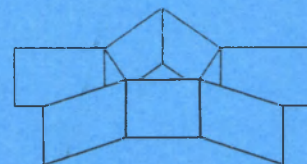


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ATO AGROTECHNOLOGIE

Agrotechnological Research Institute



ATO-RAPPORT 101

TEST REPORT OF THE 40 FOOT
REFRIGERATED CONTAINER SERIES
(MAEU 535880-536676) OF
MAERSK NL B.V. ON THE SUITABILITY
FOR FLOWER BULB TRANSPORT

Ir. J.W. Rudolphij, R.G. Bons
and H.A.M. Boerrigter

POSTBUS 17 - 6700 AA WAGENINGEN

AUGUST 1990

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1. INTRODUCTION

On request of Maersk NL b.v. a series of 40 ft refrigerated containers has been inspected by the ATO Agrotechnology, Wageningen, on the suitability for the transportation of flower bulbs on august 1 1990.

The test has been carried out by Mr. Bons and Mr. Boerrigter in the presence of Mr. van Beveren and Mr. de Winter of Maersk NL b.v. and Mr. Calcoen of Smith Holland b.v. at the premises of Smith Holland in Spijkenisse.

The containers will be used for the carriage of flower bulbs from Europe to all destinations.

The container numbers of the series range from MAEU 535880 (1) to 536676 (7)

The number of the inspected container was MAEU 536091 (7)

During the inspection the container was connected with a 380 V 50 Hz mains supply.

2. DESCRIPTION OF THE CONTAINER

The insulated container was built by Graaff in 1990, the serial number is 152196.

Condition of the box	:	new
Tare weight	:	4150 kg
Heat leak	:	--
Exterior dimensions L-W-H	:	12.19-2.44-2.89 m (40'-8'-9'6'')
Interior dimensions l-w-h	:	11.61-2.28-2.50 m
Side wall profiles	:	inverted ribs 7 mm depth, 100 mm width, 245 mm pitch
Door profiles	:	vertical ribs 12 mm depth 45 mm width, 245 mm pitch
Bulkhead profiles	:	no profile, flat
Ceiling	:	flat
Floor profiles	:	aluminum T bars of 60 mm height
Lining on exterior walls	:	aluminum
Lining on interior walls	:	stainless steel except floor
Dimensions of air supply l-w	:	2.28-0.06 m (space between floor profiles)
Dimensions of air return l-w	:	2.20-0.17 m
Drain holes	number	: 4
	location	: 4 corners in the floor
Remark	:	CSC approval, ABS

3. DESCRIPTION OF THE REFRIGERATION UNIT

The refrigeration unit was manufactured by Carrier Transicold in 1990 and has type number 69NT40-444 and serial no. BOJ 90078680.

Power source	:	electrical supply 380 V 50 Hz 3 ph 460 V 60 Hz 3 ph
Net refrigeration power	-18/+38 °C:	5300 W at 460 V 60 Hz
	2/+38 °C:	8500 W at 460 V 60 Hz
Heating power	:	5300 W at 460 V 60 Hz
Generator set	:	not provided

The heating power is sufficient to maintain the temperature under all ambient conditions.

4. TEMPERATURE CONTROL

The unit is equipped with a microprocessor temperature control system.

Type of controller: Datacorder controller TC Computer control
Manufacturer : Hamilton Standard Controls Division of UTC
Temperature range : range: -22 °F / +86 °F (-30 °C / +30 °C)

Range in chill mode (CH) : -10 / +30 °C
Location of temp. sensor : supply air in chill mode
Type of control action (CH) : suction gas modulation based on PID control

Range in frozen mode (FR) : -30 / -10 °C
Location of temp. sensor : return air freeze mode
Type of control action (FR) : compressor on/off

Temperature recorder : Datacorder (electronic system)
Partlow (mechanical recorder)
Thermometer : digital thermometers

Temp. settings, indications : degrees Fahrenheit/Celsius

5. AIR CIRCULATION

Type of air circulation : bottom-to-top
Number of fans : 2 axial fans
Power of fans : 750 W at 460 V each
Fan speed control : high speed continuous run in chill mode
low speed continuous run in freeze mode
Air circulation rate : 4200 m³/h measurement at 380 V / 50 Hz
Remark : specification 5437 m³/h at 460 V / 60 Hz

6. AIR VENTILATION

Fresh air exchange system : incorporated in refr.unit
forced ventilation by circ.fans
Location of air inlet : left middle side in front of unit
air outlet : left middle side in front of unit
Dimension of inlet : aperture 110 mm * 120 mm
outlet : aperture 110 mm * 120 mm
Control/setting : common slide cover
Ventilation rate : 150 m³/h measurement at 380 V / 50 Hz
Remark : 0-240 m³/h specified

AIR VENTS HAVE TO BE FULLY OPENED DURING FLOWER BULB TRANSPORTS WITH EXCEPTION OF LILYBULBS AT LOW TEMPERATURES WHICH DO NOT NEED HIGH VENTILATION

7. HUMIDITY CONTROL SYSTEM

The unit is provided with a humidity control system. The system decreases the humidity when in operation. The setting of the humidistat is minimal ca. 70% relative humidity. The system can be put in operation by the Data-recorder setting. Humidity control is locked out when the temperature is not in range.

8. CONCLUSION

The refrigerated containers of MAERSK LINE in the series MAEU 535880(1) - 53676(7) are suitable for flowerbulb transportation from Europe to all destinations. The requirements are met by the container specifications:

Temperature control	: accurate control of delivery air
Air circulation	: good
Air ventilation	: good
Drains	: 4 drains as required
Humidity control	: provided (recommanded)
Air distribution	: sufficient floor profile height (60 mm)

9. ANNEX

Requirements for approval of refrigerated containers for flower bulb transport.

Optimal specifications:

- Temperature control of delivery air in a band of .25 K accuracy, required range of temperature settings -2 °C up to 25 °C.
- Continuous air circulation between 4000 and 5000 m³/h for a 40 ft container (80-100 m³/m³h) at an additional pressure head of 150 Pa for cargo resistance.
- Provisions for a proper air distribution e.g. 75 mm floor profiles.
- An air ventilation rate of minimum 150 m³/h in a 40ft container (or 3 m³/m³.h empty space) without additional pressure difference at 50 cs electrical supply, to keep ethylene levels under control. Fresh air in- and outlet have to be located in the same plane.
- A possibility for dehumidification of the delivery air is favourable for flower bulbs; the optimal relative humidity for bulbs such as tulip, hyacinth, daffodil bulbs is ca. 75 %.
- Drain holes in the floor are recommended; in (sub)tropical areas 4 drain holes in the floor are mandatory in 20 ft as well as in 40 ft containers.

Acceptable specifications:

- Temperature control of the return air with capacity reduction in steps so that the temperature difference between in- and outlet is less than 4 to 6 K; required range of temperature settings is -2 °C up to 25 °C.
- Continuous air circulation of 2000-2500 m³/h (40-50 m³/m³.h) at an additional pressure head of 70 Pa.
- Provisions for proper air distribution, minimal 60 mm T profile in a 40 ft container and 30 mm in a 20 ft container.
- An air ventilation rate of minimum 150 m³/h in an empty 40 ft container (or 3 m³/m³.h) without additional pressure difference at 50 cs electrical supply. Fresh air has to be conditioned before flowing over the products and the fresh air intake must be far enough from the exhaust.
- Danger of damage by condensation water dripping from cold spots on the cargo has to be avoided.
- Drain holes in the floor are recommended; in (sub)tropical areas 4 drain holes in the floor are mandatory, in 20 ft containers as well as in 40 ft containers.

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