



HYDRO-PAC INC.



FLEXI-POWER™ High-Pressure Gas Compressors



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FLEXI-POWER™

High-Pressure Gas Compressors

HYDRO-PAC

FLEXI-POWER™ High-Pressure Gas Compressors are manufactured to meet the requirements of many industries. These FX compressors are available in powers to 200 hp and for pressures to 60,000 psi and even higher.

Because numerous industry applications involve pressurizing closed vessels, Hydro-Pac developed a new generation of compressors that fully utilizes the power supply.

Compressor Design

FLEXI-POWER™ High-Pressure Gas Compressors have two basic components, an intensifier and a hydraulic power unit.

The Intensifier, mounted on top of the console, is made up of first- and second-stage gas cylinders and a hydraulic drive cylinder. Each cylinder contains a piston.

Tie-rods attach the gas cylinders to the hydraulic cylinder. A hydraulic flange and isolation spacer between each gas cylinder and hydraulic cylinder separate the hydraulic fluid from the process cylinders.

The Hydraulic Power Unit, contained within the console, is made up of an electric motor, hydraulic pump, oil reservoir, directional control valve and other hydraulic components.

The power unit provides pressurized hydraulic oil to the intensifier. The intensifier uses this pressurized hydraulic oil to compress gas.

The four-way valve controls the direction of hydraulic oil flow to and from the intensifier.

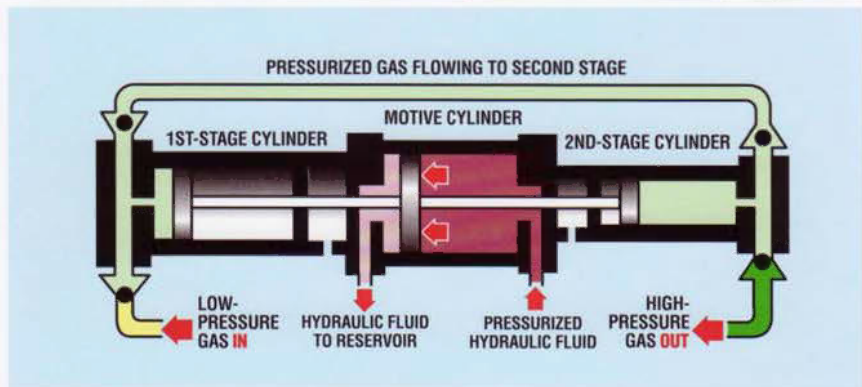
Intensifier Operation

Stage I Compression

Gas flows through the inlet check valve and fills the larger diameter first-stage cylinder.

Pressurized hydraulic fluid, acting on the hydraulic piston, strokes the piston assembly to the left compressing the gas in the first-stage cylinder.

Gas in the first-stage cylinder flows through the check valves into the smaller diameter second-stage cylinder.

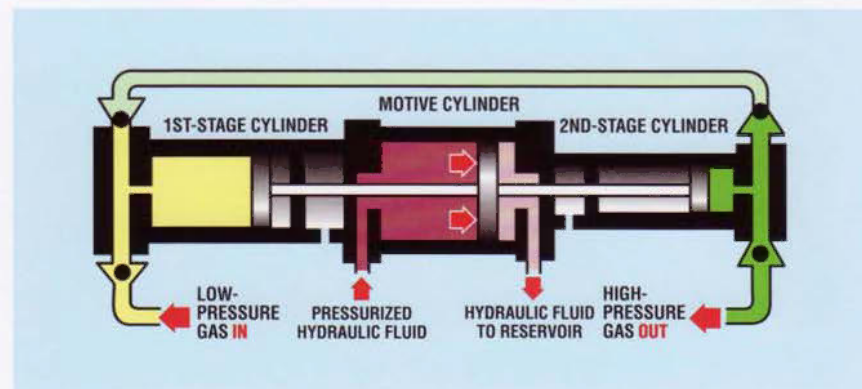


STAGE I COMPRESSION

Stage II Compression

At the end of stage I compression, the four-way valve changes position and directs pressurized hydraulic fluid to the left side of the hydraulic piston.

The piston assembly moves to the right compressing gas in the second-stage cylinder. Gas flows out of the second-stage cylinder into the discharge gas line.



STAGE II COMPRESSION

The piston assembly reverses direction at the end of the second-stage stroke and the cycle repeats.



Advances

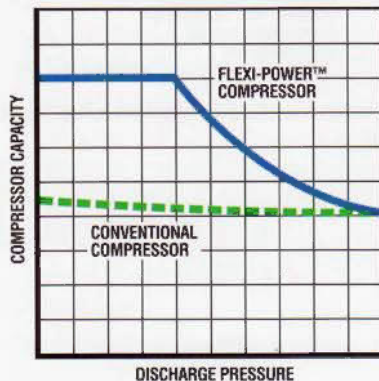
Increased Capacity at Lower Operating Pressure

FX compressors adjust their stroke rate automatically according to the operating conditions.

This increase in stroke rate makes full use of available horsepower and results in higher capacity when the discharge pressure is low. For batch process applications, a higher capacity can significantly reduce the compression time.

Variable Inlet Pressure

FX compressors efficiently accommodate a wide range of inlet pressures. It is usually unnecessary to provide an expensive pressure regulator. In addition, operation with the highest available inlet pressure increases the capacity of the machine.

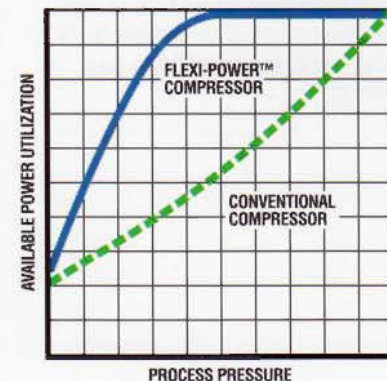
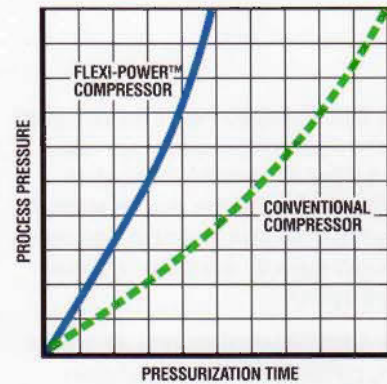


FLEXI-POWER™ Compressor Efficiency

Conventional, fixed-displacement compressors produce a near constant flow of gas when operating at fixed inlet conditions, *regardless of the discharge conditions*. When process pressures are low, a relatively small percentage of available horsepower is utilized by the compressor. These compressors waste power and time.

FLEXI-POWER™ compressors use most of their power, even when discharge pressures are low. At low discharge pressures, the intensifier strokes faster displacing more gas.

As pressure increases, FLEXI-POWER™ compressors slow down to produce a higher pressure and corresponding maximum flow-rate. At the maximum discharge pressure, the FLEXI-POWER™ compressor displaces the same amount of gas as a conventional fixed-displacement compressor.

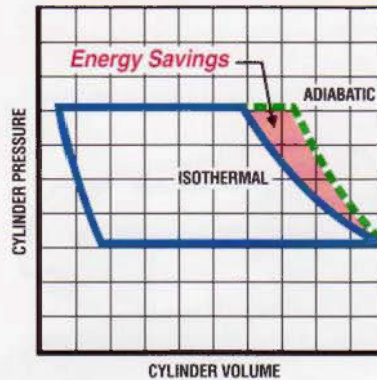


Intensifier Design Features

Near-Isothermal Compression

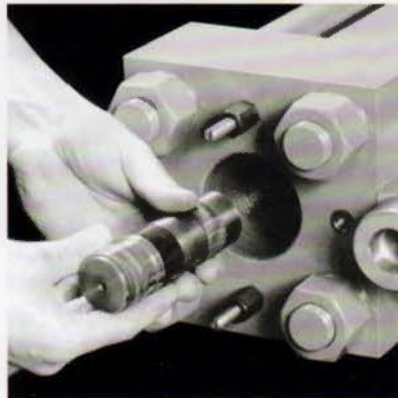
The long, slow stroke of Hydro-Pac compressors allows heat removal during the compression cycle. This near-isothermal compression cycle requires less power than the faster compression cycle of a diaphragm or crank-driven machine.

The near-isothermal compression cycle of Hydro-Pac compressors consumes less energy and requires less power to pressurize a given volume.



Patented Free-Piston Design

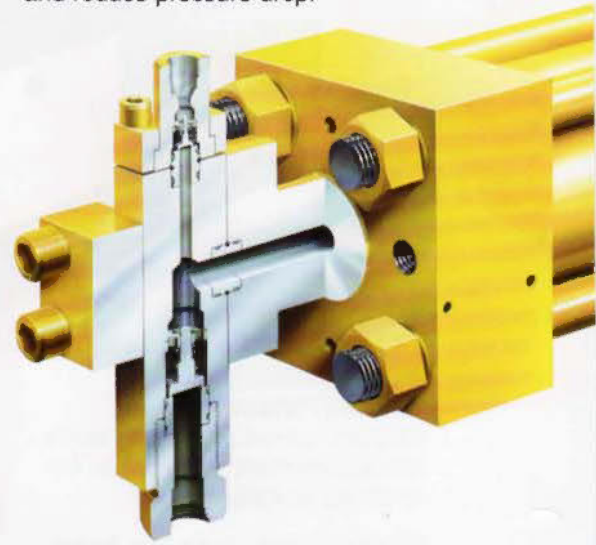
Hydro-Pac's patented free-piston design allows replacement of the high-pressure packing in minutes without major disassembly of the intensifier. These pistons are pressure energized allowing them to adjust automatically for wear. The pistons are nonlubricated unless specifically requested by the user.



Patented Free-Piston is easily replaced in minutes by unthreading a single nut.

Check Valves

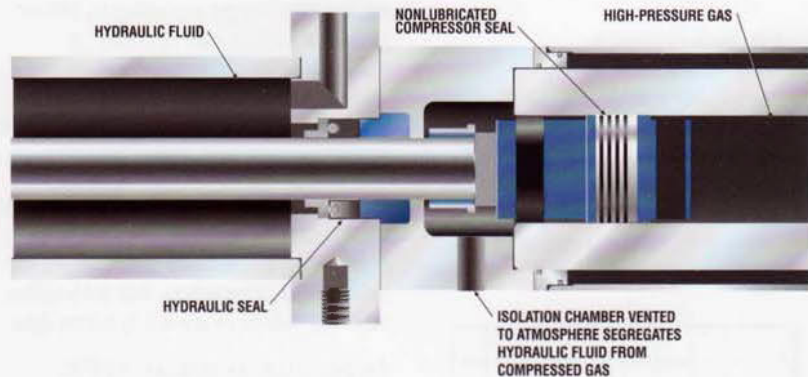
Inlet and discharge check valves are housed in a check valve body. The valve seats are reversible. The poppet, guide and spring are a cartridge. The guide accurately aligns the poppet with the seat. Large ports allow free flow of gas and reduce pressure drop.



Fail-Safe Freedom from Contamination

Hydro-Pac compressors are non-lubricated eliminating lubrication contamination of the gas. In addition, a vented isolation chamber separates the gas cylinder from the hydraulic drive cylinder.

For applications requiring ultra-pure gas, optional full-length isolation spacers are available that do not allow entry of the oil-wetted portion of the plunger rod into the gas cylinder.



Nonlubricated Hydro-Pac compressor with vented isolation chamber ensures protection from contamination.



Hydraulic Drive System Features

An advanced hydraulic drive system powers the Hydro-Pac FLEXI-POWER™ compressor.

- Easily removable, sound-dampening panels enclose the hydraulic drive system.
- The hydraulic drive system allows the machine to be started under full load. Special unloading devices are not required.
- The slow operating speed and low inertia load eliminate the need for special foundations.
- Hydraulic oil is cooled and constantly filtered.
- Oil reservoir is baffled for cooling and foam dispersion, and is furnished with a clean-out cover.

Safety

FLEXI-POWER™ High Pressure Gas Compressors are designed and built for maximum safety. Some of the specific safety features are:

- An interstage relief valve protects the interstage and first stage of the compressor from over-pressurization.
- A pressure-compensated hydraulic pump and backup hydraulic relief valve provide redundant protection against over-pressurization of the hydraulic system.
- Protective panels shield the hydraulic drive system and electric motor.
- Leak-before-failure design of the high-pressure seals enhances safety.

Hydro-Pac Quality

We are committed to providing the best compressor possible. Some of the many steps taken to ensure the quality of Hydro-Pac compressors are:

- Careful, conservative engineering of all equipment.
- Hydrostatic pressure testing of all gas cylinders prior to assembly.
- All machines run at maximum-rated conditions prior to shipment.

Applications

FLEXI-POWER™ High-Pressure Gas Compressors are ideally suited for:

- Hot isostatic pressing
- Supercritical extraction
- Pneumatic testing
- Shock tube pressurization
- Wind tunnel storage pressurization
- Calibration of transducers and other instruments
- Gas transfer and circulation
- High-pressure chemical reactions
- Well injection
- Material testing
- Gas leak testing

Service and Spare Parts

- Trained service technicians are available for field repair.
- We provide training on the operation and maintenance of our products.
- Complete product overhaul and rebuild can be done at our facility.
- Our computer based inventory allows parts shipment from stock.

Standard Equipment

FLEXI-POWER™ High-Pressure Gas Compressors are furnished as complete units.

- Gas intensifier with inlet, interstage and discharge check valves
- Electric motor, 230/460 v, 3 ph, 60 Hz, TEFC
- Hydraulic power unit with pump, directional control valve and filter
- Gauges for oil pressure, level and temperature
- Sensors for low oil level and high oil temperature
- Interstage relief valve
- Heat exchanger for hydraulic oil
- Interstage gas cooler
- Instruction manual with parts list

Standard Gases

- Argon
- Nitrogen
- Helium
- Carbon dioxide
- Dry air
- Mixtures of 20% oxygen and other inert gas
- Methane
- Other inert gases

Options are available for Compressing

- Hydrogen
- Ethylene
- Other gases

Optional Equipment

- Spare-parts kit
- Enclosure for intensifier
- Motor starter
- Pressure gauges for suction, interstage and discharge
- Relief valves for gas inlet and discharge lines
- Aftercooler
- Coolant-flow sensor
- Gas piston lubrication
- Heater for oil reservoir
- Explosion-proof motor and controls
- Special motor and control power
- Complete compressor packages
- Installation assistance

Utilities

- Electrical:
230/460 v, 3 ph, 60 Hz
(Other voltages available)
- Cooling water is required. The amount depends on the machine.

Selecting a Compressor

The selection of a FLEXI-POWER™ compressor for a batch process requires the solution of a first-order differential equation.

Hydro-Pac has developed a computer program for this solution which uses actual gas data to model the changing capacity of a FLEXI-POWER™ compressor.

This program considers changing inlet and discharge pressures, temperature, and type of gas when selecting a compressor.

Hydro-Pac can optimize compressor selection - a task best accomplished by our computer.



Specifications

| Model | Discharge Pressure | | Power | | Reservoir | | Length | | Height | | Width | | Weight | |
|-----------|--------------------|-----|-------|-----|-----------|-------|--------|------|--------|------|-------|------|--------|------|
| | psi | MPa | hp | kW | gal | liter | in | mm | in | mm | in | mm | lb | kg |
| C10-10FX | 10,000 | 70 | 10 | 7,5 | 30 | 115 | 74 | 1880 | 44 | 1120 | 26.5 | 675 | 1500 | 680 |
| C10-20FX | 10,000 | 70 | 20 | 15 | 40 | 150 | 93 | 2360 | 54 | 1370 | 26.5 | 675 | 2600 | 1180 |
| C10-40FX | 10,000 | 70 | 40 | 30 | 70 | 265 | 110 | 2795 | 59 | 1500 | 34 | 865 | 4000 | 1815 |
| C10-60FX | 10,000 | 70 | 60 | 45 | 80 | 300 | 122 | 3100 | 65 | 1650 | 37 | 940 | 7500 | 3400 |
| C10-75FX | 10,000 | 70 | 75 | 55 | 165 | 625 | 144 | 3660 | 75.5 | 1920 | 44 | 1120 | 9000 | 4080 |
| C10-100FX | 10,000 | 70 | 100 | 75 | 165 | 625 | 144 | 3660 | 75.5 | 1920 | 44 | 1120 | 9350 | 4240 |
| C15-10FX | 15,000 | 105 | 10 | 7,5 | 30 | 115 | 74 | 1880 | 44 | 1120 | 26.5 | 675 | 1500 | 680 |
| C15-20FX | 15,000 | 105 | 20 | 15 | 40 | 150 | 93 | 2360 | 54 | 1370 | 26.5 | 675 | 2600 | 1180 |
| C15-40FX | 15,000 | 105 | 40 | 30 | 70 | 265 | 110 | 2795 | 59 | 1500 | 34 | 865 | 4000 | 1815 |
| C15-60FX | 15,000 | 105 | 60 | 45 | 80 | 300 | 122 | 3100 | 65 | 1650 | 37 | 940 | 7500 | 3400 |
| C15-75FX | 15,000 | 105 | 75 | 55 | 165 | 625 | 144 | 3660 | 75.5 | 1920 | 44 | 1120 | 9000 | 4080 |
| C15-100FX | 15,000 | 105 | 100 | 75 | 165 | 625 | 144 | 3660 | 75.5 | 1920 | 44 | 1120 | 9350 | 4240 |
| C20-10FX | 20,000 | 140 | 10 | 7,5 | 30 | 115 | 74 | 1880 | 44 | 1120 | 26.5 | 675 | 1500 | 680 |
| C20-20FX | 20,000 | 140 | 20 | 15 | 40 | 150 | 93 | 2360 | 54 | 1370 | 26.5 | 675 | 2600 | 1180 |
| C20-40FX | 20,000 | 140 | 40 | 30 | 70 | 265 | 110 | 2795 | 59 | 1500 | 34 | 865 | 4000 | 1815 |
| C20-60FX | 20,000 | 140 | 60 | 45 | 80 | 300 | 122 | 3100 | 65 | 1650 | 37 | 940 | 7500 | 3400 |
| C20-75FX | 20,000 | 140 | 75 | 55 | 165 | 625 | 144 | 3660 | 75.5 | 1920 | 44 | 1120 | 9000 | 4080 |
| C20-100FX | 20,000 | 140 | 100 | 75 | 165 | 625 | 144 | 3660 | 75.5 | 1920 | 44 | 1120 | 9350 | 4240 |
| C30-10FX | 30,000 | 210 | 10 | 7,5 | 30 | 115 | 74 | 1880 | 43 | 1090 | 26.5 | 675 | 1500 | 680 |
| C30-20FX | 30,000 | 210 | 20 | 15 | 40 | 150 | 93 | 2360 | 51 | 1295 | 26.5 | 675 | 2600 | 1180 |
| C30-40FX | 30,000 | 210 | 40 | 30 | 70 | 265 | 110 | 2795 | 56.5 | 1435 | 34 | 865 | 4000 | 1815 |
| C30-60FX | 30,000 | 210 | 60 | 45 | 80 | 300 | 122 | 3100 | 65 | 1650 | 37 | 940 | 7500 | 3400 |
| C30-75FX | 30,000 | 210 | 75 | 55 | 165 | 625 | 144 | 3660 | 75.5 | 1920 | 44 | 1120 | 9000 | 4080 |
| C30-100FX | 30,000 | 210 | 100 | 75 | 165 | 625 | 144 | 3660 | 75.5 | 1920 | 44 | 1120 | 9500 | 4300 |
| C45-10FX | 45,000 | 310 | 10 | 7,5 | 30 | 115 | 74 | 1880 | 43 | 1090 | 26.5 | 675 | 1500 | 680 |
| C45-20FX | 45,000 | 310 | 20 | 15 | 40 | 150 | 93 | 2360 | 51 | 1295 | 26.5 | 675 | 2600 | 1180 |
| C45-40FX | 45,000 | 310 | 40 | 30 | 70 | 265 | 110 | 2795 | 56.5 | 1435 | 34 | 865 | 4100 | 1860 |
| C60-10FX | 60,000 | 415 | 10 | 7,5 | 30 | 115 | 74 | 1880 | 43 | 1090 | 26.5 | 675 | 1500 | 680 |
| C60-20FX | 60,000 | 415 | 20 | 15 | 40 | 150 | 93 | 2360 | 51 | 1295 | 26.5 | 675 | 2600 | 1180 |
| C60-40FX | 60,000 | 415 | 40 | 30 | 70 | 265 | 110 | 2795 | 56.5 | 1435 | 34 | 865 | 4200 | 1900 |

Capacity curves and operating envelopes are available upon request.

When ordering or inquiring about FLEXI-POWER™ Compressors please specify:

- Operating pressure
- Discharge vessel volume, temperature and starting pressure
- Inlet storage volume and starting pressure
- Time allowed to reach pressure
- Type of gas
- Utilities, voltage and frequency
- Indoor or outdoor installation
- Ambient temperature
- Options
- Model number (if known)

Other Products

Hydro-Pac designs and manufactures equipment to generate, control and monitor high-pressure fluids and gases.

- Low-pressure gas compressors 1000 to 10,000 psi, 3 to 40 hp.
- Large high-pressure gas compressors 2000 to 100,000 psi through 200 hp.
- High-pressure pumps 10,000 to over 100,000 psi, 1/2 to 400 hp.
- Large port valves, fittings and tubing for high-flow requirements at 40,000 to 100,000 psi.

- Electrical power and thermocouple glands to operate furnaces and electronic equipment in pressurized environments to 60,000 psi.

- Large high-pressure vessels designed and manufactured in accordance with ASME Code Section VIII, Divisions 1, 2 and 3.

- Complete high-pressure systems.

Call or write Hydro-Pac Inc. for your pressure equipment requirements. Our complete Product Catalog is available upon request.



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