



# Thyristor-type Static Excitation Systems for Synchronous Machines



# The thyristor-type static excitation system, due to its many advantages, excellent response characteristics, easy maintenance and simplified main machine construction, is now extensively used for medium- and large-capacity hydro- or steam-turbine generators.

MITSUBISHI have manufactured over 200 units of Thyristor-type Static Excitation Systems since 1968, and has excellent performance and high reliability.



## System configurations

The voltage regulator and potential source static excitation system functions to control the voltage of an AC generator by directly controlling the generator's DC field current. The static excitation system is composed of the followings:

### Thyristor rectifier bridge and thyristor elements

The 3phase full bridge rectifier circuit has fast response characteristics. A compact cubicle design is realized with the large on-state current and high reversed voltage flapack type thyristor elements, and forced air cooling. The thyristor elements are installed in a tray, and can be exchange during operation. For better cost performance, a tray-less-type can also be manufactured.

### Field Flashing

The field flashing circuit is necessary when a generator is started, because of self-excitation system. A DC battery is usually used as the initial excitation power supply. An AC power supply can also be adopted by means of rectifiers and a transformer.

### Field suppression

The de-excitation function is to reduce rapidly field energy when needed and also to separate the rotor circuit from the excitation system. The DC field circuit breaker is generally used. For better cost performance, a static field circuit breaker system can be supplied. This system reduce the field energy by reversing the excitation voltage by rectifier gate controls.

### Over voltage protections

The C-R absorbers and varistors are installed in each AC and DC circuit for over voltage protections of thyristor elements. In large capacitance system, a crowbar circuit is adapted on DC circuit.

### Excitation transformer

The excitation transformer reduces the supply voltage to the level required for excitation. A dry-type for small capacity or a oil-type for large capacity is generally used.

### Monitoring devices

The alarms for thyristor fuse blown, cooling fan failure and air temperature high are available. A rotor temperature converter and field earth detector can be installed in excitation cubicles optionally.

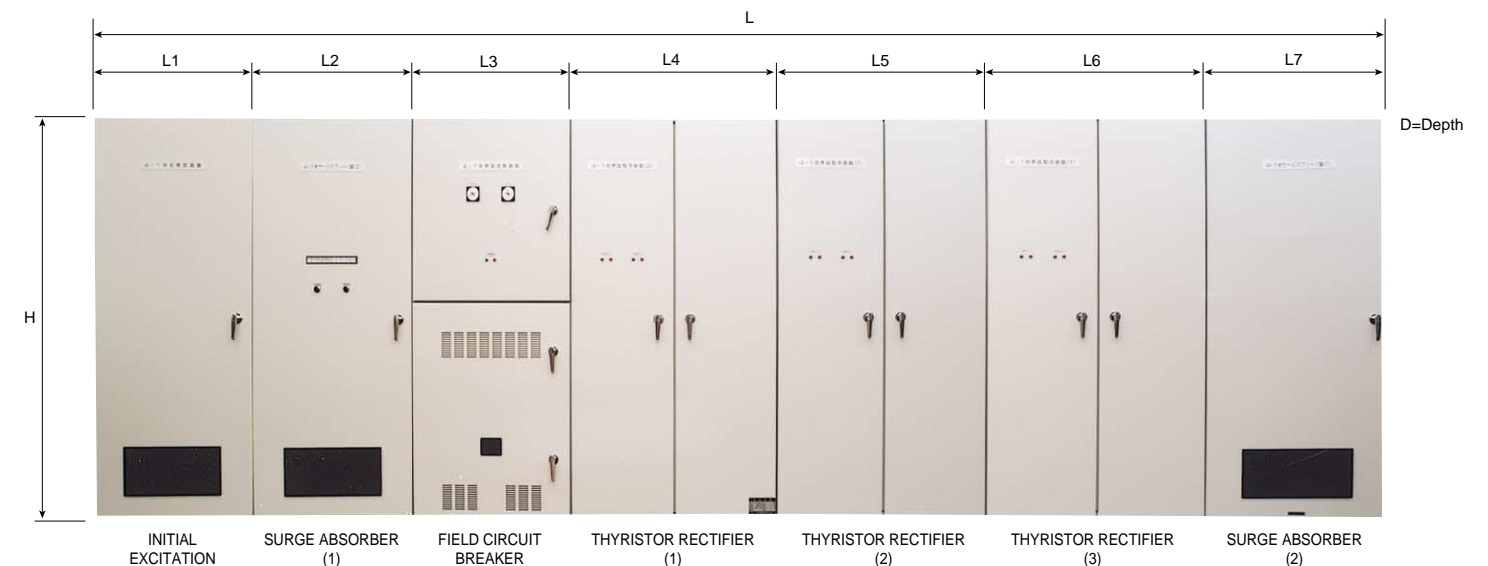


## Ratings and Dimensions

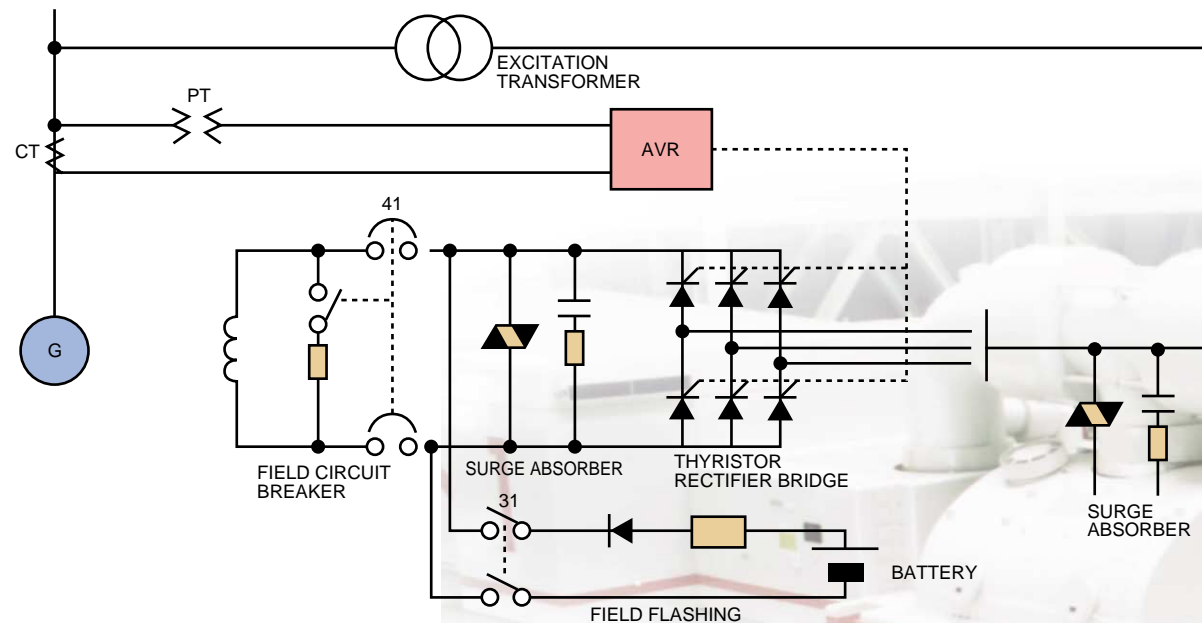
The ratings of Static Exciter are principally defined by the rating current and the ceiling voltage. The typical ratings and cubicle dimensions are as follows;

Ratings		Dimensions(mm)									
Maximum Current (A)	Maximum Ceiling Voltage (V)	L	D	H	L1	L2	L3	L4	L5	L6	L7
1350	460	2900	2000	2300	0	0	900	1000	0	0	1000
1100	1000	3000	2000	2300	0	0	1000	1000	0	0	1000
3509	1100	3200	2000	2300	0	0	1000	1200	0	0	1000
2422	1480	3400	2000	2300	0	0	1200	1200	0	0	1000
8000	1100	6000	2500	2600	0	1200	1200	1200	1200	0	1200
8000	1480	8700	2500	2600	1200	1200	1500	1200	1200	1200	1200
8566	1100	4900	2500	2600	0	1200	1000	1500	0	0	1200
9462	1600	6400	2500	2600	0	1200	1000	1500	1500	0	1200

Remarks: \*mark indicates the dimensions of tray-less and static field circuit breaker system type. Above dimensions are subject to change by detail and design progress.



## THYRISTOR-TYPE Static Excitation System Configurations.



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## ■ Reference list of Thyristor-type Static Excitation Systems

Typical and recent supply record is as follows;

Plant	Gen.rating (MVA)	current (A)	voltage (V)	ceiling voltage (V)	year	remarks
TOYAMA Pref. SHOUTOU P/S, JAPAN	27.4	640	170	370	1968	first
TUMUT-3 P/S, AUSTRALIA	278	1100	325	760	1969	second
GURI-2 P/S, VENEZUELA	805	3200	482	2000	1979	max. ceiling voltage
KANSAI Elec. Po. Co. GOBO P/S 1, JAPAN	670	5364	550	895	1982	first large thermal
⋮	⋮	⋮	⋮	⋮	⋮	⋮
CHUBU Elec. Po. Co. HEKINAN P/S 3, JAPAN	800	5094	530	935	1992	
KYUSU Elec. Po. Co. SHIN-OHITA P/S 2, JAPAN	242	3824	340	440	1993	
PETACALCO P/S 5,6, MEXICO	427.8	3333	450	953	1993	
CHUGOKU Elec. Po. Co. SHIMONOSEKI P/S1, JAPAN	195	2800	375	550	1993	
MIZUSHIMA Co-op. Elec. Po. Co., JAPAN	171	1857	280	450	1993	
KOBE Steel Co., Ltd. KAKOGAWA 4, JAPAN	97.5	720	375	375	1993	
CHUBU Elec. Po. Co. TOUSHIN S/S 2, JAPAN	100	1600	315	1000	1993	
CHUBU Elec. Po. Co. OKUMINO P/S 3,4, JAPAN	279	1415	325	490	1993	
FUKUYAMA Co-op. Elec. Po. Co., JAPAN	171	1857	280	450	1994	
HOKURIKU Elec. Po. Co. NANA-OHTA P/S 1, JAPAN	556	4875	400	1067	1994	
KUMAMOTO Pref. MIDORIKAWA 2 P/S, JAPAN	6.8	327	110	145	1994	
E.P.D.C. MATSUURA P/S 2P, JAPAN	655	5364	550	700	1995	
E.P.D.C. MATSUURA P/S 2S, JAPAN	495	5000	400	500	1995	
NEW-TIENLUN P/S, TAIWAN	117.2	1590	310	450	1995	
CHUBU Elec. Po. Co. KAWAGOE P/S 4, JAPAN	270	3000	350	812	1996	
MHI T-PLANT, JAPAN	250	2232	300	430	1996	
CHYIRHAN P/S 3, TURKEY	189	1892	370	740	1997	
KANSAI Elec. Po. Co. OKUTATARAGI P/S 5-6, JAPAN	400	1560	450	688	1997	
TOKYO Elec. Po. Co. CHIBA P/S 1, JAPAN	412	4767	430	820	1997	
TOHOKU Elec. Po. Co. HIGASHINIIGATA P/S 4, JAPAN	332	3265	490	1215	1997	

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and may result in damage to product and other property.  
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