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## The SHIN-SHINANO HVDC System

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<b>Interconnection between</b>	The 50 Hz, 275 kV AC system at Nagano Prefecture, Japan.	The 60 Hz, 275 kV AC system at Nagano Prefecture, Japan.
<b>AC System Frequency</b>	50 Hz	60 Hz
<b>AC System Voltage</b>	275 kV	275 kV
<b>Power Co.</b>	The Tokyo Electric Power Co. Inc., Japan.	
<b>Manufacturer</b>	Toshiba Electric Co., Japan for 50 Hz side. Hitachi Co., Japan for 60 Hz side. Nisshin Electric Co., Japan for the AC harmonic filters.	
<b>Commissioned</b>	December 1977 (Shin-Shinano I) May 1992 (Shin-Shinano II)	
<b>Main Purpose</b>	The interconnection is designed as an asynchronous HVDC coupling system between the two electric power systems of the east (50Hz) and the west (60 Hz) of Japan. The main purpose is peak power reserve for both electric power systems. Energy supply during emergency situations and economical exchange of excess energy in normal operation.	
<b>Main data</b>	<u>Shin-Shinano I</u> 300 MW at 125 kV DC and 1200 A x 2  Overload Capacity : none  <u>Shin-Shinano II</u> 300 MW at 125 kV DC and 2400 A  Overload Capacity : none	
<b>A.C. Networks</b>	<u>Shin-Shinano I and Shin-Shinano II</u> One 3-phase converter transformer per 6-pulse converter unit is used. The two transformers are connected to the 275 kV 50 Hz system and the other two are connected to the 275 kV 60 Hz system.  <u>Data :</u> <u>Shin-Shinano I</u>	

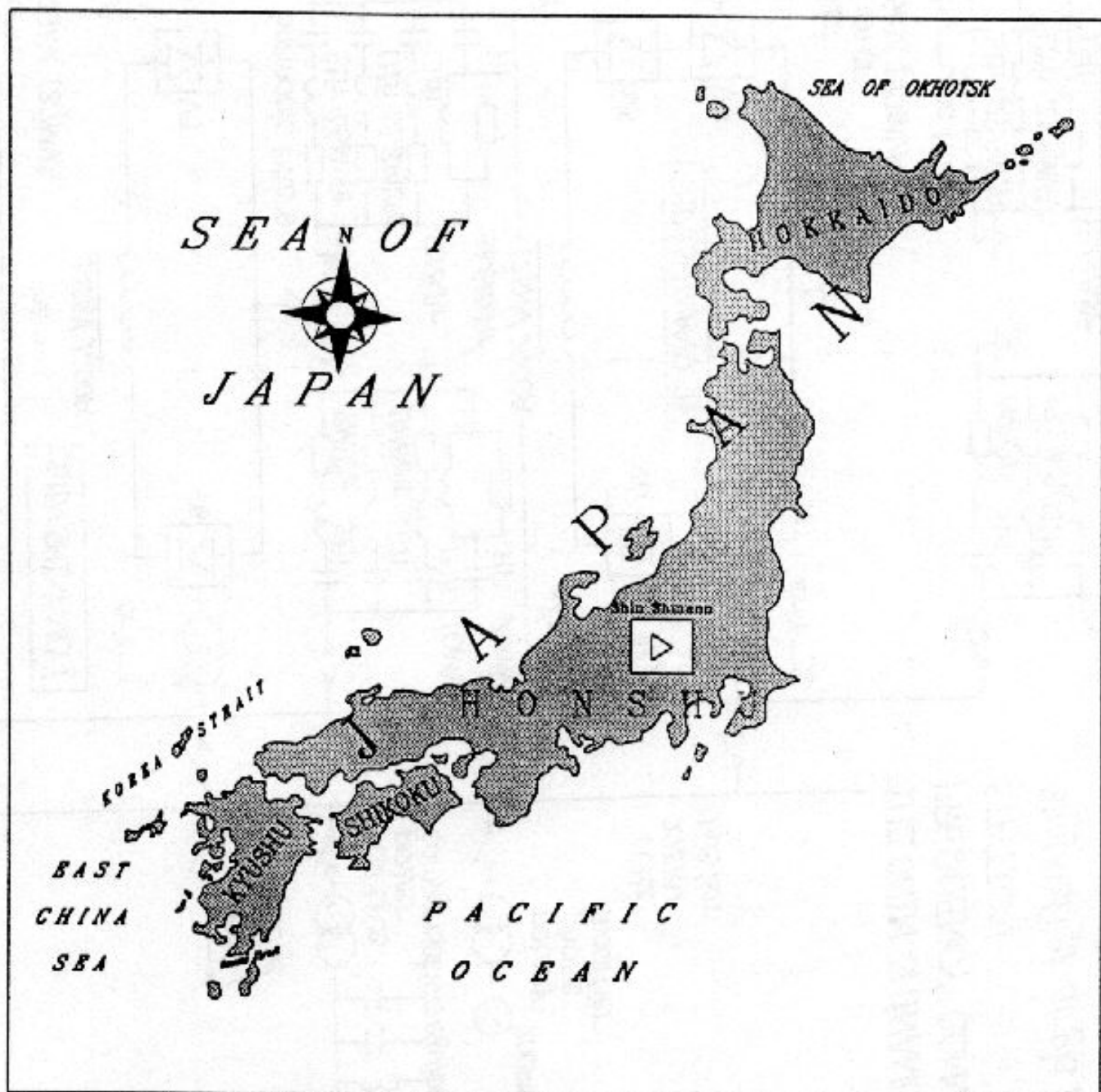
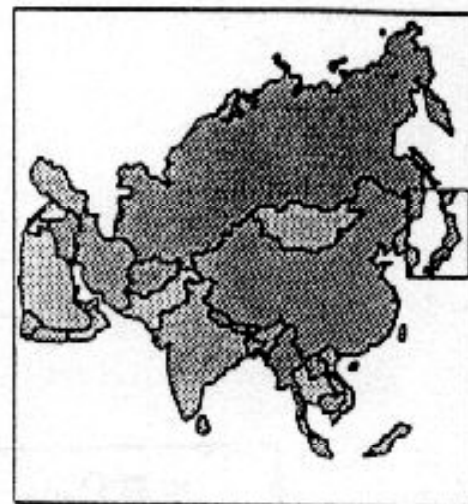
	187 MVA, 275 kV $\pm$ 11%/110 kV 20 % impedance (187 MVA base)  <u>Shin-Shinano II</u> 190 MVA, 275 kV $\pm$ 11%/56 kV 20% impedance (190 MVA base)  <u>Short circuit capacity</u> 50 Hz side = min. 3900 MVA 60 Hz side = min. 1500 MVA																																																										
<b>HVDC System</b>	Due to the station design (back to back) there are no HVDC transmission lines.																																																										
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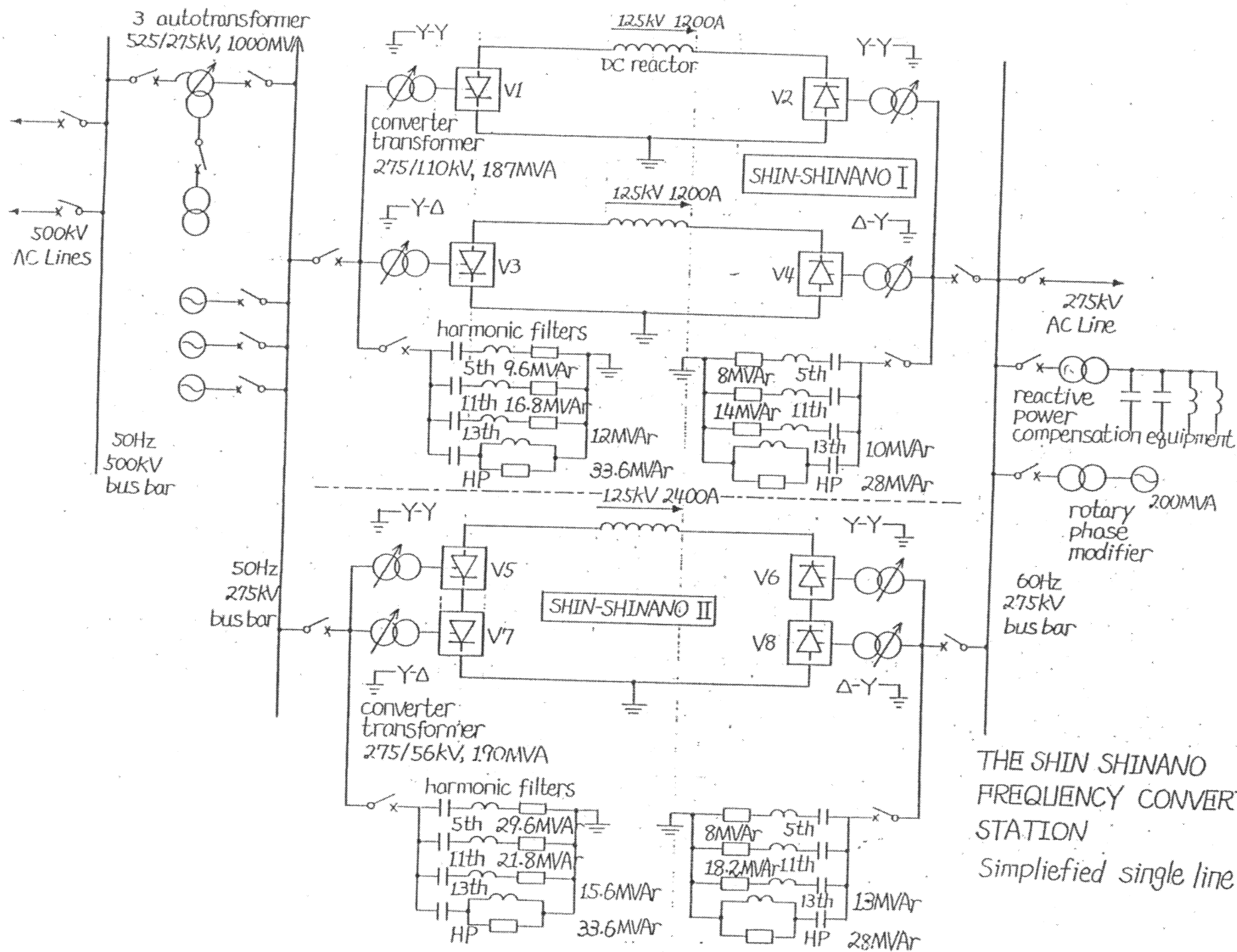
<b>HVDC Valves</b>	<p><u>Shin-Shinano I</u> Electric triggered thyristor valves are used.</p> <p>Each 50 Hz or 60 Hz terminal has two 6 pulse converter units operating in parallel to obtain 12 pulse operation. Each 6 pulse unit is connected to one 3 phase converter transformer in Y/Y or DeltaY connection respectively. The thyristor valves are designed as an outdoor type, which is oil-insulated, oil-cooled and housed in a tank containing one valve section. For the 50 Hz side : Each valve section has 192 thyristors (rated at 2500 V and 1500 A) in series connection and none in parallel. This makes a total of 1152 thyristors per 6 pulse unit.</p> <p>For the 60 Hz side : Each valve section has 120 thyristors (rated at 4000 V and 800 A) in series connection and 2 in parallel, giving a total number of 2880 thyristors or 1440 thyristors levels per 6 pulse unit. Each 6 pulse unit is for 125 kV D.C. and 1200 A The smoothing reactors are designed for 125 kV DC and 1.0 H at 1200 A</p> <p><u>Shin-Shinano II</u> Direct light triggered thyristor valves are used. Each 50 Hz or 60 Hz terminal has two 6 pulse converter units operating in parallel to obtain 12 pulse operation. Each 6 pulse unit is connected to one 3 phase converter transformer in Y/Y or DeltaY connection respectively. The thyristor valves are designed as an indoor type, which is air-insulated and water cooled. Each valve section has 28 thyristors (rated at 6000 V and 2500 A) in series connection and none in parallel. This makes a total of 168 thyristors per 6 pulse unit. The two 6 pulse units are connected as a structure of three quadrivalves. The quadruple valves are for 125kv and 2400 A. The smoothing reactor is designed for 125 kV DC and 0.25 H at 2400 A.</p>
<b>Valve Cooling</b>	
<b>D.C. Reactor</b>	<p><u>Shin-Shinano I</u> The smoothing reactors are designed for 125 kV DC and 1.0 H at 1200 A</p> <p><u>Shin-Shinano II</u> The smoothing reactor is designed for 125 kV DC and 0.25 H at 2400 A.</p>
<b>References</b>	<p><u>Shin-Shinano I</u> CIGRE 1978, paper 14-02, "Shin Shinano Frequency Converter station" by M. Yasuda, K. Mizushima, Y. Kato and A. Seki.</p> <p><u>Shin-Shinano II</u> CIGRE 1992, paper 14-02, "New Technology Applied to the Recent HVDC Converter Stations in Japan" by T. Senda, S. Horiuchi, T. Namera, Y. Muraoka, T. Horiuchi and K Qonishi.</p> <p>IEEE 1992 Winter Meeting, 92 WM 215-4 PWRD, "Design and Type Test of a</p>

	Light-Triggered Thyristor Valve for Back-to-Back Systems", by F. Nakajama, T. Yamazaki, K. Itoh, T. Matsumoto and T. Sakai.
<b>System correspondent</b>	<p>Mr H. KAWADA  The Tokyo Electric Power Co., Inc.  NO. 1-3, 1-chome, Uchisaiwai-cho  Chiyoda-ku  Tokyo 100  JAPAN</p> <p>Telex : 2224045 TODEN J</p> <p>Telephone : +81 3 3501 8111</p>

# THE SHIN SHINANO HVDC SYSTEM

Geographic map





THE SHIN SHINANO  
FREQUENCY CONVERTER  
STATION  
Simplified single line diagram