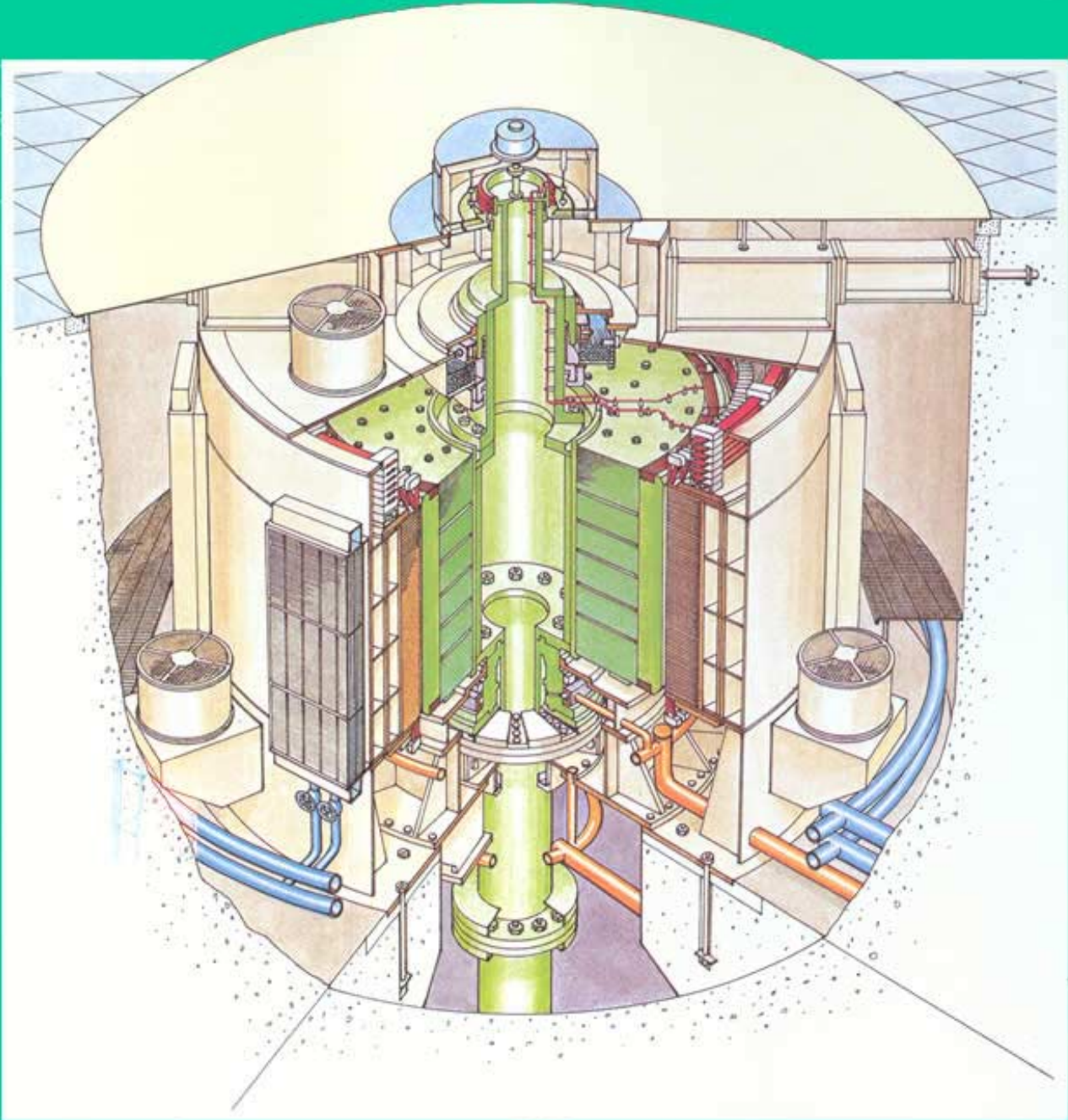


TOSHIBA

HYDRO GENERATORS



Outline of Toshiba Hydro Generators

Boasting the longest history in Japan for this type of equipment, TOSHIBA's first production of hydro generators dates back to over 80 years ago. Our endless research efforts throughout these many decades have created the largest installation records and maintained TOSHIBA as a top-ranking name in this field.

The number of hydro generators already installed and planned for near-future installation exceeds 1,200 units, their total capacity 30,000MVA.

In terms of unit capacity, including the world's largest generator of 805MVA, more than 100 units exceeding 100MVA have served our clients in a variety of 40 different models.

Export of TOSHIBA hydro generators cover U.S.A., Canada, Central and South America, Africa, Southeast Asia, Europe, and other countries and continents. With units now in production for scheduled export included, we have supplied world markets with 160 units-totalling 15,000MVA, enabling us to proudly proclaim "TOSHIBA-a world leader in heavy-electric technology."

In 1940, five 100MVA-150rpm generators were completed at our Tsurumi works. These units, later installed in the Suiho

Power Station (Korea), attained fame then as the world's largest-capacity hydro generators. Since that time until around 1960 was an era when 100MVA generators were predominantly produced and installed.

The year 1965 further triggered and accelerated a demand for even larger-capacity units. At present, as displayed in Fig. 1 below, unit capacities are increased up to 500 800MVA.

Topographical conditions at power-generating sites and operation requirements generally determine the optimum ratings/specifications of hydro generators. Specifically, determination of unit capacity and rated speed depends on the same conditions. And these requirements imposed by the hydro-power system or the electrical power system influence the degree of difficulty in designing and manufacturing the most appropriate generating system. TOSHIBA has long been engaged in producing not only hydro generators, but also hydraulic turbines. We have successfully attained the capability of solving most flexibly various technical problems related to hydraulic power generating plants.

During the course of the trend demanding larger unit capacities, the need for high-speed and low-speed equipment has also increased, the types often requiring more difficult design and production technique. Possessing rich experience and achievements in this area as well, TOSHIBA is able to handle with confidence any new construction requirements for hydro generators of high- and low-speed types.

High-speed, large-capacity generators

This type of generator is widely adopted, both in domestic and in overseas markets, as reversible generator-motors for many pumped-storage power plants.

In 1975 TOSHIBA installed one 265MVA/277MW-400rpm unit at the Ohira Power Station (Japan), in 1977 we completed factory production of two 315MVA/310MW-429rpm units for the Bajina Basta Power Station (Yugoslavia), and in 1979 we installed six 220MVA/214MW-514rpm units at the Okuyoshino Power Station (Japan). Regarding the generator-motors for the Okuyoshino P.S., the static variable frequency converter start was successfully incorporated as the first adopted in Japan.

Currently, two 335MVA/308MW-429rpm units, are under production for the Tamahara Power Station (Japan).

Low-speed, large-capacity generators

Three records, the first completed in 1969, the second in 1974 and the third in 1979, invited world attention as the largest-capacity machines produced during those time. The first is one 250MVA/250MW-225rpm unit for the Kiseniyama Power Station (Japan), the second is two 333MVA/415,000HP-225rpm units for the Bear Swamp Power Station (U.S.A.) and the third is two 367MVA/330MW-214rpm units for the Shintakasegawa Power Station (Japan).

Today, the world's largest-capacity record as air-cooled machine is 805MVA-112.5rpm generators for the Guri No.2 Power Station (Venezuela).

In 1978, we TOSHIBA as a leader of Consorcio JWG completed the production of this first 805MVA unit at our Tsurumi Works.

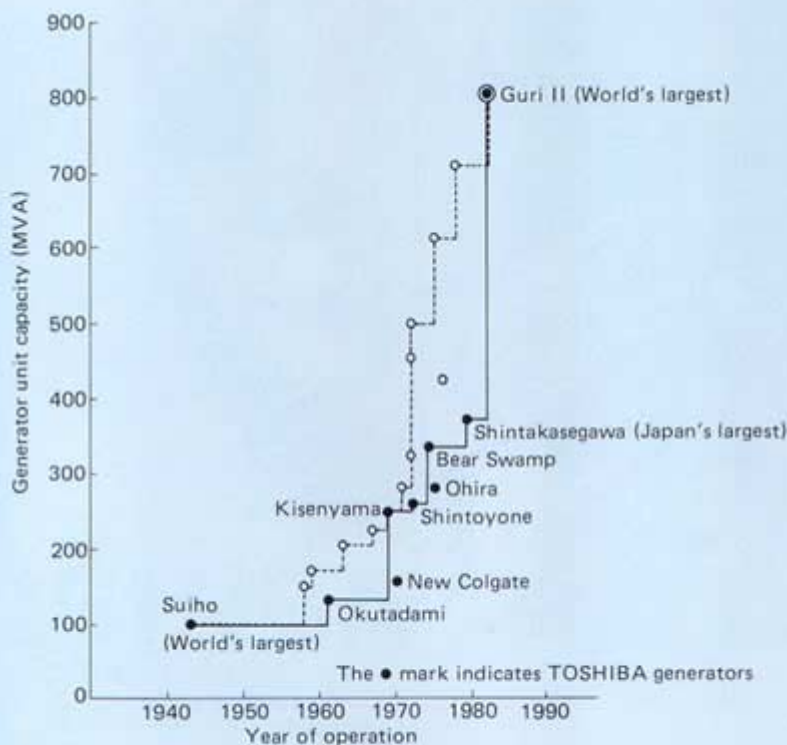
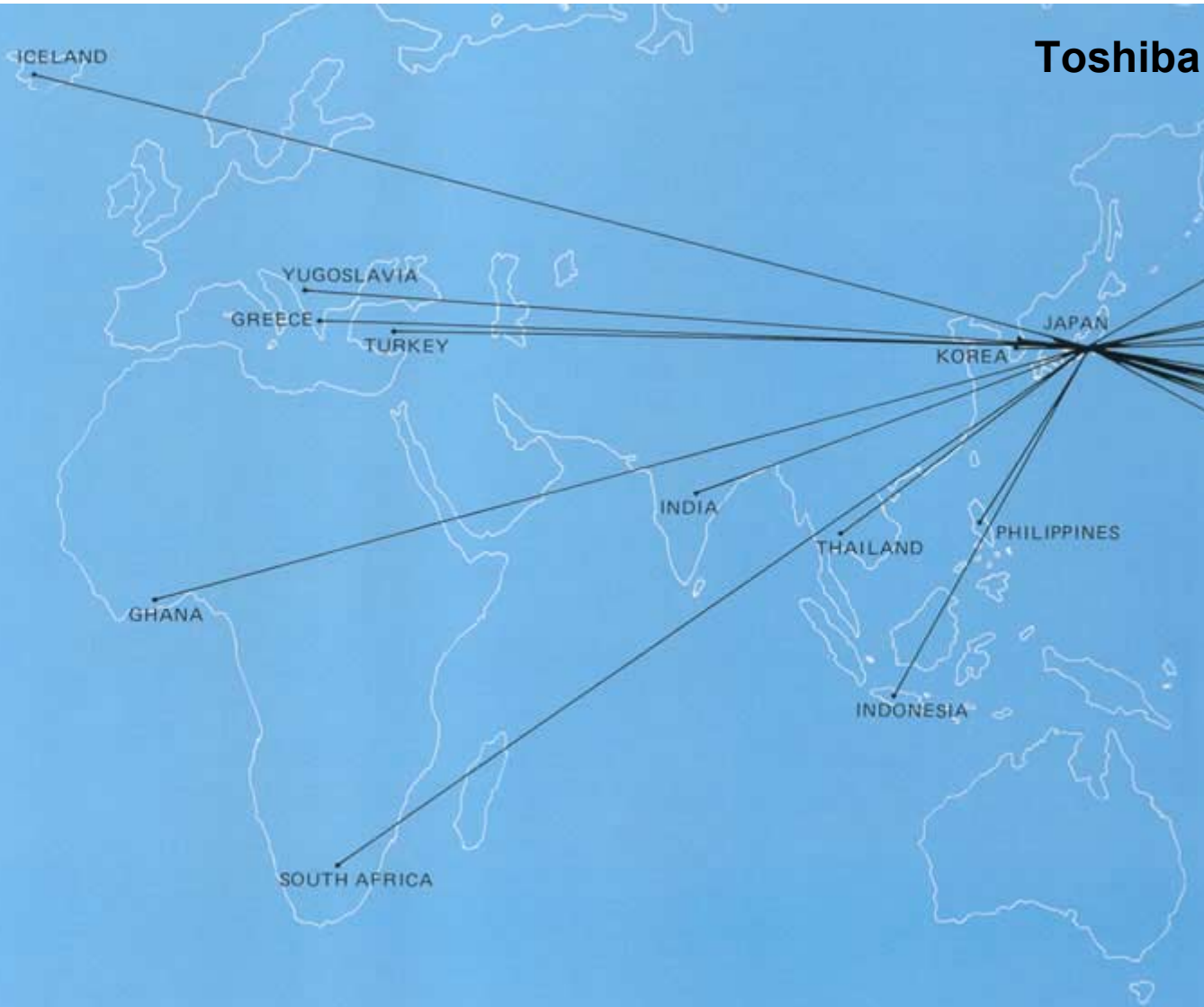


Fig. 1 Progress of hydro generators with the world's largest capacity.



Toshiba Main



Keihin Product Operations

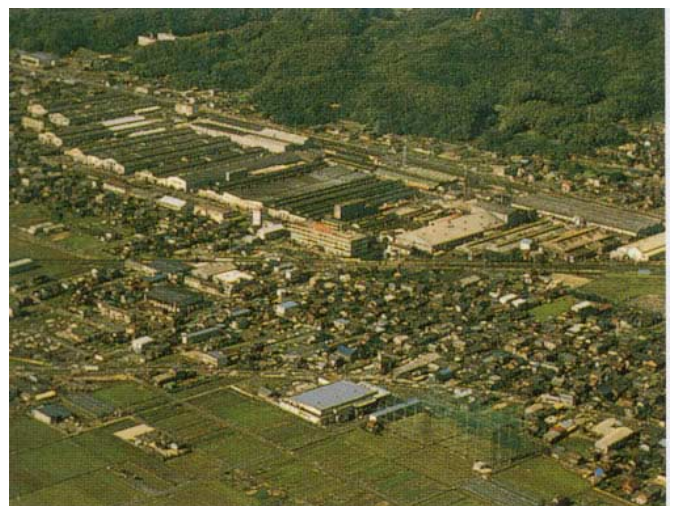


Hamakawasaki Works

...Spans the World!

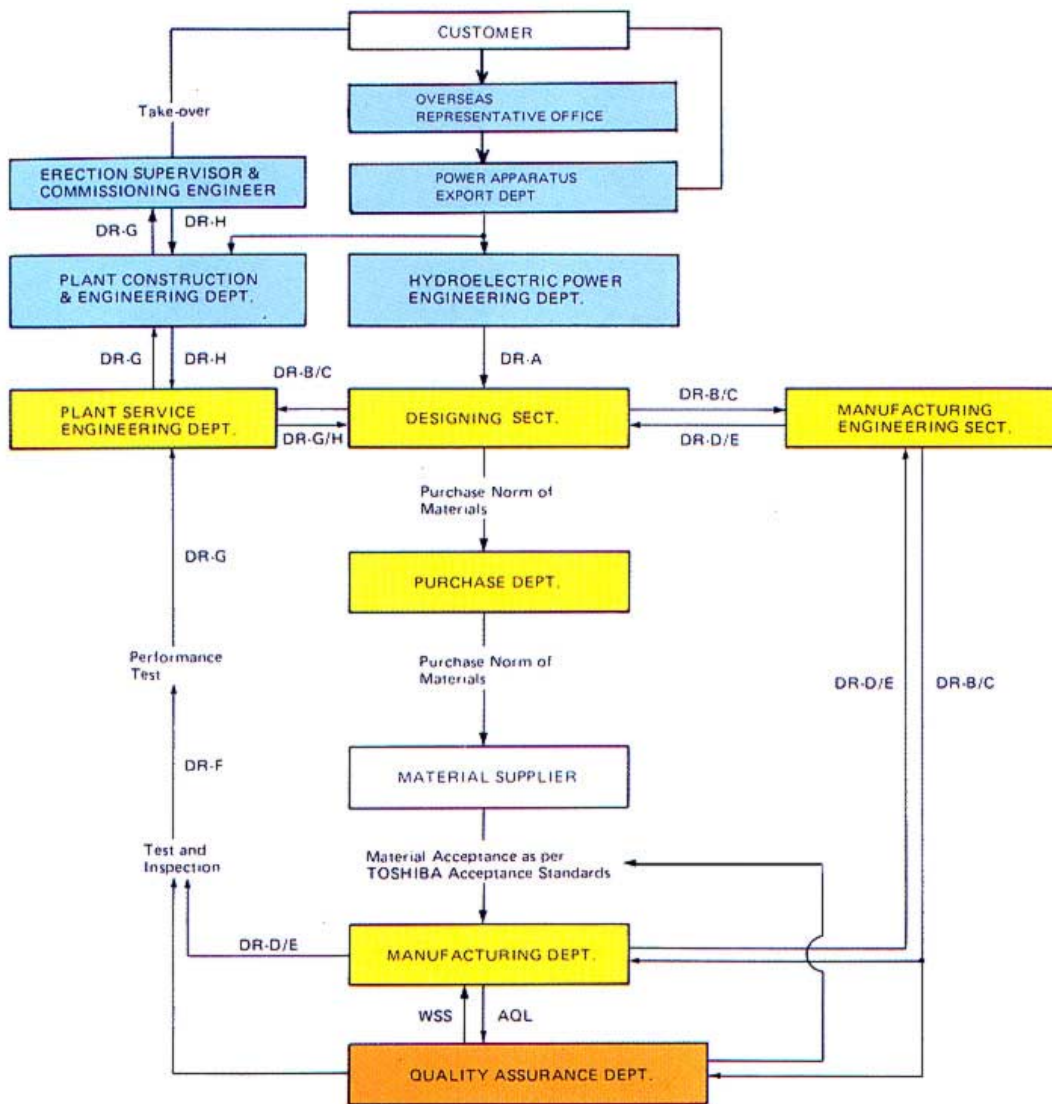


Fuchu Works



Mie Works

Organization of Total Quality Assurance System



DR : DESIGN REVIEW
 DR-A : DETAILED SPECIFICATIONS
 DR-B : FUNDAMENTAL DESIGN
 DR-C : DETAILED DESIGN
 DR-D : MANUFACTURING SYSTEM
 DR-E : MANUFACTURING PROCEDURE
 DR-F : PERFORMANCE TESTS
 DR-G : FIELD TESTS
 DR-H : OVERALL REVIEW
 WSS : WORK STATION SYSTEM
 AQL : ACCEPTABLE QUALITY LEVEL

ORGANIZATION IN HEAD OFFICE
 ORGANIZATION IN FACTORY
 INDEPENDENT DEPARTMENT

MANUFACTURING ENGINEERING SECTION is responsible for the development and improvement of manufacturing techniques, economical planning of manufacturing facilities, designing of manufacturing tools, problem solutions of production lines, determination of manufacturing procedures, and preparing process instructions and check sheets for each work station.

MANUFACTURING DEPARTMENT transforms designs and materials into quality products in accordance with the drawings, manufacturing procedures, and process instructions. Further, **MANUFACTURING DEPARTMENT** is responsible for operating and controlling the production processes to achieve the predetermined Acceptable Quality Level (AQL). Whenever any deviation from AQL is detected in each process, **MANUFACTURING DEPARTMENT** must transmit detailed information regarding such deviation to **MANUFACTURING ENGINEERING SECTION** and **QUALITY ASSURANCE DEPARTMENT**, not only for corrective action, but also as preventive action to minimize recurrence of similar shortcomings. Each person at a work station must fill out the corresponding check sheets upon the completion of each job and forward them to **QUALITY ASSURANCE DEPARTMENT** to ensure a constant monitoring quality level of the products. Check sheets are signed by authorized personnel.

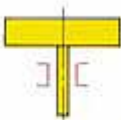
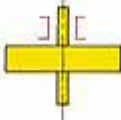
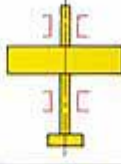
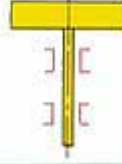

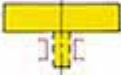
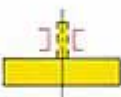
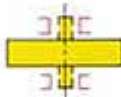
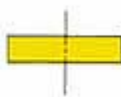


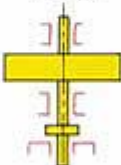
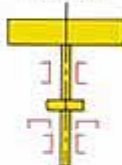
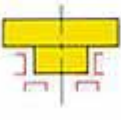





QUALITY ASSURANCE DEPARTMENT, whose responsibility is to measure and judge the quality levels of products, is an independent department. All quality data are returned to **DESIGNING SECTION**. Consequently, Design Data Books are continuously renewed in response to new information resulting from tests and inspections, field service experience, manufacturing processes, etc. This permits manufacturing various products one after another with higher quality and reliability.

ENGINEERING DEPARTMENT shall review and transmit **CUSTOMER's** quality requirements and specifications for generators, control equipment, and associated apparatus to **DESIGNING SECTION** upon the receipt of an order. Furthermore, **ENGINEERING DEPARTMENT** shall transmit information on any special requirements to **DESIGNING SECTION**, **MANUFACTURING ENGINEERING SECTION** and **QUALITY ASSURANCE DEPARTMENT**, and other concerned on **DR-A** meeting.

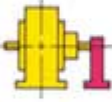
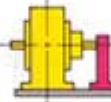
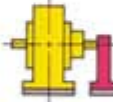
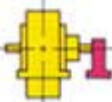
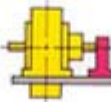
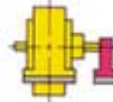
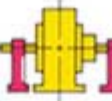
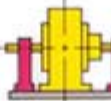
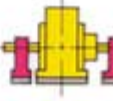
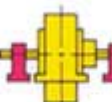
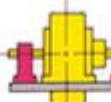
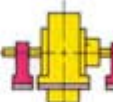
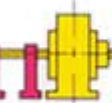
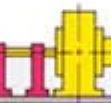
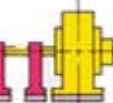
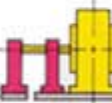
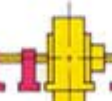
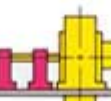
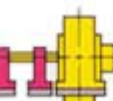
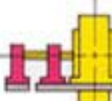
DESIGNING SECTION reviews **CUSTOMER's** requirements and specifications, translates these into

designs and prepares necessary drawings, detailed specifications including special manufacturing processes such as welding, heat treating, and nondestructive and performance tests. **DESIGNING SECTION** conveys these documents to **MANUFACTURING ENGINEERING SECTION**, **MATERIAL PURCHASE DEPARTMENT**, and **QUALITY ASSURANCE DEPARTMENT**. For preproduction quality evaluations, **DR-B** meeting is held in the early stage of fundamental designs, and **DR-C** meeting is held at the end of detailed designs to confirm whether each product quality fulfills **CUSTOMER's** requirements and specifications.

Types of Constructions of Vertical Hvdro Generators

Machines		Second numeral	Arrangement of guide bearing (third numeral)						
			Below the rotor	Above the rotor	Below and above the rotor	Two below the rotor	None		
			Type of shaft extension (fourth numeral)						
			Third numeral						
			0	1	2	3	4		
Without thrust bearing	With shaft	0	IM 8001 	IM 8011 	IM 8021 	IM 8031 	IM 8041 		
	Without shaft	1	IM 8100 	IM 8110 	IM 8120 		IM 8140 		
With thrust bearing	Below the rotor	With shaft	2	IM 8201 	IM 8211 	IM 8221 	IM 8231 		
		Without shaft	3	IM 8300 	IM 8310 	IM 8320 			
	Above the rotor	Without flywheel	With shaft	4		IM 8411 			
		Without shaft	5		IM 8510 				

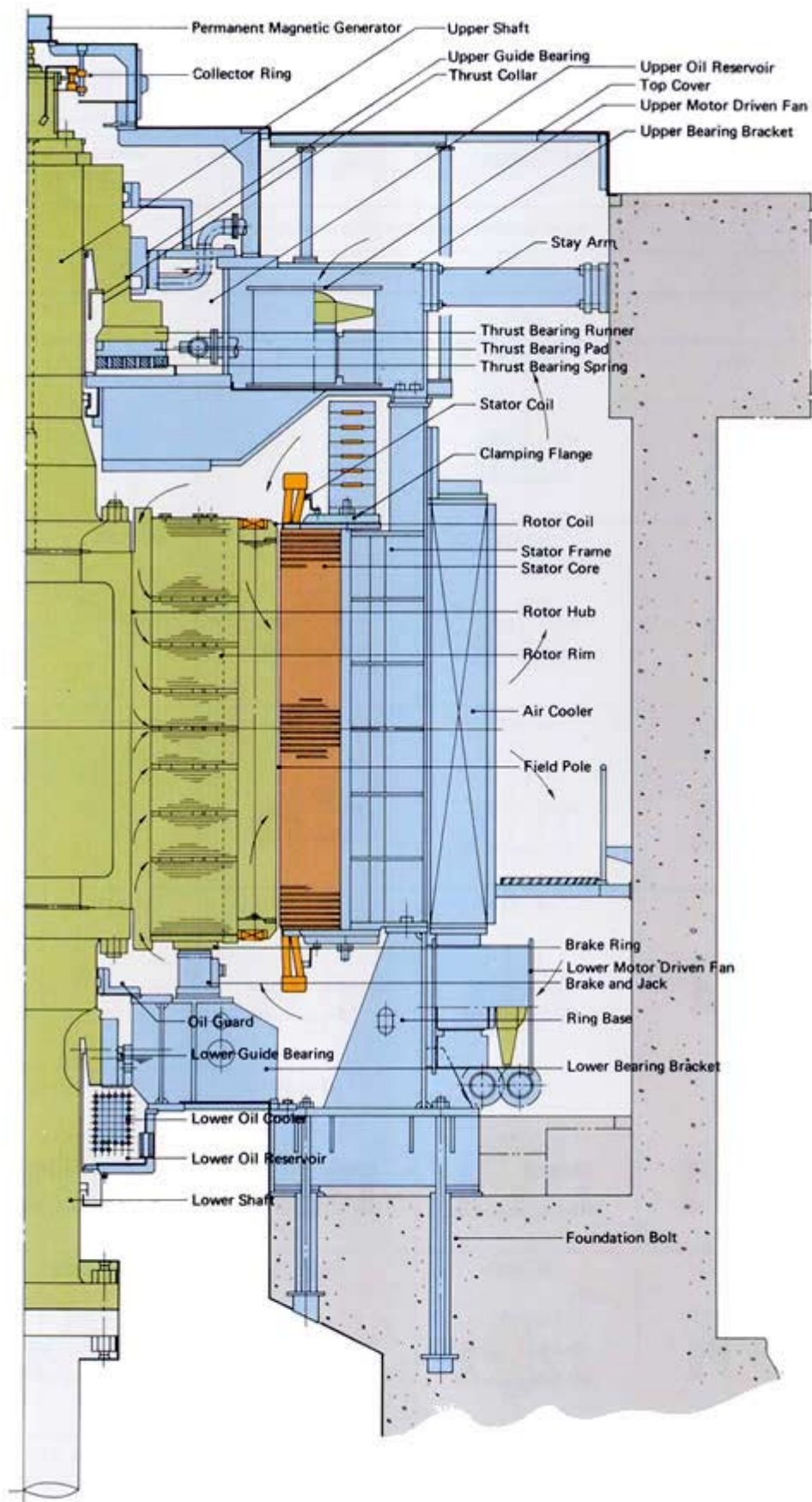
Type of Construction of Horizontal Hydro Generators

Machines			Bedplate or soleplate attachment (third numeral)				
			Without bedplate and soleplate		With bedplate	With soleplate	With soleplate and bedplate
			Type of shaft extension (fourth numeral)				
			Third numeral				
			0	1	2	3	
Number of pedestal bearings	One	With feet	0	IM 7001 	IM 7011 	IM7021 	
		With raised feet	1	IM 7101 	IM7111 	IM 7121 	
	Two	With feet	2	IM 7201 	IM 7211 	IM 7221 	
		With raised feet	3	IM 7301 	IM 7311 	IM 7321 	
	Three	With feet	4	IM 7400 	IM 7410 	IM 7420 	IM 7430 
		With raised feet	5	IM 7500 	IM 7510 	IM 7520 	IM 7530 

Defined by IEC Pub. 34-7 1972

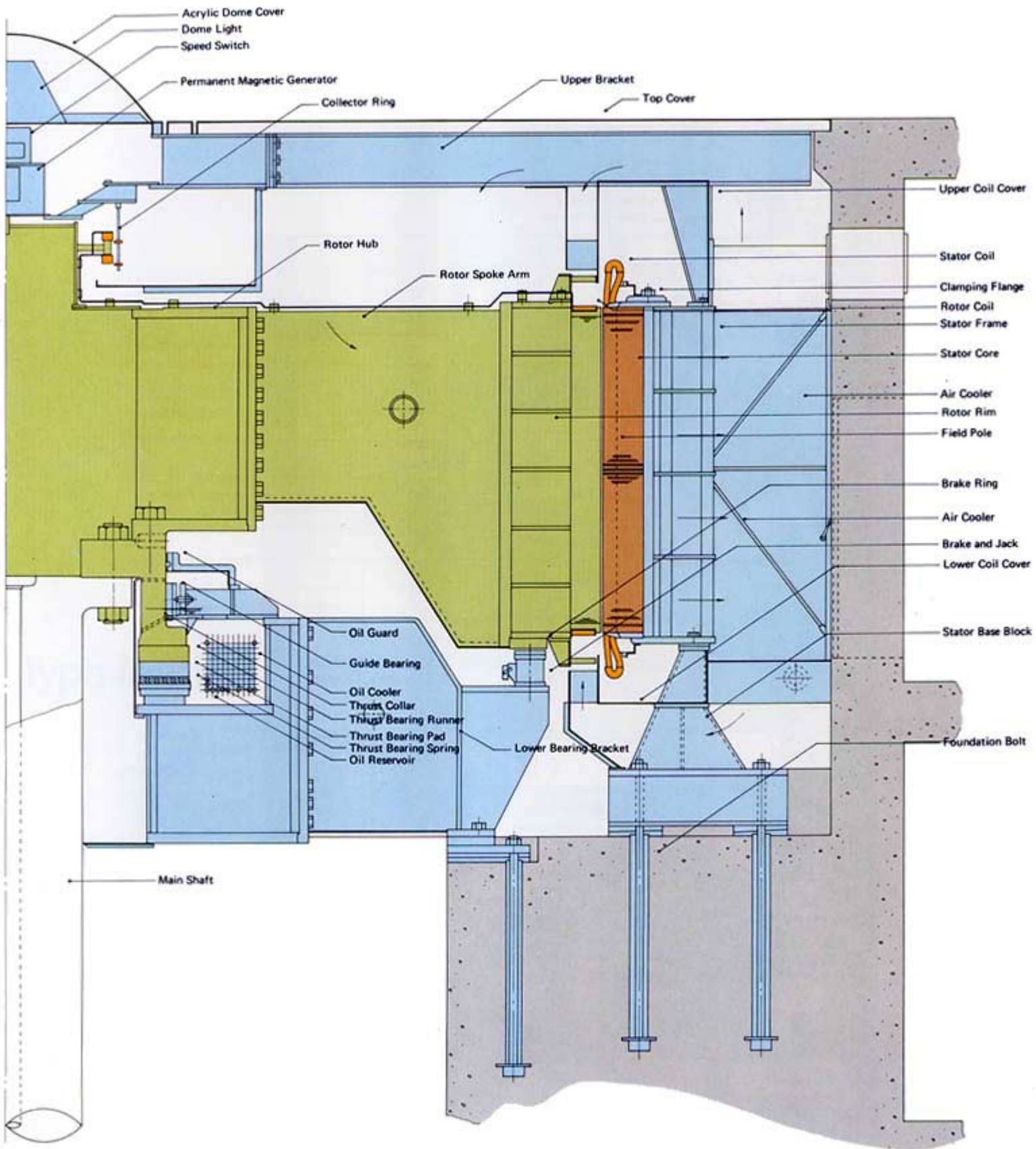
Type IM8421

Okuyoshino Power Plant, Japan
220MVA/214MW-514rpm



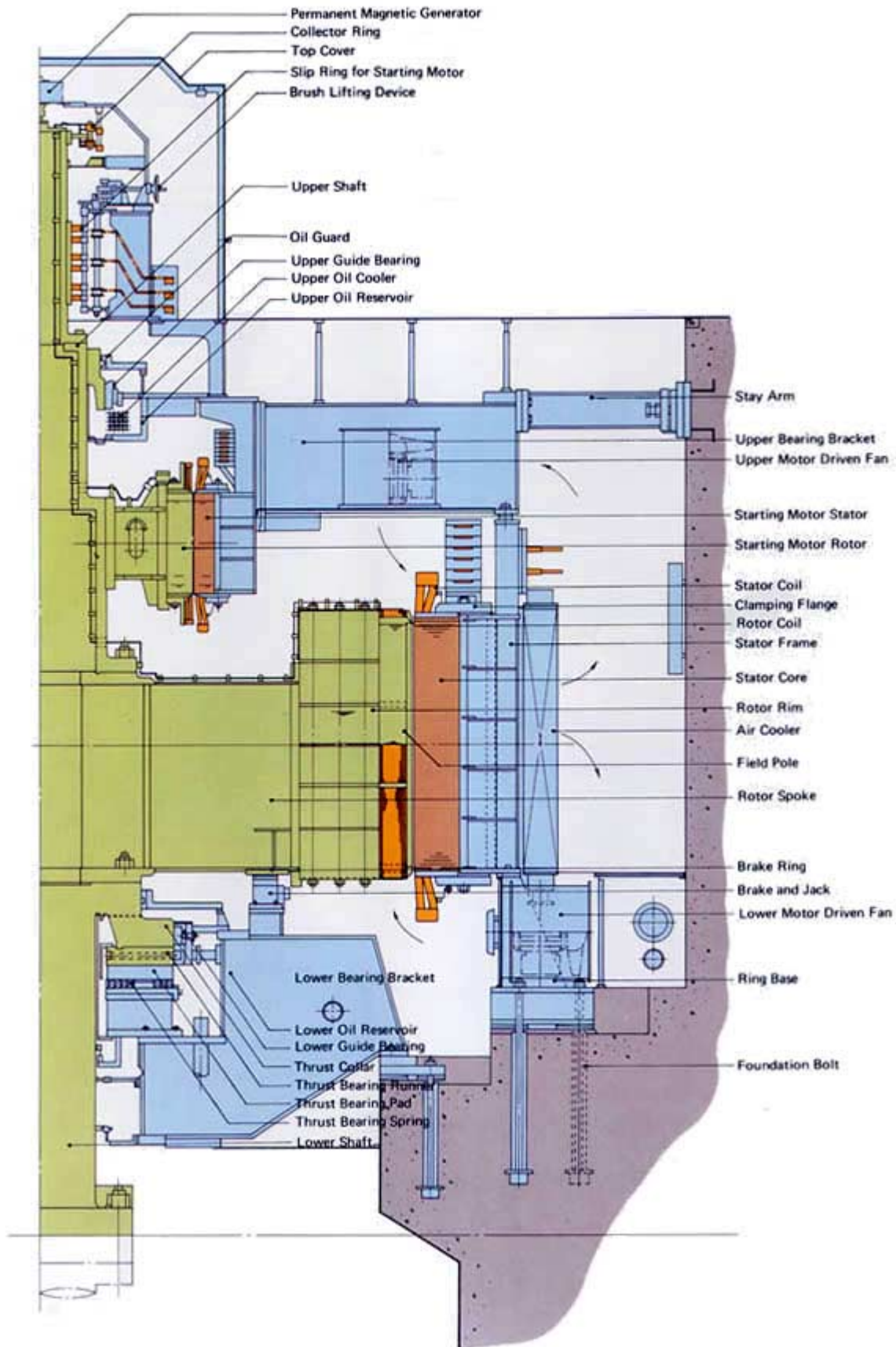
Type IM8300

G.M. Shrum Power Plant, Canada
290MVA-150rpm



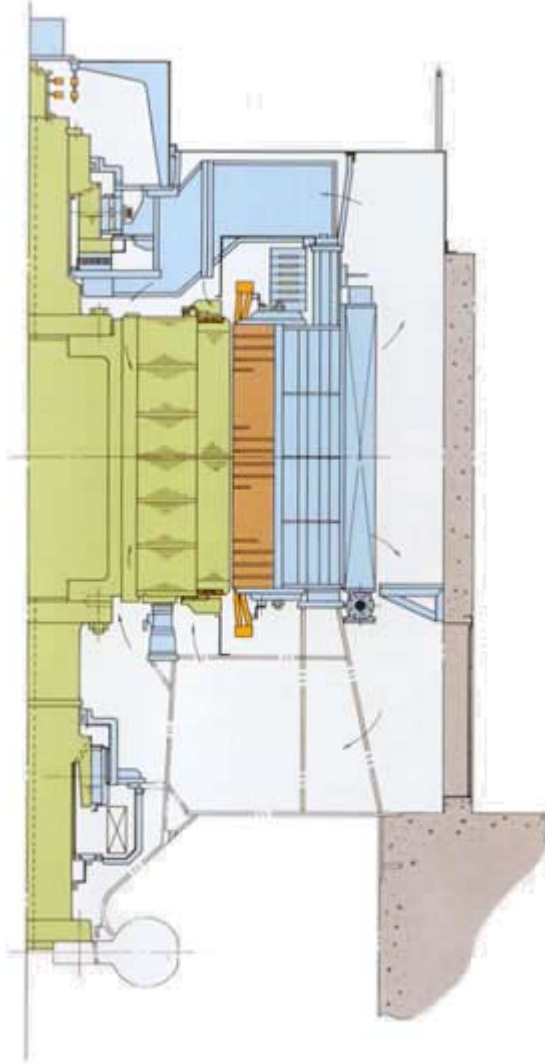
Type IM8221

Shintakasegawa Power Plant, Japan
367MVA/330MW-214rpm



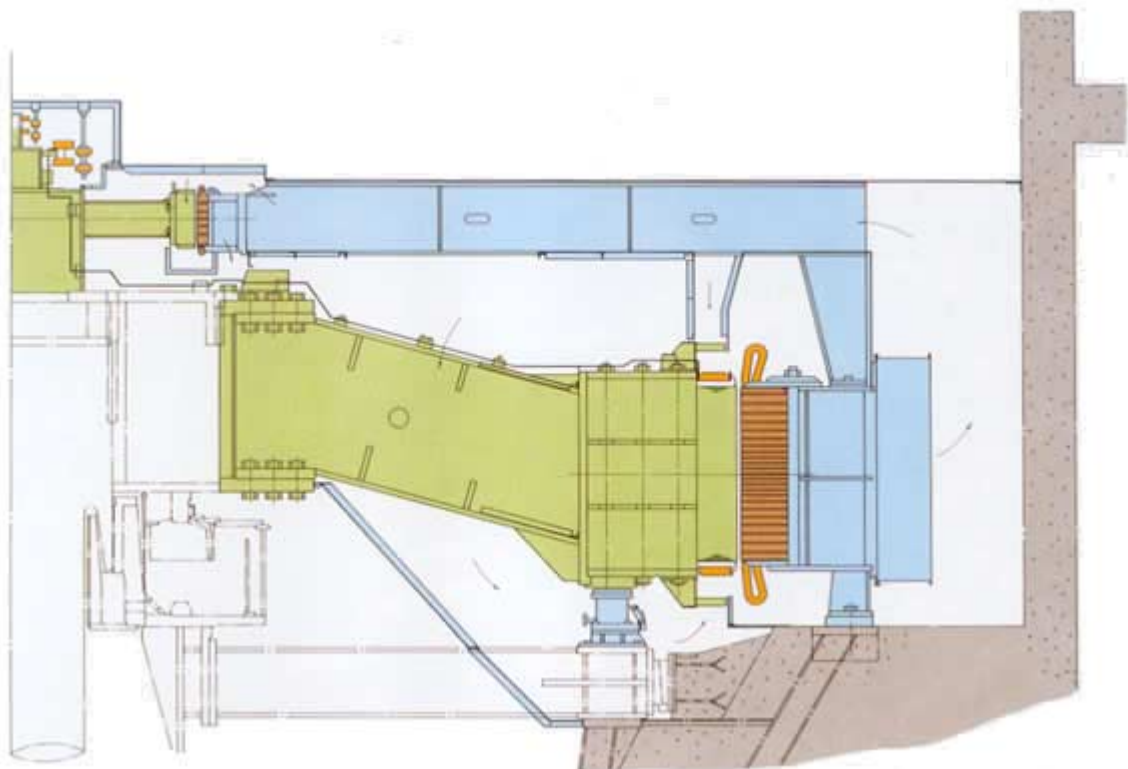
Type IM8411

Chivor Power Plant, Colombia
161MVA-450rpm



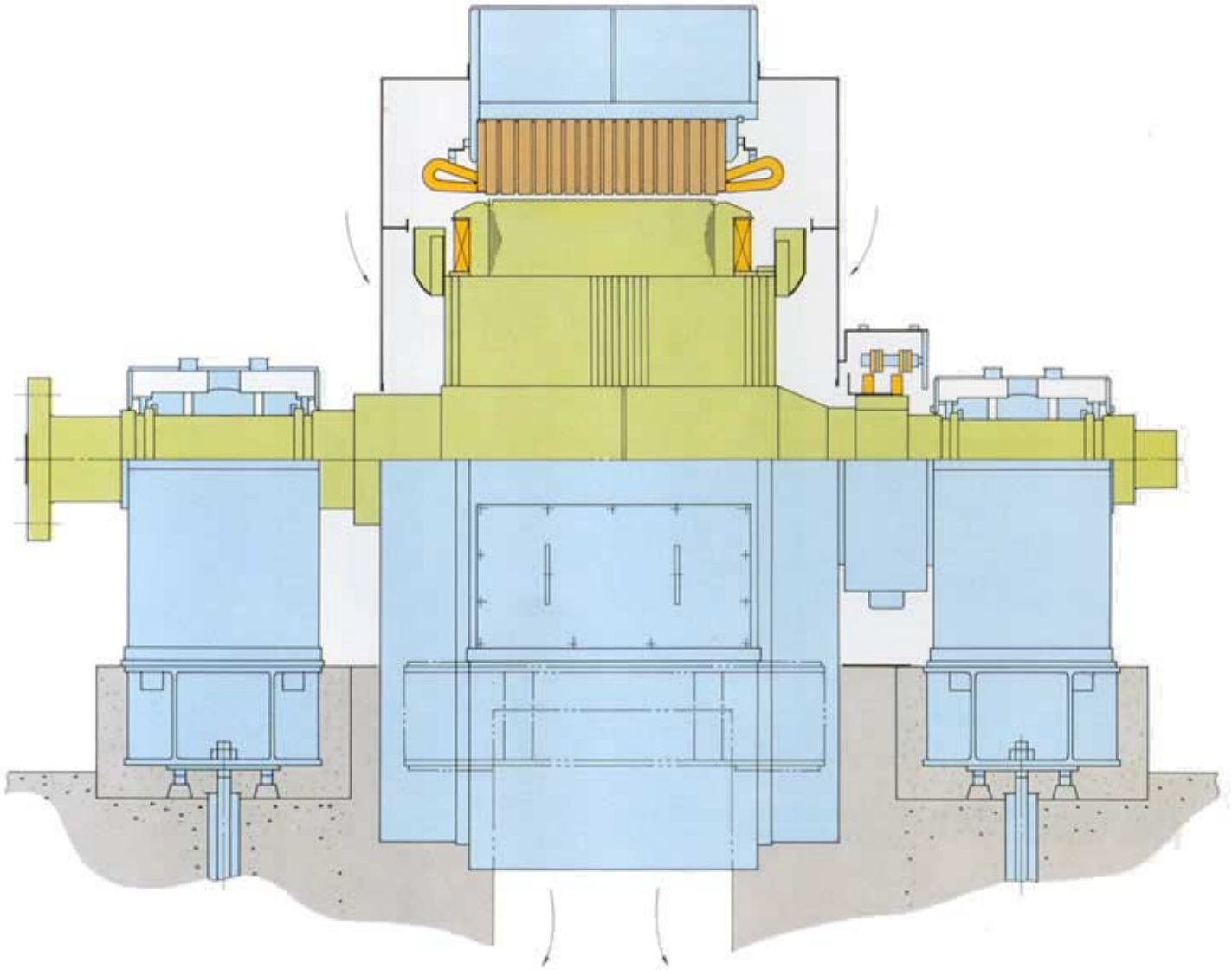
Type IM8140

Xavantes Power Plant, Brazil
115MVA-129rpm



Type IM7321

Sasakura Power Plant, Japan
11Mva-600/720rpm



TOSHIBA

TOSHIBA CORPORATION

POWER SYSTEMS AND SERVICES COMPANY

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- For further information, please contact your nearest Toshiba Liaison Representative or International Operations-Producer Goods.
- The data given in this catalog are subject to change without notice.

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