

TOSHIBA

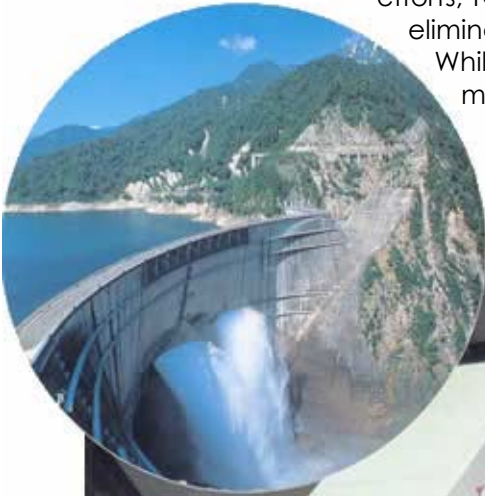
ELECTRIC SERVOMOTOR for HYDRAULIC TURBINE REGULATION



INTRODUCTION

"Clean" power generation that has a minimal impact on the environment is a perpetual task facing the human race in the present and for the years to come. Realizing the exigent state of the environment, TOSHIBA has long since engaged in the research and development of environmentally friendly technologies applicable to small and medium size hydroelectric power plant equipment. As a result of these efforts, TOSHIBA is proud to introduce a line of Electric Servomotors that eliminate the need for the pressure oil application.

While constantly striving to improve this technology for use in the small and medium size powerplants, TOSHIBA continues to expand its research and development efforts in employing this technology towards larger capacity units as well.



Electric actuated inlet valve



**Unit
Control board**



Speed governor regulation



Amplifier



DC battery



**Electric
servomotor**

SYSTEM COMPARISON

CONVENTIONAL HYDRAULIC SYSTEM

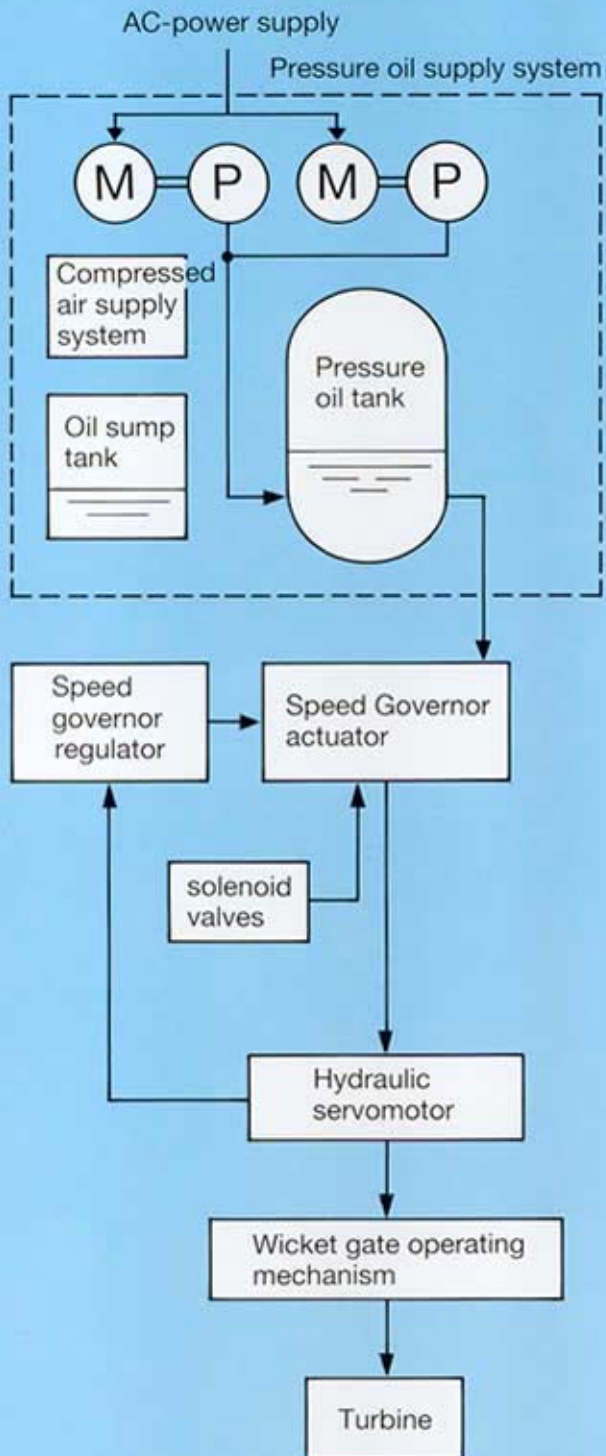
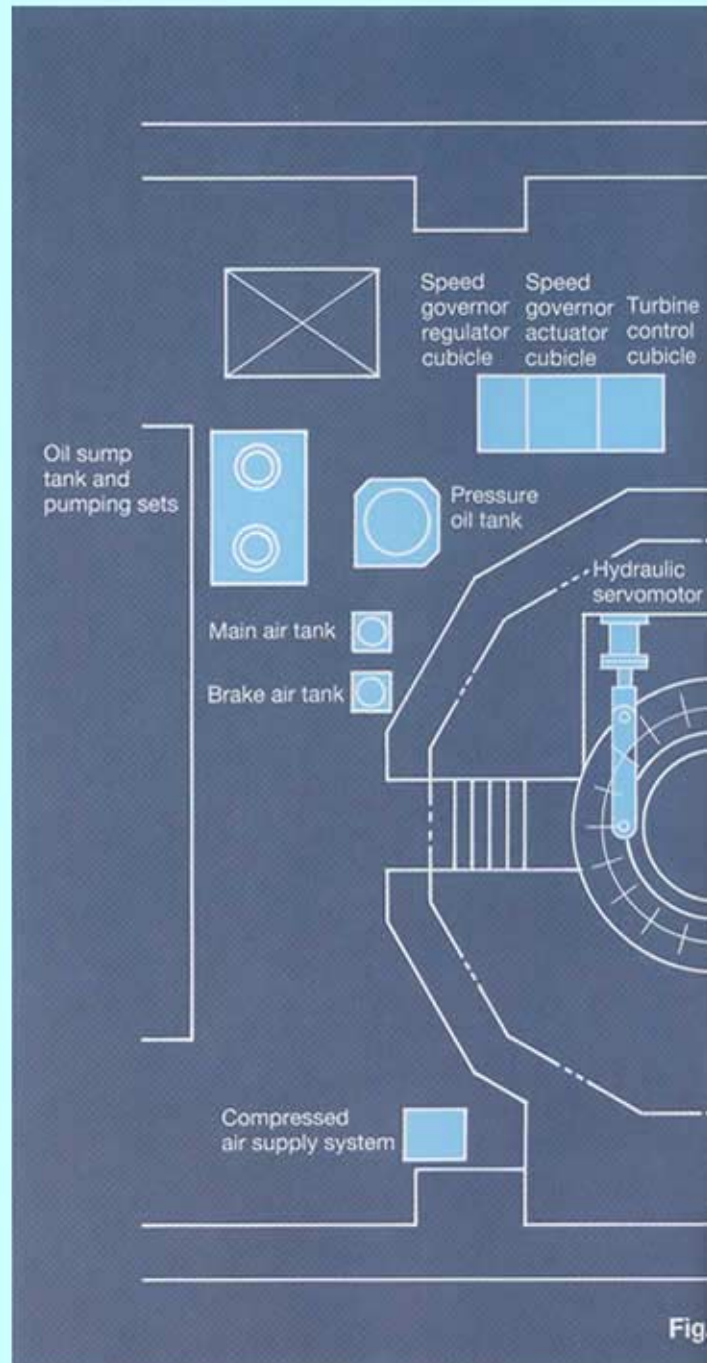
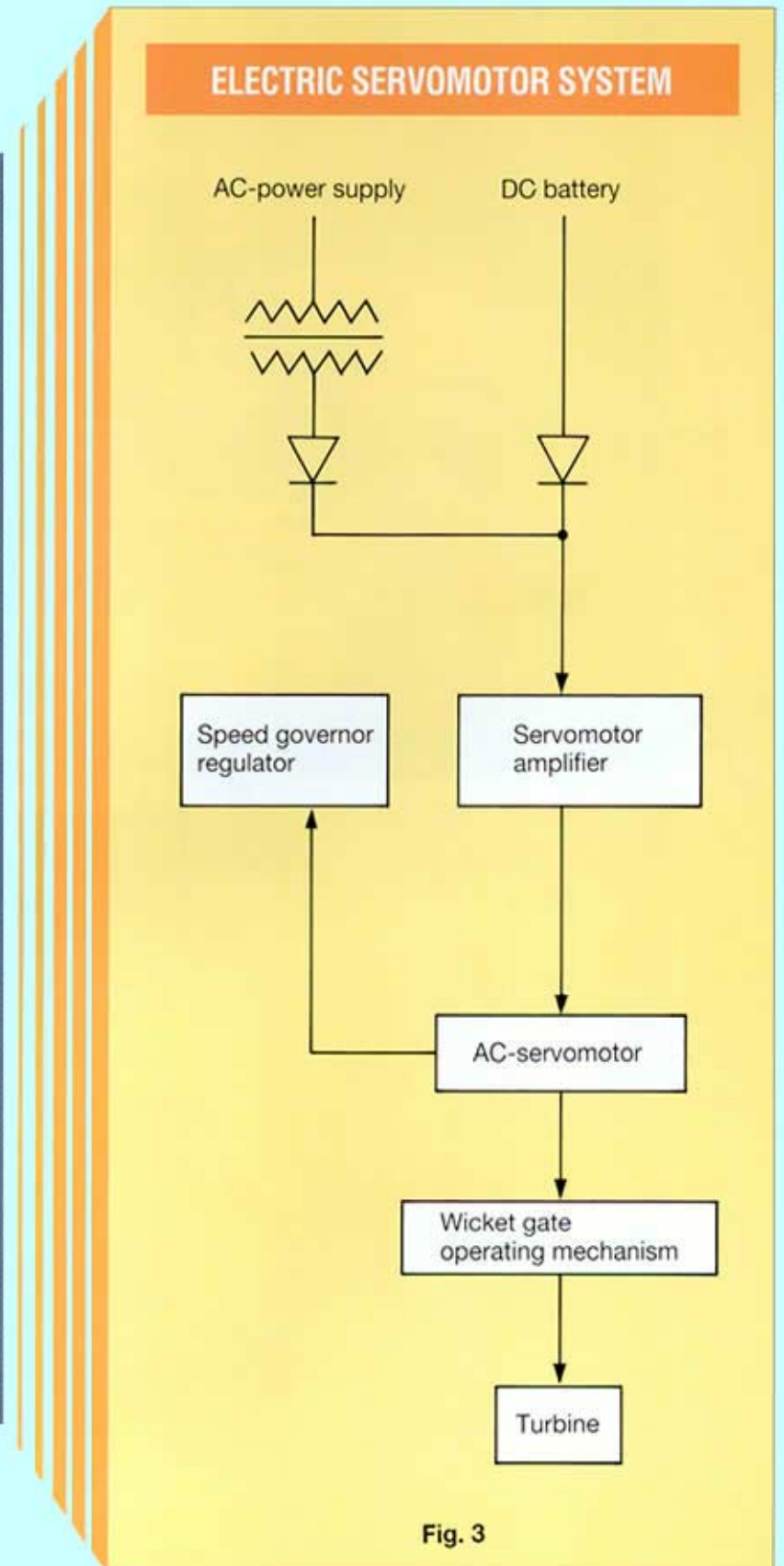
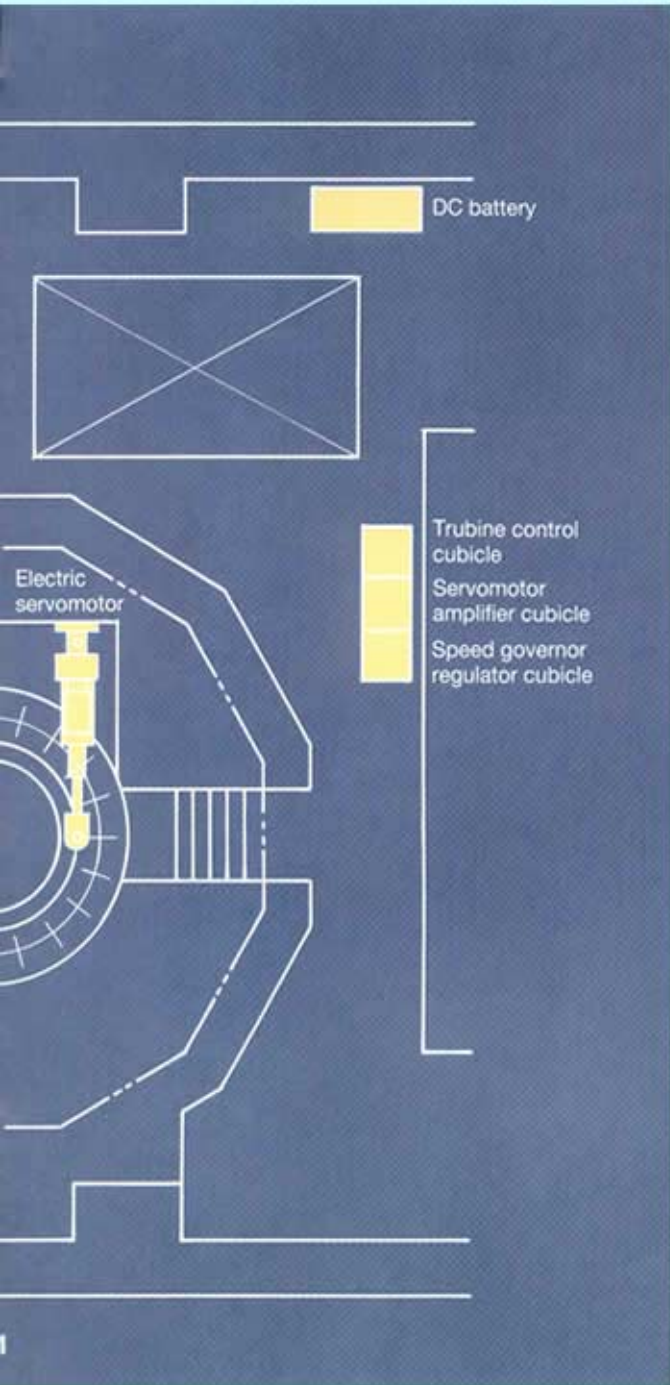


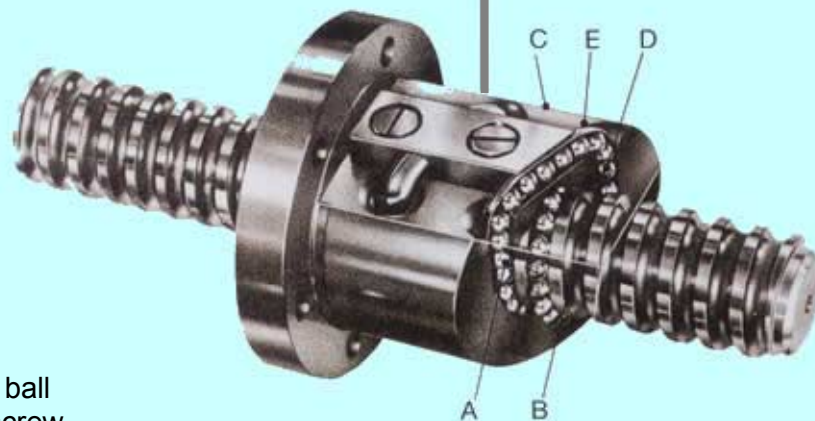
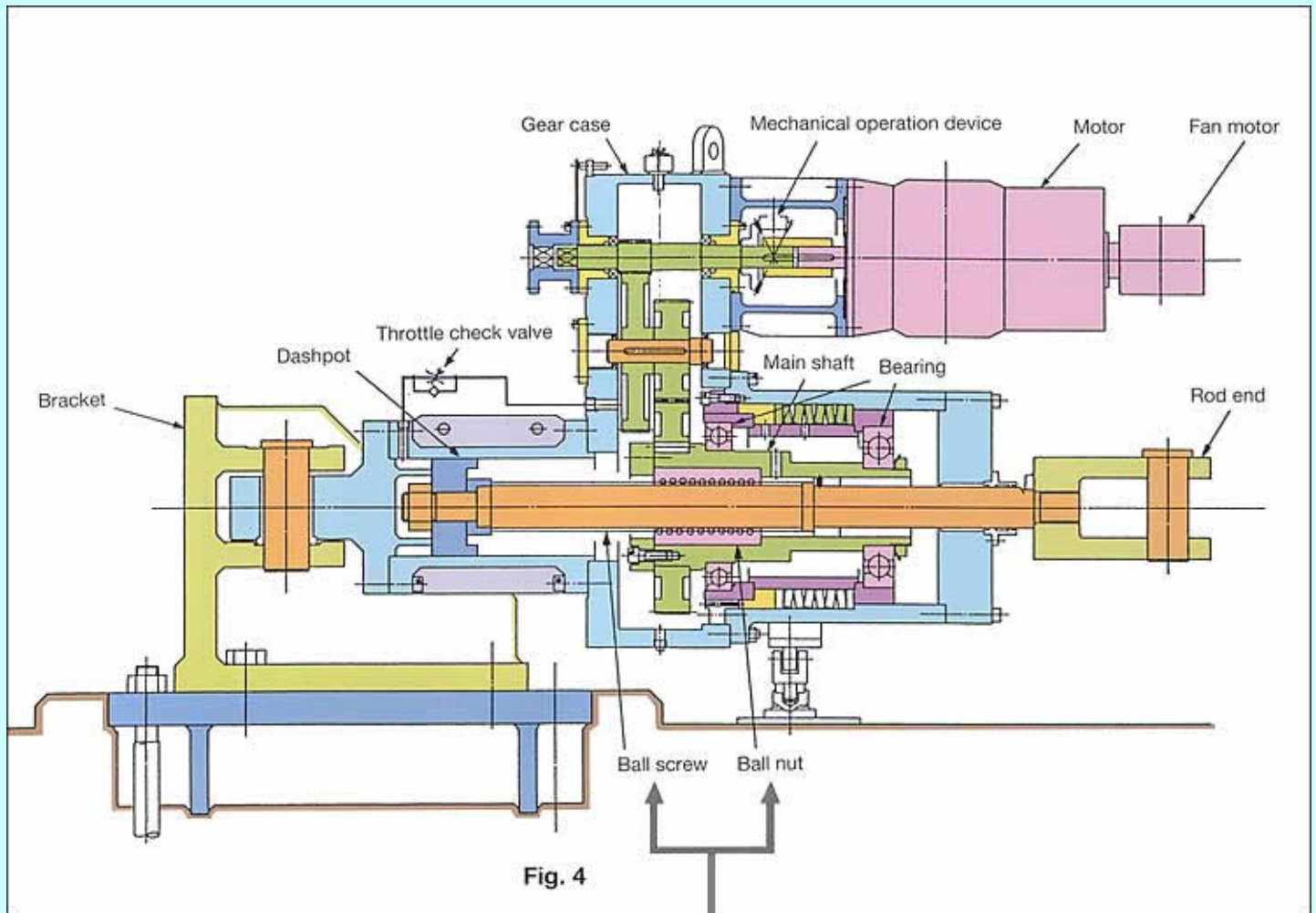
Fig. 2



Fig



ELECTRIC SERVOMOTOR



- A: Steel ball
- B: Ball screw
- C: Ball nut
- D, E: Return tube

Fig. 5



30KW ELECTRIC SERVOMOTOR



16000KW VERTICAL FRANCIS TURBINE

SERVOMOTOR AMPLIFIER

7.5KW SERVOMOTOR AMPLIFIER

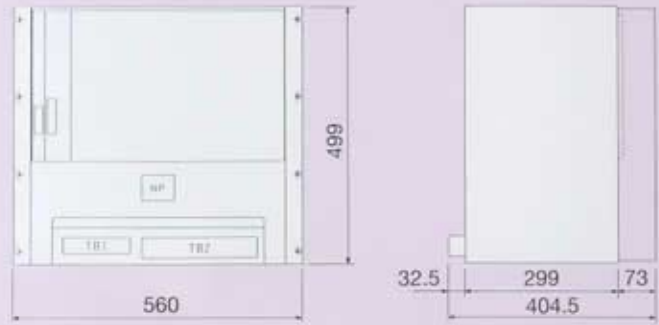


Fig. 6

22KW SERVOMOTOR AMPLIFIER

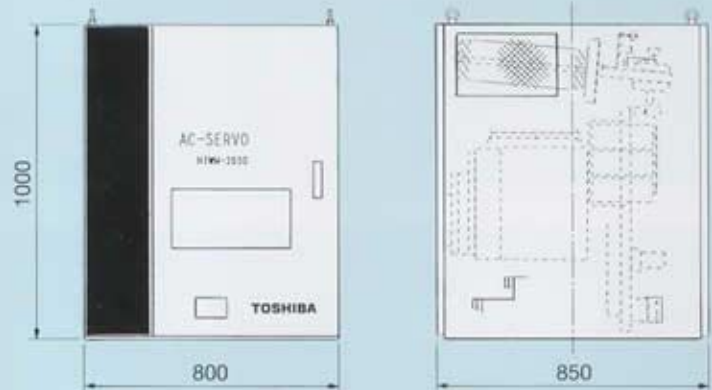


Fig. 7

30KW SERVOMOTOR AMPLIFIER

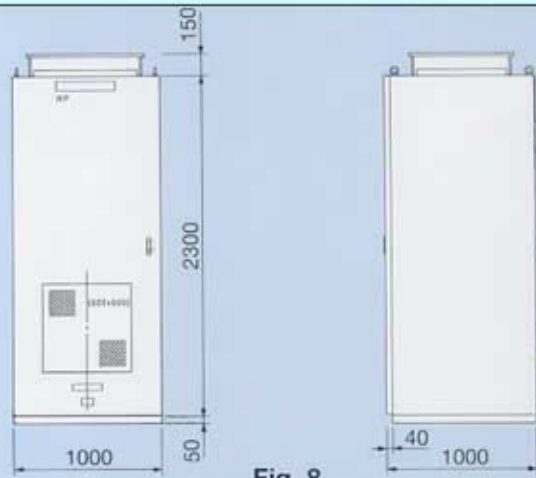
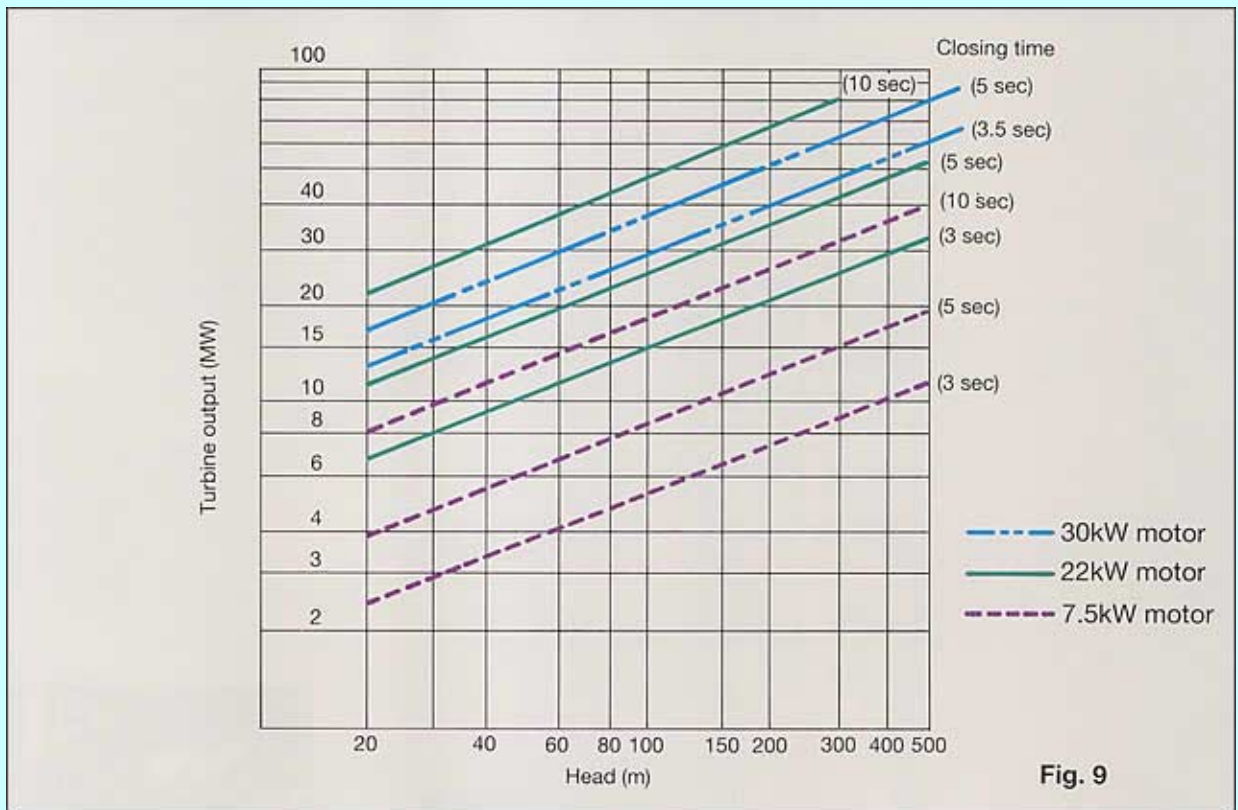


Fig. 8

CAPACITY RANGE VS TURBINE RATING



STANDARDIZED SERVOMOTOR APPLICATION

Type	MDS-1	MDS-2	MDS-4	MDS-8	MDS-12	MDS-20	MDS-30	MDS-40	MDS-50	MDS-60	
Driving force (ton)	1	1-2	2-4	4-8	8-12	12-20	20-30	30-40	40-50	50-60	
Stroke (mm)	200	300	300	300	300	300	300	300	300	300	
Dia. of ball screw (mm)	32	40	55-63	80	100	125	125-140	140-160	160-200	200-250	
Power supply AC(V)	200	200	200	200	200	200	200	200	200	200	
Motor capacity (kW)	V-80 (mm/S)	2.0	3.0	5.5	11.0	15.0	22.0	30	37	45	55
	-60 (mm/S)	1.0	2.0	3.7	7.5	11.0	18.5	22.0	30	37	45
	-40 (mm/S)	1.0	2.0	3.0	5.5	7.5	15.0	18.5	22.0	30	37
	-20 (mm/S)	0.75	1.0	1.5	3.0	3.7	7.5	11.0	15.0	22.0	30

7.5kW servomotor amplifier

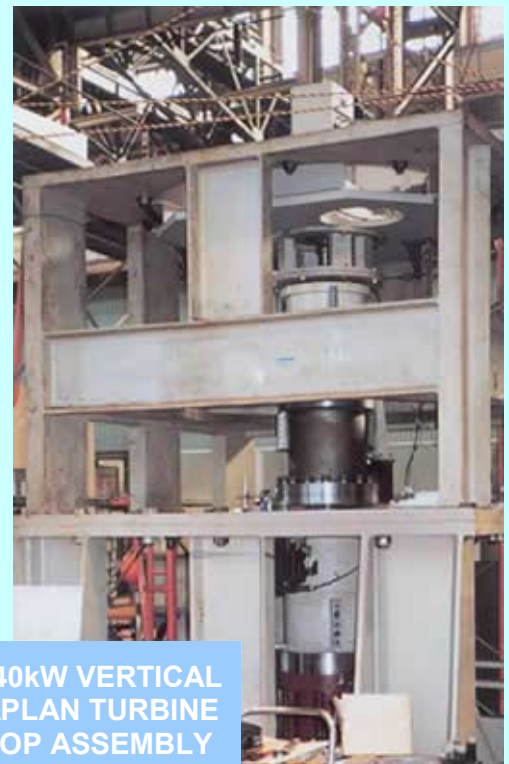
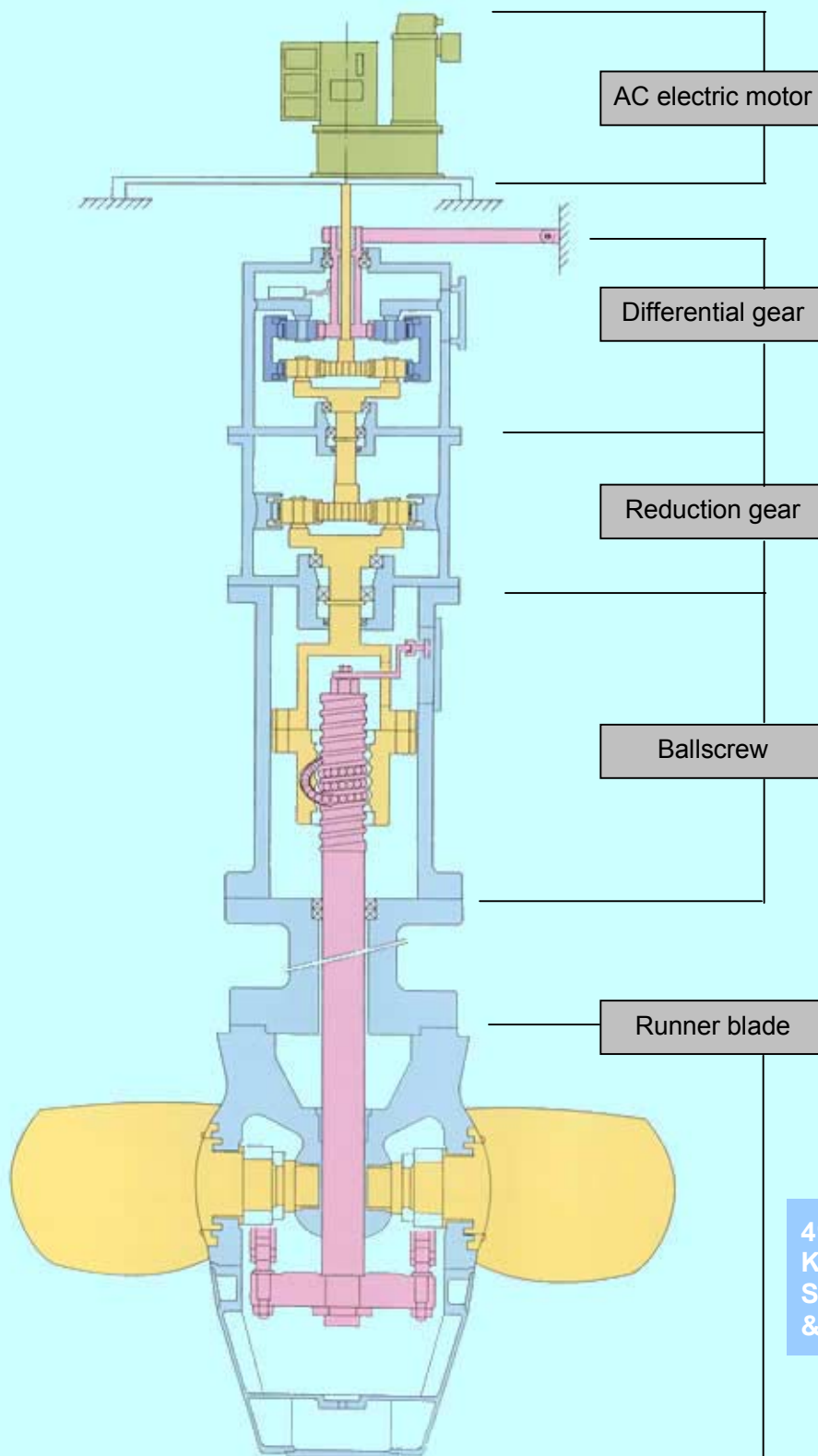
Fig. 10

22kW servomotor amplifier

30kW servomotor amplifier

Note: Actual sizing of servomotor should be consulted with Toshiba.

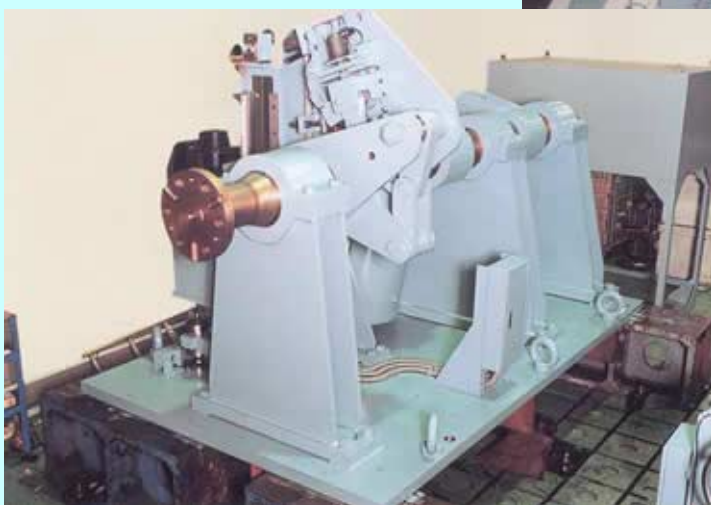
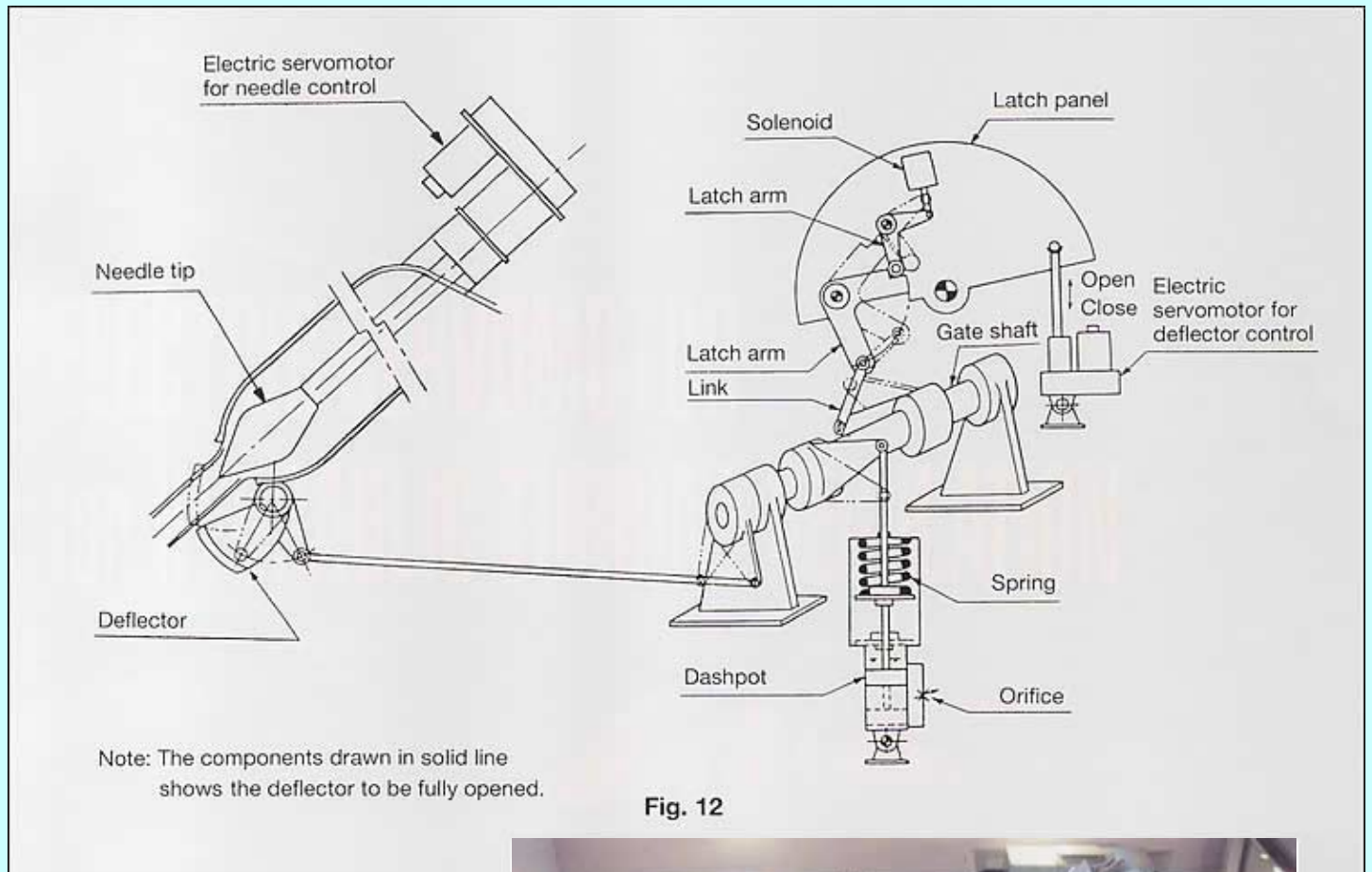
ELECTRIC SERVOMOTOR FOR RUNNER BLADE (KAPLAN)



4140kW VERTICAL KAPLAN TURBINE SHOP ASSEMBLY & TEST

Fig. 11

ELECTRIC SERVOMOTOR FOR DEFLECTOR CONTROL (PELTON)



6310KW HORIZONTAL PELTON TURBINE

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