Hennecke description of Rotamats supplied to Trane (Vidalia, GA) 2013-09-16

IMPORTANT NOTE: This Rotamat is very customized compared to a "typical" Hennecke Rotamat. Due to the center foam pouring in the middle of the panel, this unit may be unusable for most (if not all) Appliance manufacturers without major modifications.

Dry Part for Coil and Fan Door Production – "B"

ITEM NO. **DESCRIPTION**

1201 **Conveying system RotaMat 8 type**

Technical data:

number of mold carriers		8 pieces / each
length of the mold carriers		2.500 mm
width of the mold carriers		1.100 mm
installation height for molds		100 mm
weight of a mold carrier	abt.	700 kg
width of the RotaMat	abt.	4.200 mm
depth of the RotaMat	abt.	3.300 mm
height of the RotaMat	abt.	5.800 mm
working height (inclined plane)	abt.	400-1.000 mm
max. weight of one mold		
upper mold part	abt.	200 kg
lower mold part	abt.	200 kg

maximum molds to be installed per mold carrier: 3 pcs

Functional sequence:

The above mold carriers are located on a solid steel-welded structure. They turn around a common horizontal axis. The rotational movement of the RotaMat is generated by an electr. motor via rotating track. After termination of the turning movement the RotaMat is fixed in its position by means of a pneumatic cylinder.

For removing a foam-filled door, the following operating devices are used: First a pick-up device is via hydraulic cylinder against lateral supporting rollers at the lower part of the mold carrier. After this has happened, the locking rod of the mold carrier is unlocked by a lateral hydraulic cylinder. The lower part is tilted open via the above pick-up device.

Principle drawing

Please note the principle drawing for the two RotaMats proposed herein was forwarded to the customer on January 26, 2009. The drawing has been removed from this proposal since a more detailed drawing was already submitted.

Remark:

The drawing shows a RotaMat for open mold pouring with a mixhead manipulator.
The offered execution is different regarding mixhead movement.

Now the foam-filled door can be taken out by the operators. Afterwards, the cleaning of the molds (if necessary) and the insertion of the parts for the new door take place. By means of the high speed turning movement (3 sec.) already mentioned above the mold carrier is closed again in the next step.

When the RotaMat has reached this position and the mold carrier is closed the locking rod is operated by another hydraulic cylinder and the mold carrier is locked.

Foaming

The foaming occurs in the mold carrier, which is in bottom position. Therefore foaming in this station and unloading and loading in the front position mold carrier happens in parallel.

Temperature control

The mold carriers are equipped with a liquid temperature control. By means of an external temperature control unit, the temperature control liquid is brought into a laterally arranged circular pipe line via a rotary column which is located on the turning axis of the RotaMat. The circular pipe line is equipped with connectors corresponding to the number of mold carriers. From there, the connections to the upper and lower part of the mold carrier are provided by hose lines.

Semi-automatic mold change

Currently, we anticipate this changeover to be performed manually with a quick fixing and release system. Due to the high number of molds

already mounted on the RotaMats, there should be only a minimal amount of mold changes necessary on these units. When a mold change is required, the changeover time is only approximately 3-5 minutes with our quick fixing system.

Automatic mold detection system
The RotaMat is fitted with a system to determine which mold is within which position on each mold carrier. Further, a system is incorporated to determine if all door molds are loaded within the carrier. This will prevent pouring foam into a mold that does not contain a door preform. This also prevents pouring the incorrect amount of foam into a door.

1202 Heating device

The heating device is used for the temperature control of the mold carriers. It serves to heat the mold carriers by means of integrated heating calorifiers. The heating device is suitable for the operating the mold carrier plates at a working temperature of 30 - 55 °C ± 5 °C. The hot-water temperature is the regulating variable.

1203 Mold carriers

Although the automatic pallet changing system for RotaMats is still proposed as a separate option, Hennecke (per customer request) is including the pallets within the base equipment pricing. These pallets will serve as the mold carrying devices for the RotaMat. They are described as follows:

Pallets lower door mold (quantity of eight)
The pallets will be used for the installation of the lower door molds.
Length of pallets:approx. 2.500 mm
Width of pallets:approx. 1.000 mm
Material: aluminium

Pallets upper door mold (quantity of eight)
The pallets will be used for the installation of the upper door molds.
Length of pallets:approx. 2.500 mm
Width of pallets:approx. 1.000 mm
Material: aluminium

Main components

- 2 frames, made of welded steel, for upper and lower part
- 2 heating plates, made of Aluminum, machined where necessary, for upper and lower part
- 2 sets of heating coils for water temperature control inserted in the heating plates, for upper and lower part
- 1 locking bar, at the front of the upper mold carrier part
- 2 rails to be attached to the upper and lower mold halves

Functioning

The mold carrier is used for carrying the door mold consisting of one contour support for the doors.
Rails and screwing points are provided for fixing the mold. It is possible to lodge one or several molds. A quick model change is foreseen.

For loading and unloading purposes, the lower part of the mold carrier is tilted by about 80 °. After loading, the lower part of the mold carrier is closed again by means of an operating mechanism. The locking bars are moved, thus pushing the locking elements at the front of the mold carrier into one another and thus locking the mold carrier.

Design

The mold carrier is designed for a max. foaming pressure of 0.5 bar. A max. deflection of 0.5 mm may occur at the upper and lower part of the mold carrier. The stability calculation is based on a foaming pressure of 1 bar, i.e. the mold carrier stands this pressure without remaining deformation in case of a failure.

Miscellaneous

Each mold carrier is equipped with one thermosensor.
The preassembled door “as one piece” is inserted in lower mold half.

1204 **Linear actuator for guiding the mixhead**

The actuator is foreseen to move the mixhead into the filling holes of the installed molds in the bottom position of the RotaMat. The actuator is mounted near floor level underneath the RotaMat.

1205 **Safety device**

1 Laserscanner is mounted at the operator station.
If the operator enters the safety area all dangerous movements of the RotaMat and the mixhead manipulator are stopped.

The size and shape of the monitored safety area are programmable.

1206 **Electronic control system for door production**

1 Control system Allen Bradley

Consisting of 1 electric control cabinet with the complete machine and mixhead control system incl. monitoring equipment, with:

- programmable logic controller
- HMI (Human-Machine-Interface)
- troubleshooting function
- 99 metering programs
- automatic cycle cleaning, preselectable
- intermittent and weekend switching system
- shot simulation (complete metering program without foaming)
- acquisition of operating hours of all major units
- selective password protection (access control)
- 4 m of connecting cable to the machine (firmly wired) stored in the control cabinet base, thus enabling flexible positioning of the control cabinet

Process data display

The display of the process data (flow rates, pressure and temperature of Polyol and Isocyanate) is effected via the multi panel

HMI of the wet part control cabinet and offers the following functions:

- Limit value monitoring

  At the operating terminal of the control system, the operator can enter set points for flow rate, temperature and pressure. In addition, it is possible to specify two types of limit values for these set points:

  - Warning limit values, indicating that values are outside the tolerance limits. These values do not lead to any interruption of the metering process.
  - Alarm limit values, leading to an immediate interruption of the metering process, also before shot release, thus avoiding unnecessary and costly scrap.

  A limit value violation is shown in a detailed flow diagram. An additional fault message is displayed in plain text. By means of a keypress, the operator can access the corresponding setting parameters.

- Oscilloscope function

  Graphical trend chart of tank temperature and filling level as well as display of the pressure curve during the last metering operation.

- Shot logging

  The following component data are displayed on the screen in the form of a shot log and can be saved on a CF card and/or a network computer; the displayed values comprise all set points and actual values:

  - flow rates *
  - mixing ratio based on 100 parts of component A *
  - component pressure, on suction and delivery side of the metering pump
  - component pressure, measured in proximity to the mixhead *
  - raw material temperature, measured in the tank and tank outlet
  - raw material temperature, measured in proximity to the mixhead *
  - shot time
  - shot weight *
  - tank filling level

- Shift logging

Shift-related data can also be displayed and/or logged:

- number of metering operations per shift
- number of parts produced per shift
- total number of parts produced
- no. of metering program selected
- recipe name/part name
- mixhead number
- consumption of Polyol and Isocyanate per shift *

(* = when opting for "sensors for the acquisition of process data")

1207 **Door molds**

- the door molds are made of aluminum, surface hand polished
- quick fixing device for mold change (Mold change time for one mold is approx. 3 – 5 minutes)
- tempered by heat transfer due to contact with heated mold carrier surface
- based on the start-up production volume of 400,000 finished parts per year, the intention is to supply a total of 20 large door molds to operate within the RotaMat. Four of the eight mold carriers will be operating with all three molds in place – the other four mold carriers will be operating with only two of the three molds in place. Thus, to increase to full capacity in the future, Hennecke will propose an additional four (4) door molds to get to the final total of 24 required to completely fill the RotaMat 8 unit.
- Per discussion with customer February 17, 2009, all previously included “spare” molds have been eliminated from the base proposal and are now proposed separately.

The door molds are related to the different models as follows:

Door type	**number of molds**
17.5 Compact Blower Door	2
17.5 Compact Coil Door	2
17.5 Blower Door	2
17.5 Coil Door AH8	1
17.5 Coil Door AH2, AH4, AH6	2
21.0 Blower Door	2
21.0 Coil Door Short AH8	1

21.0 Coil Door Short AH2, AH4, AH6	1
21.0 Coil Door Tall AH2, AH4, AH6	1
23.5 Blower Door	2
23.5 Coil Door Short	1
23.5 Coil Door Short	2
23.5 Coil Door Tall	1
total number of molds	20

1208 **Preheat oven**

- electrically operated
- overheating protection
- insulated cabin
- length approx. 3 m

1209 **Infeed belt conveyor**

Approximately 8 meter long conveyor.

1210 **Outfeed belt conveyor**

Approximately 5 meter long conveyor.