

SERVICE NOTE

Advanced retrofitting kit solution

Direct Replacement EntelliGuard G to Emax 2 - IEC



With few modifications to your existing switchgear, retrofitting kits are a cost-effective solutions to upgrade your electrical system. The Direct Replacement retrofitting kits allows a very fast and reliable upgrade of EntelliGuard G circuit breakers and switch-disconnectors with Emax 2.

Air circuit breakers put into service many years ago might not provide the reliability and safety assurances required today. Making certain that people, equipment, and processes are properly protected is a growing concern.

When maintenance is no longer enough owing to lack of materials or when components are out of production, retrofit kits are the best solution. ABB Low Voltage Service offers a unique way to upgrade installed hardware and software to the next generation, by changing the worn or outdated parts while maintaining the original plant and equipment configuration. The kits are tested in the ABB SACE Division Lab, accredited by ACCREDIA and acknowledged by important international certification bodies such as ACAE / LOVAG, ANCE, ASTA, ETL SEMKO, UL, CSA and Naval Registers.

Safety and Service continuity

- Safety improvement.
- Service continuity guaranteed
- Ease of installation
- Reduction of the cost of maintenance
- Long availability of the product and its spare parts
- Factory tested solution.
- Wide range of mechanical and electrical accessories with Emax 2.

From Circuit-Breaker to Power Manager

Emax 2 improve the efficiency of electrical plants, creating the new standard of:



Control & Connectivity

Ekip PowerController to improve energy efficiency and saving. Integration into systems with integrated communication modules with different protocols: Modbus RS-485, Modbus TCP, Profibus, DeviceNet, EtherNet/IP, IEC61850, Bluetooth.



Ease of use

Creation of efficiency and simplicity. Power measurement with Emax 2 advanced trip units.



Easy to Maintain

Diagnosis and installation with Ekip Connect Software. Automatic notifications to remind maintenance activities. ABB Ability Asset and Energy Management is also available with Emax 2 for Predictive Maintenance.



Sustainability

Retrofitting enable a circular economy by extending the lifespan of your electrical system minimizing CO2 emissions and raw materials usage.

How to retrofit an EntelliGuard G IEC?

ABB offers a complete range of solution to upgrade EntelliGuard G IEC circuit breakers with Emax2 retrofit solutions:

- **Hard bus retrofit (RF):** it is the traditional retrofit kit for which the complete EntelliGuarg G circuit breaker needs to be dismantled. The kit consists in a new Emax 2 breaker equipped with special terminals to fit the existing busbars. This solution is available for both Fixed and Withdrawable versions.
- **Direct replacement (DR):** It is the most advanced retrofit solution. In this case only the mobile part of withdrawable circuit breakers need to be removed. A special version of Emax2 moving part is supplied by ABB to be racked in/out on the installed fixed part.

When shutdown time is an issue, the DR solutions are preferable. Installation time is reduced to minimum, as the existing fixed part are not removed; with few adaptations on-site the Emax2 moving part can be inserted. All retrofit solutions have been tested for mechanical and electrical operations, short circuit breaking capacity, short circuit withstand current and dielectric properties according to IEC standards.

The Direct Replacement is a solution suitable when the existing part is full working. Before ordering it is important to verify integrity of the fixed part according to the directions on the document 1SDH001279R0002. When fixed part is not fully working the best retrofitting solution is the Hard Bus Retrofit.

Retrofitting kit solutions for Entelliguard G IEC

Versions	EntelliGuard G													
		frame T		frame 1				frame 2				frame 3		
	Performance Level	R	K	S	N	H	F	E	M	N	H	M	G	L
FIXED	HR Terminals*	-	-	RF	RF	RF	-	RF	RF	RF	RF	RF	RF	RF
WITHDRAWABLE	HR Terminals	DR	DR	DR - RF	DR - RF	DR - RF	-	DR - RF	DR - RF	DR - RF	DR - RF	RF	RF	RF
	VR Terminals	DR	DR	DR - RF	DR - RF	DR - RF	DR - RF	DR - RF	DR - RF	DR - RF	DR - RF	RF	RF	RF

.* For EntelliGuard G fixed versions with rear vertical (RV) and front terminals (F) it is possible to obtain HBRF solutions ordering HBRF for HR terminals and, during the installation, connecting the existing EntelliGuard RV and F terminals
For Frame 2, direct replacement is compatible with EntelliGuard G cassette with universal rear terminals VR and HR and not with rear vertical terminals' cassette (Limited Derating cassette)

HBRF for withdrawable EntelliGuard G for frame 1 and frame 2 are compatible with EntelliGuard G cassette with universal rear terminals VR and HR and not with rear vertical terminals' cassette (Limited Derating cassette)

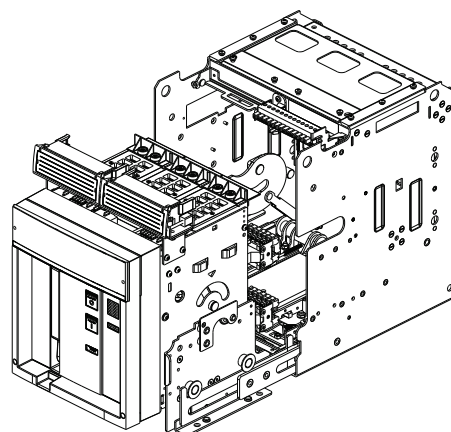
Direct Replacement – Product details

The direct replacement consists of a special Emax 2 moving part assembled and tested in ABB factory and ready to be racked-in into existing Entelliguard G cradle.

It includes:

- Sliding contacts
- Mechanical signaling
- Anti-insertion lock
- Racking in/out lever
- Kit for the door's adaption.

For EntelliGuard G Frame 2, direct replacement is not compatible with "limited derating types" versions (it is possible to distinguish them from the type GH cassette and from the type GK, GZ, GH moving part).



Direct Replacement for a 3p version

Correspondence table for Direct Replacement EntelliGuard G to Emax 2 - IEC
Automatic circuit breakers – EntelliGuard G to Emax 2 - IEC

EntelliGuard G	Iu [A]	Poles	Emax2	Iu [A]	Iu (Rating Plug) [A]	Icu 440V [kA]	Icu 500V [kA]	Icu 690V [kA]	Icw (1s) [kA]
EGG-T R	400	3p/4p	E1.2 N	800	400	50	50	42	42
	630	3p/4p	E1.2 N	800	630	50	50	42	42
	800	3p/4p	E1.2 N	800	-	50	50	42	42
	1000	3p/4p	E1.2 N	1000	-	50	50	42	42
	1250	3p/4p	E1.2 N	1250	-	50	50	42	42
	1600	3p/4p	E1.2 N	1600	-	50	50	42	42
EGG-T K	400	3p/4p	E1.2 N	800	400	65	50	50	50
	630	3p/4p	E1.2 N	800	630	65	50	50	50
	800	3p/4p	E1.2 N	800	-	65	50	50	50
	1000	3p/4p	E1.2 N	1000	-	65	50	50	50
	1250	3p/4p	E1.2 N	1250	-	65	50	50	50
	1600	3p/4p	E1.2 N	1600	-	65	50	50	50
EGG-1 S	800	3p/4p	E2.2 N	800	-	50	50	40	50
	1000	3p/4p	E2.2 N	1000	-	50	50	40	50
	1250	3p/4p	E2.2 N	1250	-	50	50	40	50
	1600	3p/4p	E2.2 N	1600	-	50	50	40	50
	2000	3p/4p	E2.2 N	2000	-	50	50	40	50
	2500	3p/4p	E2.2 N	2500	-	50	50	40	50
EGG-1 N	800	3p/4p	E2.2 N	800	-	65	65	50	65
	1000	3p/4p	E2.2 N	1000	-	65	65	50	65
	1250	3p/4p	E2.2 N	1250	-	65	65	50	65
	1600	3p/4p	E2.2 N	1600	-	65	65	50	65
	2000	3p/4p	E2.2 N	2000	-	65	65	50	65
	2500	3p/4p	E2.2 N	2500	-	65	65	50	65
EGG-1 H	800	3p/4p	E2.2 S	800	-	85	65	65	65
	1000	3p/4p	E2.2 S	1000	-	85	65	65	65
	1250	3p/4p	E2.2 S	1250	-	85	65	65	65
	1600	3p/4p	E2.2 S	1600	-	85	65	65	65
	2000	3p/4p	E2.2 S	2000	-	85	65	65	65
	2500	3p/4p	E2.2 S	2500	-	85	65	65	65
EGG-1 F	2500	3p/4p	E2.2 S	2500	-	85	65	65	65
EGG-2 E	800	3p/4p	E4.2 H	3200	800	85	85	85	85
	1000	3p/4p	E4.2 H	3200	1000	85	85	85	85
	1250	3p/4p	E4.2 H	3200	1250	85	85	85	85
	1600	3p/4p	E4.2 H	3200	1600	85	85	85	85
	2000	3p/4p	E4.2 H	3200	2000	85	85	85	85
	2500	3p/4p	E4.2 H	3200	2500	85	85	85	85
EGG-2 M	800	3p/4p	E4.2 V	2000	800	100	100	85	85
	1000	3p/4p	E4.2 V	2000	1000	100	100	85	85
	1250	3p/4p	E4.2 V	2000	1250	100	100	85	85
	1600	3p/4p	E4.2 V	2000	1600	100	100	85	85
	2000	3p/4p	E4.2 V	2000	-	100	100	85	85
	2500	3p/4p	E4.2 V	2500	-	100	100	85	85
	3200	3p/4p	E4.2 V	3200*	-	100	100	85	85
	4000	3p/4p	E4.2 V	4000	-	100	100	85	85
EGG-2 N	2500	3p/4p	E4.2 N	3200	2500	65	65	50	65
	3200	3p/4p	E4.2 N	3200*	-	65	65	50	65
	4000	3p/4p	E4.2 N	4000	-	65	65	50	65
EGG-2 H	2500	3p/4p	E4.2 H	3200	2500	85	85	85	85
	3200	3p/4p	E4.2 H	3200*	-	85	85	85	85
	4000	3p/4p	E4.2 H	4000	-	85	85	85	85

* Derating to 3000A with cradles with horizontal terminals.

For 4 poles circuit-breakers it's mandatory to specify in the order the position of the neutral.

Neutral's position by choosing between standard sequence (N, L1, L2, L3) or neutral on right side sequence (L1, L2, L3, N).

Switch disconnectors – EntelliGuard G to Emax 2 – IEC

EntelliGuard G	Iu [A]	Poles	Emax2	Iu [A]	Icw (1s) [kA]
EGG-T R	400	3p/4p	E1.2 N	800	42
	630	3p/4p	E1.2 N	800	42
	800	3p/4p	E1.2 N	800	42
	1000	3p/4p	E1.2 N	1000	42
	1250	3p/4p	E1.2 N	1250	42
	1600	3p/4p	E1.2 N	1600	42
EGG-1 S	800	3p/4p	E2.2 N	800	50
	1000	3p/4p	E2.2 N	1000	50
	1250	3p/4p	E2.2 N	1250	50
	1600	3p/4p	E2.2 N	1600	50
	2000	3p/4p	E2.2 N	2000	50
	2500	3p/4p	E2.2 N	2500	50
EGG-1 N	800	3p/4p	E2.2 N	800	65
	1000	3p/4p	E2.2 N	1000	65
	1250	3p/4p	E2.2 N	1250	65
	1600	3p/4p	E2.2 N	1600	65
	2000	3p/4p	E2.2 N	2000	65
EGG-1 F	2500	3p/4p	E2.2 N	2500	65
EGG-2 M	800	3p/4p	E4.2 H	3200	85
	1000	3p/4p	E4.2 H	3200	85
	1250	3p/4p	E4.2 H	3200	85
	1600	3p/4p	E4.2 H	3200	85
	2000	3p/4p	E4.2 H	3200	85
	2500	3p/4p	E4.2 H	3200	85
	3200	3p/4p	E4.2 H	3200*	85
	4000	3p/4p	E4.2 H	4000	85
EGG-2 N	2500	3p/4p	E4.2 N	3200	65
	3200	3p/4p	E4.2 N	3200*	65
	4000	3p/4p	E4.2 N	4000	65

* Derating to 3000A with cradles with horizontal terminals.

For 4 poles switch disconnectors it's mandatory to specify in the order the position of the neutral.

Neutral's position by choosing between standard sequence (N, L1, L2, L3) or neutral on right side sequence (L1, L2, L3, N).

With the retrofit kits with Emax 2 it is possible to choose amid three different Trip Units to replace the ones of EntelliGuard G, Mpact and Mpact plus: Ekip Dip, Ekip Touch, Ekip Hi-Touch. Emax 2 Trip Units are available in the versions LI, LSI, and LSIg.



Protection functions	GE EntelliGuard TU	Ekip DIP	Ekip Touch	Ekip Hi-Touch
Basic protection functions				
L - Overload protection	S	S	S	S
S - Selective short-circuit	S	S	S	S
I - Instantaneous short-circuit	O	S	S	S
G - Earth fault	O	S	S	S
Neutral protection	O	S (4p); M (3p)	S (4p); M (3p)	S (4p); M (3p)
Thermal memory for L&S protections	S (L only)	S	S	S
Advanced protection functions				
Start-up function for L, S, & G protections	S	-	S	S
G_ext - Earth fault on toroid	O	-	S	S
Zone selectivity short circuit	O	-	S	S
Measurement functions				
Phase & Neutral current (RMS)	S	M+C	S	S
Voltage: phase-phase, phase-neutral	O	-	M	S
Power: active, reactive, apparent	O	-	M	S
Energy: active, reactive, apparent	O	-	M	S
Frequency	O	-	M	S
Power factor	O	-	M	S
Peak factor	O	-	M	S
Maximum current value for phase	S	C	S	S
Average & max. power, max. & min. voltage	O	-	M	S
Trip history	S	C	S	S
Event log	S	C	S	S
Mechanical operator counter	M	M	M	M
Electric operator counter	S	C	S	S
Total operating time	S	C	S	S
Contact wear	S	C	S	S
Maintenance indicators	S	C	S	S
Data logger	O	-	S	S
Network analyzer	-	-	-	S
Power controller	-	-	O	O

S= supplied as standard

O= optional

M= module or device needed

C= control panel or connection software needed

Accessories compatibility

EntelliGuard G	DR EntelliGuard G to Emax 2
Electrical charging mechanism (motor)	Emax 2 standard M (springs charging motor)
Closing coil	Emax 2 standard YC
Command closing coil	Remote command available in Emax 2 standard YC (local command not available)
Shunt release (continuously rated type)	Emax 2 standard YO
Shunt release (impulse type)	Emax 2 standard YO + AUX 4Q 400V in series
Undervoltage release	Emax 2 standard YU
Time delay module	Emax 2 standard UVD
Remote reset coil	Emax 2 standard YR
Auxiliary contacts packages:	Auxiliary contacts packages:
Power rated contacts 3 NO & 3 NC (standard supply for all EntelliGuard frames)	Emax 2 standard 4Q 400V + re-use the EntelliGuard G existing external auxiliary contacts for extra power rated 2Q (for E1.2) Emax 2 standard 6Q 400V (for E2.2...E6.2)
Power rated contacts 4 NO & 4 NC (only for frame T)	Emax 2 standard 4Q 400V + re-use the EntelliGuard G existing external auxiliary contacts for extra power rated 4Q
Power rated contacts 8 NO & 8 NC (only for frames 1/2/3)	Emax 2 standard 4Q 400V + 6Q 400V + re-use the EntelliGuard G existing external auxiliary contacts for extra power rated 6Q
Power rated contacts 3 NO & 3 NC + signal rated contacts 2 NO & 2 NC (only for frames 1/2/3)	Emax 2 standard 4Q 24V + 6Q 400V
Power rated contacts 4 NO & 4 NC + signal rated contacts 4 NO & 4 NC (only for frames 1/2/3)	Emax 2 standard 2Q 400V & 2Q 24V + 6Q 24V + re-use the EntelliGuard G existing external auxiliary contacts for extra power rated 6Q
Terminal block for auxiliary contacts	Re-use the EntelliGuard G terminal block for auxiliary contacts
Bell alarm contact	Emax 2 standard S51 & S51/2 contacts
Cassette position indication contacts: connect/disconnect/test (carriage switches)	Re-use the ones of EntelliGuard G fixed part
Spring charged contact	Emax 2 standard S33 M/2 contact*
Ready to close contacts	Emax 2 standard RTC contact*
Mechanical interlock type A,B,C,D	Re-use EntelliGuard G mechanical interlock type A,B,C,D (interlocks compatibility is valid only if all the EGG are replaced with direct replacement)
Padlock in OFF position	Emax 2 standard padlock in open position PLC
Facia push-button padlocking facilities	Emax 2 standard protection device for opening and closing pushbuttons PBC
Breaker key lock facilities	Emax 2 standard key lock in open position KLC
Cassette key lock facilities	Re-use EntelliGuard G cassette key lock facilities
Door interlock	Re-use EntelliGuard G door interlock
Operations counter	Emax 2 standard mechanical operation counter MOC
IP54 cover	Re-use EntelliGuard G IP54 cover
Current sensor for neutral conductor outside circuit-breaker	Emax 2 current sensor for neutral conductor outside CB (only for 3 poles CB, local adaptation is needed)
Sensors, Rogowski coils	Replace zero sequence CT for the earthing conductor of the main power supply by Emax 2's homopolar toroid
Sensors, current transformers	Replace zero sequence CT for the earthing conductor of the main power supply by Emax 2's homopolar toroid

* S33 M/2 and RTC are in alternative each other.

The following Emax 2 accessories are not compatible with the Direct Replacement:

- Mechanical locks for compartment door
- All accessories of Emax 2 fixed part.

While the following Emax 2 accessories can be installed with an external re-wiring with local adaptation:

- Ekip Multimeter
- Ekip Control Panel
- Remote Reset YR
- Ekip View.

Ekip Cartridge for DR EGG to Emax 2

This external device is dedicated for the direct replacement EntelliGuard G to Emax 2. It is connected directly to the Ekip Touch/Ekip Hi-Touch Trip Unit allowing to use most of the connectivity modules: Ekip Supply, Ekip Com, Ekip Link, Ekip Signalling, Ekip Synchro check, Ekip AUP.

The Ekip Cartridge has 4 solts (1 Ekip Supply + 3 modules). If needed, when circuit-breakers in the withdrawable version are used, it is possible to connect the position AUP contacts to the related pins of the cartridge to avoid failure messages on the communication channel.

The cartridge can be installed on a DIN-rail everywhere in the panel. The cable that connects the trip unit with the Ekip Cartridge is 1m long.

