SUPRATHEEK TURBO ENGINEERING SERVICES
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STES	Assembly Protocol 2021	VSPL
Hyderabad		Karnataka

SUPRATHEEK
Turbo Engineering Services

Customer: VIJAYANAGR SUGAR PVT LTD- Karnataka

WORK: MAJOR OVERHAULING OF 32MW STG

Dedicated to Serve Our Customer
Supratheek Turbo Engineering Services

32 MW Extraction Cum Condensing Steam Turbine Refurbishment

Project Overview

Supratheek Turbo Engineering Services successfully executed the complete refurbishment of a **32 MW Extraction Cum Condensing Steam Turbine** originally supplied by Hangzhou, China. The turbine was successfully recommissioned and restored to reliable operation.

Scope of Work

- Complete assessment and refurbishment of the turbine.
- Reverse engineering of Rotor Blades and Guide Blade Carriers.
- Design and development of turbine components for all **19 stages**.
- Manufacturing and quality inspection of turbine blades.
- Assembly of rotor blades and guide blade carriers.
- Low-speed rotor balancing.
- High-speed rotor balancing.
- Complete rotor assembly and alignment.
- Site commissioning and performance testing.

Project Highlights

- Successful reverse engineering performed in the absence of original manufacturing support.
- Precision manufacturing of critical turbine components.
- Restoration of turbine performance and reliability.
- Seamless integration of refurbished components into the existing turbine system.
- Safe and timely completion of commissioning activities.

Value Delivered

- Extended operational life of the turbine.
- Improved reliability and availability of the unit.
- Cost-effective refurbishment solution compared to equipment replacement.
- Dedicated technical support throughout design, manufacturing, balancing, commissioning, and testing phases.

Conclusion

The refurbished 32 MW turbine was successfully commissioned and continues to operate reliably, demonstrating Supratheek Turbo Engineering Services' expertise in turbine refurbishment, reverse engineering, rotor dynamics, balancing, and commissioning of critical rotating equipment.

TURBINE TECHNICAL DETAILS

Customer: VIJAYANAGAR SUGARS PVT.LTD., INDIA

Drive Machine	**Generator**
Steam Turbine no	**WT7652**
Type	**EHNKS50/71/32**
Make:	**M/s HTC(China)**
Rated Output	**32000KW**
Rated Speed	**5743 r/min**
Critical Speed	**2640/4853**
Trip Speed	**6317**
Max.Steam Flow	**120TPH**
Live Steam Pressure	**103kg/cm^2**
Live Steam Temperature	**538 ˚C**
Exhaust Pressure	**0.01Mpa(a)**

Rotor Centering Actual

Rotor Front Centring

FEC

	00	
00	R1	00
00		-12
	+35	

FOG

	00	
00	R2	00
00		-04
	+45	

Rotor Rear Centring

REC

	00	
00	R1	00
00		-29
	-13	

ROG

	00	
00	R2	00
00		00
	-17	

FSG

	00	
00	R3	00
0		00
	+05	

FOC

	00	
00	FOC	00
0		+04
	+16	

RSG

	00	
00	R3	00
0		+01
	+01	

ROC

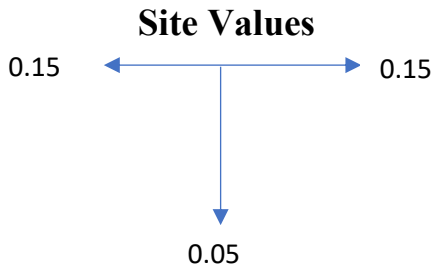
	00	
00	ROC	00
0		+16
	+02	

OUTER CASING CENTERING AFTER BOX-UP

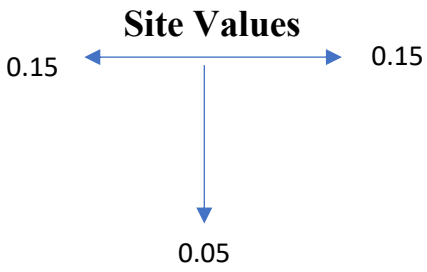
	+18	
00	FOC	-34
00		+04
	+16	

TURBINE OIL & STEAM GLAND CLEARANCES

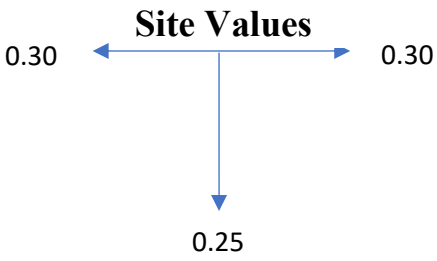
Front Oil Gland



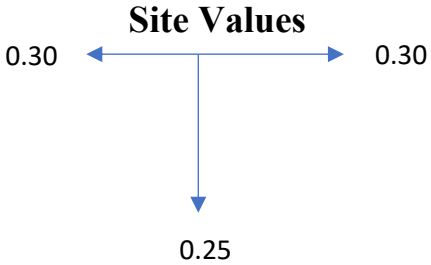
Rear Oil Gland



Front Steam Gland



Rear Steam Gland



Turbine Bearing Clearances

Description	Actual Values	Design Values
Thrust Bearing float	0.35	0.36-0.48
Front Journal Bearing	0.33	0.24-0.38
Rear Journal Bearing	0.42	0.38-0.45
Rotor Free Float	5.00	

Radial Clearances

1.Front Steam Gland Radial Clearances

Design Big fin:0.27-0.40		Design Small fin:0.27-0.40	
Fin no.	**Fin Size**	**Left**	**Right**
1	Big	0.30	0.30
2	small	0.30	0.30
3	Big	0.35	0.30
4	small	0.30	0.35
5	Big	0.30	0.30
6	small	0.35	0.35
7	Big	0.35	0.30
8	small	0.30	0.30
9	Big	0.30	0.35
10	small	0.35	0.30
11	Big	0.30	0.35
12	small	0.30	0.35
13	Big	0.35	0.30
14	small	0.35	0.30
15	Big	0.30	0.30
16	small	0.30	0.30
17	Big	0.30	0.30
18	small	0.35	0.35
19	Big	0.30	0.35
20	small	0.35	0.30
21	Big	0.30	0.30
22	small	0.35	0.30
23	Big	0.35	0.30
24	small	0.30	0.30
25	Big	0.35	0.35
26	small	0.35	0.30
27	Big	0.35	0.30
28	small	0.30	0.30

29	Big	0.30	0.35
30	small	0.30	0.35
31	Big	0.35	0.35
32	small	0.30	0.30
33	Big	0.30	0.35

2.Rear Steam Gland radial clearances

	Design:0.30-0.50		Design:0.30-0.50	
	Rotor fin		Gland fin	
Fin no.	Left	Right	Left	Right
1	0.30	0.30	0.30	0.30
2	0.30	0.30	0.30	0.30
3	0.30	0.30	0.30	0.35
4	0.30	0.30	0.30	0.30
5	0.30	0.35	0.30	0.35
6	0.30	0.30	0.30	0.35
7	0.30	0.35	0.35	0.35
8	0.35	0.30	0.30	0.30
9	0.30	0.30	0.30	0.35
10	0.30	0.30	0.35	0.35
11	0.35	0.35	0.30	0.35
12	0.30	0.30	0.30	0.35
13	0.30	0.35	0.35	0.35
14	0.30	0.30	0.30	0.35
15	0.35	0.35	0.30	0.30
16	0.30	0.30	0.30	0.30
17	0.30	0.30	0.35	0.30
18			0.30	0.30

GBC-1 Rotor fin radial clearances

	Design:0.55-0.81			
	Rotor fin(SRLE)		Carrier fin(SRLA)	
Fin no.	Left	Right	Left	Right
3/103	0.55	0.55	0.70	0.60
3/103	0.60	0.55	0.70	0.60
4/104	0.60	0.55	0.70	0.55
4/104	0.60	0.60	0.70	0.70
5/105	0.55	0.55	0.70	0.60
5/105	0.60	0.55	0.70	0.55
6/106	0.60	0.60	0.70	0.55
6/106	0.60	0.60	0.70	0.60
7/107	0.60	0.60	0.70	0.55
7/107	0.65	0.60	0.55	0.55
8/108	0.60	0.55	0.70	0.60
8/108	0.60	0.55	0.55	0.70
9/109	0.65	0.60	0.70	0.55
9/109	0.65	0.60	0.70	0.55
10/110	0.60	0.60	0.70	0.70
10/110	0.60	0.60	0.55	0.55
GBC Vertical Lifting: **Top=0.55** **Bottom=0.65**				

GBC-2 Rotor fin and Carrier fin radial clearances

	Design:0.65-0.92			
	Rotor fin(SRLE)		Carrier fin(SRLA)	
Fin no.	Left	Right	Left	Right
11/111	0.75	0.55	0.80	0.70
11/111	0.75	0.55	0.80	0.70
12/112	0.75	0.55	0.80	0.70
12/112	0.75	0.60	0.80	0.65
13/113	0.75	0.55	0.80	0.70
13/113	0.75	0.55	0.80	0.65
14/114	0.70	0.55	0.80	0.65
14/114	0.75	0.55	0.80	0.70
15/115	0.70	0.60	0.80	0.70
15/115	0.70	0.60	0.80	0.65
16/116	0.75	0.60	0.80	0.60
16/116	0.75	0.55	0.80	0.60
GBC Vertical Lifting: **Top=0.70** **Bottom=0.80**				

GBC-3 Rotor fin and Carrier fin radial clearances

	Design:0.65-0.92			
	Rotor fin (SRLE)		Carrier fin (SRLA)	
Fin no.	Left	Right	Left	Right
17/117	0.60	0.70	0.70	0.75
17/117	0.60	0.70	0.70	0.75
18/118	0.60	0.70	0.60	0.75
18/118	0.60	0.70	0.55	0.75
19/119	0.60	0.70	0.55	0.75
19/119	0.60	0.70	0.60	0.75
20/120	0.65	0.70	0.55	0.75
20/120	0.65	0.70	0.55	0.75
20/120	0.65	0.70	0.55	0.75
21/121	0.65	0.70	0.55	0.75
21/121	0.65	0.70	0.65	0.75
21/121	0.70	0.70	0.60	0.75
	0.70	0.65	0.60	0.75
			0.55	0.75
			0.65	0.75
GBC Vertical Lifting: **Top=0.75** **Bottom=0.75**				

GBC-4 Rotor fin and Carrier fin radial clearances

	Design:0.75-1.03			
	Rotor fin (SRLE)		Carrier fin (SRLA)	
Fin no.	Left	Right	Left	Right
22/122	0.60	0.75	0.80	0.75
22/122	0.60	0.80	0.80	0.75
22/122	0.55	0.80	0.80	0.75
	Design:0.40-0.80			
91/191	0.55	0.75		
91/191	0.55	0.75		
91/191	0.55	0.70		
	Design:1.30-1.90			
92/192	1.40	1.30		
	Design:0.50-0.90			
93/193	0.75	0.75		
93/193	0.75	0.80		
93/193	0.75	0.80		
GBC Vertical Lifting: **Top=0.70** **Bottom=0.75**				

LP Grid Valve radial clearances

	Design:0.90-1.37		Design:0.70-1.17	
	Rotor fin		**Carrier fin**	
Fin no.	Left	Right	Left	Right
1	0.70	0.80	0.75	0.80
2	0.70	0.80	0.75	0.80
3	0.70	0.80	0.70	0.80
4	0.70	0.80	0.75	0.80
5	0.70	0.80	0.70	0.80
6	0.70	0.80	0.70	0.80
7	0.65	0.80	0.70	0.80
8	0.65	0.80	0.70	0.80
9	0.65	0.80	0.70	0.80
10	0.65	0.80	0.70	0.80
LP Grid valve carrier Vertical Lifting: Top=0.75 Bottom=0.85				

Turbine Rotor Axial Clearances

Design Ref	Stage no.	Front (SALE)		Design Ref	Rear (SALA)	
	GBC-1	Left	Right		Left	Right
>2.5	3/103	4.2	4.9	>3.7	3.8	3.4
>2.6	4/104	4.5	5.0	>3.8	3.3	3.2
>2.6	5/105	4.8	4.9	>3.9	3.5	3.8
>2.7	6/106	4.6	4.8	>4.0	4.0	3.6
>2.8	7/107	4.2	4.5	>4.2	4.2	4.2
>2.9	8/108	4.2	4.7	>4.3	4.1	3.9
>2.9	9/109	4.5	4.4	>4.4	4.2	4.1
>3.0	10/110	4.2	4.4		-	-
	GBC-2	Left	Right		Left	Right
>3.2	11/111	5.7	5.0	>4.7	4.3	4.5
>3.3	12/112	4.7	4.6	>4.8	4.6	5.1
>3.4	13/113	4.9	4.8	>4.9	5.4	5.1
>3.4	14/114	4.2	4.6	>5.1	6.0	5.9
>3.5	15/115	4.4	4.6	>5.2	6.1	6.0
>3.6	16/116	4.7	4.8		-	-
	GBC-3	Left	Right		Left	Right
>3.7	17/117	4.6	5.6	>5.5	4.6	5.1
>3.8	18/118	5.2	5.2	>5.7	6.0	6.2
>4.0	19/119	4.9	4.8	>5.9	7.0	6.9
>4.2	20/120	5.3	5.4	>6.1	7.0	6.6
>4.3	21/121	5.3	5.2			
>5.1	22/122	5.8	5.8			

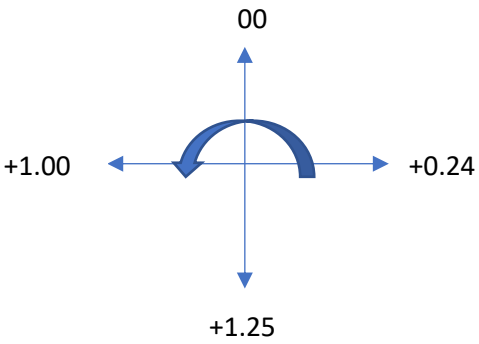
Turbine Rotor Run-out

	Thrust collar	Journal	Oil gland	Steam gland	Bp-gland
Front	0.01	0.00	0.01	0.02	0.02
Rear	-	0.01	0.01	0.01	-
Intermediate stage run-out			0.02		

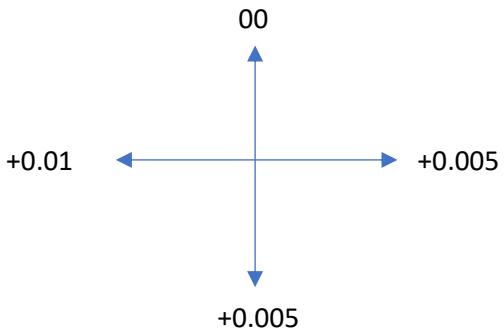
ALIGNMENT

Turbine – Gear Box (Dial on Pinion)

Radial



Axial



HP-Actuator Calibration

Governor %	Secondary Oil Pressure(kg/cm^2)		Scale(mm)
	DCS	Local	
0	1.6	1.6	0
10	1.88	1.9	3
20	2.15	2.2	5
30	2.43	2.45	7
40	2.43	2.45	9
50	2.74	2.70	10.5
60	3.06	3.0	12.5
70	3.40	3.40	15
80	3.75	3.70	18
90	4.10	4.05	22
100	4.49	4.45	28
90	4.10	4.05	22
80	3.78	3.75	18
70	3.42	3.40	15
60	3.08	3.05	12.5
50	2.76	2.70	11
40	2.46	2.50	9
30	2.17	2.20	7
20	1.90	1.90	5
10	1.63	1.65	2.5
0	1.45	1.40	0

LP-Actuator Calibration

Governor %	Secondary Oil Pressure(kg/cm^2)		Scale(mm)
	DCS	Local	
0	1.50	1.55	0
10	1.62	1.80	1
20	1.88	2.0	8
30	2.17	2.30	16
40	2.46	2.60	25
50	2.76	2.90	34
60	3.08	3.20	42
70	3.41	3.50	51
80	3.75	3.85	60
90	4.12	4.20	69
100	4.50	4.55	78
90	4.15	4.20	69
80	3.79	3.55	62
70	3.43	3.50	52
60	3.10	3.20	43
50	2.79	2.90	35
40	2.48	2.60	26
30	2.10	2.30	18
20	1.91	1.80	9
10	1.64	1.79	1
0	1.40	1.55	0

Rotor axial position

	Actual	Site Values
E1	163.80	163.8
E2	168.20	168.2

Axial Displacement of the Rotor at the Casing, X is offset Value.

	Actual	Site Values
X+	3.15	2.96
X-	1.90	1.96

Casing Holding Bolt Clearance maintained-6no.s=0.20

Control valve idle Lifts

Valve Pole Circumvolve 90° Inspect			Conclusion:		Acceptable
Clearance			Tighten the Screws		
serial number	Reference	Actual	serial number	Reference	Actual
SA: Left	2.5±0.6	2.50			
SA: Right	2.5±0.6	2.50			
SR1	2.0±0.30	5.40	1	≥550Nm	550Nm
SR2	6.5±0.30	10.00	2	≥550Nm	550Nm
SR3	14.5±0.30	17.00	3	≥550Nm	550Nm
SR4	21.0±0.30	23.00	4	≥550Nm	550Nm

Thermal Gap & PP-level

S. No	Carriers		GBC 1	GBC 2	GBC 3	GBC 4	ST. CHAMBER
1	**Thermal GAP**	**LEFT**	2.50	2.60	2.90	2.95	4.45
		RIGHT	2.50	2.65	2.75	4.20	4.40
2	**P.P LEVEL**	**LEFT**	-0.12	+0.02	-0.07	+0.05	-0.14
		RIGHT	0.00	-0.04	+0.02	0.00	-0.24
3	**VERTICAL FLOAT**	**TOP**	0.55	0.70	0.75	0.75	0.70
		BOTTOM	0.65	0.80	0.75	0.70	0.75
4	**TOP SPHERICAL WASHER TO P.P CLEARNCE**	**LEFT**	-0.20	-0.20	-0.20	-0.20	NA
		RIGHT	-0.20	-0.20	-0.20	-0.20	NA

GEAR BOX

Technical Data of Gear Box

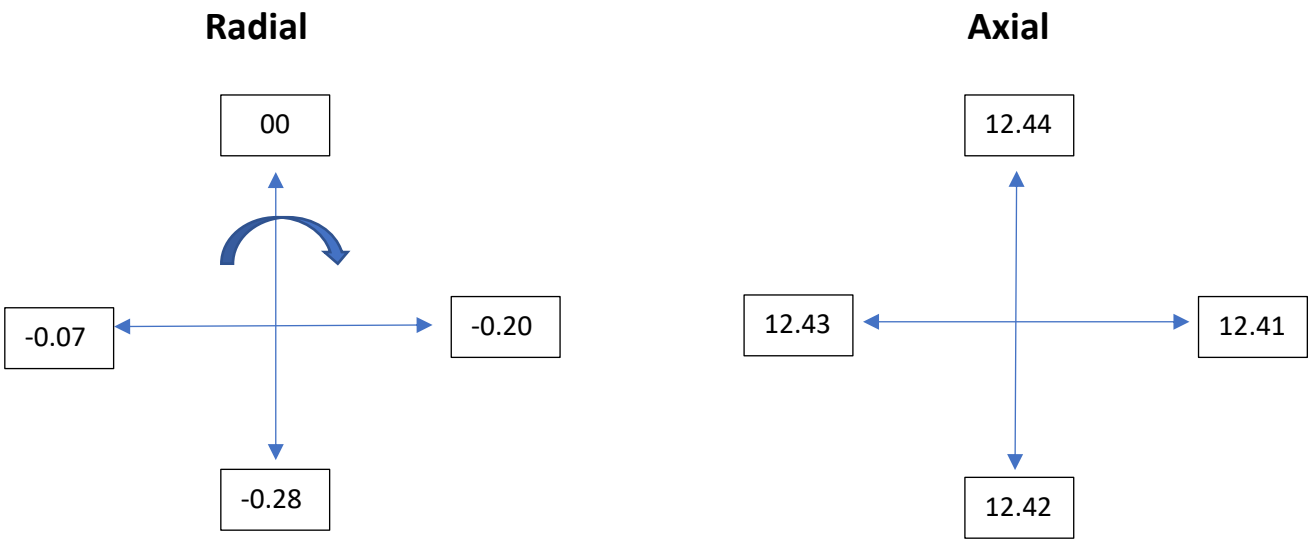
Make	M/s Flender Graffenstaden
Gear Type	Double Helix
Year of Installation	2010
Gear Ratio	3.83
Rated speed Input/Output	5743/1500
Rated Power	32000kw
Service Factor	1.3
Oil Viscosity	ISO VG-46
Oil Flow	645 l/mn
Oil Inlet Pressure	1.5bar
No. of teeth (Gear/Pinion)	134/35

Gear Box Clearances

Description	Actual Values	Design Values	Interferences Values
Gear Wheel (DE)	0.42	0.38-0.45	0.04
Gear Wheel	0.41	0.38-0.45	0.04
Pinion FJB(DE)	0.49	03.6-0.418	0.05
Pinion RJB	0.50	0.36-0.418	0.04

Description	Actual Clearances	Design Clearances
Gear wheel thrust float	0.35	0.30-0.55
Gear wheel-Pinion Backlash	0.61	0.54-0.65

Gear Box-Generator Alignment



Add Shim equal both sides=1.1mm

GENERATOR

GENERATOR TECHNICAL DATA

Make: M/s NANYANG EXPLOSION PROTECTED GROUP CO., LTD	
Phase	Three Phase Synchronous Generator
Type	QFW-32-4
Rated Capacity	40MVA
Rated output	32000kw
Rated Stator Voltage	11000V
Rated Stator Current	2099.5 A
Rated Exciting current	361.3A
Rated Speed	1500 r/min
Weight	9000Kg
Rated Frequency	50Hz
Power Factor	0.8
Connection Type	Y-Type

GENERATOR BEARING CLEARANCES

Description	Actual Values	Interferences Values	Design Values
Generator Front Bearing	0.62	0.02	
Generator Rear Bearing	0.59	0.02	

GENERATOR OIL GLAND CLEARANCES

Description	Actual Values	
	Left	Right
Front Inner oil Gland	0.20	0.20
Front Outer oil Gland	0.35	0.20
Rear Inner Oil Gland	0.15	0.15
Rear Outer Oil Gland	0.30	0.20

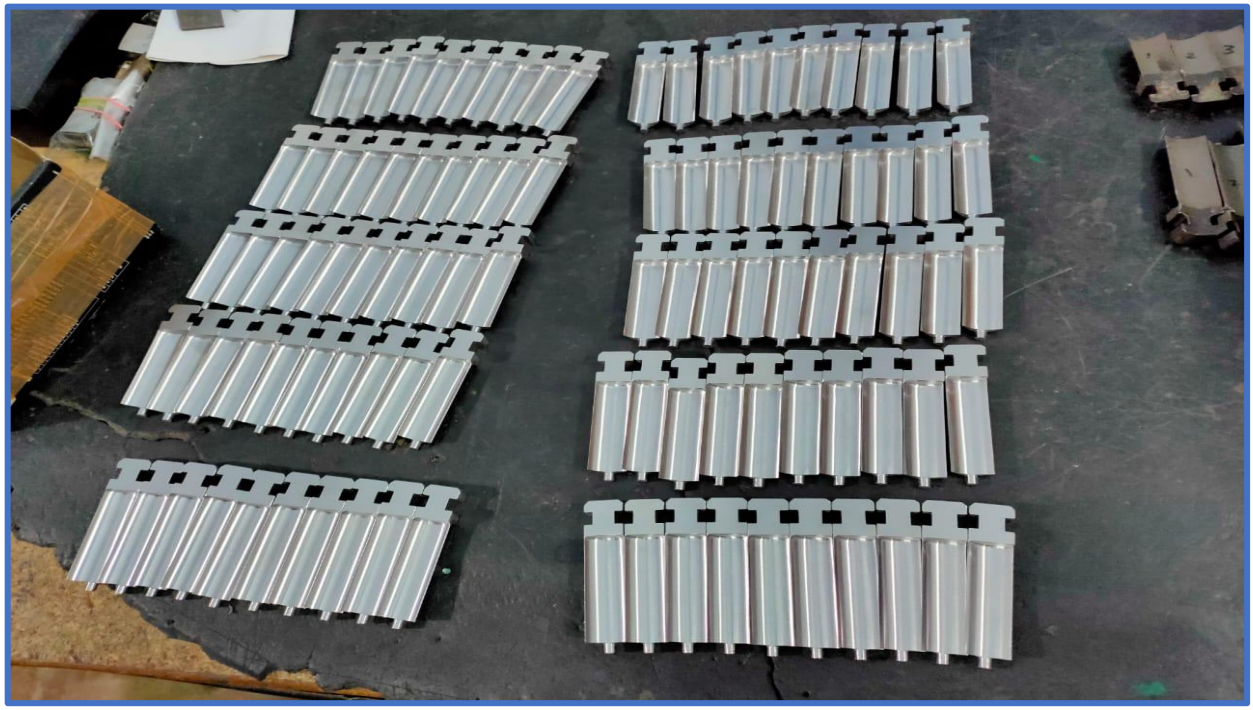
Turbine Pictures

Turbine Rotor blades drilling and removing

Turbine Rotor new blades drilling

Turbine Rotor GBC fins Re-finning

Turbine Rotor New blades



Turbine Rotor blades machining

Turbine Rotor GBC blades machining