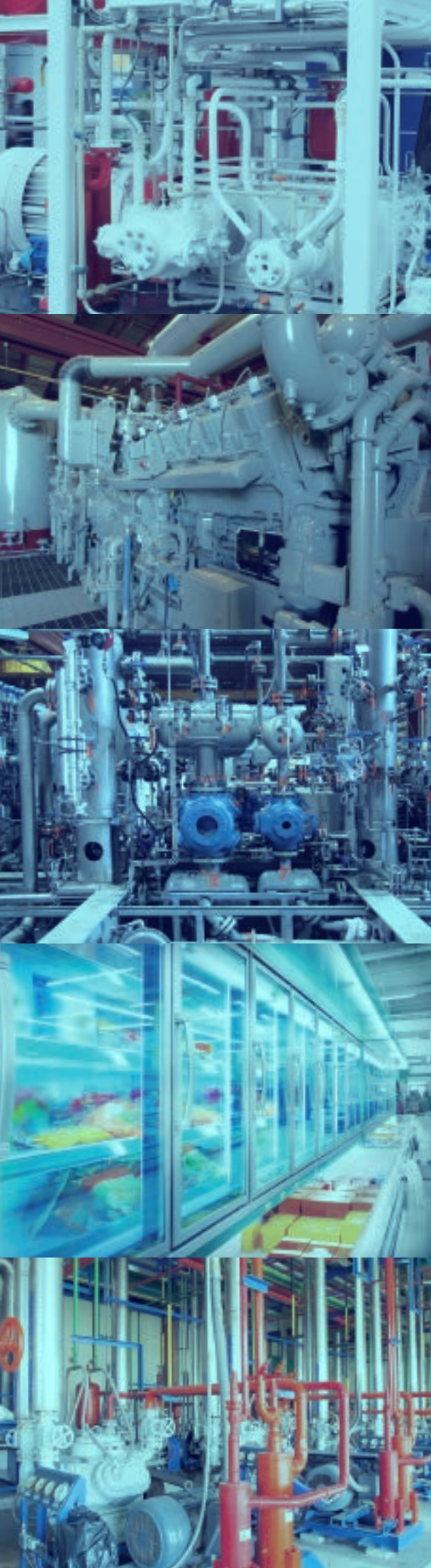


YASKAWA



YASKAWA AC DRIVES
Application Solution

Compressor



YASKAWA AC Drive
GA700



YASKAWA Matrix Converter
U1000

YASKAWA provides the answers to your compressor needs.

YASKAWA ELECTRIC always stands in the shoes of our customers and delivers the AC drive with the most uncompromising quality and performance ahead of others in the industry. Decades of certain application experiences allow us to provide AC drive features that is prompt and flexible solutions to your desire. Our loyal commitment to quality and ease of use make Yaskawa AC drive the best choice for all of your drive applications.



Application Benefit

- Energy efficiency at light load is substantially improved
- Realize the system minimization by high speed operation
- No need for a control panel while realizing the system minimization by improving the system design flexibility
- Realizing $K_5 = 0$ by using Matrix Converter
- Applicable to IPM motors for best performance in gas compression
- Regen capability and harmonics mitigation with one drive (U1000)



Product Lineup



YASKAWA AC Drive High Performance Type **GA700**

We have allowed for control of high efficiency motors, while keeping costs down to provide added value for all of your industrial applications.

[Applicable Motor Capacities]

200 V Class 0.4 to 110 kW
400 V Class 0.4 to 630 kW



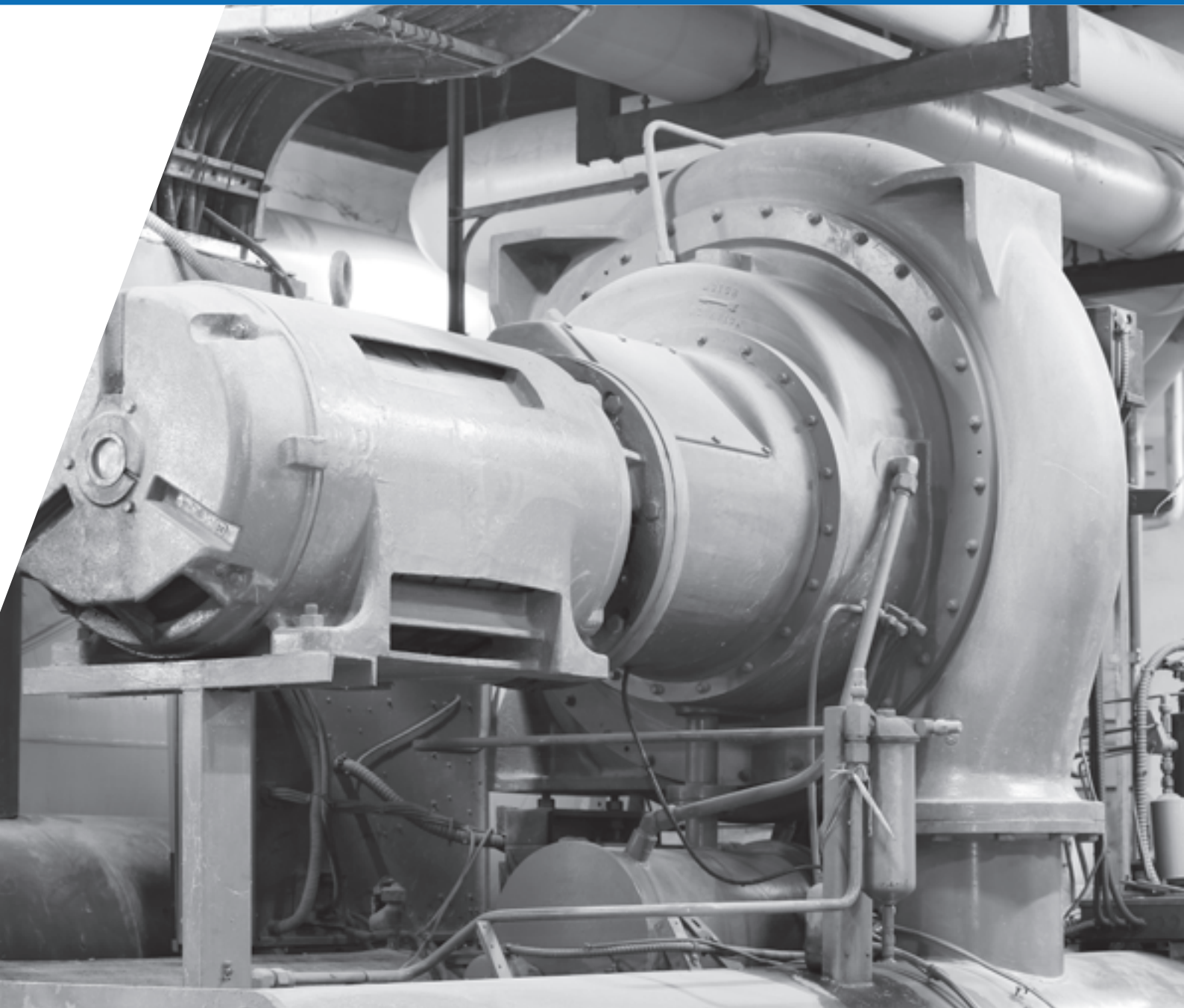
YASKAWA Matrix Converter **U1000**

The U1000 is a compact and total all-in-one solution with ultra-low harmonics and full regenerations. The ultimate choice for power quality and energy savings.

[Applicable Motor Capacities]

200 V Class 5.5 to 55 kW
400 V Class 2.2 to 500 kW

Note: The kW capacity range serves as a guide.



Recommended AC drives

■ Turbo (Centrifugal Compressors)

GA700

U1000

■ Capacity (Reciprocating Compressors)

GA700

U1000

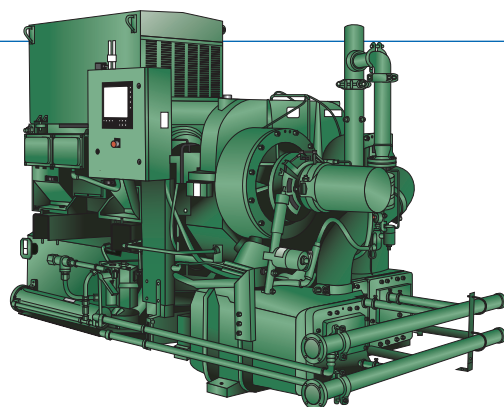
■ Capacity (Screw Compressors)

GA700

U1000

Turbo

Centrifugal Compressors

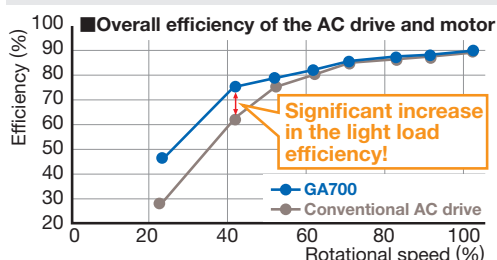


Answer 1

Energy efficiency at light load is substantially improved

Recommended
Product
GA700

The new control method will maximize the energy efficiency while monitoring the energy consumption to achieve the highest energy savings. The example shows how much kWh and CO₂ emission can be reduced per year.



Effect (Annual)

- Amount of power saving per year

Approx. **1,000 kWh**

- Reduction in CO₂ per year

Approx. **410 kg**

[Conditions]

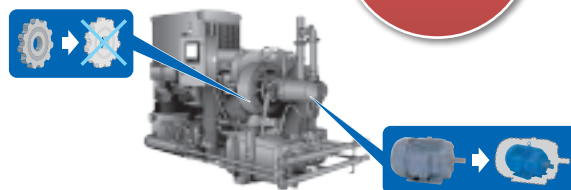
Application: Compressors
Motor: 7.5 kW (i.e. IE3 High efficiency motor)
Load factor: 40%
No. of annual operating days: 24 hours a day, 365 days a year
CO₂ coefficient: 0.412 (kg/kWh)

Answer 2

Realize the system minimization by high speed operation

Recommended
Product
GA700

The maximum operation frequency of standard GA700 is 590 Hz and it's able to operate high speed motors up to 1000 Hz with special software. Driving high speed motors directly eliminates the need for a high speed gear increasing energy saving, reducing system volume and lowering audible noise.



Answer 3

No need for control panel and realizing the system minimization by improving the system design flexibility

Recommended
Product
GA700

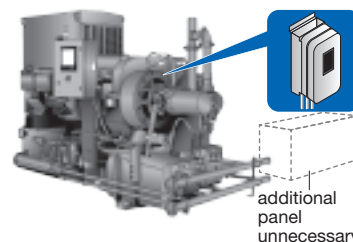
GA700 can be mounted both vertically and horizontally to best fit the system design and save space. (up to 75 kW*¹, airflow and de-rating are needed)
With the additional protection configuration, the GA700 can meet an IP55 rating without an additional panel*².

*¹: Horizontal installation is supported up to 75 kW.
*²: Under preparation.

■ Horizontal installation is possible



■ IP55-compatible (Factory option)



Answer 4 Realizing $K_s = 0$ by using Matrix Converter



It is possible to achieve high harmonic suppression ($K_s = 0$) without using additional peripheral equipment (e.g. PWM converter, reactor and high harmonic filter) that was necessary conventionally by implementing the U1000 matrix converter. This reduces the control panel housing space and the number of wires to contribute to space saving. Furthermore, it is possible to reduce the surrounding facility power generator and power capacity in addition to reducing the control panel. This achieves a reduction in total costs.

Strength No High Harmonics

	Power Current Waveform Samples	Input Current Spectrums	Current Distortion	Power factor
<p>AC drive without reactor</p>			88%	0.75
<p>AC drive with DC reactor</p>			33%	0.9
<p>Matrix Converter U1000</p>			5%	0.98

Guidelines of Harmonics Reduction Clear

Conforms to IEEE519

Reduce power supply capacity

Realization of an All-in-one High Harmonic Measure System

Control Panel Configuration Example

[Conventional Configuration]

Requires wide space for wiring

Peripheral equipment is required for high harmonic measures

[U1000 Matrix Converter Configuration]

There is no need for peripheral equipment for high harmonic measures

Saving on energy during manufacturing

65% reduction in the installation area

70% reduction in the wiring

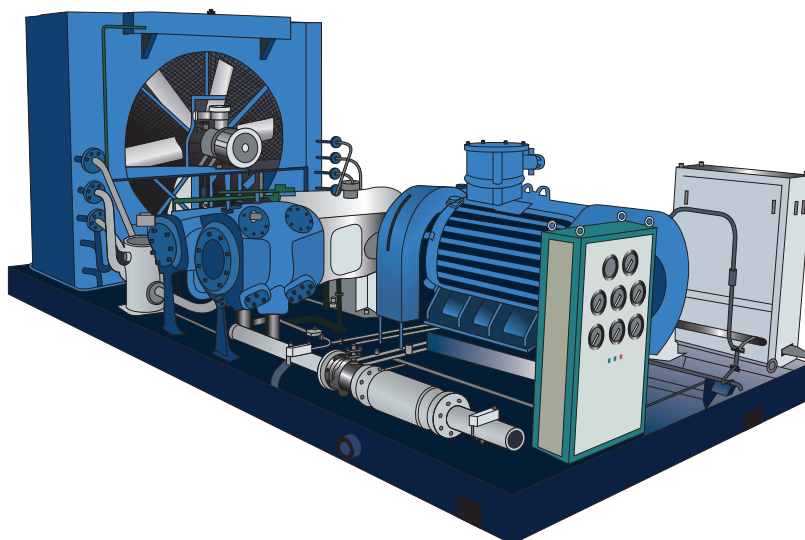
19% reduction in losses

43% reduction in installation costs

Note: Wiring and area: 400 V and 30 kW example / Efficiency: 400 V and 15 kW example / Cost: 400 V and 45 kW example

Capacity

• Reciprocating Compressors

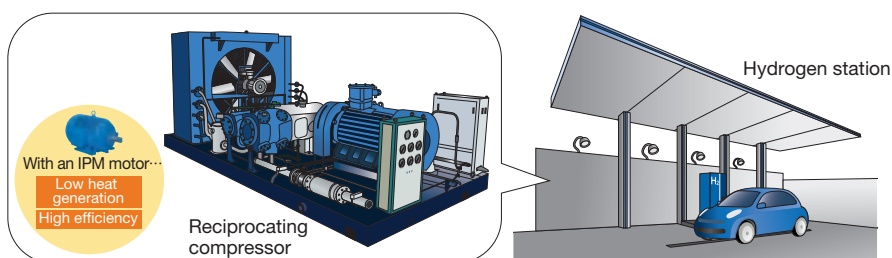


Answer 1

Applicable to IPM motors for best performance in gas compression

Recommended Product
GA700

The high performance advanced vector control without PG allows stable and smooth startup while suppressing the starting current. Ex. Reciprocating compressor for a Hydrogen station.



[Startup torque] 200%/0 min⁻¹
Conditions: In the case of advanced vector control without PG for PM

Answer 2

No need for control panel and realizing the system minimization by improving the system design flexibility

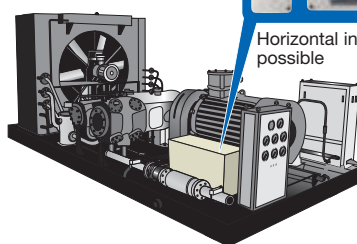
Recommended Product
GA700

GA700 can be mounted both vertically and horizontally to best fit the system design and save space. (up to 75 kW*¹, airflow and de-rating are needed)
With the additional protection configuration, the GA700 can meet an IP55 rating without an additional panel*².

*1: Horizontal installation is supported up to 75 kW.

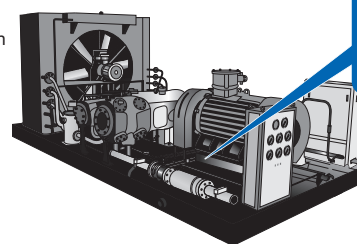
*2: Under preparation.

■ Horizontal installation is possible



Horizontal installation possible

■ IP55-compatible (Factory option)



additional panel unnecessary

Answer **3**

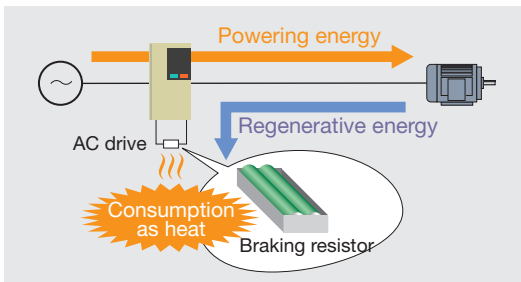
Achieve the processing of regenerative energy that generates during deceleration and high harmonic measures with a standalone unit



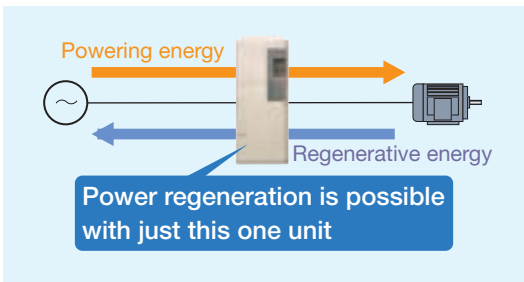
It is possible to achieve high harmonic suppression ($K_s = 0$) without using additional peripheral equipment (e.g. PWM converter, reactor and high harmonic filter) that was necessary conventionally by implementing the U1000 matrix converter. This reduces the control panel housing space and the number of wires to contribute to space saving. Furthermore, it is possible to reduce the surrounding facility power generator and power capacity in addition to reducing the control panel. This achieves a reduction in total costs.

Strength 1 Energy Saving with Use of Regenerative Energy

[Braking Resistance System]



[U1000 Matrix Converter]



Strength 2 No High Harmonics

	Power Current Waveform Samples	Input Current Spectrums	Current Distortion	Power factor
AC drive without reactor			88%	0.75
AC drive with DC reactor			33%	0.9
Matrix Converter U1000			5%	0.98

Guidelines of Harmonics Reduction Clear

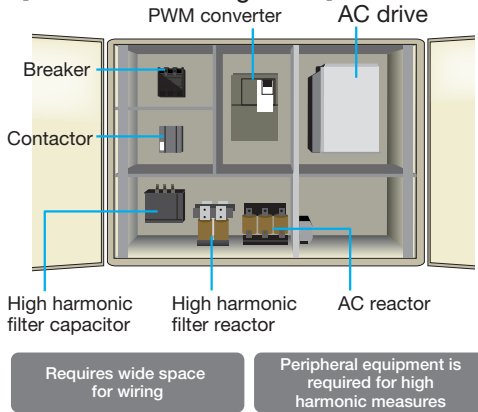
Conforms to IEEE519

Reduce power supply capacity

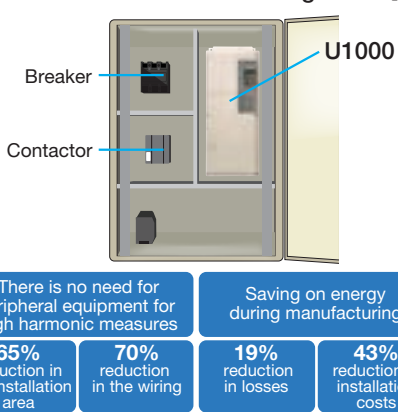
Realization of an All-in-one High Harmonic Measure System

Control Panel Configuration Example

[Conventional Configuration]



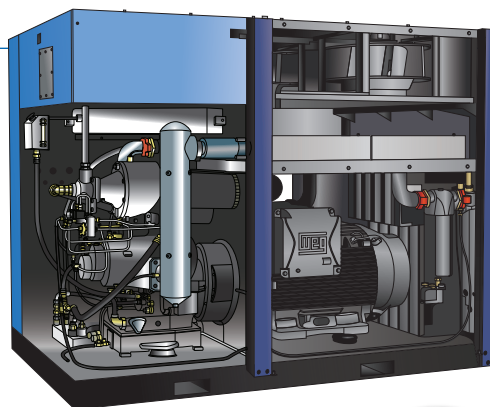
[U1000 Matrix Converter Configuration]



Note:
Wiring and area: 400 V and 30 kW example /
Efficiency: 400 V and 15 kW example /
Cost: 400 V and 45 kW example

Capacity

•Screw Compressors (Single / Twin)

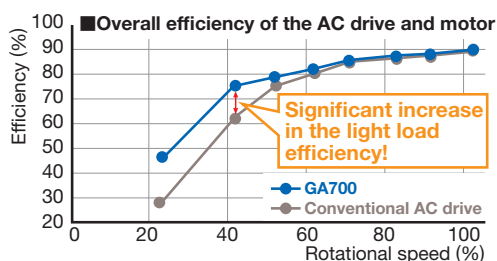
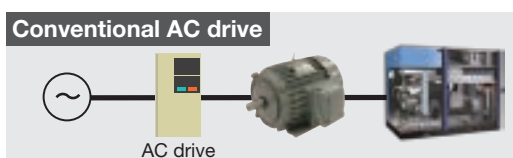


Answer 1

Energy efficiency at light load is substantially improved

Recommended
Product
GA700

The new control method will maximize the energy efficiency while monitoring the energy consumption to achieve the highest energy savings. The example shows how much kWh and CO₂ emission can be reduced per year.



Effect (Annual)

- Amount of power saving per year

Approx. **1,000 kWh**

- Reduction in CO₂ per year

Approx. **410 kg**

[Conditions]

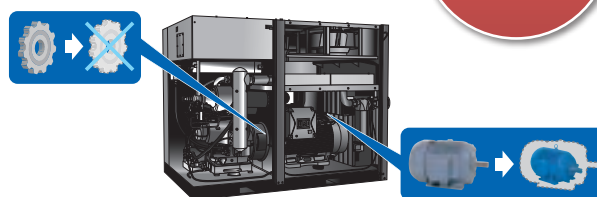
Application: Compressors
Motor: 7.5 kW (i.e. IE3 High efficiency motor)
Load factor: 40%
No. of annual operating days: 24 hours a day, 365 days: a year
CO₂ coefficient: 0.412 (kg/kWh)

Answer 2

Realize the system minimization by high speed operation

Recommended
Product
GA700

The maximum operation frequency of standard GA700 is 590 Hz and it's able to operate high speed motors up to 1000 Hz with special software. Driving high speed motors directly eliminates the need for a high speed gear increasing energy saving, reducing system volume and lowering audible noise.



Answer 3

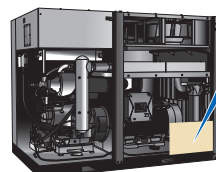
No need for control panel and realizing the system minimization by improving the system design flexibility

Recommended
Product
GA700

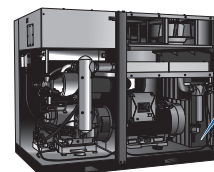
GA700 can be mounted both vertically and horizontally to best fit the system design and save space. (up to 75 kW*¹, airflow and de-rating are needed)

With the additional protection configuration, the GA700 can meet an IP55 rating without an additional panel*².

■ Horizontal installation is possible



■ IP55-compatible (Factory option)



*1: Horizontal installation is supported up to 75 kW.
*2: Under preparation.

Answer 4 Realizing $K_5 = 0$ by using Matrix Converter



It is possible to achieve high harmonic suppression ($K_5 = 0$) without using additional peripheral equipment (e.g. PWM converter, reactor and high harmonic filter) that was necessary conventionally by implementing the U1000 matrix converter. This reduces the control panel housing space and the number of wires to contribute to space saving. Furthermore, it is possible to reduce the surrounding facility power generator and power capacity in addition to reducing the control panel. This achieves a reduction in total costs.

Strength No High Harmonics

	Power Current Waveform Samples	Input Current Spectrums	Current Distortion	Power factor
<p>AC drive without reactor</p>		<p>Total Harmonic Distortion (Current)</p>	88%	0.75
<p>AC drive with DC reactor</p>		<p>Total Harmonic Distortion (Current)</p>	33%	0.9
<p>Matrix Converter U1000</p>		<p>Total Harmonic Distortion (Current)</p>	5%	0.98

Guidelines of Harmonics Reduction Clear

Conforms to IEEE519

Reduce power supply capacity

Realization of an All-in-one High Harmonic Measure System

Control Panel Configuration Example

[Conventional Configuration]

Requires wide space for wiring

Peripheral equipment is required for high harmonic measures

[U1000 Matrix Converter Configuration]

There is no need for peripheral equipment for high harmonic measures

Saving on energy during manufacturing

65% reduction in the installation area

70% reduction in the wiring

19% reduction in losses

43% reduction in installation costs

Note: Wiring and area: 400 V and 30 kW example / Efficiency: 400 V and 15 kW example / Cost: 400 V and 45 kW example

Compressor

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In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply. Specifications are subject to change without notice for ongoing product modifications and improvements.

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