

**Medical Air Supply System with TMA7 and TMA11
EN ISO 7396-1/HTM 02-01 and HTM2022 EurPh
400V 50Hz, 4 Bar, 7 Bar & 10 Bar Outlet**

SPECIFICATION

Air System



Intended use of Medical Air Supply System TMA7 and TMA11

Medical Air Supply System TMA7 and TMA11 is a duplex Medical Air Supply System with 100% redundancy within a single package. It is designed to provide pharmacopoeical quality medical air to healthcare establishments. The TMA7 and TMA11 can be used for medical, surgical, or combined medical and surgical air supply.

The unit is equipped with the HTM mandated features as per table (reference on page no. 3) and can be used in EN ISO 7396-1, HTM02-01, HTM2022, NFPA99 (instrument air) compliant medical gas pipeline systems.



The Distinctive features of the Medical Air Supply System TMA7 and TMA11:

Features	Customer benefit
Duplex systems with built-in dryers, filters, and compressors controls and instrumentation combined in a single container	Compact, quick and easy to install with 100% redundancy.
Every control between the compressors and the dryers is hooked and connected.	Fast installation and commissioning, less time wasted on site for the system control setup
The system is tested at factory as a complete medical device	Assurance of the performance as a complete system with factory test
EU Medical Device certificate for the complete unit	Factory guaranteed conformance with complete test certificate.
Set of features mandated by NHS HTM code	Continuity and quality of supply with compliancy to HTM code
Configurable with VSD compressors as primary source	Energy saving and longer lifetime at lower initial investment cost
Compact design	Less space in the plant room. Easier to upgrade between HTM2022 and HTM02-01..
Full feature design: all necessary safety, regulations and control elements included and connected	Less time to assemble and commission, less brazing points, no room for connections mistake

Medical Air Supply System TMA unit specification²

Features	TMA11-13/10	TMA11-10/7	TMA7-13/10	TMA7-10/4
Nominal System Output Pressure ³ (bar)	10	7	10	4
Nominal Free Air delivery ² (l/min)	1200	1458	786	1014
Nominal power ¹ (kW)	11	11	7.5	7.5
Dew point (°C)	-46			
Air quality	Meets European Pharmacopeia			
Amount of cooling air (each unit) (m ³ /s)	0.5			
Dryers	Duplex desiccant dryer with purge saver			
Purge	15% (maximum, purge saver deactivated)			
Compressors	Duplex oil injected compressors			
Controllers	Mk5s Touch Central controller, 2 (two) MK5 graphic compressor controllers, 2 (two) independent dryers controllers			
Pressure regulators	Duplex integrated pressure regulators			
Connectivity	MyMedGas enabled			
Outlet connection	1 x G3/4 with 22 mm copper stub extension			
Interconnections for the receivers	2 x G3/4 with 22 mm copper stub extension			
Voltage/Frequency	400V±10%/50Hz; two 3PH leads for compressors, one single phase lead for main cubicle			
Dimensions L x W x H (mm)	1846 x 909 x 1388			
Weight (kg)	670			
Medical device Certification	MDR Class IIa (in progress)			

¹ Each unit of duplex

² The unit specification reference conditions for the system design flow refer to the system configuration table below.

³ Rated at the outlet, after the integrated regulators

Sources of Supply
HTM02-01/EN ISO 7396-1

Triplex compressor configurations will produce the primary supply with two compressors of TMA7 and TMA11 on standby. Each compressor will be capable of supplying the specified volumetric flow for duplex and triplex systems, and half flow for quadruplex. For duplex systems, the reserve supply shall be from an Automatic Manifold capable of supplying at average demand for 4 hours. For triplex and quadruplex systems, the standby compressors will form the secondary supply.

HTM2022 EurPh

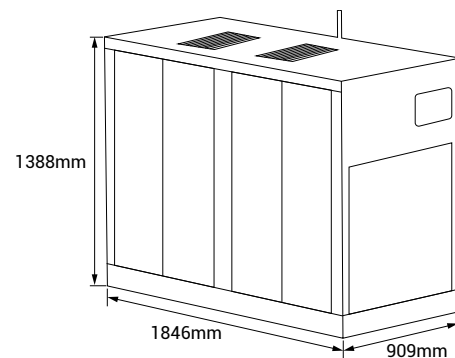
Duplex compressors of TMA7 / TMA11 configurations will produce the primary supply with one compressor on standby. A reserve supply shall be from an Automatic Manifold capable of supplying at average demand for 4 hours.

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 system fault, system 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 controller shall be equipped with a remote monitoring function.

Air Compressors

The air system should incorporate duplex oil-injected rotary screw compressors suitable for both continuous and frequent start/stop operation at a nominal outlet pressure of 1000 kPa (10 bar) or 1300 kPa (13 bar) gauge.


Additional Variable Speed Compressors

In case a third compressor in a triplex system is provided, it will be an Atlas Copco GA VSD+ MED single-stage oil injected rotary screw compressor fitted with Variable Speed Drive. By including an AC-DC converter, along with associated control hardware and software, it will enable the compressor to continuously match its running speed with the flow demand required by the hospital. By using such technology, starting currents will be reduced, machine life will be prolonged and energy savings of up to 50% can be achievable.

The compressor shall be fitted with an oil-cooled permanent magnet synchronous motor of minimum IE4 efficiency class and IP66 pressure-tight ingress protection. The motor bearings shall be oil-cooled and maintenance free. The noise level of the compressor should be maximum 62dB(A).

The compressor will have the HTM mandated features as per table (reference on page no. 3).

The TMA Medical Air Supply System are equipped with following HTM mandated features:

HTM code specific features	Function
Aftercooler temperature sensors	To identify the cooling system failure (for example fan failure) and to prevent hot air going to the dryer, which can cause dryer damage
Separate power lead for central controller	Independent controller electrical supply allows to disconnect any of the compressor lead from the main board keeping the system control operational
Separate power leads for each compressor	Allows to set up the electrical supply redundancy
Ampere meters outside the unit	Allow to monitor the power supply status and the current easily
Failed-to-go-on-load switch	Allows central controller to verify that compressor responded to the controller command and is producing the compressed air
Main power switches on the units	Allows disconnecting each compressor and safely perform service intervention on one compressor while another compressor is running
Automatic restart after power failure	Resumes medical air supply automatically after power failure or after switching from main to the emergency power supply
Emergency forced local mode	Allows to manual override the automatic unit control and to get the system running in emergency mode
Separated compressors cubicles	Allows to perform service intervention on one compressor while another unit is running
Dew point sensor	Allows to achieve the required dewpoint with purge saver function
Automatic dryer switchover	Allows automatic dryer switch periodically, to keep continuous operation and to switch dryer from one to another in case of failure
Back up pressure switch	Automatically overrides control system and activate both primary and secondary supply in case air supply pressure drops below limit

Dryer/Filter/Regulator System

The duplexed filter and dryer module shall incorporate high efficiency water separators, oil coalescing general purpose & high efficiency filters, heatless regenerative desiccant dryers, activated carbon filters with Hopcalite catalyst (optional) and bacterial filters. The performance of the filters shall be according to the specification below:

- Oil coalescing general purpose filter: mass efficiency of 99,3%, tested according to ISO 8573-2 & ISO 12500-1;
- Oil coalescing high efficiency filter: mass efficiency of 99,92%, 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 99,98% at MPPS=0.06µm, 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 following table:

Contaminant	Threshold
H ₂ O	67 ppm v/v
Dry particulates	Free from visible particulates in a 75 litre sample
Oil (droplet or mist)	0.1 mg/m ³
CO	5 ppm v/v
CO ₂	500 ppm v/v
SO ₂	1 ppm v/v
NO	2 ppm v/v
NO ₂	2 ppm v/v

Dryer Purge Control

The dryer control system shall incorporate Purge Saver Energy Management system that freezes the regeneration of the desiccant once an 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.

Receiver Assembly

The air receiver shall be supplied with relevant test certificates. Each air receiver shall be fitted with a zero-loss electronic drain valve. The receiver assembly shall be fitted with a pressure safety valve, set at 10% receiver overpressure. The receiver shall further include a pressure gauge. The receivers shall be installed separately and sized according to the design guidelines.

OSC Oil water separator


If the oil in the 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 the outlet. In addition, the OSC offers zero-hassle maintenance thanks to its easily removable filter bags and cartridges.

Medical Air Supply System configured with TMA7 and TMA11 units according to HTM2022


Duplex compressors of TMA7 / TMA11 configurations will produce the primary supply with one compressor on standby. A reserve supply shall be from an Automatic Manifold capable of supplying at average demand for 4 hours. One integrated dryer will be used as the primary supply, and another will be kept on stand-by. The control system will rotate the primary and secondary compressor and dryer.

HTM2022 Duplex Medical/Surgical Air systems with TMA7

Parameter	Surgical Air	Surgical Air	Medical Air	Combined	Combined
Supply pressure (bar)	10	7	4	7	10
System Configuration	TMA7-13/10 1 x 1000L vessel 1 x 1000L vessel kit ¹	TMA7-10/7 1 x 1000L vessel 1 x 1000L vessel kit ¹	TMA7-10/4 1 x 1000L vessel 1 x 1000L vessel kit ¹	TMA7-10/7 bar 1 x 1000L vessel 1 x 1000L vessel kit ¹	TMA7-13/10 bar 1 x 1000L vessel 1 x 1000L vessel kit ¹
System design flow for Surgical Air (l/min)	660	860	-	Any split between Surgical and Medical Air with total 860 l/min	Any split between Surgical and Medical Air with total 660 l/min
System design flow for Medical Air (l/min)	-	-	860		
Total System design flow (l/min)	660	860	860	860	660

HTM2022 Duplex Medical/Surgical Air systems with TMA11

Parameter	Surgical Air	Surgical Air	Medical Air	Combined	Combined
Supply pressure (bar)	10	7	4	7	10
System Configuration	TMA11-13/10 1 x 1000L vessel 1 x 1000L vessel kit ¹	TMA11-10/7 1 x 1500L vessel 1 x 1500L vessel kit ¹	TMA11-10/4 1 x 1500L vessel 1 x 1500L vessel kit ¹	TMA11-10/7 1 x 1500L vessel 1 x 1500L vessel kit ¹	TMA11-13/10 1 x 1000L vessel 1 x 1000L vessel kit ¹
System design flow for Surgical Air (l/min)	1000	1240	-	Any split between Surgical and Medical Air with total 1240 l/min	Any split between Surgical and Medical Air with total 1000 l/min
System design flow for Medical Air (l/min)	-	-	1240		
Total System design flow (l/min)	1000	1240	1240	1240	1000

¹ Accessory vessel kit for medical air receiver is completed with data plate, pressure safety valve, zero-loss electronic drain valve (with isolation and bypass valve), pressure gauge (with isolation valve), copper inlet and outlet connection pipes (each with isolation valve).

Medical Air Supply System configured with TMA7 and TMA11 units according to HTM02-01


Triplex compressor configurations will produce the primary supply with two compressors of TMA7 and TMA11 on standby. Each compressor will be capable of supplying the specified volumetric flow for duplex and triplex systems. For triplex and quadruplex systems, the standby compressors will form the secondary supply. The design flow and receiver size calculation for Combined Air System according to HTM02-01 is different from HTM2022 and depends on the split between Medical (MA) and Surgical (SA). See the guide for sizing below.

HTM02-01/ ISO7396-1 compliant Medical/Surgical Air systems with TMA7

Parameter	Combined Air		Surgical Air		Medical Air
Surgical to medical ratio	50% SA, 50% MA ²	50% SA, 50% MA ²	100% SA	100% SA	100% MA
Supply pressure (bar)	10	7	10	7	4
System Configuration	TMA7-13/10 2 x 500L vessels 2 x vessel kits ¹ 1 x GA7VSD+	TMA7-10/7 2 x 1000L vessels 2 x vessel kits ¹ 1 x GA7VSD+	TMA7-13/10 2 x 500L vessels 2 x vessel kits ¹	TMA7-10/7 2 x 1000L vessels 2 x vessel kits ¹	TMA7-10/4 2 x 1000L vessels 2 x vessel kits ¹ 1 x GA7VSD+
System design flow for Surgical Air (l/min)	393	507	786	1014	-
System design flow for Medical Air (l/min)	393	507	-	-	1014
Total System flow (l/min)	786	1014	786	1014	1014

¹ Accessory vessel kit for medical air receiver is completed with data plate, pressure safety valve, zero-loss electronic drain valve, pressure gauge (with isolation valve), copper inlet and outlet connection pipes (each with isolation valve).

² Split between surgical and medical air for a combined system is chosen from 50% to 50% for reference purposes. To calculate the design flow at different splits please refer to the calculation guide below and the HTM code.

HTM02-01/ ISO7396-1 compliant Medical/Surgical Air supply system with TMA11

Parameter	Combined Air		Surgical Air		Medical Air
Surgical to medical ratio	50% SA, 50% MA ²	50% SA, 50% MA ²	100% SA	100% SA	100% MA
Supply pressure (bar)	10	7	10	7	4
System Configuration	TMA11-13/10 2 x 1000L vessels 2 x vessel kits ¹ 1 x GA11VSD+	TMA11-10/7 2 x 1000L vessels 2 x vessel kits ¹ 1 x GA11VSD+	TMA11-13/10 2 x 1000L vessels 2 x vessel kits ¹	TMA11-10/7 2 x 1000L vessels 2 x vessel kits ¹	TMA11-10/4 2 x 1000L vessels 2 x vessel kits ¹ 1 x GA11VSD+
System design flow for Surgical Air (l/min)	600	729	1200	1458	-
System design flow for Medical Air (l/min)	600	729	-	-	1458
Total System flow (l/min)	1200	1458	1200	1458	1458

¹ Accessory vessel kit for medical air receiver is completed with data plate, pressure safety valve, zero-loss electronic drain valve, pressure gauge (with isolation valve), copper inlet and outlet connection pipes (each with isolation valve).

² Split between surgical and medical air for a combined system is chosen from 50% to 50% for reference purposes. To calculate the design flow at different splits please refer to the calculation guide below and the HTM code.

Receiver Selection Table
Steel, Powder Coated ML Approval

Receiver Capacity (litres)	300	500	1000	1500	2000	3000
Maximum working pressure (bar)	11	11	11	11	11	11
Individual Receiver Dimensions (diameter, height, mm)	500/1750	590/1982	800/2480	900/2872	1000/3075	1200/3548
Receiver Weight (kg)	155	178	380	600	800	1000
Receiver pipe size (mm)	28	28	42	42	42	42
Receiver Part Number	4109500506	4109500507	4109500508	4109500531	4109500509	4109500528
Receiver Accessory Kit *	4109400407	4109400408	4109400409	4109400436	4109400410	4109400434

Receiver Capacity (litres)	300	500	1000	1500	2000	3000
Maximum working pressure (bar)	14	14	14	14	14	14
Individual Receiver Dimensions (diameter, height, mm)	500/1750	590/1982	800/2480	900/2872	1000/3075	1200/3548
Receiver Weight (kg)	155	178	380	600	800	1000
Receiver pipe size (mm)	28	28	42	42	42	42
Receiver Part Number	4109500526	4109500527	4109500524	4109500532	4109500525	4109500529
Receiver Accessory Kit *	4109400430	4109400431	4109400432	4109400437	4109400433	4109400435

*Accessory kit for medical air receiver complete with data plate, pressure safety valve, zero-loss electronic drain valve (with isolation and bypass valve), pressure gauge (with isolation valve), copper inlet and outlet connection pipes (each with isolation valve).

Compressor Selection Table (used as a primary source in the triplex systems)

Model Name	GA7 VSD+	GA11 VSD+
Free Air delivery at 10 bar (min-max) (lpm)	408-1080	420-1632
Free Air delivery at 13 bar (min-max) (lpm)	438-852	456-1410
Nominal motor power (kW)	2.9-7.9	2.9-12.1
Dimensions (W x L x H) (mm)	630 x 610 x 1420	630 x 610 x 1420
Compressor weight (kg)	208	211
Noise level (dBA)	62	62
Outlet connections (mm)	28	28
Voltage (v)	380-400	380-400
Full load current (A)	18.4	24.4
Approx. starting current (A)	Not exceeding full load current	
Cooling air (m ³ /s)	0.8	0.8

Taxonomy

TMA	11	-	10	/	7	ASME	HTM	400	50
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Nomenclature	Description
TMA	Model name
11	Unit size (motor power, kW, single unit)
10	Internal compressor pressure (bar)
7	Nominal air system output pressure (bar)
ASME	Pressure equipment certification (ASME, MOM, ML)
HTM	Medical regulation (HTM, ISO, NMPA)
400	Nominal Voltage (V)
50	Frequency (Hz)

Part Numbers

Equipment	Product Number
HTM compliant equipment with ASME certification	
TMA7-10/4 ASME HTM 400 50	4109003852
TMA7-10/7 ASME HTM 400 50	4109003863
TMA7-13/10 ASME HTM 400 50	4109003864
TMA11-10/4 ASME HTM 400 50	4109003853
TMA11-10/7 ASME HTM 400 50	4109003866
TMA11-13/10 ASME HTM 400 50	4109003867
ISO compliant equipment with ML certification	
TMA7-10/4 ISO ML 400 50	4109003856
TMA7-10/7 ISO ML 400 50	4109003857
TMA7-13/10 ISO ML 400 50	4109003858
TMA11-10/4 ISO ML 400 50	4109003859
TMA11-10/7 ISO ML 400 50	4109003860
TMA11-13/10 ISO ML 400 50	4109003861
ISO compliant equipment with MOM certification (applicable for Malaysia)	
TMA7-10/4 ISO MOM 400 50	4109003868
TMA7-10/7 ISO MOM 400 50	4109003869
TMA7-13/10 ISO MOM 400 50	4109003870
TMA11-10/4 ISO MOM 400 50	4109003871
TMA11-10/7 ISO MOM 400 50	4109003872
TMA11-13/10 ISO MOM 400 50	4109003873

Part Numbers

Equipment	Product Number
Standalone compressors in triplex system with ML certification	
GA7 VSD+ P ML 400V 50 ISO MED	4109004012
GA11 VSD+ P ML 400V 50 ISO MED	4109004014
GA7 VSD+ P ML 400V 50 HTM MED	4109004851
GA11 VSD+ P ML 400V 50 HTM MED	4109004852
Standalone compressors in triplex system with AS certification	
GA7 VSD+ P AS 400V 50 ISO MED	4109004006
GA11 VSD+ P AS 400V 50 ISO MED	4109004008
GA7 VSD+ P AS 400V 50 HTM MED	4109004940
GA11 VSD+ P AS 400V 50 HTM MED	4109004941
Optional equipment	
CO sensor	0000066915
CO + CO2 sensor	0000066947
CO + CO2 + O2 sensor	0000066874
Hopcalite	0000066946

Condensate Management Options

Description	Type	Part number
Oil Water Separator, 900 l/min	Activated carbon	8102046581
	Organo clay ¹	8102046607
Oil Water Separator, 1860 l/min	Activated carbon	8102046623
	Organo clay ¹	8102046649
Oil Water Separator, 3780 l/min	Activated carbon	8102046664
	Organo clay ¹	8102046730
Oil Water Separator, 6360 l/min	Activated carbon	8102046672
	Organo clay ¹	8102046748
Oil Water Separator, 12780 l/min	Activated carbon	8102046680
	Organo clay ¹	8102046755
Oil Water Separator, 22500 l/min	Activated carbon	8102046698
	Organo clay ¹	8102046763

¹Stronger emulsions: RS Xtend, RS foodgrade, Oil mixtures

Combined Air System 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 flowrates (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 System Flow Rate Multiplier Value 'A'

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)
(10 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)
= dMED25 inlet flow 2025 l/min, outlet flow 1746 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:-

dMED inlet - dMED outlet = purge losses lpm
= 2025 - 1746 = 279 l/min

Compressors should be selected with a flow rate greater than
1306 l/min + 279 l/min = 1585 l/min

Receiver Sizing

From Table 2 surgical air DF is between 500-2000 l/min, so the multiplying factor 'B' = 2 x 2/3

Capacity = (Med. DF x 0.5) + (Surg. DF x B)
= (555 x 0.5) + (1138 x 2 x 2/3)
= 278 + 1518
= 1796 liters

A combination of receivers with a minimum number of 2 should be selected

Selected receiver capacity = 2000 liters (2 x 1000 litre)

System Selection

Selected system part number = cAIR.1746.TGF10

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.

Surgical Air Receivers	
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'.

Example 2 - Large District Hospital

Flow Rate and Dryer Sizing

Medical Air DF = 4920 l/min (FAD) (4 Bar)
Surgical Air DF = 2888 l/min (FAD) (11 Bar)
Combined/total DF = 7808 l/min (FAD) (10 Bar high pressure system)

A dryer greater than 7808 l/min should be selected (outlet flow is the inlet flow minus purge losses)
= dMED145 inlet flow 11745 l/min, outlet flow 10124 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

System flow rate = Med. DF + (Surg. DF x Value 'A')
= 4920 + (2888 x 0.66)
= 4920 + 1907
= 6827 l/min

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

dMED inlet - dMED outlet = purge losses lpm
= 11745 - 10124 = 1621 l/min

Compressors should be selected with a flow rate greater than
6827 l/min + 1621 l/min = 8448 l/min

Receiver Sizing

From Table 2 surgical air DF is between 2001-3500 l/min, so the multiplying factor 'B' = 2 x 1/2

Capacity = (Med. DF x 0.5) + (Surg. DF x B)
= (4920 x 0.5) + (2888 x 2 x 1/2)
= 2460 + 2888
= 5348 liters

A combination of receivers with a minimum number of 2 should be selected

Selected receiver capacity = 6000 liters (3 x 2000 litre)

System Selection

Selected system part number = n/a - special configuration required

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.

