Medical Air Purification and Control Module PMA for EN ISO 7396-1/HTM 02-01 and HTM2022 EurPh Compliant Medical Air Supply Systems

PMA Dryer:

Description

The PMA is a duplex air purification module with central controller intended for producing medical air in EN ISO 7396-1 and NHS Health Technical Memorandum HTM02-01 or HTM2022 compliant medical air supply systems. Medical quality air to the European Pharmacopoeia monograph shall be delivered at pressures of 400 kPa (4 bar), 700 kPa (7 bar) or 1000 kPa (10 bar) gauge.

The PMA module purifies the air and controls the medical air supply system with up to 6 compressors (with one or two compressors on stand-by).

The PMA is a CE-marked with approval from a notified body.

Sources of Supply

HTM02-01/EN ISO 7396-1

The Medical air supply system will produce the primary supply with two compressors on standby (unless an Automatic Manifold is used as secondary (HTM02-01) or third (ISO7396-1) supply). For duplex plant, the secondary (HTM02-01) or third (ISO7396-1) supply shall be an Automatic Manifold. For triplex plant, each compressor can supply the total hospital flow. If more than three compressors are installed, the total hospital flow will be split over multiple compressors.

HTM2022

The Medical air supply system will produce the primary supply with one compressor on standby. For duplex plant, each compressor can supply the total hospital flow. If more than two compressors are installed, the total hospital flow will be split over multiple compressors. The back-up compressor will form the secondary supply. A third supply shall be from an Automatic Manifold capable of supplying the average hospital demand for 4 hours.

The Distinctive Features of the PMA Medical Dryers:

Features	Customer benefit
Complete Air Purification Package	Everything to clean the air is pre-piped and wired in a fully duplexed package, with a six-step purification process that provides European Pharmacopeia compliant air
Advanced Medical Controls	The advanced master controller monitors and controls both the compressors and the air purification module. Filled with redundancy and medical safety features, the controller operates the system efficiently with a very tight pressure band and equalization of running hours on the compressors and dryers.
MyMedGas Embedded	All parameters of the systems can be seen and stored via MyMedGas
Compact design	With the unique design of the extruded aluminum desiccant dryer towers, the air purification package components are compactly configured to minimize footprint without compromising service access.
Optional Hopcalite catalysator	Less time to assemble and commission, less brazing points, no room for connections
Optional Integrated gas sensor	Combination of gas sensors allows continuous gas quality monitoring with trends stored in MyMedGas

Air Purification Module

Dryer and filter system

The duplexed air purification module shall incorporate high efficiency water separators, oil coalescing filters, heatless regenerative desiccant dryers, activated carbon filters with optional hopcalite catalyst, bacterial filters and pressure regulators. The performance of the filters shall be according to below specifications:

- Oil coalescing two-in-one high efficiency filter: mass efficiency of 99.99%, tested according to ISO 8573-2 & ISO 12500-1
- Activated carbon filter: max remaining total oil content of 0,003 mg/m³, tested according to ISO 8573-5 & ISO 12500-2
- Bacterial filter: particle count efficiency of 99.97% at MPPS=0.1µm, tested according to ISO 12500-3

Contaminants in the delivered air downstream of the bacterial filters shall be maintained at levels below those shown in the table below :

Contaminant	Threshold
H_2O	67 ppm v/v
Dry particulates	Free from visible particulates in a 75 litre sample
Oil (droplet or mist)	0.1 mg/m³
CO	5 ppm v/v
CO_2	500 ppm v/v
SO_2	1 ppm v/v
$NO + NO_2$	2 ppm v/v
O_2	20.4% - 21.4% v/v

Plant Control System

The central control system shall have a touch screen and provide an intelligent human machine interface incorporating on board flash memory and real-time clock for recording operational parameters in the event log. The central control system shall operate at low voltage and include BMS connection for plant fault, plant emergency, reserve fault and pressure fault.

The central control unit shall incorporate a user friendly 5" high-definition color touch screen display with clear pictograms and LED indicators, providing easy access to system operational information. The central controller shall be equipped with the remote monitoring function via the cellular network.

Dryer Purge Control

The dryer control system shall incorporate a Purge Saver Energy Management system that freezes the regeneration of the desiccant once adequate dew point is reached in the inactive tower. Only when the dewpoint level in the active tower deteriorates to an unacceptable level will the intelligent controller switch towers.

Dryer General Data - All types

Parameter	Value
Atmospheric Dew point (°C)	-46
Air quality	Meets European Pharmacopeia
Dryer type	Duplex desiccant dryer with purge saver
Purge	≤ 20%
Controllers[1]	MK5s Touch Central controller, two independent dryer controllers
Test point	BS5682
Pressure regulators	Duplex integrated pressure regulators
Connectivity	MyMedGas embedded
Outlet connection	22 mm (S,M)/28 mm (L,XL) copper stub extension
Inlet connection	22 mm (S,M)/28 mm (L,XL) copper stub extension
Voltage/Frequency	230 V/1 phase/50 Hz or 60 Hz and 115 V/1 phase/50 Hz or 60 Hz; one single phase lead for main cubicle
Medical device Certification	MDR Class IIa
Piping material	Stainless steel
Condensate drains	Electronic

1. The MK5s Touch Central Controller is considered as main software.

Dryer Dimensional Data - All types

Platform	S	M	L	XL1	XL2
Length (mm)	1070	1270	1800	1880	2165
Width (mm)	800	800	850	850	900
Height (mm)	1741	1868	1901	1905	1905
Weight (kg)	293	302	593	850	880

Condensate Management Options

If the oil in compressor condensate is not removed before it enters the sewage system, it can cause significant environmental damage. Therefore, condensate treatment is not only the responsible thing to do in most countries it's the law. Thanks to its multi-stage filtration, Atlas Copco's OSC Oil Water Separator removes oil from your compressor's condensate with unmatched precision to achieve an oil content of 10 ppm at outlet. In addition, the OSC offers zero-hassle maintenance thanks to its easily removable filter bags and cartridges.

Options

The dryer is available with the following options.

Description	Part number
PMA OSC Activated carbon	0000066948
PMA OSC Organo clay[1]	0000069349
PMA CO	0000066949
PMA CO+CO_2	0000066950
PMA CO+CO_2+O_2	0000066951
PMA String test	0000069353
Specific voltage for Saudi[2]	0000069350

1. Stronger emulsions: RS Xtend, RS food grade, oil mixtures
2. If need 60Hz voltage, this option need to be ordered together with PMA machine.

Dryer Selection Table

Dryer Taxonomy

PMA	-	M1	-	10	/	7

Nomenclature	Description
PMA	Model name
M1	Platform size
10	Inlet pressure (bar)
7	Output pressure (bar)

Model Description	Maximum Inlet Pressure (Bar)	Minimum Outlet Pressure (Bar)	Maximum Inlet Flow (l/min)	Maximum Outlet Flow (l/min)	Part Number Without Hopcalite	Part Number With Hopcalite
PMA-S1-7/4	7	4	300	252	4109004760	4109006000
PMA-S2-7/4	7	4	550	462	4109004761	4109006001
PMA-S3-7/4	7	4	859	722	4109004762	4109006002
PMA-S4-7/4	7	4	1150	966	4109004763	4109005785
PMA-M1-7/4	7	4	1650	1386	4109004764	4109006003
PMA-M2-7/4	7	4	2000	1680	4109004765	4109006004
PMA-M3-7/4	7	4	2300	1932	4109004766	4109006005
PMA-L1-7/4	7	4	3300	2772	4109004767	4109006006
PMA-L2-7/4	7	4	4000	3360	4109004768	4109006007
PMA-L3-7/4	7	4	6200	5208	4109004769	4109006008
PMA-XL1-7/4	7	4	8520	7158	4109005095	–
PMA-XL2-7/4	7	4	8520	7158	-	4109005096
PMA-S1-10/7	10	7	414	348	4109004770	4109006009
PMA-S2-10/7	10	7	759	638	4109004771	4109006010
PMA-S3-10/7	10	7	1186	996	4109004772	4109006011
PMA-S4-10/7	10	7	1587	1333	4109004773	4109006012
PMA-M1-10/7	10	7	2277	1913	4109004774	4109006013
PMA-M2-10/7	10	7	2760	2318	4109004775	4109006014
PMA-M3-10/7	10	7	3174	2666	4109004776	4109006015
PMA-L1-10/7	10	7	4554	3825	4109004777	4109006016
PMA-L2-10/7	10	7	5520	4637	4109004778	4109006017
PMA-L3-10/7	10	7	8556	7187	4109004779	4109006018
PMA-XL1-10/7	10	7	11040	9276	4109005107	–
PMA-XL2-10/7	10	7	11040	9276	-	4109005108
PMA-S1-13/10	13	10	525	441	4109004780	4109006019
PMA-S2-13/10	13	10	963	809	4109004781	4109006020
PMA-S3-13/10	13	10	1503	1263	4109004782	4109006021
PMA-S4-13/10	13	10	2013	1691	4109004783	4109006022
PMA-M1-13/10	13	10	2888	2426	4109004784	4109006023
PMA-M2-13/10	13	10	3500	2940	4109004785	4109006024
PMA-M3-13/10	13	10	4025	3381	4109004786	4109006025

Model Description	Maximum Inlet Pressure (Bar)	Minimum Outlet Pressure (Bar)	Maximum Inlet Flow (l/min)	Maximum Outlet Flow (l/min)	Part Number Without Hopcalite	Part Number With Hopcalite
PMA-L1-13/10	13	10	5775	4851	4109004787	4109006026
PMA-L2-13/10	13	10	7000	5880	4109004788	4109006027
PMA-L3-13/10	13	10	10850	9114	4109004789	4109006028
PMA-XL1-13/10	13	10	13980	11742	4109005119	-
PMA-XL2-13/10	13	10	13980	11742	-	4109005120

* PMA-XL1 is equipped with QD+ filter, which does not have hopcalite catalysator. PMA-XL2 is equipped with QDT+ filter, which has hopcalite catalysator.
* The standard inlet temperature condition of PMA is 35°C. If the actual inlet temperature is higher than 35°C, correction factor should be considered.
* The maximum outlet flow is calculated based on 16% purge loss.

Inlet Temperature (°C)	25	30	35	40	45	50
Correction Factor	1	1	1	0.97	0.88	0.73

Combined Air Plant Sizing Guide

In HTM02-01, the relative size of receiver capacity and compressor capacity on surgical air or combined medical/surgical air systems changes according to the design flow rate. In order to correctly calculate the receiver capacity and compressor capacity, both the medical and surgical design flow-rates (DF's) are required. It should be noted that for all combined air systems, an additional duplex regulating station (ordered separately) is needed to supply the medical air pipeline.

Surgical Air Compressors	
Design Flow (l/min)	Value 'A' FAD (l)
<500	0.33 x DF
500-3500	0.66 x DF
>3500	0.5 x DF

Table 1: Surgical Air Plant Flow Rate Multiplier Value 'A'

Steps on ordering Air Plant:

1. Determine total flow (l/min) required from dryer outlet and at what pressure (bar)
2. Select dryer model at what outlet pressure (bar)
3. Select compressor model at what outlet pressure (bar)
4. Select vessel(s) size with proper pressure relief valve

Example 1 - Small Day Treatment Centre (Upgrade)

Flow Rate and Dryer Sizing

Medical Air DF = 555 l/min (FAD) (4 Bar)
Surgical Air DF = 1138 l/min (FAD) (7 Bar)
Combined/total DF = 1693 l/min (FAD)
(7 Bar high pressure system)

A dryer greater than 1693 l/min outlet flow should be selected (outlet flow is the inlet flow minus purge losses)

= PMA-M1-10/7 inlet flow 2277 l/min, outlet flow 1913 l/min

Flow Rate and Compressor Sizing

From **Table 1,** surgical air DF is between 500-3500 l/min, so the multiplying factor 'A' = 0.66

Compressor flow rate = Med. DF + (Surg. DF x A)
= 555 + (1138 x 0.66)
= 555 + 751
= 1306 l/min

We also need to add the purge losses to the compressor output. For additional purge consumption use

PMA inlet - PMA outlet = purge losses l/min
= 2277 - 1913 = 364 l/min

Compressors should be selected with a flow rate greater than
1306 l/min + 364 l/min = 1670 l/min

Example: G15-MED at 2166 l/min (10 bar output), or
GA15 VSD+ MED at 2130 l/min (10 bar output)

Receiver Sizing

Surgical Air Compressors	
Design Flow (l/min)	Value 'B' Receiver water capacity (l)
<500	1 x 200% x DF
500-2000	2 x 66.6% x DF
2001-3500	2 x 50% x DF
>3500	3 x 33.3% x DF

Table 2: Surgical Air Receiver Multiplier Value 'B'

From **Table 2,** surgical air DF is between 500-2000 l/min, so the multiplying factor 'B' = 2 x 66.6%

Capacity = (Med. DF x 0.5) + (Surg. DF x B)
= (555 x 0.5) + (1138 x 2 x 0.66)
= 278 + 1502
= 1780 litres

A combination of receivers with a minimum number of 2 should be selected.
Selected receiver capacity = 2000 litres (2 x 1000 litre)

Plant System Selection

Selected plant capacity should be above calculated sizing value.
If no standard model is available for selection from the standard range a bespoke configuration of dryer, compressors and receivers are available and can be quoted by our sales and sales support teams.

Plant Ordering Example #1

HTM02-01 Combined Air Plant capable for 1693 l/min, to serve 4 bar for patient and 7 bar for surgical tools, with fixed speed oil-lubricated screw compressors.

Note: Duplex reducing sets are required when dual pipeline systems are supplied by one medical air plant system.

Plant selection:

cAIR-TGF-M1-7-HTM 02-01 50 Hz
(1802 l/min at 7 bar dryer output)

Item	Description	Part No.	Qty
Compressor	G15 MED 10 bar	4109000107	3
Purifier	PMA-M1-10/7	4109004774	1
Receiver	1000L 11 Bar	4109500508	2
Receiver kit	1000L 11 bar kit	4109400409	2

Example 2 - Large District Hospital

Flow Rate and Dryer Sizing

Medical Air DF = 3920 l/min (FAD) (4 Bar)
Surgical Air DF = 1138 l/min (FAD) (10 Bar)
Combined/total DF = 5058 l/min (FAD)*
(10 Bar high pressure system)

*Similar calculations applied as in Example 1

Plant Ordering Example #2

HTM2022 Combined Air Plant capable for 5058 l/min, to serve 4 bar for patient and 10 bar for surgical tools, with variable speed (VSD) oil-lubricated screw compressors.

Note: Duplex reducing sets are required when dual pipeline systems are supplied by one medical air plant system

Plant selection:

cAIR-DGV-L2-10-HTM 2022 50 Hz
(5780 l/min at 10 bar dryer output)

Item	Description	Part No.	Qty
Compressor	GA45 VSD+ -MED 13 bar	4109004860	2
Purifier	PMA-L2-13/10	4109004788	1
Receiver	3000L 14 bar	4109500529	1
Receiver kit	3000L 14 bar kit	4109400435	1

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