



COMPRESSOR TECHNOLOGY

**CNG - COMPRESSORS
TURN KEY STATIONS
for REFUELLING CNG**

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OVERVIEW PRODUCTS

Overview Product range / Field of Applications

LMF's high pressure compressor systems for the compression of air, natural gas, technical and industrial gases (process gases) are designed according to international standards, using standard design principles.

As a single source LMF offers design, engineering, production, testing under full load, erection, start-up and related services with over 40 years of experience in the high pressure compressor business.

LMF's special modular system makes it possible to find the optimal solution in each specific case - both from a technical and an economical point of view.

The careful selection of materials and components ensures troublefree operation, even under the most arduous operating conditions.

Aircooled V-compressors		Aircooled High Speed Boxer		Compound Systems	Watercooled V-compressors		Process Gas Compressors API 618		
V 16	V 7(d)	BT 4	BS 102	BT	VGd	VC	T 91-93	B 92-94	V 92-94
V 17			BS 204	BS	VHGd	VCS	T 121-123	B 122-124	V 122-124
VP 2			BS 302	VC / VCS		VCL	T 151-153	B 152-154	
			BS 604	Nitrogen			T 181-183	B 182-184	B 252-256

										Oil / Gas Applications
■		■								Seismic research
			■		■					Pipeline testing
					■					Well-services
			■					■		Gasgathering/ -lift and -transport
			■					■		Flaregas / Gasreinjection
							■	■	■	Petrochemical plants
	■						■	■	■	Refineries
	■						■	■	■	Chemical plants
■			■				■	■		- ind. gas handling H ₂ , CO, CO ₂
			■			■		■		Fuel injection
■			■		■					Platform motion compensation
										CNG
			■							Bus stations
■			■							Private cars
										PET
							■			Bottle blowing
										Industrial Applications
■			■							Power plants
■		■	■							Marine / Defence
■			■				■			Heavy duty applications (mining)
	■						■			Dry industrial air
					■					Wind tunnels
			■		■					Wet oxydation

Customer's benefit

In this brochure we present to you **CNG compressors**, air- and watercooled for various applications.

LMF's comprehensive product range enables you to find the optimal technical solution for your specific compression requirements. All you need from a single source.

High Pressure Compressors for CNG Filling Stations

LMF's CNG compressors are mainly produced for CNG filling stations (also turn-key), especially in the range of high capacities as they are usually needed for the fleet refuelling at busses and truck stations.

The delivery program ranges from bare blocks only up to complete compressor units on skid with drive and control system.

The CNG compressors are designed with a capacity range of between 50 and 7000 Nm³/h (80 to 4355 scfm) usually at a final pressure rate of 250

The compressor package can also be extended to complete filling stations with blow down vessel, adsorption dryer, HP - quick fill storage system and dispensers etc.

In this way "tailor-made" solutions can be offered to the customer, to correspond with his individual needs.

bar (3600 psi) - on request up to 350 bar (5075 psi). The rated powers of 20 to 600 kW (30 to 820 hp) are made up of individual modules.

Basic Compressor Designs

Following basic compressor designs are available:

G-line - Compressors

Aircooled, single-acting reciprocating type, four and five stages
The closed gas tight system operates without any leakage to atmosphere.

Suction pressures: 1,4 / 2 bar_{abs} (5,6 psig / 15 psig)

Power range: 20 to 110 kW (30 to 150 hp)

Capacity range: 50 to 340 Nm³/h (31 to 211 scfm)

VP-line - Compressors

Air- or watercooled, single-acting reciprocating type, two or three stages, four cylinders

The closed pressure tight gas system - for suction pressures up to 19 barg (275 psig) - operates without any leakage to atmosphere.

Power range: 50 to 90 kW (70 to 125 hp)

Capacity range: 247 to 517 Nm³/h (154 to 322 scfm)

BS-line - Compressors

High Speed Boxer with two or four aircooled cylinders (balanced-opposed, double-acting) and step pistons, low lubricated cross head design, 2/4 throws, crankcase oil and dust-proof.

Suction pressures: 5 bar_{abs} (58 psig) up to 42 bar_{abs} (595 psig)

Power range: 50 to 600 kW (70 to 820 hp)

Capacity range: 210 to 7000 Nm³/h (131 to 4355 scfm)

CNG means COMPRESSED NATURAL GAS

Natural gas / CNG

► creates less environmental pollution than gasoline and diesel,

and

► in this way it is ideal as fuel for vehicles - especially in the cities

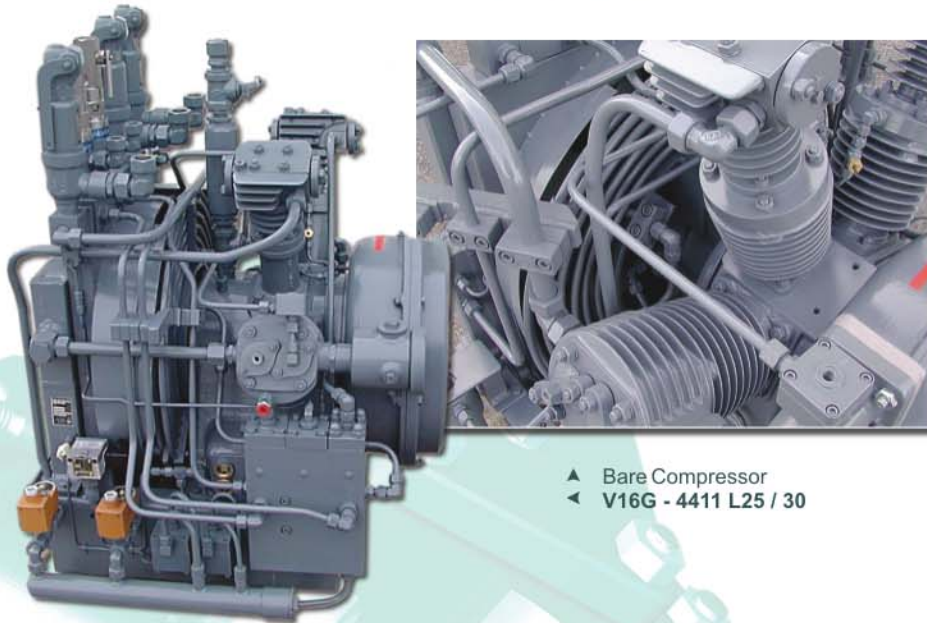
Design Features G-line / Compressor

Aircooled, single-acting reciprocating type with four and five stages and closed gas system (without any leakage to atmosphere).

The gas tight crankcase (with special double sealing system of the crankshaft) allows to feed back all gas leakage from the crankcase to the suction line of the compressor.

Crankshaft bearings are carried out as roller bearings, the connecting rods have needle bearings on the small and big end for the V16G, but needle bearings on the small and bushings on the big end on the V17G and V19G.

Pistons are of plunger type, whereby the small pistons are screwed on to guide pistons.



▲ Bare Compressor
◀ V16G - 4411 L25 / 30

Design Features G-line / Lubrication

Combined splash-spray / forced feed lubrication on the V16G and forced feed lubrication on the V17G and V19G.

A gear type oil pump with oil inlet strainer driven directly off the crankshaft is incorporated in the crank case.

The high pressure cylinders are lubricated by oil lines outside the crank case. The pressure of the oil pump is monitored by an oil pressure switch. An oil filter assures the continuous filtration of the lubricant.

Technical Advantages G-line

- ▶ **Efficient Fan Cooled** cylinders, inter stage and after coolers
- ▶ **Gas Tight** - leakage free compressor block & crankshaft-sealing up to 1 barg
- ▶ **Compact Design** ensures very low space requirement
- ▶ **Direct Coupling** with electric motors acc. to the frequency 50/60 cps with 1500/1200/1000 rpm or V-belt drive between 750-1500 rpm available
- ▶ **Well Balanced Compressor Design**, removing the need for special foundations and increasing component life time
- ▶ **Factory Tested Package** allowing quick and simple installation
- ▶ **Service Minded Design** ensures easy access for maintenance and repair

Bare Compressor
V17G - 5518 L25 / 35



Customer's benefit offered by LMF CNG compressors

- ▶ All internal gas leakage are collected and fed back to the suction line of the compressor
- ▶ Gentle compression of the gas in 2, 3, 4 or 5 stages

Design Features VP-line / Compressor

Air- or watercooled, single-acting reciprocating type with four cylinders, two or three stages.

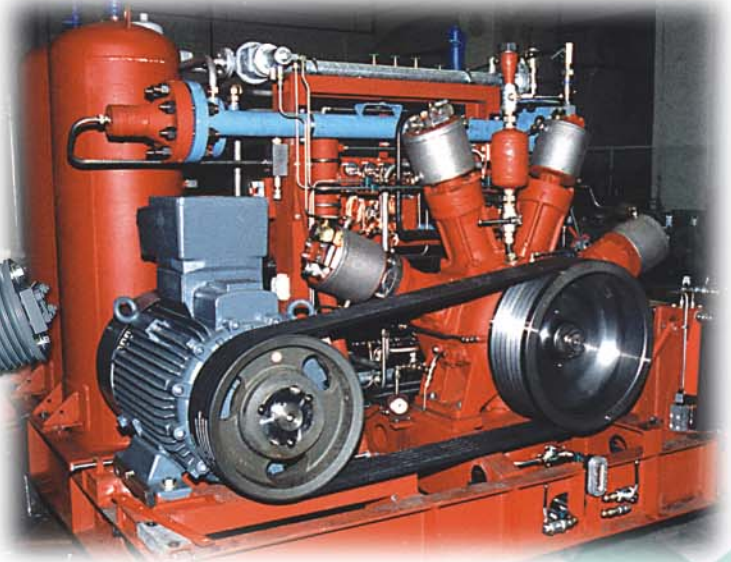
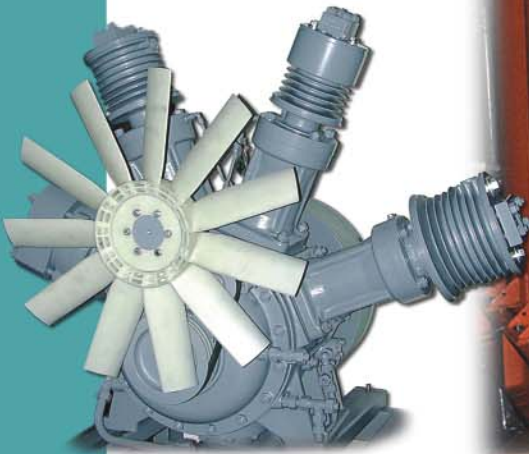
The closed pressure tight gas system - for suction pressures up to 19 bar g operates without any leakage to atmosphere. The pressure tight crankcase (with special hydrodynamic sealing system of the crankshaft) allows to feed back all gas leakage from

the crankcase to the suction line of the compressor.

Crankshaft bearings are carried out as roller bearings, connecting rods bearings on the small end are needle bearings and bushings on the big end.

Pistons are of plunger type, whereby the small pistons are screwed on to guide pistons.

▼ Bare Block VP2 -3410
aircooled version



Design Features VP-line / Lubrication

Forced feed lubrication.

A gear type oil pump with oil inlet strainer driven directly off the crankshaft is incorporated in the crank case. The high pressure cylinders are

lubricated by oil lines outside the crank case. The pressure of the oil pump is monitored by an oil pressure switch. An oil filter assures the continuous filtration of the lubricant.

Technical Advantages VP-line

- ▶ **Efficient Air- or Water Cooled** cylinders, inter stage and after coolers
- ▶ **Pressure Tight** - leakage free compressor block & crankshaft-sealing up to 20 barg
- ▶ **Compact Design** ensures very low space requirement
- ▶ **Direct Coupling** with electric motors acc. to the frequency 50/60 cps with 1200/1000 rpm or V-belt drive between 600-1200 rpm available
- ▶ **Optimized Smooth Running** due to low mass forces and low vibrations
- ▶ **Highest Life Time** of all components - due to the heavy duty industrial design
- ▶ **Factory Tested Package** allowing quick and simple installation
- ▶ **Service Minded Design** ensures easy access for maintenance and repair

Customer's benefit offered by LMF CNG compressors

- ▶ Excellent serviceability
- ▶ Weight and space efficiency

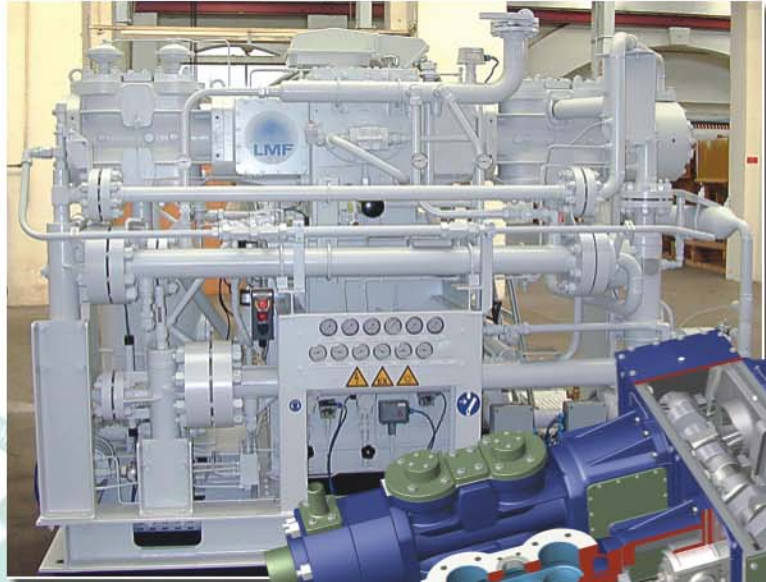
Design Features BS-line / Compressor

Two (*four*) aircooled cylinders, balanced -opposed, double-acting and step pistons.

Low lubricated, cross head design, 2 (4) throws, crankcase oil and dust-proof, crankshaft bearings are carried out as

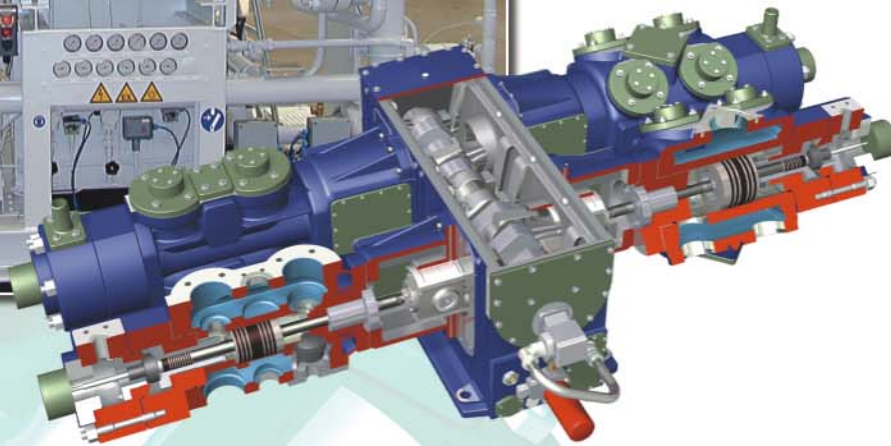
anti friction bearing, connecting rod bearing as split bearing (bush).

Stuffing box with gas vent connection to the blow off gas pipe or to be fed back to suction line.



◀ Compressor package
BS 302 - 313 S 25/30

BS 604
▼ (4 cylinder version, aircooled)



Design Features BS-line / Lubrication

Forced feed lubrication of the motion work through gear pump mounted in the crankcase and combined external high pressure lubrication pump for

stuffing box and cylinder lubrication driven by auxiliary electric motor.

Oil receiver for cylinder lubrication system - 10 (20) ltrs capacity.

Technical Advantages BS-line

- ▶ **Horizontally opposed compressor**, heavy rigid crosshead design for continuous running, ensuring lowest vibrations due to well balanced mass forces
- ▶ **Proven Cylinder Design** - double acting, air cooled cylinders (eliminating water cooling from cylinder jacket) yields significant advantages over water cooled cylinders:
 - larger gas passages reduce pressure drop losses and increase the efficiency
 - lower maintenance due to the avoided water corrosion and water scaling
- ▶ **Automatic Unloader System** with blow down recovery tank, for gas feed back to suction line and condensate collection
- ▶ **Efficient Cooling** of inter stage and after coolers. Water cooling optionally with radiator modules or fully air cooled gas-to-air heat exchangers available
- ▶ **Direct coupling** with E-motors acc. to the frequency 50/60 cps with 1500/1800 rpm or gas engine drive between 1200-1800 rpm (avoiding V-belt or gear losses)

Customer's benefit offered by LMF CNG compressors

- ▶ Package on compact base frame completely tested at LMF
- ▶ Heavy duty operation
- ▶ Industrial applications

CNG COMPRESSOR APPLICATIONS

UBCT bus station
Site: Teheran, Iran
LMF CNG compressors
with 2 BS 302-313 S 25



CNG station, AGIP
Site: Delitzsch, Germany
LMF CNG compressor
V17G-5518 L 25



ECO station, Tokyo Gas
Site: Yokohama, Japan
LMF CNG compressor
VP2-3410 L 25





▲ **LMF CNG compressor BS302 - 313 S 25/30**
 capacity 1254 - 2145 Nm³/h (780 to 1335 scfm), suction pressure 11,35 - 18,25 bara,
 speed 1500 rpm / 315 kW 430 hp) main drive



▲ **LMF CNG compressor V17G - 5518 L25**
 ▲ capacity 140-200 Nm³/h (87 to 125 scfm),
 suction pressure 1,02 - 1,4 bara
 speed 1200 rpm, hydraulic motor,
 MAN gas engine (130 kW / 180 hp) for
 hydraulic pump and E-generator,
 housing in the dimension of a 30ft container,
 high pressure 3 bank storage system

ASSEMBLING & AUXILIARIES



◀ Two CNG compressor units
V16G-4411 L 25



▲ Assembling of CNG compressor package
BS302 - 313 S 25/30 at LMF works



▲ Three line double hose
High flow dispenser
(2x40 or 2x100 kg/min)

▲ HP adsorption dryer



▲ HP bottle storage
modules of 25x80 ltrs