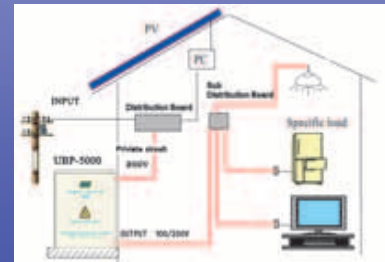
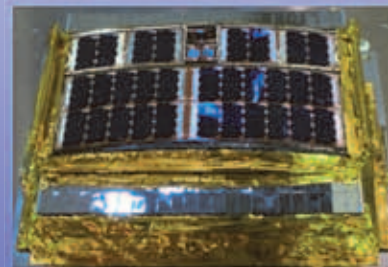


Super-capacitor / Li-ion capacitor
“EDLC / LIC”

Latest Applications 2nd edit.

While new energy source and their saving technologies are being introduced rapidly, energy storage system based on Super-capacitors or Li-ion Capacitors will play an important role where conventional batteries are not suitable. This publication explains its great advantages and actual applications. You must not miss it!

Publishing Editor: CAPACITORS FORUM May 16, 2014



CAPACITORS FORUM All rights reserved

Table of contents

1.Mazda Motor Corporation 「Mazda i-ELOOP」	E3
2.HONDA R&D CO.,LTD. 「Start-Stop system with EDL-Capacitor for HONDA」	E4
3.Toyota Motor Corporation 「TS030HYBRID Supercapacitor (WEC series)」	E5
4.BEIJING JIAOTONG UNIVERSITY 「Stationary Ultracapacitor Energy Storage System (UCESS) Used in Urban Mass Transit」	E6
5.Hitachi Construction Machinery Co., Ltd. 「20t Hybrid Excavator ZH200-5B (Released in Dec.,2013)」	E7
6.Komatsu Ltd. 「Hybrid Hydraulic Excavator (20-ton class:3rd generation:Released in Oct.2013)」	E8
7.HOKUSHO CO.,LTD. 「VEAS, Peak Power Assist System with Energy Storage」	E9
8.SANYO DENKI CO.,LTD. 「SANUPS K33A Peak Cut Device」	E10
9.SHIZUKI ELECTRIC CO.,INC.「Voltage sag Compensator (VB・SB serie)」	E11
10.Nissin Electric Co.,Ltd.「VOLTAGE DIP COMPENSATOR」	E12
11.TMEIC:Toshiba Mitsubishi-Electric Industrial Systems Corporation 「A Voltage Sag Compensator for High Voltage Users Adopting EDLC」	E13
12.MAXWELL TECHNOLOGIES 「Ultracapacitor-Based Unit for Starting Heavy-Duty Deasel Enginnes 」	E14
13.MAXWELL TECHNOLOGIES 「Automotive Voltage Stabilization System Utilizing Ultracapacitors」	E15
14.The Furukawa Battery CO.,LTD.「Capacitor Hybrid Type Lead Acid Battery "The UltraBattery for Automotive Applications"」	E16
15.The Furukawa Battery CO.,LTD.「Capacitor Hybrid Type Lead Acid Battery "The UltraBattery for Stationary Apprications"」	E17
16.Japan Aerospace Exploration Agency 「On-Orbit Demonstration of Next Generation Instrumentsfor Electric Power Syatem by NESSIE」	E18
17.MISAWA-international,Inc 「Electric energy strage system for houses UBP-5000」	E19
18.Ricoh Company,LTD.「 Copier with Supercapacitor (B&W High-speed machine 2003.12~)」	E20



Mazda i-ELOOP

In the 2nd step of Building Block Strategy, brake energy regeneration system applicable to engine vehicle without electric motor has been developed. By converting kinetic energy to electricity as a vehicle decelerates, 10% fuel economy improvement is expected in combination with i-stop depending on driving scenes.

New Atenza and New Axcela are equipped with this!

i-ELOOP ; Intelligent Energy Loop

Brake Energy Regeneration System i-ELOOP

i-ELOOP recovers kinetic energy as the vehicle decelerates and reuses it as electricity. By utilizing deceleration energy, engine does not have to generate power for driving, thus, fuel economy is improved.

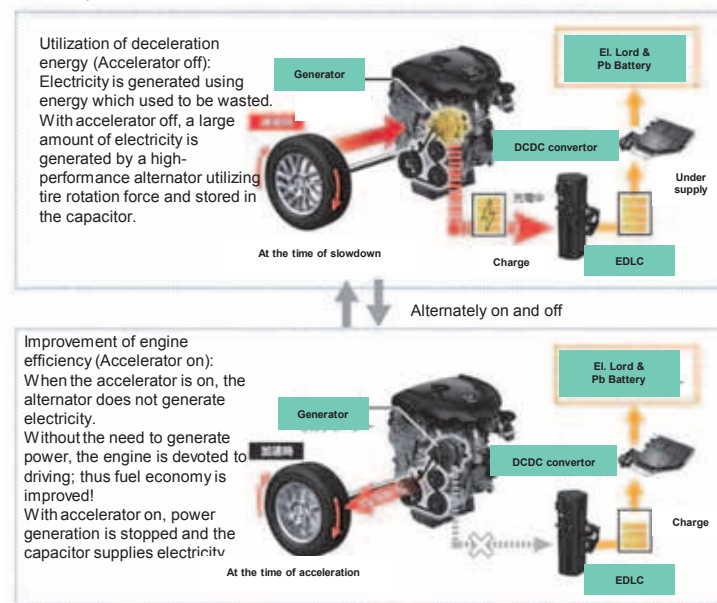
To this end, it needs to:

- (1) Regenerate: recover deceleration energy efficiently.
- (2) Store: store recovered energy quickly.
- (3) Use: take out stored energy quickly and use it efficiently.

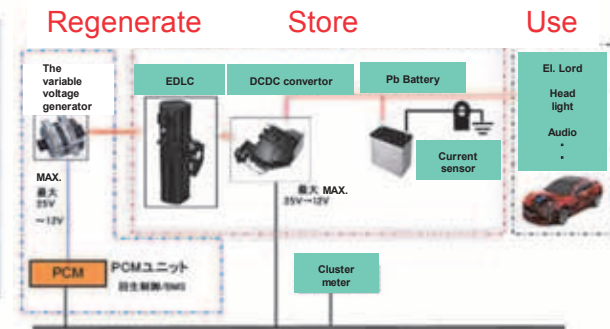
Mazda has developed the following new technologies to make it happen:

- Variable Voltage Alternator (12V-25V) to efficiently recover energy
- High-volume Electric Double Layer Capacitor (EDLC) to instantly store recovered energy and take it out efficiently

Operation of i-ELOOP



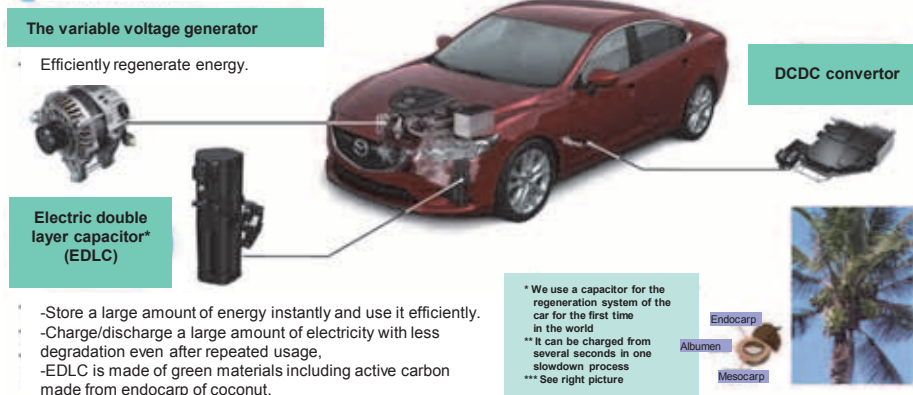
System Overview



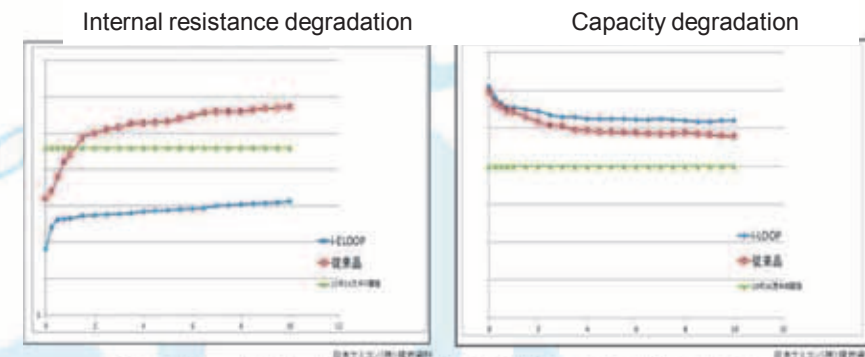
Effect: Contribution to Engine Efficiency (Fuel Economy)

- Contribute to fuel efficiency: Fuel used for power generation is reduced.
- Extend idle stop time: Capacitor supplies electricity during idle stop to support power supply.
- Extend life time of lead battery: Electricity stored in the capacitor is used for electric features to reduce load on the lead battery.

System Component



Ref. Degradation character of low-resistance high-volume capacitor



Lower resistance and longer life than conventional capacitor (=less capacity decrease)

Start-Stop system with EDL-Capacitor for Honda

HONDA R&D Co., LTD.

1. System Feature

- This is the start-stop system with EDL-Capacitor for brake energy regeneration and engine restart.
- This system not only improves fuel efficiency but also applies inexpensive Lead-acid battery.



Fig. 1. FIT3 (launched Sep. 2013) and its EDL-Capacitor Module

2. System Outline

- This start-stop system was developed for FIT3 this is a small and inexpensive car. Therefore, this system uses conventional alternator and starter to be minimized extra cost.
- This system equips three new components. An EDL-Capacitor module, a buck-boost converter for charge/discharge EDL-Capacitor and a contactor for start an engine with a lead-acid battery.
- This system applies a normal Lead-acid battery this is not high durability type. Using EDL-Capacitor decreases load of the lead-acid battery.
- This system gets regeneration energy to the EDL-Capacitor with the converter when the vehicle is breaking. The regeneration energy is used for electric loads when the vehicle run.
- This system restarts the engine with only the EDL-Capacitor.

Table 1. Specifications of EDL-Capacitor module

Item	Specification
Cells	6-series(15.5V)
Capacitance	225F

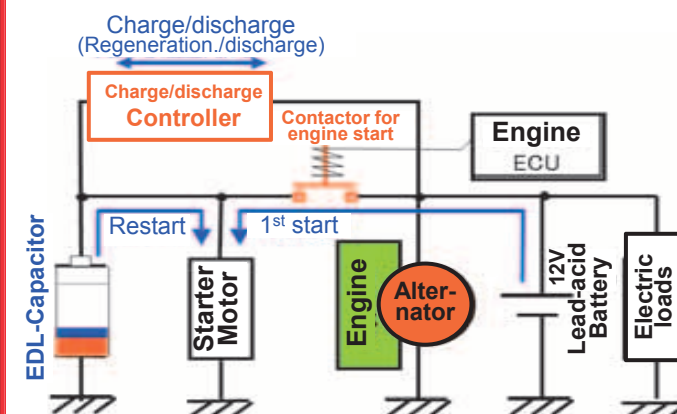


Fig. 2. Start-Stop System configuration

TS030HYBRID Supercapacitor (WEC series)

TOYOTA HYBRID

1. Summary of activities

- By utilizing hybrid technology in racing
 - Further advance technologies that can be applied to production vehicles.
 - Showcase the positive impact of hybrid technologies on performance, not just fuel economy.
- System concept
 - Recover potential energy wasted in the form of heat during braking by converting it into electrical energy and storing it for use during acceleration phase.
 - Since 2007, Toyota has been jointly developing the electrical double-layer capacitor (supercapacitor) energy storage system with Nissin Holdings Inc.



Fig 1. TS030HYBRID race vehicle

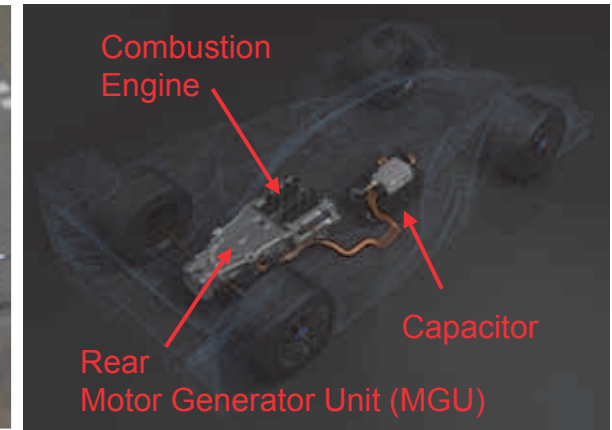


Fig 2. THS-R system

2. System summary

① Braking characteristics of racing vehicles

- Compared to normal production car braking patterns, race vehicles require very short braking periods.
- Recovering the maximum amount of braking energy requires a storage system with high specific power.

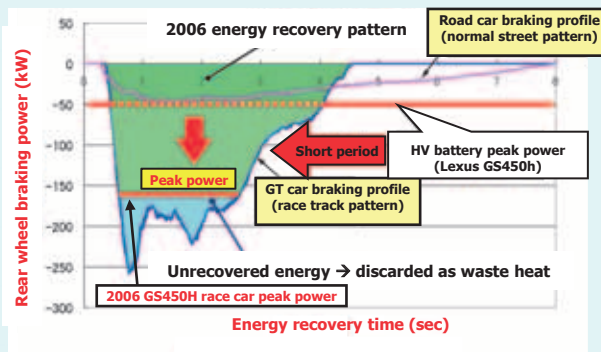


Fig 3. Production car vs race car braking characteristics

② Capacitor power storage device

Adopted the use of capacitors to provide the necessary high specific power.

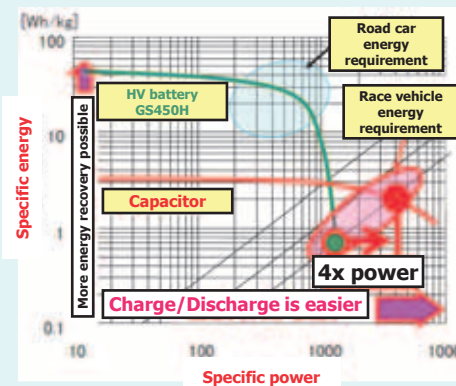


Fig 4. Energy storage systems

③ Energy recovery during braking

- Front brake rotors: Conventional brake system uses only friction for brake energy so rotor glows red-hot.
- Rear brake rotors: MGU absorbs part of brake energy required so rotors remain relatively cool (dark).



Fig 5. Energy recovery at the racetrack



Stationary Ultracapacitor Energy Storage System (UCESS) Used in Urban Mass Transit

1. Background

- In urban mass transit system, the voltage of traction network fluctuate because of the frequent traction and brake of the train. Due to the feature match between ultracapacitor and urban mass transit, UCESS is regarded as a suitable solution to the problem.
- Characteristics of ultracapacitor :
 - ◆ High power density, high efficiency;
 - ◆ Fast response ;
 - ◆ Long life cycle.



Fig 1. 200kW UCESS

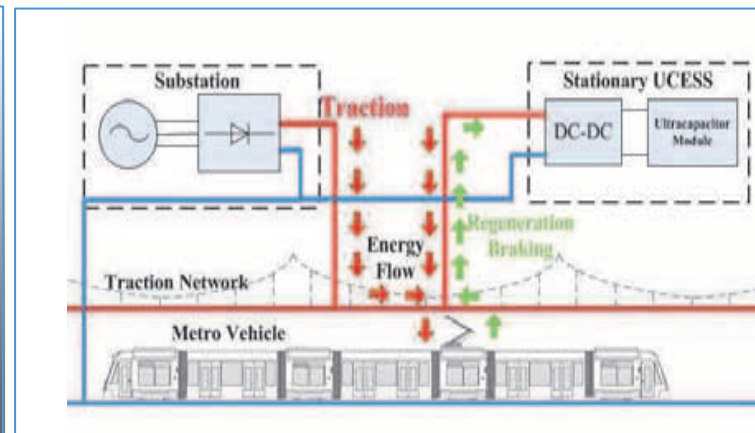


Fig 2. System diagram

Table1. Specifications

	200kW Stationary UCESS
Input Voltage	500V~900V
Rated Output Parameter	400A, 250V~500V
Peak Power	200kW
Cell	125V 63F Module
System	2 Parallel, 4 Series, 500V, 400A, 36mΩ

2. Summary

- When the train accelerating, UCESS will release energy to reduce voltage drop of traction network. When braking, UCESS could absorb the regenerated energy to reduce voltage rise of traction network and achieve the goal of energy saving.
- 200kW UCESS prototype has been developed by Beijing Jiaotong University which is successfully used in vehicle depot of Beijing subway line 10.
- In the future, MW power level UCESS will be developed and installed in substations of Beijing subway line 10.

Hitachi Construction Machinery 20t Hybrid Excavator ZH200-5B (Released in Dec., 2013)

HITACHI

1. Target / Feature

- “Practical hybrid excavator” providing excellent cost performance
- 15% less fuel than current standard machine ZX200-5B, 30% less fuel than former standard machine ZX200-3

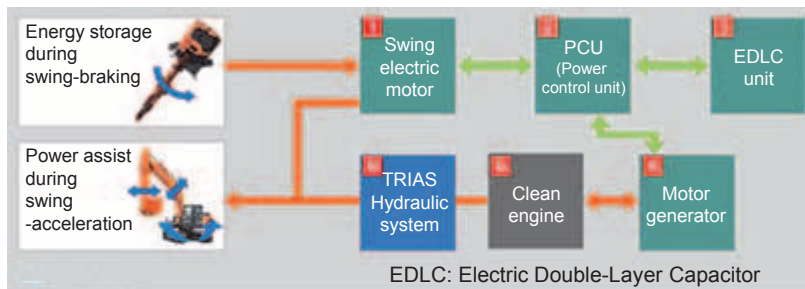


Figure 2. Outline of TRIAS-HX Hybrid System.

2. Outline

- Kinetic energy is regenerated as electric energy during swing braking, stored in EDLC, and reused.
- EDLC capacitance data of all market-existing machines is collected and monitored via wireless communication system (Global e-Service).
- Replacement free design for EDLC (Longer lifetime than that of machine itself in standard operating condition).
- Data from market-existing machines can be used for future design of machines or devices.

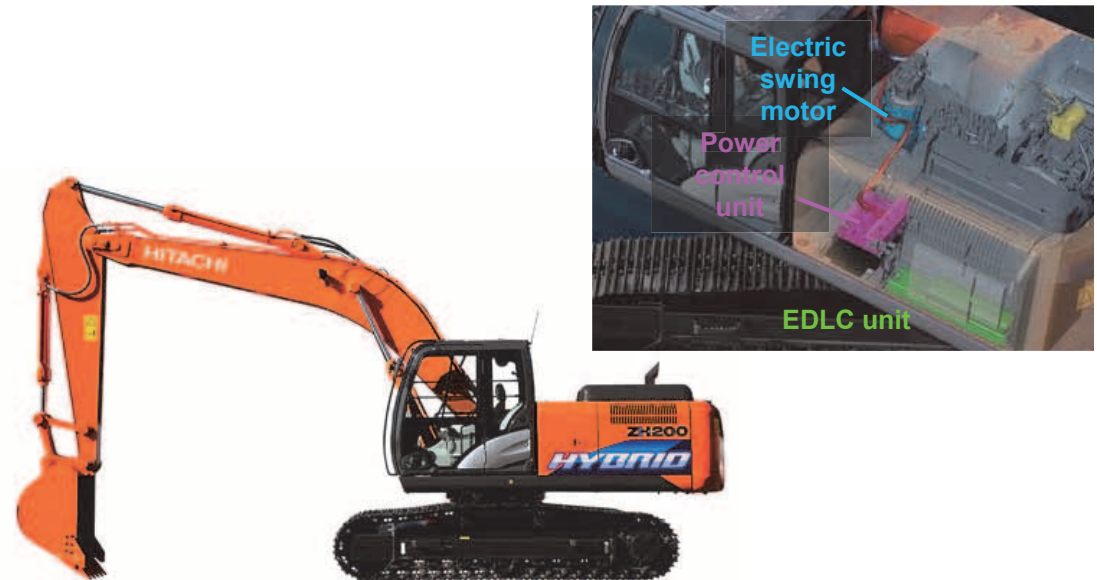


Figure 1. Appearance of ZH200-5B, and Layout of Power Electric Components.

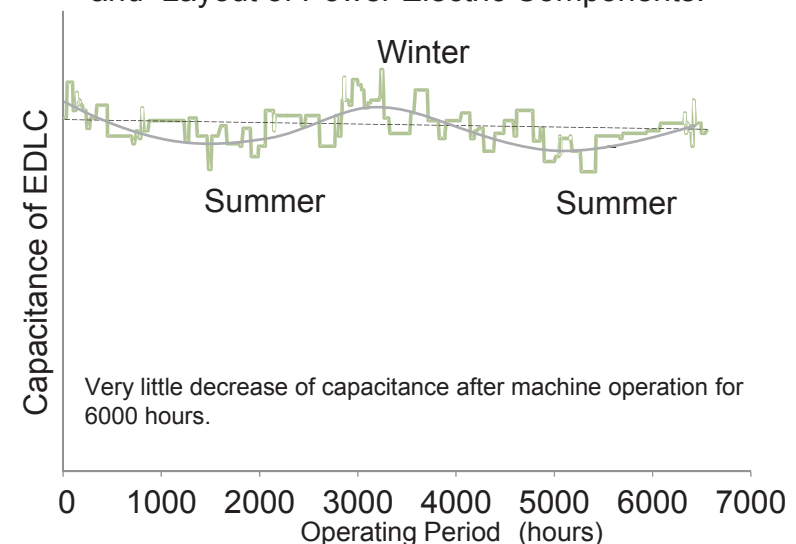


Figure 3. Capacitance Transition during Machine Operation.

KOMATSU

Hybrid Hydraulic Excavator (20-ton class: 3rd generation: Released in Oct. 2013)

1. Features

- Have Komatsu original, world's first hybrid system[1]
- Have basic performance equivalent to PC200 which is well known for its high performance and economy, and also realize further reduction of fuel consumption and CO2 emission

<Conformance to Tier3 emission>

Original	PC200-8E0	Jun. 2008	Reduction of 25%[2]
2nd generation	HB205-1	Dec. 2010	Reduction of 25%[2]

<Conformance to Tier4 interim emission>

3rd generation	HB205- 2	Oct. 2013	Reduction of 30%[2]
----------------	----------	-----------	---------------------

[1] Among machines in the market.

[2] Market average reduction effect of fuel consumption measured with Komatsu standard (compared with conventional PC200-8).

In actual operation, fuel consumption reduction depends on operations.



Fig.1. Overview of HB205-2 and Capacitor

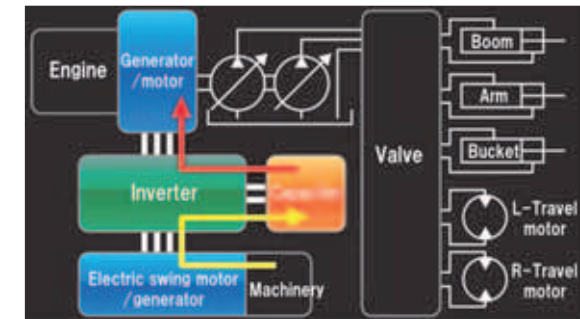


Fig.2. Structure of Hybrid System

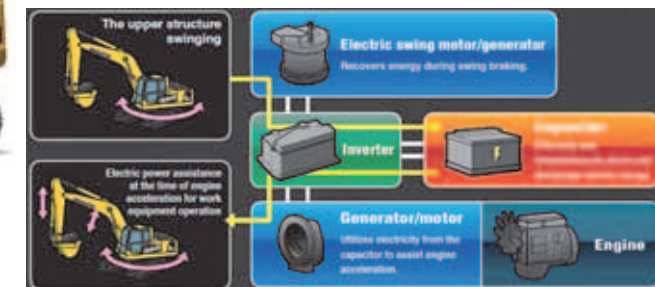


Fig.3. Outline of Komatsu Hybrid System

2. Outline of Komatsu Hybrid System

- Komatsu hybrid system realized great reduction of fuel consumption by using an electric swing motor to store energy in a capacitor during swing braking, and a generator motor to use this energy not only to accelerate swinging but also to assist engine acceleration.
 - The system uses a capacitor to enable efficient and instantaneous charge and discharge of energy during swing braking and acceleration.
 - Since a capacitor does not utilize chemical reactions, it theoretically does not generate heat and shows no degradation.
- Therefore, it is very suitable for construction machinery which is in continuous operation over long period of time.
- All of hybrid components are made by Komatsu, and they are greatly reliable and durable.

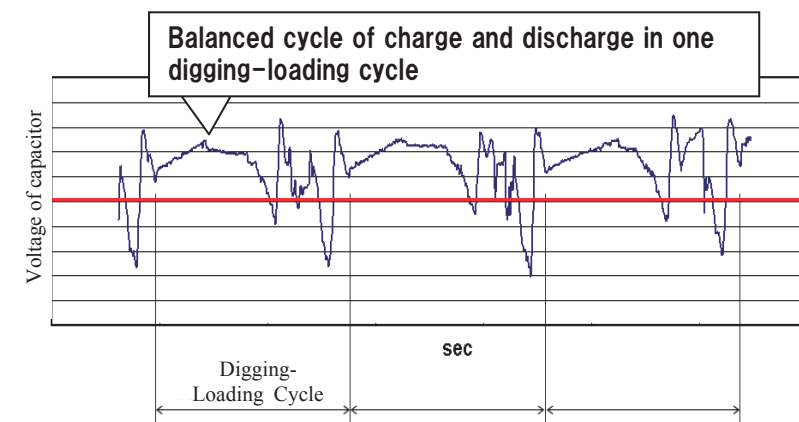


Fig.4. Charge and Discharge Pattern of Capacitor

Energy Saving Controller for Heavy Goods Vertical Transfer Conveyor VEAS, Peak Power Assist System with Energy Storage



HOKUSYO CO.,LTD.

1. Features

The energy saving controller equipped in heavy goods transfer models of the vertical transfer system “Autolator”, lifting goods up and down like an elevator. It can shave peak current for acceleration by up to 50% with an energy storage device and a quick charge & discharge control technology. Moreover, regenerative energy can be reused as an assist power.

- The system can cut a maximum electric demand (the value to make an electric bill) by reducing an equipment electric capacity by up to 40%. Material costs of equipment can be also reduced.
- The system can save energy by up to 25% by recovering regenerative energy.

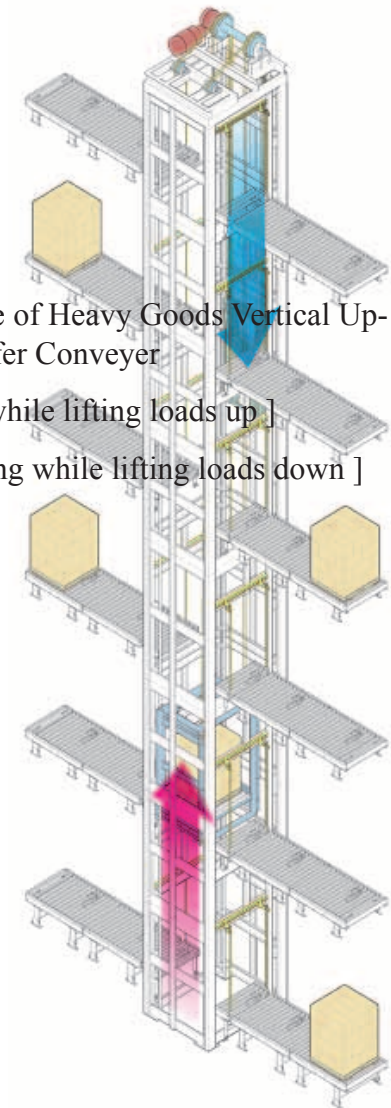


Fig 1. VEAS

Fig 2. Image of Heavy Goods Vertical Up-Down Transfer Conveyor

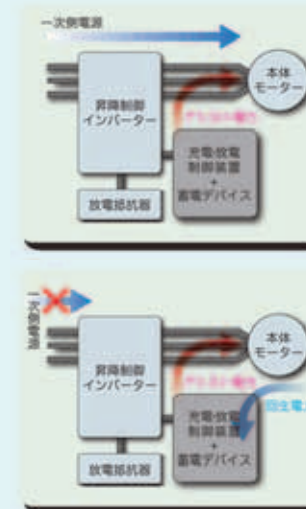
[Powering while lifting loads up]

[Regenerating while lifting loads down]



2. Overview of Peak Power Assist System “VEAS”

- Constant Peak Power Shaving
VEAS can assist peak current to accelerate motors by up to 50% by supply power from an energy storage device (ultracapacitor). The system charges the device to full while motors stop, so can provide constant peak power assists every time.
- Recovery of Regenerative Energy
VEAS can charge regenerative energy from motors to an energy storage device (ultracapacitor) while lifting loads down and reuse the energy as an assist power.



SANUPS K33A Peak Cut Device

SANYO DENKI

1. Features

- Reduce a power supply capacity by shaving a peak of input power to equipment.
- Save input energy and cut an electricity expense by reusing regenerative energy.
- More compact and longer life than conventional systems with electrolytic capacitors by using EDLC.
- Suppress voltage flickers by smoothing input power fluctuations to equipment.



Fig. 1 Peak Cut Device

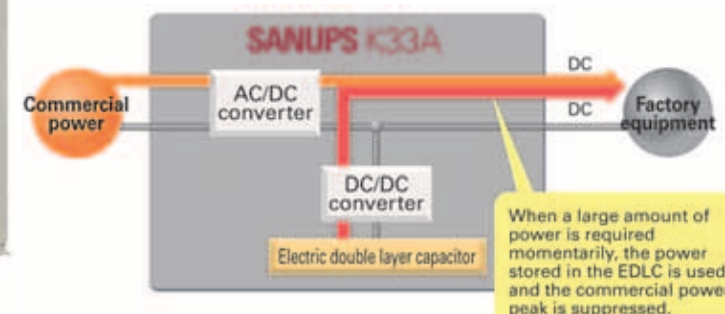


Fig. 2 Block Diagram of Peak Cut Device

2. Overview

- A servo-drive press machine is one of equipment for the system in a plant.
- When input power to servo-drive press machines while powering motors exceeds the limit, “SANUPS K33A” assists power to shave the excess peak power with energy stored in EDLC so the input power can be controlled within the limit.
- “SANUPS K33A” charges EDLC from AC utility power after powering motors.
- Regenerative energy from motors is stored in EDLC and reused as an assist power in next powering operation.

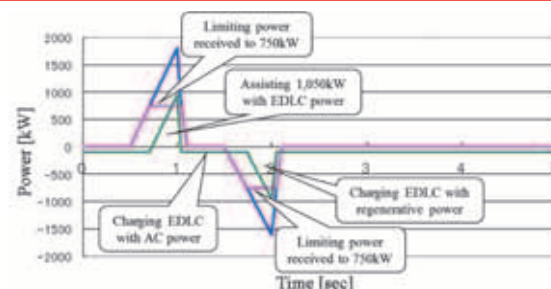


Fig.3 Power Profile with SANUPS K33A operating

Table 1 Specifications of Peak Cut Device “SANUPS K33A”

Item	Units	Standard specifications	Remarks
Device capacity	kW	1800	
Input capacity (max.)	kW	800	AC/DC converter capacity
Assistance capacity	kW	1000	DC/DC converter capacity
AC input	No. of phases/wires	— Three phase, three wire	
	Rated voltage	V 380	
	Voltage fluctuation range	V 342 to 418	
	Rated frequency	Hz 50/60	
	Frequency fluctuation range	% ± 5	
DC output	Rated voltage	V 660	
	Voltage fluctuation range	V 594 to 726	
	Maximum output capacity	kW 1800	
Storage device			
Item	Units	Standard specifications	Remarks
Type	—	Electric double layer capacitor	EDLC
Charge/discharge voltage range	V	376 ~ 540	
Rated DC voltage	V	460	
Charge/discharge power	kWs	93.3	

Voltage sag Compensator (VB-SB series)

1. Summary

- To maintain the supply voltage to a load by a capacitor, even if the voltage supplied from a commercial power source drops instantaneously.
- Voltage sag Compensator covers a wide capacity range of up to 400kVA from 5kVA at a low voltage.



Fig1. V-Backup200E 200kVA(L)
Sag-Backup200 7.5kVA(R)

	Voltage Sag Compensator	
Model	V-Backup series	Sag-Backup series
Power supply	Compensate for dropped voltage	
Phase / wire	3P 3W	
Rated voltage	200V	
Rated capacity	200kVA	10kVA
Charging device	EDLC	Electrolytic capacitors
Switching lag	Non-interruptible	Non-interruptible
Compensation time	1s(100%)	300ms(100%)、1s(30%)
Dimensions	1350W × 1850H × 750D	408W × 554H × 570D
Weight	900kg	50kg
Power efficiency	98% or more	98%
Charging device life	Around 10 years	Around 10 years

Table1. Typical specification

2. Major features of Sag-Backup series

- 1) Down-sizing
 - Realize down-sizing by 1/3 in volume. (compared to VB200E 7.5kVA)
 - Ensure space saving for the distributed implementations.
- 2) Non-interruptible
 - The direct feed SW can be opened uninterruptibly.
- 3) Superior TCO
 - Super low-loss and maintenance-saving can realize the long-termed non-stop operations.
 - “Extremely high efficiency” enables more than US\$15K tariff saving for 10 years against UPS.

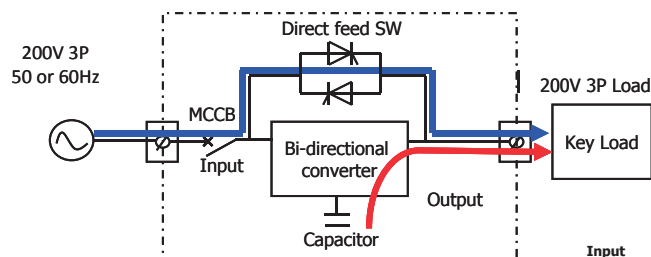


Fig2. Circuit diagram

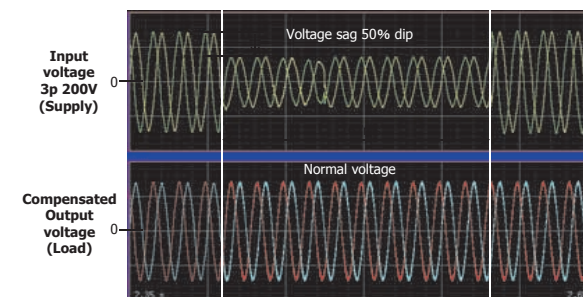


Fig3. Compensated voltage wave form

Nissin Electric Co., Ltd.

VOLTAGE DIP COMPENSATOR

UNISAFE®

NISSIN
ELECTRIC

1. Purposes / Features

UNISAFE is an easy-to-use, easy-to-introduce voltage dip compensator, and ensures the reduction of loss caused by the stoppage of production lines resulting from voltage dip.

◆ Energy storage device : condenser / EDLC

- Over 15 years of life expectancy (ambient temperature 30 °C)
- Available in clean rooms with no restrictions

◆ Commercial power supply method in usual times

- High performance at the efficiency rate of 98% or more

◆ Insufficient-voltage compensation method

- Longer compensating time to areas where frequent voltage dip occurs

◆ Adaptable with a continuous voltage dip

- Makes effective use of energy

◆ Space saving

- The world's most compact equipment of this type



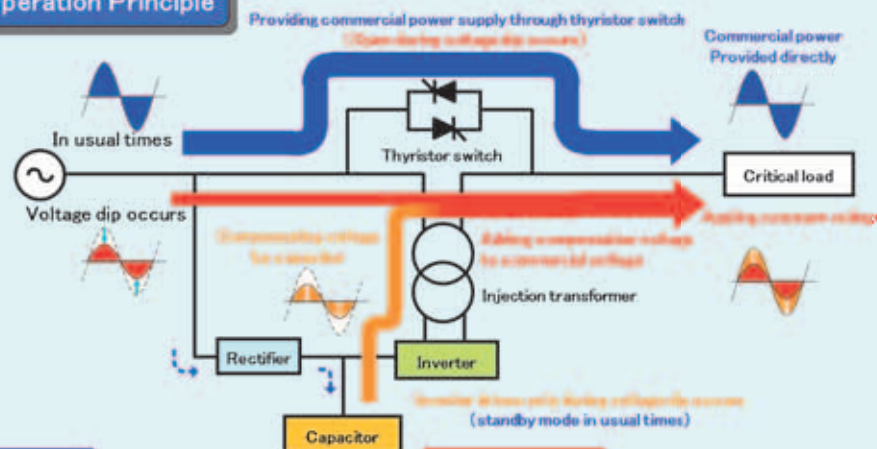
Fig1. Appearance

Table 1. Specifications

Item	UNISAFE	
Circuit voltage	Low voltage (3-phase 200/400V)	
Rated capacity	100~400kVA	
Frequency	50 or 60Hz	
Energy storage device	Condenser	EDLC
Compensation method	Commercial power supply method in usual times / Insufficient voltage serial compensation	
Compensation performance	0.09~2sec (dependent on voltage dip range)	1~5sec (dependent on voltage dip range)
Change time	Within 1/4 cycle (in case of 3-phase 60% voltage dip)	
Efficiency rate	Over 98%	
Install condition	indoor	
Dimension (mm)	W1250 × D750 × H1950 (at 200kVA)	W1750 × D750 × H1950 (at 200kVA)
Mass (kg)	1300 (at 200kVA)	1500 (at 200kVA)

2. Summary of UNISAFE

Operation Principle



In usual times

UNISAFE uses thyristor switch to provide commercial power supply in usual times, while capacitor is charged and inverter is standby mode. (Commercial power supply method in usual times)

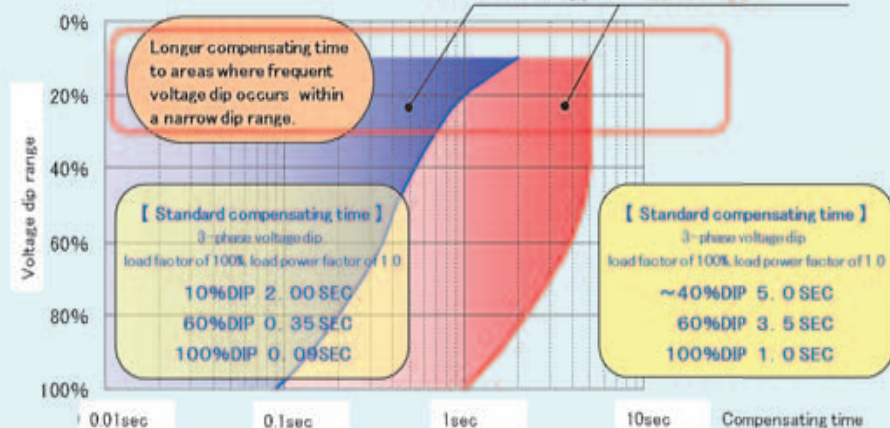
Voltage dip occurs

Thyristor switch will be turned OFF and inverter compensates the insufficiency of voltage immediately. Constant voltage is applied to the load continuously. (Insufficient-voltage compensation method)

Compensation Characteristics

Compensation performance corresponding to the actual situation of voltage dip

Condenser type EDLC type



※ Compensating time is extended according to the aspect of the voltage dip, the load factor, and load power factor. (Compared with standard compensating time)

- ◆ Aspect of voltage dip : 2-phase dip ⇒ 1.5 times as long, 1-phase dip ⇒ 3 times as long
- ◆ Load condition (Load power factor) : Load power factor 0.8 ⇒ 1.25 times as long

TMEIC : Toshiba Mitsubishi-Electric Industrial Systems Corporation

A Voltage Sag Compensator for High Voltage Users Adopting EDLC

1. Advantages of Adopting EDLC

Comparison with the lead acid battery system.

① **35% downsizing** for 1sec-compensation system.

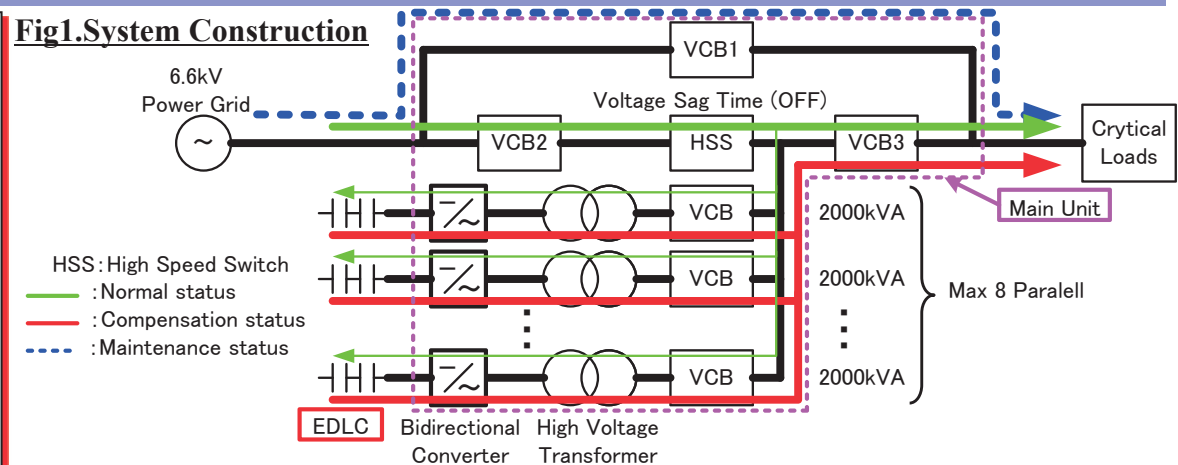
② Highest Efficiency **99.7%**

The bidirectional converter can drive intermittently since the continuous voltage control is not necessary while the lead acid battery system requires it.

③ Progress of power supply reliability

Floating life and charge/discharge life of the EDLC are longer than the lead battery.

Fig1. System Construction



2. Outline

- The system consists of a main unit (a mechanical high speed switch (HSS), bidirectional converters, VCBs and high voltage transformers), and EDLCs.
- Dimensions of the main unit for **2000kVA 1sec-compensation** are 5.6m-wide, 2.4m-depth and 2.35m-height and those of the **EDLC 1.4m-wide**. The EDLC consists of **5000 cells** and its total capacity is **10MF**.
- While the 6.6kV power grid is normal, the electric power is supplied from the 6.6kV power grid through the HSS to the critical loads. The bidirectional converters charge the EDLCs.
- When a voltage sag occurs, the HSS opens instantaneously and the electric power flows from the EDLCs to the critical loads through the bidirectional converters. After the recovery of the 6.6kV power grid, the bidirectional converters synchronize their output voltage with the 6.6kV power grid. Then, the HSS is reclosed.
- In maintenance, VCB1 closes and VCB2, VCB3 open.

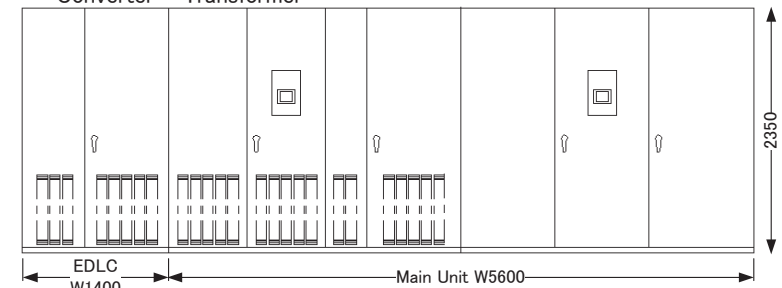


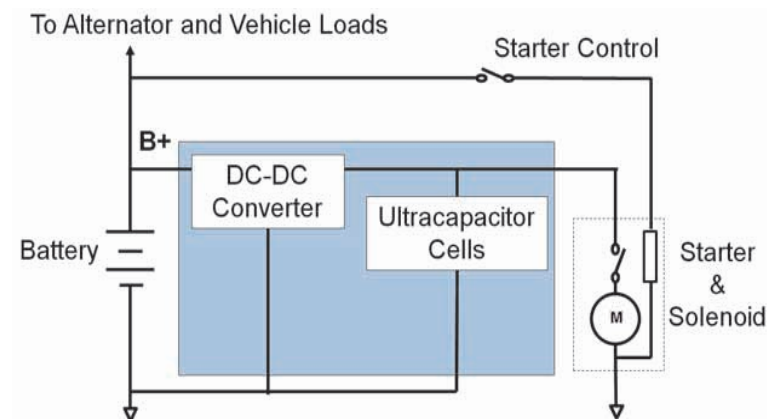
Fig2. Outline of a 2MVA-system

Item	System Specifications
Rated Capacity	1000~12000kVA
Rated Voltage	6600V(3300V)±10%
Frequency	50/60Hz±5%
Output Voltage Accuracy	Within 5%
Change-over Switch	Mechanical High Speed Switch
Change-over Time at Occurring a Voltage Sag	4msec
Change-over Time at Recovering a Power Grid	No Interruption
Efficiency	~99.7%
Electric Power Storage Module	Lead Battery / EDLC
Dimensions	W5600mm, D2400mm, H2350mm(Main Unit) W1400mm, D2400mm, H2350mm(EDLC)
Location	Indoor/Outdoor

Ultracapacitor-Based Unit for Starting Heavy-Duty Diesel Engines

Features/Fundamentals*

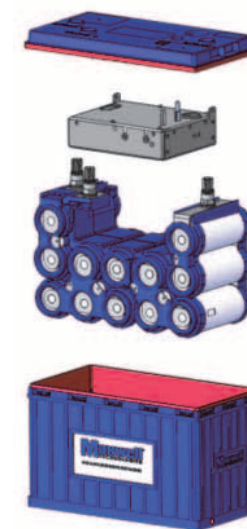
- Provides 1800 CCA at every start (3 second crank)
- BCI Group 31 form factor
- Installs quickly, replacing one Group 31 battery
- Recharges fully in less than 15 minutes
(Initial charge requires 30 minutes or less)



Purpose/Benefits

- Performs all engine cranking
- Reliable starts from -40°C to 60°C
- Reduces or eliminates costly jump-starts
- Resists shock, vibration and overcharging
- Easily cranks diesel engines size to 16L
- Limited 4-year warranty
- Assembled in the USA

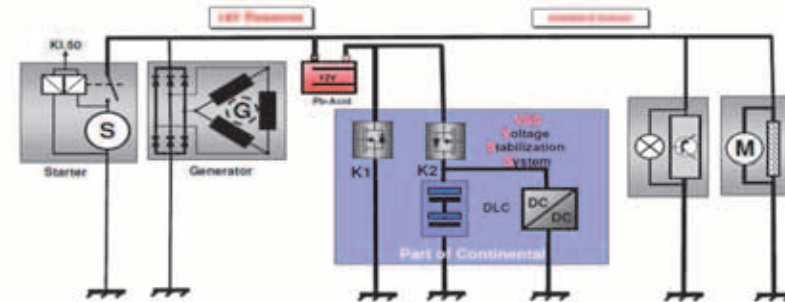
*Lead acid batteries still power ECM/ECU. Results may vary. Additional terms and conditions, including the limited warranty, apply at the time of purchase. See the warranty details and user manual for applicable operating and use requirements.



Automotive Voltage Stabilization System Utilizing Ultracapacitors

Features/Fundamentals

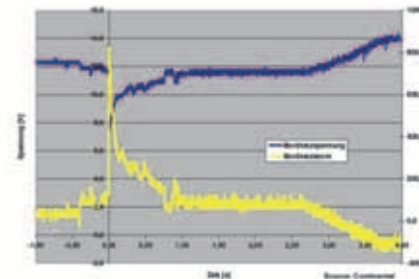
- Provides fuel economy up to 16% to 18%
- Quieter start
- Eliminates resets due to voltage sags
- Enables very high current during crank
- Extends battery life



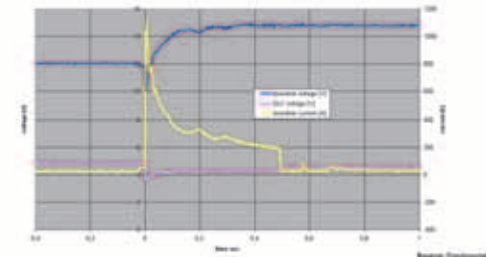
Purpose/Benefits

- Reduction in fuel cost
- Increase in ride comfort
- Reduction in emissions
- Undisrupted performance
- Fast and seamless engine start
- Reduction in lead recycling

Restart without VSS



Restart with VSS





THE FURUKAWA BATTERY CO., LTD.

Capacitor Hybrid Type Lead Acid Battery “The UltraBattery for Stationary Applications”

1. Features

- Integration of capacitor to electrode
- Optimum for rapid charge and discharge
- Excellent durability under PSOC operation
- Excellent charge acceptability
- Suppressed sulfation

※PSOC Partial State of Charge



Fig.1 The photos of the UltraBattery

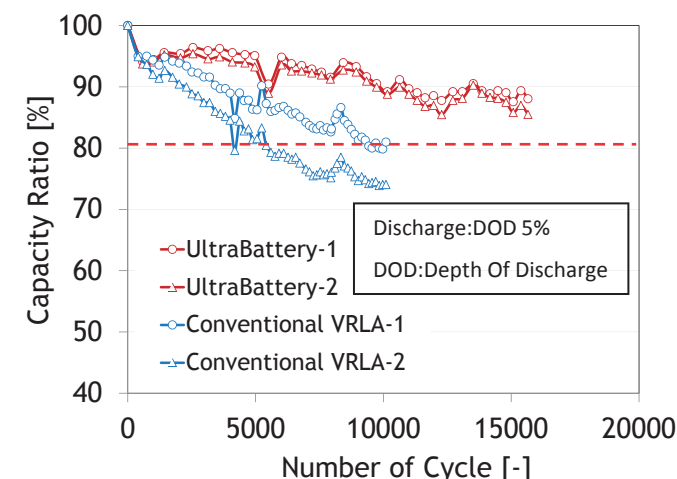


Fig.2 The results of high rate PSOC cycle test (UB-1000)

2. Details of The UltraBattery

➤ Cycle life

Significantly improved cycle life performance under PSOC conditions, therefore the UltraBattery overcomes a weakness of conventional lead-acid batteries (Fig.2)

➤ Equalizing charge

The UltraBattery reduces frequency of equalizing charge. Therefore operation rate of the Ultrabattery is increased. Conventional battery needs equalizing charge once a week, on the other hand the UltraBattery needs only once a month.

➤ Cost

The UltraBattery is inexpensive compare with LIB, because UltraBattery is based on lead acid battery.

Table1 The UltraBattery specification

Type	UB-50-12	UB-100-6	UB-500	UB-1000
Nominal capacity	50Ah	100Ah	500Ah	1000Ah
Nominal voltage	12V	6V	2V	2V
Dimension (mm)	220×363	220×345	502×167	508×303
H×L×W	×128	×128	×160	×172
Weight (kg)	22kg	22kg	35.5kg	73kg

3. Applications

➤ Peak shaving, Peak shift of electric power

The Ultrabattery is charged in the night and is discharged depending on demand of electric power in the day. Therefore, it is possible to reduce peak electric power.

➤ Smoothing the fluctuation of electric power by wind turbine

The Ultrabattery is charged/discharged depending on fluctuation of electric power by wind turbine, and the fluctuation is made smooth. Therefore, quality of electric power is improved.

Capacitor Hybrid Type Lead Acid Battery “The UltraBattery for Automotive Applications”

1. Features

➤ Excellent charge acceptability

The UltraBattery exhibits the excellent charge acceptability in the re-regenerative braking system.

➤ Excellent durability

The UltraBattery exhibits the excellent durability under PSOC (Partial State of Charge) condition.

➤ Longest guarantee service in the aftermarket

The UltraBattery for aftermarket in Japan guarantees the service periods of 36 months or the driving distance of 60,000 km *1).

*1) Until either reaches early

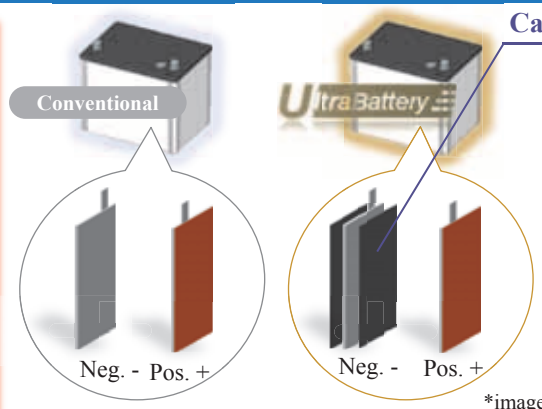


Fig.1 Difference on structure between the conventional lead acid battery and the UltraBattery.

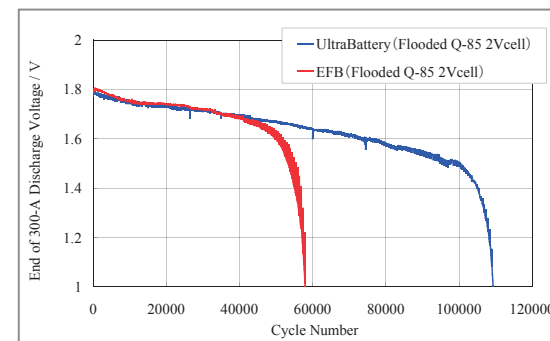


Fig.2 DCA test of UltraBattery and EFB.

2. Details of UltraBattery

- Ultrabattery is a hybrid energy storage device, which combines a supercapacitor and a lead-acid battery in a single unit, without extra, expensive, electronic control (Fig. 1). The capacitor electrode acts as a buffer to share the currents with the lead-acid negative plate and thus prevent it being discharged and charged at the full rates.
- In the field trial test, the excellent durability of the UltraBattery extends idling stop periods and it contributes to reduce fuel consumption of the idling stop/start vehicle. The excellent charge acceptability of the UltraBattery reduces alternator load and it reduces fuel consumption as well.
- Under the DCA test *2) condition which modified SBA S 0101 test of BAJ standard, the flooded type Ultrabattery exhibits two times longer cycle life compared with EFB (Extended Life Flooded Battery), because the sulfation is prevented (Fig. 2).
- The lead-acid battery portion of the UltraBattery is based on “ECHNO IS” technology.
- The Furukawa Battery released the flooded-type UltraBattery to the aftermarket in Japan in April, 2013 (Fig. 3).
- The flooded-type UltraBattery was adopted by Honda ODYSSEY (ABSOLUTE) vehicle in November 2013 by the excellent charge acceptability and the excellent durability (Fig. 4).

*2) DCA test is standardized as the life cycle test for micro hybrid vehicle in Europe. (As of September, 2013)



Fig.3 Photograph of the flooded UltraBattery for aftermarket.



Fig.4 Photograph of Honda ODYSSEY vehicle in which the flooded UltraBattery was installed.
(The photograph was provided Honda Motor Co., Ltd.)

Table1 The flooded UltraBattery specification.

Type	Voltage (V)	5HR (Ah)	Dimensions (ca. mm)				Weight (ca. kg)
			Overall Height	Container Height	Width	Length	
M-42	12	33	227	200	128	196	10.7
N-55		36	227	200	128	237	13.2
Q-85		54	225	200	172	231	17.2
S-95		64	225	200	172	259	19.7

On-Orbit Demonstration of Next Generation Instruments for Electric Power System by NESSIE



1. Feature

- The world's first use of lithium ion capacitors as a power source of spacecraft.
- Lithium ion capacitors, which are characterized by safety, long life, wide operating temperature range, high charge/discharge rates, are promising energy storage devices for spacecrafts.



Fig. 1 NESSIE mounted on HISAKI/SPRINT-A

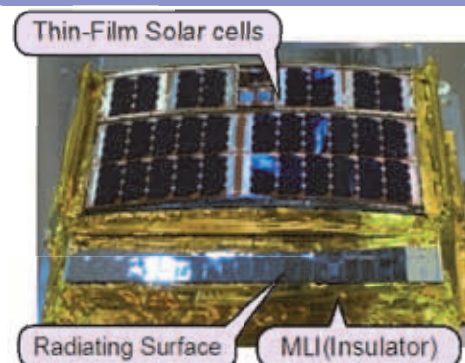


Fig. 2 NESSIE

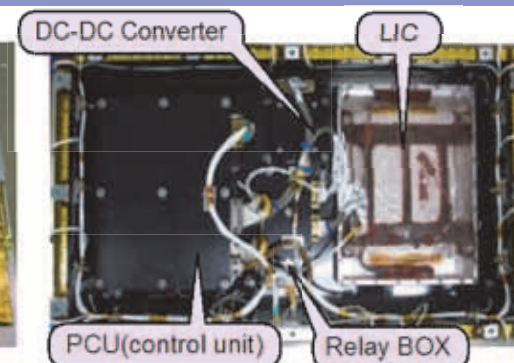


Fig. 3 Internal structure of NESSIE

Table 1. Specifications of NESSIE

Dimension	550 mm × 453 mm × 204 mm
Mass	10.05 kg
Launch date	Sept. 14, 2013
Orbit	Altitude 946.8 km × 1,156.8 km, Period 106.2 min. (Eclipse 35.4 min.)

2. Outline

- The essentiality of power systems for spacecrafts leads to a dilemma of a need for on-orbit demonstrations and risk of complete loss of spacecrafts in the case of failure.
- The NESSIE, which has an independent power bus, and supported by its master satellite HISAKI regarding the attitude control and the data communication, is an ideal testbed for power devices.
- Because aluminum laminated film LIC pouch cells retains the capacity even when they expand in vacuum, we were able to use a light-weight simple mounting hardware.
- Making the most of low impedance of LICs, we applied a simple constant-power charging circuit without feedback control instead of the popular cc/cv charger, resulting in optimized solar array area.

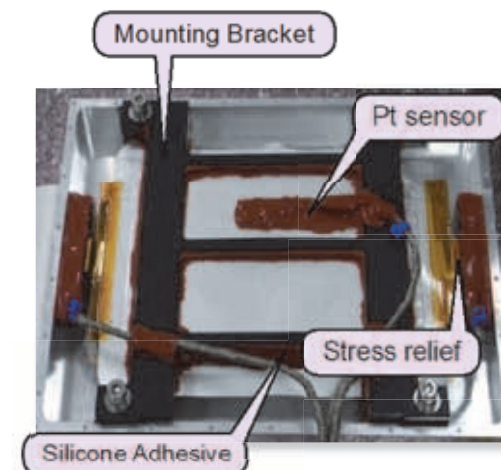


Fig. 4 Mounting hardware of LIC

Safe stationary energy storage device

Housing for generating electricity by solar cells and fuel cells has become very popular. Making smart of housing becomes reality by deregulation of the low voltage power. Storage function is required for the house. In the case of the housing system, safety and long life become the most important element.

The capacitor was adopted as an electric energy storage device which can satisfy safety and long life. We chose the lithium ion capacitor with bigger energy density than EDLC.

Functions of UBP-5000 are power interruption backup and peak cut off power and remote monitoring.



Fig1. UBP-5000

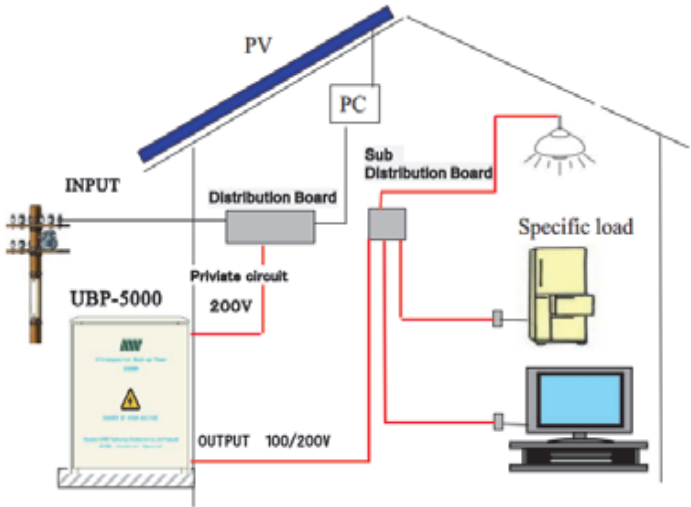


Fig2. System diagram



Fig 3. Outview (25000F capasitor cell)

Part number	UCK40V25000
Operating Voltage, V	3.0~4.0
Capacitance, F	25000
ESR, mΩ	0.5
Storage Energy, kJ	≥ 75
Maximum Charge (Discharge) Current, A	150
Weight, g	540
Dimension(L × W × H), mm	305 × 110 × 13

Table1. Capasitor cell Spec.

	spec
Storage Energy	5kWh
Output power	2kW
Output voltage	AC100V/200V
Output frequency	50Hz/60Hz
Input voltage	AC200V
Input frequency	50Hz/60Hz
function	UPS peakcut remort monitoring
dimention	W1200 × D460 × H1260 mm
weight	330kg

Table2. UBP-5000 Spec.

RICOH COMPANY, LTD.

Copier with Supercapacitor (2003.12~)



1. Purposes · Features

- This copier is equipped with a Supercapacitor as an auxiliary power source for the main electricity. This technology is the Ricoh's original system named "HYBRID-QSU".
- Energy-saving and Good-usability
 - Reduction of energy consumption: 59%*
 - Warm-up time: 30 sec.(5min.*)
 - Start-up time:10sec.

*compared with the conventional copier, imagio Neo751



Fig.1 Copier(imagio MP7500)

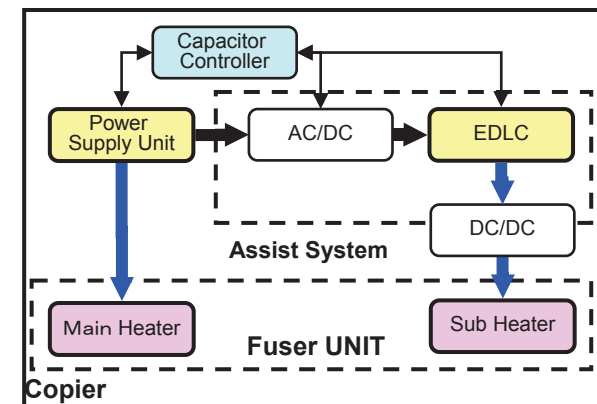


Fig.2 System diagram

2. Summary

- In copiers, heat roller is used to fix the toner image on paper. Con-ventional energy-saving technology was based on the thin-wall heat roller in order to increase the heating efficiency.
- Because of the smallness of heat capacity of the fusing roller, high speed printing of 75 sheets per minute leads to the drop of the temperature of paper, and then deteriorates the printing quality.
- To address the problem, we adopted Supercapacitors as an auxiliary power, which are capable of fast charge and discharge. Electric power during standby mode is stored in the capacitor and is used to replenish the heat energy of the roller taken away by the paper.
- The capacitor controller manages the charging and discharging operation to monitor the state of the Supercapacitor. Precise control of over-charge or over-discharge ensures long-term reliability and maximizes their capability.
- We achieved start-up time less than 10 seconds in high-speed copiers, which are accepted in the market as energy-saving and good-usability copiers.

Table1. Specifications

Model	imagio MP7502
Copy Speed	75 copies/minute
Dimensions (WxDxH)	690 × 799 × 985mm
Power Requirements	100V, 15A, 1.5kWmax.
Warm-up	30sec
start-up time	10sec
Energy consumption efficiency	108Wh/h
Cell	2. 5V 1600F
System	1Parallel, 10Series 25V 14Wh
Sub heater	800W

CAPACITORS FORUM

Purpose and Activities

- **We, Capacitors Forum, research, collect and supply the information about the efficient use of electric energy with supercapacitors.**
- **We also intend to help raising public awareness of efficient use of energy and the global environment, through establishing application technology of supercapacitors.**
- **We will supply the place of discussion to encourage sustainable economic growth and to contribute to global environment protection by these activities.**