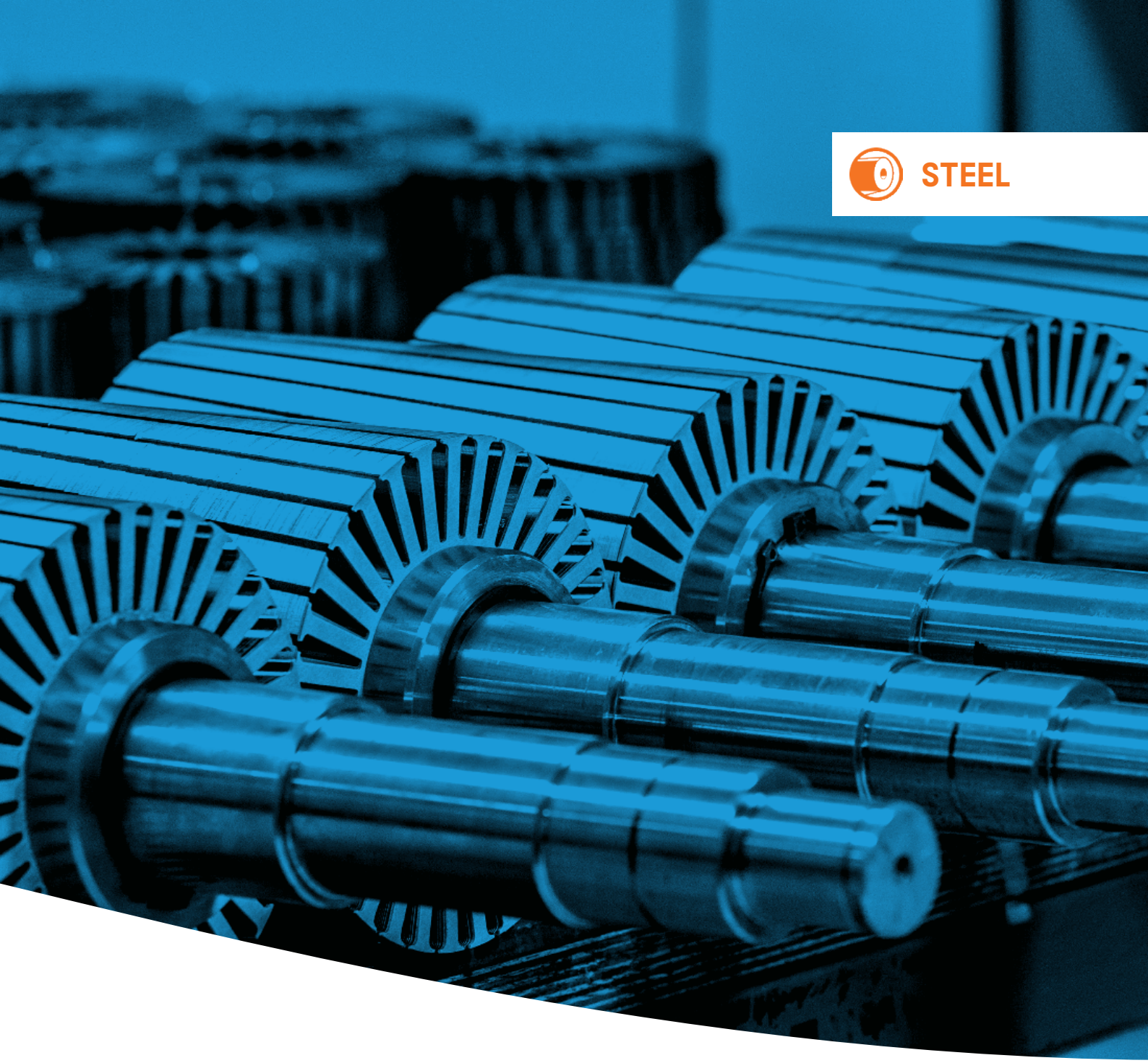


STEEL

Advancing Electrification. Together.

Insulating Coatings for Non-Grain Oriented Electrical Steel Used in Laminated Cores

Quaker Houghton™

Forward Together™

Quaker Houghton: Applied Expertise

Electrical steel coatings are integral to the performance of electric motors and generators, restricting eddy current losses by insulating each sheet of steel within the lamination stack.

Applying our expertise in silicon steel production, surface chemistry and downstream processing, Quaker Houghton offers a full range of non-grain oriented (NGO) electrical steel coatings including full-face bonding varnish (also known as backlack).

The Benefits:

- Excellent substrate bonding and insulation properties
- Chrome-free technology supports the latest legislative requirements
- Water-based formulations reduce solvent usage
- Good punchability for extended tool life
- Protection against corrosion

Our Portfolio

PRODUCT	APPLICATION
QH EVERTREAT™ 2030 C3 Organic Coating	Ideal for use in the magnetic cores of air and oil-cooled small and medium-sized electric motors, as well as transformers and distribution boards. Due to its excellent punchability, it is ideal for fast-running punching processes. The laminations may be fixed by means of rivets, clamps or interlocking.
QH EVERTREAT™ 2050 C5 Organic/ Inorganic Coating	Ideal for use in small and medium sized electrical motors with high demand on interlaminar insulation. QH EVERTREAT™ 2050 supports further annealing and welding processes.
QH EVERTREAT™ 2060 C6 Organic/ Inorganic Coating	Ideal for use in medium and large sized electrical motors, generators, high-power rotating machines and core packages of contactors, where high heat and pressure loads are expected as well as vibration damping.
QH EVERTREAT™ 7000 C3 Bonding Varnish	Ideal for small and large size magnetic cores with high demands on interlaminar insulation and bonding such as high efficiency electrical motors (e.g. electric and hybrid vehicles) and generators (e.g. wind turbines). Self-bonding technology eliminates the need to weld or rivet the magnetic core.
QH EVERTREAT™ 7100 C3 Bonding Varnish	Ideal for small and large size magnetic cores with high demands on interlaminar insulation and bonding such as high efficiency electrical motors (e.g. electric and hybrid vehicles) and generators (e.g. wind turbines). QH EVERTREAT™ 7100 results in a completely sealed stack after final assembly, ideal for preventing leakage of the cooling oil in internally-cooled motors.

QH EVERTREAT™ 2050: C5 Coating

Excellent Substrate Adhesion and Electrical Insulation

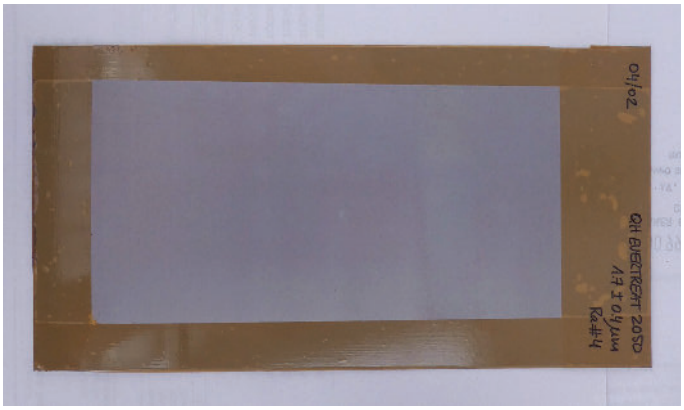
QH EVERTREAT™ 2050 shows great resistance to cracking and peeling from the substrate.

No adhesion loss in bending test: 3 mm cylindrical mandrel followed by tape adhesion test (ISO 1519)

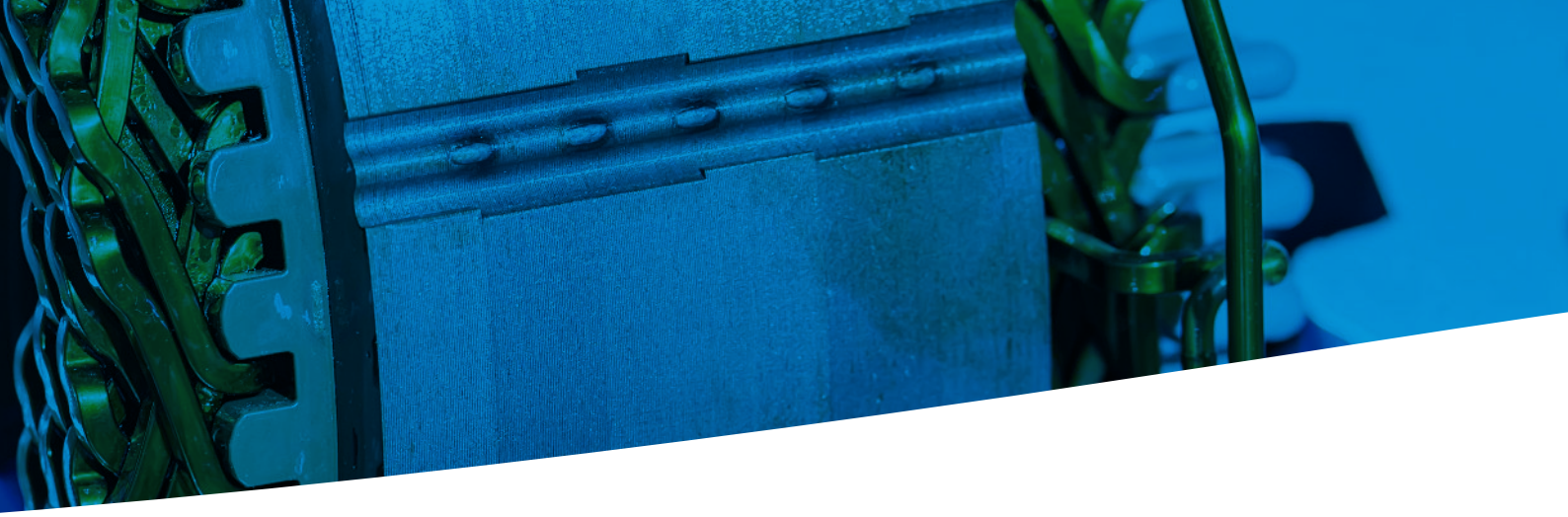
HIGH ELECTRICAL RESISTANCE	
Dry Film Thickness (µm)	**Insulation Value* (Ω·cm2) Franklin test device (ASTM A717-A)**
≥ 2	∞
1.5-2.0	> 20000
< 1.5	4000 - 20000

*Highly substrate and substrate roughness dependent

Strong Protection Against Corrosion



No corrosion observed on panel coated with QH EVERTREAT™ 2050 (DFT 1.5 µm) after 8 hours of 5% NaCl at 35°C, 1.2 bar pressurized



The Latest in Full-Face Bonding Varnish Technology

The demand for more efficient electric motors and generators is driving a trend to use thinner, more complex core plate design, in order to reduce core losses.

Bonding varnish, also known as backlack, provides both insulation and adhesion for these high efficiency core stacks, eliminating the need for traditional joining techniques such as interlocking, welding or clamping that are harder to achieve with thin-gauge steel and can impair magnetic performance.

Quaker Houghton has developed QH EVERTREAT™ 7000: a universal, one-component, self-bonding varnish for simplified, flexible production of high-performance bonded lamination stacks. This allows for both longer bonding times at lower temperatures for large stacks, as well as fast bonding where high productivity is required, without compromising on adhesion.

Enhancing Production and Performance Across the e-Motor Value Chain

Steel Coil

- ★ Suitable for fast-running coil coating lines for improved productivity
- ★ Broad peak metal temperature (PMT) range for initial cure fits individual steel plant operations

Lamination

- ★ Improved lubrication for longer die life
- ★ Flexible stack bonding time/temperature allows balance of production speed and energy consumption

Motor

- ★ Full-face bonding supports freedom of design
- ★ Secure bonding prevents laminations slipping from the stack during handling and assembly
- ★ Oil-tight variant for internal motor cooling

QH EVERTREAT™ 7000:
C3 Bonding Varnish/Backlack

Fast, Flexible Curing Times Without Compromise on Adhesive Strength

CURING CONDITIONS (STATE B)			BONDING CONDITIONS (STATE C)			DIN EN 1464
Dwell Time	PMT	Dry Film Thickness	Bonding Time	Bonding Pressure	Bonding Temperature	RSP Peel Resistance
seconds	°C	µm	minutes	MPa	°C	N/mm
20	235	3.5	60	3	140	6.52
20	235	3.5	45	3	150	8.47
20	235	3.5	30	3	160	7.98
20	235	3.5	15	3	180	9.72
20	235	3.5	10	3	200	9.83
20	235	3.5	2	3	230	10.28

Peel resistance results of QH EVERTREAT™ 7000 on 0.5 mm M800-50A substrate* at varying **temperature/time** schedules from 2 minutes at 230°C to 60 minutes at 140°C.

CURING CONDITIONS (STATE B)			BONDING CONDITIONS (STATE C)			DIN EN 1464
Dwell Time	PMT	Dry Film Thickness	Bonding Time	Bonding Pressure	Bonding Temperature	RSP Peel Resistance
seconds	°C	µm	minutes	MPa	°C	N/mm
15	210	2.50	2	3	230	4.38
15	210	3.50	2	3	230	5.70
15	210	4.00	2	3	230	7.03

Peel resistance results of QH EVERTREAT™ 7000 on 0.25 mm high performance automotive substrate* at **varying dry film thickness** and short bonding time of just 2 minutes.

*Optimal bonding parameters and RSP results are dependent on the steel grade.

QH EVERTREAT™ 7000:
C3 Bonding Varnish/Backlack

Withstands Very High Temperature to Ensure Strong Adhesion Throughout Assembly and Sealing

PEEL RESISTANCE AFTER VERY HIGH TEMPERATURE EXPOSURE		
Test Conditions	**Typical Value**	**Unit**
after 30 minutes at 250°C	4.27	N/mm
after 60 minutes at 250°C	3.16	N/mm

During the assembly operation, like impregnation or trickling, the temperature of the stack may reach up to 250°C for a short duration.

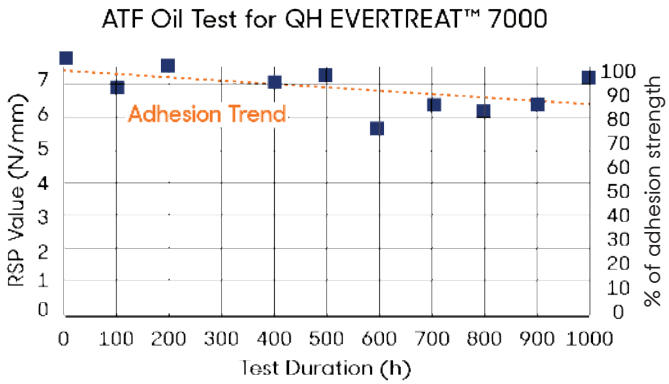
Withstands the Full Range of Motor Operating Temperatures

The adhesion remains strong from cold weather parking temperature to peak operating temperature.

TENSILE RESISTANCE AT VARYING TEMPERATURES		
Test Conditions	**Typical Value**	**Unit**
-20°C	30.8	N/mm^2
25°C	31.5	N/mm^2
120°C	7.3	N/mm^2
180°	6.0	N/mm^2

PEEL RESISTANCE AT VARYING TEMPERATURES		
Test Conditions	**Typical Value**	**Unit**
-20°C	6.85	N/mm
25°C	6.87	N/mm
120°C	3.16	N/mm

Compatible with Automatic Transmission Fluid (ATF)



Limited adhesion loss seen over 1000 hours in ATF at 150°C

Long-Lasting Adhesion Supports Extended Motor Life

SIMULATED LONG-TERM AGING EFFECT ON TENSILE RESISTANCE		
Test Conditions	**Typical Value**	**Unit**
after 8 weeks at 160°C	29.4	N/mm^2
after 16 weeks at 160°C	23.5	N/mm^2
Temperature Index (20,000 h)	155-160	°C

Tensile and peel resistance results of QH EVERTREAT™ 7000 on 0.35 mm high-performance automotive substrate* at 205°C PMT, 20 seconds dwell time for state B, and short bonding time of just 2 minutes at 230°C and 3 MPa for state C. 3.5 µm DFT.

*Optimal bonding parameters and RSP results are dependent on the steel grade.

Forward Together™

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