# PNEUDRI

Compressed Air Dryers

ENGINEERING YOUR SUCCESS.

# PNEUDRI

## High efficiency compressed air drying

The PNEUDRI range of heatless and heat regenerative dryers has proven to be the ideal solution for many thousands of compressed air users worldwide and in a wide variety of industries.

PNEUDRI totally cleans and dries compressed air down to -40˚C pressure dewpoint (pdp) as standard.

For critical applications, PNEUDRI can be specified to provide a pressure dewpoint of -70˚C pdp. It is worth noting that a pressure dewpoint of -26°C or better will not only prevent corrosion, but will also inhibit the growth of micro-organisms within the compressed air system.

Compressed air purification equipment must deliver uncompromising performance and reliability whilst providing the right balance of air quality with the lowest cost of operation. Many manufacturers offer products for the filtration and purification of contaminated compressed air, which are often selected only upon their initial purchase cost, with little or no regard for the air quality they provide, the cost of operation throughout their life or indeed their environmental impact. When purchasing purification equipment, delivered air quality, the overall cost of ownership and the equipment's environmental impact must always be considered.

## The Parker domnick hunter Design Philosophy

Parker domnick hunter has been supplying industry with high efficiency filtration and purification products since 1963. Our philosophy 'Designed for Air Quality & Energy Efficiency' ensures products that not only provide the user with clean, high quality compressed air, but also with low lifetime costs and reduced $CO_2$ emissions.


## PNEUDRI Modular Dryers

**PNEUDRI MiDAS**

- **Heatless Regeneration (PSA) Pressure Swing Adsorption**
- **5.1 – 34 $m^3$/hr ( 3 – 20 cfm )**

**PNEUDRI MIDIplus**

- **Heatless Regeneration (PSA) Pressure Swing Adsorption**
- **49 – 299 $m^3$/hr ( 24 – 176 cfm )**

**PNEUDRI MX MAXI**

- **Heatless Regeneration (PSA) Pressure Swing Adsorption**
- **Single Bank 408 – 2040 $m^3$/hr (240 – 1200 cfm )**
- **Multi Bank >2041 $m^3$/hr ( >1201cfm )**

**PNEUDRI DH MAXI**

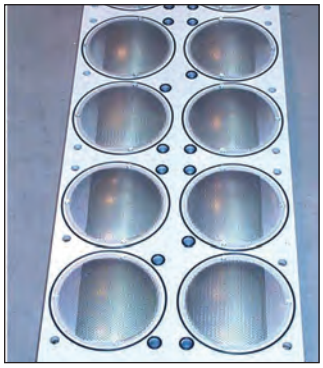
- **Heat Regenerative (TSA) Thermal Swing Adsorption**
- **Single Bank 238 – 1189 $m^3$/hr ( 140 – 700 cfm )**
- **Multi Bank > 1190 $m^3$/hr ( > 701 cfm )**


bar
psi
WIKA
ECO
OK
C
R

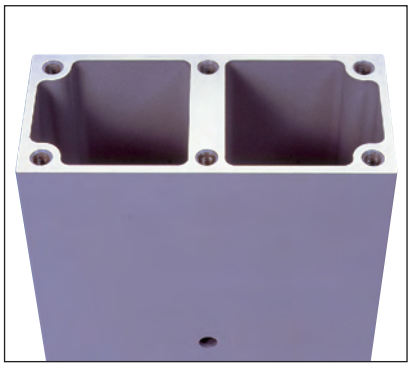
# The PNEUDRI modular design

The PNEUDRI design replaces large, heavy, steel pressure vessels with smaller, more compact and lightweight aluminium extrusions

- **Distribution manifolds and drying columns are all constructed from lightweight, high tensile extruded aluminium**
- **The shape of the extrusion varies on each model range**
- **All extrusions are below 150 mm (6”) in diameter, which is under the pressure vessel inspection requirements of ASME**
- **World-wide design approvals include PED, CRN, CE**
- **Fully corrosion protected**



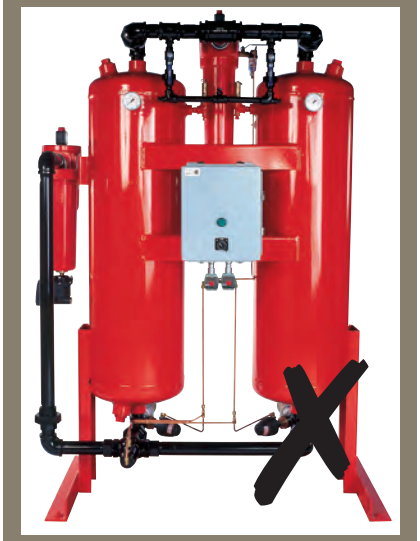
Distribution Manifold



Drying Column

## Unique extruded aluminium construction

Unlike their welded, carbon steel counterparts, the unique extruded aluminium construction of PNEUDRI eliminates these models from the costly annual pressure vessel inspection. PNEUDRI models are also typically half the size and weight of traditional twin tower dryers.



## Traditional Adsorption Dryers

- **Typically, adsorption dryers are constructed from carbon or stainless steel**
- **They consist of two large, heavy pressure vessels which contain the adsorbent material**
- **Separate, interconnecting piping is used for valving, etc.**
- **This method of construction has a direct impact on the performance of the dryer and the air quality it provides**

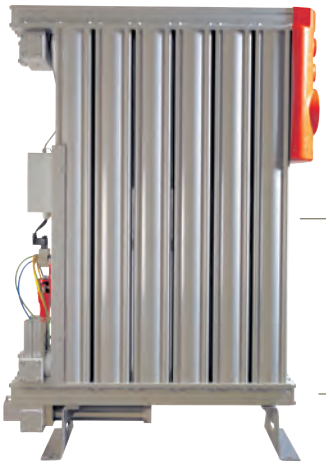
# Advanced modular drying system

## PNEUDRI MiDAS and MIDIplus models

- **PNEUDRI MiDAS & MIDIplus models use only single extrusions, with a pressure die-cast inlet and outlet assembly**
- **Compressed air capacity within these ranges is increased by varying the length of the drying columns**
- **The greater the flow required, the longer the drying column**


## PNEUDRI MAXI models

- **MAXI models use multiple drying columns of equal length to provide required compressed air capacity**
- **The greater the flow required, the more drying columns are used (up to the maximum length of the manifold)**



Upper distribution manifold

Drying columns

Lower distribution manifold

### Multi-banking

Unlike the loose filled adsorbent bed of traditional twin tower dryer designs, PNEUDRI with it's snowstorm filled adsorbent beds provides an equal resistance to air flow. Therefore, when the system flow of an installation exceeds the capacity of the largest single dryer model, PNEUDRI can be multi- banked to meet the demand. Should demand increase in the future, there is no need to replace the dryer with a larger unit, additional capacity can be covered by simply adding an extra bank or banks, a feature only possible with PNEUDRI.

### Flexibility during maintenance

Multi-banking of dryers enables individual banks to be easily isolated for routine maintenance work. This means minimal interruption to your clean, dry air supply.

### 100% stand-by

Compared to traditional twin tower designs, 100% standby is available at a fraction of the cost as only one extra dryer bank is required.

### Fits through a standard doorway

Unlike traditional twin tower designs, PNEUDRI dryers will fit through a standard doorway, eliminating the need for special access or facility structural dismantling during installation.

# Air quality

Adsorption dryers remove water vapour by passing air over a regenerative adsorbent material known as desiccant, which strips the moisture from the air. All adsorption dryers remove water vapour using this method, however the adsorbent must be periodically regenerated to ensure a continuous supply of dry air. A number of different regeneration methods are available.

**Pressure Dewpoint (Pdp)**

Pressure dewpoint is the term used to describe the temperature at which condensation will occur and the water removal efficiency of a dryer is expressed as a pressure dewpoint (written as a temperature). Adsorption dryers are extremely efficient and typically provide pressure dewpoint's of -40°C or -70°C. This means for water vapour to condense into a liquid, the air temperature would need to drop below -40°C or -70°C respectively.

Typically, a pressure dewpoint of -40°C is used in most applications as compressed air with a dewpoint below -26°C will not only prevent corrosion, it will also inhibit the growth of micro-organisms within the compressed air system.

# PNEUDRI utilises four key features to guarantee the required pressure dewpoint.


PNEUDRI MiDAS Dryer

## OIL-X EVOLUTION pre & after filtration

Adsorption dryers are designed only for the removal of water vapour, and not liquid water, water aerosols, oil, particulates or micro-organisms. Only by using Parker domnick hunter OIL-X EVOLUTION pre and after filtration can the removal of these contaminants be guaranteed and air quality in accordance with ISO 8573-1 : 2001 be delivered.

## Adsorbent desiccant material

Selected for optimum dewpoint performance, dryers delivering a -40°C pressure dewpoint utilise a split bed of activated alumina and molecular sieve. For critical applications, dryers delivering a -70°C pressure dewpoint are filled with a special blend of silica gel and molecular sieve.

### All desiccant materials are specially selected to provide:

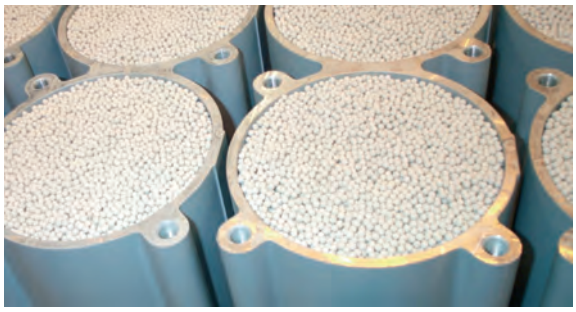
- **Optimum adsorption and regeneration capacity - to ensure consistent dewpoint**
- **Low dusting - to prevent blockage of downstream filtration**
- **High crush strength - to prevent breakdown of the desiccant during operation**
- **High resistance to aggressive and oil-free condensate - for compatibility with all types of air compressor, their lubricants and condensate**

PNEUDRI MX Dryers

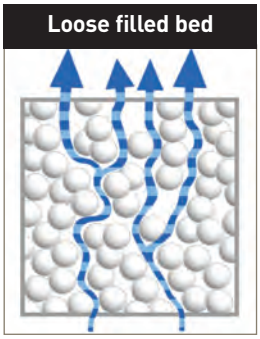
## Modular aluminium design

The award winning PNEUDRI design first introduced by Parker domnick hunter in 1985, replaces the traditional, large, heavy carbon steel twin tower adsorption dryer and it's complex valving and interconnecting piping, with a smaller, more compact and lightweight design.

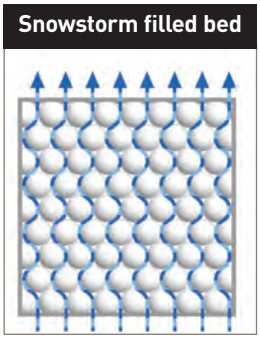
Aluminium extrusions are used throughout for drying chambers and distribution manifolds. This design allows the desiccant material to be retained within the drying chambers and when used in conjunction with the unique snowstorm filling technique, prevents movement of the desiccant material during operation and all but eliminates desiccant attrition and breakdown which leads to loss of pressure dewpoint.



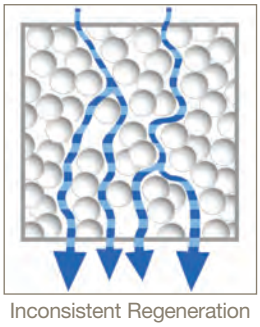
Maximum Packing Density



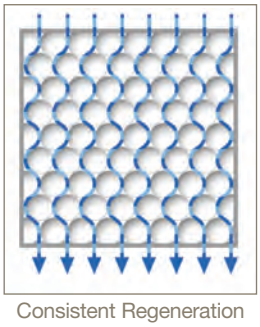

Inconsistent drying and desiccant attrition




Consistent drying with no desiccant attrition



Inconsistent Regeneration



Consistent Regeneration

## Adsorbent fill method - snowstorm filling

Unique to Parker domnick hunter modular dryers is the snowstorm filling technique used to charge the drying chambers with adsorbent desiccant material. The benefits of the snowstorm filling technique include:

- **Achieves maximum packing density for the desiccant material, fully utilising all of the available space envelope**
- **Prevents channelling of air through the desiccant as seen on traditional twin tower designs. Due to channelling, twin tower designs require more desiccant to achieve an identical dewpoint, increasing physical size, operational and maintenance costs**
- **Prevents desiccant attrition which can lead to dusting, blocked filters and loss of dewpoint**
- **Allows 100% of the available desiccant material to be used for drying, therefore reducing the amount of desiccant required and maintenance costs**
- **100% of the desiccant is regenerated ensuring consistent dewpoint**
- **Provides a low, equal resistance to air flow allowing multiple drying chambers and multiple dryer banks to be used, a feature only available with PNEUDRI**
- **Ensures continuous dewpoint performance**

# PNEUDRI Operation

## Drying of Compressed Air

Adsorption dryers work on the principle of moisture always migrating to the driest medium possible. Therefore, water vapour is removed from compressed air by passing it over an adsorbent desiccant material.

As the air contacts the adsorbent material, water vapour transfers from the wet air to the dry desiccant, however, adsorbent materials have a fixed adsorption capacity and once this capacity is reached, they must be regenerated or replaced.

Therefore, to provide a continuous supply of clean, dry compressed air, adsorbent dryers utilise two chambers of desiccant material and at any one time, whilst one chamber is on-line, drying the incoming compressed air, the other is either off-line, being regenerated or is re-pressurised, ready to come on-line. All adsorption dryers remove water in this manner.

The energy consumed by an adsorption dryer can be directly attributed to the method used to regenerate the adsorbent material. Parker domnick hunter PNEUDRI dryers utilise either the Heatless PSA or the Heat Regenerative TSA method to regenerate the adsorbent material.

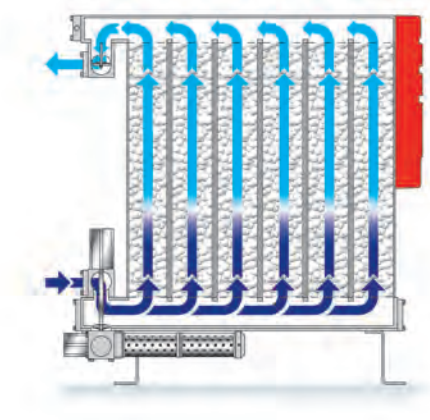
# PNEUDRI Operation - Drying Cycle

The process air enters the dryer through the inlet and is directed into the on-line drying chamber via the inlet valves and lower manifold.

(PNEUDRI models can be made up of either single or multiple drying columns, depending upon the range)

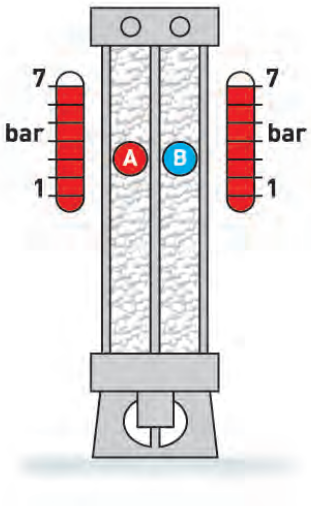
The air is evenly distributed through the drying columns and passes over the desiccant material, reducing the water vapour content.

The dried process air then combines in the upper manifold and exits the dryer via the outlet check valves.




# Column Changeover

Before the on-line (drying) and off-line (regenerating) columns change over, the dryer exhaust valve, is closed, allowing the purge air to re-pressurise the off-line columns. This ensures a consistent system pressure and dewpoint when the drying chambers change over.



# PNEUDRI Operation - Regeneration Cycle
## (Heatless PSA or Pressure Swing Adsorption)

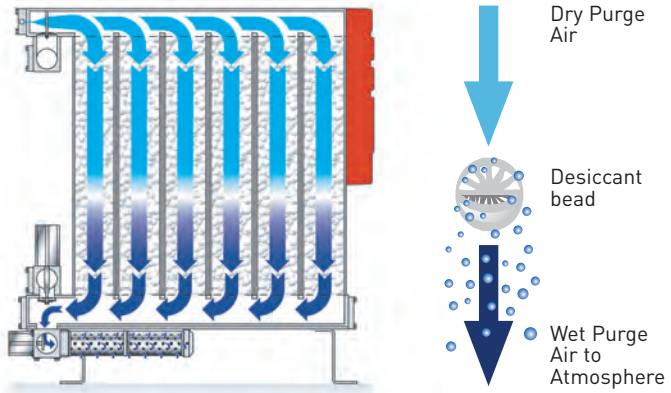
At the start of the regeneration cycle, the exhaust valve of the dryer is closed and the off-line chamber is at full line pressure. The air in the off-line chamber has a dewpoint equal to the air leaving the dryer.

The exhaust valve is then opened and the dry air within the chamber expands rapidly as it leaves the dryer via the exhaust silencer, forcing water to be removed from the desiccant material.

Once the off-line chamber has de-pressurised, a continuous bleed of dried process air is directed into the off-line upper manifold. This air is known as purge air.

With the exhaust valve open, the purge air expands from line pressure to atmospheric pressure and flows downwards through the columns, over the off-line desiccant material.

As the purge air at line pressure contains a fixed amount of water vapour, allowing it to expand means the purge air becomes even drier, increasing its capacity to remove water from the saturated desiccant bed.




| Time (minutes) | Standard Drying / Regeneration Cycle | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 2.5 | 3 | Changeover | 0 | 2.5 | 3 |
| Side A | Regeneration | Re-pressurisation | | | Drying | | |
| Side B | Drying | | | | Regeneration | Re-pressurisation | |

# PNEUDRI Operation - Regeneration Cycle
## (Heat Regenerative TSA or Thermal Swing Adsorption)

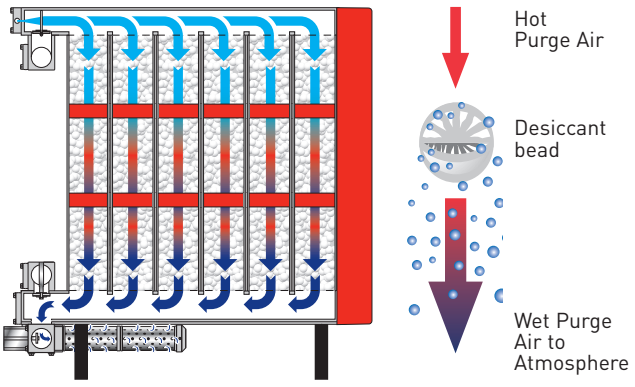
The regeneration cycle of a TSA dryer is similar to that of the PSA dryer described above, however to reduce the amount of purge air required, heat is added to assist the process.

Two heater assemblies are strategically placed in each drying column to heat the purge air, optimising regeneration.

The heaters are switched on after the column has de-pressurised, to again reduce energy consumption.

The combination of dry purge air and heat uses less energy to remove the water from the saturated desiccant bed than is consumed by purge air alone.

After a pre-set time, the heaters are switched off and the off-line bed is allowed to cool before changeover.




| Time (minutes) | Standard Drying / Regeneration Cycle | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | 60 | 74 | 75 | Changeover | 0 | | 60 | 74 | 75 |
| Side A | Depressurisation | Regeneration | | | Repressurisation | | Drying | | | | |
| | | Purge with heaters on | Purge with heaters off | | | | | | | | |
| Side B | Drying | | | | | | Depressurisation | Regeneration | | | Repressurisation |
| | | | | | | | | Purge with heaters on | Purge with heaters off | | |

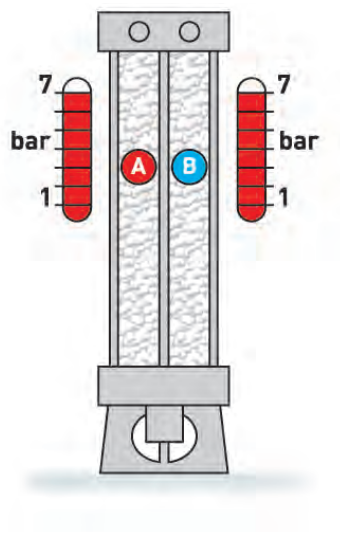
# Saving energy with the dewpoint dependent switching (DDS) energy management system

The energy required to regenerate the off-line desiccant bed in an absorption dryer is constant, and based upon the assumption that the dryer is operating at its full capacity and the desiccant bed requiring regeneration has been fully saturated. In reality, a dryer is rarely operating at full capacity all of the time, for example during shift work and periods of low demand. Daily and seasonal fluctuations in ambient temperature and humidity also change the moisture loading placed upon the dryer.

Under such conditions, at the point in the drying cycle where the air flow is switched from one drying chamber to the other, there is the potential for drying capacity to remain in the desiccant material about to undergo regeneration. As the energy used to regenerate this partially saturated bed is based upon the assumption that the bed is fully saturated, more energy (purge air) is consumed than is actually necessary.

## Dewpoint Dependent Switching (DDS) Energy Management System

With the DDS Energy Management system installed, the drying cycle remains unchanged, however as the drying chambers are about to change, the DDS system overrides normal operation to fully utilise the drying capacity of the on-line desiccant material.




### DDS operation

At column changeover, the exhaust valve is closed to allow the purge air to re-pressurise the off-line column, thus ensuring no loss of system pressure. At this time, both drying chambers are at full line pressure, so that no purge air is being used and the dryer is in a state of zero energy consumption.

Under normal operation, the drying chambers would proceed to change over automatically, however the DDS energy management system incorporates a hygrometer which is used to monitor the pressure dewpoint of the air leaving the dryer. If the air is drier than the pre-set dewpoint, the desiccant material is only partially saturated and has drying capacity remaining within it, therefore change over is delayed.

The hygrometer constantly monitors the outlet dewpoint until the pre-set level has been achieved, at which point, change over will occur.

The drying and regenerating cycle will then continue normally until the end of the next column changeover when the DDS energy management system may again extend the drying period as dictated by the outlet air quality.

## DDS Operation - Energy Saving Cycle (Heatless Dryer example shown)

<table>
<tr><td rowspan="2">Time (minutes)</td><td colspan="9">DDS Drying / Regeneration Cycle</td></tr>
<tr><td>0</td><td>2.5</td><td>3 changeover time dictated by outlet dewpoint</td><td rowspan="3">changeover</td><td>0</td><td>2.5</td><td>3 changeover time dictated by outlet dewpoint</td><td rowspan="3">changeover</td></tr>
<tr><td>Side A</td><td>Regeneration</td><td>Re-pressurisation</td><td>Energy Saving</td><td colspan="3">Drying</td></tr>
<tr><td>Side B</td><td colspan="3">Drying</td><td>Regeneration</td><td>Re-pressurisation</td><td>Energy Saving</td></tr>
</table>

Using DDS will ensure that the energy consumed by PNEUDRI is directly proportional to the actual air flow, temperature and moisture loading, not the dryers rated capacity, thus providing significant energy and environmental savings.

## DDS Energy Saving (Heatless Dryer example shown)

| Air Demand % | Energy Saving % | Energy Saving P/A Kw | Environmental Saving P/A Kg $CO_2$ |
|---|---|---|---|
| 100 | 33.00 | 95,040 | 40,867 |
| 90 | 40.00 | 115,200 | 49,536 |
| 80 | 47.00 | 135,360 | 58,205 |
| 70 | 53.00 | 152,640 | 65,635 |
| 60 | 60.00 | 172,800 | 74,304 |
| 50 | 66.00 | 190,080 | 81,734 |

System pressure 6 bar g. Max Temp 35°C. System flow 1700 m³/hr (1000 cfm). Average pressure 6.5 bar g. Average Temp 30°C.

# Dryer control systems

## PNEUDRI Controllers


| | | DRYER MODEL | | | | |
|---|---|---|---|---|---|---|
| | | MiDAS (DAS) | MIDI (DME) | MAXI (MX) | MAXI (MPX) | MAXI (DH) |
| CONTROLLER | MiDAS | ● | | | | |
| | Smart | | ● | ● | ● | |
| | Smart DDS | | ● | ● | ● | ● |
| | Electronic | | | | ● | ● |
| | Advanced | | | ● | | |
| | Pneumatic | | ● | ● | | |

## PNEUDRI Controller Features

| Controller Options | FUNCTION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Power on Indication | Fault Indication | Display fault condition values | Service interval Indication | Service countdown timers | Configurable alarm settings | Remote Volt Free Alarm Contacts | Filter Service Timer | DDS Energy Mgmt System |
| MiDAS | ● | | | ● | | | | | |
| Smart | ● | ● | | ● | | | ● | | |
| Smart DDS | ● | ● | | ● | | | ● | | ● |
| Electronic | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Advanced | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Pneumatic | | | | | | | | | |

**If you would like more information about these or other ranges of Parker domnick hunter purification products please visit: www.domnickhunter.com, Email: dhindsales@parker.com or contact your local Parker domnick hunter representative.**

Compressed Air Capabilities
17 400 4401

PNEUDRI MiDAS
17 400 4407

PNEUDRI MIDIplus
17 400 4408

OIL-X EVOLUTION Filters
17 400 4402

PNEUDRI MX
17 400 4410

PNEUDRI MPX
17 400 4411

PNEUDRI Heat Regenerative
17 400 4409

MAXIGAS Nitrogen Generators
17 400 4704

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