

FACTS

from Ronk Electrical Industries, Inc.

Bulletin 2981

Static Phase Converters



ADD-A-PHASE® POWER CONVERTER

UL Listed and CSA Approved Models Available

FREQUENTLY ASKED QUESTIONS & ANSWERS

GENERAL

What is the ADD-A-PHASE® power converter?

It is a static converter capable of producing symmetrical three-phase currents from a single-phase source. The name, ADD-A-PHASE®, implies a phase is added to the already present single-phase. This is true—and is accomplished by an autotransformer and a capacitor bank along with the motor's impedance. Through this combination a third phase is introduced whose relation to the other two comprises symmetrical three-phase. The motor can then be made to operate as if it were connected to a three-phase power line.

What horsepower ratings are available with the ADD-A-PHASE®?

Standard types are available from 1 through 100 HP. Units up to 150HP have been constructed. Where high horsepower loads are to be operated the power supplier should be consulted to determine that the single-phase line capacity is sufficient to carry the load.

What are typical applications?

The ADD-A-PHASE® has been successfully applied to operate motors on many different kinds of equipment. Some of the principle applications are pumps, fans, valve actuators, oil pump jacks, and piston type compressors.

What motor speeds can be satisfactorily operated with the standard ADD-A-PHASE®, Type 2S?

Speeds of 3600 and 1800 can be operated from the standard units. For speeds below 1200 RPM, the PHASE-SHIFTER® may be a better choice, depending on the motor's power factor.

Are special models of the ADD-A-PHASE® available?

Yes. Consult the factory for details. Our engineers are always willing to work on problems arising from specialized applications.

Is the ADD-A-PHASE® available for 120 volt operation?

Yes. However, the 120 volt converter is not a standard production item due to limited demand. The factory should be consulted for prices and delivery.

Is the ADD-A-PHASE® available for 50 cycle as well as 60 cycle?

Yes. The basic ADD-A-PHASE® types are designed for 60 cycle, but 50 cycle units are available. Again, consult the factory for prices and delivery.

Is the ADD-A-PHASE® available for 480 volt or 575 volt operation?

Yes. The units for 480 volt are cataloged but the factory should be consulted for 575 volt operation.

Can the ADD-A-PHASE® operate an air conditioner?

Yes. Most air conditioners can be operated with the Type 2SAC. Note any additional three-phase motors, like evaporator fan motors. Multi-motor ADD-A-PHASE® units will be required for these systems.

Can the ADD-A-PHASE® be applied to submersible pumps?

Yes. It is necessary to check the full load amp rating of the motor. If the FLA of the submersible's motor is higher than a standard NEMA motor's FLA of the equivalent horsepower, the Type "SUB" should be used.

Can 480 volt three-phase motors be operated from a 240 volt single-phase line?

Because of voltage drop, wiring size, starter size, etc., it may be desirable to operate large motors, submersible pumps, etc., at 480 volts when only 240 volt single-phase is available; the Type "3" ADD-A-PHASE® is designed for these applications. Other special voltages are also available such as 240 in/208 out. Consult the factory for pricing and specifics.

How does the ADD-A-PHASE® benefit the utility?

The ADD-A-PHASE® draws close to unity power factor while the motor is starting and running, resulting in lower line current and lower losses in line voltage. The inrush current of the ADD-A-PHASE® and three-phase motor is only 3 to 4 times the running current.

Will a three-phase motor produce 100% rated power when operated through the ADD-A-PHASE®?

Yes. The ADD-A-PHASE® is the only static converter for which this is possible due to its autotransformer design. In fact, continuous overload (service factor) operation is available that equals the permissible overload of the average three-phase motor (1.15).

Note: while this operation is possible, some motor manufacturers (notably submersible pump motor manufacturers) may not warranty their motors if it is operated into its service factor range while powered by a phase converter. In practice, it is best to avoid service factor operation if possible to assure normal life expectancy of equipment.

Can the ADD-A-PHASE® be used to operate a motor larger than the rating of the converter?

It is not recommended, however, there may be applications where the load of the motor is reduced and within the rating of the converter. Extreme caution should be observed, and it is advisable to contact the factory before attempting such an operation.

Sales Information: 1-800-221-7665



Service & Support: 1-217-563-8333

FREQUENTLY ASKED QUESTIONS & ANSWERS

Can the ADD-A-PHASE® operate smaller motors than the rating of the converter?

Yes. The design of the autotransformer converter permits a smaller motor to be operated with capacitor adjustments.

Can more than one motor be operated from a single ADD-A-PHASE®?

The DUO ADD-A-PHASE® is designed specifically for independent or simultaneous operation of two motors. Special models are also available for other multiple motor applications. Consult the factory for recommendation.

Can two speed motors be operated satisfactorily?

RONK offers converters to operate two speed applications. The DUO ADD-A-PHASE® or Auto Adjust ADD-A-PHASE® can be used for some two-speed motors. Consult the factory for recommendation.

Is the ADD-A-PHASE® suitable for outdoor installations as well as indoor?

Although the ADD-A-PHASE® is primarily designed for indoor installation, the louvered enclosure is drip proof and may be mounted outdoors.

Can the ADD-A-PHASE® be installed and operated in damp underground locations?

Yes. An example would be the many satisfactory applications in underground sewage lift stations.

Is the ADD-A-PHASE® available in an explosion-proof enclosure?

No. Normal heat rise of components requires sufficient cooling, one of the factors which has made the explosion-proof case impractical.

What is the life expectancy of the ADD-A-PHASE®?

The components selected and manufactured for the ADD-A-PHASE® have a life comparable to that of the average three-phase motor. This long life and reduced maintenance is one of the many advantages of the ADD-A-PHASE® over the conventional single-phase motor.

What is the availability of the ADD-A-PHASE®?

Distributors are located throughout the United States and Canada. Most ADD-A-PHASE® types are available from these distributors within a week (plus shipping time), except special application types, which may require slightly longer.

What is the need and availability of replacement parts?

The ADD-A-PHASE®, being a static device with only a few moving parts, is relatively free of maintenance. Should replacement parts be necessary, immediate shipment can be made from factory stocks, or they can be readily acquired from local sources.

What is the warranty of the ADD-A-PHASE®?

The ADD-A-PHASE® is warranted to be free from defects in material and workmanship under normal use and service for a period of one year from date of installation or 18 months from original date of shipment. A postpaid warranty validation card is supplied with each unit which must be filled out and returned to the factory within 15 days of installation to validate warranty.

TECHNICAL

What is the power factor during starting?

The power factor will be very high during starting, near unity. The ADD-A-PHASE® draws a reduced starting current during starting due to the capacitance built into the converter. Due to this, starting KVA is approximately that of the 3-phase across-the-line starting.

What is the power factor when the three-phase motor is supplied with energy from the ADD-A-PHASE®?

Independent laboratory studies rate the power factor of the converter at almost unity on the single-phase line. This feature is of extreme importance and advantage to both the power supplier and user. On the other hand, repulsion-induction single-phase motors have a power factor range of only 60 to 80%.

How close can the currents be balanced?

On a constant load application, balance can be effected as close as that of the three-phase motor operating from a three-phase line.

Are currents in balance under all conditions, particularly where a swinging load is encountered as with oil pumping?

No. Swinging load conditions necessitate the phases being balanced on installation for the maximum load. Where the load is reduced due to swinging, the unbalance should be disregarded insofar as none of the phases carries a current exceeding the nameplate rating. Minimal loss of efficiency is normally encountered.

Do the balanced current and voltage relationships exist only when both motor and converter are in normal operation under load?

Yes. The voltage that exists, with the converter energized and the motor off, will reflect the autotransformer's settings. They are only useful for identifying the phases and the tap setting. The motor must be connected, with its normal load applied, to take readings which verify, or can be used to achieve, balanced currents and voltages.

Can the ADD-A-PHASE® be balanced by checking output voltages?

Yes, but it is not recommended. For best results and accuracy, readings should be taken with an ammeter of the three leads to the motor. When the currents are balanced, the voltages should also be balanced.

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FREQUENTLY ASKED QUESTIONS & ANSWERS

What is the single-phase inrush current during starting?

When starting the three-phase motor through the ADD-A-PHASE® the inrush current ranges from 3 to 4 times the rated single-phase running current. This will be dependent upon the motor's code letter.

Will the ADD-A-PHASE® operate both "delta" and "wye" wound motors?

Yes. The type of winding in the motors is immaterial as far as the operation of the ADD-A-PHASE® is concerned. Unlike some other phase converters, the ADD-A-PHASE® will operate any configuration three-phase induction motor.

What starting torque can the standard ADD-A-PHASE® develop?

The standard Type 2S will develop a minimum of 150% starting torque, sufficient for most general applications.

Are models available which have a higher starting torque than the standard ADD-A-PHASE®?

Yes. Consult the factory if special starting conditions exist.

What breakdown torques can be expected?

The ADD-A-PHASE® will generally provide minimum breakdown torque of 150%. This greatly exceeds most motor load requirements. Higher breakdown torques are possible with some motors or with use of the Auto Adjusting ADD-A-PHASE®.

Does the three-phase motor operating through the ADD-A-PHASE® lose its normal efficiency?

No. The overall efficiency, when properly balanced, is the same as the motor's efficiency on a balanced three-phase line.

What is the overall efficiency of the ADD-A-PHASE®?

The overall efficiency is approximately 97%.

What about efficiency with other type converters?

Efficiencies with other types of converters, exclusive of the ADD-A-PHASE®, are limited to 80% or less, since the phase currents are not normally balanced or a rotating element must be maintained.

What is the voltage input to the ADD-A-PHASE®?

The voltage input should be within 10% of rated voltage.

How is the ADD-A-PHASE® affected by low voltage?

As with a motor, too low a voltage can create a malfunction of the converter, particularly during starting. If low voltage is encountered, the cause should be determined and corrected.

Is there a limitation to the number of starts per hour?

The general purpose ADD-A-PHASE® incorporated electrolytic capacitors which are designed for twenty starts of three second duration, or ten-six second starts per hour. If more starts per hour are required, other types (HE & HD) are available.

Is there an ADD-A-PHASE® type with no limitation to the number of starts per hour?

Yes. The Type HD, which does not incorporate electrolytic capacitors.

Can an across-the-line magnetic starter be installed?

Yes, and it is recommended with all installations. Consult the factory if anything other than an across-the-line starter is supplied with the equipment. Three-phase electronic "soft" starters cannot be used with the ADD-A-PHASE®.

Where should the magnetic starter be installed?

Between the motor and the ADD-A-PHASE®, in accordance with the instructions which accompany each unit.

Can an ADD-A-PHASE®/three-phase motor be automatically controlled?

Yes. Power for the control circuits should be taken from the single-phase or the B-C phase of the converter.

May three-phase unbalance protection equipment be used with ADD-A-PHASE®/three-phase motor installations?

This is not recommended because of the voltages that exist when the motor is off. If over/under voltage protection is necessary, it should be used across the two single-phase power leads only. Current monitors that do not look at voltage can be used, however.

What auxiliary equipment is required and recommended?

A single-phase fused disconnect switch and an across-the-line magnetic starter with overload protection is required. A three-phase disconnect may also be required where the "in sight" rule in Section 430 of the NEC applies.

What size single-phase switch is required?

The installation should include a single-phase switch sufficient to carry the single-phase FLA of the ADD-A-PHASE®, plus other auxiliary equipment, if any, on the single-phase line. These fuses must be of the lag type to allow starting of the motor.

Within what temperature range should the ADD-A-PHASE® be operated?

For best operating results the ADD-A-PHASE® should be operated within a temperature range of -25 degrees F. to 110 degrees F.

FREQUENTLY ASKED QUESTIONS & ANSWERS

Must the ADD-A-PHASE® be installed near the motor?

Not necessarily. The ADD-A-PHASE® can be located at any reasonable distance from the motor. When the unit is to be located at a considerable distance it may be necessary to increase the wire size to compensate for loss of voltage. Also, "in-sight" rules of Section 430 of the NEC may apply. Consult the converter wiring diagram and NEC before installation.

Can the single-phase be applied to the ADD-A-PHASE® at all times, and the motor controlled from the three-phase side?

Yes, idle losses are very low. These are due to eddy current losses in the transformer and range from 5-200 watts depending on the size and type of the ADD-A-PHASE®.

What KVA transformer is required per horsepower of motor load?

Generally, with the induction motor, 1 KVA is recommended per HP. Since losses in the ADD-A-PHASE® are very low, this same guideline is recommended for ADD-A-PHASE® applications; 1 KVA per connected HP.

Why does RONK manufacture both rotary and static converters?

Satisfactory converter operation requires application of the best converter for the job. Only RONK provides the broad product line and experience necessary to provide a converter for any application providing the best performance at the lowest cost.

How does the ADD-A-PHASE® differ from the ROTOVERTER® and ROTO-CON®?

The ADD-A-PHASE® is a static phase converter, whereas, the ROTOVERTER® and ROTO-CON® are rotary types. Rotary converters are best applied to applications when several motors operate independently or for non-motor loads.

What are the determining factors in selecting a static or rotary phase converter?

ADD-A-PHASE® is usually recommended for single motor applications that operate at constant loads, though there are some exceptions such as multi-speed motors. In these applications, where automated operation is required, the ADD-A-PHASE® is generally recommended. A rotary converter is usually recommended for the operation of a group of motors or motors with varying loads. The rotary converter is also recommended for three-phase resistive, rectifier, or electronic loads.

Does the ADD-A-PHASE® cost more than rotary converters?

Rotary converters may be significantly less expensive for multiple-motor applications where load characteristics allow their use. However, additional equipment is often required when rotary converters are used in automated applications, which raises the installation and maintenance costs. The ADD-A-PHASE®'s higher efficiency offers significant savings in operating costs. These savings can offset its higher initial cost.

How do the maintenance costs of the ADD-A-PHASE® compare to that of a rotary converter?

The ADD-A-PHASE® has no moving parts and will generally require less service.

Is the efficiency of the ADD-A-PHASE® higher than that of the ROTOVERTER® and ROTO-CON®?

Yes. The losses will be greater in a rotary converter. The losses are much greater when the rotary converter is running, but has no load applied.

Can the phase currents be more closely balanced using ADD-A-PHASE® than a rotary converter?

Generally they can be, however, adjustments are available on both the ADD-A-PHASE® and ROTOVERTER® for balancing of all three of the phase currents. The ROTOVERTER® is the only rotary converter that provides this capability.

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