

# Toshiba 50 Hz-250 MVA Steam Turbine Generator

Make: Toshiba  
Type: Generator  
Year: 2009

## **Specification:**

- Extraction & condensing
- Inlet pressure: 104 bar

## **Extractions:**

- MP2: 22 bar
- MP1: 10 bar
- LP: 4.5 bar
- Feed Water: 0.4 bar

## **Minimum load:**

- No extractions
- Only bleeds
- Steam flow: 45 kg/s

## **Maximum load:**

- Steam flow: 270 kg/s

## Condenser



- Average: 17 °C
- Min: 15 °C
- Max: 25 °C

## Generator



- 250 MVA
- Air to Water Cooled
- 18 kV

- 8019 A
- 50 Hz
- 3000 rpm

**Freight**

- Total weight: ~2,800 Freight ton
- Total items: 74

**Heavy Lifts:**

- Condenser Top Cover: 2 x 15 ton
- Condenser: 2 x 85 ton
- Turbine: 268 ton
- Generator: 277 ton

**Weight**

- Total weight:~2,800 Freight ton
- Total items: 74

**with Design Points (A-F):**

Inlet HP steam, 104 bar:

(A) 60 Kg/s (B) 170 Kg/s (C) 200 Kg/s (D) 230 Kg/s (E) 260 Kg/s (F) 260 Kg/s

MP2, 22 bar:

(A) 0 Kg/s (B) 7 Kg/s (C) 8 Kg/s (D) 9 Kg/s (E) 11 Kg/s (F) 10 Kg/s

MP1, 10 bar:

(A) 0 Kg/s (B) 17 Kg/s (C) 21 Kg/s (D) 24 Kg/s (E) 29 Kg/s (F) 25 Kg/s

LP, 4.5 bar:

(A) 6 Kg/s (B) 76 Kg/s (C) 91 Kg/s (D) 102 Kg/s (E) 122 Kg/s (F) 112 Kg/s

Feed water preheat 0.4 bar:

(A) 3 Kg/s (B) 7 Kg/s (C) 9 Kg/s (D) 11 Kg/s (E) 12 Kg/s (F) 14 Kg/s

Condenser Flow:

(A) 50 Kg/s (B) 62 Kg/s (C) 69 Kg/s (D) 82 Kg/s (E) 84 Kg/s (F) 98 Kg/s

**Design Point F1 (Swallowing Capacity):**

Inlet HP steam 104 bar, 270 Kg/s, MP2 22 bar, 10 Kg/s, MP1 10 bar, 25 Kg/s, LP 4.5 bar 112 Kg/s, Feed water Preheat 0.4 bar, 14 Kg/s, Condenser Flow 109 Kg/s

**Design Points (A-F1) and Generated Power:**

(A) 60 Kg/s, 54 MW

(B) 170 Kg/s, 134.3 MW

(C) 200 Kg/s, 160.6 MW

(D) 230 Kg/s, 188 MW

(E) 260 Kg/s, 206 MW

(F) 260 Kg/s, 215.6 MW

(F1) 270 Kg/s, 224 MW

**Turbine Specification:**

Extraction & Condensing, Inlet Pressure 104 bar, Output 215 MW, Minimum Load No Extractions, Only Bleeds, Steam Flow 45kg/s, 268 Ton Shipping Weight

**Condenser Specification:**

Cooling Water: 17 C Average, 15 C Min., 25 C Max., Shipping Weight: (2) x 85 ton Heat Exchanger, (2) x 15 ton

**Generator:**

250 MVA, Air to Water Cooled, 18 kV, 8019 Amp, 50 Hz, 3000 rpm, Heating Elements, Shipping Weight 277 ton

Ordered from Toshiba Japan in 2007, Delivered 2009, Currently stored indoors and secured, Turbine & Generator completely Sealed, Silica Gel is inserted in the Turbine & Generator and regularly replaced. Equipped with Electronic Monitoring Sensors for Humidity & Temperature with criteria from Toshiba for Storage, Monitoring report Generated Monthly, Inspection of Unit every (2) Weeks, Thorough Inspections were done every (6) months until 2012, then Yearly, Inspection Protocols Available

### **2.1.1.1 General**

This turbine is a single flow extraction condensing type. Steam initially enters the steam inlet flange near the end of the high-pressure section and flows through the turbine stages toward the generator end of the unit. After passing through the turbine stages, the steam is exhausted to condenser. The exhaust hood is keyed to the foundation plates at a point near its center of the exhaust hood to prevent axial motion. The turbine expands axially from this point. The front standard is free to slide axially but the standard and hood are guided to prevent transverse movement.

### **2.1.1.11 Control Valve (CV) of Main Steam**

Steam, after passing through the MSV, is admitted through the CV to the high-pressure turbine. CV controls the amount of steam passing to the turbine. It is opened and closed by actuator and is controlled by Digital Electro-Hydraulic Control (D-EHC) system through turbine hydraulic system.

### **2.1.2 Technical Specification of Steam Turbine & Aux**

Type: Single Casing Single Flow impulse type condensing turbine

Rated Output: 188,000 kW at Generator terminal

Speed: 3,000 rpm

Rotation: CCW (Viewed from front of Turbine)

Last Stage Bucket Active Length: 42" (Nominal)

Allowable Cycle Change: 48,5 - 50,5 Hz

### **2.1.5.1 Condensate System**

Type: Horizontal Surface Cooling, with divided waterbox, Two-Pass Type

### **2.2.1.1 Generator General**

The generator consists of the stator, rotor, cover, bearing, air-to-water cooler. The stationary armature is attached to and supported by generator base. The rotor is supported by the bearings. Air-to-water coolers are mounted above the stator. The cooling system is completely enclosed to prevent entrance of dust and moisture.

### **2.2.1.2 Extraction System**

The brushless generating system consists of main generator, rotating AC Exciter, Rotating Rectifier (R-RF), Direct Coupled PMG (Permanent Magnetic Generator) and AVR (Automatic Voltage Regulator). Main components of hte AVR are the digital automatic controller, AVR Amplifier, three phase thyristor rectifier and U-ISO Isolation Unit.













