

The results obtained by ourselves in investigating the effect of stress on oriented 50% iron-nickel core are shown in Fig. 8 and 9.

Fig. 8 shows the result about a specimen of the dimensions of  $30 \times 50\phi \times 60\phi$  (mm) compressed in the direction of the diameter. Fig. 9 is the result about a similar sized specimen being repeatedly dropped on the floor, each time the height being increased.

## V. APPLICATION

The products manufactured by our Company using the cores with rectangular hysteresis loop are given below, while more new varieties of application are being planned for the future.

- (1) Contact converters
- (2) Magnetic amplifiers
- (3) D-C current (voltage) transformers
- (4) Voltage stabilizers

In these reports are described the case of oriented 50% iron-nickel alloy, but also research work on orient silicon steel and alloys, of the Permalloy system is carried out obtaining materials with excellent characteristics to be used in the above instruments.

- (5) Acknowledgement

The writers wish to extend their gratitude of Dr. K. Mihara of his guidance in the research and production of special magnetic materials such as oriented 50% iron-nickel alloy and other materials.

# HEAVY CURRENT SELENIUM RECTIFIER FOR WATER ELECTROLYSIS

CAPACITY 180 kW 90 V 2,000 A

Supplied to the Fukiai Factory of the Kawasaki Seitetsu K. K.

Selenium rectifiers are one of those that have greatly extended its sphere of application in recent days. Their maintenance is simple and operation easy, with advantage of high efficiency at any load. Production of superior selenium rectifier element has resulted in long life and extensive use in various fields. As a typical the selenium rectifier for water electrolysis recently supplied to Fukiai Factory of the Kawasaki Seitetsu K.K. is accounted for herein.

This equipment is composed of a system which receives as shown in the connection diagram of the main circuit in Fig. 1, 3 phase power at 2,200 V 60 c and is adjusted to the required voltage by an induction voltage regulator, after which it is supplied to a selenium rectifier through a transformer and is converted to a D.C. power of 90 V-50 V 2000 A.

Details of each instrument are as follows:

- (1) Selenium Rectifier 1 set  
Type: Indoor use oil circulating water cooled  
Rated Output 180 kW Continuous  
Rated Voltage 90 V  
Rated Current 2,000 A  
Rectifying system 3 phase full wave bridge connection  
Accessories Water cooled oil cooling device, oil conservator, oil circulation pump, etc.
- (2) Rectifier Transformer 1 set  
Type: Indoor use oil immersed self cooled  
Capacity 230 kVA continuous  
Number of Phase 3 phase

Primary voltage 2,830 V  
Secondary voltage 80 V (Equivalent to 90 V D.C.)

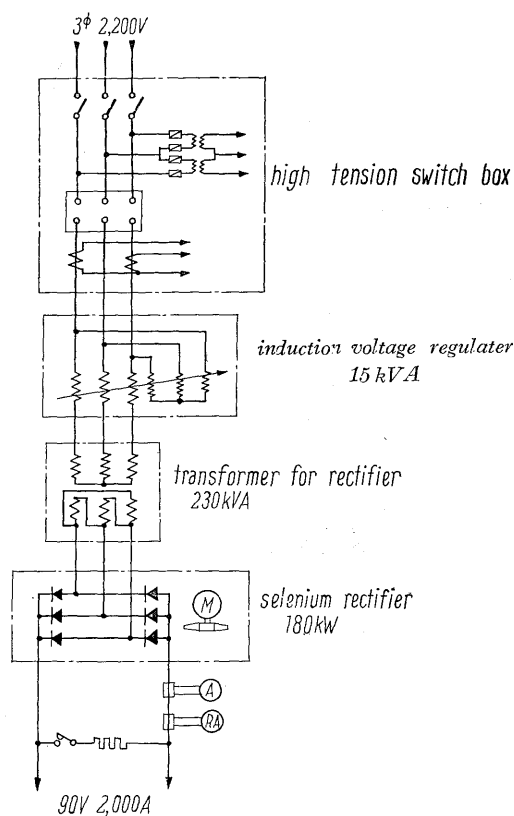


Fig. 1. Connection diagram of main circuit

- Frequency 60 c
- (3) Induction Voltage Regulator 1 set  
Type: Indoor use oil immersed self cooled,  
motor operated
- Capacity 55 kVA
- Number of Phase 3 phase
- Primary Voltage 2,200 V
- Secondary Voltage 2,200 V  $\pm 660$  V
- Frequency 60 c
- (4) High Tension Closed Type Switch Cubicle 1 set
- (5) Self Stand Type Sheet Iron Switchboard 1 set

As a set to be used for water electrolysis, it must stand continuous full load running for long period from the nature of its load. For this reason the selenium rectifier is of the oil immersed type, in which a motor operated oil pump is used to force the cooling oil circulate through a water cooled oil cooler. The oil cooling device forms part of the main tank, saving installation space and assuring efficient cooling.

The oil cooling device is attached to both left and right sides of the selenium rectifier tank, and its specification is as follow:

Temperature of cooling water	Inlet	25°C
	Outlet	30°C
Temperature of oil	Inlet	55°C
	Outlet	50°C

Cooling water volume 60 l/min

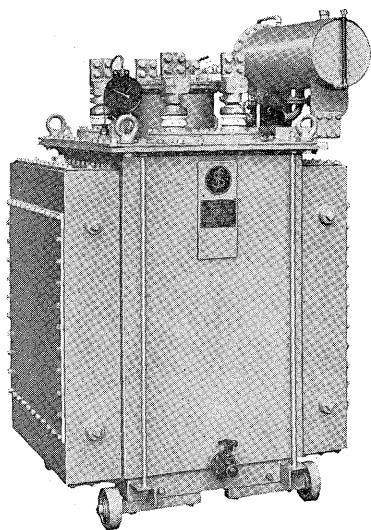


Fig. 2. Water cooled oil circulating type selenium rectifier

The inside wall of the cooler is coated with an asphaltic acidproof alkali paint to prevent corrosion by the cooling water.

The selenium rectifier element used for it is the Ea 400 type which has uniform characteristics, and it is constituted of 4S 20 P 6A, totalling 480 pieces.

It is most important from the point of life to maintain the selenium rectifier element at normal temperature.

To this device are provided an alcohol thermometer and a dial type thermometer with alarm contacts to watch the cooling oil temperature, besides Buchholts relay is attached to detect any internal fault.

The oil circulation pump is of 1/6 HP, 220 V, 60 c, 900 r.p.m. It is a motor operated centrifugal pump operated totally immersed in oil. In spite of it being of entirely new design, in an actual load tests the temperature rise of the selenium rectifier element was successfully conferred to be 30°C (cooling water temperature 22°C)

When it is running a white signal lamp is lighted on the switchboard.

For the rectifier transformer, in addition to the rated secondary voltage of 80 V, compensating taps equivalent to 89 V are attached to the primary winding for use after the selenium rectifier elements are aged, and can be easily changeable through a hand hole.

In this device, for electrolytic cell having reverse voltage loads, cell energy is to be discharged by inserting a discharge resistance after the A.C. breaker is opened. Overall efficiency of 83.5 is guaranteed for the above equipment, and combined load tests were completed satisfactorily at the factory. As the first large capacity selenium rectifier being built by our company, it is now in commercial operation. It is expected that they will be widely applied as a power source, of this kind at various fields for the one introduced herein is a typical of the kind.

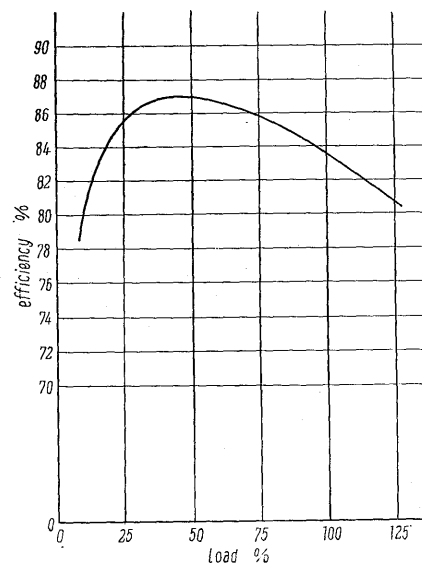


Fig. 3. Total efficiency