J.P. SAUER & SOHN
MASCHINENBAU GMBH

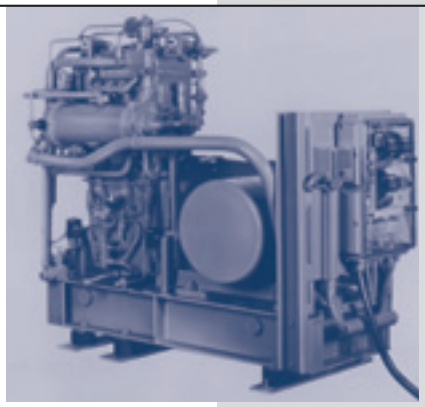
Sauer Compressors

for Gas Compression

- innovative
- competent
- advanced

Ein Mitglied der
SAUER-Gruppe

2005: Gas-tight WP 276L gas compressor used to 'drive' the gas in a closed re-circulation loop for a modern metal heat-treatment process



1978: WP 136 water-cooled helium recovery gas compressor that allows re-liquefaction of the helium gas

The Sauer Group "Compressors"

DEPENDABLE Compressors

Sauer-Group Compressors – the ideal partner for industry

With more than 70 years of innovative compressor design and the combination of highest quality, leading compression technology and a comprehensive product line. Sauer Gas Compressors have long convinced customers of their worth in industrial, shipping and marine areas.

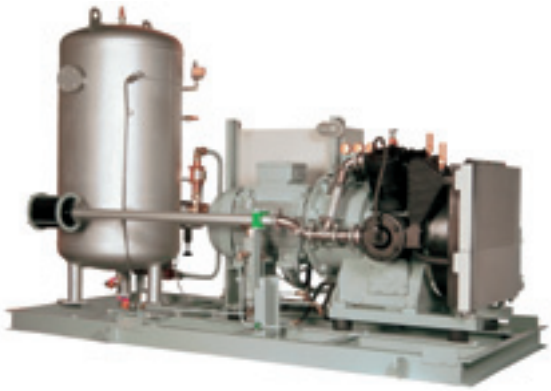
A great variety of Sauer Gas Compressors have proven themselves in numerous fields of application, in particular, for process engineering that require high quality compressed gas or air. Sauer's good name was won as early as the '70's in delivering gas compressors to Linde.

Experience and know-how make it possible: alongside individually designed compressor packages. Today we offer 3- and 4-stage gas compressors for up to 350 bar in an extensive, and standardised, product range.

Sauer Gas Compression Technology

Sauer Compressors have merged competence with innovation and now serve the needs of a wide variety of industries for air and gas compressors as a global provider for compression solutions.

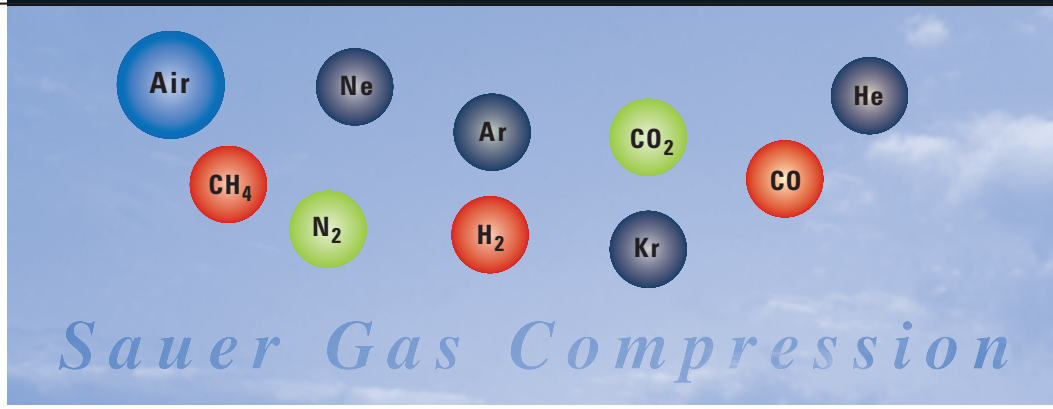
Bare compressors
(Multi-stage, oil-lubricated, coolers, separators)



Sub packages
(Compressor, pulsation vessels and piping mounted on skid)

Complete "Turn-Key" packages
(Compressor, recovery vessels and piping with electrical control skid mounted)

Wide range of air and gas compressor booster applications



Sauer provide know-how and support for:

- process design
- engineering solutions
- safety advice
- operational start-up
- continued support, after-care and servicing

The Sauer Gas Compressors

'H' series compressors

In
Inert gases

A
air-cooled

'H' series compressors are used for **Air** or **Nitrogen** compression.

Each compressor is an air-cooled, single acting, three or four stage-reciprocating piston compressor with the combination of oil pressure fed crankshaft bearings, and cylinder oil splash with regulated injection for the final high-pressure piston plunger design.

Performance with inert gases, such as **Nitrogen**, ranges from **10 to 150 Nm^3/h** within a final pressure range of **100 to 350 bar** including the Sauer unique *NitroFlex* integrated 'all-in-one' – Compressor, generator and gas booster.

Inert Gas Compressors		
max. power	gas flow rate	max. pressure
55 kW	150 m^3/h	350 bar

Nitroflex – Nitrogen Generator/Booster		
max. power	gas flow rate	max. pressure
45 kW	35 m^3/h	300 bar

'W' series compressors

W
water-cooled

In
Inert gases

'W' series compressors are oil-lubricated, single acting water-cooled piston compressors for air or inert gas compression in two or three stages from **10 to 100 bar** with gas flow-rates from **65 to 400 Nm^3/h**.

Inert Gas Compressors		
max. power	gas flow rate	max. pressure
75 kW	400 m^3/h	100 bar

'LB' series inert gas boosters

In
Inert gases

A
air-cooled

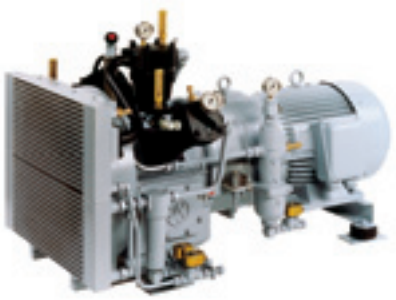
'LB' series inert gas boosters are dedicated nitrogen gas boosters that can accept suction pressures from 4 to 14 bar to deliver gas to a **maximum of 40 bar**. This single stage gas booster range is the result of years of trouble-free experience with the 'L' range.

Inert Gas Booster		
max. power	gas flow rate	max. pressure
22 kW	40 – 450 m^3/h	40 bar

A air-cooled

In Inert gases

‘L’ series compressor/boosters



‘L’ series compressor/boosters offer a wide range of gas flow-rates from **10 to 400 m ^ 3/h** at pressures **to 40 bar** in two or three stages based upon the established marine diesel air-start Sauer range of two and three stage oil-lubricated, piston compressors. Even as air compressors they can be safely adapted for use in Ex-atmospheres to ATEX regulations

Inert Gas Compressors		
max. power	gas flow rate	max. pressure
87 kW	400 m ^ 3/h	40 bar

‘G’ series compressor/boosters

In Inert gases

Ex Ex-proof

GT Gas tight

No Noble

A air-cooled

‘G’ series compressor/boosters have been engineered with a gas-tight crankcase (‘special’ double crankshaft seals and jointing) to prevent gas leakage, typically to less than 0.1 mbar per l/s, and are oil-lubricated, single acting reciprocating compressors with air-cooling.

The ‘G’ series have similar performance to the ‘H’ series; for noble gases such as **Helium, Argon and Neon,** and **hazardous gases** such as Carbon Monoxide, Hydrogen and Natural Gas.

The combination of oil pressure feed to the crankshaft bearings and oil splash for compression, with Sauer regulated oil injection system for the final piston plunger design, ensures high reliability.

The ability to handle elevated suction pressure for both noble or hazardous gases, gives enhanced performance to final pressures **between 20 to 40 bar** reliably in three stages and **from 100 to 350 bar** in four stages within the gas flow rate range of **10 to 400 m^3/h**.

Hydrogen Gas Compressors		
max. power	gas flow rate	max. pressure
55 kW	250 m ^ 3/h	350 bar

Natural Gas Compressors		
max. power	gas flow rate	max. pressure
55 kW	400 m ^ 3/h	350 bar

Helium Gas Compressors		
max. power	gas flow rate	max. pressure
75 kW	335 m ^ 3/h	350 bar

Scope of Supply and Options

			Maximum Pressure [bar]	Gas Flow-rate [m^3/h]	Multi-stage oil-lubricated piston compressor	Inter-stage and final after-cooler with oil/water separators	Final after-cooler with oil/water separator	Over-pressure saftey valves at each stage	Gas-tight over-pressure safety valves at each stage (piped exit, manifold)	Automatic oil/water drain valves	Auto-starting relief integrated with drain system	Pressure indicator at each stage	Gas over-temperature protective shutdown sensor	Oil lubrication including protection sensor	Pressure and temperature indicators and sensor-switch at all stages	Air-blast cooling fan and flywheel	Lubricating oil level alarm	Gas suction connection (flange, pipe)	Gas-tight crankcase (breather, evacuation flange)	Gas-tight crankshaft 'double seals'	Gas-tight oil system (refill, oil-level sight glass)	Crankcase oil sump heating	Ex-proof crankcase oil sump heating
H Series	A	In	420	10–150	■	■		■	●	■	■	■	■	■	●	■	●	■				●	
W Series	W	In	100	65–550	■	■		■	●	■	■	■	■	■	●		●	■		●		●	
L Series	A	In	40	10–400	■	■		■	●	■	■	■	■	■	●	■	●	■				●	
LB Series	A	In	40	40–450	■		■	■	●	■	■	■	■	■	●	■	●	■				●	
G Series	A	No	350	10–335	■	■			■	■	■	■	■	■	●	■	●	■	■	■	■	●	
G Series	A	Ex	350	10–500	■	■			■	■	■	■	■	■	●	■	●	■	■	■	■		●

Key:

■ **standard**

● **optional**

option for ATEX version

In Inert gases

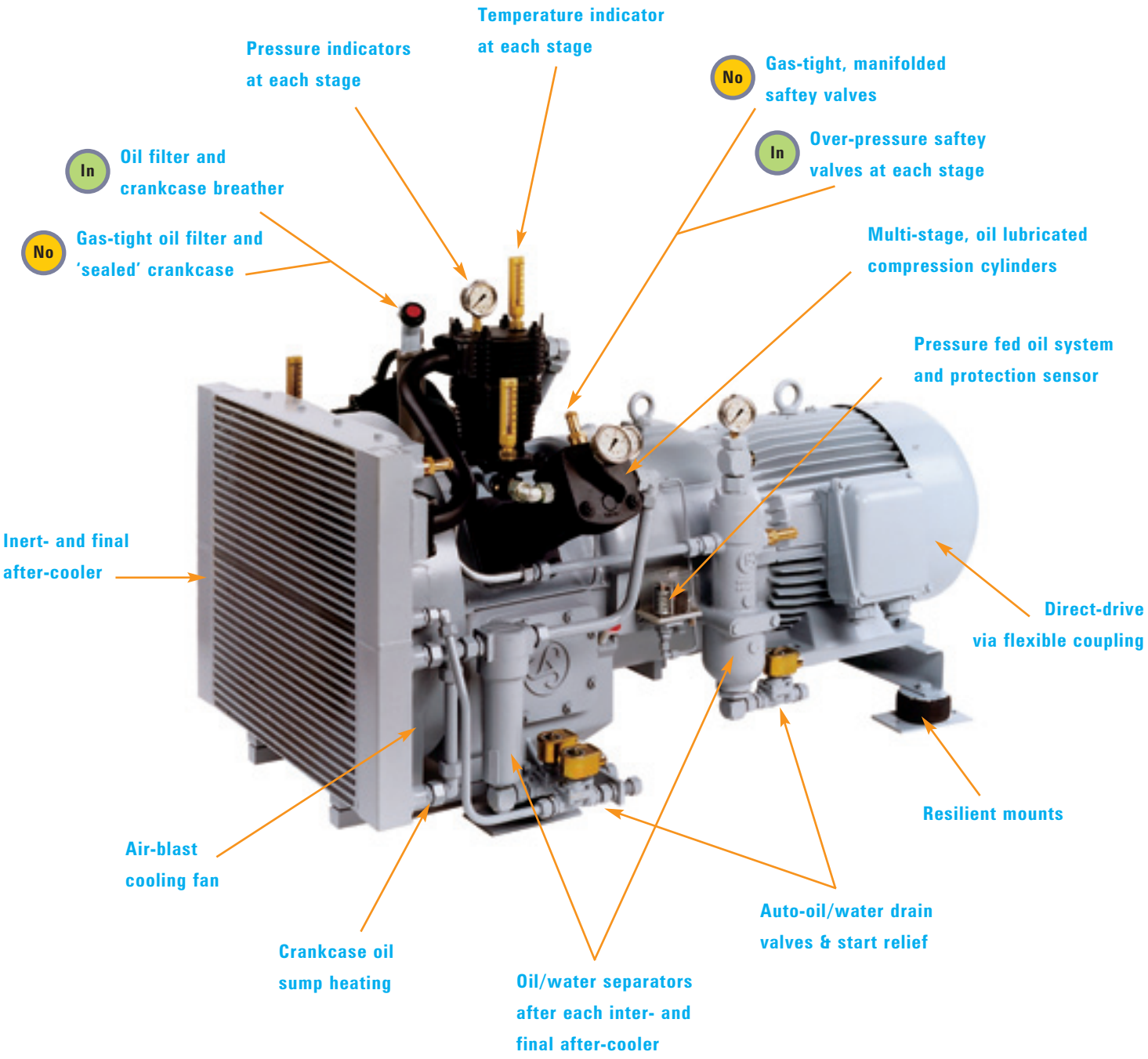
Ex Ex-proof

GT Gas tight

No Noble

A air-cooled

W water-cooled



In Inert gases
GT Gas tight
No Noble
A air-cooled

The Sauer Compressor Units

Scope of Supply and Options

			Maximum Pressure [bar]	Gas Flow-rate [m^3/h]	Flexible drive coupling	Direct drive Electric Motor	Direct-drive Ex-motor (ATEX)	Resilient AV mounts	Outlet flexible hose with non-return valve	Flexible oil/water drain hose	Auto Start-Stop pressure sensor control	Oil/water drain gas seprator 'Demister' vessel	Oil/water collection tank	Oil/water collection tank (level alarm)	Electrical Control Panel (Safe Area, Start/Stop, alarms, shutdowns)	Acoustic enclosure (internal heater, fan ventilation, gas detection)	Cooling water inlet shut-off solenoid valve	Cooling water pump	Cooling water thermostatic control	Cooling water closed-loop cooling system (inc. Pump, fan-cooled radiator & control)	Ex-proof drive coupling (ATEX 95)	Anti-static air-blast cooling fan (ATEX 95)	Iintrinsic safe relays for pressure and temperature monitoring	Intrinsic safe terminal box for electrical connections	Electrical Control panel to ATEX zone 1 and 2
H Series	A	In	420	10–150	■	■	●	■	■	■	●	●	●	●	●	●					●	●			●
W Series	W	In	100	65–550	■	■	●	■	■	■	●	●	●	●	●	●	●	●	●	●	●	●			●
L Series	A	In	40	10–400	■	■	●	■	■	■	●	●	●	●	●	●					●	●			●
LB Series	A	In	40	40–450	■	■	●	■	■	■	●	●	●	●	●	●					●	●			●
G Series	A	No	350	10–335	■	■		■	■	■	●	●	●	●	●	●									
G Series	A	Ex	350	10–500	■		■	■	■	■	●	●	●	●	●	●					■	■	●	●	●

Key:

■ **standard**

● **optional**

option for ATEX version

In Inert gases

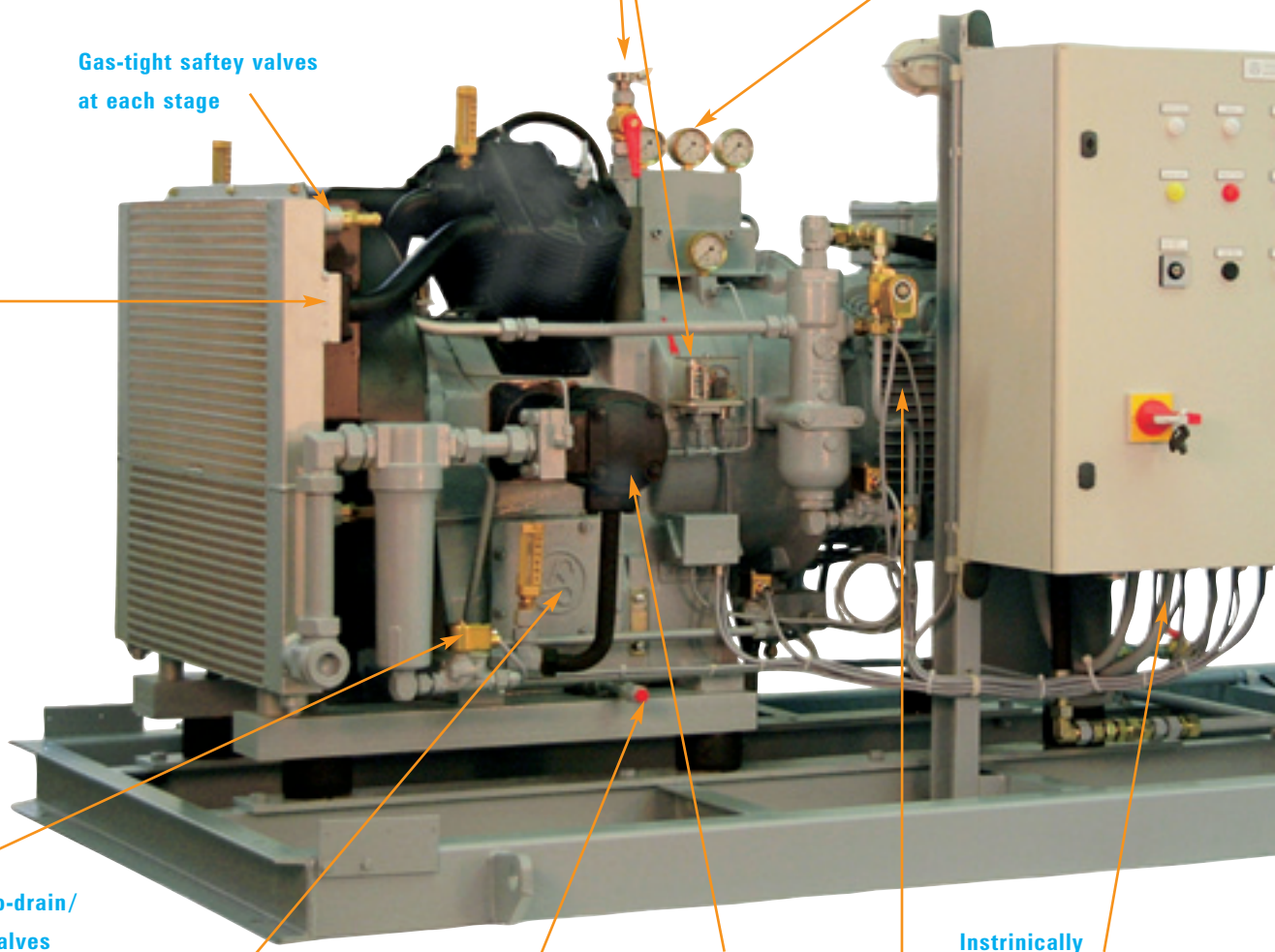
Ex Ex-proof

GT Gas tight

No Noble

A air-cooled

W water-cooled



Ex
Ex-proof

A
air-cooled

The Sauer Compressor "Turn-Key" Systems

Scope of Supply and Options

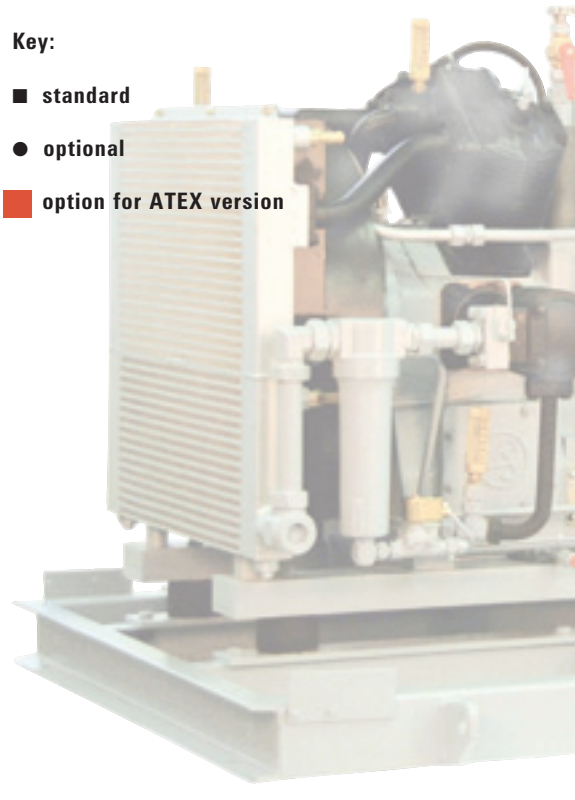
			Maximum Pressure [bar]	Gas Flow-rate [m^3/h]	Supply gas pressure sensor control (Auto-Stop/Restart)	Supply gas isolating valve (manual, solenoid, actuator, electrical inter-lock)	Supply gas non-return valve	Supply gas excess flow valve	In-line gas suction filter	Suction gas regulation (pressure reducing valve)	Suction gas shut-off valve (solenoid, actuated)	Capacity control (re-cycling by-pass valve, discharge back to suction)	Inlet gas pulsation damper (suction 'buffer tank' inc. drain/purge valve)	Suction gas protection (safety valve, pressure gauge, high/low pressure sensor-switch)	Flexible suction gas hose	Outlet oil coalescing filtration (manual, auto drain)	Outlet oil vapour activated carbon filtration (manual drain)	Outlet purge connection	Final Pressure Maintaining Valve	Gas recovery, or 'blow-down', vessel (purge, drain, safety valve, pressure gauge)	Gas detection (alarm)	Gas drying (suction, outlet HP Dryer)
H Series	A	In	420	10–150	●	●			●	●	●	●	●	●	●	●	●	●	●			●
W Series	W	In	100	65–550	●	●			●	●	●	●	●	●	●	●	●	●	●			●
L Series	A	In	40	10–400	●	●			●	●	●	●	●	●	●	●	●	●	●			●
LB Series	A	In	40	40–450	●	●			●	●	●	●	●	●	●	●	●	●	●			●
G Series	A	No	350	10–335	●	●			●	●	●	●	■	■	●	●	●	●	●	■	●	●
G Series	A	Ex	350	10–500		●	●	●	●	●	●	●	■	■	●	■	●	■	■	■	●	●

Key:

■ **standard**

● **optional**

option for ATEX version



In Inert gases

Ex Ex-proof

GT Gas tight

No Noble

A air-cooled

W water-cooled

Gas-tight
safety valve

Supply gas pressure sensor
Stop/Start control

Gas suction
connection

Ex-proof gas
shut-off valve

Back-pressure
maintaing valve

Outlet gas
coalescing filter

Ex
Ex-proof

A
air-cooled

GT
Gas tight

Gas recovery vessel
(blow-down tank)

Compressor suction
protection

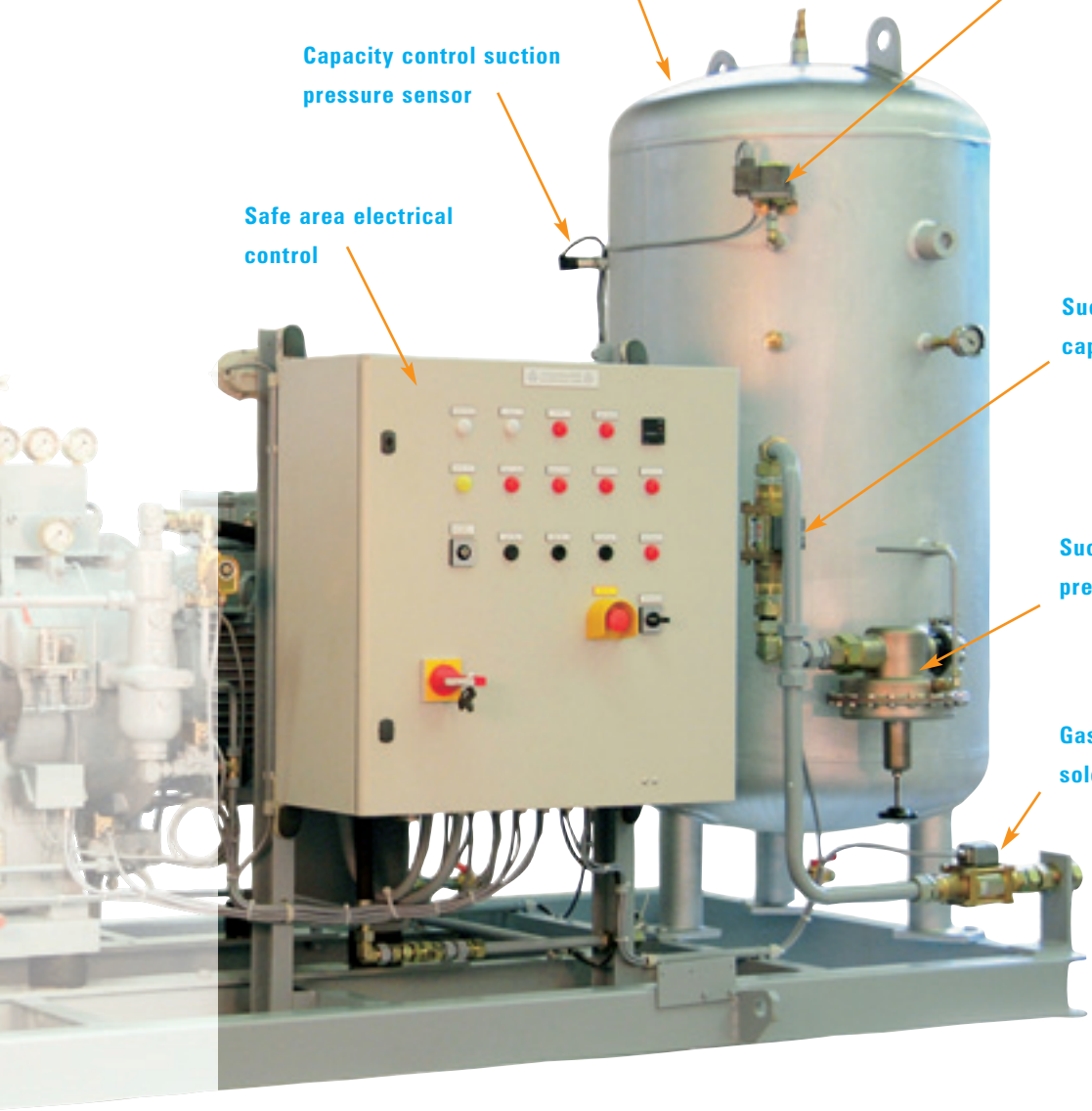
Capacity control suction
pressure sensor

Safe area electrical
control

Suction gas
capacity control

Suction gas
pressure regulation

Gas supply
solenoid valve



GT
Gas tight

No
Noble

A
air-cooled

Nitrogen Gas Packages

Sauer WP 33L dedicated Nitrogen gas compressor/booster package

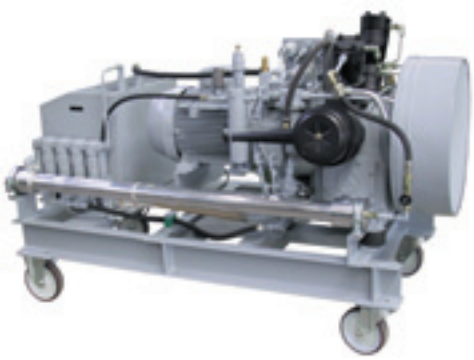
Sauer & Sohn experience with integrated N2 generation and compression is both varied and widespread.

Nitrogen gas generated from either:

- **Cryogenic liquid (LN2)**
- **On-site air separation, via membrane or PSA**

can be compressed by the Sauer 'L', 'LB' or 'H' series model nitrogen gas packages.

Either way Sauer has a purpose designed compressor/booster package to raise the nitrogen gas pressure for the most cost effective solution for both 'normal' and 'periodic' use.



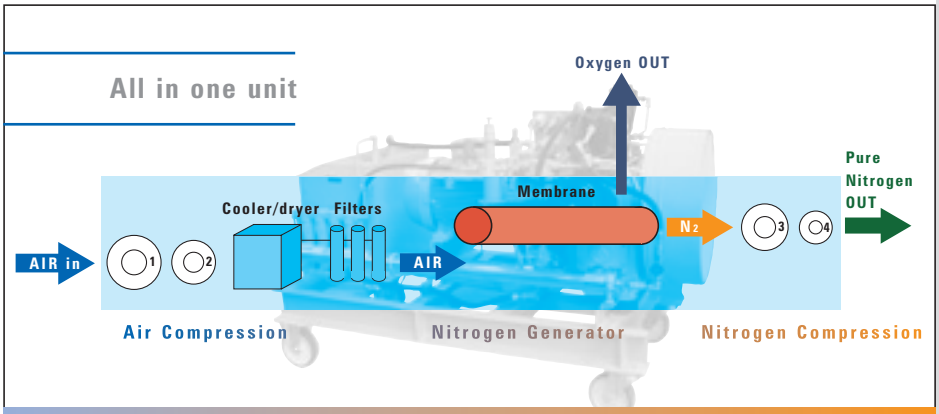
The NitroFLEX

Sauer unique integrated nitrogen generator and gas booster using alternative membrane technology. **NitroFLEX** stand-alone nitrogen generator and has everything needed to generate high purity gas to 99.5%.

Nitrogen in a single unit from **13 to 300 bar** and comes complete with:

- **Feed air compressor**
- **Nitrogen membrane generator**
- **Gas booster – all part of the same unit**

Atmospheric air is compressed within the **NitroFLEX** then cooled and passed to series of filters to protect the integrated membrane generator. Nitrogen generated then goes to the higher compression cylinders where the nitrogen pressure can be boosted anywhere up to a maximum pressure of **300 bar**.



Gas Assisted Injection Moulding (GAIM)

Any fluctuation in supply gas from an on-site generator is carefully monitored and adjusted with the Sauer 'by-pass' valve control to provide continuous feedback to automatically maintain N2 flow-rate and purity.

Complete PSA generator and WP 4331 high-pressure 'H' series compressor

Laser Cutting

Using PSA gas generator and WP 4331 high-pressure 'H' series compressor

WP 4351 'H' series compressor at 300 bar for sheet-steel cutting

Helium Gas Recovery and 'Mixed' Gases

Gas resources can be very limited and the economics of installing recycle systems have become increasingly attractive.

Recovering and then recycling **HELIUM GAS**, for example, can be applied to many differing applications, **in a University laboratory, filling balloons or 'fast-gas' metal treatment.**

Sauer has the experience with compressors at anywhere between **10 and 300 bar** in applying its own unique recovery – recycling system to achieve +99% gas recovery when used to evacuate a vessel, or balloon, and then re-compress and store the process gas to continuously repeat the same process.

The **'G' gas-tight series** have been engineered in a compact, soundproof package with:

- **Additional sealing to prevent ingress of air with 'special' joint seals**
- **Additional crankshaft seals**
- **Attention to joint bolting**
  This has meant a gas leakage rate of less than **0.1 mbar per litre/s.**
- Every compressor is performance tested on Helium gas. Packages arrive **filled with He gas**, ready to start, avoiding the need of purging on commissioning.

Advantages of Sauer 'Mixed Gas' Recovery/Recycling

Three main functions in a gas recovery/recycling system are:

- **Gas recovery from the waste gas stream**
- **Compressed gas purification**
- **Returning recovered gas back to the process**

All three functions are tackled by the **Sauer 'G' series recovery/recycling gas packages** without gas loss.

The Sauer 'G' series gas-tight compressor recovery/recycling packages have been developed to handle pure 'bone-dry' inert and noble gases or mixed gas recovery/recycling solutions for the quenching atmosphere in heat treatment furnaces.

MIXED GASES – increasingly 'fast-gases' such as **Helium** gas are becoming more widely used, sometimes mixed with **Carbon Dioxide**, or hazardous gases such as **Carbon Monoxide** and **Hydrogen**.

Sauer can offer a unique solution to evacuate the treatment cell and re-compress the gas, and safely, repeat time-and-again the process using the same gas.

Gas 'waste' Recovery

Capacity control using pressure sensors; uniquely regulate the changing suction gas pressure, or flow-rate, while evacuating a vessel using the Sauer 'by pass'-control system.

This ensures the process vessel can be completely emptied. At the same time this process gas is re-compressed and stored ready for the next process sequence.

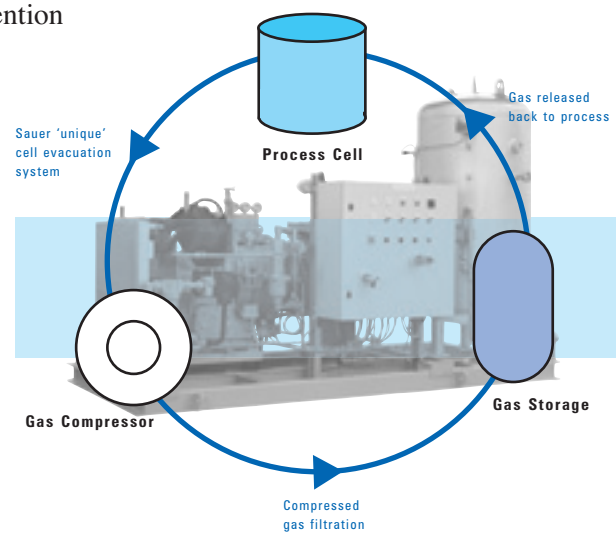
Compression & Purification

Sauer gas-tight compressors deliver 'oil-free' helium gas at a pressure **up to 300 bar**. Filtration at the compressor outlet can guarantee gas with a residual **oil content to 0.001 mg/m³** and particulate retention of 99.999 % of 0.01 nm particles.

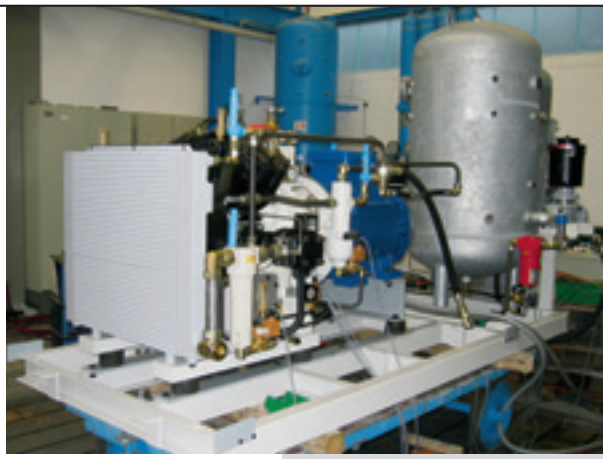
Re-compression

A gas recovery on system is engineered to recapture the gas when starting, stopping or when draining the compressor to safely return the gas back to the compressor suction intake for re-compression.

Cell evacuation system



Natural Gas and Ex-proof Compressors



Sauer Natural Gas compressors are aimed at both NGV (Natural Gas Vehicles) for in-vehicle refuelling systems as an alternative fuel for internal combustion engines.

All the **'G' series** with three or four stages include a closed loop gas system to prevent any hazardous gas leakage to the atmosphere.

The standard Natural Gas package suction contains a suction shut-off valve to secure the gas supply, pressure regulation to a suction buffer vessel (inlet pulsation damper), complete with safety valve, protective sensor(s), purging connections and a gas recovery system or expansion 'blow-down' tank. An optional gas suction filter can also be used.

A Weatherproof/Soundproof canopy with thermostatic regulated cooling/ventilation fan, when needed, and gas detection alarm can be provided.

The complete compressor Gas package is then typically coded as ***EU ATEX regulations***: CE Ex **II 2 G EEx c IIC T3 T200°C** or suitable for **US CLASS I DIVISION 2**.

- **Solenoid shut-off valve**
- **Suction pressure regulation**
- **Inlet pulsation vessel**
- **Oil lubricated multi-stage gas-tight piston compressor**
- **Pressure and temperature gauges, safety valves and sensors suitable for Zone 1 or Class I Division 1 areas**
- **Direct drive via Zone 1 or Class I, electric motor**
- **Automatic oil/water drain and unloading system**
- **Gas recovery system ('blow-down tank')**
- **Outlet oil and particle filtration**
- **Gas dryer (when needed)**
- **Compressor auto-control and supervision via Local Control Panel**

Model		WP 4331	WP 4341	WP 4351
Discharge Pressure range	bar.g	100 ~ 350	100 ~ 350	100 ~ 350
Volume @1.013 bar 0°C	Nm^3/h	50	80	150
Electric Motor	kW	18.5	30	45

Model		WP 156L	WP 276L	WP 316L
Discharge Pressure range	bar.g	20 ~ 40	20 ~ 40	20 ~ 40
Volume @1.013 bar 0°C	Nm^3/h	165	300	400
Electric Motor	kW	30	55	75

Sauer gas auto-unloader/drain valve system, with Ex solenoid valves, safely activate gas operated valves for the higher-pressure stages, sequentially unloading and periodically draining the gas booster of oil and any water.

The vented gas is then safely captured in a purpose designed gas recovery vessel ('blow-down' tank) and returned to the compressor suction without hazardous gas leakage.

Additional outlet filtration can reduce oil content in outlet gas to <0.001 ppm.

Three phase EExd motor are suitable for use in ***ATEX Zone 1*** with any pressure and temperature sensors typically coded:

CE II 2G EEx ia IIC T6 IP65

CE II 2G EEx de IIC T4 IP55

An electrical Control Panel to Start/Stop and monitor the compressor is provided in a water resistant enclosure for installation in a safe area, or as 'explosion proof' in a strong enclosure.

The Control Panel contains control interface relays, terminals and controls the following alarms, sensors and indicators with their functions:

- **Low Oil Pressure (LOP)**
- **High or Low Gas suction pressures**
- **Compression Stage pressures & temperatures**

Compliant with EU ATEX 94/9/EC 'explosive gas' regulations – coded surface and electrical components or US Class I.

Intrinsically Safe (IS) techniques can also be applied to limit the electrical energy in hazardous-area circuits using a 'shunt-diode safety barrier'.

Hydrogen Compression

Sauer & Sohn commitment to innovation for developing technologies and products, has resulted in the 'G' series compressors being adapted as a low-cost and reliable supply of hydrogen.

Sauer experience with both Natural Gas and 'light gases' makes the Sauer **'G' series compressors**, with improved sealing, readily adaptable for a wide range of hydrogen gas applications from power stations, hydrogenation to the emerging technology; the fuel cell.

'G' series compressor/boosters again are oil-lubricated, single acting piston compressors with air-cooling and a gas-tight crankcase safely engineered for flammable and explosive gases, such as hydrogen.

- **Ability to handle elevated hazardous gas suction pressures – enhanced performance to final pressures between 20 to 350 bar in four stages**
- **Mass balanced configuration for low vibration**
- **High efficiency moisture and oil separators with auto-drainage – reduced need to dry the intake gas and can handle 'wet' suction gas**
- **Large oil sump capacity – extended service intervals**
- **Alternative material selection – internal protection against corrosive gas contaminants**
- **Gas recovery vessel – capture and recover gas safely back to suction**

Enquiry Reference

Fax +49 (0) 4 31/39 40-24

Date: _____

Customer

Company: _____

Telephone: _____

Fax: _____

Email: _____

Technical Data

Gas type
to be compressed
(eg Air, N2, H2, Ar, He, CO, CH_4)

Gas contents
(eg Cl, NH_4, KOH, H_2S, etc.)

Suction
Pressure
Temperature
Gas conditions
(eg water content, particulate, etc.)

Outlet conditions
Pressure
Final gas condition
(eg purity, dew-point, oil content, particulate, etc.)

		Max.	Min.	Units
Suction Volume				
Volume@Normal (eg Nm^3/h)				
Volume@Standard (eg SCFM)				
Mass flow				
Ambient conditions				
Pressure				
Temperature				
Humidity				
Location (eg outdoor, safe, Ex-zone, US Class, Div, etc.)				
Noise level requirement				
Electric supply	Voltage			
	Frequency/ph			
Control	Voltage			

Option(s):

J.P. SAUER & SOHN MASCHINENBAU GMBH

Ein Mitglied der
SAUER-Gruppe

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Phone +49 (0) 4 31/39 40-83
39 40-18
Fax 39 40-24
e-mail: sales@sauersohn.de

Custumor service/spares
Phone +49 (0) 4 31/39 40-86
39 40-87
Fax 39 40-89
e-mail: service@sauersohn.de

24-hour emergency service
Phone +49 (0) 172-4 14 63 94

Quality Assurance
DIN ISO 9001
certified

05/2006