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Feature

"Mobile Power Supply System"

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1. Introduction

The stable supply of electric power is vital in a highly developed information society.
The largest earthquake to hit directly a major city, the Hanshin-Awaji earthquake that struck Kobe in Japan, showed that early restoration and stable supply of lifeline services are critical when the power fails over a wide area. Mobile power supply systems were found to be effective due to their excellent mobility and emergency service functions.
We market two types of "Mobile Power Supply System": a one-box-car type and a truck type. The one-box-car type carries a power generator having a maximum output capacity of 100 kVA, while the truck type has a maximum output capacity of 500 kVA.
"Mobile Power Supply System" has an operational guidance function that we have newly developed, and is a low noise, environmentally friendly system that is easy to operate by almost anyone. We describe the details of this new "Mobile Power Supply System" below.

2. Outline of the System

An outside view of "Mobile Power Supply System" is shown in Fig. 1, the internal layout in Fig. 2, the skeleton diagram in Fig. 3, and the main installation and specifications in Table 1. The features are described below.

- This is a low noise system that carries a 30 kVA generator that can be used for non-linear loads (allowable equivalent negative phase sequence current of 30% or more) and a diesel engine mounted on a two-ton vehicle that can be driven by someone possessing an ordinary driver's license.
- The fuel tank and rechargeable starter battery are used by both the diesel engine and the vehicle to reduce weight.
- The load output voltage supplies two output voltages of 210 V and 100 V for various load conditions.
- The entire system can easily and surely be operated by using the operation guidance (touch-key) system .
- For charging the starter battery, an external AC input connector allows the starter battery to be charged even during standby. Switching between the commercial power source and engine generator is automatic.
- In order to improve the efficiency of cable connection work, the power output is equipped with a connector that enables the output power to be connected at a single touch.

Table 1 Installation and specifications

Items		Units	Specifications	Remarks
Rated output		kVA	30	
Voltage		V	210	
Number of phases		-	3	
Frequency		Hz	50 or 60	Note1
Power factor		-	0.8	
Allowable equivalent negative phase sequence current		%	30 or more	
phase sequence current		rpm	1,500	
Continuous operating hours		Hr	3 or more	Note2
Maximum sequence operating hours		Hr	30 or more	Note3
Noise value		dB(A)	65 or less	Note4
Supplied cables (with drum)		-	15m×2drums	Note5
Vehicle	Maximum payload	tons	2	
	crew	persons	3	
	Drive system	-	Four-wheel drive	
	Hill climbing ability	$\tan\theta$	0.69	
	Minimum turning radius	m	5.1	
	Driver's license required	-	Normal driver's license	

Note 1: Both 50 Hz and 60 Hz systems are available.
Note 2: Continuous operating hours when the fuel tank is full and the vehicle operates at the rated load.
Note 3: The maximum continuous operating hours without maintenance such as replacing the oil filter, etc., with refueling only.
Note 4: The average noise value in the four directions measured at 1 m from the vehicle and 1.2 m above ground.
Note 5: The standard specification is 2PNCT-3 wire cable.

3. Noise Reduction

Demand is increasing for quieter equipment in urban areas at night, irrespective of whether the power supply system is mobile or not.
Reducing noise and maintaining a good heat balance are mutually contradictory, thus making it difficult to design compact power supply .
To reduce noise, we have reviewed the structure of "Mobile Power Supply System", and have developed a unique sound-proof structure that uses a sound absorption

material for the equipment packaging, and features a sound-absorption duct structure for the air intake and exhaust openings. The noise level is reduced to 65 dB (A)/1 m or less against the standard noise level of 75 dB.

4. Measures for Harmonics

Semiconductor products such as rectifiers, AC power supply system, inverter air conditioners, inverter lighting equipment and so forth are becoming more widespread as the loads on "Mobile Power Supply System".
Since distorted current flows through such equipment, the harmonic currents contained therein generate heat and distort the voltage waveform.
As a countermeasure for harmonics, the number of damper windings of the generator rotor is increased to reduce the impedance. As a result, 30% or more of the allowable equivalent negative-phase sequence current is permissible as its yield strength against the standard strength of 20%. This raises the reliability of the system.

5. Control System with Operation Guidance Function

5.1 Structure and Layout of Control System

The control system has a compact, stand-alone structure. All the connections with external equipment are made by connectors, so the system can be easily installed.
All inspection works can be performed from the front by opening the front door; maintenance, inspection and parts replacement can be performed from the front so maintenance engineers do not need to go into the mobile power supply vehicle.
The control equipment is installed in the rear side of the mobile power supply vehicle. All controls are concentrated in one location, and can be easily performed by opening the small door of the mobile power supply vehicle.
Illuminations above the switchboard enable the meters and indicators to be checked visually from outside the vehicle through the inspection window even in the dark.

5.2 Running and Operation

The running and operation block is shown in Fig. 4.
"Mobile Power Supply System" has conventionally had to be operated by experienced staff, or it had need to use operation manuals prepared by maintenance staff. This system has been improved so that it can be used by anyone by using the built-in guidance function.
When the small door of the mobile power supply vehicle is opened, the operation block appears, and this block has a color touch-panel LCD of 320×240 dots. After turn on the control power, the operation guide messages prompt the operator to select either YES or NO on the touch keys to operate the system.
Safe, simple and secure operation has been ensured by including check items in the guidance, and maintainability has also been improved.
An example of the operation guidance is shown in Fig. 5.
When an error occurs, the "Display of All Troubles" appears, highlighting where troubles occurred. When the operator touches the highlighted area, the check points of high error probability are displayed in order to locate the cause of trouble swiftly.
An example of trouble display is shown in Fig. 6.

5.3 Display Block

The display block has a color touch-panel LCD of 320×240 dots. Various devices of the operation sequence can be checked on the display with their associated data. The eight-color display and the high-lit indication help ensure correct operation of the system.
Because of the built-in sequencer, the display items such as number of troubles to be displayed, switches, contents of guidance, etc., can be modified by the software without modifying the hardware, thus flexibly satisfying the various requests of users.

6. Easy Overhaul
Because the useful lifespan of the vehicle and the power supply is different, overhauling and replacement of "Mobile Power Supply System" will become necessary in the future.
The vehicle and the power supply are conventionally combined into one structure so that overhaul or replacement work takes a long time.
New "Mobile Power Supply System" has the structure in which the vehicle (chassis with cab) and the storage package can be separated to facilitate replacement work. At the same time, all the components in the storage package are fixed by bolts so that they can be pulled out from the rear of the vehicle for easy overhauling, which reduces the overhaul time greatly.

7. Conclusion

We have outlined our "Mobile Power Supply System" that has an operation guidance function. We will continue to develop highly reliable, handy, low-cost systems that help preserve the environment by emitting less exhaust and noise, in order to help restore lifeline services, to supply backup power for many hours, and to assist in case of emergency.

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Fig.1 Outside view of "Mobile Power Supply System"

Fig.2 Internal layout

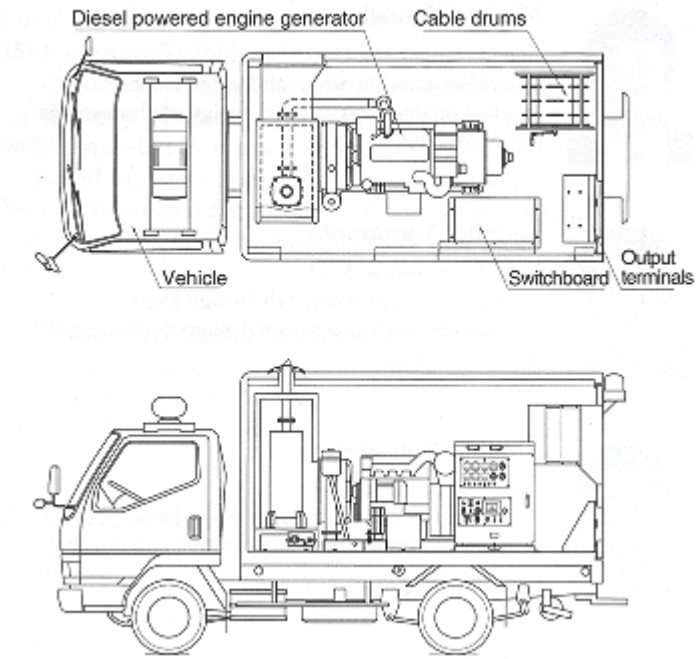

Fig.3 Skeleton diagram

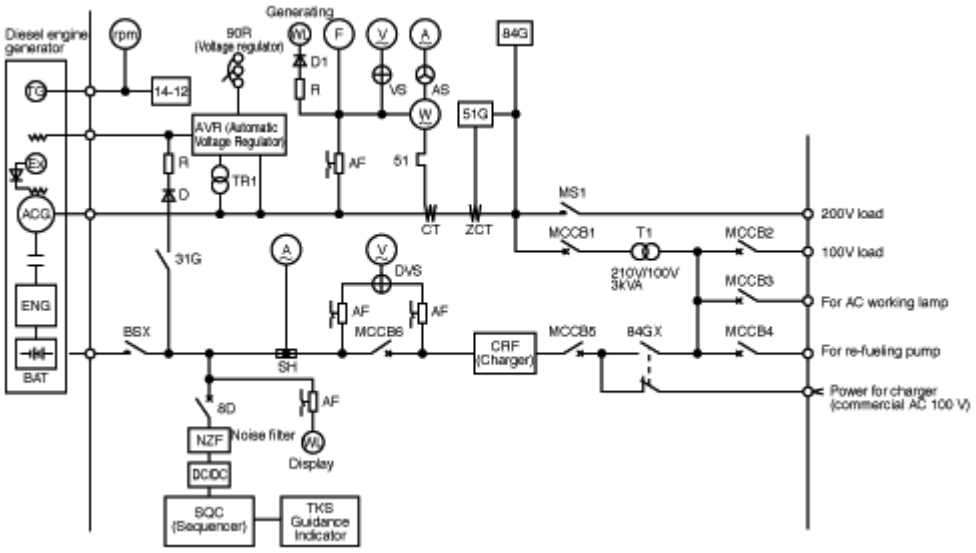

Fig.4 Running and operation block

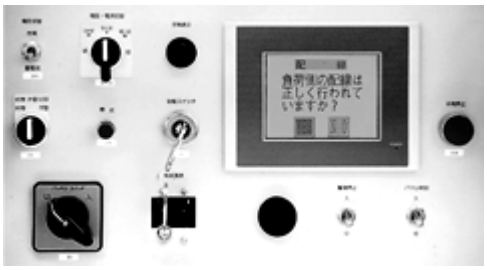

Fig.5 Example of the operation guidance

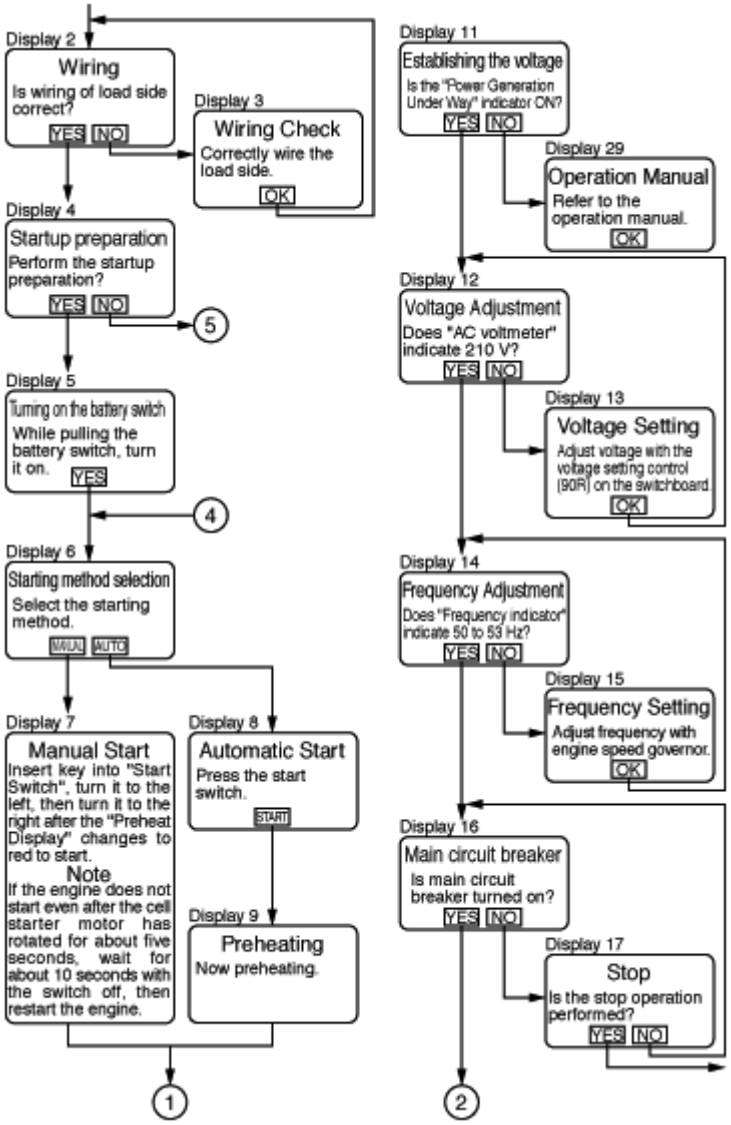

Fig.6 Example of trouble display