

# TMS SERIES

GRAIN  
COOLING  
UNITS

# TMS

INDUSTRIAL REFRIGERATION



# TKS

WITH THE TMS/TKS SERIES  
GRAIN COOLING UNITS

INCREASE YOUR  
EARNINGS WHILE  
REDUCING LOSSES  
IN THE GRAIN SILOS!



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Despite the fact that the production amounts of grains are high, in private conditions such as they shall not be consumed in a short time and regional climatic changes, because of the fact that they gain more importance for countries, they shall be stored under convenient conditions. In order to the fact that the stored items are to be protected without losing their value in terms of quality and quantity and with the minimum losses, storage conditions of the item shall be known properly and the items shall be controlled.

In storage of grains there are many effective and determinant factors. Foremost among them can be counted keeping under control the grain and storage humidity content and temperature continuously. Other factors are the amount of foreign substances within the stored grain mass, microorganisms, insect pests and storage characteristics. Because of the fact that during the storage the issues that shall be followed are not obeyed and because of also other reasons, in storage of grains various problems are encountered.

# GENERAL INFORMATION

Grain, is among the significant comestibles around the World. It is grown and harvested with a great care and attention. According to United Nations Food and Agriculture Organization (FAO), annual degradation of the grain that is harvested around the World is more over 20%. Significant amount of this loss arises from insect activity and mould formation.

Through reducing the changes of quality and quantity of a product into minimum, with the purpose of protecting that item for a much longer period with the storage process the grains, shall be protected without getting degraded in long storage periods.



In recent years grain cooling is developed around the World in considerable rates. Nowadays grain cooling is among the important and essential part of modern storage keeping systems. Temperature values that rise with climatic changes and expectation of high quality, cooling, drying and air conditioning systems' usage are increased.

The fact that storage holding temperature decreases below 10°C, leads the biological growth level to decrease in grain to minimum levels. This situation enables the formation of parasite, fungus and moulds and prevents the grain to breathe. Breathing of the grain – which means the biochemical division of carbohydrate into carbon dioxide and water with the release of heat – leads to significant amount of grain losses. Degradations in grain structure, protein denaturation, polysaccharide degradation, water vapour formation and germination occurs.

With the TKS series cooling operation, in fresh and healthy environments grains are protected and saved for long times. Thus, until the proper sales time is reached, protection without risk shall be possible. Together with the cooling technology offered, chemical solutions are removed and environmental factor shall not damage to the items. Factors that generate risk on the product in terms of health are removed. Usage of chemical pesticides terminates the living parasites but not their larva. That's why chemical processes shall be repeated more than once. This operation is subjected to serious limitations today.

In many applications seen and widely used cooling system with the external environmental air, in rainy and foggy air conditions brings highly rated energy consumptions and their bad consequences together.

In medium and large scaled storage systems stored grains losses are prevented in significant rates, thus, investments made on the TKS products come back to their investors in a very short time.



# TKS

## HARVEST TIME

In the growth phase of the grain, during the harvest time the highest maturity is reached. But on the postharvest period grain still keeps on living further on; and it breathes. In the cellular respiration oxygen is absorbed and following this carbohydrates are converted into water and heat. During the period that is experienced, if precautions shall not be taken moulding, pediculosis and helminthiasis begins and this leads to serious amounts of losses.

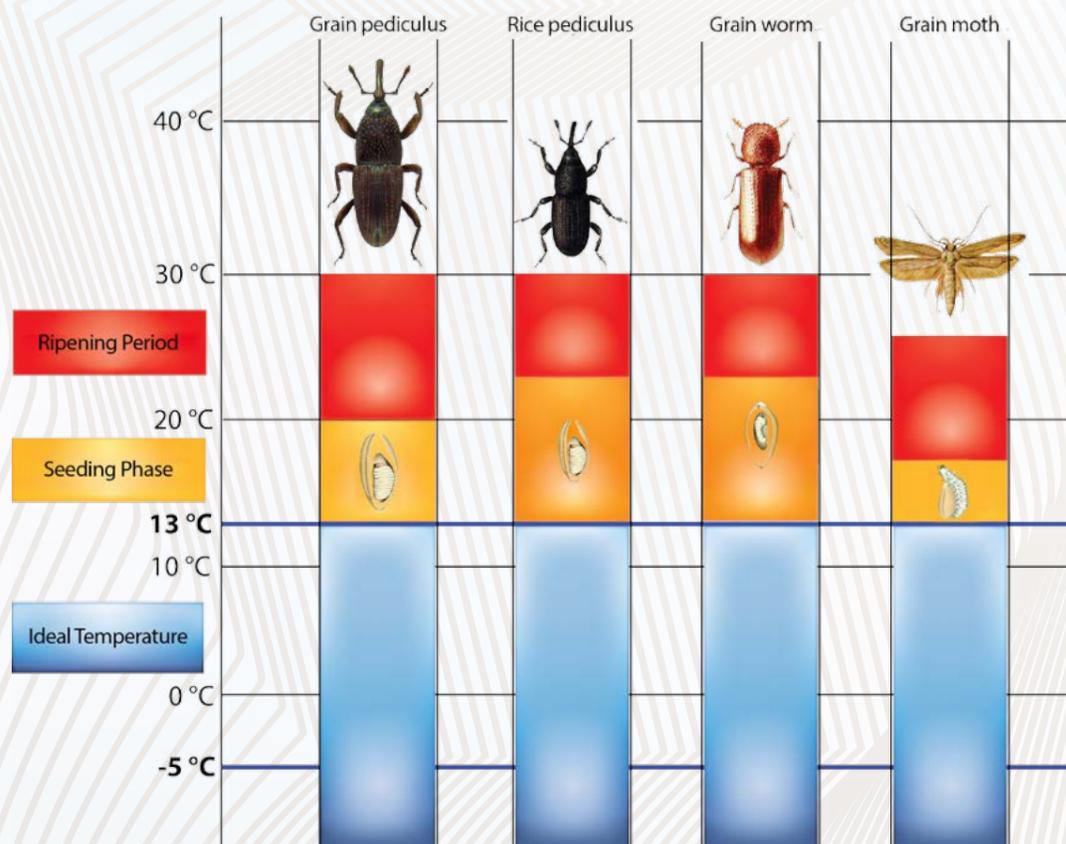
# GRAIN LOSSES EXPERIENCED IN STORAGE OPERATION

According to the research studies executed, around the world in general terms annually 13 million tons of grain is lost because of wrong storage conditions; and averagely 170 million tons of grain is lost because of parasite, fungus and mould formation.

During the storage of grains, inconvenient humidity and temperature threat the grains and initiates the degradation process and shall be counted among the significant factors affect the degradation rate. That's why grain storages and stored grains' humidity and temperature content shall be kept continuously under control.

## PREVENTION OF PESTS AND PARASITES REPRODUCTION IN GRAIN STORAGE

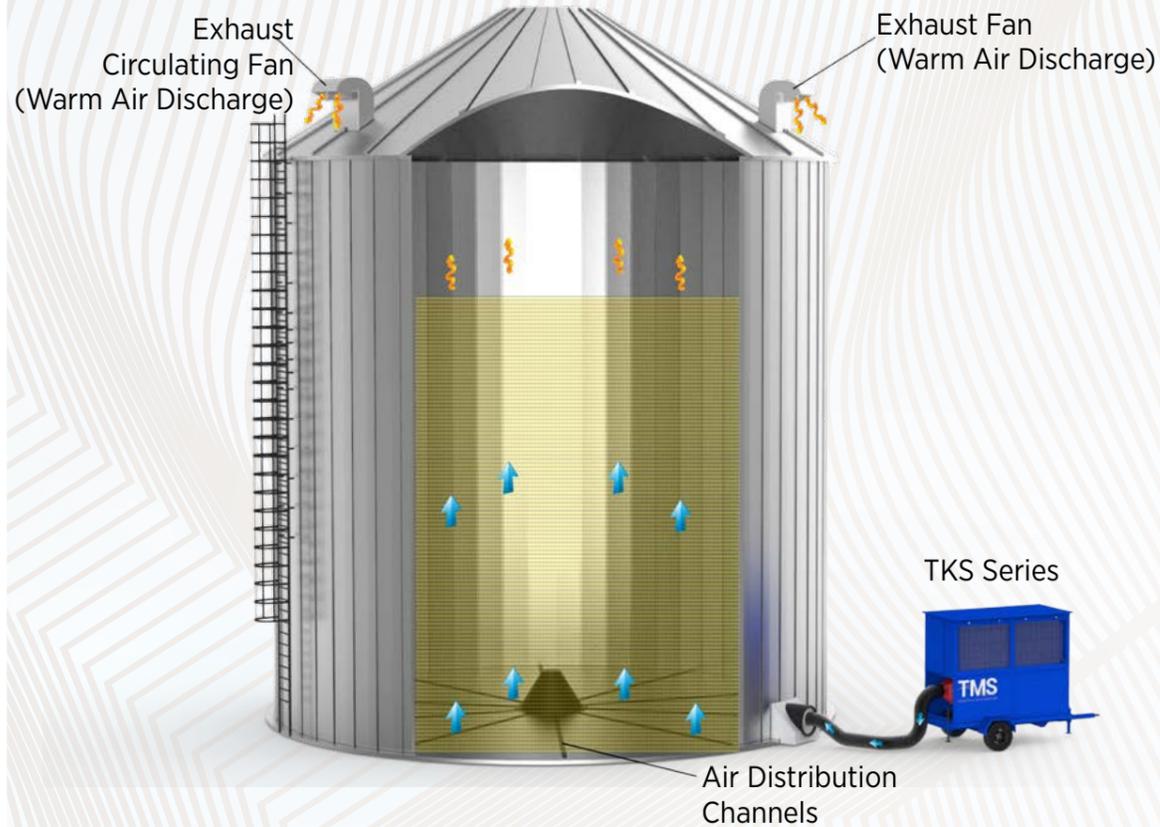
The reproduction of pests such as *Sitophilus granaries* that is known as grain pediculus and *Tribollium confusum* that is also known as grain pediculus, is based on the humidity and temperature rate within the silo. Such types of pests generally are started to get reproduced when the silo internal temperature is raised up to +13 °C. That's why in order to provide these pests are not to be reproduced and to provide the fact that they stay in sleep during the storage process, starting from the storage period of the grain, silo internal air temperature shall be continuously kept under 10°C.



# MAIN ISSUES TO BE FOLLOWED AND APPLIED IN STORAGE OF GRAINS

- 1- The humidity contents of the grains to be stored shall be low (wheat 12-14%). If required initially the stored grains shall be dried.
- 2- Broken grains when compared with the not degraded grains are in the inclination of 7 (seven) times more breathing. Grains shall be purified from broken, damaged particles and foreign seed and particles.
- 3- Grains before getting put into storage shall be purified moulded and degraded particles as much as possible.
- 4- In storage operation and storage selection, grain territorial climatic characteristics shall be taken into consideration.
- 5- At the storages where grain protection shall be made, temperature and humidity values that are required for grains shall be provided.
- 6- Storages and silos shall be constructed at places that are convenient of air conditioning.
- 7- Humidity and temperature of stored grains and storage air shall be controlled continuously.
- 8- In grain storages, excluding the air conditioned air, precautions shall be taken to prevent any other air flow.
- 9- If storage zones are founded on the concrete and soil grounds, in order not to the fact that ionized humidity shall not get into storage field, storage zones shall be ionized very well.

# APPLICATION EXAMPLE



TKS units generally are connected to silo via flexible air channels. Cooled and purified from humidity air with the circulating fans with high pressure within the TKS Unit, is blown into the channels inside the silo and grain is provided to be kept in required temperature and humidity. At the silo roof located exhaust circulating fans enables the cool air to move towards the silo roof. The air heated is exhausted to the external atmosphere air.

## The Advantages of TKS Grain Cooling Units

- Whatever the air conditions are, it ensures grain is stored under convenient conditions.
- Grain quality is kept on the maximum level.
- It minimizes the losses because of breathing of grains.
- It prevents parasites, fungus and moulding.
- It removes the restoring and expensive chemical operational costs.



# TKS Series Design and Technical Details

Because of the invertors together with the high pressure fans involved within the TKS products, according to the counter pressure within the silo outlet air flow rate is regulated. Based on the air flow rate, temperature and humidity rates that are inclined to be in showing variability, are fixed with air flowed compressors and heating batteries with variable temperature and humidity values.



## Remote Monitoring with the 3G Technology:

With the 3G modem and software system offered optionally together with the TKS Series, it is provided to the users that the opportunity to remotely connect to TKS unit either from their mobile phones or from their computers and to monitor cooling systems and that control them. During the programmed working period, the stoppings and defections to occur in the cooling system, are sent information to user via SMS. As a consequence, final users are connected to the remote system and detect the experienced problem and attempt to solve this problem in a rapid way.

## TKS Capacity interval and model options:

TKS series cooling capacity is as a standard in the interval of 15 KW and 160 KW. In compressions motors used in cooling circuit, in order to respond variable cooling capacities, with invertors speed/cycle controls are made. TKS units are generally classified as Standard and Tropical series. Standard series are used under geographies where climatic conditions are lighter; and Tropical series are used in geographies where climatic conditions are observed to be generally at high temperatures and humidity.

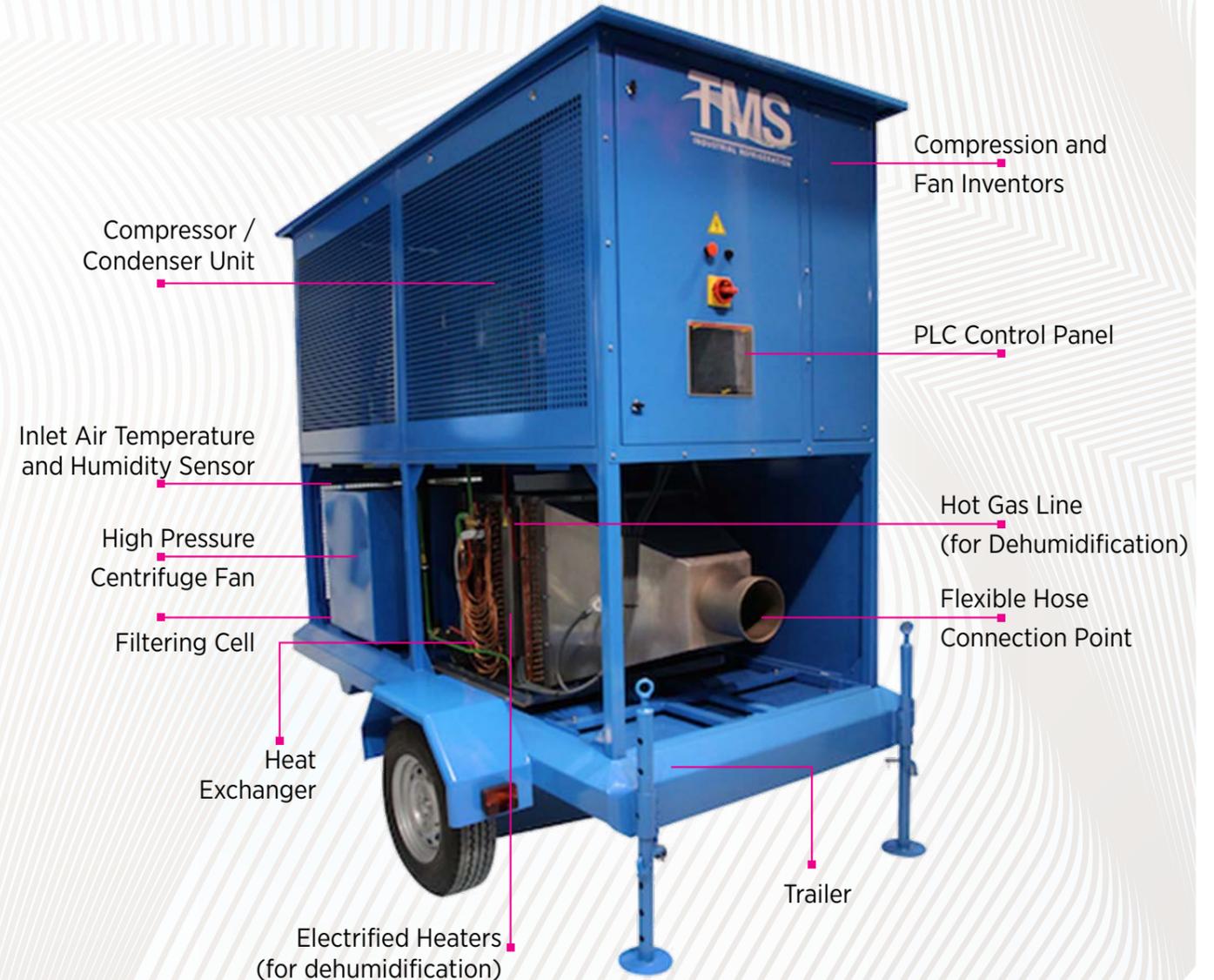
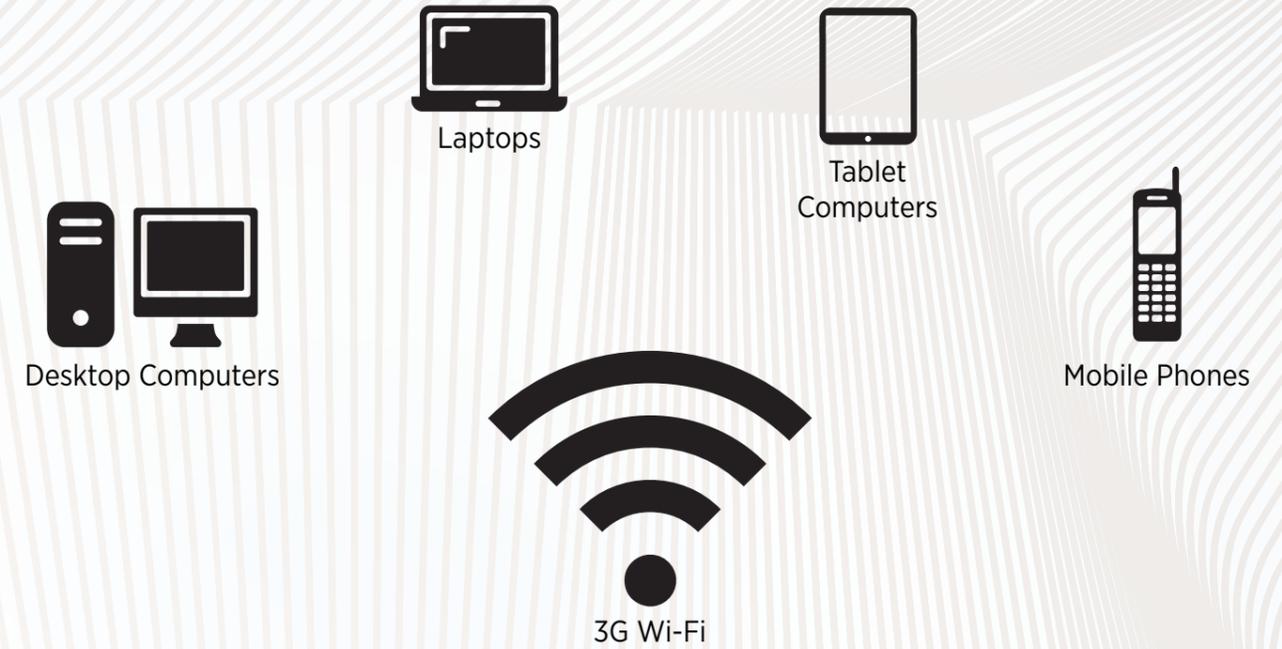
## Process of dehumidification:

Air temperature that is taken from external atmosphere is decreased up to 2°C with the cooling heat exchanger. For decreasing the air humidity at the outlet of heat exchanger, hot gas line is used that is also used in cooling cycle and thus energy efficiency is provided. For the dehumidification process additionally electrified heaters are used. For the dehumidification process if hot gas line is insufficient, electrified heater is automatically activated and fixes the humidity value that is expected in the blowing air. Dehumidification system in TKS series is offered as a standard service.

## High pressure centrifuge fans:

High pressure centrifuge fans that are used in TKS series possess air flow rate intervals between 1,800 m<sup>3</sup>/h and 21,000 m<sup>3</sup>/h and they possess pressure intervals of 1,000 and 7,000 Pascal. In case of request higher capacity fans shall be used and in order to the fact that fan motors supply the variable counter pressure expectations are controlled together with the invertors. In such a case for the changing technical characteristics please get in touch with TMS.

Because of its trailer design offered optionally together with the TKS series shall be mobilized among the silos simply. Because of this characteristics for each silo also extra cooling unit investment is not enough. All equipment used TKS series and general structure of the unit is designed so that they shall be used in external atmospheric conditions.



# TKS Standard Series

# TKS Tropical Series

TKS Standard Series Selection Table

MODEL	UNIT	TKS / 100S	TKS / 200S	TKS / 350S	TKS / 600S	TKS / 800S	TKS / 1100S	TKS / 1600S	
MAX COOLING CAPACITY <sup>1</sup>	Ton / Day	55	120	170	280	365	590	685	
NOMINAL COOLING CAPACITY <sup>2</sup>	Ton / Day	25	65	110	170	240	345	420	
NOMINAL AIR FLOW RATE <sup>3</sup>	m <sup>3</sup> /h	1300	4600	7700	10800	15200	18000	21000	
MAXIMUM DEVICE EXTERNAL STATIC PRESSURE <sup>4</sup>	Pa	3400	4500	5800	6000	6000	6000	6000	
BLOWER POWER MAXIMUM INLET	kW	4,00	7,50	15,00	22,00	30,00	37,00	37,00	
COOLING CAPACITY	kW	13	46	78	109	147	169	205	
COMPRESSOR POWER INLET <sup>5</sup>	kW	2,99	8,97	15,62	22,39	27,67	35,00	38,77	
COMPRESSOR TYPE	HERMETIC SCROLL								
COMPRESSOR QUANTITY	2				3				
REFRIGERANT	R407C								
CONDENSER FAN MAXIMUM POWER INLET	kW	0,84	1,90	3,80	7,60	7,60	11,40	15,20	
CONDENSER FAN QUANTITY	1		2		4		8		
ELECTRIFIED HEATER MAXIMUM POWER INLET	kW	3,6	12,3	21,1	29,6	38,2	41,3	53,2	
TOTAL POWER INLETS	kW	11,43	30,67	55,52	81,59	103,47	124,7	144,17	
TOTAL CURRENT <sup>6</sup>	A	28	79	141	206	245	317	356	
SUPPLY SWITCH	A	32	80	160	250		400		
POWER INPUT <sup>7</sup>	400VAC/3Ph/50Hz								
FLEXIBLE HOSE CONNECTION OUTLET	Ø mm	355		400		600 (2x400) <sup>8</sup>		800 (2x600) <sup>8</sup>	
CONDENSED WATER	kg/h	7	23	38	53	71	80	121	
CONDENSED WATER DISCHARGE CONNECTION	inch	1"				2X1"			

1- 22°C 52% Relative Humidity environmental conditions  
 2- At the optimum working point  
 3- It is the value given under 1000 Pressure  
 4- In case of request for higher pressures special production shall be done.  
 5- It is the power inlet at 0°C evaporation and 30°C condensation temperature.  
 6- Maximum current value  
 7- For different feeding options please get in touch with TMS  
 8- In order as per the request single or double air outlet is given.

TKS Standard Series Selection Table

MODEL	UNIT	TKS / 100T	TKS / 200T	TKS / 350T	TKS / 600T	TKS / 800T	TKS / 1100T	TKS / 1600T	
MAX COOLING CAPACITY <sup>1</sup>	Ton / Day	55	120	170	280	365	590	685	
NOMINAL COOLING CAPACITY <sup>2</sup>	Ton / Day	25	65	110	170	240	345	420	
NOMINAL AIR FLOW RATE <sup>3</sup>	m <sup>3</sup> /h	1300	4600	7700	10800	15200	18000	21000	
MAXIMUM DEVICE EXTERNAL STATIC PRESSURE <sup>4</sup>	Pa	3400	4500	5800	6000	6000	6000	6000	
BLOWER POWER MAXIMUM INLET	kW	4,00	7,50	15,00	22,00	30,00	37,00	37,00	
COOLING CAPACITY	kW	12	42	70	98	138	162	194	
COMPRESSOR POWER INLET <sup>5</sup>	kW	3,11	11,72	18,06	24,69	37,94	44,16	56,57	
COMPRESSOR TYPE	HERMETIC SCROLL						SEMI HERMETIC PISTON		
COMPRESSOR QUANTITY	2			3			2		3
REFRIGERANT	R134a								
CONDENSER FAN MAXIMUM POWER INLET	kW	0,84	1,90	3,80	7,60	7,60	11,40	15,20	
CONDENSER FAN QUANTITY	1		2		4		8		
ELECTRIFIED HEATER MAXIMUM POWER INLET	kW	2,80	9,80	16,50	23,40	32,40	38,50	46,50	
TOTAL POWER INLETS	kW	10,75	30,92	53,36	77,69	107,94	131,06	155,27	
TOTAL CURRENT <sup>6</sup>	A	29	93	151	220	290	320	410	
SUPPLY SWITCH	A	32	100	160	250	400	400	630	
POWER INPUT <sup>7</sup>	400VAC/3Ph/50Hz								
FLEXIBLE HOSE CONNECTION OUTLET	Ø mm	355		400		600 (2x400) <sup>8</sup>		800 (2x600) <sup>8</sup>	
CONDENSED WATER	kg/h	6	20	33	47	65	76	92	
CONDENSED WATER DISCHARGE CONNECTION	inch	1"				2X1"			

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## Tailor Made Solutions

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