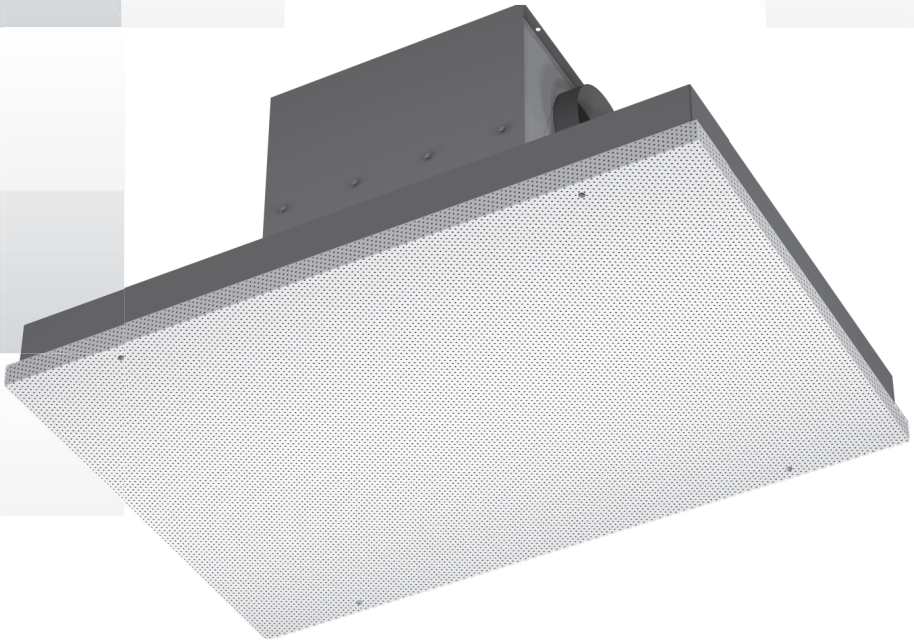


# LAMINAR “DOWN-FLOW” DIFFUSERS
## PERFORATED

**PHT | PHW TYPE**

BARCOL-AIR
AIR DISTRIBUTION

# Laminar “Down-flow” Diffusers

## Perforated

✓ Supply

### Application

- Types PHT..O4 and PHW..O4 laminar “down-flow” diffusers are designed to have a minimum aspiration and give a vertical discharge for applications where clean air control is especially important. These diffusers with their “piston effect” air pattern use the (filtered) supply air to create a protective clean air curtain around the working area. Typical applications are hospital operating rooms, X-ray rooms, intensive care rooms, pharmaceutical laboratories, chip factories and all other kinds of clean rooms. Laminar “Down-flow” diffusers may also be specified in situations where the air change requirements exceed the capabilities of other diffusers.

### Technical information

*Features:*
- Minimum aspiration.
- Vertical “piston effect” air pattern.
- Suitable for Class 100 through Class 100.000 systems according to Federal Standard 209.
- Integral equalising grid assures a uniform air distribution across the diffuser face.
- Removable face-plate.
- Filter frame for HEPA filter (optional), 66 or 150 mm thick.
- Test points for leakage test (optional).
- Can be installed in existing ceilings, or may be designed as a complete ceiling incorporating light fittings, gas tracks, etc.
- Low installation height.

*Construction:*
- Adaptor and plenum box: galvanised sheet steel constructed in compliance with ANSI /NFPA 90A, SMACNA and DIN standards.
- Perforated face-plate: sheet steel, finished n° 4 white stove enamelled, RAL 9010. Stainless steel optional.
- Filter frame: high quality, extruded aluminium profiles with welded corners and silicone gasket.
- Other versions are available upon request.

*Delivery format:*
- Diffuser and plenum box are supplied as a single assembly.
- Diffuser with filter section is supplied without filter. The thickness of the filter is to be mentioned when ordered.

*Mounting:*
- Placing on T-bar grid system (type PHT), or around T-bar grid system (type PHW)

### Type designation

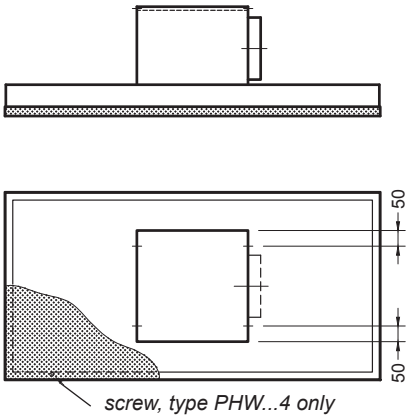
- PHT15O4 :Down-flow diffuser with fixed face-plate and circular top connection (adaptor).
- PHT11O4 :Down-flow diffuser with fixed face-plate and uninsulated plenum box.
- PTTOOO4 :Dummy panel.
- PHW.... :Down-flow diffuser with removable face-plate.
- PHW17O4 :Down-flow diffuser with removable face-plate and uninsulated plenum box with filter frame.
- PHW87O4 :Down-flow diffuser with removable face-plate, uninsulated plenum box, filter frame and leakage test connection.

### Specify as

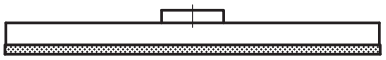
*Example:*
Supply and install laminar “Down-flow” diffusers with a minimum of aspiration to prevent entrancement of air outside the protected area. Plenum box and adaptor shall be constructed of galvanised sheet steel and have an integral equalising grid to assure a uniform air distribution across the diffuser face. Complete with aluminium filter frame for 150 mm thick HEPA filter, test points for leakage test and
a removable face-plate. Finish, white stove enamelled, RAL 9010.

Barcol-Air type: PHW87O4

Sizes and arrangements as shown on the plans.



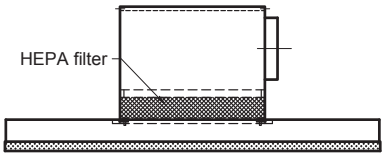

*Type PHT11O4 / PHW11O4*



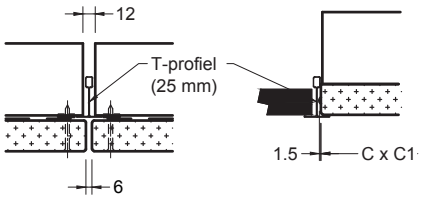
*Type PHT15O4 / PHW15O4*



*Type PTTOOO4 / PTWOOO4 (dummy panel)*

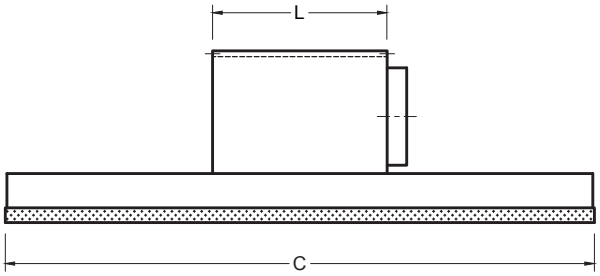



*Type PHW18O4*

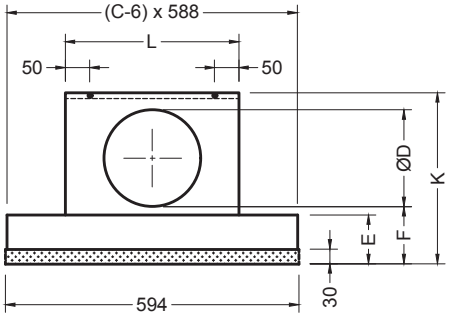


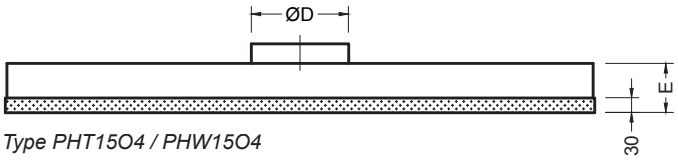

*Type PHW..O4* *Type PHT..O4*

*Placing on T-bar grid system or around T-bar grid system*

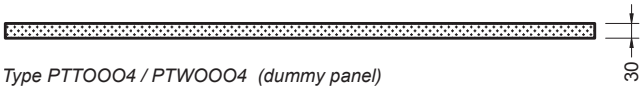



*Type PHT11O4 / PHW11O4*

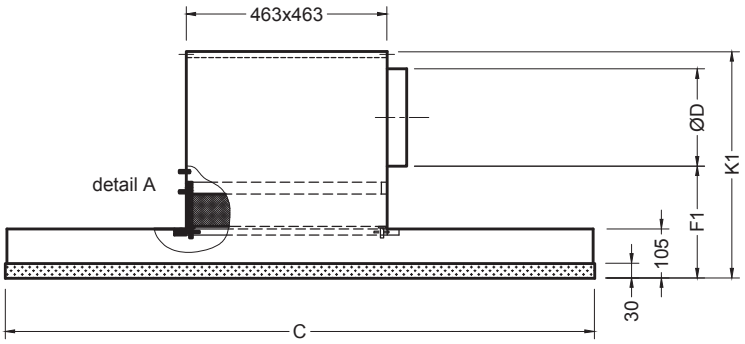


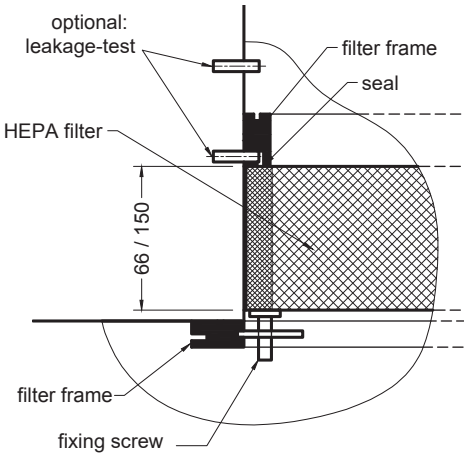

*Type PHT15O4 / PHW15O4*




*Type PTTOOO4 / PTWOOO4 (dummy panel)*




*Type PHW17O4 / PHW87O4*




| Model | C | Ø D | L | PHT | | | | PHW | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | E | F | K | $K_{VL}$ | E | F | K | $K_{VL}$ |
| **600 x 600** | 594 | 158 | 253 | 100 | 117 | 310 | 250 | 105 | 122 | 315 | 255 |
| **900 x 600** | 894 | 198 | 355 | 100 | 117 | 350 | 275 | 105 | 122 | 355 | 280 |
| **1200 x 600** | 1194 | 198 | 355 | 100 | 117 | 350 | 275 | 105 | 122 | 355 | 280 |

| Model | C | Ø D | L | PHWO7O4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | filter 66 mm | | | filter 150 mm | | |
| | | | | F1 | K1 | $K1_{VL}$ | F1 | K1 | $K1_{VL}$ |
| **600 x 600** | 594 | 158 | 253 | 228 | 410 | 350 | 313 | 495 | 435 |
| **900 x 600** | 894 | 198 | 355 | 228 | 450 | 375 | 313 | 535 | 460 |
| **1200 x 600** | 1194 | 198 | 355 | 228 | 450 | 375 | 313 | 535 | 460 |

*Notes:*
1. *All dimensions in millimetres.*
2. *Filterafmeting t.b.v. PHWO7O4: 457x457*
3. *The plenum box is at the upper side equipped with 4 or 6 suspension holes. The exact location is indicated with a center line at the bottom view.*
4. *The plenum box can be fitted to the diffuser in a centric or ex-centric way. For further information see page 5.*
5. *Exposed T-bar grid system to be supplied by others.*
6. *$K(1)_{vl}$ = $K(1)_{lowered}$ = lowered plenum box*
   *When a lowered plenum box is used it will be equipped with an oval stutz. De diameter will be equal to the original size. (ØD).*
   *The height of the lowered plenum box is mentioned in the dimension table.*

# Laminar “Down-flow” Diffusers
## Perforated

✓ Supply

### Design considerations

Hospital operating rooms must be provided with a constant supply of clean air. High Efficiency Particulate Air (HEPA) filters are only a part of an overall contaminant control program because many of the contaminants as dust, vapours, human shedding of contaminants etc. are already in the operating room. With this in mind Barcol-Air developed the laminar Down-flow diffuser which makes it possible to introduce conditioned supply air with a minimum of turbulence and aspiration.

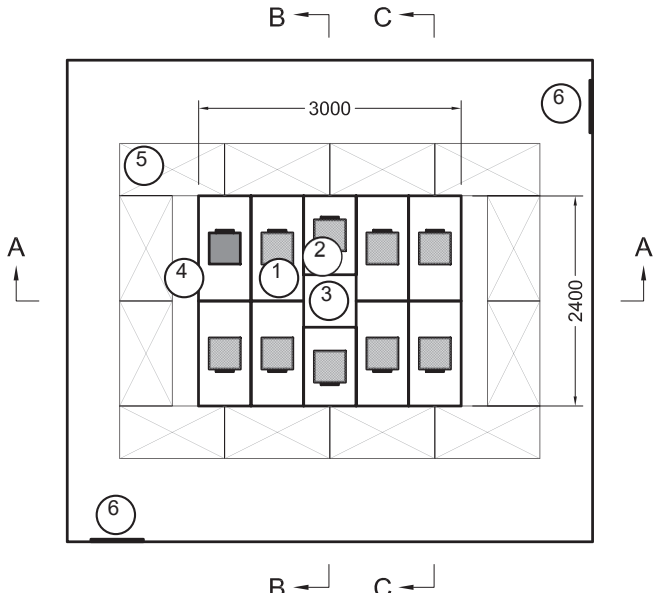
These diffusers supply air in a vertical downwards flow pattern, developing a clean air curtain around the operating table thus washing and cooling the surgical team and patient in a uniform manner.

*Laboratory mock-up tests:*
Tests were conducted in a full scale mock-up of a operating room 5.5 x 6 x 3 m (L x W x H) with two temperature differences between room air and supply air (5°C and 3°C). The room under test conditions had a 4400W sensible load consisting of ceiling lights, surgical lamp (1500W) and two 1000W heat elements simulating people and equipment.

The supply air was introduced at a low face velocity (0.11 m/s) to assure a minimum room air motion (draft) and minimum aspiration. The velocity/temperature traverses below are the results of these tests. Further investigations with other face velocities revealed an acceptable range of 0.08 to 0.13 m/s.

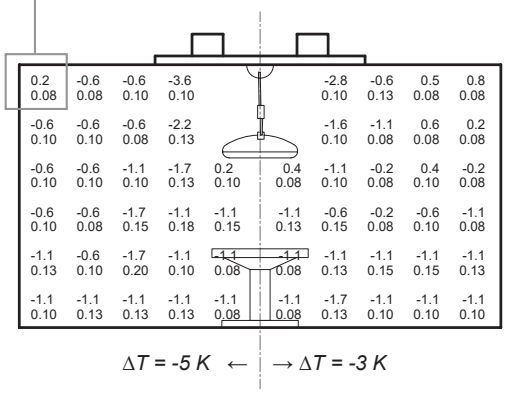
*Recommendations:*
- Long linear exhaust grilles along at least two walls (diagonally positioned), will improve the air pattern.
- For safety reason we recommend exhaust diffusers at high and low level in the room to exhaust surgical gases with a different density than air.
- Since the room walls are outside the working area, a return air temperature sensor is more responsive as a wall thermostat.

*Legend:*
1. Laminar Down-flow diffusers model 1200 x 600
2. Laminar Down-flow diffusers model 900 x 600
3. Dummy panel 600 x 600 and location for surgical light support
4. Gas track
5. Ceiling lights
6. Exhaust grilles size 600 x 450

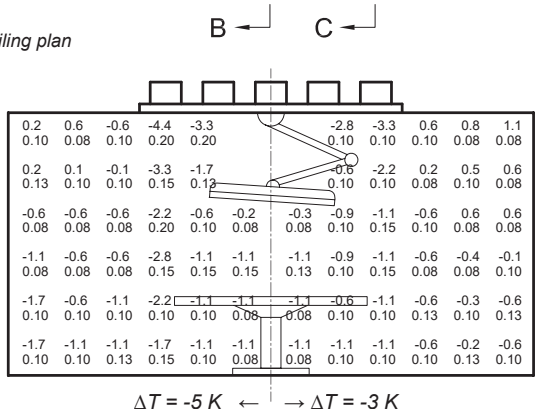



*Ceiling plan*

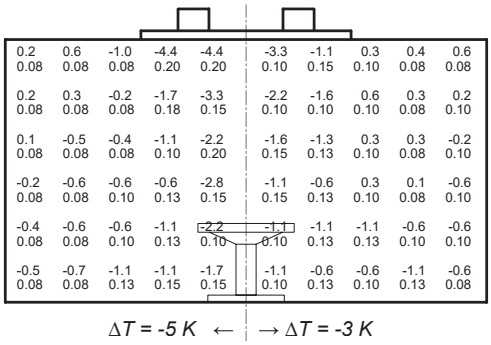
0.2 = ΔT (temperature difference between supply and room air in K)
0.08 = air velocity in m/s




*Section B-B*




*Section A-A*




*Section C-C*

**Type PHT15O4 and PHW15O4, diffuser without plenum box** **76 - 379 m³/h**

| Model | 600 x 600 | | | | 900 x 600 | | | | 1200 x 600 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Face velocity | Air volume | | $\Delta p_s$ | LpA | Air volume | | $\Delta p_s$ | LpA | Air volume | | $\Delta p_s$ | LpA |
| m/s | $m^3/s$ | $m^3/h$ | Pa | dB(A) | $m^3/s$ | $m^3/h$ | Pa | dB(A) | $m^3/s$ | $m^3/h$ | Pa | dB(A) |
| **0.06** | 0.021 | 76 | 2 | -- | 0.032 | 115 | 3 | -- | 0.043 | 153 | 3 | -- |
| **0.08** | 0.028 | 101 | 4 | -- | 0.042 | 153 | 5 | -- | 0.057 | 204 | 6 | -- |
| **0.10** | 0.035 | 126 | 6 | -- | 0.053 | 191 | 8 | -- | 0.071 | 255 | 9 | -- |
| **0.11** | 0.039 | 139 | 8 | -- | 0.058 | 210 | 9 | -- | 0.078 | 281 | 10 | -- |
| **0.12** | 0.042 | 152 | 9 | -- | 0.064 | 229 | 11 | -- | 0.085 | 306 | 12 | -- |
| **0.13** | 0.046 | 164 | 11 | -- | 0.069 | 249 | 13 | -- | 0.092 | 332 | 15 | -- |
| **0.14** | 0.049 | 177 | 13 | -- | 0.074 | 268 | 15 | -- | 0.099 | 357 | 17 | 19 |
| **0.15** | 0.053 | 190 | 14 | -- | 0.080 | 287 | 17 | -- | 0.106 | 383 | 20 | 20 |
| **0.20** | 0.070 | 253 | 26 | 19 | 0.106 | 382 | 31 | 23 | 0.142 | 511 | 35 | 24 |
| **0.25** | 0.088 | 316 | 40 | 22 | 0.133 | 478 | 48 | 26 | 0.177 | 638 | 54 | 27 |
| **0.30** | 0.105 | 379 | 58 | 25 | 0.159 | 574 | 70 | 29 | 0.213 | 766 | 78 | 30 |

**PHT11O4 and PHW11O4, diffuser with uninsulated plenum box** **76 - 766 m³/h**

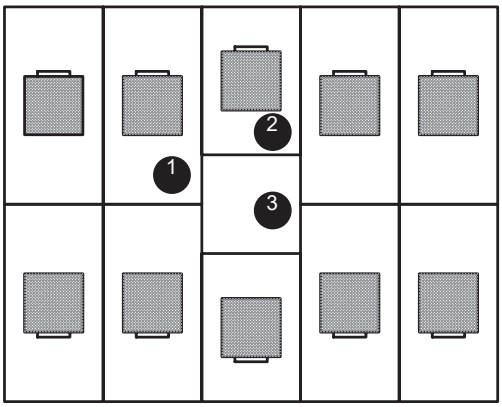
| Model | 600 x 600 | | | | 900 x 600 | | | | 1200 x 600 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Face velocity | Air volume | | $\Delta p_s$ | LpA | Air volume | | $\Delta p_s$ | LpA | Air volume | | $\Delta p_s$ | LpA |
| m/s | $m^3/s$ | $m^3/h$ | Pa | dB(A) | $m^3/s$ | $m^3/h$ | Pa | dB(A) | $m^3/s$ | $m^3/h$ | Pa | dB(A) |
| **0.06** | 0.021 | 76 | 4 | -- | 0.032 | 115 | 5 | -- | 0.043 | 153 | 6 | -- |
| **0.08** | 0.028 | 101 | 7 | -- | 0.042 | 153 | 8 | -- | 0.057 | 204 | 10 | -- |
| **0.10** | 0.035 | 126 | 11 | -- | 0.053 | 191 | 13 | -- | 0.071 | 255 | 16 | -- |
| **0.11** | 0.039 | 139 | 14 | -- | 0.058 | 210 | 15 | -- | 0.078 | 281 | 20 | 20 |
| **0.12** | 0.042 | 152 | 17 | -- | 0.064 | 229 | 18 | -- | 0.085 | 306 | 24 | 21 |
| **0.13** | 0.046 | 164 | 19 | -- | 0.069 | 249 | 22 | 19 | 0.092 | 332 | 28 | 22 |
| **0.14** | 0.049 | 177 | 22 | 19 | 0.074 | 268 | 25 | 20 | 0.099 | 357 | 32 | 23 |
| **0.15** | 0.053 | 190 | 26 | 20 | 0.080 | 287 | 29 | 21 | 0.106 | 383 | 37 | 24 |
| **0.20** | 0.070 | 253 | 46 | 25 | 0.106 | 382 | 51 | 26 | 0.142 | 511 | 66 | 29 |
| **0.25** | 0.088 | 316 | 72 | 29 | 0.133 | 478 | 80 | 29 | 0.177 | 638 | 102 | 34 |
| **0.30** | 0.105 | 379 | 103 | 32 | 0.159 | 574 | 115 | 32 | 0.213 | 766 | 147 | 38 |

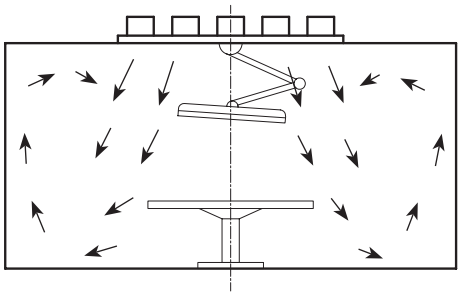
*1. The face velocity in m/s is based on the nominal diffuser size.*
*2. The sound pressure levels are based on a room absorption of 10 dB. Levels less than 20 dB(A) are indicated by “--”.*
*3. The pressure drop and sound data apply to diffusers without filter.*
*4. The selection data is valid for a room height of 2.70 - 3.00 meter.*
*5. The data is based on the down-flo principle with a maximum ΔT for:*
*- comfort: +/-3K*
*- industrial: +/-6K.*
*6. For non standard selections please contact our technical staff.*

# Laminar “Down-flow” Diffusers
## Perforated

✓ Supply

**Example diffuser arrangement “Down-flow” diffusers**



1. Type PHW17O4 1200 x 600 (8x)
2. Type PHW17O4 900 x 600 (2x)
3. Type PTWOOO4 600 x 600 (1x)

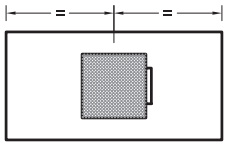
**Quick selection** **1968 - 2954 m³/h**

| Face velocity | Air volume (total) | | Δps | LpA |
|---|---|---|---|---|
| m/s | m³/s | m³/h | Pa | dB(A) |
| 0.08 | 0.547 | 1968 | 13 | 26 |
| 0.09 | 0.615 | 2214 | 16 | 28 |
| 0.10 | 0.683 | 2460 | 20 | 29 |
| 0.11 | 0.752 | 2708 | 25 | 29 |
| 0.12 | 0.821 | 2954 | 29 | 31 |

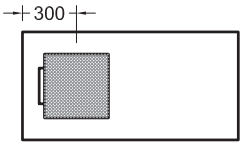
*Notes:*
1. *All dimensions in millimetres.*
2. *The face velocity (in m/s) is the velocity which is calculated on the gross diffuser surface.*
3. *The static pressure drop levels Ps are based on diffusers without filters.*
4. *The sound pressure levels are based on a room absorption of 10 dB.*

**Position plenum box**

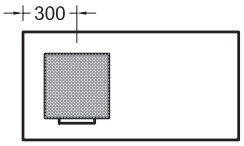
Because the available space in the ceiling void is normally limited due to cable trays, pipes etc., the plenum box can be fitted to the diffuser in 6 different ways; centric or ex-centric and the spigot can be turned (4x 90°).
The standard delivery is according to code “A”, other options must be specified when ordered (code “B” to “F”).



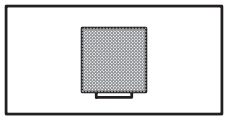

Code - A



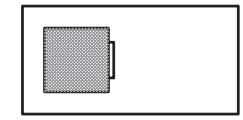

Code - C



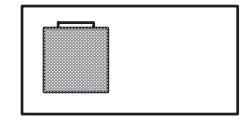

Code - E



Code - B



Code - D



Code - F

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**WWW.BARCOL-AIR.NL**