

**DATA FOR STEAM BOILERS, AND STEAM AND GAS
TURBINES**

- 1. Station 'A' Steam Turbine Hall (Turbines No.1, 2, 3 and 4)**
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Note: the content of this Document is a reproduction of Documents received from the Client

1. Station 'A' Steam Turbine Hall (Turbines No.1, 2, 3 and 4)

- 1) 2 Nos. 15 MW GEC pass out steam turbine unit (Units N° 1 & 2), with associated Electrical Generators rated at 17.650 MVA, Manufacturer GEC.
- 2) 1 No. 15 MW Franco Tosi steam turbine unit (Unit N° 3), with associated Electrical Generator rated at 16.666 MVA, Manufactured by E. Marelli, Italy,
- 3) 1 No. 15 MW MAN steam turbine unit (Unit N°. 4), with associated Electrical Generator rated at 16.7 MVA, manufactured by Siemens,

TURBINE DATA				
Unit number	TG N° 1	TG N° 2	TG N° 3	TG N° 4
Manufacturer	G.E.C.	G.E.C.	F. Tosi	M.A.N.
Turbine Serial N°				10 766
Year of commissioning	1963	1963	1967	1970
Fabrication N°.			4396	941 002
Operational	1963-1998	1963-2001	1967-1998	1970-2001
Shut down	1998	2001	1998	2001
Nominal rating				12 000 kW
Maximum rating	15 000 kW	15 000 kW	15 000 kW	15 000 kW
Speed (RPM)	3000	3000	3000	3000
Emergency trip. Speed (RPM)				3300
Live steam pressure (kg/cm ² a)				
• Normal	43,2	43,2	43,2	43,2
• Maximum				47
Live steam temperature (° C)				
• Normal	455	455	455	455
• Maximum				464
Pass out pressure (kg/cm ² a)				1.84
Pass out flow (t/h)				0 – 54.4
Press. after last stage (kg/cm ² a)			0,089	0,086
Condenser pressure (kg/cm ² a)			0,089	0,086
Number of pass out points	1	1	1	1
Number of bleed points	2	2	2	2
Generator type	BS 2613/1957	BS 2613/1957	SGT17262 D3	FT 480/53-2
Generator serial N°.	ELT 2534/1	ELT 2534/1	785505	M21703

2. Steam Turbine Auxiliary equipment

Unit number	TG N° 1	TG N° 2	TG N° 3	TG N° 4
AC motor driven turning gear and hand barring facilities.	1 Set	1 Set	1 Set	1 Set
Half-coupling for connection to the generator.	1 Set	1 Set	1 Set	1 Set
Lubricating, jacking and control oil system	1 Set	1 Set	1 Set	1 Set
Lube oil coolers	2 Nos.	2 Nos.	2 Nos.	2 Nos.
Steam surface condenser	1 No.	1 No.	1 No.	1 No.
Ejector set	1 Set	1 Set	1 Set	1 Set
Condensate pumps with electro motor	2 Nos.	2 Nos.	2 Nos.	2 Nos.
Deareators with BFW storage tank	1 No.	1 No.	1 No.	1 No.
LP Condensate pumps with electro motor	2 Nos.	2 Nos.	2 Nos.	2 Nos.
LP Condensate heater	1 No.	1 No.	1 No.	1 No.
HP Condensate pumps with electro motor	2 Nos.	2 Nos.	2 Nos.	2 Nos.
HP BFW heater	1 No.	1 No.	1 No.	1 No.
Maintenance equipment	1 Set	1 Set	1 Set	1 Set
Spare parts	1 Set	1 Set	1 Set	1 Set
Operating Manuals	Incomplete	Incomplete	Incomplete	Incomplete

3. HP Steam Boilers

STEAM BOILERS DATA				
Unit number	Boiler N° 1	Boiler N° 2	Boiler N° 3	Boiler N° 4
Manufacturer	Babcock & Wilcox	Babcock & Wilcox	F. Tosi	John Thompson
Year of commissioning	1963	1963	1967	1970
Operational	1963-2001	1963-2001	1967-1996	1970-1997
Shut down	2001	2001	1996	1997
Design capacity (t/hr)	100	100	80	100
Design Steam pressure (kg/cm ² a)	43,9	43,9	43,9	43,9
Design Steam temperature (° C)	455	455	455	455

4. Station 'B' Gas Turbine Hall (Turbines No.5, 6, 8 and 9)

- 1) 2 Nos. 13.83 MW Fiat Avio Gas Turbine Generator units (Units N° GTA-5 & 6), with associated Electrical Generators 20.6 MVA, Manufacturer, English Electric.
- 2) 2 Nos. 24.92 MW Fiat Avio Gas Turbine Generator units (Units N° GTA-8 & 9), with associated Electrical Generators 35.6 MVA, manufactured, by GEC.

TURBINE DESIGN DATA				
Unit number	GTA N° 5	GTA N° 6	GTA N° 8	GTA N° 9
Year of commissioning	1970	1970	1973	1974
Turbine serial N°.	148	149	213	217
Type	TG.16	TG.16	TG.20B	TG.20B
Operational	1970-2002	1970-2004	(*)	1970-2004
Shut down	2002 (**)	2004 (**)	2004	
R. hours since installation	159969	200676	182333	182925
Fuel	Distillate oil / Crude oil / Gas			
Rating (ISO)	23 400 kW at 26,7 °C			
Site conditions	See level			
Maximum ambient temp.	48 °C			
Minimum ambient temp.	0 °C			
Compressor				
• Speed	4810			
• Stage	15			
• Inlet temperature	48 °C max, 0 °C min.			
• Atmospheric pressure	760 mm Hg			
Turbine				
• Speed	4810 RPM			
• Stage				
• Exhaust temperature	399 °C			
Starter type	Diesel engine		Diesel engine	
Accessory gear type				
Load gear type				
Generator type	GG1412/27A4		TG 33.4 – 85	
Generator serial N°.	AZY3700/0001	AZY3700/0002	53931/02/580	53931/06/580

(*) Turbine was not operational, due vibration problems.

(**) Turbine was not operational due to Generator Rotor damage.

5. Station 'C' Gas Turbines (GTA N° 7, 10, 11 & 12)

4 Nos. 18.35 MW Stand alone, self contained Thomassen Frame 5, Gas Turbine Generating units, open cycle, with Associated Electrical Generators 27.687 MVA, Manufacturer Hitachi, composed of the following sections-compartments:

	APPROXIMATE SHIPPING WEIGHT & DIMENSIONS	WEIGHT (kg)	HEIGHT (m)	WIDTH (m)	LENGTH (m)	
1.	CONTROL COMPARTMENT	13430	3,81	3,20	3,00	
2.	ACCESSORIES & TURBINE COMPARTMENT	97000	3,81	3,28	11,64	
3.	GENERATOR COMPARTMENT	82100	3,97	3,31	7,75	
4.	GENERATOR AUXILLIARY	15400	3,81	3,21	5,00	
5.	INLET AIR FILTER	12280	3,86	7,18	7,01	
6.	INLET DUCTING	I	1550	3,34	4,75	2,30
7.		II	4250	2,64	4,75	3,60
8.		III	3100	2,64	4,75	3,92
9.		VI	2000	3,00	4,52	1,55
10.		VII (2x)	2 x 500	2,68	0,71	1,20
11.	EXPANSION BELLOW	350	1,32	4,68	0,29	
12.	EXHAUST DUCTING	A	7800	2,51	4,73	3,24
13.		B	7800	2,51	4,73	3,24
14.		C	2375	1,51	4,73	3,24
15.	SUPPORT STRUCTURE	8000				

TURBINE DESIGN DATA				
Unit number	GTA N° 7	GTA N° 10	GTA N° 11	GTA N° 12
Year of commissioning	1972	1974	1975	1975
Serial N°.	214302	215775	214303	226289
Operational	1972-2007	1974-2007	1975-2007	1975-2007
Shut down	End 2007	End 2007	End 2007	End 2007
R. hours since installation	198,346	192,098	190,975	179,911
Fuel	Distillate oil / Crude oil / Gas			

Rating (ISO)	23,400 kW at 26,7 °C
Site conditions	Sea level
Maximum ambient temp.	48 °C
Minimum ambient temp.	0 °C
Compressor	
• Speed	5,100 RPM
• Stage	17
• Inlet temperature	48 °C max, 0 °C min.
• Atmospheric pressure	760 mm Hg
Turbine	
• Speed	5,100 RPM
• Stage	2
• Exhaust temperature	482 °C
Starter	
• Type	Diesel engine Detroit
• Rating	(British standard) 500 HP
• Inlet temperature	48 °C max, 0 °C min.
• Atmospheric pressure	760 mm Hg
Accessory gear	
• Type	A 500 BG 2 LM Alcatel
• Lube oil pump	104 m ³ /h, 4,5 kg/cm ²
Load gear type	CD – 565 T Hitachi
Generator type	EFSZ/B 1 LA-k Hitachi
Generator auxiliary comp.	Type B (GACM-ANST) Hitachi

AUXILLIARY EQUIPMENT				
	GTA N° 7	GTA N° 10	GTA N° 11	GTA N° 12
Packed Fuel (gas & oil) forwarding skid			x	x
Packed Fuel oil forwarding skid	x	x		
Fuel gas treatment unit	x	x		
Diesel service tanks,	1 No. - 15 m ³		1 No. - 15 m ³	
Water air cooled heat exchangers	x	x	x	x