

WITH MORE THAN 60 YEARS OF EXPERIENCE IN COMPRESSOR TECHNOLOGY AND HIGHLY DEDICATED EMPLOYEES, OUR FOCUS IS ON DEVELOPING AND

APPLYING ADVANCED COMPRESSOR TECHNOLOGIES TO ACHIEVE STANDARD SETTING PERFORMANCE FOR LEADING PRODUCTS AND BUSINESSES AROUND THE WORLD.



SECOP COMPRESSORS FOR CHALLENGING ENVIRONMENTS

GUIDELINE

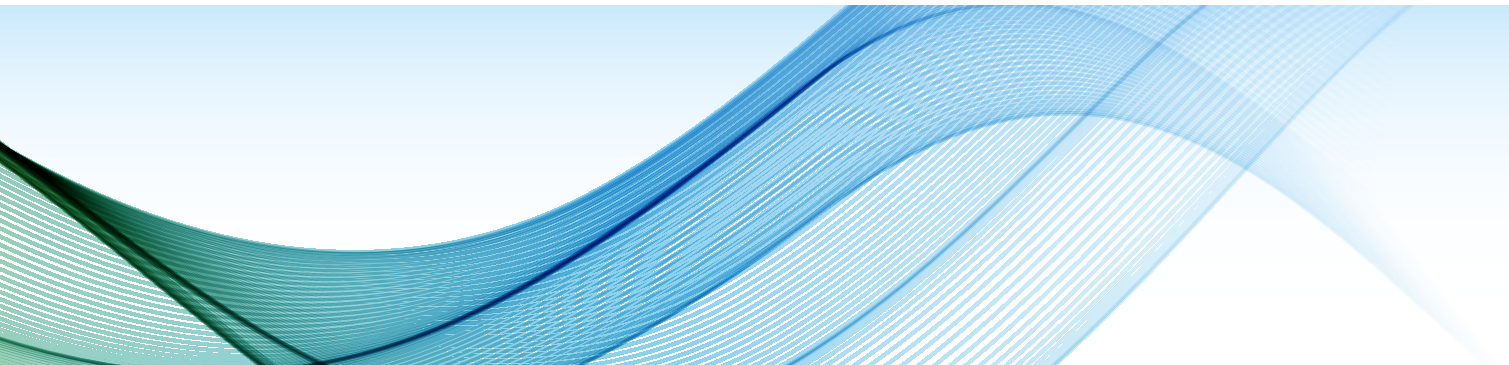


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For more than 60 years Secop, formerly known as Danfoss Compressors, has set the standard whenever environmental conditions presented a challenge. As Danfoss Compressors, we were the first to introduce compressors dedicated to regions with tropical conditions, and with the SC and FR (later followed by TL and NL compressors), we have kept delivering outstanding solutions for harsh environment with high ambient temperatures and fluctuating voltages.

This standards-setting objective has endured to this day. The only difference now is the name, Secop which is a result of Danfoss divesting Danfoss Compressors to the AURELIUS Group in 2010.

It means that Secop compressors continue to be the only original compressors based on the worldwide engineering legacy of the former Danfoss Compressors. It also means that if you encounter other compressor brands with the Danfoss name, they have nothing in common with Secop (formerly Danfoss Compressors) or the reliable quality that comes with 60 years of leading experience.

At Secop, we focus on a wide range of innovative, tropical compressors for R600a with variable speed technology, the forthcoming models will outperform everything currently on the market.

As an interim solution to R600a refrigerant we can now offer energy-efficient KAPPA super tropical R134a compressors. They can work as "bridge solution" to a later application update with KAPPA R600a compressors.

The level of mutual trust we have thanks to highly qualified local agents and distributors is just as standards-setting as our products. These local agents and distributors work together with Secop sales managers to form a highly competent team which is dedicated and focused on customer's requirements. This is, of course, combined with skilled engineers dedicated to the region ensures you:

- Highest compressor quality and reliability in harsh, challenging environments
- A global partner that stands behind its products and improves customer products and ensures quality by providing fast and professional after-sales service
- Unique application support that assists customers with design and optimisation through testing that is conducted in worldwide application laboratories
- Flexible customer support for efficient and effortless service – at all times

Solving today's problems while meeting the challenges of tomorrow. This approach is reflected in all our products, services and information. Consider it as the best reason to think of us as your reliable partner in the region.

Kind Regards,
Kim Quvang
Senior Sales Director, South Asia, Africa, Middle East & Oceania

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INTRODUCTION

No two places are alike around the world. Some regions have high temperatures and others low temperatures. Some regions have dry conditions and others damp and moist conditions. These global differences in weather and climate influence not just people but also the technology people use.

This guideline for Secop compressors is designed to support countries with a particular focus on the

Middle East, South Asia and Africa – regions which experience harsh and challenging environments and where voltage fluctuations as well as high ambient temperatures need to be taken into account.

This guideline will provide you with background knowledge of our compressors, customer support and technical information to make it easier for you to take precise action.



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ABOUT SECOP OUR HISTORY

A NEWCOMER WITH 60 YEARS OF EXPERIENCE

Continuing the legacy of Danfoss, Secop – formerly known as Danfoss Compressors – is one of the founding fathers of modern compressor technology with an experience that goes back to the start of the 1950s when demand rose for something smarter than iceboxes for refrigeration.

Our first compressor entered the market in 1952 and revolutionised the possibilities of producing private refrigerators with its compact "Pancake" design. In the late 1960s and early 1970s, when tropicalisation was in focus, we again set a standard to follow.

It is safe to say that it is in our DNA to be a forerunner on the market with innovative compressors of superior quality and value. Changing the name to Secop in 2010, after being acquired by the German investment group,

Aurelius AG, only strengthened this innovative spirit. Our team of highly dedicated staff are committed to the development, application and support of advanced compressor technologies in order to improve sustainability and performance for leading businesses around the world.

On August 1, 2017, Nidec successfully acquired Secop with its production facilities located throughout the world.

Antitrust concerns about additional acquisitions by the Nidec Corporation in the refrigeration compressor industry led the company to sell off Secop which transitioned to ESSVP IV in September 2019. This fund is managed by Orlando Management AG, a private equity firm with a long and successful track record in developing businesses in the industrial sector.



1956 Production facility and headquarters in Flensburg, Germany founded.	1970 Introduction of SC compressors. The birth of a standards-setting platform in the light commercial market.	1990 Introduction of NL compressors.	1992 Introduction of PL compressors.	1999 Start of production with natural refrigerant R290 (Propane).	2005 Introduction of GS compressors.	2008 Production facility in Wuqing, China founded.	2013 Introduction of the XV compressor – opening a new chapter in refrigeration history. Secop acquires ACC Fürstenfeld, Austria.
1958 Start of production for PW compressors.	1972 Introduction of FR compressors.	1977 Introduction TL and BD compressors.	1993 Start of production with natural refrigerant R600a (Isobutane). Production facility in Crnomelj, Slovenia founded.	2002 Production facility in Zlate Moravce, Slovakia founded.	2010 Introduction SLV-CNK.2 and SLV-CLK.2 variable speed compressors. Introduction BD1.4F Micro DC compressor. Introduction of DLX and NLU compressors.	2015 New generation of energy-efficient propane compressors. New variable speed platforms for household and light commercial applications.	

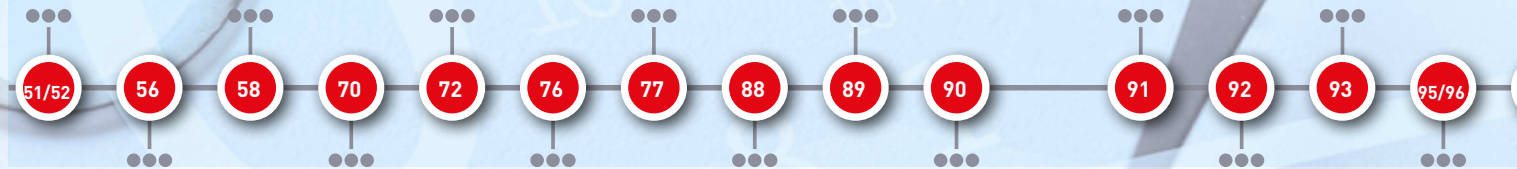
You can see some of our milestones of standards-setting technologies and developments in the timeline above.



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SECOP TIMELINE (DANFOSS COMPRESSORS)



- 1951/52**
- Introduction of the "Pancake" compressor.
 - The licensed manufacture of hermetic compressors has begun. Due to its flat appearance the compressor was named "Pancake", influencing strongly the development of refrigerators in Europe for household appliances.

- 1956**
- Headquarters in Flensburg, Germany, founded.
 - Introduction of the PW compressor.

- 1958**
- Production facility in Flensburg, Germany, founded.
 - Start of production for PW compressors.

- 1970**
- Introduction of SC compressors and PTC starting devices.
 - The birth of a standard setting platform in the light commercial market.

- 1972**
- Introduction of SC compressors and PTC starting devices.
 - The birth of a standard setting platform in the light commercial market.

- 1976**
- Introduction of TL compressors.

- 1977**
- Introduction of BD compressors.
 - The start of standard setting performance for mobile freezers and refrigerators safeguarding food preservation.

- 1988**
- Consolidation in Flensburg

- 1989**
- 100,000,000 compressors produced.

- 1990**
- Introduction of NL and TLES compressors.

- 1991**
- Compressors for R134a.

- 1992**
- Introduction of PL compressors.

- 1993**
- Introduction of compressors for R600a.
 - Start of production of natural refrigerant compressors by using more eco-friendly R600a refrigerant grade isobutane, making a valuable contribution to protecting the environment.
 - Production facility in Crnomelj, Slovenia founded.
 - In 1993 Danfoss Compressors' focus on the environment and contribution to healthier working environment, along with energy-saving production methods and products, resulted in the "Umweltpreis 1993" award. The award was obtained by "Studien- und Fördergesellschaft der Schleswig-Holsteinischen Wirtschaft e.V".

- Danfoss Compressors S.A. de C.V. in Mexico.

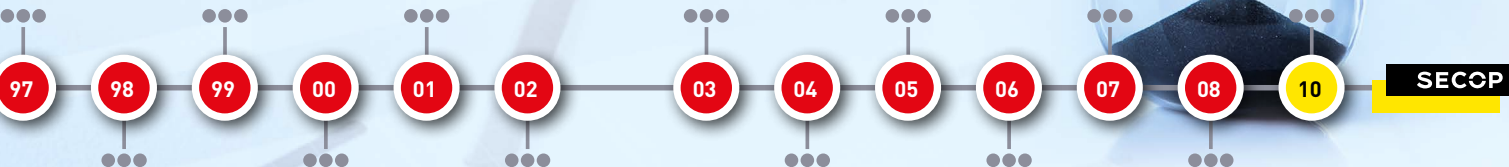
1995

- 1996**
- Introduction of NLY compressors.

- 1997**
- 150,000,000 compressors produced.

- 1998**
- Introduction of BD35F compressors for 12 or 24 V DC.
 - Setting the standard for less energy consumption by variable speed control starting devices.

- 1999**
- Introduction of TLV compressors with variable speed technology.
 - Start of production with natural refrigerant R290 (propane).
 - Introduction of BD50F compressors for 12 or 24 V DC.



- 2000**
 - Introduction of NLV compressors with variable speed technology.
 - Introduction of TLX compressors.
- 2001**
 - Introduction of ePTCs (electronically controlled starting devices).
 - 200,000,000 compressors produced.
- 2000**
 - Introduction of NLV compressors with variable speed technology.
 - Introduction of TLX compressors.
- 2001**
 - Introduction of ePTCs (electronically controlled starting devices).
 - 200,000,000 compressors produced.
- 2002**
 - Production facility in Zlate Moravce, Slovakia founded.
 - Introduction of BD150F compressors with variable speed technology and 12/24 volt option.
- 2003**
 - Introduction of the CO2 compressors for small commercial applications.
 - Danfoss Compressors won the "Umweltpreis" again for its environmentally conscious efforts.
 - BD35F & BD35K (DC) for solar applications.
 - Introduction of "X-treme" series, NLX-KK/TLX-KK.3 compressors.
- 2004**
 - CO2 Compressor Winner of the 2004 AHR Refrigeration Innovation Award.
 - "Ultra Fast Optimization". Introduction of NLX-KK2 compressors.
 - Introduction of BD80F compressors for 12 or 24 V DC.

- 2005**
 - Introduction of GS compressors.
 - Introduction of BD250GH compressors & AC/DC electronic unit.
- 2006**
 - Introduction of SLV variable speed compressor.
 - Danfoss PLUG & COOL™ Winner of the 2006 AHR Refrigeration Innovation Award.
 - Introduction of OPTYMA™ condensing units.
- 2007**
 - Introduction of BD350GH compressors for 12 or 24 V DC.
 - Introduction of OPTYMA PLUS™ condensing units.
- 2008**
 - Production facility in Wuqing, China founded.
- 2010**
 - Acquisition by AURELIUS AG and change of name from Danfoss Compressors to Secop.
 - Introduction of the SLV-CNK.2 and SLV-CLK.2 variable speed compressors.
 - Introduction of BD1.4F Micro DC compressors.
 - Introduction of the DLX and NLU compressors.

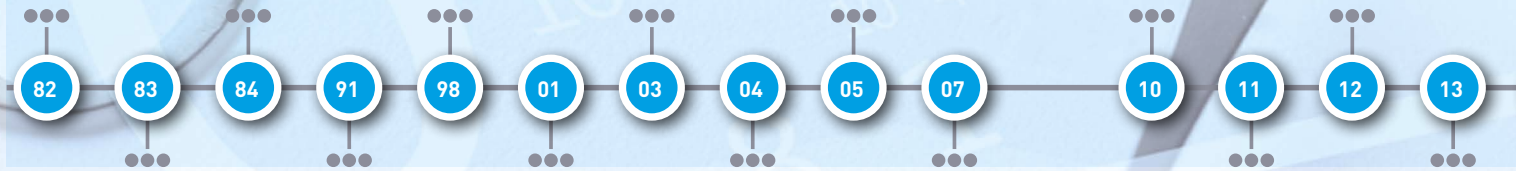
The first hermetic Danfoss compressor entered the market in 1952 and revolutionized the possibilities of producing private refrigerators with its compact "Pancake" design. The production facility and headquarters were founded 1956 in Flensburg, Germany. From then on, Secop – formerly known as Danfoss Compressors – set the standard and have influenced the global market with innovative compressors of superior quality and value ever since.

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SECOP AUSTRIA TIMELINE

(ACC AUSTRIA)



- 1982**
 - Established by Zanussi as "Verdichter Oe".
 - BOSCH Cpr. plant & licence acquired by Zanussi.
- 1983**
 - ALPHA compressors – Start of production.
- 1984**
 - Electrolux acquires Zanussi.
- 1991**
 - Electrolux Quality Award.
- 1998**
 - Electrolux Award for "Engineering Excellence".
- 2001**
 - Austrian State Award. Launch of KAPPA compressors.
- 2003**
 - PE consortium acquires and combines Electrolux compressor business and Sole Motors to form ACC.
 - "Verdichter Oe" sold to ACC group.
- 2004**
 - Austrian State Price for "Export".
 - Austria's leading companies "Big Player" 1st place.
- 2005**
 - Award "Top of Styria".
 - 1st place in "Innovation".
 - 2nd place in "Production".
 - 2nd place "Austria's Leading Companies".
 - 1st place "Big Player".

- 2007**
 - Over 7,000,000 compressors produced.
- 2010**
 - "Hidden Champion" for innovation performance.
 - "Fast Forward" Styrian Innovation Award.
- 2011**
 - Introduction of DELTA compressors.
 - Austrian National Award for Innovation.
- 2012**
 - Launch of DELTA compressors.
- 2013**
 - 100,000,000 compressors sold.
- 2014**
 - Secop takes over ACC Austria.
 - Secop Austria GmbH starts operations on January 7.

SECOP

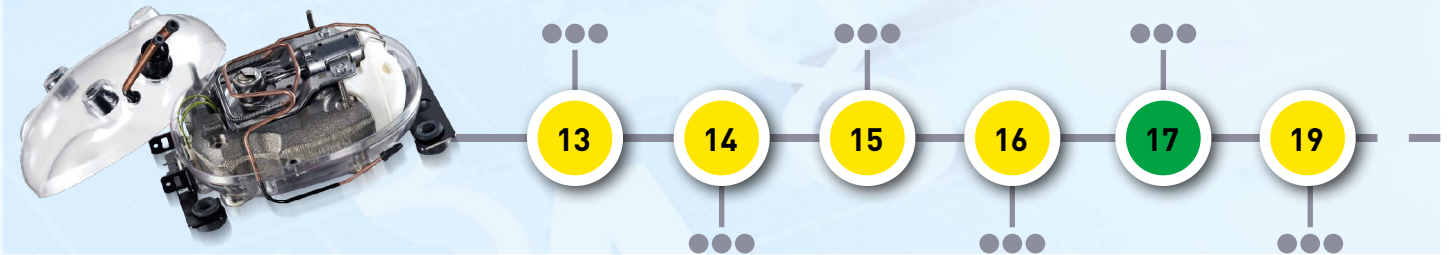
Number of compressors produced by Secop from the very start until August 2019:
 – Secop (formerly Danfoss Compressor): **353 million**
 – Secop Austria (formerly ACC Austria): **113 million**



JOINT SECOP TIMELINE

Secop (formerly Danfoss Compressor)
Secop Austria (formerly ACC Austria)

(2013-2019)



- | | |
|---|---|
| <p>2013</p> <ul style="list-style-type: none"> • Introduction of the XV compressor, opening a new chapter in refrigeration history. • Secop acquires ACC Fürstenfeld in Austria. • China Refrigeration Exhibition – Innovation Award SC-MNX/BD Micro compressors. • CHEAA Technology Progress Awards – XV compressor won the 1st place. <p>2014</p> <ul style="list-style-type: none"> • China Refrigeration Exhibition – Innovation Award XV compressor. • CHEAA Technology Progress Awards – DELTA compressor won the 3rd place. <p>2015</p> <ul style="list-style-type: none"> • New generation of energy-efficient DLE and NLE propane compressors. • Development of new variable speed platforms for household and light commercial applications (NLV, DLV compressors). • China Refrigeration Exhibition – Environmental Pioneer Award. | <p>2016</p> <ul style="list-style-type: none"> • Introduction of energy-efficient SCE compressors. • Introduction of DELTA-MA (MBP) and KAPPA-AT (tropical) compressors. <p>2017</p> <ul style="list-style-type: none"> • China Refrigeration Exhibition – Innovation Award SCE21MNX compressor. • On August 1, 2017, Nidec successfully acquired the German compressor manufacturer Secop • Change of name from Secop to: Nidec Global Appliance (GA) Compressors (from 08/2017 to 09/2019) <p>2019</p> <ul style="list-style-type: none"> • Antitrust concerns about additional acquisitions by the Nidec Corporation in the refrigeration compressor industry led the company to sell off Secop which transitioned to ESSVP IV in September 2019. This fund is managed by Orlando Management AG, a private equity firm with a long and successful track record in developing businesses in the industrial sector. |
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CABINET OPTIMISATION

One of the most vital elements of compressor technology is the cabinet. Secop is continuously searching for improved solutions and ensures global support in order to provide optimal reliability and high efficiency.

Secop compressor components are subject to stringent testing. However it is important to point out that all components require caution with regard to handling and application.



Evaporator

For successful evaporation, we recommend taking note of the following issues:

- Large evaporator area
- Sufficient air ventilation
- In case of capacity problems in the freezing compartment of double door cabinets use the O type instead of C type.
- Optimal channel cross sections depending on refrigerant type and compressor capacity

Condenser

Always use the largest possible condenser size with the best air ventilation. Appropriate tube dimension is necessary in order to avoid a drop in pressure or too much refrigerant charge.

Accumulator

When using the accumulator, be aware that the size and shape has to be adapted for the different refrigerants.

Internal heat exchanger for capillary tube

Always use an internal heat exchanger. The capillary dimensions should be determined depending on:

- Refrigerant type
- Compressor size
- Application

Charge determination

The right amount of charge is the premise for ensuring low consumption and high efficiency.

Optimal compressor size

Compressor size is just as important as charge determination. The rule is simple: compressors should be as small as possible. Too much capacity can lead to increased energy consumption. In order to establish efficient conditions smaller, compressors should run at:

- Possible high evaporation temperature t_0
- Possible low power condensing temperature t_c

Variable capacity compressors such as the Secop XV compressor can increase system efficiency. Please be advised that too small capacity can lead to insufficient cabinet temperatures at extreme conditions.

Equal and sufficient insulation

In order to maintain equal and sufficient insulation, please avoid thermal bridges and be sure to have sufficient sealing gaskets and door labyrinths.

Optimal thermostat values

The thermostat influences compressor running time and as a result it also influences the average condition (pressure) and energy consumption. The rule of thumb for fixed speed compressors is that long compressor run times lead to low average evaporation temperatures and too much energy consumption.

Avoid electrical heating

It is important at all times to avoid electrical heating:

- Anti-condensation heaters should be an extension of the condenser tube.
- Insulation thickness and the proper placement of frame heaters (anti-condensation heater) can avoid sweating
- Double-door evaporators should be designed to prevent a geyser-effect from occurring. Placing a heater on a refrigerator evaporator plate is not required.
- Secop can provide support for evaporator designs

Door labyrinth and gaskets

Please notice that doors with gaskets are a general weak point in heat transfer. A sufficient door labyrinth, though, will support the gasket. Secop can provide support for new labyrinth designs.

Furthermore, gaskets have to be designed so as to minimise heat transfer. This can be done with different chambers, sufficient overlay, especially at corner sections, and a flat front on the appliance housing.

CONVERSION TO FLAMMABLE REFRIGERANTS

One of the best ways to reduce the environmental impact of ozone-depleting emissions is to convert to a refrigerant with a significantly lower ozone-depleting potential.

Refrigerant R600a and R290 are possible replacements. They have both zero ozone depletion potential (ODP) and negligible global warming potential (GWP).

When planning refrigerant conversion, it is important to make sure that the new refrigerant is compatible with all system materials and components, including design, size and safety standards, as each refrigerant type is different in:

- Pressure
- Density
- Enthalpy
- Heat
- Viscosity

Design parameters

Conversion to different refrigerant types demands different design parameters:

The **evaporator** for R600a (household) requires a certain tube cross section (25 to 30 mm²). Moreover, the rising tubes can require smaller tubes.

The **condenser** requires a tube diameter that must not increase compared to R134a.

The flow rate of the **capillary tube** for the R600a refrigerant should be increased about 40-60 % compared to R134a.

Last but not least, the amount of **R600a charge** must typically be less than half that of R134a.

Regarding the **drier**, the molecular sieve must be compatible.

Compressor size

Same appliances must have the same cooling capacity. This will lead to higher compressor stroke volume for a R600a compressor:

Refrigerant	Compressor	Capacity	Volume
R134a	TLES6.5FT.3	183* W	6.49 cm ³
	NL7.3FT	186* W	7.27 cm ³
R600a	TLES10KTK.3	168* W	10.13 cm ³
	NLE11KTK.2	199* W	11.15 cm ³

*) Q₀ ASHRAE LBP

Safety standards

To minimise hazards and maximise a safe working environment, the following data must be taken into account:

- Up to 150 g flammable refrigerant
- IEC 60 335-2-24 (household refrigerated appliances)
- IEC 60 335-2-89 (commercial refrigerated appliances and ice machines)

Practical benchmarks

R290 Propane	R600a Isobutane
Capacities similar to R22/R404A	Capacities similar to R134a
105 W to 1010 W (ASHRAE LBP)	22 W to 290 W (ASHRAE LBP)
Pressure ~ R22	Pressure ~ 1/2 R134a
Roll-Bond not possible	Roll-Bond possible



Basic rules

It is important to follow a basic sequence of safety-related rules and considerations in order to make the correct decision. First all, it is important to separate the gas and ignition sources and to have:

- Separated compartments
- Separation layers (e.g. double layer "safety Roll-Bond")

Burst pressure

It is essential to avoid any kind of burst in pressure:

- Evaporator: R600a \geq 25 bar; R290 \geq 38 bar
- Condenser: R600a \geq 35 bar; R290 \geq 89 bar

Leak simulation

A leak simulation test according to international standards must be conducted.

Electrical connectors

Electrical connectors need a certain quality.

This includes:

- Tolerances
- Contact force

Lamp holder

The quality requirements for lamp holders are:

- Contact force
- Rotation angle
- Certain lamp socket contact
- Other quality requirements

Heater

- Special heater test (max. 360 °C).

General thermostat demands in leak areas

- Connector quality; tolerances; contact force
- Thermostat with sealed contacts

Fans

The requirements for fans in leak areas are:

- Fan IP 20
- Temperature limit (360 °C)
- Sealed switch

Evaporator design

There are three different design options:

Conventional evaporator inside compartment

- Thermostat outside on top, or safety thermostat with sealed contacts, or electronic thermostat
- Door switch outside on top, or safety switch
- Conventional light outside
- Standard Roll-Bond

Safety evaporator inside compartment

- Safety Roll-Bond w/o welding inside
- Standard thermostat, light and switch can be inside

Evaporator outside compartment (hidden evaporator)

- Standard thermostat, light and switch can be inside

Starter

The requirements for the starter are:

- Start relay has to be gas tight
- Connector with certain quality (tolerances contact force)

Warning symbol

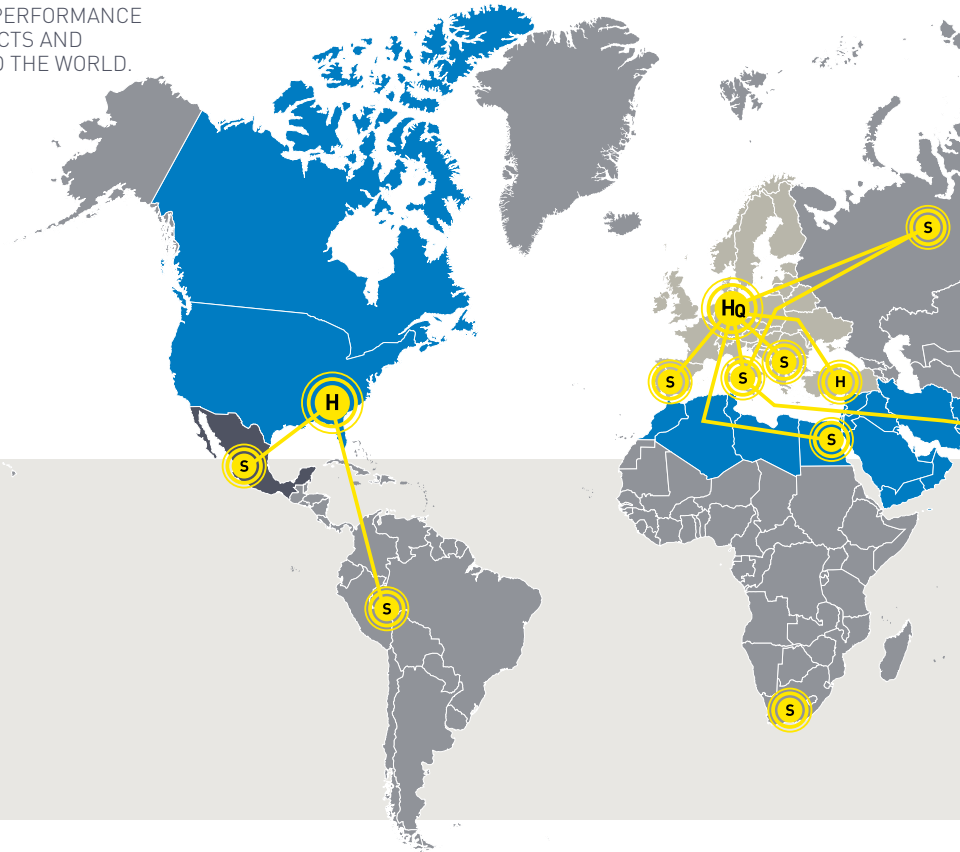
- ISO standard symbol visible for service technician



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CUSTOMER SUPPORT



At Secop, the development of leading compressor technologies goes hand in hand with global customer support.

Secop has facilities in Flensburg, Germany and further production facilities in Austria, China and Slovakia. Beyond this, Secop has sales offices in USA, Russia, China and Turkey as well as strategically located support centres.

We operate with a global "hub and satellite set-up". The idea is simple: always offer the best possible technical support nearest you.

Support level 1 – Satellites

With strategically located satellite support centres in Mexico, Europe, Africa, Asia and Australia, Secop is able to assist customers in all regions. This global presence makes it easy to:

- Support customer development
- Solve potential problems quickly
- Arrange technical meetings with customers

Support level 2 – Hubs

In addition to the satellite support centres, Secop has 3 hubs, placed in USA, Europe and in China. The hubs represent a large-scale concentration of expert knowledge within innovative compressor technology and offer support, technical training and customer and product development.

Customers in all regions have complete support of

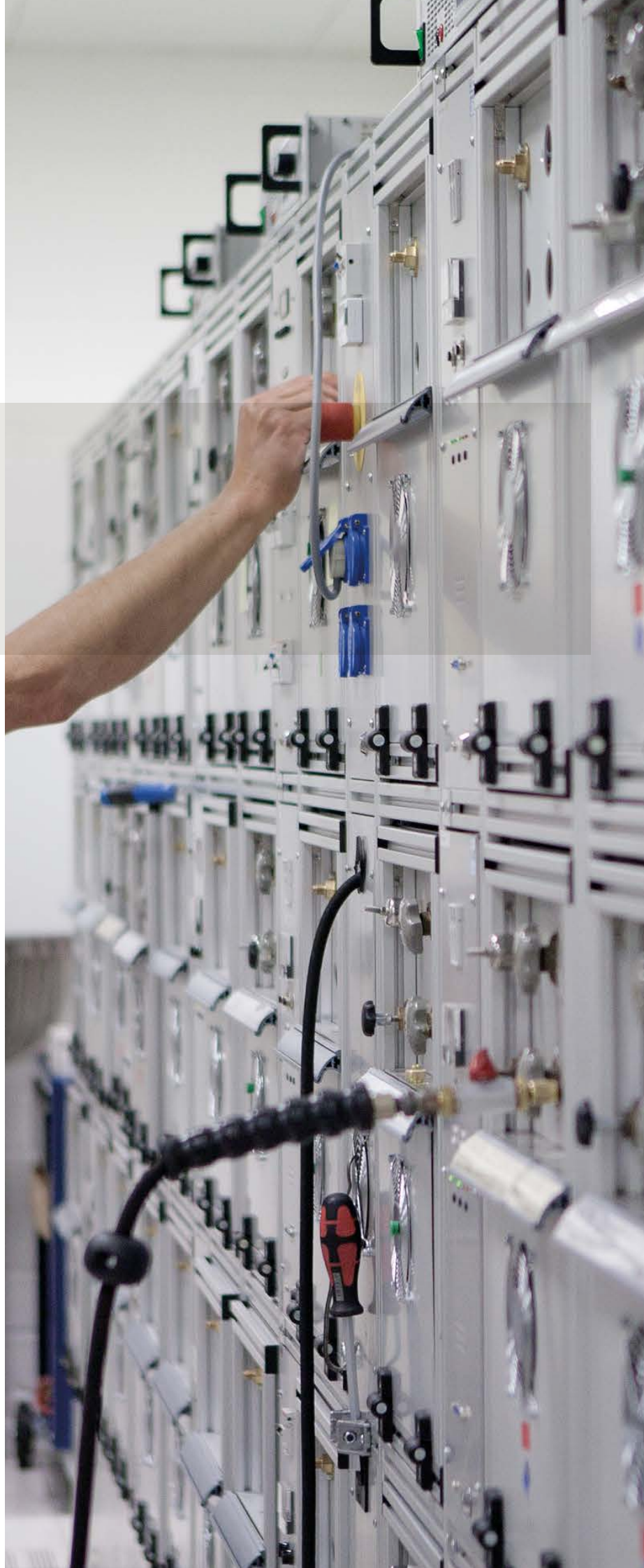
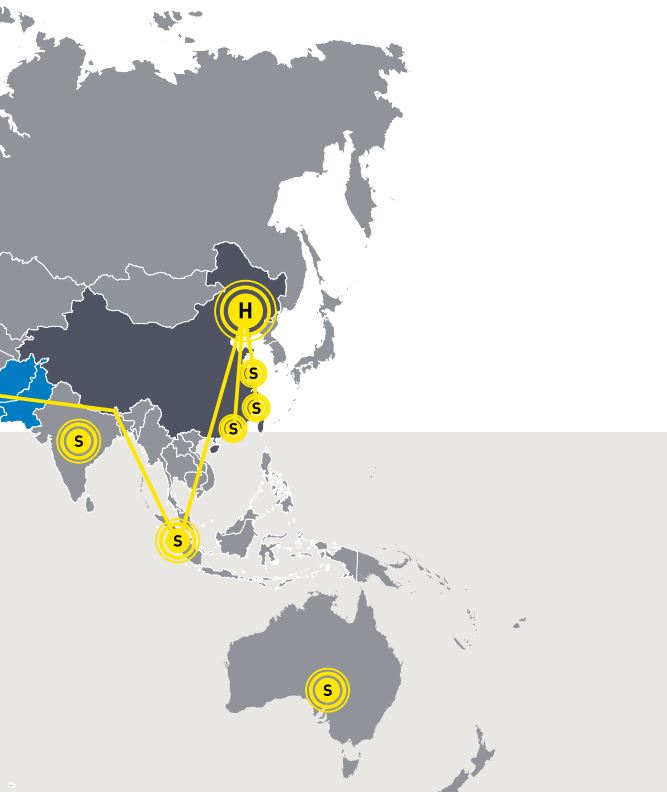
their activities and can take benefit from:

- Technical support and training
- Technical documentation
- Product application support
- Market information and benchmark support
- Sampling process

Support level 3 – Laboratories

Secop has established laboratories and facilities at the global hubs including climate and noise rooms which make it possible to conduct a wide range of testing. The facilities are a part of the ambition to engineer immediate and vital support to customers and partners around the world. These include:

- Appliance tests
 - Standard tests
 - Customer tests)
- Customer tests include:
 - Compressor and refrigerant selection
 - Cabinet improvements
 - Charge determinations
 - Selection on components
 - Energy consumption
 - Capacity
 - Trouble shooting
 - and much more



Climate rooms

Secop's climate rooms are used for functional and performance tests under extreme conditions. The rooms help to test compressors in real applications and those in which controlling the climate is essential.

The climate rooms make it possible to examine and solve potential problems for customers, improve appliances and their efficiency and capacity.

Moreover, testing in the climate rooms also continuously helps to improve on designs and with changeovers such as from R12 to R134a in the past and more recently from R134a to R600a.

Noise rooms

Besides climate rooms that put compressors under extreme climate conditions, there are test rooms dedicated to examining noise.

Noise has long been an important issue in modern cooling and refrigeration. Secop has for many years put cutting-edge expertise into this area, helping customers and setting a high benchmark within low noise operation. Tests include:

- Appliance tests
- Standard tests
- Customer tests
- Cabinet improvements
- Trouble shooting
- and much more

RELIABILITY AND PERFORMANCE

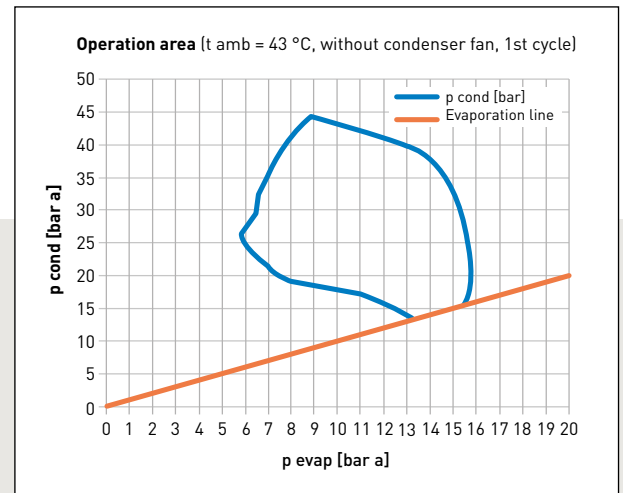


Fig. 1

Reliability is everybody's major concern in refrigeration applications along with the level of performance. In order to meet these two requirements, Secop has engineered a step-by-step-procedure for ensuring products and solutions continue to set a global standard.

The following pages provide an overview of the steps.

1. Application analysis
2. Definition of compressor specification
3. Performance tests, targets and evaluations
4. Reliability tests and evaluation of results
5. Release of a new compressor type

STEP 1: APPLICATION ANALYSIS

A new compressor model always starts out with a thorough check of functionalities and performance.

- Defining performance targets
- Running special operation tests with regard to cooling cabinets
- Drawing information about measurements and needed operation range

STEP 2: DEFINITION OF COMPRESSOR SPECIFICATIONS

Using an application analysis, Secop creates a CRD (Customer Requirements Document) for the new compressor type. The CRD summarises all demands which the compressor has to fulfil.

- Operation envelope (ranges of voltage, pressures, temperature)
- Cooling performance (capacity, energy efficiency, start, stall)
- Noise performance (noise, vibration, pulsation)
- Reliability demands and special functions

Different market needs can lead to special variants of a CRD (e.g. "normal use" and "special use"). The CRD covers all possible variables involved in using the compressor.

STEP 3: PERFORMANCE TESTS, TARGETS AND EVALUATIONS

The Secop R&D team set up performance tests, targets and evaluations according to CRD definitions,

- **Extreme load conditions:** winding temperature, protector function, motor load
- **Optimisation conditions:** cooling capacity, energy efficiency, noise
- **Pull down and start:** maximum pressures, minimum voltage, reverse rotation
- **Overload situation:** fan out failure - maximum pressures
- **Transportation:** wear, particles, etc.

Before a prototype is released, all details and designs must be measured and documented. All tests are run inside Secop and according to Secop test specifications (see Fig. 1 and 2).

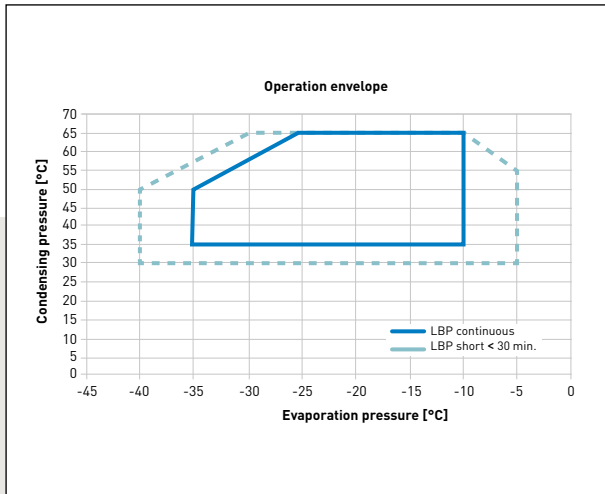


Fig. 2

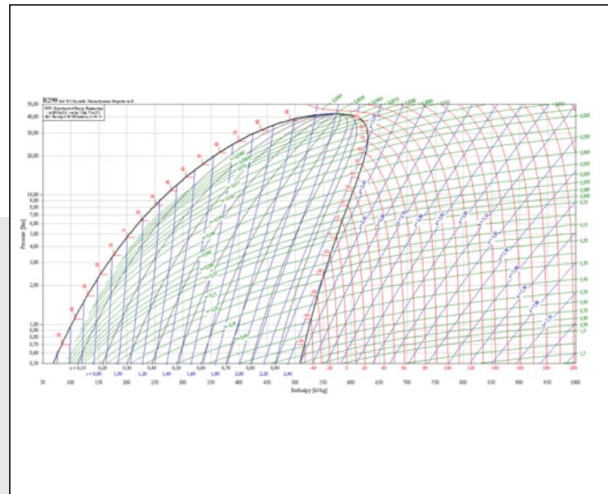


Fig. 3

STEP 4: RELIABILITY TESTS AND EVALUATION OF RESULTS

Based on various extreme operation conditions and linked impact time, specialists define conditions for the reliability tests. All reliability tests are accelerated tests and coincide with the refrigerant.

Secop’s reliability tests are conducted to visualise behaviour of wear and fatigue of compressor components after a “working life” of 15 years.

All reliability tests are run, analysed and documented according to Secop specifications and in Secop laboratories (see Fig. 3).

STEP 5: RELEASE OF A NEW COMPRESSOR TYPE

Prior to the release of a new compressor type, Secop run final release tests with pilot series compressors.

This extensive step-by-step procedure ensures the reliability and high performance synonymous with Secop compressors.

Reliability and performance

Pertains in particular to the Middle East, South Asia and Africa.

Ranges of target values or boundary conditions can be different but the testing, which examines reliability and performance, always follows the same rules. This ensures that the quality of Secop compressors is always of the highest level, regardless of the application or operation environment.

Special boundary conditions

Compressors and unstable power sources are a challenge. In order to ensure the best conditions, please note the following:

- Start at very low voltage up to very high voltage must be possible.
- Short time (<30 min) operation at very high voltage must be possible.
- Fast restart after power source blackout must be possible.
- Reverse rotation after power source brownout must be avoided or possible.
- Operation at very high ambient temperatures and extreme voltages must be possible.

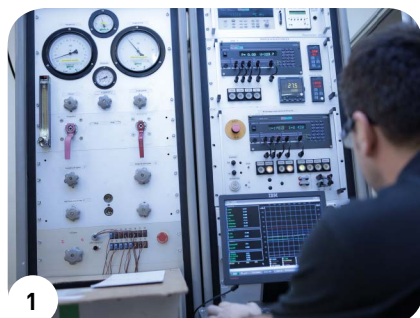
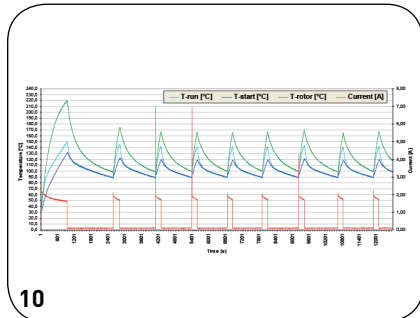
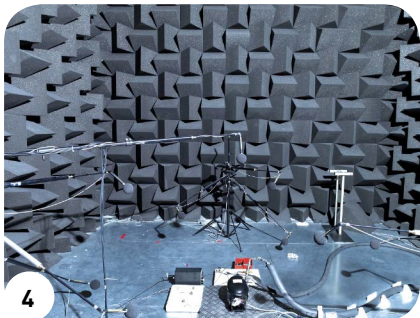
Boundary conditions, as described above, will be linked to the application-related compressor demands. Unique compressors can be produced if the exact specifications are known.



LABORATORY TESTS

Countless testing is the key to the performance and reliability of Secop compressors. Below is an overview of our tools and processes.

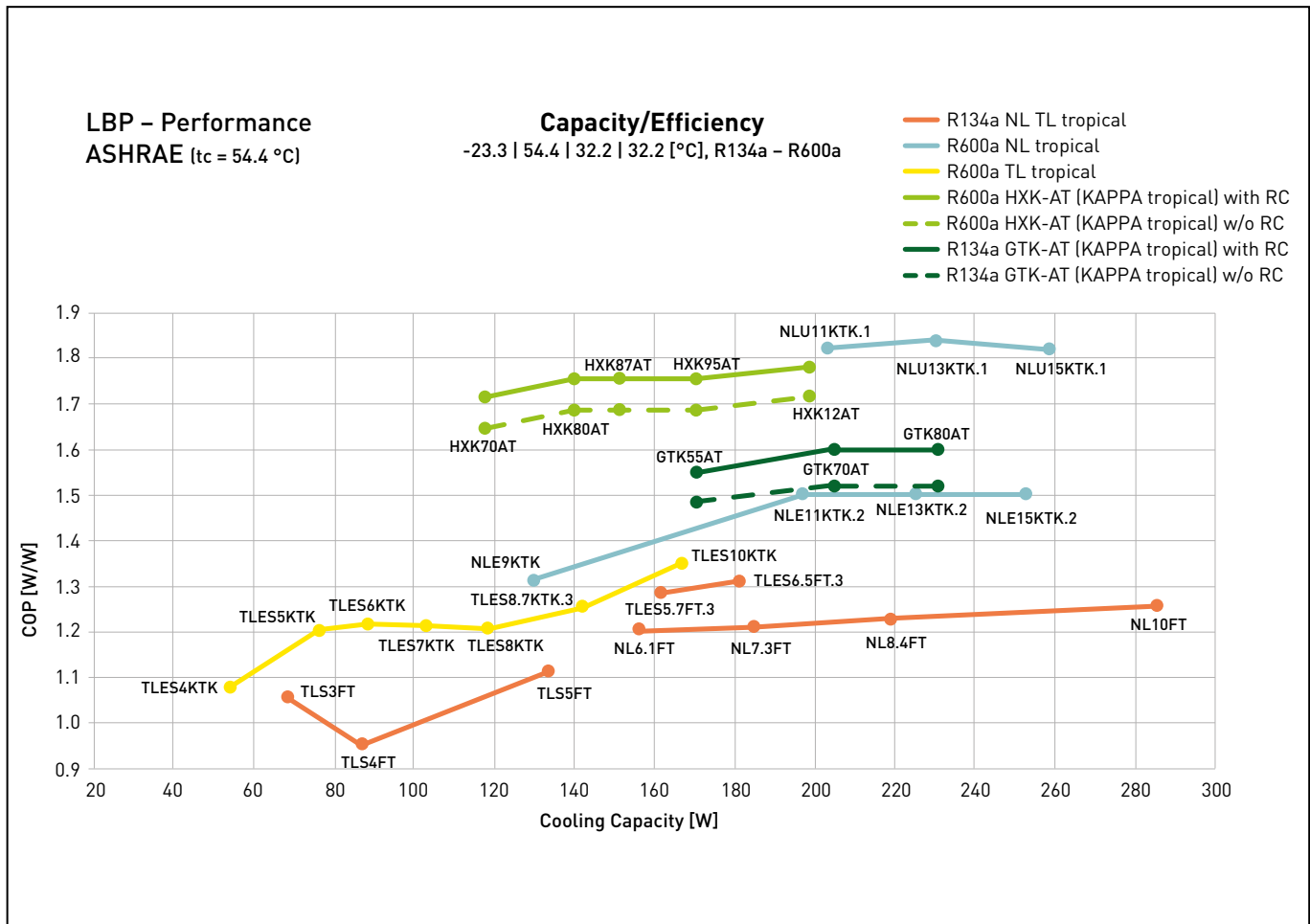
- **Calorimeter:** To determine capacity, consumption, efficiency-factor (COP, EER) and temperature condition (1).
- **Running-in panels:** To obtain uniform conditions for the various compressor tests (2).
- **External oil circulation:** To determine the amount of compressor oil circulating in the refrigeration system (3).
- **Noise tests:** Rotating boom and reverberation chamber to determine the level of sound emitted by the compressors (4).
- **Start test:** To determine the lowest voltage at which the compressor can start under different load conditions.
- **Stall tests:** To determine the breakdown condition after compressor start of a compressor (5).
- **Run order program:** To determine the right protector for a compressor. Progress starts with dimension tests and ends with approval tests for the authorities (VDE, UL and others).
- **Start/stop life test:** To determine the mechanical strength of the connecting elements in a compressor during the start and stop cycles (6).
- **Start/stop noise test:** To determine the noise on a compressor during the start and stop cycles (7).
- **Purity testing panels:** To determine the weekly control of a compressor's purity for the different refrigerants (8).
- **High-temperature lifetime tests:** To examine the wear characteristics of the load bearings in an extreme environment simulated by a high-ambient temperature.
- **Lifetime panels:** To examine the wear characteristics of the valve system, load bearings and contact interfaces of the compressor in an extreme environment (9).
- **Wear tests:** To determine the mechanical strength of the compressor within a relatively short period of time.
- **Locked rotor tests:** To determine the right motor protection for a compressor. Progress starts with dimension tests and ends with approval tests for the authorities (VDE, UL and others) (10).
- **Vibration & drop test:** To examine the vibration strength of the compressor and to check if the assembled compressor is resistant function properly due to the effects of handling and transport.
- **Appliance test:** To examine the wear characteristic of the load bearings in an application environment (11).



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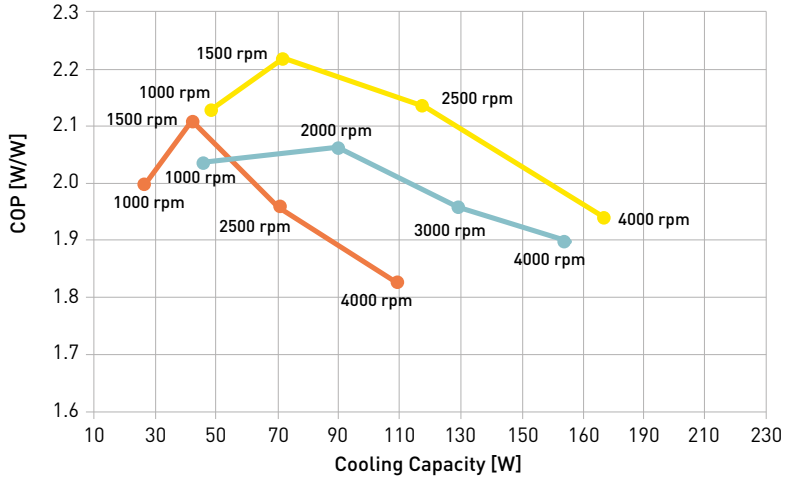
PERFORMANCE DATA



LBP – Performance
ASHRAE (t_c = 45 °C)

Capacity/Efficiency
-23.3 | 45 | 32.2 | 32.2 [°C], R600a

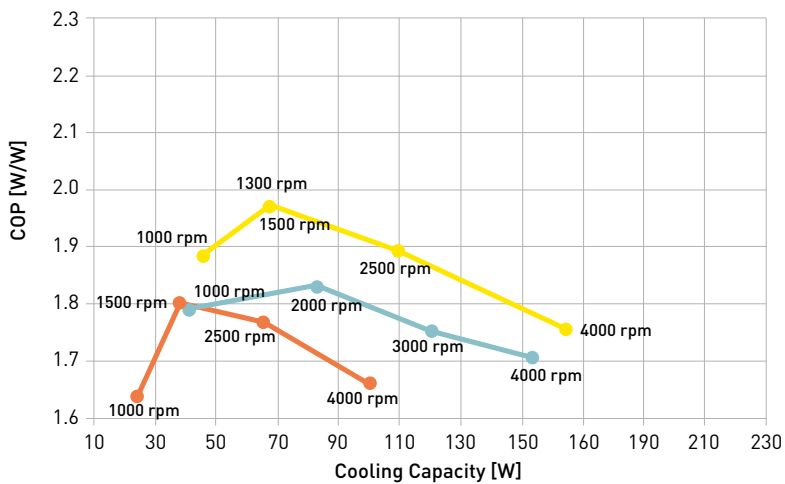
XV5.0KX
XV7.2KX
XV8.0KX



LBP – Performance
ASHRAE (t_c = 54.4 °C)

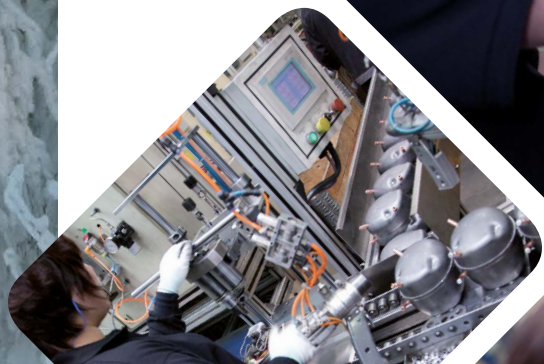
Capacity/Efficiency
-23.3 | 54.4 | 32.2 | 32.2 [°C], R600a

XV5.0KX
XV7.2KX
XV8.0KX



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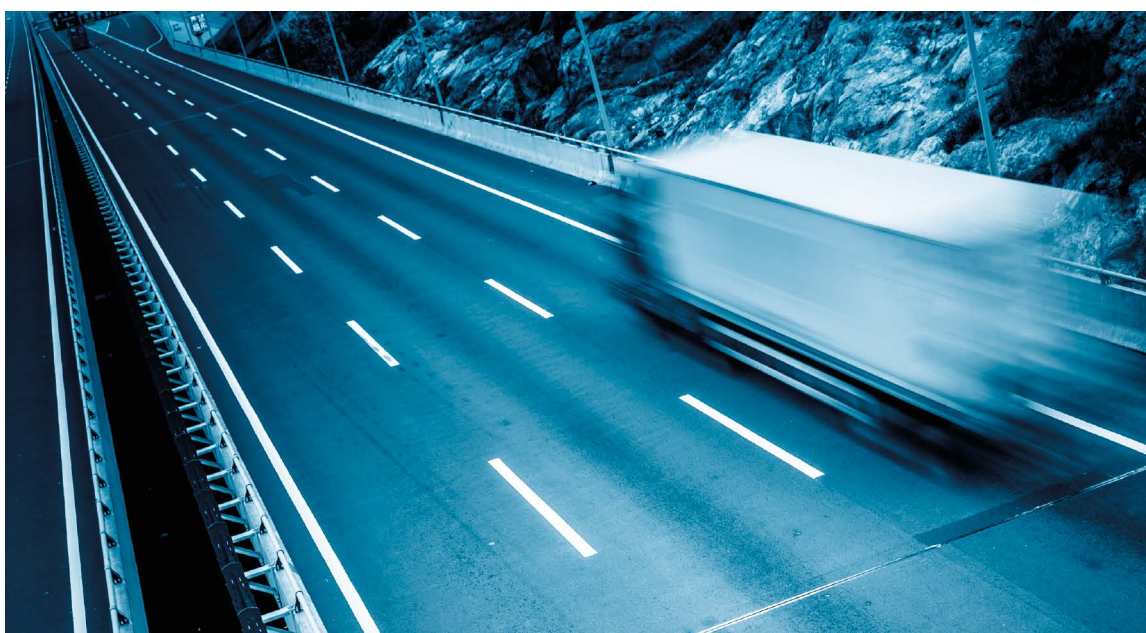
SHIPMENT POSITIONS OF REFRIGERATION APPLIANCES

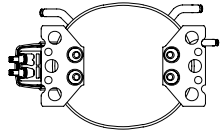
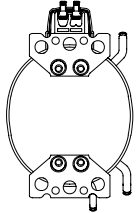
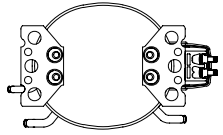
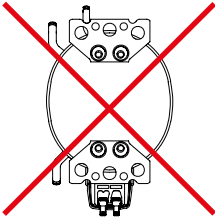
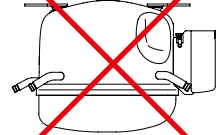
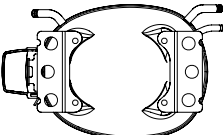
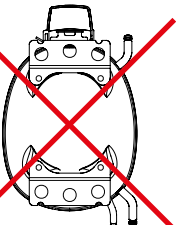
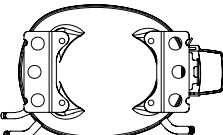
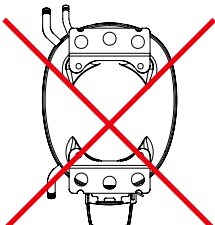

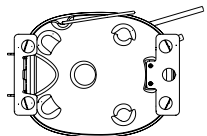

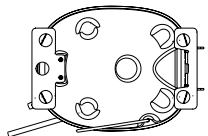
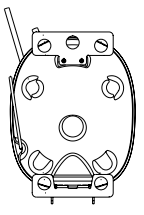
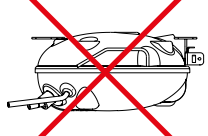
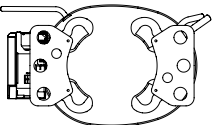
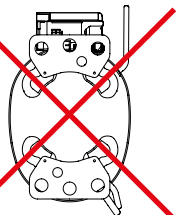
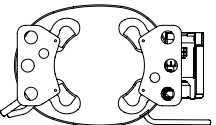
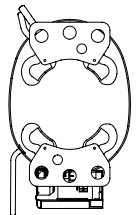
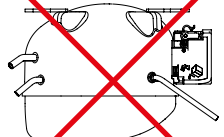
Shipment of refrigeration appliances in horizontal position

Shipping refrigeration appliances in the standard vertical position will normally not cause any damage to the compressor. If transported in a horizontal position, the compressor must be oriented as shown in the table on the next page to prevent the accumulation of oil in the muffler and subsequent risk of damage. It is important to note that the compressor must be securely fastened and

well supported during transportation. Refrigeration appliances can be safely transported in horizontal position:

- by lorries on roads and motorways in good condition
- by ship in containers
- on railways in good condition



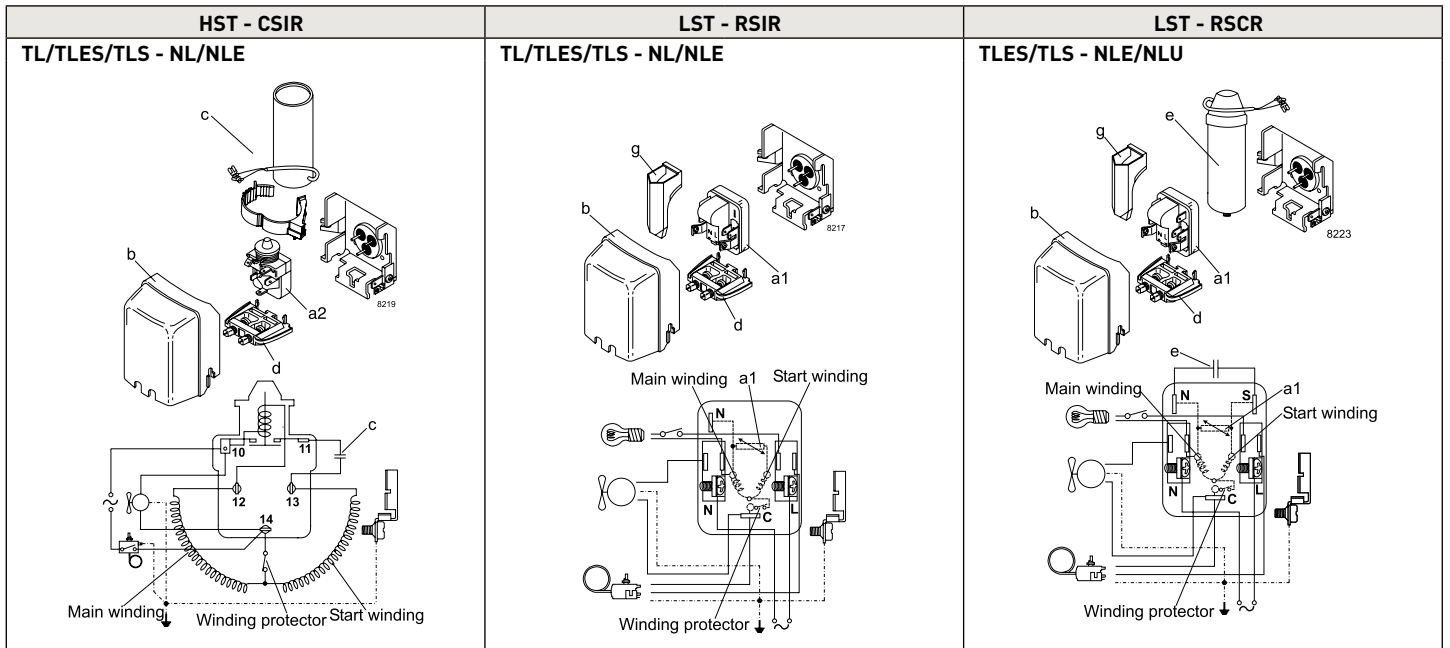
Compressors	Shipment positions of refrigeration appliances - Position X must not be used				
	Connectors up	Electrical lead-in up	Connectors down	Electrical lead-in down	Base plate up
T - Series					
N - Series					
X - Series					
KAPPA (GTK/HXK)					

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ELECTRICAL EQUIPMENT TL, NL AND KAPPA





Description

- a1:** PTC starting device
- a2:** Starting relay
- b:** Cover
- c:** Starting capacitor
- d:** Cord relief
- e:** Run capacitor
- g:** Protection screen for PTC

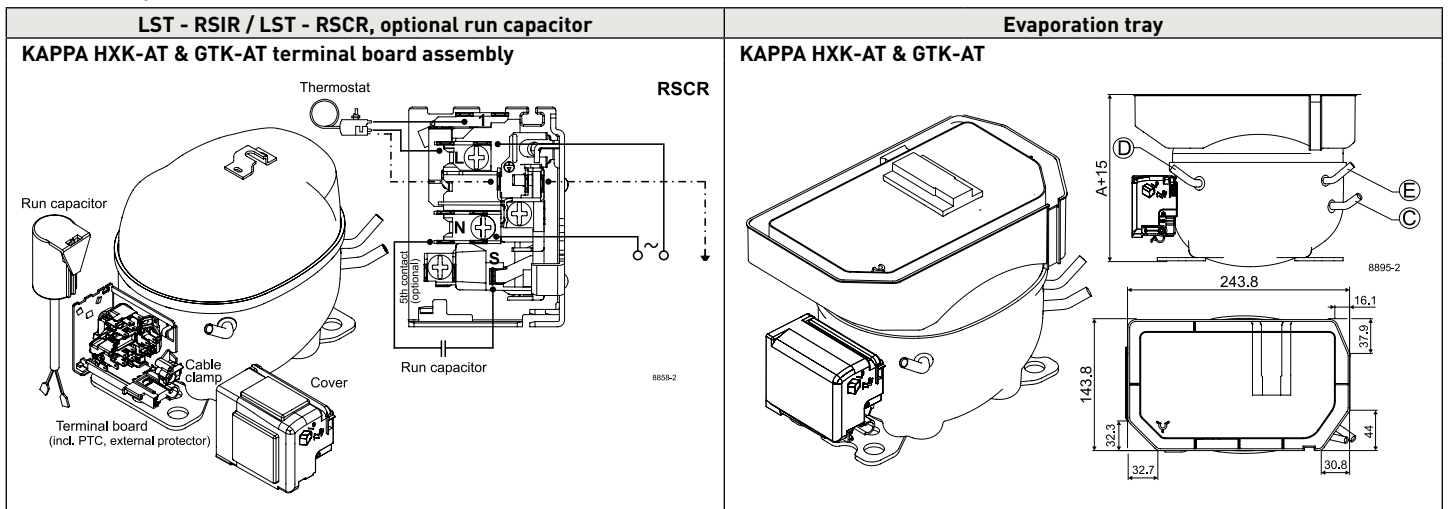
To fulfil the requirements of EN 60355-2-34, the protection screen 103N0476 must be applied to the PTC starting device.

Motor types

- RSIR:** Resistant Start Induction Run
- RSCR:** Resistant Start Capacitor Run
- CSIR:** Capacitor Start Induction Run
- CSR:** Capacitor Start Run

Starting devices

- LST:** Low Starting Torque
LST is used with capillary tube control and pressure equalising. (Pressure equalising may exceed 10 minutes). The PTC starting device requires 5 minutes cooling before each start.
- HST:** High Starting Torque
HST consisting of relay and starting capacitor is used for expansion valve control or for capillary tube control without pressure equalising.



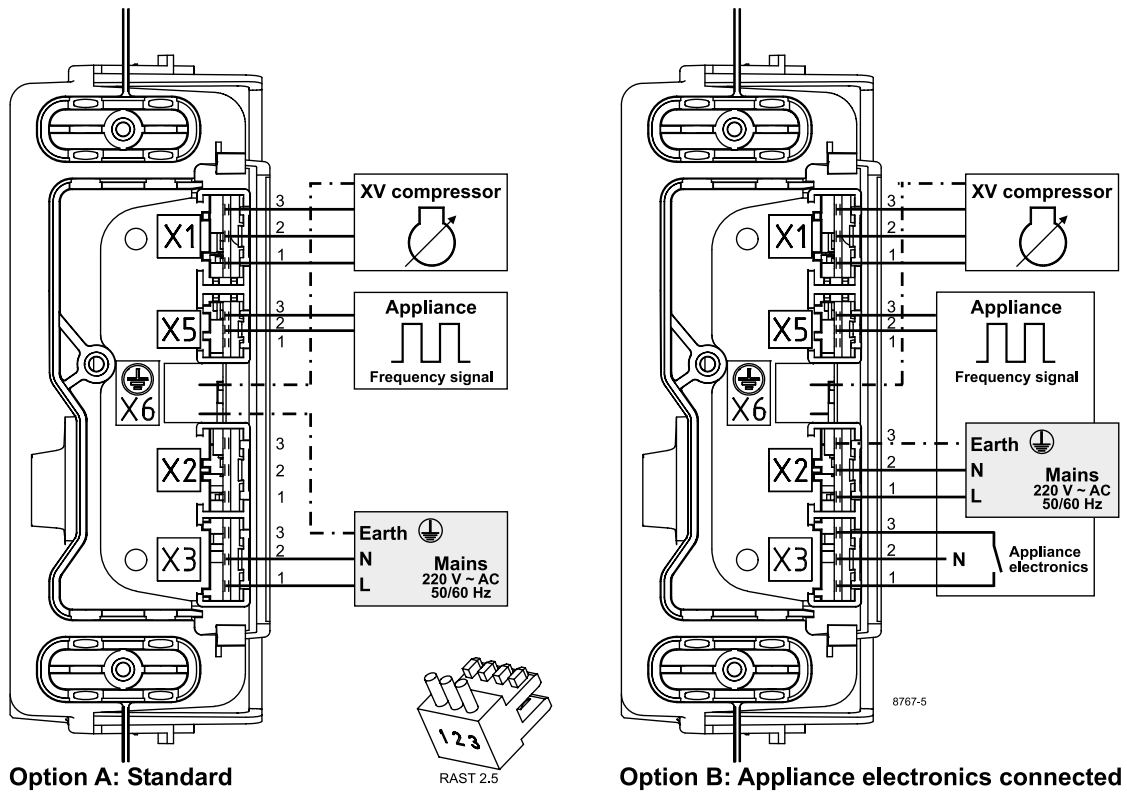
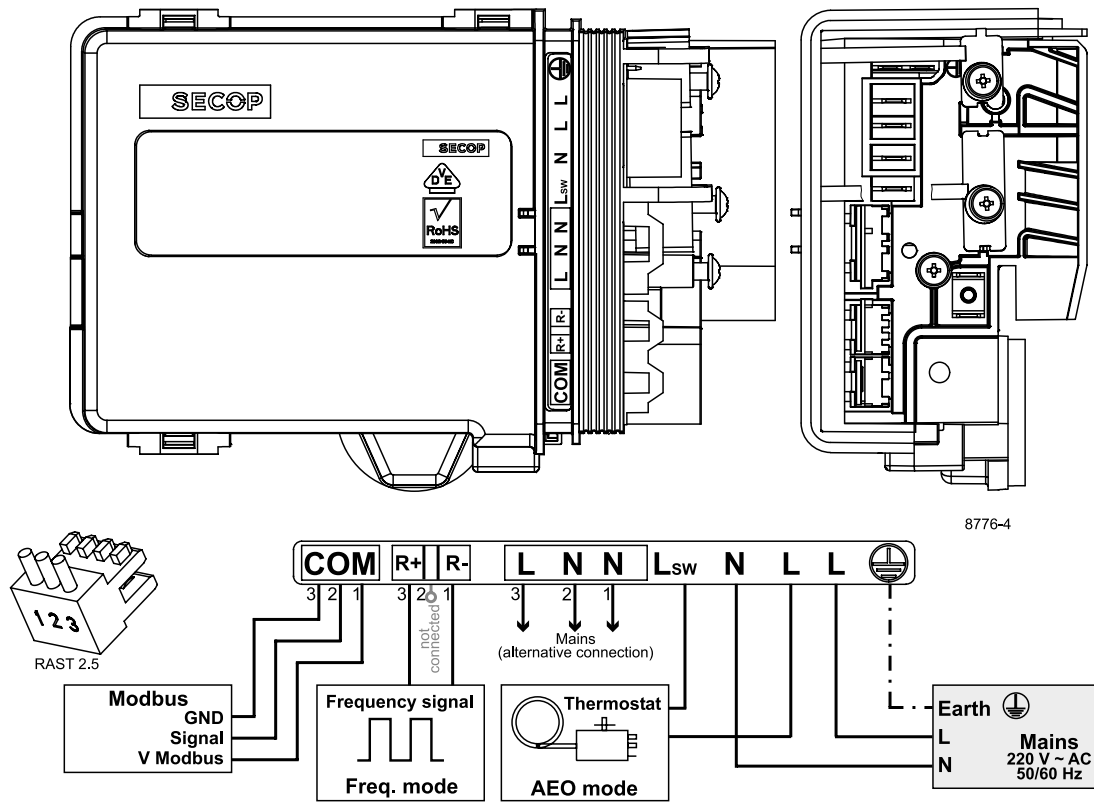
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ELECTRICAL EQUIPMENT

XV





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APPLYING ADVANCED COM TECHNOLOGIES TO ACHIEVE STANDARD SETTING PERFORMANCE FOR LEADING PRODUCTS BUSINESSES AROUND THE

PRODUCT RANGE

Low

Cooling Capacity

HOUSEHOLD

AC



DC



DC-POWERED



High



LIGHT COMMERCIAL



Series

F-Series

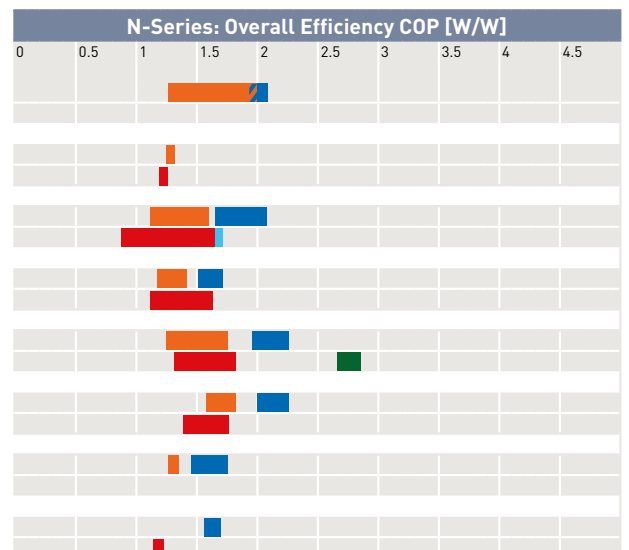
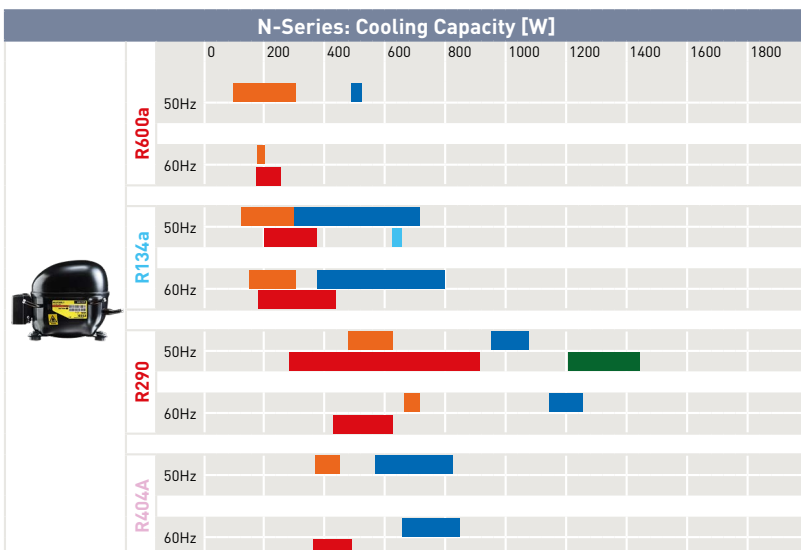
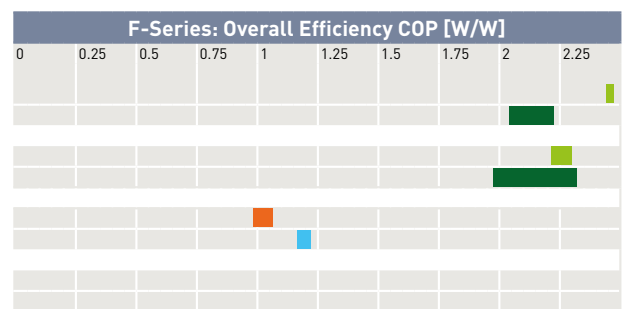
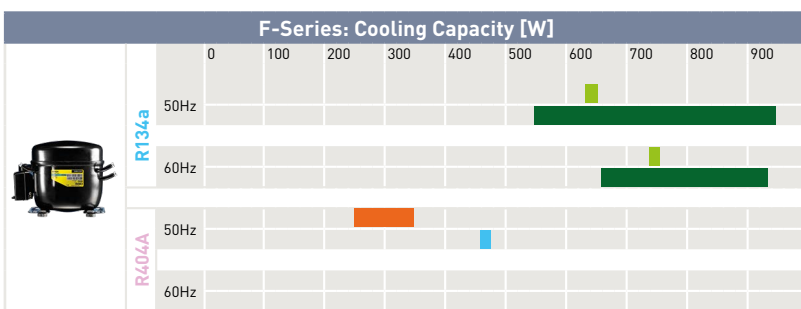
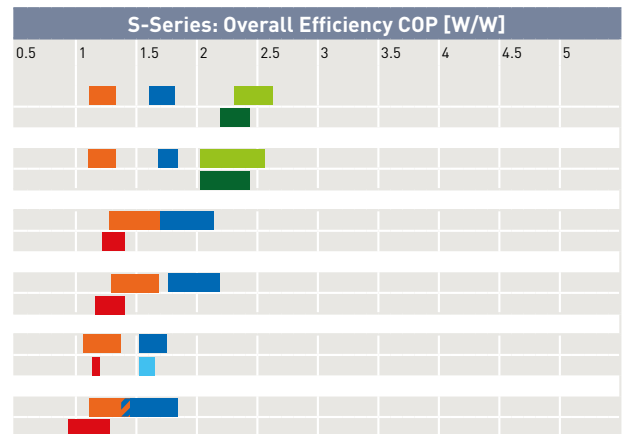
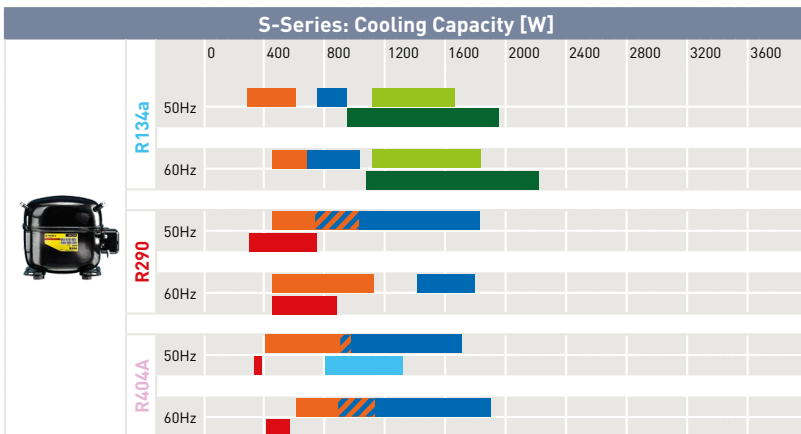
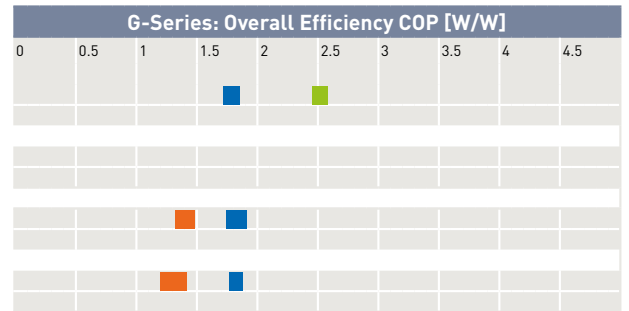
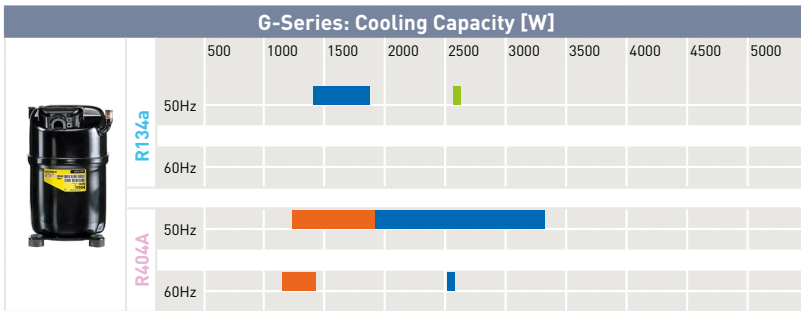
S-Series

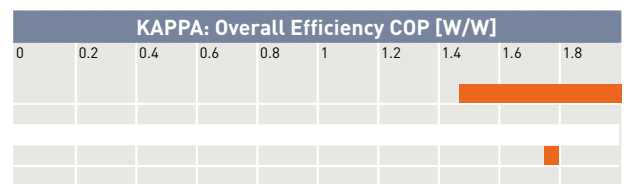
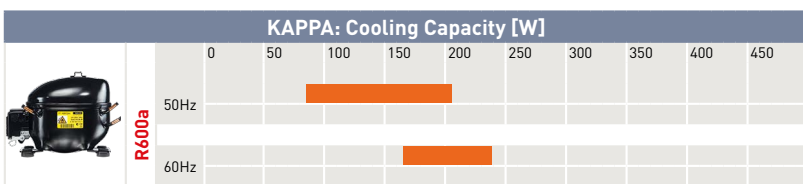
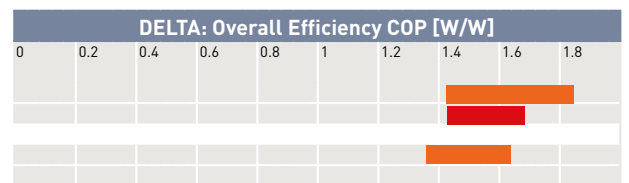
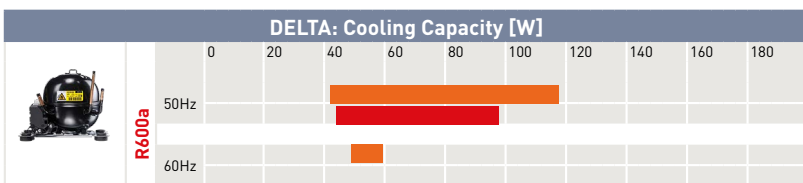
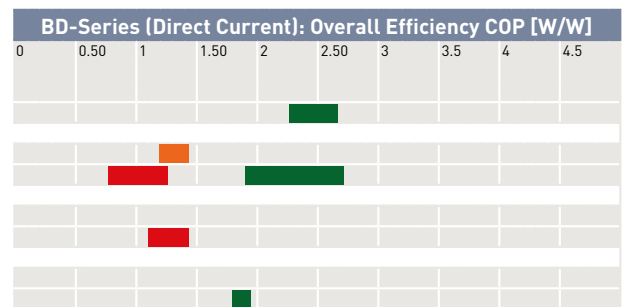
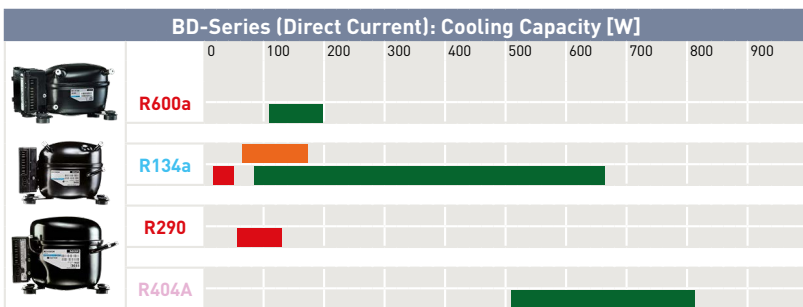
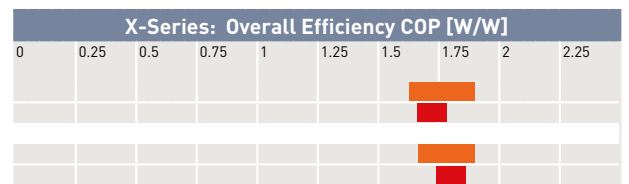
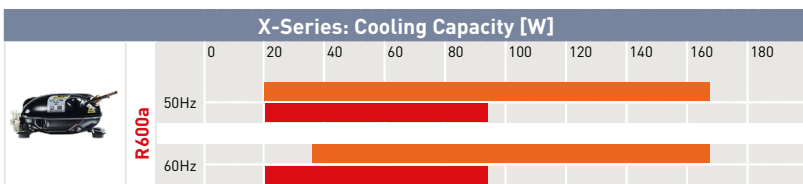
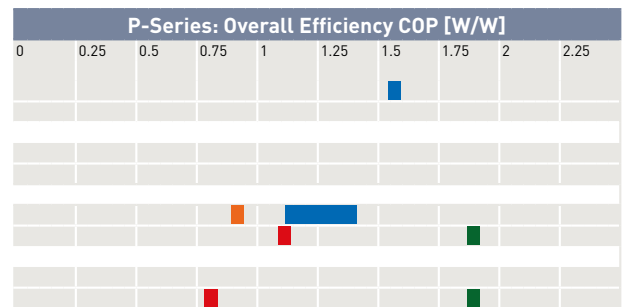
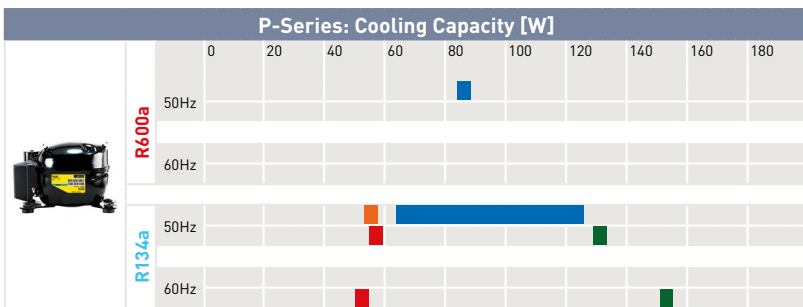
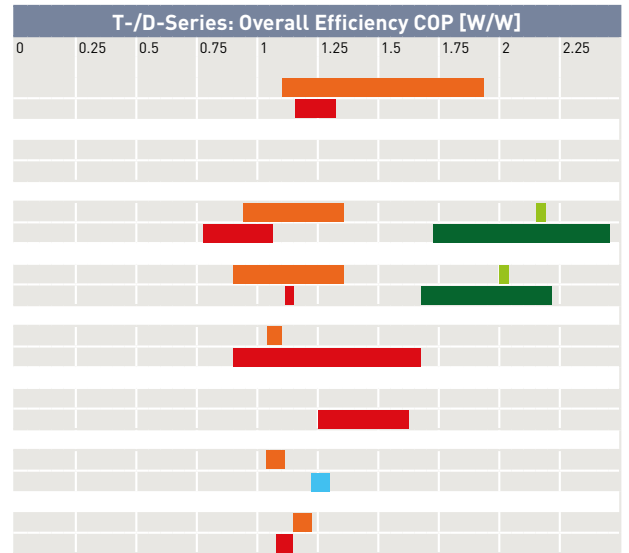
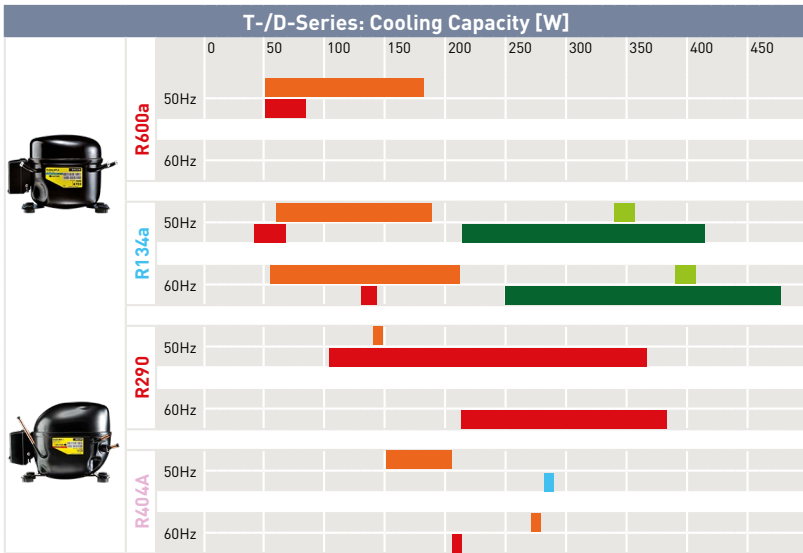
G-Series



PRODUCT PORTFOLIO

SECO^P





	50/60 Hz	LBP	MBP	HBP	LBP+MBP	MPB+HBP	LBP+MBP+HBP
T _{evap} [°C]		-23.3	-6.7	7.2	-23.3	-6.7	7.2
T _{cond} [°C]		54.4	54.4	54.4	54.4	54.4	54.4
T _{suc} [°C]		32.2	35	35	32.2	35	35
T _{liq} [°C]		32.2	46.1	46.1	32.2	46.1	46.1



LEADING TECHNOLOGY THE RESPONSIBLE WAY



At Secop, the development of leading compressor technologies always goes hand in hand with social and environmental responsibility.

We think it is the least we can do, helping our customers to meet regulations and build a better world.

This means all Secop compressors are designed to save energy and reduce emissions in customer applications all over the world.

It also means that we carry out environmental manufacturing practices wherever we operate.

It means we are a participant of the Global Compact, an initiative of the United Nations for businesses that are committed to aligning their operations and strategies with ten universally accepted principles in the areas of human rights, labour, environment, and anti-corruption.

And it means that when you choose a Secop compressor, you're opting for high-performing solutions that cool with a conscience – now and in the future.