Pluakdaeng, 21140 Rayong
Phone (66) 38 929000
infodfe@thailand.danieli.com

WORLDWIDE OFFICES AND SERVICE CENTERS

USA
114 Chesser Crane Road
Chelsea, AL 35043
Phone (1) 205.6787451
info@usa.danieli.com

CANADA
P.O. Box 24062
Sault St. Marie
Ontario P6C 6G7
Phone (1) 705.9468779
info@canada.danieli.com

BRAZIL
Rua Georg Rexroth, 609
Jardim Padre Anchieta
CEP 09951 270 Diadema, SP
Phone (55) 11.35085900
info@brazil.danieli.com

MEXICO
Edificio Sierra Madre
Ave.Vasconcelos Oriente 310
Colonia del Valle
66250 Garza Garcia, N.L.
Phone (52) 81.83781055
Fax (52) 81.83781058
info@mexico.danieli.com

SWITZERLAND
Olsbergerstrasse 2
4310 Rheinfelden
Phone (41) 61.8368310
info@switzerland.danieli.com

RUSSIA
Leningradskiy Prospekt 31A
Building 1, floor 24
125284 Moscow
Phone (7) 495.9819073
info@russia.danieli.com

RUSSIA
Lenin avenue 130, office 109
Chelyabinsk region
455038 Magnitogorsk
Phone (7) 963.4768886
info@russia.danieli.com

RUSSIA
Business Center Vysotskiy
Malyshev street 51, floor 42
Office 43/07
620075 Ekaterinburg
Phone (7) 343.3784517
info@russia.danieli.com

RUSSIA
Avtozavodskoye Shosse 48
Nizhniy Novgorod region
606000 Dzerzhinsk
Phone (7) 8313.310310
info@russia.danieli.com

UKRAINE
Most Citi Business Center
Glinky Street, 2, 3rd Floor
49000 Dnepropetrovsk
Phone (380) 56.7904301
Fax (380) 56.7904304
info@ukraine.danieli.com

EGYPT
Mohamed Farid Street, 37
11351 Heliopolis West-Cairo
Phone (20) 2.26379229
info@egypt.danieli.com

UAE
Etihad Towers 5 - Flat 5104
P.O. Box 127231 Abu Dhabi
Phone (971) 2.6812268
info@uae.danieli.com

KSA
Silver Tower 6th floor
P.O. Box 4867
Al-Khobar 31952
Phone (966) 3.8993145
info@ksa.danieli.com

TAIWAN
26F-1, No. 31
Hai-BianRoad
Kaohsiung City, Taiwan 802
Phone (886) 7.3358655
info@taiwan.danieli.com

THAILAND
Muang Thai-Phatra Office
16th Floor, Tower II
252-91 Rachadaphisek Road
Huaykwang - Bangkok 10310
Phone (66) 2.6933520
info@thailand.danieli.com

INDIA
271 Business Park, 5th floor
Model Industrial Colony
Off Aarey road
Goregaon (E) Mumbai 400 063
Phone (91) 22.39917100
info@india.danieli.com

KOREA
#602 6th floor, Yeondang Building
439 Teheran-Ro
Gangnam-Gu, 06158, Seoul
Phone (82) 2.5626622
info@korea.danieli.com

JAPAN
42F, Yokohama Landmark Tower
2-2-1, Minatomirai, Nishi-ku,
Yokohama-City
220-8142 Japan
Phone (81) 45.651.7077
info@japan.danieli.com

VIETNAM
Sang Tao Road, E-Office Park
Tan Thuan Exp. Pro. Zone
Tan Thuan Dong Ward, Dist. 7
Ho Chi Minh City, Vietnam
Phone (84) 08.62999130
info@vietnam.danieli.com


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