Danfoss Drives

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To Whom it May Concern;

The Trane variable frequency drive (VFD) is manufactured by Danfoss Power Electronics, the world's largest manufacturer of HVAC VFD's. They meet or exceed industry standards for variable frequency drives on a global basis. The following pages list the national and international standards that were observed during the design of the product.

Trane Drives, as manufactured by Danfoss, have been used globally for over twelve years in every imaginable HVAC/R application with great market acceptance. There are over 350,000 Trane Drives installed globally in every type of HVAC/R application.

TR200/TR150 VFDs have been rigorously tested and qualified by Trane, to Trane's exacting standards for quality, reliability and dependability. They are designed and tested for applications in Trane's OEM AHUs, Chillers and other variable speed products. They are further field tested and qualified for self-standing VFD applications for renovation, retrofit and new construction projects.

The Trane drive is sold by trained Trane sales engineers and is supported by over 5,000 trained technicians nationwide. It is also supported by the Danfoss Technical Support Group and a staff of Trane dedicated personnel.

Trane Drives are backed by one of the industry's strongest warranty programs and one of the largest service and parts organizations in the world – Trane Service and Trane Supply.

If you have any questions about the Trane Drive, we are available to help.

Respectfully submitted,

Gary Axe
Trane CSO Global Account Manager
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Certificate of Conformity

The below listed national and international directives/standards were observed during the design of the VLT® HVACDrive series FC-102, VLT® AQUA Drive series FC-202 and VLT® AutomationDrive series FC-301 & FC-302

Directive/standard/norm	Description
73/23/ECC (EN 61800-5-1 as preferred safety standard)	**LOW VOLTAGE DIRECTIVE**
EN 61800-5-1 **Part 5-1:**	**Adjustable speed electrical power drive systems - Safety requirements – Electrical, thermal and energy**
EN 50178	**Electronic equipment for use in power installations**
section 9.4.1 to establish compliance with the following sub clauses:	Visual inspections
• 5.2.1	Requirements for protections against electric chock
• 5.2.2	Protection against direct contact
• 5.2.4	Protection by means of enclosures and barriers
• 5.2.4.1	Distances
• 5.2.8.3	Protection by means of protective impedance
• 5.2.8.4	Protection by using limited voltage in control circuits
• 5.2.9	Protection with regard to indirect contact
• 5.2.9.1	Insulation between live parts and exposed conductive parts
• 5.2.9.2	Protective bonding
• 5.2.14	Solid insulation, insulation of circuits
• 5.2.15.1	Clearances and creepage distances
• 5.2.18.1	Constructive measures
• 5.3	Requirements for EE in installations with regard to protection against electric shock
• 5.3.1	Protection with regard to direct contact
• 5.3.1.2	Connection of EE with protective separation
• 5.3.2	Protection with regard to indirect contact
• 7.1.8	Electrical connections
• 7.2	Marking, identification, documentation
section 9.4.2.1 (EN60068-2-2, test Bd /IEC 60068-2-2, test Bd)	Dry heat test
section 9.4.2.2 (HD 323.2.3 S2, test Ca/ IEC 60068-2-3, test Ca)	Damp heat steady state
section 9.4.3.1 (EN 60068-2-31, test Ec/IEC 60068-2-31, test Ec)	Topple test
section 9.4.3.2 (EN 60068-2-6, test Fc/IEC 60068-2-6,test Fc)	Vibration, sinusoidal
section 9.4.4.2 (EN 60529/ IEC 60529)	Non-accessiblity test
section 9.4.4.3(EN 60529/ IEC 60529)	Enclosure test
section 9.4.5.1 (HD 588.1 S1/ IEC 60664-1)	Impulse voltage test
section 9.4.5.2	AC or DC voltage test
section 9.4.5.3 (HD 625.1 S1)	Partial discharge test
section 9.4.6.1 (see under EMC Directive)	Emission of EMC disturbances
section 9.4.6.2 (see under EMC Directive)	Immunity from EMC disturbances
section 9.4.6.3	Short-circuit withstand capability

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89/336/EEC (EN61800-3/ IEC61800-3 as preferred standard)	**EMC DIRECTIVE**
EN61800-3/ IEC61800-3	**Emission PDS Product Standard**
EN/IEC61600-6-3/4	**Emission- public/industry**
EN 55011	Conducted Class A-1
EN 55011	Conducted Class B-1
EN 55011	Radiated Class A-1
EN/IEC61600-6-1/2	**Immunity- public/industry**
EN 61800-3/IEC61800-3	**Immunity Industri**
EN 61000-4-2 (IEC 61000-4-2)	Electrostatic discharge (ESD)
EN 61000-4-3 (IEC 61000-4-3)	Electromagnetic radiated field, A.M. modulated
EN 61000-4-4 (IEC 61000-4-4)	Burst transients
EN 61000-4-5 (IEC 61000-4-5)	Surge transients
EN 61000-4-6 (IEC 61000-4-6	RF field, common mode
EN 61800-3 (IEC 61800-3)	**Low frequency immunity**
IEC 61000-2-4	Harmonics
IEC 60146-1-1	Commutation notches
IEC 61000-2-4	Voltage variations and fluctuations
IEC/EN61000-4-11	Voltage dips and short interruptions
IEC 61000-2-4	Voltage unbalance
IEC 61000-2-4	Frequency variations
EN 61800-3/ (IEC 61000-3)	**Low frequency emission**
EN 61000-3-2 (IEC 61000-3-2)	Harmonics (I ≤ 16A)
EN 61000-3-12 (IEC 61000-3-12)	Harmonics (I > 16A)
UL 508c	**Safety for Power Conversion Equipment**
Enclosure Construction	
section 6 (UL 50)	Frames and Enclosure
Environmental Rating Related Enclosure Construction	
section 7 (UL 50)	General
section 8 (UL 50)	Protection against corrosion
Environmental Rating Related Enclosure Performance	
section 9 (UL 50)	General
Non-Environmental Rating Related Enclosure Performance	
section 10	General
section 11	Securement of snap-on cover test
Instructions and Marking Pertaining to Enclosures	
section 12	Permanence of marking
section 13	details
Device Construction	
section 14	General
section 15	Protection against corrosion
section 16	Provisions for Mounting
section 17	Insulation Material
section 18	Means for switching
section 19	Live Parts
section 20	Drive Protection
section 21	Capacitors
section 22	Fuseholders
section 23	Internal wiring
section 24	External Interconnections

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section 25	Transformers
section 26	Blower Motors
section 27	Supply Connections
section 29	Risk of Electric shock
section 30	Risk of Fire
section 32	Secondary Circuits
section 35	Isolation Devices
section 36 (UL840)	Spacings
section 37	Grounding
section 38	Accessories
Device Performance	
section 39	General
UL 508c	**Safety for Power Conversion Equipment**
section 40	Temperature
section 41	Abnormal operation tests
section 41.1	General
section 41.3	Single phasing
section 41.4	Inoperative blower motor
section 41.6	Current limiting control
section 42	Full-load motor-running current tables
section 43	Solid state motor overload protection test
section 44	Dielectric voltage withstand test
section 45	Short circuit test-standard fault currents
section 48	Transient-voltage-surge surpression test
section 50	Brake down of components test
section 51	Terminal torque test
section 54	Rating
Device Marking	
section 55	General
section 56	Overload, Over current, Over speed
section 57	Branch circuit short circuit protection
section 60	Wiring terminal markings
section 61	Cautionary markings
section 62	Instructions and markings pertaining to accessories
section 63	Marking location
Manufacturing and production line test	
section 64	Circuit functionality evaluation
CAN/CSA-C22.2 No. 14-95 (approved by UL)	**Industrial Control Equipment**
CAN/CSA-22.2 No. 0.15-95	Adhesive Labels

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Miscellaneous standards/norms:

Danfoss Corporate Guideline: 500B0430 and ISTA, procedure 1A and 1	Guideline for Transportation test (Packaging)
Danfoss Corporate Guideline: 500B0432, Sinus Vibration, curve V (IEC 68-2-6, test Fc)	Guideline for Vibration test Vibration, Sinus
Random vibration, curve E / F	Vibration, Random
IEC 60068-2-64	Vibration, random, broad-band
VDE 0160	Mains transients test pulse, class 1/2
EN 50178 (section 5.2.11)	Leakage current and fault current
EN50178 (section 6.1, table 7)(IEC 721-3-3)	Temperature (Class 3K3), Relative humidity (Class 3K3), Air pressure (Class 3K3)
EN 50178 (section 6.1, table 7)(IEC 721-3-1)	In Storage: Temperature (Class1K4), Relative humidity (Class 1K3), Air pressure (Class 1K4)
EN 50178 (section 6.1, table 7)(IEC 721-3-2)	During transportation: Temperature (Class 2K3), Relative humidity (Class 2K3), Air pressure (Class 2K3)
VBG-4	Direct touching

Functional Safety:

ISO/EN 13849-1:2006 (former EN 954-1)	Safe Stop function, PL d ($MTTF_d$ = 24816 years, DC=99,99%, Category 3)
EN 954-1:1996	Safety Category 3
IEC 61508-1:1998, IEC61508-2:2000	Safe Stop function, SIL 2 (PFH= λ_{du} =$7e^{-10}$FIT, λ_{dd}=3.9FIT, λ_s=154FIT, SFF>99%, HFT=0)
EN 61800-5-2:2007	Safe Stop function conforms with STO – Safe Torque Off, SIL 2 Capability
EN 62061:2005	Safe Stop function, SILCL 2
EN 60204-1	Stopping Category 0, Unintended Restart Protection

The conditions for observing the above mentioned directives/standards/norms, see the Operation Instruction or Design Guide for the specific product series.

Issued by:

Lars Erik Donau
Quality Systems Manager