PARASOL

Integrated Comfort Module

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Comfort module Parasol

Parasol is the generic name of a family of products consisting of comfort modules. The modules are designed to supplement one another and together create optimal room comfort.

Modules:	Supply air
	Supply air and water based cooling
	Supply air, water based cooling and heating
Installation:	Flush mounting for suspended ceilings

Function

The comfort modules operate on a basic principle that is closely akin to that of chilled beams. The difference is mainly that the comfort module distributes air in four directions instead of two. This maximizes the area where supply air is mixed with room air so that the modules discharge air at high capacity, yet they do not occupy more ceiling space than necessary.

The comfort modules are also optimized to quickly mix the discharged air with room air providing better comfort in the room. In heating applications, this technique can be advantageously utilized to efficiently provide heat from the ceiling.

Flexibility

The easily adjustable nozzles in combination with Swegon ADC[II] (Anti-Draft Control), offer maximal flexibility if changes in the room layout become necessary.

All the sides can be set independently of one another so that the comfort module can distribute more or less air and simultaneously discharge air in whichever direction is desired in the room.

Design

The face plate of the Parasol has three different perforation patterns. As standard, the face plate has round perforations arranged in a triangular pattern however other variants are available as special order.

Key figures

Primary airflow:		Up to 117 cfm
Pressure range:		0.2 to 0.6 inWG
Total cooling capacity:		Up to 7018 Btuh
Heating capacity:	Water:	Up to 9200 Btuh
Sizes:		24" module: 24 x 24 in. 48" module: 48 x 24 in.
Height:		8.66 in.

Silent, draft-free indoor climate

The Parasol has four-way air distribution, providing low air velocities into the space. The low air velocity is reached by distributing the cooled air over a large surface area. The special design of the outlet creates a turbulent flow, which causes the primary air to be quickly mixed with the room air. The comfort module's closed design with a recirculation grille for induced air in the face of the unit also contributes to the advantageous mixing performance.

Variants

The Parasol is available in three basic variants:
Variant A: Ventilation and water-based cooling from a coil
Variant B: Ventilation, water-based cooling and heating from coils
Variant C: Ventilation

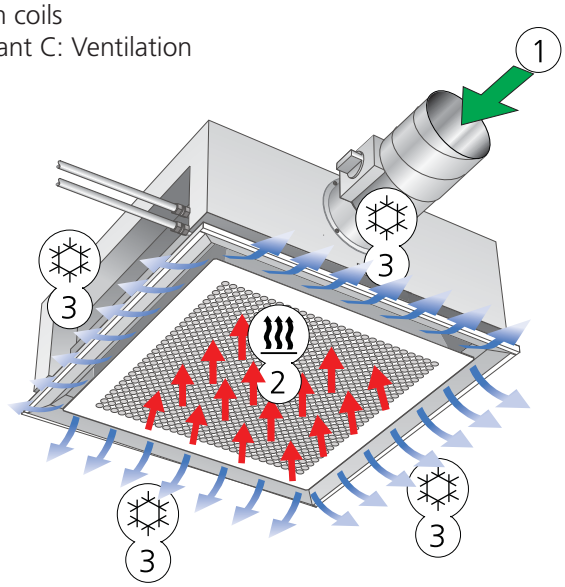


Figure 1. Variant A: Cooling function
1 = Primary air
2 = Induced room air
3 = Primary air mixed with cooled room air

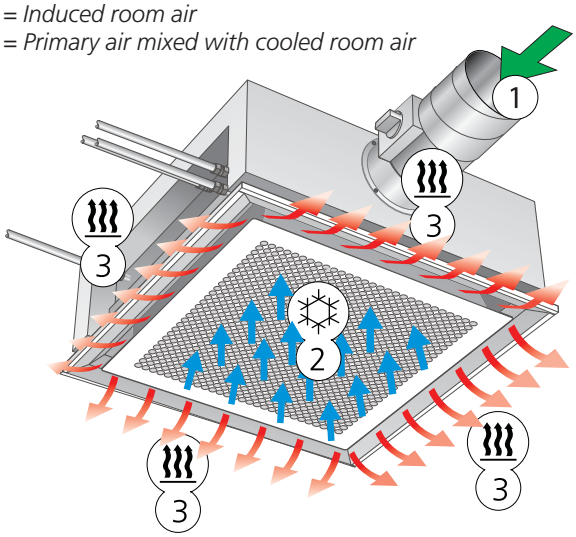


Figure 2. Variant B: Heating function (also includes cooling function)
1 = Primary air
2 = Induced room air
3 = Primary air mixed with heated room air

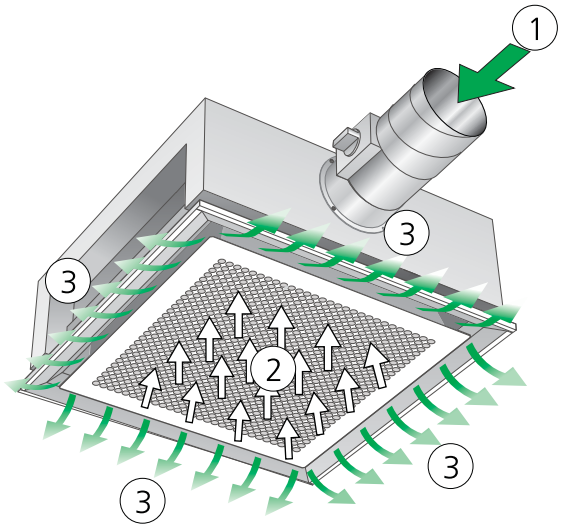


Figure 3. Variant C: Supply air function
1 = Primary air
2 = Induced room air
3 = Primary air mixed with room air

Supply air module

A comfort module for supply air only is available (variant C – without a coil) to supplement certain types of rooms where the occupants need a large quantity of air, but only a smaller amount of water-based cooling energy. This applies, for instance, to certain conference rooms or the inner zones in large rooms. To avoid over-sizing, it is common to combine units with cooling function and units with supply air function only. Since the supply air variant is also designed according to the induction principle, it is possible to discharge supply air substantially below room temperature and yet not need to think about possible reheating, which may be required in combined systems with chilled beams and air diffusers. The rate of induction varies depending on pressure and flow conditions but lies generally in the range of 3-5 which means that if you add 65 cfm of primary air, 3 to 5 times as much warm room air (195–325 cfm) will be induced. The mixed air then has a substantially higher temperature than the temperature of the supply air which reduces the risk of draft in the occupied zone.

Another advantage of the supply air module is, that it operates with the same duct pressure as the modules with coil. In other words, there is no need to throttle the pressure in any duct branch more than necessary. Instead of incorporating a coil into the supply air module, the module has an induction control with punched nozzles that is designed to provide the same rate of induction as the units with a coil. This makes it possible to use Swegon ProSelect, the dimensioning program for sizing the throw lengths, even for supply air modules. If shorter throw lengths than standard are desirable, certain openings can be plugged to reduce the free area in the induction control, to reduce the percentage of induced room air. The capacity of the primary air is never affected by an increase or decrease in the rate of induction.

High capacity

Thanks to its high capacity, the Parasol utilizes 40-50% less ceiling surface to take care of the cooling load in a normal office, compared with a traditional chilled beam.

Simple to adjust

By means of its integrated nozzle adjustment with a multitude of possible settings, the Parasol provides optimal comfort and can easily be adapted in the event of refurbishment of room sizes or if the nature of the business changes. The comfort module can be set so that different volumes of air are distributed on each side and for both high and low rates of airflow.

Range of application

The Parasol is ideal for use as a standard application in such premises as:

- Offices and conference rooms
- Classrooms
- Hotels
- Restaurants
- Hospitals
- Shops
- Shopping centers

With its many installation options, the Parasol functions can easily be adapted to a new kind of business or to changes in the layout of the room.

Simple to install

The dimensions of the small, compact Parasol units fit those of the most commonly used ceiling modules, which also makes them easy to install. The small dimensions are useful during handling, especially at the building site, with less damage caused by handling and reduced health and safety issues.

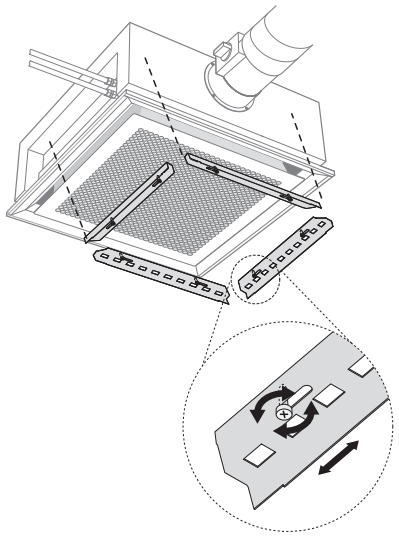


Figure 4. Nozzle adjustment

ADC^{II}

All the comfort modules contain ADC^{II} as standard. ADC stands for Anti Draft Control, which enables you to set the diffusion pattern of the air being distributed to avoid risk of draft. A number of ADC^{II} sections with four air deflectors per section are arranged on each side of the unit. Each section is adjustable from a straight setting to 40° air deflection to the right or left in increments of 10°. This provides enormous flexibility and can be easily adjusted without tools and at all having to affect the system as a whole.

The sound level and static pressure is not affected at all by the ADC^{II}. The water capacity is reduced by 5-10% when the ADC^{II} is adjusted to fan-shape setting.

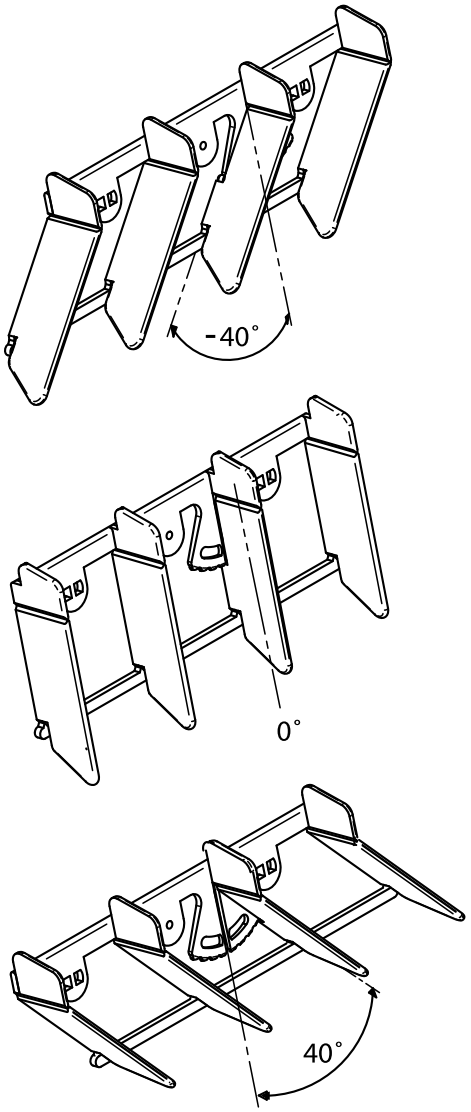


Figure 5. ADC^{II}, setting range from -40° to +40° in increments of 10°

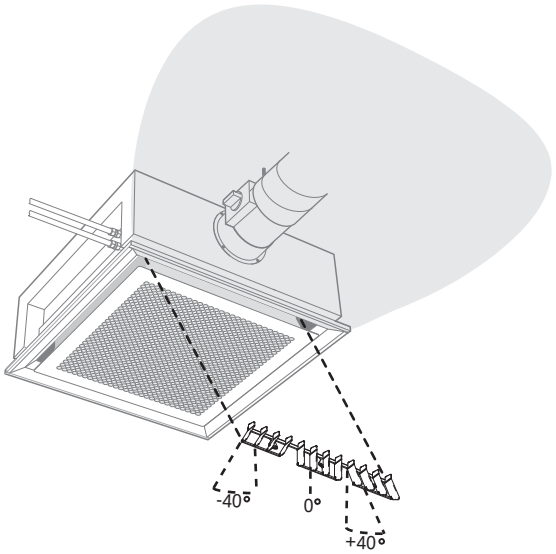


Figure 6. Possible settings for the ADC^{II}, Fan shape

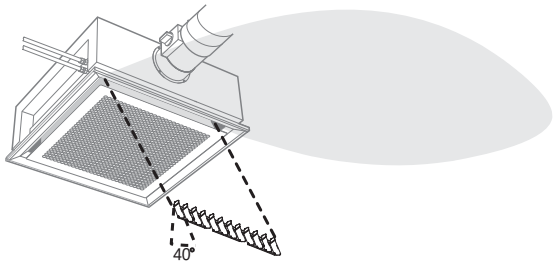


Figure 7. Possible settings for the ADC^{II}, X-shape

Aesthetic flexibility

The face of the unit is available with three different perforation patterns, so that it can be adapted to suit different kinds of ceiling components, e.g. light fittings and exhaust grilles that share the surface in a suspended ceiling. This avoids the clutter effect of mismatched components.

Other patterns are, of course, available on special order. For further details, get in touch with your nearest Swegon representative.

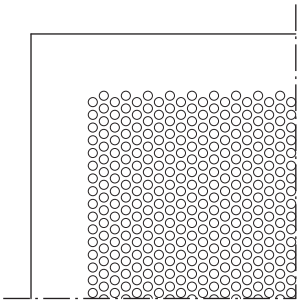


Figure 8. Standard face plate

Circular holes arranged in a triangular pattern

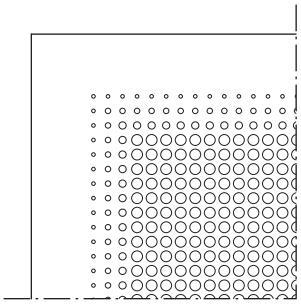


Figure 9. PD face plate

Circular holes arranged in a square pattern with a graduated border

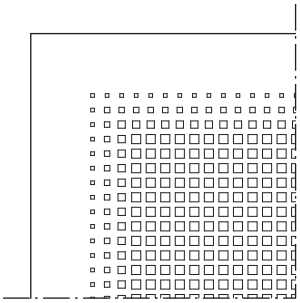


Figure 10. PE face plate

Square holes arranged in a square pattern with a graduated border

Installation

Recommended types of ceiling

Parasol is designed for use in most T-bar ceiling systems and clip-in type ceilings in terms of length and width. To guarantee a quality finish in T-bar systems, we recommend a T profile with a width of 0.9 in.

Suspension

The double-module units have four mounting brackets for their suspension, and are installed using one threaded rod in each mounting bracket **(Figure 11)**. A double threaded rod with a thread lock should be used if there is substantial distance between the overhead slab and the unit. If the unit is to be mounted directly against the ceiling, use a 8 in. long threaded rod.

Connection dimensions

Water - cooling, plain pipe end (Cu)	0.47 in OD, 0.04 in wall thickness
Water - heating, plain pipe end (Cu)	0.47 in OD, 0.04 in wall thickness
Air, connecting piece	4.92 in OD

To connect the air

Parasol is supplied as standard with an open air connection on the right-hand side (seen from the side where the water is connected).

The air connection piece is supplied and must be installed so that it can then be connected to the primary air duct (see **Figure 13**). A cap is fitted at the factory to the left-hand air connection, but the connections can easily be switched if the air connection inlet has to be fitted to the left.

To connect the water

Connect the water pipes using push-on couplings, clamping ring couplings or sleeve nut. Note that clamp ring couplings require support sleeves inside the pipes.

Do not use a solder coupling to connect the water pipes. High temperatures can damage the unit's existing solders.

Condensation-free cooling

Since the comfort modules have to be dimensioned to operate without condensation, no drainage system is required.

ETL listed

Parasol has been tested and is compliant to the ETL standard.

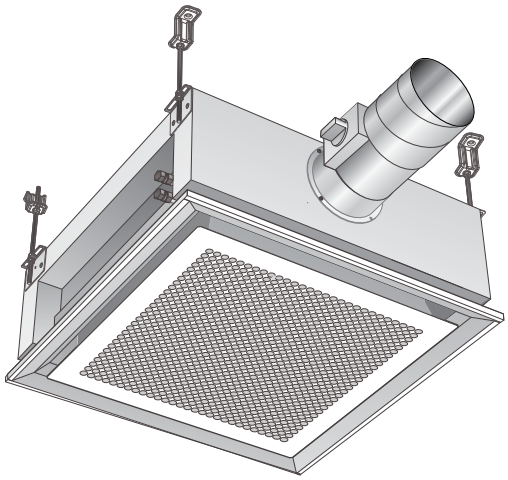


Figure 11. Suspending a single-module unit

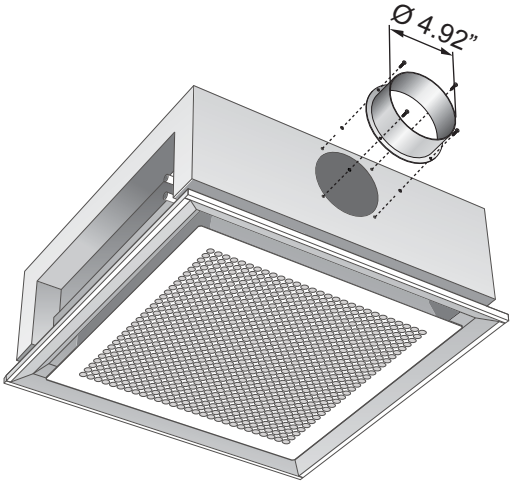


Figure 13. Air connection piece

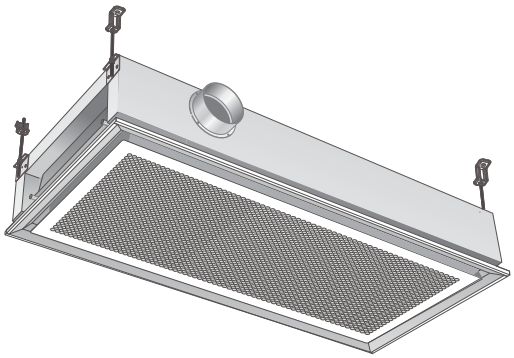


Figure 12. Suspending a double-module unit

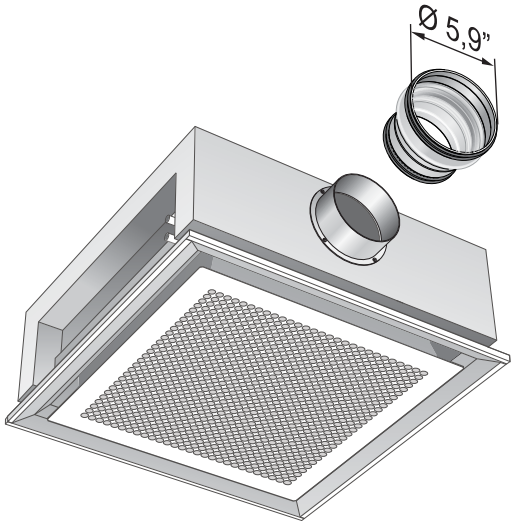


Figure 14. Accessory, air connection piece, SYST AD-150

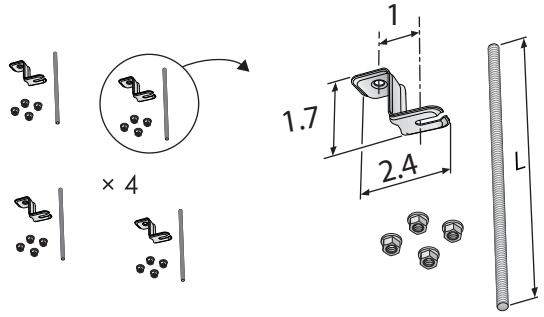


Figure 15. Assembly piece SYST MS-1, ceiling mount and threaded rod.

Technical data

Cooling capacity, max.	7000 Btuh
Heating capacity, water, max.	9200 Btuh
Heating capacity, electric, max.	3400 Btuh
Airflow	
Single-module unit	15-72 cfm
Double-module unit	15-117 cfm
Length	
24" module	24 in. nominal
48" module	48 in. nominal
Width	24 in.
Height	8.66 in.

Dimensions of the units have a tolerance of (±0.08) in.

Weight table

Size in.	Functional variant	Dry weight (lb)	Filled with water (lb)
24	A	31.5	34.2
24	B	31.7	35.0
24	C	25.6	-
48	A	48.9	52.0
48	B	56.8	62.2
48	C	44.3	-

Recommended limit values

Pressure levels	
Coil working pressure, max.	230 psi
Coil test pressure, max.	350 psi
Nozzle pressure	0.2-0.6 inWG
Recommended min. nozzle pressure if coil heat is used, p_i	0.28 inWG
Recommended min. nozzle pressure with face plate in the high output mode	0.28 inWG
Water flow	
Ensures evacuation of any air pockets in the system.	
Cooling water, min.	0.475 gpm
Heating water, min.	0.206 gpm
Temperature differentials	
Cooling water, temperature increase	3.6-9 °F
Heating water, drop in temperature	7.2-18 °F

Temperature differences are always expressed in °F.

Flow temperature	
Cooling water	**
Heating water, max.	140 °F

*** Cooling water must always be kept at a level that ensures that no condensation is formed.*

Designations

P	Capacity (Btuh)
t_l	Temperature of primary air (°F)
t_r	Temperature of room air (°F)
t_m	Mean water temperature (°F)
ΔT_m	Temperature difference t_r - t_m (°F)
ΔT_l	Temperature difference t_l - t_r (°F)
ΔT_k	Temperature difference of cooling water flow and return (°F)
ΔT_v	Temperature difference of heating water flow and return (°F)
v	Water velocity (fpm)
q	Airflow (cfm)
P	Air pressure (inWG)
Δp	Water pressure drop (ftWG)

Supplementary index: k = cooling, v = heating, l = air, i = initial adjustment, corr = correction

Pressure drop in nozzle

$$\Delta p_l = (q_l / k_{pl})^2$$

Δp_l	Pressure drop in nozzle (inWG)
q_l	Flow of primary air (cfm)
k_{pl}	Pressure drop constant for nozzle setting, see **Tables 2-5**

Cooling

Standard

The cooling capacities have been measured in accordance with EN 15 116 and have been converted for constant water flow according to **Chart 2/3**.

Calculating Formula - Cooling

Below are some formula that enable the user to calculate which comfort module selection is applicable. The values for the calculations can be taken from the tables.

Pressure drop in cooling circuit

$$\Delta p_k = (q_k / k_{pk})^2$$

Δp_k	Pressure drop in cooling coil (ftWG)
q_k	Flow of cooling water (gpm), see **Chart 1**
k_{pk}	Pressure drop constant for cooling circuit, see Tables 2-5

Cooling capacity of the air

$$P_l = 1.08 \cdot q_l \cdot \Delta T_l$$

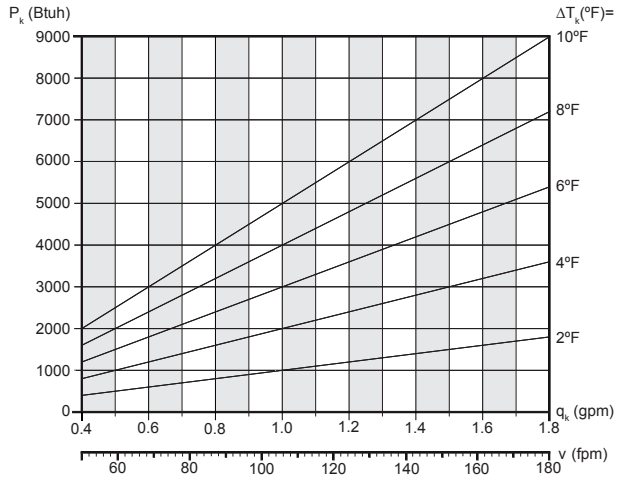
P_l	Cooling capacity of the primary air (Btuh)
q_l	Flow of primary air (cfm), see **Tables 2-5**
ΔT_l	Temperature difference between primary air (t_l) and room air (t_r) (°F)

Water's cooling capacity

$$P_k = 500 \cdot q_k \cdot \Delta T_k$$

P_k	Cooling capacity of the water (Btuh)
q_k	Cooling water flow (gpm), see **Tables 2-5**
ΔT_k	Temperature difference of cooling water flow and return (°F)

Chart 1. Water Flow – Cooling Capacity



Corrected capacity – water flow

Different water flow rates to some extent have effects on the capacity output. By checking calculated water flow against **Chart 2** or **3**, the capacity indicated in **Tables 2-5** may need to be slightly adjusted up or down.

Corrected Capacity – Water Flow

$$P_{corr} = k \cdot P_k$$

P_{cor}	Corrected capacity (Btuh)
k	Correction factor
P_k	Cooling capacity of the water

Chart 2. Corrected Capacity – Water flow, Parasol 24" module

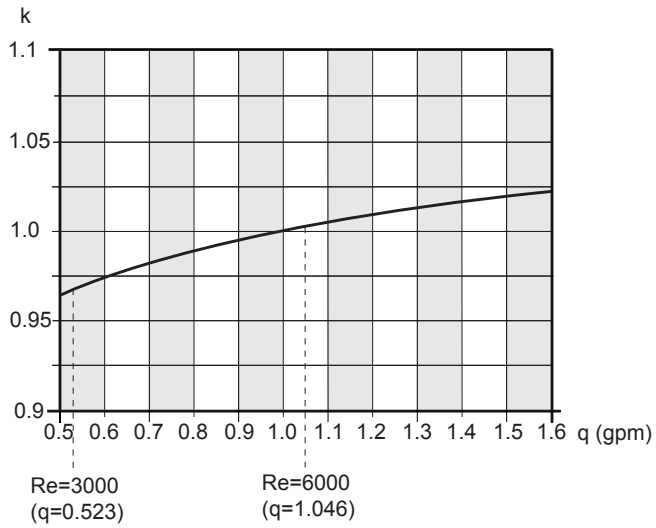


Chart 3. Corrected Capacity – Water flow, Parasol 48" module

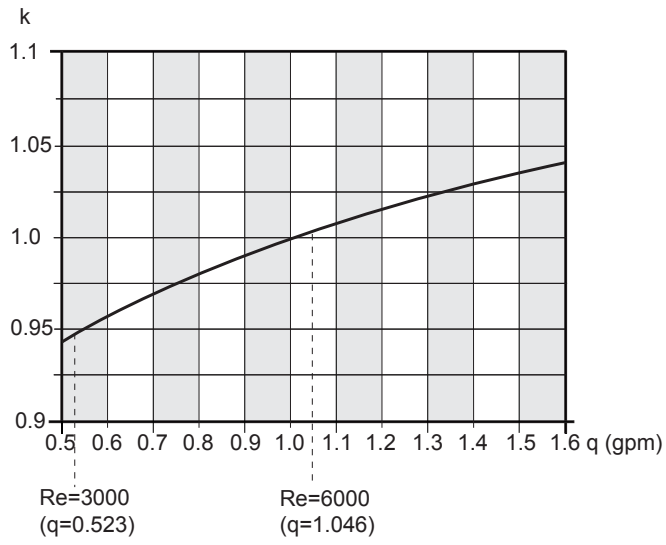


Chart 4. Pressure Drop – Cooling Water Flow

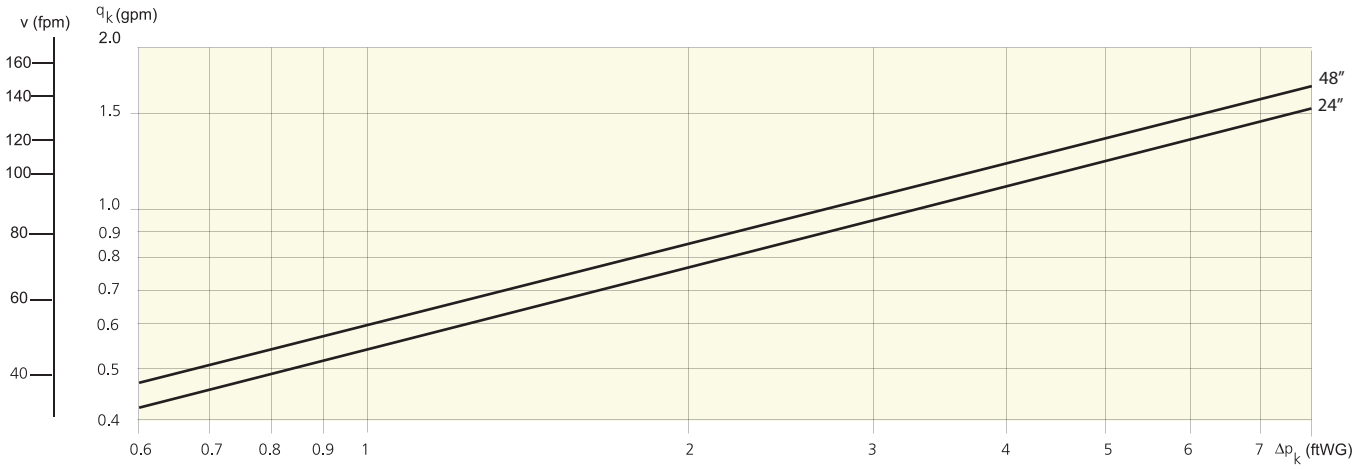


Table 2 – Data – Cooling Sizing Guide for Parasol MF units (24" module)

Unit size	Nozzle setting	Primary airflow	Sound level in dB(A)	Nozzle pressure $p_i x10^{-2}$	Cooling capacity Primary air (Btuh) at ΔT_l (F)				Cooling capacity water (Btuh) at ΔT_{mk} (F) 3.						Pressure drop constant air/water	
in.	1.	(cfm)	2.	(inWG)	10	14	18	22	10	12	14	16	18	20	k_{pl}	k_{pk}
24	LLLL	15	<20	19.2	162	227	292	356	607	720	833	946	1055	1168	33.8	0.548
24	LLLL	17	<20	24.8	184	257	330	404	695	822	952	1084	1212	1341	33.8	0.548
24	LLLL	19	<20	31.7	205	287	369	451	771	913	1059	1206	1348	1496	33.8	0.548
24	LLLL	21	<20	39.3	227	318	408	499	836	995	1156	1314	1471	1631	33.8	0.548
24	LLLL	25	21	56.2	270	378	486	594	954	1138	1322	1503	1687	1870	33.8	0.548
24	HHHH	42	<20	20.8	454	635	816	998	910	1083	1256	1426	1598	1772	92.7	0.548
24	HHHH	49	<20	27.7	529	741	942	1164	1035	1231	1426	1618	1810	2003	92.7	0.548
24	HHHH	55	22	35.3	594	832	1069	1307	1148	1362	1576	1787	1997	2210	92.7	0.548
24	HHHH	64	27	46.9	691	968	1244	1521	1276	1513	1749	1983	2216	2451	92.7	0.548
24	HHHH	72	30	60.2	778	1089	1400	1711	1388	1647	1903	2155	2407	2658	92.7	0.548

Table 3 – Data – Cooling Sizing Guide for Parasol LF units (48" module)

Unit size	Nozzle setting	Primary airflow	Sound level in dB(A)	Nozzle pressure $p_i x10^{-2}$	Cooling capacity Primary air (Btuh) at ΔT_l (F)				Cooling capacity water (Btuh) at ΔT_{mk} (F) 3.						Pressure drop constant air/water	
in.	1.	(cfm)	2.	(inWG)	10	14	18	22	10	12	14	16	18	20	k_{pl}	k_{pk}
48	LLLL	14	<20	24.0	151	212	272	333	936	1113	1292	1469	1646	1823	30.1	0.603
48	LLLL	16	<20	31.3	173	242	311	380	1053	1256	1456	1658	1857	2058	30.1	0.603
48	LLLL	19	<20	39.7	205	287	369	451	1158	1380	1602	1824	2045	2265	30.1	0.603
48	LLLL	21	<20	48.9	227	318	408	499	1255	1495	1732	1972	2213	2452	30.1	0.603
48	LLLL	23	<20	59.4	248	348	447	546	1336	1595	1852	2108	2363	2621	30.1	0.603
48	MMMM	19	<20	19.6	205	287	369	451	953	1140	1325	1513	1697	1887	42.8	0.603
48	MMMM	21	<20	24.4	227	318	408	499	1048	1255	1461	1668	1874	2083	42.8	0.603
48	MMMM	25	<20	35.3	270	378	486	594	1216	1457	1697	1938	2178	2421	42.8	0.603
48	MMMM	29	<20	48.1	313	438	564	689	1361	1627	1897	2167	2435	2926	42.8	0.603
48	MMMM	33	<20	62.6	356	499	642	784	1480	1776	2071	2363	2660	2956	42.8	0.603
48	HHHH	33	<20	21.6	356	499	642	784	1276	1524	1774	2023	2274	2524	42.8	0.603
48	HHHH	38	<20	27.3	410	575	739	903	1395	1670	1944	2218	2493	2770	42.8	0.603
48	HHHH	44	<20	37.3	475	665	855	1045	1551	1859	2164	2471	2779	3087	42.8	0.603
48	HHHH	50	<20	48.5	540	756	972	1188	1689	2022	2356	2691	3025	3367	42.8	0.603
48	HHHH	57	20	61.4	616	862	1108	1354	1808	2169	2527	2886	3247	3608	42.8	0.603

1. For the sizing of alternative nozzle settings, use Swegon ProSelect, the sizing program that is available at www.swegon.com.
2. The specified noise level is applicable to connection without damper or with fully open damper. In other applications that call for throttling by means of a SYST CRPc 9–125 commissioning damper fitted directly to the unit, the required data can be read using the Swegon ProSelect sizing program. Room attenuation = 10 dB
3. The specified capacities are based on operation with the face plate in the high capacity position. Operation with the face plate set to the normal position reduces the water capacity of the Parasol 24" module by about 5% and that of the Parasol 48" module by about 10 %.

The water capacity can vary depending on the installation and how the air deflectors are set. The primary air capacity is not affected.

N.B.! The total cooling capacity is the sum of the air-based and water-based cooling capacities.

Table 4 – Data – Cooling. Sizing Guide for Parasol MF unit (48" module)

Unit size	Nozzle setting	Primary airflow	Sound level in dB(A)	Nozzle pressure $p_i x10^{-2}$	Cooling capacity Primary air (Btuh) at ΔT_i				Cooling capacity water (Btuh) at ΔT_{mk} (F) 3.						Pressure drop constant air/water	
in.	1.	(cfm)	2.	(inWG)	10	14	18	22	10	12	14	16	18	20	k_{pl}	k_{pk}
48	LLLL	19	<20	19.6	205	287	369	451	997	1193	1388	1583	1799	1976	42.8	0.603
48	LLLL	21	<20	24.4	227	318	408	499	1099	1317	1531	1749	1963	2183	42.8	0.603
48	LLLL	25	<20	35.3	270	378	486	594	1275	1526	1777	2029	2281	2538	42.8	0.603
48	LLLL	29	<20	48.1	313	438	564	689	1424	1705	1987	2269	2551	2838	42.8	0.603
48	LLLL	33	<20	62.6	356	499	642	784	1554	1862	2170	2478	2786	3097	42.8	0.603
48	MMMM	27	<20	20.0	292	409	525	642	1112	1330	1551	1769	1986	2211	61.5	0.603
48	MMMM	31	<20	26.9	335	469	603	737	1265	1513	1759	2003	2246	2497	61.5	0.603
48	MMMM	36	<20	34.1	389	544	700	855	1401	1671	1939	2208	2474	2745	61.5	0.603
48	MMMM	42	<20	47.3	454	635	816	988	1578	1878	2176	2472	2768	3069	61.5	0.603
48	MMMM	46	20	57.4	497	696	894	1093	1680	1999	2316	2629	2942	3255	61.5	0.603

Table 5 – Data – Cooling. Sizing Guide for Parasol HF units (48" module)

Unit size	Nozzle setting	Primary airflow	Sound level in dB(A)	Nozzle pressure $p_i x10^{-2}$	Cooling capacity Primary air (Btuh) at ΔT_i (F)				Cooling capacity water (Btuh) at ΔT_{mk} (F) 3.						Pressure drop constant air/water	
in.	1.	(cfm)	2.	(inWG)	10	14	18	22	10	12	14	16	18	20	k_{pl}	k_{pk}
48	LLLL	27	<20	20.0	292	408	525	642	1228	1457	1689	1918	2148	2379	61.5	0.603
48	LLLL	31	<20	26.9	335	469	603	737	1357	1616	1873	2125	2380	2634	61.5	0.603
48	LLLL	36	<20	34.1	389	544	700	855	1476	1754	2032	2307	2585	2862	61.5	0.603
48	LLLL	42	<20	47.3	454	635	816	998	1626	1934	2240	2543	2848	3154	61.5	0.603
48	LLLL	46	20	57.4	497	696	894	1093	1711	2038	2362	2682	3005	3327	61.5	0.603
48	MMMM	48	<20	20.8	518	726	933	1140	1442	1712	1983	2250	2516	2786	107.1	0.603
48	MMMM	55	<20	26.5	594	832	1069	1307	1567	1859	2149	2439	2728	3017	107.1	0.603
48	MMMM	63	21	35.3	680	953	1225	1497	1707	2026	2346	2659	2974	3289	107.1	0.603
48	MMMM	72	25	45.3	778	1089	1400	1711	1832	2174	2516	2854	3189	3527	107.1	0.603
48	MMMM	82	29	59.8	886	1240	1594	1948	1969	2338	2703	3064	3425	3789	107.1	0.603

1. For the sizing of alternative nozzle settings, use Swegon ProSelect, the sizing program that is available at www.swegon.com.
2. The specified noise level is applicable to connection without damper or with fully open damper. In other applications that call for throttling by means of a SYST CRPc 9–125 commissioning damper fitted directly to the unit, the required data can be read using the Swegon ProSelect sizing program. Room attenuation = 10 dB
3. The specified capacities are based on operation with the face plate in the high capacity position. Operation with the face plate set to the normal position reduces the water capacity of the Parasol 24" module by about 5% and that of the Parasol 48" module by about 10 %.

The water capacity can vary depending on the installation and how the air deflectors are set. The primary air capacity is not affected.

N.B.! The total cooling capacity is the sum of the air-based and water-based cooling capacities.

Table 6. Cooling capacity from natural convection

Unit size	Cooling capacity (Btuh) for temperature difference, room - water ΔT_{mk} (F)					
	10	12	14	16	18	20
Parasol 24" module	51	67	82	99	116	133
Parasol 48" module	127	163	171	209	250	294

Nozzle setting

The unique built-in nozzle control in the Parasol means that each of the four sides can be set individually. Depending on the unit's location and the room's primary air requirement, the primary air can be guided in all the desired directions. The direction of the airflow can be easily optimized using the Swegon ProSelect sizing program available at www.swegon.com.

All units are preset to the same nozzle setting on all four sides (for particulars of the delivery settings, see the shaded area in the tables). The airflow direction can be easily commissioned when installing the unit using the commissioning tools supplied with the unit. This provides logistic advantages since the fitter does not have to take specific room markings into account.

k-factor (C.O.P.)

Each nozzle setting has a specific k-factor. A total k-factor for the unit can be determined by adding together the k-factors for the nozzle settings on each side. The relevant k-factor (C.O.P.) for optimized nozzle setting can also be obtained in ProSelect.

Type of unit:	Primary airflow	Side	Nozzle setting	k-factor (C.O.P.)
Parasol MF (24" module)	Low	Any	L	0.253
	Medium	Any	M	0.440
	High	Any	H	0.693
	None	Any	C	0
Parasol LF (48" module)	Low	Short side	L	0.124
	Medium	Short side	M	0.176
	High	Short side	H	0.300
	None	Short side	C	0
	Low	Long side	L	0.328
	Medium	Long side	M	0.464
	High	Long side	H	0.792
	None	Long side	C	0
Parasol MF (48" module)	Low	Short side	L	0.176
	Medium	Short side	M	0.253
	High	Short side	H	0.429
	None	Short side	C	0
	Low	Long side	L	0.464
	Medium	Long side	M	0.667
	High	Long side	H	1.131
	None	Long side	C	0
Parasol HF (48" module)	Low	Short side	L	0.253
	Medium	Short side	M	0.440
	High	Short side	H	0.693
	None	Short side	C	0
	Low	Long side	L	0.667
	Medium	Long side	M	1.160
	High	Long side	H	1.827
	None	Long side	C	0

Specific nozzle settings

To specify optimized nozzle settings, always begin from the side where there are water connections. From there, specify side after side in counter-clockwise order, see **Figures 16-18**. If you like, you can order the units preset from the factory.

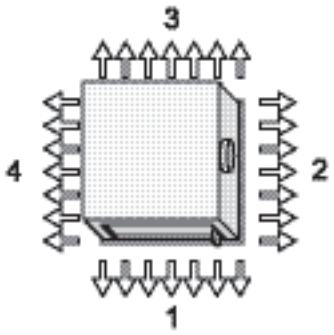


Figure 16. Top view of Parasol 24" module, side 1-4

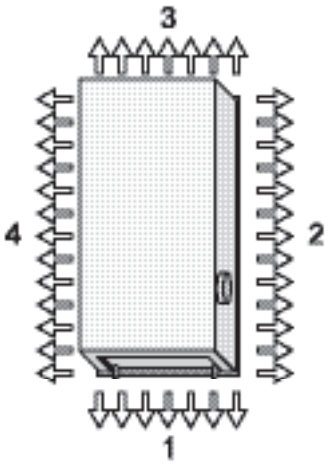


Figure 17. Top view of Parasol 48" module, side 1-4

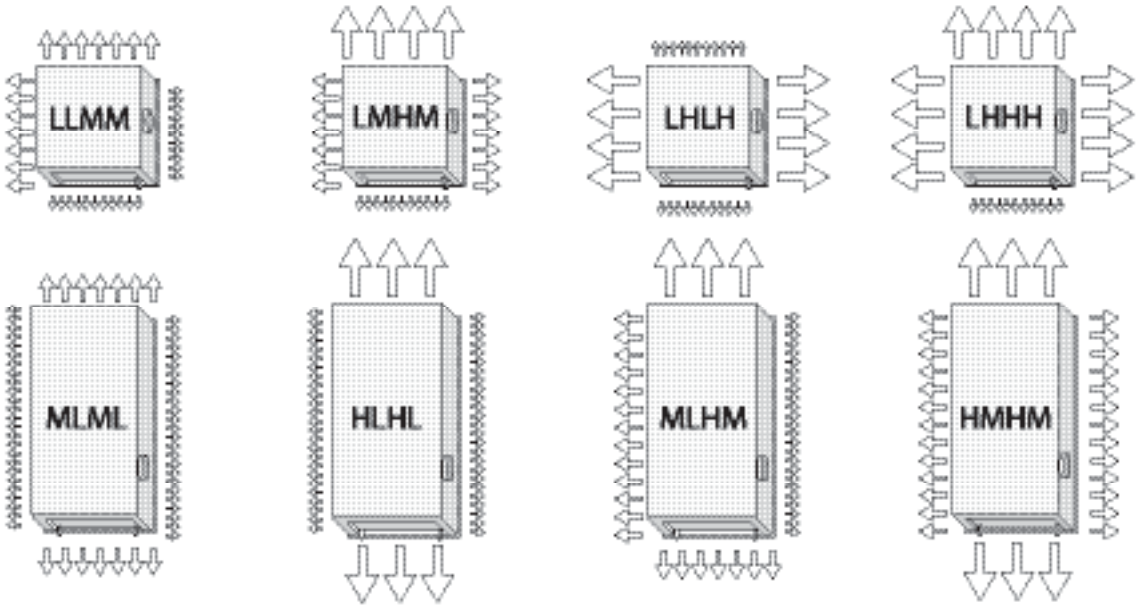


Figure 18. Examples of optimized nozzle setting.

Calculation Example - Cooling

An office with dimensions w x l x h = 8 x 14 x 9 ft is to be equipped with comfort modules. The total cooling load is estimated at 24 Btuh/ft^2. To meet this cooling load, a Parasol is required that produces 24 x 8 x 14 = 2688 Btuh.

Design room temperature (t_r) 75 °F, cooling water temperature (flow/return) 57/61 °F and the primary air temperature (t_l) 60 °F produces:

ΔT_k = 4 °F

ΔT_{mk} = 16 °F

ΔT_l = 15 °F

The desired primary air flow to the room (q_l) has been fixed at 36 cfm.

The level of flow-generated sound emitted from the unit must not exceed 25 dB(A).

Solution

Cooling

The cooling capacity of the primary air can be calculated using the following formula: $P_l = 1.08 \cdot \Delta T_l \cdot q_l$

$P_l = 1.08 \cdot 15 \cdot 36 = 583$ Btuh

The Parasol comfort module must therefore be able to provide 2688 – 583 = 2105 Btuh in cooling capacity on the water side.

From **Table 4** we find that a 48 x 24 in Parasol 48" module with nozzle setting MMMM for a primary airflow of 36 cfm produces 2208 Btuh in cooling capacity on the water side side at ΔT_{mk} = 16 °F. This is sufficient for coping with the cooling load in the room.

Cooling Water

With a cooling capacity requirement of 2105 Btuh for cooling water, the necessary water flow is obtained in **Chart 1**. A temperature increase of ΔT_k = 4 °F produces a water flow of 1.05 gpm.

In **Chart 2** we can read that a water flow of 1.05 gpm produces a fully turbulent flow which means that no correction of the capacity is needed in this case.

The pressure drop is calculated on the basis of a water flow of 1.05 gpm and the pressure drop constant k_{pk} = 0.603, which is taken from **Table 4.**

The pressure drop can now be read at 3.03 ftWG from **Chart 4.**

Sound Level

In Table 4 we see that the sound level with an open damper (or without a damper) reaches <20 dB(A). To see the commissioning range and the current sound level after adjustment with separate type SYST CRPc 9-125 damper, use the Swegon ProSelect sizing program, which is available at www.swegon.com.

Heating

Heating function

Because of the comfort module's ability to quickly mix primary air with room air, PARASOL is ideal for providing both cooling and heating. In other words, heating spaces, with air heated above room temperature, from the ceiling is a good alternative to conventional heating by radiators. The benefits achieved include lower installation costs, simpler installation and perimeter walls free from piping and radiators.

Regardless of the type of heating system installed it is important to consider the operative temperature in a room. Most people are comfortable when the operative temperature in winter is in between 68–75 °F, and the optimal comfort requirements are normally met when the room temperature is 71 °F. This means that for a room with a cold perimeter wall, the air temperature must be higher than 71 °F to compensate for the chilling effect. In new buildings with normal insulated perimeter walls and windows that conform to normal standards of glazing, the difference between the room air temperature and the operative temperature is small. But for older buildings with worse windows, it may be necessary to raise the air temperature to compensate for the chilling effect. Different operating scenarios can be simulated easily using the Swegon ProClim Web software where both the room air temperature and operative temperature are specified.

Supplying heated air from the ceiling results in some stratification of the air. With a maximum supply temperature of 104 °F, the stratification is non-existent, while at 140 °F it can be around 7 °F in the occupied zone. This only applies during the warming-up phase, when the room is unused and there is no internal load. When the room is being used and lighting, computers and people are present, the stratification is reduced or disappears depending on the heating load.

Laboratory studies, computer simulations and reference projects all show that a good indoor climate is achieved with the aid of a PARASOL comfort module whatever the time of year.

Calculation formula - water-based heating

Below are some formula that enable the user to calculate which comfort module selection is best-suited for the application. The values for the calculations are in Tables 8-11.

The cooling or heating capacity of the air:

$$P_l = 1.08 \cdot q_l \cdot \Delta T_l$$

P_l The cooling or heating capacity of the air (Btuh)

q_l Flow of primary air (cfm)

ΔT_l Temperature difference between primary air (t_l) and room air (t_r) (F)

Heating capacity of the water:

$$P_v = 500 \cdot q_v \cdot \Delta T_v$$

P_v Heating capacity of the water (Btuh)

q_v Flow of heating water (gpm)

ΔT_v Temperature difference between the heating water's flow and return flow (F)

Pressure drop for heating circuit (ftWG)

$$\Delta p_v = (q_v / k_{pv})^2$$

Δp_v Pressure drop in heating circuit (ftWG)

q_v Flow of heating water (gpm), see **Chart 6**

k_{pv} Pressure drop constant for heating circuit, see **Tables 8-11**

Chart 5. Water Flow – Heating Capacity

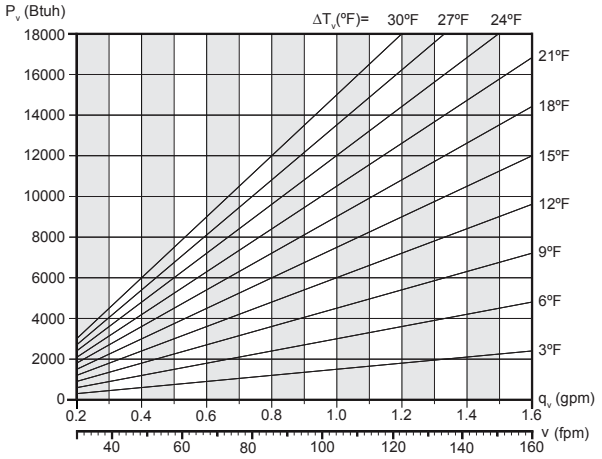


Chart 6. Pressure Drop – Heating Water Flow

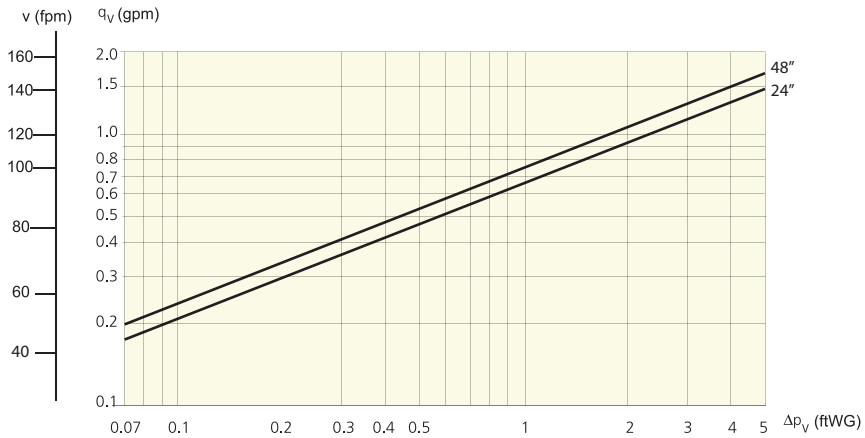


Table 8 – Data – Heating. Sizing Guide for Parasol MF units (24" module)

Unit size	Nozzle setting	Primary airflow	Sound level in dB(A)	Nozzle pressure $p_i x10^{-2}$	Heating capacity water (Btuh) at ΔT_{mv} (F) 3.						Pressure drop constant air/water	
in.	1.	(cfm)	2.	(inWG)	10	20	30	40	50	60	k_{pl}	k_{pv}
24	LLLL	14	<20	19.2	371	743	1114	1482	1850	2216	33.8	0.660
24	LLLL	16	<20	24.8	421	841	1259	1679	2095	2511	33.8	0.660
24	LLLL	19	<20	31.7	466	929	1391	1851	2312	2771	33.8	0.660
24	LLLL	21	<20	39.3	504	1007	1505	2006	2505	3005	33.8	0.660
24	LLLL	25	21	56.2	569	1140	1707	2275	2842	3409	33.8	0.660
24	HHHH	42	<20	20.8	550	1090	1610	2127	2637	3142	92.7	0.660
24	HHHH	48	<20	27.7	603	1201	1778	2350	2915	3476	92.7	0.660
24	HHHH	55	22	35.3	652	1298	1922	2544	3158	3769	92.7	0.660
24	HHHH	63	27	46.9	709	1413	2093	2770	3440	4109	92.7	0.660
24	HHHH	72	30	60.2	758	1508	2241	2968	3690	4406	92.7	0.660

Table 9 – Data – Heating. Sizing Guide for Parasol LF units (48" module)

Unit size	Nozzle setting	Primary airflow	Sound Level dB(A)	Nozzle pressure $p_i x10^{-2}$	Heating capacity water (Btuh) at ΔT_{mv} (F) 3.						Pressure drop constant air/water	
in.	1.	(cfm)	2.	(inWG)	10	20	30	40	50	60	k_{pl}	k_{pv}
48	LLLL	14	<20	24.0	626	1254	1874	2494	3114	3734	30.1	0.748
48	LLLL	16	<20	31.3	709	1413	2116	2816	3516	4216	30.1	0.748
48	LLLL	19	<20	39.7	778	1557	2328	3101	3872	4642	30.1	0.748
48	LLLL	21	<20	48.9	843	1686	2521	3356	4189	5022	30.1	0.748
48	LLLL	23	<20	59.4	902	1800	2693	3585	4543	5406	30.1	0.748
48	MMMM	19	<20	19.6	735	1456	2132	2798	3452	4098	42.8	0.748
48	MMMM	21	<20	24.4	785	1561	2302	3039	3763	4481	42.8	0.748
48	MMMM	25	<20	35.3	872	1741	2596	3451	4299	5145	42.8	0.748
48	MMMM	29	<20	48.1	948	1894	2847	3799	4753	5707	42.8	0.748
48	MMMM	33	<20	62.6	1009	2027	3063	4102	5146	6194	42.8	0.748
48	HHHH	33	<20	21.6	865	1732	2589	3447	4229	5114	73.0	0.748
48	HHHH	38	<20	27.3	948	1899	2839	3779	4719	5657	73.0	0.748
48	HHHH	44	<20	37.3	1058	2118	3166	4216	5263	6309	73.0	0.748
48	HHHH	50	<20	48.5	1153	2305	3450	4592	5732	6871	73.0	0.748
48	HHHH	57	20	61.4	1237	2472	3701	4925	6147	7368	73.0	0.748

1. For the sizing of alternative nozzle settings, use Swegon ProSelect, the sizing program that is available at www.swegon.com.
2. The specified noise level is applicable to connection without damper or with fully open damper. In other applications that call for throttling by means of a SYST CRPc 9–125 commissioning damper fitted directly to the unit, the required data can be read using the Swegon ProSelect sizing program. Room attenuation = 10 dB
3. The specified capacities are based on operation with the face plate in the high capacity position. Operation with the face plate set to the normal position reduces the water capacity of the Parasol 24" module by about 5% and that of the Parasol 48" module by about 10 %.

The water capacity can vary depending on the installation and how the air deflectors are set. The primary air capacity is not affected.

N.B.! The total cooling capacity is the sum of the air-based and water-based cooling capacities.

Table 10 – Data – Heating. Sizing Guide for Parasol MF units (48" module)

Unit size	Nozzle setting	Primary airflow	Sound Level in dB(A)	Nozzle pressure $p_i x10^{-2}$	Heating capacity water (Btuh) at ΔT_{mv} (F) 3.						Pressure drop constant air/water	
in.	1.	(cfm)	2.	(inWG)	10	20	30	40	50	60	k_{pl}	k_{pv}
48	LLLL	19	<20	19.6	770	1527	2233	2932	3618	4294	42.8	0.748
48	LLLL	21	<20	24.4	823	1637	2411	3182	3941	4696	42.8	0.748
48	LLLL	25	<20	35.3	914	1825	2721	3614	4504	5392	42.8	0.748
48	LLLL	29	<20	48.1	990	1986	2982	3979	4979	5979	42.8	0.748
48	LLLL	33	<20	62.6	1058	2122	3208	4296	5390	6490	42.8	0.748
48	MMMM	27	<20	20.0	736	1486	2275	3074	3884	4704	61.5	0.748
48	MMMM	31	<20	26.9	861	1728	2615	3508	4407	5311	61.5	0.748
48	MMMM	36	<20	34.1	967	1936	2912	3887	4862	5842	61.5	0.748
48	MMMM	42	<20	47.3	1108	2211	3296	4378	5456	6532	61.5	0.748
48	MMMM	46	20	57.4	1191	2371	3521	4666	5804	6936	61.5	0.748

Table 11 – Data – Heating. Sizing Guide for Parasol HF units (48" module)

Unit size	Nozzle setting	Primary airflow	Sound Level in dB(A)	Nozzle pressure $p_i x10^{-2}$	Heating capacity water (Btuh) at ΔT_{mv} (F) 3.						Pressure drop constant air/water	
in.	1.	(cfm)	2.	(inWG)	10	20	30	40	50	60	k_{pl}	k_{pv}
48	LLLL	27	<20	20.0	656	1411	2541	3483	4139	5076	61.5	0.748
48	LLLL	31	<20	26.9	728	1562	2818	3862	4588	5627	61.5	0.748
48	LLLL	36	<20	34.1	789	1696	3059	4192	4980	6107	61.5	0.748
48	LLLL	42	<20	47.3	872	1870	3370	4621	5491	6732	61.5	0.748
48	LLLL	46	20	57.4	918	1972	3555	4872	5790	7100	61.5	0.748
48	MMMM	48	<20	20.8	769	1644	2980	4084	4852	5947	107.1	0.748
48	MMMM	55	<20	26.5	834	1790	3228	4425	5260	6447	107.1	0.748
48	MMMM	63	21	35.3	910	1952	3520	4826	5733	7029	107.1	0.748
48	MMMM	72	25	45.3	975	2094	3775	5174	6150	7539	107.1	0.748
48	MMMM	82	29	59.8	1047	2249	4056	4225	5273	8097	107.1	0.748
48	HHHH	76	20	20.4	873	1875	3382	4635	5508	6752	168.7	0.748
48	HHHH	84	22	25.2	936	2006	3618	4956	5890	7222	168.7	0.748
48	HHHH	95	25	32.1	1002	2151	3879	5318	6320	7912	168.7	0.748
48	HHHH	105	28	39.3	1063	2282	4115	5639	6702	8218	168.7	0.748
48	HHHH	116	30	47.7	1119	2400	4327	5930	7048	8641	168.7	0.748

1. For the sizing of alternative nozzle settings, use Swegon ProSelect, the sizing program that is available at www.swegon.com.
2. The specified noise level is applicable to connection without damper or with fully open damper. In other applications that call for throttling by means of a SYST CRPc 9–125 commissioning damper fitted directly to the unit, the required data can be read using the Swegon ProSelect sizing program. Room attenuation = 10 dB
3. The specified capacities are based on operation with the face plate in the high capacity position. Operation with the face plate set to the normal position reduces the water capacity of the Parasol 24" module by about 5% and that of the Parasol 48" module by about 10 %.

The water capacity can vary depending on the installation and how the air deflectors are set. The primary air capacity is not affected.

N.B.! The total cooling capacity is the sum of the air-based and water-based cooling capacities.

Calculation Example - Heating

In an office with dimensions w x l x h = 8 x 14 x 9 ft (the same room as in the example for cooling), in the wintertime, there is also a heating requirement of 1800 Btuh. The primary air flow must be the same as in the summer scenario: 36 cfm.

Design room temperature (t_r) 71 °F, heating water temperature (flow/return) 100/82 °F and the primary air temperature (t_l) 68 °F produces:

ΔT_v = 18 °F

ΔT_{mv} = 20 °F

ΔT_l = -3 °F

Solution

Heating

The primary airflow of 36 cfm in combination with the primary air temperature of 68 °F produces a negative impact on the heating capacity:
1.08 x 36 x (-3) = -117 Btuh.
The heating capacity required from the heating water is thus increased to 1800 + 117 = 1917 Btuh. From **Table 10** we find that a Parasol 48" module with nozzle setting MMMM at ΔT_{mv} = 20 °F and primary air volume 36 cfm obtain a heat capacity of P_v = 1936 Btuh from a double-module unit, which is sufficient to meet the heating requirements.

Heating Water

With a heating requirement of 1917 Btuh and ΔT_v = 18 °F, we obtain the required water flow from **Chart 5**: 0.2 gpm. The pressure drop for the heating water is calculated on the basis of a water flow of 0.21 gpm and pressure drop constant k_{pv} = 0.748, which is taken from **Table 10**. The pressure drop will then be: $\Delta p_v = (qv/kpv)^2 = (0.21 / 0.748)^2$ = 0,08 ftWG. Alternatively, the pressure drop can be read off from **Chart 6**.

ACOUSTICS

Initial Adjustment Range

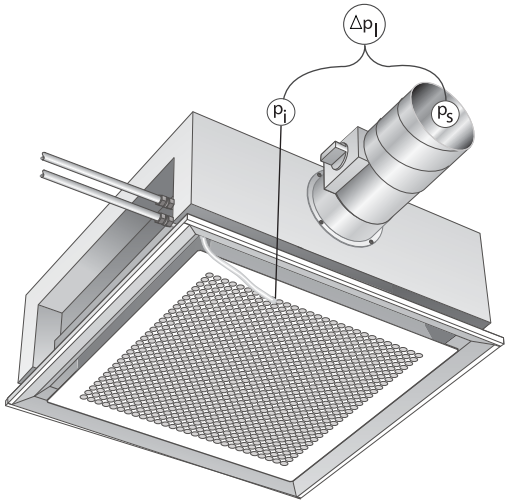


Figure 19. Pressure Conditions - Air

Damper throttling range

$\Delta p_l = p_i \cdot p_s$

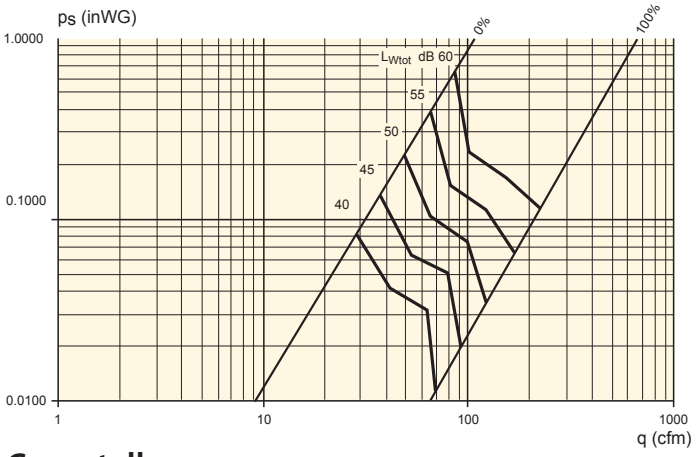
Δp_l Throttling range of fitted damper p_s - p_i, see **Chart 7**

p_i Nozzle pressure (easily measured with a manometer connected to measurement hoses).

p_s Static pressure before the the unit and commissioning damper

Chart 7 shows the total generated sound power (L_{Wtot} dB), as a function of the airflow and pressure drop across the damper. By correcting L_{Wtot} with the correction factors from Table 17, the sound power levels for the corresponding octave bands can be obtained ($L_W = L_{wtot} + K_{ok}$).

Chart 7. Adjustment range, CRPc 9-125 damper



Cross-talk

Typical R_w values between offices with Parasol where the partition wall finishes at the suspended ceiling (with a good seal). It is assumed that the partition wall has at least the same R_w value as in the table.

Table 12. R_w values

Design	Suspended Ceiling R_w (dB)	With Parasol R_w (dB)
Light acoustic suspended ceiling. Mineral wool or perforated steel/ aluminium coffers or screen.	22	22
Light acoustic suspended ceiling. Mineral wool or perforated steel/ aluminium coffers or screen. Suspended ceiling is covered with 1.9 in. mineral wool*.	30	30
Light acoustic suspended ceiling. Mineral wool or perforated steel/ aluminium coffers or screen. Upright 3.9 in. mineral wool panel forming the seal between the offices*.	30	30
Perforated plaster panels in T-section bar system. Acoustic insulation on top side (0.9 in.).	30	30
Sealed plaster suspended ceiling with insulation on top side.	39	38
* Rockwool 4 lb/ft³, Gullfiber 3 lb/ft³.		

Orifice Attenuation and End Reflection

Orifice attenuation ΔL (dB) including end reflection.

Table 13. Orifice Attenuation ΔL (dB) Parasol MF (24" module)

Nozzle setting	Octave band (Hz) 63	125	250	500	1k	2k	4k	8k
LLLL	13	14	11	10	11	10	9	9
MMMM	11	12	9	8	9	8	7	7
HHHH	9	10	7	6	7	6	5	5

Table 14. Orifice Attenuation ΔL (dB) Parasol LF (48" module)

Nozzle setting	Octave band (Hz) 63	125	250	500	1k	2k	4k	8k
LLLL	13	14	11	10	11	10	9	9
MMMM	12	13	10	9	10	9	8	8
HHHH	9	10	7	6	7	6	5	5

Table 15. Orifice Attenuation ΔL (dB) Parasol MF (48" module)

Nozzle setting	Octave band (Hz) 63	125	250	500	1k	2k	4k	8k
LLLL	12	13	10	9	10	9	8	8
MMMM	10	11	8	7	8	7	6	6
HHHH	8	9	6	5	6	5	4	4

Table 16. Orifice Attenuation ΔL (dB) Parasol HF (48" module)

Nozzle setting	Octave band (Hz) 63	125	250	500	1k	2k	4k	8k
LLLL	10	11	8	7	8	7	6	6
MMMM	8	9	6	5	6	5	4	4
HHHH	6	7	4	3	4	3	2	2

Table 17. Sound power level for CRPc 9-125 commissioning damper, Correction factor, K_{ok}

Size	Mid-frequency (Octave band) Hz							
CRPc -9	63	125	250	500	1k	2k	4k	8k
125	0	-5	-22.5	-37.5	-50	-62.5	-72.5	-87.5
Tol. ±	2	2	2	2	2	2	2	2

Dimensions

Table 18. Dimensions - Parasol

Unit	Length of the unit (in.)	Width W (in.)
Parasol 24" module	24	24
Parasol 48" module	48	24

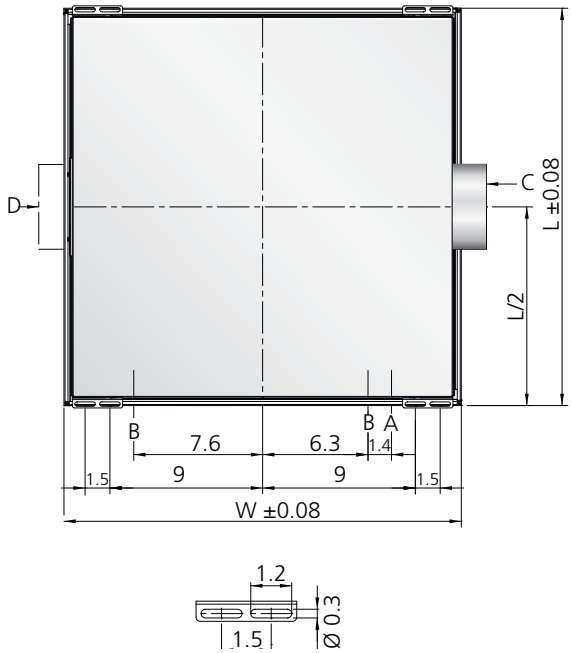


Figure 20. Parasol 24" module, top view
A = Inlet and return, cooling water Ø 0.47 x 0.04 in. (Cu)
B = Inlet and return, heating water Ø 0.47 x 0.04 in. (Cu)
C = Connection piece for primary air Ø 4.92 in.
D = Capped alternative air connection

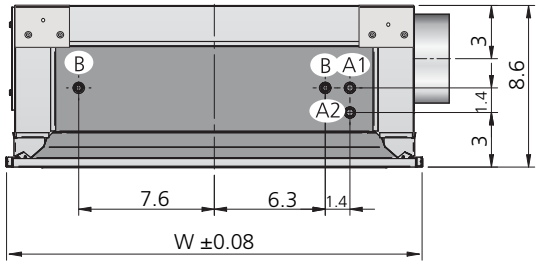


Figure 21. Parasol 24" module, end view and connections
A1 = Inlet, cooling water Ø 0.47 x 0.04 in. (Cu)
A2 = Return, cooling water Ø 0.47 x 0.04 in. (Cu)
B = Inlet / return, heating water Ø 0.47 x 0.04 in. (Cu)

Important

For the single-module unit, it is important that the cooling water is connected correctly to the connection pipe. The flow direction is essential to obtain full cooling capacity. **The water flow and return direction are indicated on the end of the unit by means of arrows.**

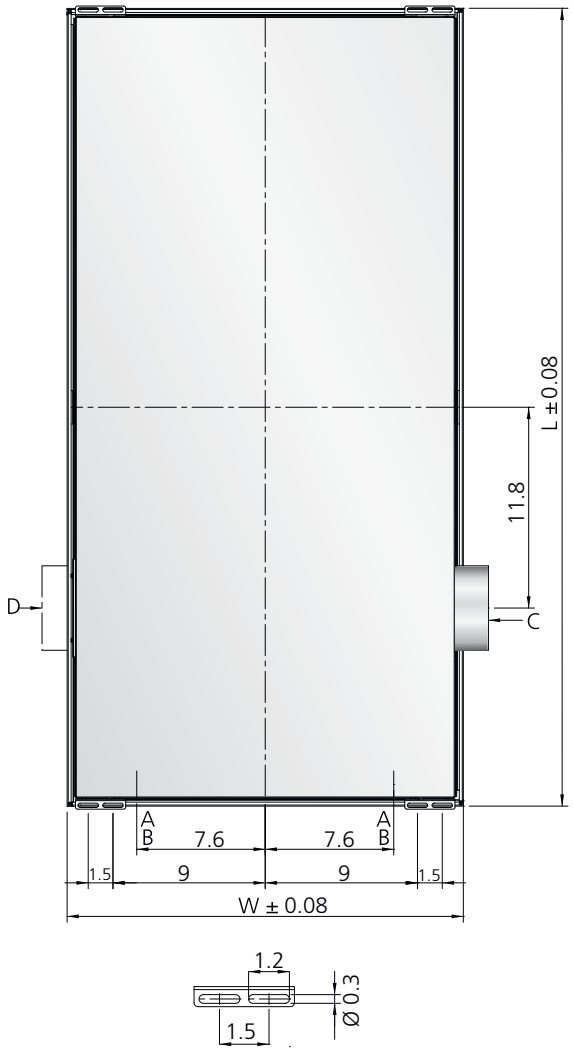


Figure 22. Parasol 48" module, top view
A = Inlet and return, cooling water Ø 0.47 x 0.04 in. (Cu)
B = Inlet and return, heating water Ø 0.47 x 0.04 in. (Cu)
C = Connection piece for primary air Ø 4.92 in.
D = Capped alternative air connection

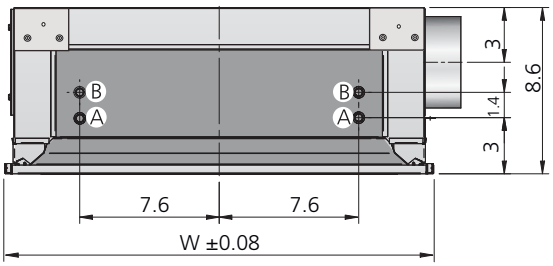


Figure 23. Parasol 48" module, end view and connections
A = Inlet and return, cooling water Ø 0.47 x 0.04 in. (Cu)
B = Inlet and return, heating water Ø 0.47 x 0.04 in. (Cu)

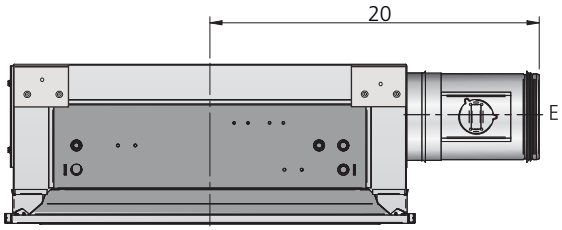


Figure 24. Connection with commissioning damper, end view
E = Commissioning damper fitted SYST CRPc 9-125 (Ø 4.92 in.)

If the sound levels specified are to apply, it is important that the damper is fitted with the dial pointing left viewed in the direction of primary airflow.

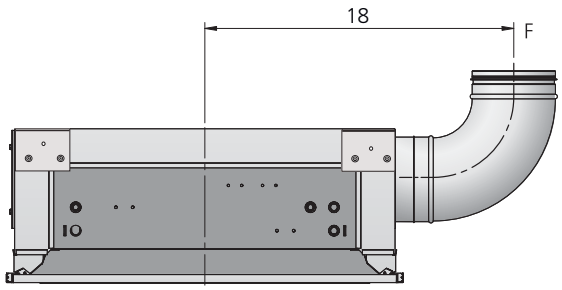


Figure 25. Connection with duct bend, end view
F = Connection piece fitted SYST CA 125-90 (Ø 4.92 in.)

Ordering Key

Contractor demarcation

Swegon's delivery ends at the connection points for water and air, and the connection of indoor climate control equipment (see **Figures 21 and 23**).

- The plumbing contractor connects the water to the plain pipe end, the system, bleeds it and tests the pressure. If the indoor environment control system is fitted at the factory, the return pipe for chilled water and heating is connected directly to the valve (DN 0.5" male threads).
- The ventilation contractor connects ducting to the air connection piece.

Available to order, Parasol features

Size	24" module: 24 x 24 in. 48" module: 48 x 24 in.
Function	The units can be ordered in various functional versions:
ADC[II]	Factory-fitted ADC[II] is supplied as standard
Airflow variant	24" module: MF (medium flow) 48" module: LF (low flow) MF (medium flow) HF (high flow)
Nozzle setting	Each side can be set in four different ways: L, M, H or C L = Low airflow M = Medium airflow H = High airflow C = No airflow
Color	The units are supplied in prepainted parts, Swegon standard shade of white RAL 9010, gloss ratio 30 ± 6%. Other colors, special order.

Ordering Key, Parasol 24" module

Parasol	Parasol	b	24-	b-	MF-	cdef
Version:						
24						
Function:						
A = Cooling and supply air.						
B = Cooling, heating and supply air						
C = Supply air only						
Nozzle setting:						
Side 1: L; M; H; C						
Side 2: L; M; H; C						
Side 3: L; M; H; C						
Side 4: L; M; H; C						

Ordering Key, Parasol 48" module

Parasol	Parasol	b	48-	b-	cc-	defg
Version:						
48						
Function:						
A = Cooling and supply air						
B = Cooling, heating and supply air						
C = Supply air only						
Airflow variant						
LF = Low flow						
MF = Medium flow						
HF = High flow						
Nozzle setting:						
Side 1: L; M; H; C						
Side 2: L; M; H; C						
Side 3: L; M; H; C						
Side 4: L; M; H; C						

Available to order, Accessories

Perforation patterns	Perforation patterns are available in three different versions.
Assembly piece	Ceiling mount and threaded rod for ceiling mounting. Double threaded rods with thread lock also available.
Plasterboard ceiling frame	Plasterboard ceiling frame for single- module and double-module units.
Connection piece, air	The connection pieces are either straight or 90° angular, Ø 4.92 in. or Ø 5.91 in..
Initial adjustment damper	Initial adjustment damper, can be ordered if needed.
Tool for nozzle adjustment	One tool for nozzle adjustment is supplied with each order free of charge. Several tools must be specified separately.

Ordering Key, Accessories

Perforation pattern	Parasol	b	T- PP-	a-	bb
Version:					
Type:					
1 = Parasol 24"					
2 = Parasol 48"					
Perforation variant:					
PD					
PE					

Assembly piece	SYST MS-	aaaa-	b-	RAL 9010	
Length of threaded rod (in.):					
8; 20; 39					
Type:					
1 = One threaded rod					
2 = Two threaded rods and one thread lock					

Plasterboard ceiling frame	Parasol	b	T- FPB-	aaaa
Version:				
Length (in.):				
24; 48				

Connection piece, air	SYST AD-	aaa
Ø125 (Ø 4.92 in.)		
Ø150 (Ø 5.91 in.)		

Connection piece (90° duct bend), air	SYST CA 125-90
Initial adjustment damper	SYST CRPc 9-125, Ø 4.92 in.
Tool for Nozzle adjustment	SYST TORX 6-200, Ø 4.92 in.

Examples

The following examples show how to fill in various specifications.

First of all, use the ProSelect program or the calculation formula and tables to calculate which dimensions the units should have to meet the requirements.

Sample order 1
After sizing, it has been decided that a Parasol comfort module unit with dimensions 24 x 24 in. would suit a given cellular office. It has already been decided that radiators should be installed to provide the heating requirement, so a unit with coil heating is not necessary. In the design, a diffusion pattern has been selected in which an equal amount of air is discharged in all four directions at nozzle setting M to provide the desired air volume. There is no special preference with regard to perforation pattern. The accessories required in this example are one initial adjustment damper and a 20 in. assembly piece.

Ordering Keys
Parasol b 24"-A-MF-MMMM

SYST CRPc 9-125

SYST MS 500-1

Sample order 2
In an open-plan office eight Parasol comfort module units in the high-flow version are required with standard dimensions 48 x 24 in. to meet the cooling requirement. Earlier in the project, the team selected a suspended ceiling system with a c-c distance of 27 in. between the T-sections. The product dimensions 53 x 26 in. are ideal for this suspended ceiling system. The perimeter wall has a low U-value, with triple-glazed windows providing good insulation. Bearing this in mind, comfort module units with coil heating have been selected. Four of the comfort modules are located close to partition walls. To further play safe against potential draft issues, the diffusion pattern for these units is adapted so that only a smaller volume of air is directed towards the partition walls. The architect has chosen the PD perforation pattern in the face plate. Other accessories selected are an initial adjustment damper and assembly piece with 39 in. long threaded rods.

Specification
4 Parasol b 48"-B-HF-MMMM

2 Parasol b 48"-B-HF-MLMM

2 Parasol b 48"-B-HF-MMML

8 Parasol b T-PP-2-PD

8 SYST CRPc 9-125

8 SYST MS 1000-1