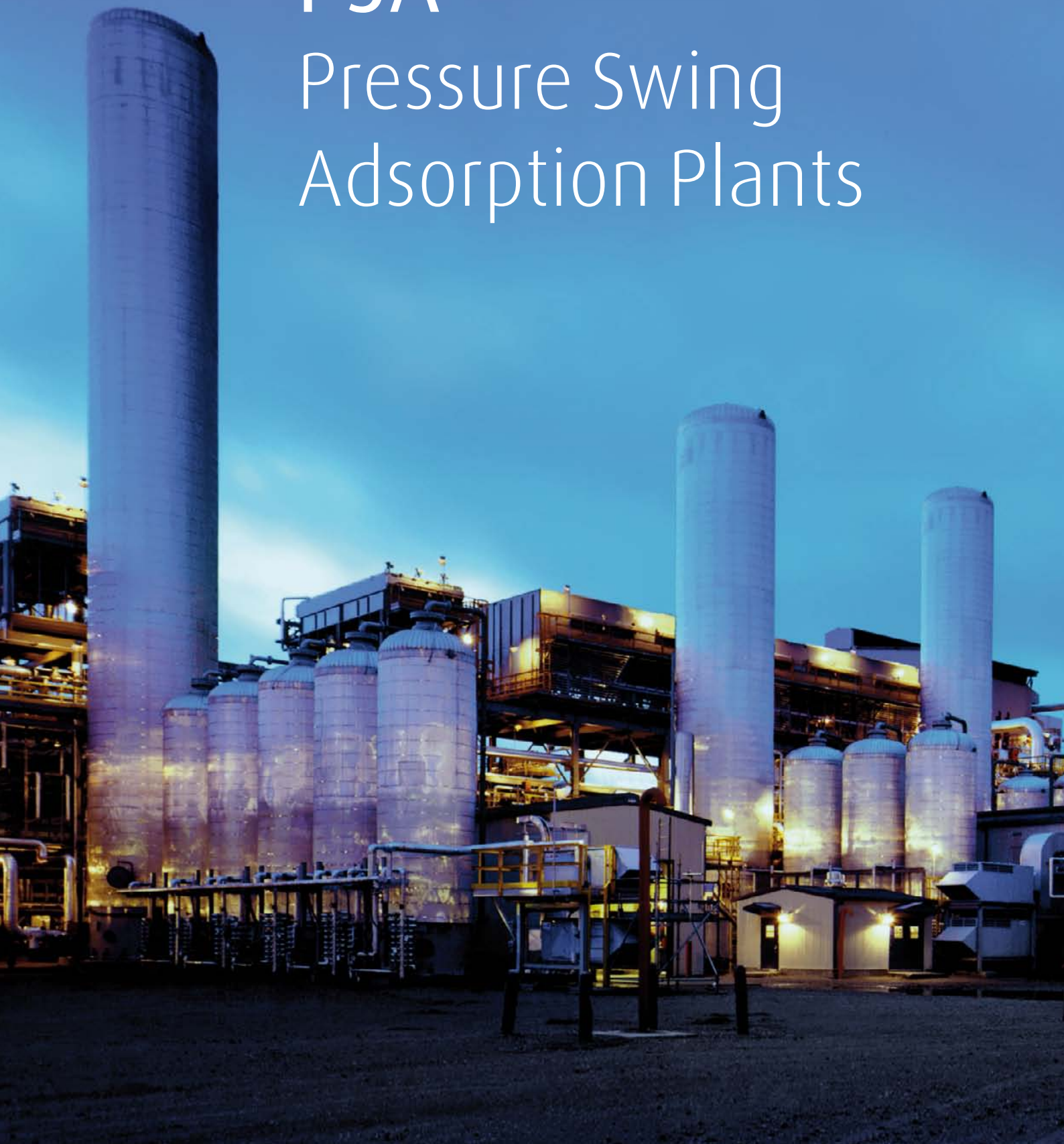
THE LINDE GROUP

Linde

PSA
Pressure Swing Adsorption Plants



PSA - Pressure swing adsorption plants.

Linde has continued with innovative improvements of the pressure swing adsorption process (PSA) and strengthened its position as world leader in this field of technology. Over 500 PSA plants - including the world's largest units - have been designed and supplied by Linde. The well proven Linde high performance PSA systems provide an economic and reliable separation and purification of a wide range of process gases. The capacities range from small plants of 100 Nm^3/h to large scale plants of over 400,000 Nm^3/h feed gas flow. These PSA systems are suitable for the most different applications in the refining, petrochemical, chemical and iron/steel-making industry.

Hydrogen recovery and purification

The main application of this modern Linde process is the recovery and purification of hydrogen from raw gases, such as synthesis gases from steam reforming, partial oxidation or gasification processes, as well as refinery off-gases, ethylene off-gas, coke oven gas, methanol and ammonia purge-gases. The hydrogen product obtained meets every purity requirement (up to 99.9999 %) and is achieved at highest recovery rates.

Carbon dioxide removal and purification

Linde pressure swing adsorption systems (PSA) and vacuum regenerated pressure swing adsorption systems (VPSA) are successfully employed for the bulk removal of carbon dioxide in direct reduction plants in the iron-making industry. Linde PSA/VPSA plants are also used for the recovery and purification of carbon dioxide from various raw gases in order to make them suitable for liquefaction or other consumers.

Oxygen VPSA plant in Chile

PSA units for H_2 and CO_2 recovery in a refinery in Germany

Oxygen production

The production of gaseous oxygen with a purity between 90 % and 94 % and with capacities of up to 6,000 Nm^3/h can be most effectively achieved with the Linde VPSA process (Vacuum Pressure Swing Adsorption).

The advantages of this process are low specific energy consumptions and the simplicity of operation with regard to start-up and turn-down operation.

Nitrogen generation

Linde supplies also PSA units for the generation of nitrogen for capacities up to 5,000 Nm^3/h and purities of 98 % to 99.9 % (and higher).

These plants can be engineered and fabricated fully tailored to the requirements and specifications of our clients, among which are well-known companies in the oil and gas business.

Other applications

Furthermore, Linde PSA processes have proven their capability in the recovery of helium and in the upgrading of natural gas to pure methane.

Features

The particular features of Linde's PSA technology are high product recovery rates, low operating costs and operational simplicity. Highest reliability and on-stream availability of the plants is achieved by special design features and the use of proven high-quality plant components. Modular skid design of the PSA plants reduces erection time and costs at site. The fully prefabricated skids are thoroughly tested before they leave the workshop. Commissioning and start-up of the plants as well as operator training and after-sales service are performed by experienced specialists.

Designing processes – constructing plants.

Linde´s Engineering Division continuously develops extensive process engineering know-how in the planning, project management and construction of turnkey industrial plants.

The range of products comprises:

- Petrochemical plants
- LNG and natural gas processing plants
- Synthesis gas plants
- Hydrogen plants
- Gas processing plants
- Adsorption plants
- Air separation plants
- Cryogenic plants
- Biotechnological plants
- Furnaces for petrochemical plants and refineries

Linde and its subsidiaries manufacture:

- Packaged units, cold boxes
- Coil-wound heat exchangers
- Plate-fin heat exchangers
- Cryogenic standard tanks
- Air heated vaporizers
- Spiral-welded aluminium pipes

More than 3,800 plants worldwide document the leading position of the Engineering Division in international plant construction.

Engineering Division
Schalchen Plant
Tacherting, Germany
Phone +49.8621.85-0
Fax +49.8621.85-6620
plantcomponents@linde-le.com

Linde-KCA-Dresden GmbH
Dresden, Germany
Phone +49.351.250-30
Fax +49.351.250-4800
lkca.dresden@linde-kca.com

Selas-Linde GmbH
Pullach, Germany
Phone +49.89.7447-470
Fax +49.89.7447-4717
selas-linde@linde-le.com

Cryostar SAS
Hésingue, France
Phone +33.389.70-2727
Fax +33.389.70-2777
info@cryostar.com

Linde CryoPlants Ltd.
Aldershot, Great Britain
Phone +44.1.252.3313-51
Fax +44.1.252.3430-62
info@linde-lcl.com

Linde Impianti Italia S.p.A.
Rome, Italy
Phone +39.066.5613-1
Fax +39.066.5613-200
r.tikovsky@lindeimpianti.it

Linde Kryotechnik AG
Pfungen, Switzerland
Phone +41.52.3040-555
Fax +41.52.3040-550
info@linde-kryotechnik.ch

CRYO AB
Gothenburg, Sweden
Phone +46.3164-6800
Fax +46.3164-2220
gunnar.lenneras@cryo.aga.com

Linde Process Plants, Inc.
Tulsa, OK, U.S.A.
Phone +1.918.4771-200
Fax +1.918.4771-100
sales@lppusa.com

Selas Fluid Processing Corp.
Blue Bell, PA, U.S.A.
Phone +1.610.834-0300
Fax +1.610.834-0473
sales@selasfluid.com

Linde Engenharia do Brasil Ltda.
Rio de Janeiro, Brazil
Phone +55.21.3545-2255
Fax +55.21.3545-2257
jaime.basurto@linde.com

Linde Process Plants (Pty.) Ltd.
Johannesburg, South Africa
Phone +27.11.490-0513
Fax +27.11.490-0412
lindepp@global.co.za

Linde-KCA Russia Branch
Moscow, Russia
Phone +7.495.987-1223
Fax +7.795.987-1224
lkca.moskau@linde-kca.com

Linde Arabian Contracting Co. Ltd.
Riyadh, Kingdom of Saudi Arabia
Phone +966.1.419-1193
Fax +966.1.419-1384
linde-ksa@linde-le.com

Linde Arabian Contracting Co. Ltd.
Alkhobar, Kingdom of Saudi Arabia
Phone +966.3.887-0133
Fax +966.3.887-1191
ahmed.al.ghamdi@linde-le.com

Linde Engineering Middle East LLC
Abu Dhabi, United Arab Emirates
Phone +971.2.6981-400
Fax +971.2.6981-499
leme@linde.com

Linde Engineering India Pvt. Ltd.
Vadodara, Gujarat, India
Phone +91.265.3056-789
Fax +91.265.2335-213
sales@linde-le.com

Linde Engineering Far East, Ltd.
Seoul, South Korea
Phone +82.2789-6697
Fax +82.2789-6698
hanyong.lee@linde.com

Linde Engineering Division
Bangkok, Thailand
Phone +66.2751-9200
Fax +66.2751-9201
anuwat.krongkrachang@linde.com

Linde Engineering Co. Ltd.
Dalian, P.R. of China
Phone +86.411.3953-8819
Fax +86.411.3953-8899
dalian.led@lindeled.com

Linde Engineering Co. Ltd.
Hangzhou, P.R. of China
Phone +86.571.87858-222
Fax +86.571.87858-200
hangzhou.leh@lindeleh.com

Linde Engineering Division
Beijing Representative Office
Beijing, P.R. of China
Phone +86.10.6437-7014
Fax +86.10.6437-6718
lindechina@vip.163.com

Linde Engineering Taiwan Ltd.
Taipei, Taiwan
Phone +886.2.2786-3131
Fax +886.2.2652-5871
bernhard.puerzer@linde-le.com

Linde AG
Engineering Division, Head office, Dr.-Carl-von-Linde-Str. 6-14, 82049 Pullach, Germany
Phone +49.89.7445-0, Fax +49.89.7445-4908, E-Mail: info@linde-le.com, www.linde.com

HA/1.1.e/11