Installation of ACN/ACW644 +V991 Spare part Phase module kit and operation instructions AND dc-capacitor reforming guide

1. Rules for parallel connected ACN/ACW644 +V991 Spare part Phase modules

ATTENTION!! Parallel connection of the new +V991 type of phase module (or upgraded phase module) and old type of phase module is not allowed. It is extremely forbidden to run the drive with the +V991 phase module(s) and old type of phase module(s) in parallel. Serious IGBT failure is obvious if this rule is ignored!

- **In 1xR11i or 1xR12i drive, one phase module is minimum upgrade**
- **In 2xR11i or 2xR12i drive, two phase modules is minimum upgrade**
- **In 4xR11i or 4xR12i drive, four phase modules is minimum upgrade**
- **An example of minimum upgrade marked with [X] in figures 1 and 2 in the case phase W is damaged**

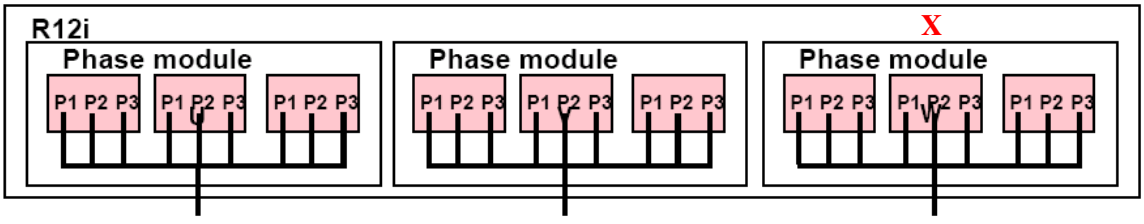


Figure 1. A principle drawing of parallel connected IGBTs in 1x R12i drive, minimum upgrade is one phase module.

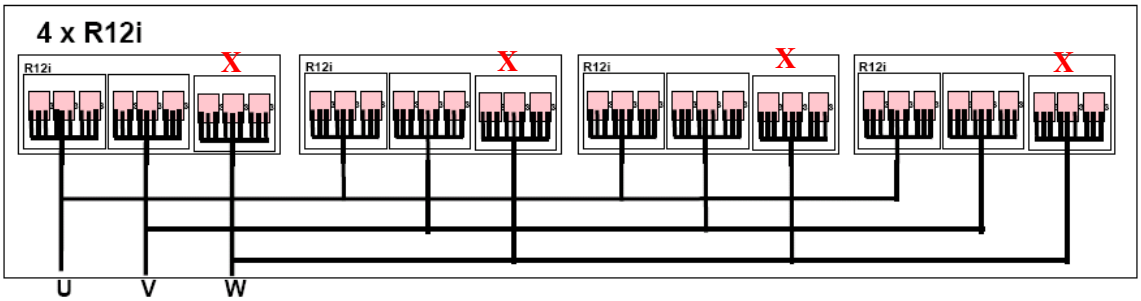


Figure 2. A principle drawing of parallel connected IGBTs in 4x R12i drive, minimum upgrade is four phase modules.

Minimum upgrade is marked with X in the case one phase module is damaged. In figures phase W is damaged.

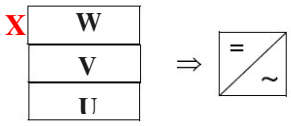
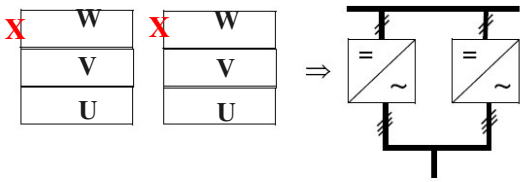
R12i	three phase modules (ACW 644 xxxx) = one inverter 
2 x R12i	two times three phase modules (ACW 644 xxxx) = two phase module blocks ⇒ one inverter 

Figure 3. A principle drawing of parallel connected IGBTs in 1x R12i and 2xR12i ACW600 Multidrive. Minimum upgrade is marked with [X] in the case one phase module is damaged. In figures phase W is damaged.

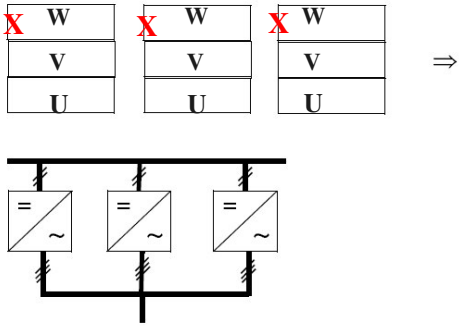
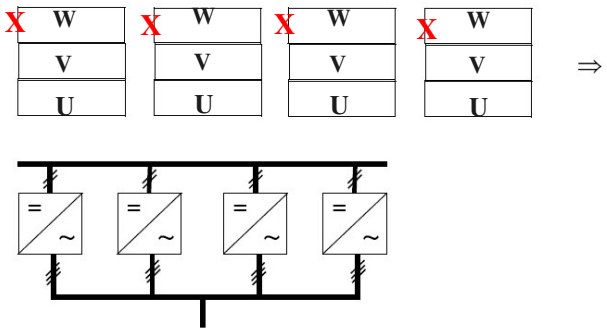
3 x R12i	three times three phase modules (ACW 644 xxxx) = three phase module blocks ⇒ one inverter 
4 x R12i	four times three phase modules (ACW 644 xxxx) = four phase module blocks ⇒ one inverter 

Figure 4. A principle drawing of parallel connected IGBTs in 3x R12i and 4xR12i ACW600 Multidrive. Minimum upgrade is marked with [X] in the case one phase module is damaged. In figures phase W is damaged.

2. Before installing operation

An ACN/ACW +V991 module is equipped with an *IGBT upgrade kit*, meaning that the *Powerplate* IGBT has been replaced by a *PrimePack* IGBT.

This document shows how to modify an ACX644 +V991 R10i, R11i or R12i V-phase module into a U/W -phase module, and how to connect +V991 modules during cabinet installation. This instruction substitutes the original instruction 63987751. When installing other than ACX644 +V991 modules, refer to the original document.

The spare part phase module kits always consist of:

- *V-phase module*
- *NXPP-01/02 control distribution board*
- *An extra base plate for NINT-XX*
- *Control board shield busbar and 4 M4x8 screws*
- *An insulating spacer screw*
- *Short-circuit adapter* connected to X414 on NINT-XX board (This only applies to sizes R10i and R11i, where NGPS-XX board is not used. In R12i NGPS-XX is always used.)
- *Configuration manual of main circuit interface board NINT-XX*
- *This document*

In case of installing an upgrade kit to an existing ACN644 phase module on site, refer to chapter 4 for instructions about cabinet installation.

3. Repairing of V-phase module with spare part +V991 phase module kit

a) Jumpers

The spare part module is ready to be installed as a V-phase module. In this case the included NXPP-XX board is not needed. First check the *current adjustment jumpers (S2…S4)* of NINT-XX that they are applicable for power plate ratings. The current adjustment procedure is explaned in the NINT-XX board configuration manual (3AFE 6149 8842).
Check from the documentation or from the phase module if NGPS-XX board is used or if there's a short-circuit adapter connected to X414 on NINT-XX. If NGPS-XX is not used, the short-circuit adapter can be taken from the old phase module or the one, that comes with the new spare part module, can be used as well.

b) Installation

Attach the module *electrically to (+) and (-) bus bars with screws at the top* and *mechanically to the frame of the cubicle with two clamps (or screws) at the top.* Connect the phase output bus bars of R12i modules with *three screws in the middle.* Connect the R10i and R11i modules with *one screw.* Attach all module types *to the frame with two screws* at the frontside bottom and the Marine models also with *two screws* at the backside bottom.

c) Note

Do not damage *black insulation parts* or *bus bars*, when installing the module. It is very important to check the *installation of flat cables*, *the output voltage measurement wires* and *insulation of the cables.* Remember to lock the *flat cables.* Check the *condition of fibre cable connectors* especially after power plate explosion. Check also the *installation* and the *bending radius of the fibre cables*. The radius must be more than 35 mm.

If adjacent U/W phase modules are of type +V991, see chapter 5 to ensure their correct connection.

4. Repairing of U- or W-phase modules with spare part +V991 phase module kit

a) Uninstalling of redundant boards

NOTICE! Remove every unnecessary board. They can be used as spare parts in other modules. Boards that can be removed are *NPOW-XX, NGPS-XX* and in 690V modules *NRED-61.*
Remove boards *with bottom plate*. Then it is easy to remove also *the supply cables (+) and (-) of NPOW-XX* and in 690V modules *NRED-61.* The supply cables are connected to the capacitor bank. In certain models the *cable of discharging resistor* is also connected to the capacitor bank. Check that the cable is fastened properly.
Undamaged *bottom plate of NPOW-XX board* can be reused from faulty phase module. The bottom plate is mounted to the both sides of the module with four or six screws.

b) In urgent cases

In urgent cases remove only the following cables of NGPS-XX and NPOW-XX boards:
NGPS-XX : X3 ----------> NINT-XX : X414
NPOW-XX : X32 ----------> NINT-XX : X42
Do not remove any boards. Let also NPOW-XX and for 690V modules NRED-61 remain connected. These boards do not influence on the operation of the drive. This case is described *as an option*, because removing of the supply cables of NPOW-XX and NRED-61 can last long.
IMPORTANT! Spacer modifications for U/W phase modules must be done in all cases, see following chapter c.

c) Configuring control pcb section from V-phase to U / W phase module

All new phase modules are delivered as a V-phase.
NOTICE! This method is different from one described in original ACX644 instruction 63987751. Follow steps 1-6 in order to ensure correct operation of the modules.

1. Disconnect control wires and remove the NINT-XX assembly (figure 1).

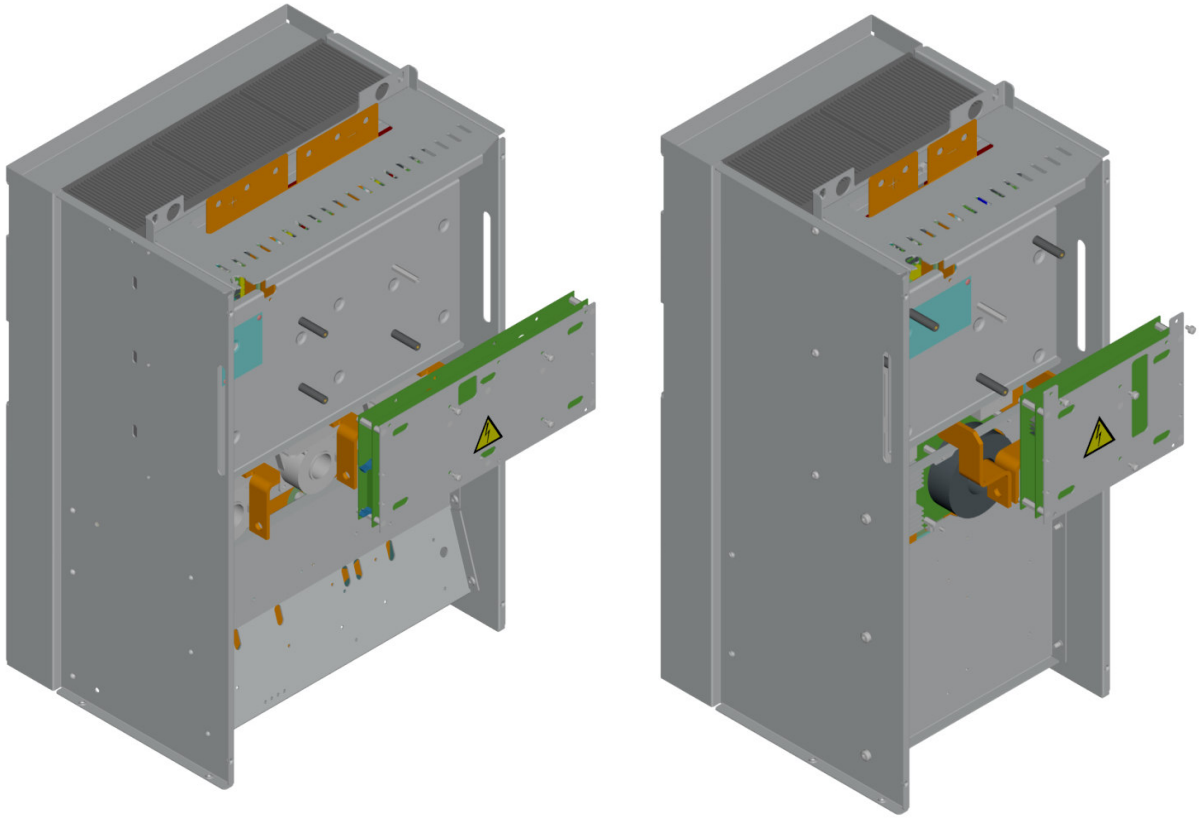


Figure 1. Remove 4 pcs M4x8 and the control pcb assembly
Left: R12i, right: R10i/R11i

2. Remove the NINT-XX subassembly. Replace the NINT-72C/73C with NXPP-02C/03C (figure 2).

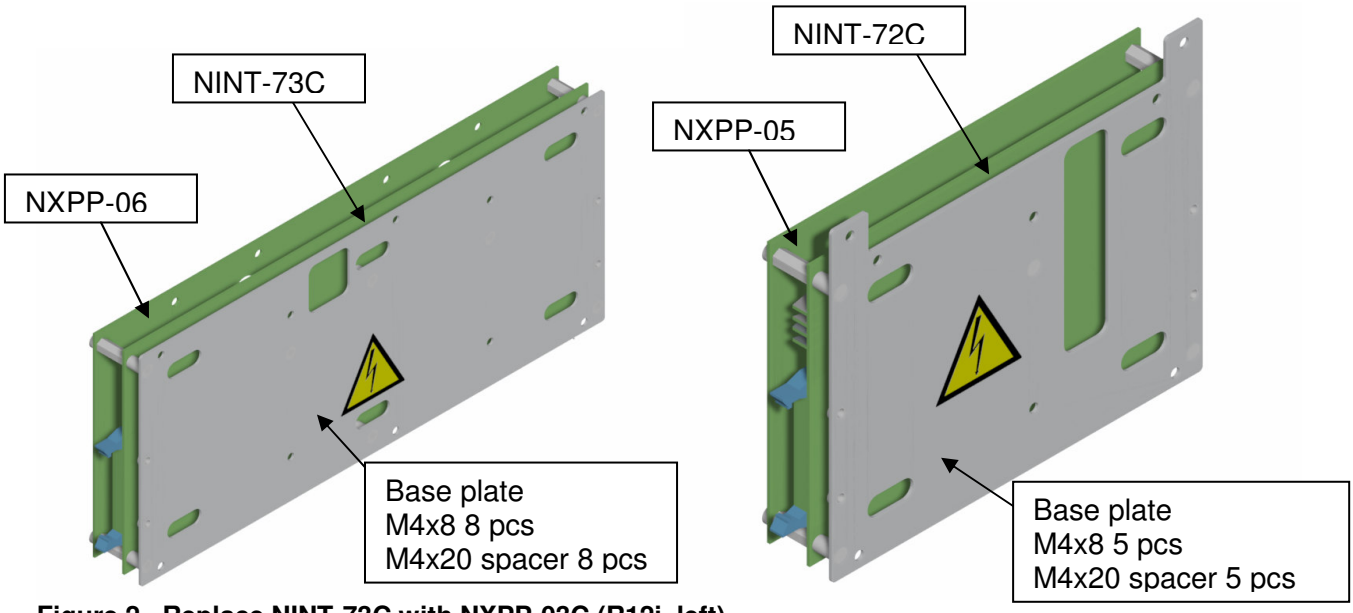


Figure 2. Replace NINT-73C with NXPP-03C (R12i, left)
Replace NINT-72C with NXPP-02C (R10i/R11i, right)

3. Remove the shield plate (figure 3). When removing note the positions of different spacer screws.

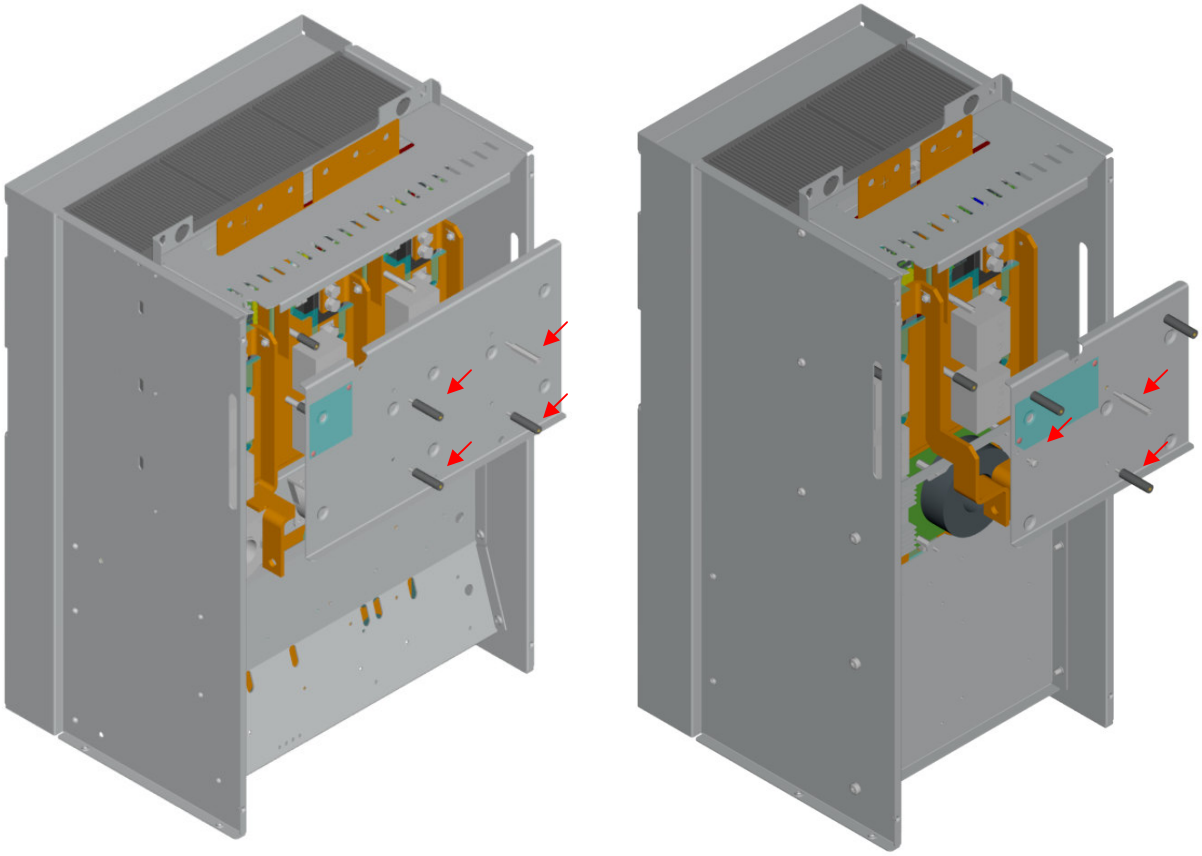


Figure 3. Remove the shield plate.
R12i (left): Remove 3 insulating spacers, 1 metal spacer and the shield plate.
R10i/R11i (right): Remove 1 insulating spacer, 1 metal spacer, 1 M4x8 screw and the shield plate.

4. Replace the metal spacer with a provided insulating spacer as shown in figure 4.

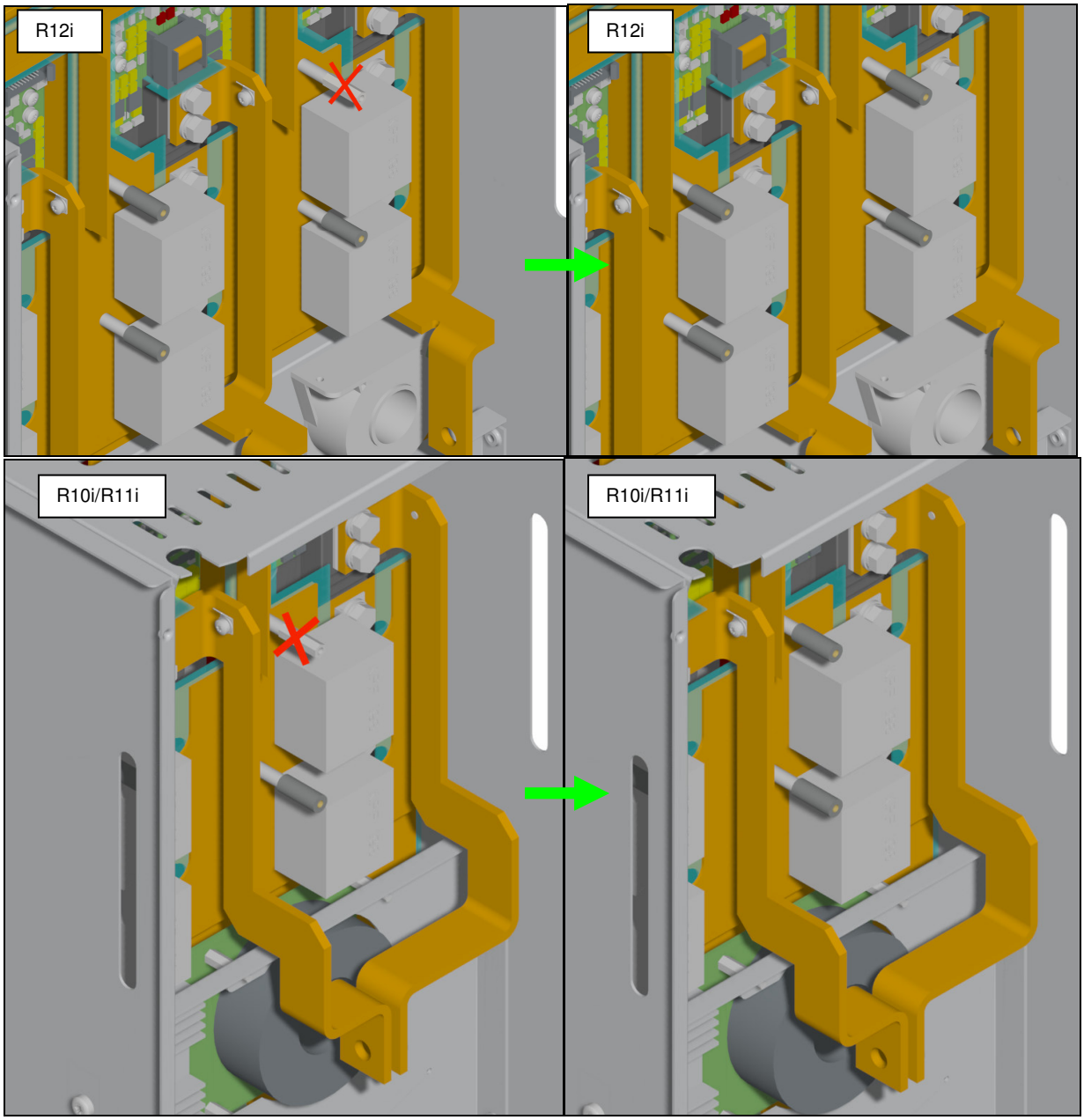


Figure 4. Replace 1 metal spacer with an insulating spacer.

5. Re-assemble the module by making steps 1-3 in reverse order.

6. Replace the *old NINT-XX board* of the V-phase module with the *new one from the new phase module*. This is done for precaution. Check the *current adjustment jumpers (S2…S4)* of NINT-XX that they are applicable for power plate ratings. The current adjustment procedure is explaned in the NINT-XX board configuration manual (3AFE 6149 8842).

5. Connecting +V991 phase modules in cabinet

When installing +V991 phase modules into cabinet, the control pcb base plates of phases U and W must be connected to the adjacent V-phase. This is done to ensure that the control cirquit's reference voltage is constant for all phases. Follow the instructions carefully, depending on whether the V-phase is of +V991 or the original type.

If only V-phase is of type +V991, no extra actions are needed after normal wiring and installation. (Figure 5)

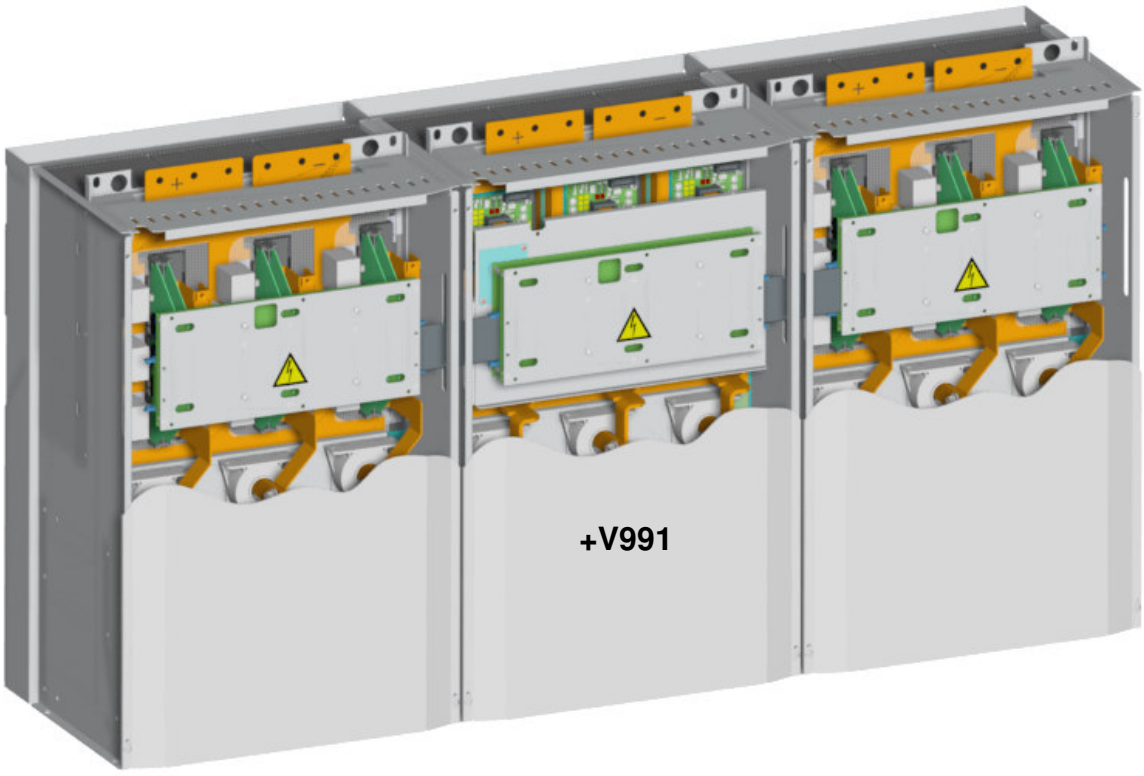


Figure 5. Example: V- phase with +V991 construction (R12i). Connecting phase modules is as with original ACS600 design.

Connecting +V991 U or W phase modules if phase V is <u>not</u> +V991

Replace the V-phase module's original NINT-xx base plate with the one provided in the spare part module kit. This must be done in order to attach the shield busbar between phase modules.

After installing and wiring the modules, connect the adjacent U/W- and V-phase modules' control board base plates to each other with the provided busbar and M4 screws. Slide the busbar over the flat cable through the holes on modules' side walls. See the examples in figures 6 and 7.

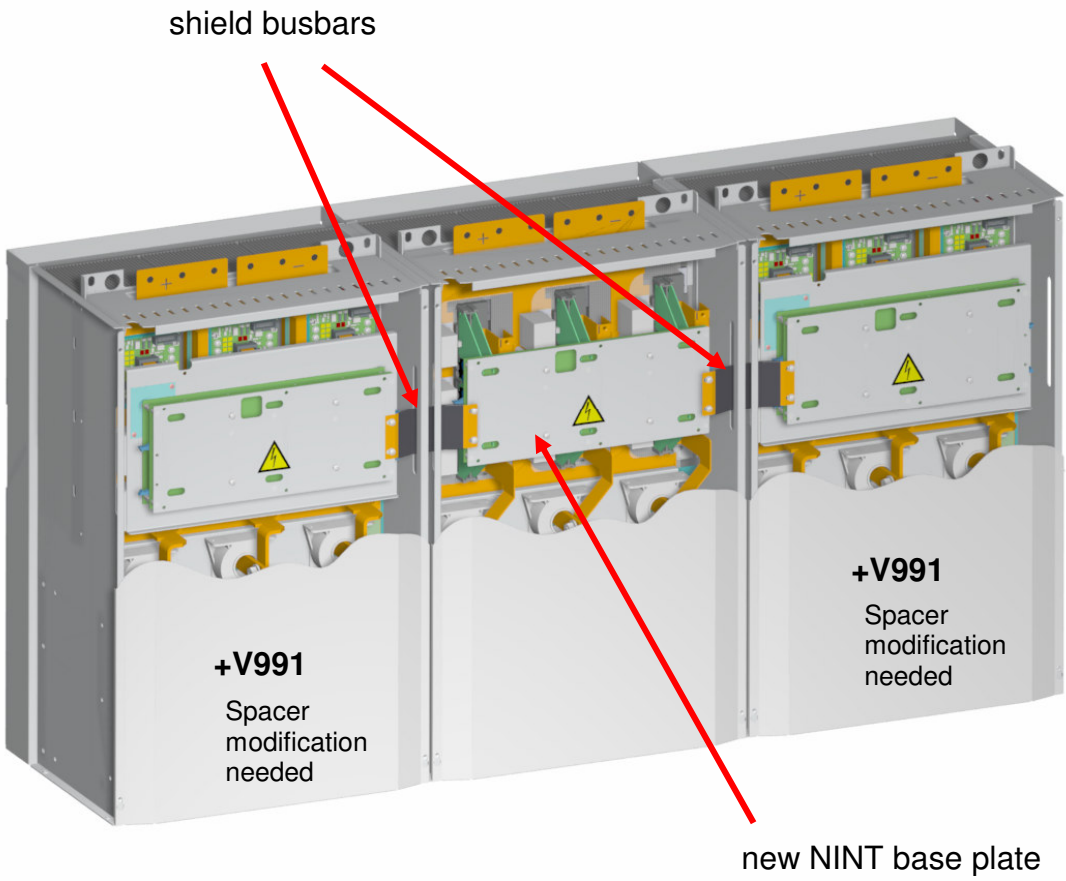


Figure 6. Example: U- and W- phases with +V991 construction (R12i). U- and W-phases are connected to V-phase with the shield busbar. The pcb base plate of V-phase is changed to a new version for attaching the shield busbar.

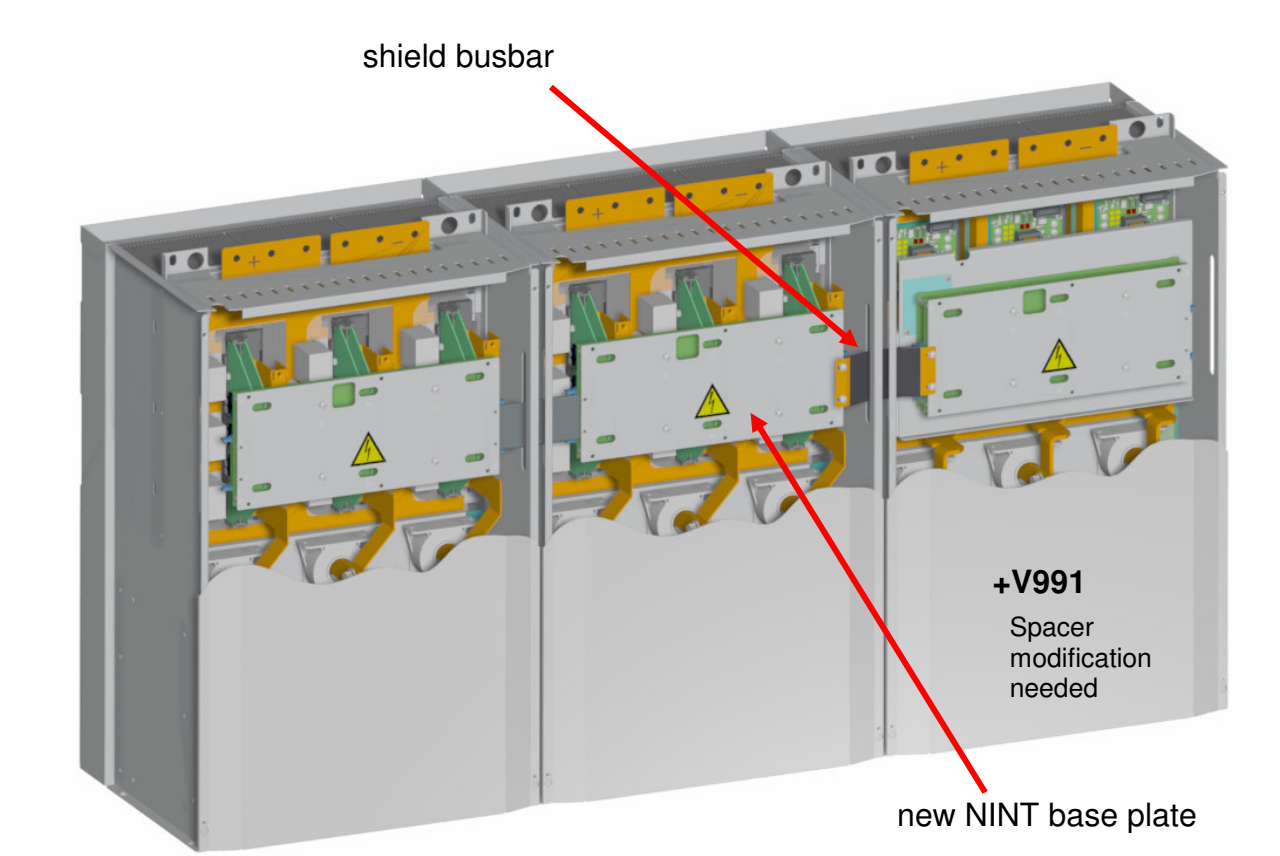


Figure 7. Example: W-phase with + V991 construction (R12i). W-phase is connected to V-phase with the shield busbar. The pcb base plate of V-phase is changed to a new version for attaching the shield busbar.

Connecting +V991 U or W phase modules if phase V is +V991

After installing the modules into cabinet, connect the adjacent U/W- and V-phase modules' control board base plates to each other with the provided busbar and M4 screws. Slide the busbar over the flat cable through the holes on modules' side walls. See the example in figure 8.

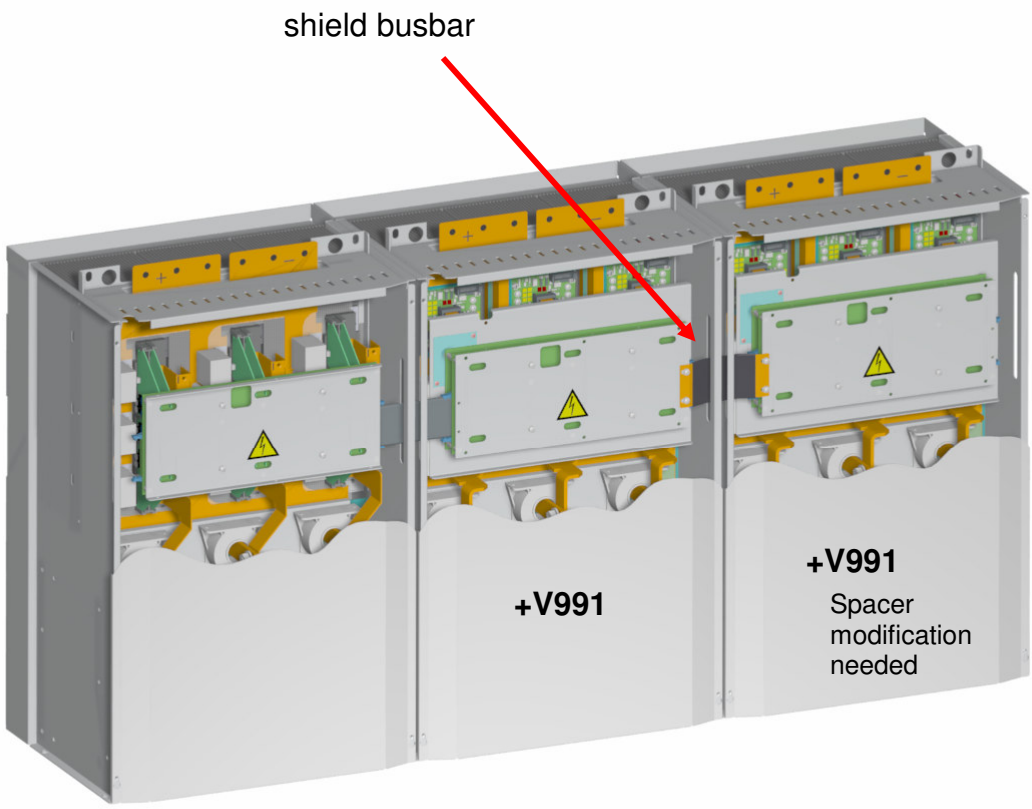


Figure 8. Example: V- and W-phase with + V991 construction (R12i). W-phase is connected to V-phase with the shield busbar.

6. Converter intermediate cirquit capacitor reforming (re-ageing) after storage

Introduction

Converter DC link capacitors need to be reformed (re-aged) if the converter has been non-operational for more than one year. Without reforming capacitors may be damaged when the converter starts to operate. The reforming methods introduced in this guide require, that the converter has been stocked clean and dry. It is recommended to reform the capacitors once a year.

How to check the converter age

Converter serial number defines the week, when the converter has been built:

- 7 digit: e.g. 7260034, 7 denotes manufacturing year (1997), 26 manufacturing week and 0034 running manufacturing number.
- 8 digit: e.g. 18250125, 1 denotes manufacturing country (1= Finland), 8 manufacturing year (1998), 25 manufacturing week and 0125 running manufacturing number.
- 10 digit: e.g. 1983200725, 1 denotes manufacturing country, 98 manufacturing year, 32 manufacturing week and 00725 running manufacturing number.

Reforming time

The intermediate circuit of the converter is kept in its nominal voltage for the reforming time to "wake up" the capacitors. The reforming time required depends on how long the converter has been stocked (non-operational).

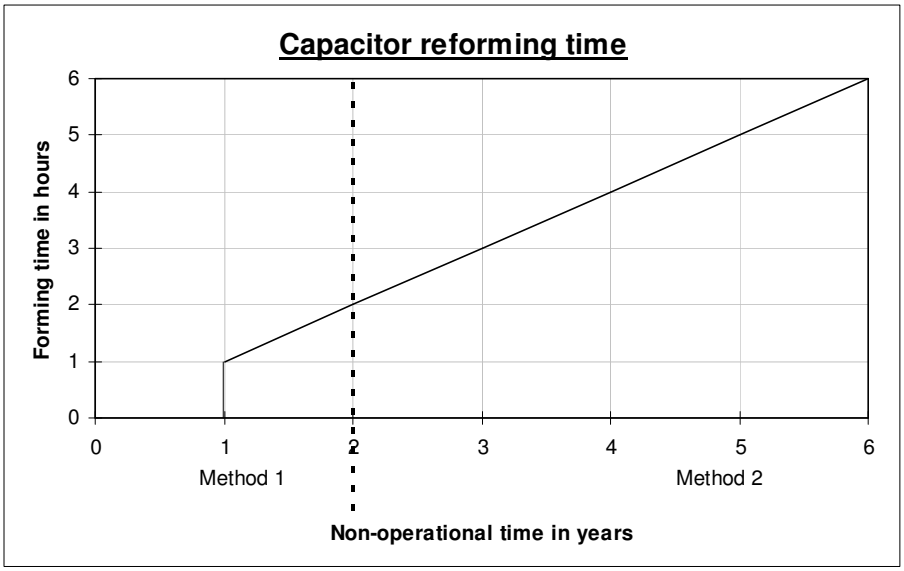


Figure 1. Capacitor reforming time for Method 1 and Method 2

Converters stocked (non-operational) less than 2 years

Switch the power on to the converter for a time given in Figure 1 (Method 1). The converter "wakes up" its capacitors by itself. Power the ACS 600 MultiDrive ACN 634 drive units and the ACx 604/607 units 0400-3, 0490-5 and 0490-6 and up once a year to keep the capacitors in operational condition.

Converters stocked (non-operational) for 2 years and over

Use method 2 A or method 2 B (below) for capacitor reforming if the converters have been stocked (non-operational) for two or more years.

WARNING! The inverter module of ACS 600 MultiDrive units and ACX 604/607 units 0400-3, 0490-5 and 0490-6 and up must be reformed outside the cabinet.

Method 2 A:

Capacitor reforming is realised by switching-in a rectifier and a resistor circuit, which is connected to the converter DC link. The reforming circuit is given below. Circuit component values for different voltages are given in the Table 1 below. See the reforming time from Figure 1.

WARNING! The converter supply must be disconnected, while reforming circuit is connected.

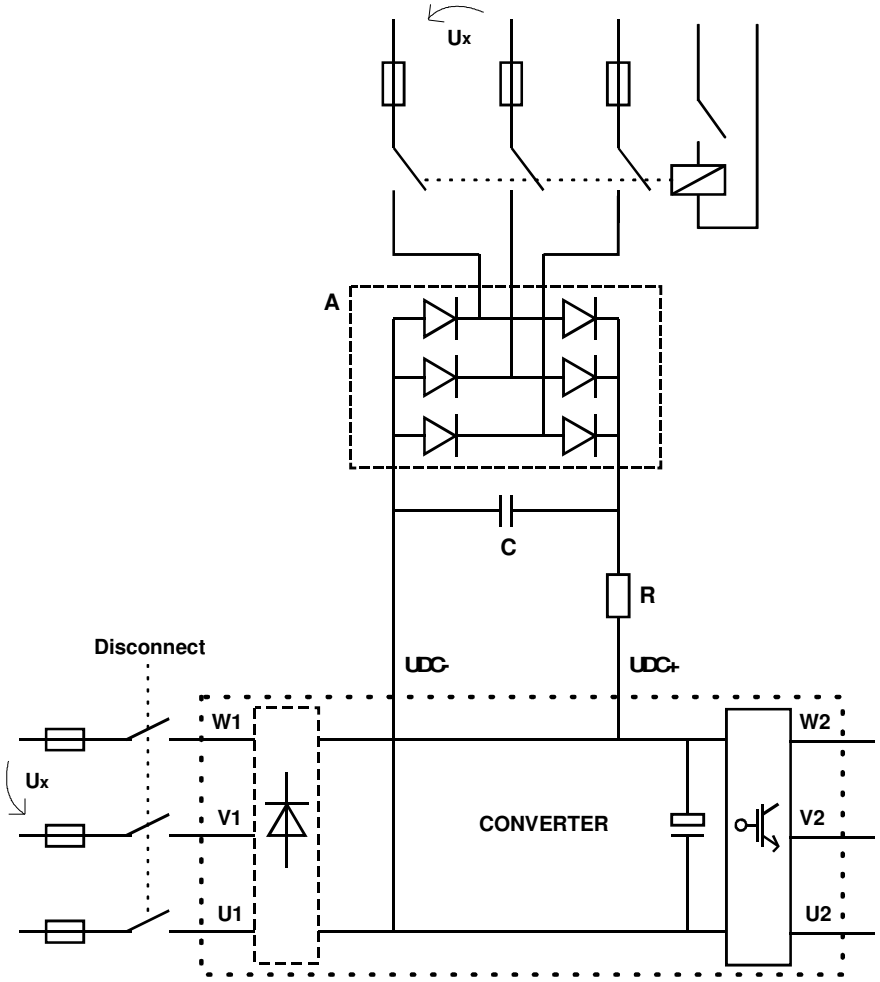


Figure 2: Reforming circuit for method 2 A.

	Recommended components		
	A	R	C
380 V < Ux < 415 V	SKD 82/16	220 Ohm / 700 W	22 nF / 2000 V
380 V < Ux < 500 V	SKD 82/16	470 Ohm / 1200 W	22 nF / 2000 V
525 V < Ux < 690 V	SKD 82/16	680 Ohm / 1700 W	22 nF / 2000 V

Table 1: Component values for reforming above.

Method 2 B:

Capacitor reforming is based on DC power supply, which is connected to converter DC link. Power supply current charges converter capacitors. If power supply cannot limit the current, voltage is increased gradually (with e.g. 100 V steps). Maximum recommended reforming current is 500 mA. An appropriate reforming voltage is (1.35... $\sqrt{2}$)x U_X. See reforming time from Figure 1.

WARNING! The converter supply must be disconnected, while reforming circuit is connected.

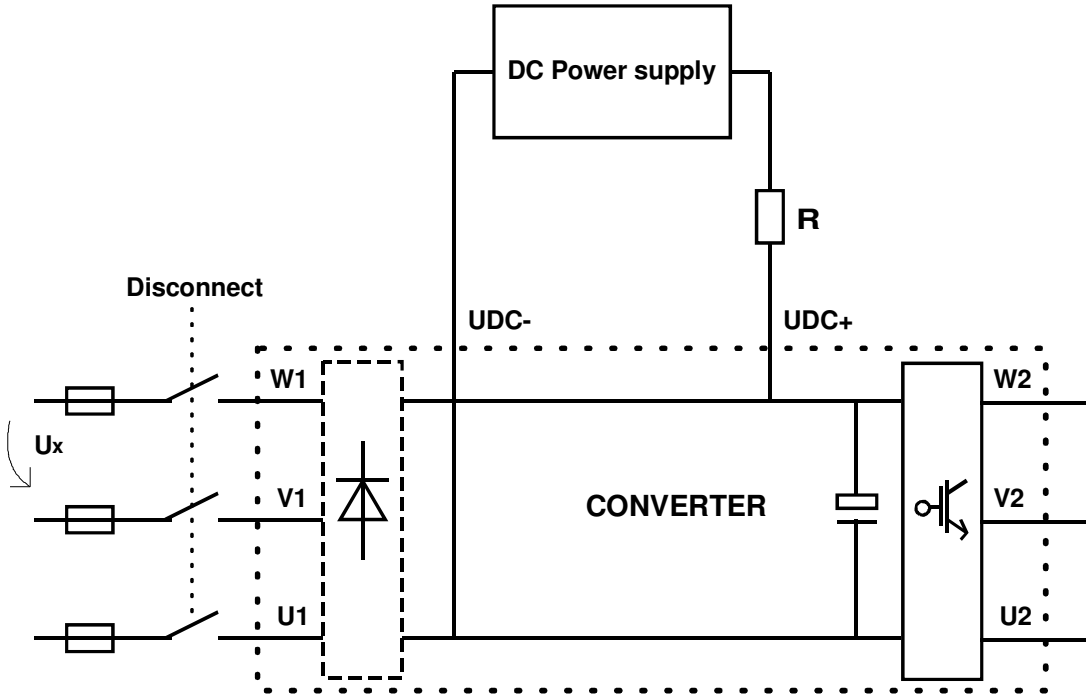


Figure 3: Reforming circuit for method 2 B. (R = 100 Ohm / 500 W)