it’s all about innovation
Founded 1906 by Gunnar Gregersen

- “To support Danish industry, mainly small enterprises, by providing technical assistance in the form of teaching, advice, testing and technological research”
- Self-owned company
- Not-for-profit
HM the Queen of Denmark – patron of DTI
Copenhagen
# Organization

## Danish Technological Institute

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<tr>
<th>Division</th>
<th>Vice President</th>
<th>Subsidiaries</th>
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<tr>
<td>Building and Construction</td>
<td>Mette Glavind</td>
<td>DTI Robotics US, Inc.</td>
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## 1100 Employees
Energy & Climate

- Automobile technology
- Biomass and Biorefinery
- Energy efficiency and ventilation
- Refrigeration and heat pump technology
- Installation and calibration
- Pipecentre
- Transport and Electric Systems

190 Employees
Revenue: 144,9 million EUR

- Performance contracts: 27%
- Danish business customers: 27%
- Organisations and public customers: 12%
- International customers: 24%
- Research and Development activities: 10%
Refrigeration and Heat Pump Technology

Organisation (30 employees):

- **Director**
  Claus S. Poulsen

- **Secretary**
  Jannie G. Würtz

- **Refrigeration and Heat Pump Laboratory**
  Team Manager:
  Lasse Søe

- **Energy Use in Buildings**
  Team Manager:
  Esben V. Foged
Refrigeration and Heat Pump Technology

- Services:
  - Testing in state-of-the-art test facilities
  - Expert consultation
  - R&D project cooperation, funded and commercial projects

- Business area – among others:
  - Refrigeration and heat pump technology
  - Solar energy
  - Drying and separation technology
  - CFD and FEM analysis
  - Modelling and simulation
  - SmartGrid
  - Intelligent building management
  - Natural refrigerants
  - Standardization
One of the most advanced laboratories on refrigeration and heat pump technology in the world with specially designed test facilities.

The section comprises five laboratories:

- **Refrigeration lab.** (component test i.e. compressors, valves etc., refrigeration system test, R&D project cooperations, NH$_3$ & CO$_2$)
- **Water vapour lab.** (development water vapour compressor and refrigeration system)
- **Energy efficiency lab.** (plug-in commercial and domestic freezers, refrigerators, electronics)
- **Heat pump lab.** (A2A, A2W & W2W)
- **Condensing unit lab.**
Refrigeration and Heat Pump Technology
– Refrigeration Laboratory

- Quality management system in accordance with EN ISO 17025 and 17020
  - [http://enerkvalitet.teknologisk.dk/23173](http://enerkvalitet.teknologisk.dk/23173)
  - Equipment database to track all measurement equipment
- EN ISO 9001 certified
  - Required by Danish law when employing refrigeration technicians and performing work on refrigeration systems
Refrigeration and Heat Pump Technology – Refrigeration Laboratory

We carry out various commercial assignments for national and international clients, e.g.:

- Testing of pressure loss in vertical riser (NH₃)
- Design validation of riser inlet (NH₃)
- Testing of oil separators (CO₂)
- Development of sensors and valves
- Testing of control valves (CO₂, NH₃ etc.)
- Testing of units and control systems (CO₂, NH₃)
- Freezing of food stuff (CO₂, NH₃)
- Testing of compressors (CO₂, NH₃)
- Component and system test (HFO & hydrocarbon)
Refrigeration and Heat Pump Technology
– Refrigeration Laboratory, case

Study on pressure drop in R717 vertical risers

- One project focused on the vertical riser itself
- One project focused on the riser inlet configuration
- Saturation temperatures from -40°C to +10°C
- Circulation rates from 2 - 10
Refrigeration and Heat Pump Technology – Refrigeration Laboratory, case

HB Products - test of sensor for measurement of vapour quality in two phase NH$_3$

1. Commercial test assignment (short time schedule to evaluate technology for investors’ decision)
2. R&D project (further development of sensor & test at different applications)
Test of R744 condensers/gas coolers

- 6 units tested in 2014 as gas coolers and condensers
- More than 25 capacity measurements per unit
- Results used to calibrate the manufacturers calculation models
- Capacity measured directly in the refrigeration cycle
- Capacity validated on air side, all with an energy balance within 2-3%
- Capacity range from 3 to 35 kW
Refrigeration and Heat Pump Technology – Water Vapour Laboratory

- **Axial compressor development process – state-of-the-art R&D project**

  - 1998 – 2001 Feasibility study, scaled tests
    - York, DTI (DEA)

  - 2003 – 2011 Full scale development of two sizes of prototypes
    - Tokyo, Chubu and Kansai Electrical Power Companies, Kobe Steel, DTI, JCD (DEA)

- 2012 – 2016 Commercial chiller development
  - JCD, LEGO, Rambøll, DTI (DEA)

- 2014 – 2016 Evaporator with ice generation
  - DTI, JCD, Augustenborg District Heating, Arla (DEA)
Refrigeration and Heat Pump Technology – Water Vapour Laboratory

- Feasibility study – identifying optimal compressor type
Refrigeration and Heat Pump Technology – Water Vapour Laboratory

- Two types of prototype turbo compressors developed
  Axial
  Centrifugal
Refrigeration and Heat Pump Technology – Water Vapour Laboratory

- Axial compressor development process
Refrigeration and Heat Pump Technology
– Energy Efficiency Laboratory

Accredited testing of

• Commercial refrigerated cabinets
• Electronic household and office equipment
• Household refrigerating appliances
• Vaccine storage units and transportation boxes

Your Contact

Hans Walløe
Senior Specialist
Refrigeration and Heat Pump Technology

+45 72 20 24 72
Refrigeration and Heat Pump Technology – Energy Efficiency Laboratory

Accredited testing according to EN/ISO 23953 and PrEN 16825 of commercial refrigerated cabinets

- Display Cabinets
- Beverage Coolers
- Storage Cabinets
- Vending Machines
- Ice-cream Freezers
Refrigeration and Heat Pump Technology
– Energy Efficiency Laboratory

Accredited ecodesign compliance testing of electronic household and office equipment

Services within the field of:
• Ovens
• Coffee machines
• Computers
• External power supplies
• Printers
• Scanners
• Televisions
• Etc.
Refrigeration and Heat Pump Technology – Energy Efficiency Laboratory

Household refrigerating appliances and vaccine storage units

- EN/ISO 62552
- Ecodesign regulation 643/2009
- Energy labelling 1060/2010

Vaccine storage units and transportation boxes

- Accredited by WHO
Refrigeration and Heat Pump Technology – Heat Pump Laboratory

Our state-of-the-art Heat Pump Laboratory is specially designed to test the efficiency, performance and sound power level of a heat pump at the same time and at different climate conditions.

Covering all relevant international standards..
Refrigeration and Heat Pump Laboratory

Organisation (17 employees + 1 engineer trainee):
Refrigeration and Heat Pump Technology – Heat Pump Laboratory

- Testing heat pumps for more than 30 years
- Test laboratory complies with EN ISO/IEC 17025
- List of methods – accredited heat pump testing
  
  http://english.danak.dk/English/database_eng/
  
  - EN14511
  - EN14825
  - EN16147
  - EN12102 (EN/ISO 3743-1)
  - EN13215 & EN13771-2 (CDU)

- Certification schemes
  
  - EHPA approved test institute
  - CEN Keymark test and inspection (application in process)

- Market surveillance tests
  
  - National Measurement Office UK
  - Danish Energy Agency
  - Norwegian Energy Agency
  - Prosafe (EU market surveillance)
Refrigeration and Heat Pump Technology – Heat Pump Laboratory

- Test capability (accredited)
  - Facility 1: A2W & A2A up to 15 kW - reference climate: colder, average and warmer - low temperature -45C (A2A calorimeter room method)
  - Facility 2: A2W up to 30 kW & CDU up to 65kW (sound power) - reference climate colder, average and warmer – low temperature -25C (restrictions: circulators and size of flow meter)
  - Facility 3: A2W up to 20 kW (sound power) - reference climate colder, average and warmer – low temperature -25C (restrictions: circulators and size of flow meter)
  - Facility 4: A2W up to 20 kW – low temperature -25C (including gas hybrid)
  - Facility 5: W2W up to 15 kW - all types of brine
  - Facility 6 W2W up to 30 kW - all types of brine (restrictions: circulators and size of flow meter)

- Note: DTI lab includes a 2 MW W2W NH₃ chiller which can be applied for testing of heat pumps & chillers
Refrigeration and Heat Pump Technology
– Heat Pump Laboratory

- **Number of possible tests per year (SCOP)**
  - Facility 1: A2W & A2A up to 15 kW – 15 to 20 units
  - Facility 2: A2W up to 40 kW (sound power) – 15 to 20 units
  - Facility 3: W2W up to 15 kW – 20 to 25 units
  - Facility 4: W2W up to 40 kW – 20 to 25 units
  - Facility 5: A2W up to 30 kW – 15 to 20 units
  - Facility 6: A2W up to 20 kW – 15 to 20 units

- **Number of heat pumps tests during 2015**
  (SCOP & SEER, EHPA, HARP, NL, MCS)
  - A2A – 21 (single split)
  - A2A – 7 (mono bloc)
  - A2W – 37 (including 19 sound power measurements & DHW test)
  - W2W – 3
  - Total - 68
Refrigeration and Heat Pump Technology

Accredited by DANAK

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<thead>
<tr>
<th>Company</th>
<th>Contact</th>
<th>Email</th>
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<tbody>
<tr>
<td>Teknologisk Institut</td>
<td>T2 Energi's sekretariat</td>
<td>infoteknologisk.dk</td>
</tr>
<tr>
<td>Kompagniet</td>
<td>Aarhus C</td>
<td>Denmark</td>
</tr>
<tr>
<td>DK-8000</td>
<td>Phone: 72 10 10 10</td>
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<tr>
<th>Scope of Accreditation</th>
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<tr>
<td>Testing</td>
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<tr>
<td>- Construction products</td>
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<tr>
<td>- Engineering materials and products</td>
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<tr>
<td>- Machinery and industrial plants</td>
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<tr>
<td>- Toys, sport &amp; leisure equipment</td>
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<tr>
<td>Testing</td>
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<tr>
<td>- Electrical and electronical testing</td>
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<td>- Mechanical testing</td>
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<td>- Physical testing</td>
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<td>- Sampling</td>
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Flexible accreditation regarding systems and components (test objects) and equivalent methods for VA area

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<thead>
<tr>
<th>Standard of Accreditation</th>
<th>EN 15798/IEC 17025:2005</th>
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<tbody>
<tr>
<td>List of methods</td>
<td>Click here</td>
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<tr>
<td>Certification</td>
<td>The company further complies with the relevant requirements in REGULATION (EU) No 305/2011 for construction products</td>
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From DANAK's registry of accredited and approved companies
Why DTI as test and R&D partner?

- High quality testing & engineering
  - State-of-the-art testing facilities
  - High accuracy measurements
  - Experienced and dedicated test and refrigeration engineers

- Acknowledge test institute
  - Market surveillance tests
    - National Measurement Office UK
    - Danish & Norwegian Energy Agency
    - Prosafe (Energy Agency from: BE, UK, SE, NL, BG & DK)
  - Represent the Norwegian Energy Agency and the Danish Energy Agency as technical experts in terms of Energy labelling and Ecodesign
  - Several nominated and award winning R&D projects (link: https://youtu.be/nxnRqMDiw8c)

- Large range of accredited test
  - Accredited testing of HVAC 10,000 m3/h, electrical motors, fans, circulators/pumps and hoods
  - Accredited testing of heat pumps including sound power measurements
  - Accredited testing of condensing units
  - Acc. test of commercial & domistic refrigerated cabinets & appliance, electronics and vaccine storage
  - WHO approved test institute
  - EHPA approved test institute (Q-label)
  - CEN Keymark (application in process)

- High flexibility in terms of
  - Customer requirements
  - Ongoing feedback
  - Speed-is-key (authorized personal only - not production site risk assessment)

- Competitive prices