



MAPNA GROUP  
MAPNA Turbine Blade Eng & Mfg. Co-PARTO





## About us

MAPNA Turbine Blade Engineering and Manufacturing Company (PARTO) was established in 2000 to add to what MAPNA Group represents: excellence. Since then, the company has strived to realize that objective in every aspect by bringing creative people together, utilizing state-of-the-art technology and digging in turbine blade manufacturing knowledge.

PARTO started with acquisition of Siemens license for production of V94.2 (160MW) gas turbine blades and vanes. Several other types of gas turbine blades and vanes (such as GE-F9, H25, F6, GT13-E2) were reverse-engineered at the next step and successfully delivered to the power generation market, relying on PARTO'S engineering capabilities and production system which was based on OEM methodology, and through smart utilization of lessons learnt from know-how transfer.

To respond to markets demands, PARTO also diversified its product portfolio and produced turbine blades with DS (Directional Solidification) & SX (Single Crystal) technologies.

## Market Share

More than 130,000 pieces of products delivered to the power generation market, accumulating more than 15 million EOH (Equivalent Operating Hours)  
An international footprint by exporting products to Europe, Middle East, and East Asia  
A reliable partner for power generation and oil & gas industries through manufacturing and developing more than 100 types of gas turbines blades & vanes

# PARTO At a Glance

## Achievements

Manufacturing Siemens V94.2 (SGT5-2000E) gas turbine blades & vanes under OEM license  
Manufacturing gas turbine hot components such as GE F9, GE F6, GE F5, Hitachi H25, SGT400, GT13E2 through reverse engineering & reengineering  
Mass production of new generation of gas turbine blades through DS (Directional Solidification) & SX (Single Crystal) technologies  
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## MGT75

MGT75 is a 222MW F-Class turbine designed and manufactured by MAPNA Group. All Stages of Blades and Vanes of the turbine is manufactured in PARTO.

Type	Weight	Coat	Cooling	No .in row
Blade Stage 1	3.5 Kg	Yes	Yes	86
Blade Stage 2	4.5 Kg	Yes	Yes	85
Blade Stage 3	12 Kg	Yes	Yes	56
Blade Stage 4	31 Kg	Yes	NO	48
Vane Stage 1	16 Kg	Yes	Yes	38
Vane Stage 2	13.5 Kg	Yes	Yes	43
Vane Stage 3	14 Kg	Yes	Yes	59
Vane Stage 4	24 Kg	Yes	NO	63



MGT75-Blade Stage 4



MGT75-Blade Vane 3



MGT75-Vane Stage 4

## MGT 70

In ISO conditions, this turbine has an output of 162 MW. PARTO is manufacturing all the blades and vanes of this turbine.

In order to increase power output and efficiency of MGT70 turbines during recent years, MAPNA group initiated three large projects, namely MAP2+, MAP2A and MAP2B which led to increase the output and efficiency of this turbine to 181MW

Type	Material	Weight	Coat	Cooling	No. In row	
First Stage Blade	MGT 70	IN 738 LC	3.5 Kg	MCrAlY	Yes	89
	MAP2 + MGT70 (1)	IN 738 LC	3.6 kg	MCrAlY + TBC	Yes	89
	MAP2 A MGT70 (2)	IN 738 LC	3.6 kg	MCrAlY + TBC	Yes	89
	MAP2 B MGT70 (3)	Rene 80	4 kg	MCrAlY + TBC	Yes	89
Second Stage Blade	MGT 70	IN 738 LC	5 Kg	MCrAlY	Yes	89
	MAP2 + MGT70 (1)	IN 738 LC	5 Kg	MCrAlY	Yes	89
	MAP2 A MGT70 (2)	IN 738 LC	5 Kg	MCrAlY + TBC	Yes	89
	MAP2 B MGT70 (3)	Rene 80	4.7 kg	MCrAlY + TBC	Yes	89
Third Stage Blade	MGT 70	IN 738 LC	14 Kg	MCrAlY	No	63
	MAP2 + MGT70 (1)	IN 738 LC	14 Kg	MCrAlY	NO	63
	MAP2 A MGT70 (2)	IN 738 LC	14 Kg	MCrAlY	No	63
	MAP2 B MGT70 (3)	Rene 80	14.1 Kg	MCrAlY	NO	63
Fourth Stage Blade	MGT 70	IN 738 LC	31 Kg	No	No	44
	MAP2 + MGT70 (1)	IN 738 LC	31 Kg	NO	No	44
	MAP2 A MGT70 (2)	IN 738 LC	31 Kg	NO	No	44
	MAP2 B MGT70 (3)	Rene 80	25.3 Kg	NO	No	44



MAP2B- Blade Stage1



MAP2B- Blade Stage2



MAP2B- Blade Stage 3



MAP2B- Blade Stage4

# MGT 70

Type	Material	Weight	Coat	Cooling	No. In row	
First Stage Vane	MGT 70	IN 738 LC	17 Kg	MCrAlY	Yes	46
	MAP2 + MGT70 (1)	IN 738 LC	17 kg	MCrAlY + TBC	Yes	46
	MAP2 A MGT70 (2)	IN 738 LC	17 kg	MCrAlY + TBC	Yes	46
	MAP2 B MGT70 (3)	Rene 80	16.8 kg	MCrAlY + TBC	Yes	46
Second Stage Vane	MGT 70	IN 738 LC	13.5 Kg	MCrAlY	Yes	48
	MAP2 + MGT70 (1)	IN 738 LC	13.5 Kg	MCrAlY + TBC	Yes	48
	MAP2 A MGT70 (2)	IN 738 LC	13.5 Kg	MCrAlY + TBC	Yes	48
	MAP2 B MGT70 (3)	Rene 80	13.3 kg	MCrAlY + TBC	Yes	48
Third Stage Vane	MGT 70	IN 738 LC	15.5 Kg	NO	yes	51
	MAP2 + MGT70 (1)	IN 738 LC	15.7 Kg	MCrAlY	yes	51
	MAP2 A MGT70 (2)	IN 738 LC	15.7 Kg	MCrAlY	yes	51
	MAP2 B MGT70 (3)	Rene 80	15.3 Kg	MCrAlY + TBC	yes	51
Fourth Stage Vane	MGT 70	IN 792 LC	24 Kg	No	No	55
	MAP2 + MGT70 (1)	IN 792 LC	24 Kg	NO	No	55
	MAP2 A MGT70 (2)	IN 792 LC	24 Kg	NO	No	55
	MAP2 B MGT70 (3)	Rene 80	25.8 Kg	NO	No	55
Swirler	All Type	Hatelloy X	2.5 Kg	No	No	16



MGT 70 - Vane Stage 1



MAT 70 - Vane Stage 2



MAP 28 - Vane Stage 3



MAT 70 - Vane Stage 3



MAP 2B - Vane Stage 1



MAP 2B - Vane Stage 2



MAT 70 - Vane Stage 4

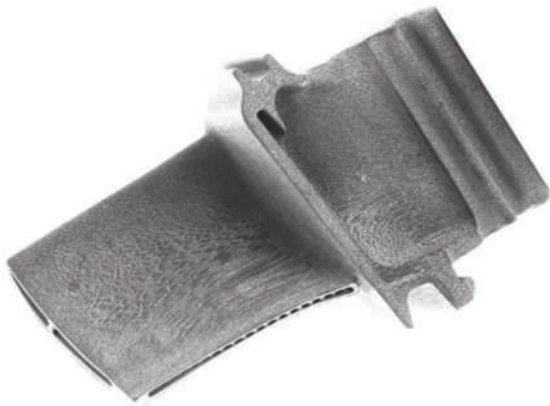


MGT 70 - Swirler

## MTB19(SGT400)

The SGT-400 is a simple, robust twin-shaft gas turbine, suitable for both power generation and mechanical drive applications. The product services the 10 – 15 MW power band and can be used in all climates, onshore and offshore. In PARTO, 1 and 2 stage blade of SGT400 turbine is manufactured via SX and DS technologies.

Type	Material	Weight	Coat	Cooling	No .in row
Blade Stage 1	CMS X4	0.2 Kg	Yes	Yes	59
Blade Stage 2	CM 186 L	0.25 Kg	Yes	Yes	53



MTB19(SGT400) - Bucket stage 1



MTB19(SGT400) - Bucket stage 2

## MTB10(F9-E (PG9171E))

In ISO conditions this turbine has an output of 123 MW. Here at PARTO we produce all the blades and vanes of this turbine via reverse engineering.

Specifications of some of these products are as follows

Type	Material	Weight	Coat	Cooling	No. In row
First Stage Bucket (F9)	EEQ111	12 kg	Yes	Yes	92
First Stage Bucket (MF9)	EEQ 111	12 kg	Yes(TBC)	Yes	92
Second Stage Bucket (F9)	EEQ 111	12.5 Kg	Yes	Yes	92
Second Stage Bucket (MF9)	EEQ111	12.5 Kg	Yes	Yes	92
Third Stage Bucket (F9)	IN 738 LC	11.5 Kg	No	No	92
Third Stage Bucket (MF9)	IN 738 LC	10.5 Kg	No	No	92
First Stage Nozzle (F9)	FSX 414	41 Kg	optional	Yes	18
First Stage Nozzle (MF9)	FSX 414	41 Kg	Yes(TBC)	Yes	18
Second Stage Nozzle (F9)	EEQ222	114 Kg	Yes	Yes	16
Second Stage Nozzle (MF9)	EEQ 222	114 Kg	Yes	Yes	16
Third Stage Nozzle (F9)	EEQ222	140 Kg	No	No	16
Third Stage Nozzle (MF9)	EEQ 222	138 Kg	No	No	16



F9-Bucket Stage 1



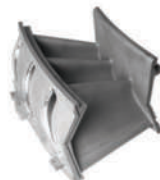
F9-Bucket Stage 2



F9-Bucket Stage 3



F9- Nozzel Stage 1



F9- Nozzel Stage 2



F9 - Nozzel Stage 3



## MGT-40(F6)

Relying on its long term experience of manufacturing F9-E buckets and nozzles, PARTO Company produced 1st stage buckets through Directional Solidification technique. Stage 1 to 3 nozzles of this 6581B version are also being manufactured in PARTO and can easily be installed in previous versions without need for modification into the gas turbine.

Other special services such as coating, heat treatment, weight charting/sequencing and the like can be performed on the parts based on customer order and requirements.

Type	Material	Weight	Coat	Cooling	No. In row
Bucket Stage 1	EEQ111 DS	2.5 Kg	Yes	Yes	92
Bucket Stage 2	IN738	2.4 Kg	Yes	Yes	92
Bucket Stage 3	IN738	2.4 Kg	No	No	92
Nozzle Stage 1	FSX – 414	9 Kg	Optional	Yes	18
Nozzle Stage 2	EEQ 222	16 Kg	Yes	Yes	16
Nozzle Stage 3	EEQ 222	20 Kg	No	No	16



MGT40 - Bucket Stage 1



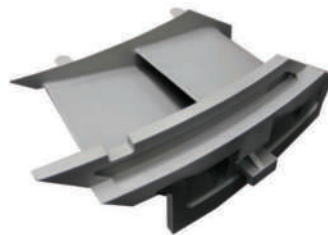
MGT40 - Bucket Stage 2



MGT40 - Bucket Stage 3



MGT40 - Nozzel Stage 1



MGT40 - Nozzel Stage 2



MGT40 - Nozzel Stage 3

## MTB15(F5 (MS5002C&D)

The MS5002 is a 30MW class gas turbine which was initially introduced in the 1970s and has been updated and up-rated since then to meet the industry's output requirements. It is a two-shaft, heavy-duty gas turbine designed for a wide range of speed and load conditions.

Type	Material	Weight	Coat	Cooling	No. In row
First Stage Bucket	EEQ111DS	3.7 kg	Yes	No	80



F5- Bucket Stage 1

## MTB23(GE10-2)

The GE 10 is a 12 MW range heavy-duty gas turbine available in both single-shaft and two-shaft versions. In PARTO, 1 and 2 stage blade of GE-10.2 turbine is manufactured via DS technology.

Type	Material	Weight	Coat	Cooling	No .in row
Bucket Stage 1	GTD111-DS	0.6 Kg	Yes	Yes	60
Bucket Stage 2	GTD111-DS	0.66 Kg	Yes	Yes	60



MTB23(GE10 - 2) - Bucket stage 1



MTB23(GE10 - 2) - Bucket stage 2

## MTB14(GT13E2)

One of the first and leading non-OEM manufacturer of GT13 E2 hot section parts, PARTO Company developed several parts of this turbine through sophisticated re-engineering and reverse engineering processes.

Today, components delivered to the customers are running smoothly in the gas turbine, showing the same reliability and stability working level as of the OEM.

The GT13E2 (VA/96) is a medium-sized gas turbine of the 170 MW class. It has a 21-stage compressor with a variable inlet guide vane, an annular combustion system with close-loop combustor cooling and a 5-stage turbine.

Type	Material	Weight	Coat	Cooling	No. In row
First Stage Blade	IN738 LC	6.1 Kg.	Yes	Yes	63
Second Stage Blade	IN738 LC	9.8 Kg.	Yes	Yes	63
Third Stage Blade	IN 738 LC	12.4 Kg.	Yes	Yes	63
Fourth Stage Blade	IN 792	14.6 Kg.	Yes	No	63
Fifth Stage Blade	NIM 101	24.1 Kg.	No	No	63
First Stage Vane	IN738LC	8.8 Kg.	Yes	Yes	40
Second Stage Vane	IN 939	8.4Kg.	Yes	Yes	60
Third Stage Vane	IN 738 LC	10.8 Kg.	Yes	No	60
Fourth Stage Vane	X45	69 Kg.	Yes	No	20
Fifth Stage Vane	X45	29.17Kg.	No	No	50



GT 13 E2 - Blade Stage 1



GT 13 E2 - Blade Stage 2



GT 13 E2 - Blade Stage 3



GT 13 E2 - Vane Stage 1



GT 13 E2 - Vane Stage 4



GT 13 E2 - Vane Stage 5

## MTB14(GT13E2)

Type	Material	Weight	Coat	Cooling	No. In row
Stator Heat Shield Row 1	IN738	1.95 Kg.	No	Yes	36
Stator Heat Shield Row 3	Hastelloy X	19.5 Kg.	No	No	20
Stator Heat Shield Row 4	Hastelloy X	27.1 Kg.	No	No	20
Stator Heat Shield Row 5	Hastelloy X	11.95 Kg.	No	No	40
Inside Segment 1	Hastelloy X	2.8 Kg.	No	Yes	36
Inside Segment 2	Hastelloy X	2.8 Kg.	No	Yes	36
Inside Segment 3	Hastelloy X	2.8 Kg.	No	Yes	36
Outer Segment 1	Hastelloy X	4.2Kg.	No	Yes	36
Outer Segment 2	Hastelloy X	4.2 Kg.	No	Yes	36
Outer Segment 3	Hastelloy X	4.2 Kg.	No	Yes	36
Front Segment	Hastelloy X	6.7 Kg.	Yes	Yes	36
Generator Fan Blade (DE & NDE)	Al6082	2 Kg.	No	No	46
EV Burner	Hastelloy X	28.9 Kg.	Yes	Yes	72
Rotor Heat Shield 1	IN738	3kg.	No	Yes	63
Rotor Heat Shield 2	IN738	3.2 Kg.	No	Yes	63
Rotor Heat Shield 3	IN738	3.8 Kg.	No	Yes	63
Rotor Heat Shield 4	IN738	3.8 Kg.	No	Yes	63
Lance	Stainless Steel	8kg.	No	No	72



GT 13 E2 - Stator Heat Shield Row 1



GT 13 E2 - Stator Heat Shield Row 3



GT 13 E2 - Stator Heat Shield Row 5



GT 13 E2 - Front Segment



GT 13 E2 - Quarter Segment 3



GT 13 E2 - Ev Burner

## MGT30 (ZORYA DU80L & DG80L)

In ISO conditions this turbine has an output of 25 MW. PARTO produces all the blades and vanes of this turbine.

Specifications of some of the products are as follows:

Type	Material	Weight	Coat	Cooling	No. In row
<b>First Stage Blade</b> (DU80L – DG 80L)	CM – 88Y	0.25 Kg	Yes	Yes	86
<b>Second Stage Blade</b> (DU80L – DG 80L)	CM – 88Y	0.33 Kg	Yes	Yes	86
<b>Third Stage Blade</b> (DU80 L)	CM – 88Y	2.1 Kg	No	No	76
<b>Third Stage Blade</b> (DG 80L)	CM – 88Y	3.1 Kg	No	No	76
<b>Fourth Stage Blade</b> (DU 80L)	CM – 88Y	3.2 Kg	No	No	76
<b>Fourth Stage Blade</b> (DG 80L)	CM – 88Y	4.1 Kg	No	No	76
<b>First Stage Vane</b> (DU 80L – DG 80L)	CM 104	0.5 Kg	Yes	Yes	40
<b>Second Stage Vane</b> (DU 80L – DG 80L)	CM 104	8.2 Kg	Yes	Yes	15
<b>Third Stage Vane</b> (DU 80L)	CM 104	8 Kg	Yes	Yes	18
<b>Third Stage Vane</b> (DG 80L)	CM 104	3.3 Kg	No	No	32
<b>Fourth Stage Vane</b> (DU 80L)	CM 104	10 Kg	No	No	18
<b>Fourth Stage Vane</b> (DG 80L)	CM 104	4 Kg	No	No	32
<b>Fifth Stage Vane</b> (DG 80L)	CM 104	2.5 Kg	No	No	32
<b>Sixth Stage Vane</b> (DG 80L)	CM 104	8.5 Kg	No	No	32



MGT30- Blade Stage1



MGT30- Blade Stage3



MGT30- Blade Stage4



MGT30- Blade Stage5



MGT30- Vane Stage1



MGT30 Vane Stage 2



MGT30- Vane Stage 3

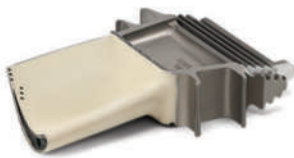


MGT30- Vane Stage5

## MTB17(Hitachi H25)

The Hitachi H-25 is a 30 MW class heavy-duty, single shaft gas turbine with horizontal split casings. PARTO has manufactured all stages of this turbine via reverse engineering.

Type	Material	Weight	Coat	Cooling	No .in row
Blade Stage 1	Rene 80	1.2 Kg	Yes	Yes	82
Blade Stage 2	IN738	1.5 Kg	Yes	Yes	82
Blade Stage 3	IN738	2.1 Kg	No	No	78
Nozzle Stage 1	FSX – 414	4.4 Kg	Yes	Yes	16
Nozzle Stage 2	FSX – 414	5.6 Kg	Yes	Yes	24
Nozzle Stage 3	FSX – 414	10.1 Kg	Yes	Yes	24
Swiler	AISI	1.2 Kg	No	Yes	10



Hitachi H25 - Blade Stage1



Hitachi H25 - Blade Stage 2



Hitachi H25 - Blade Stage 3



Hitachi H25 - Vane Stage 1



Hitachi H25 - Vane Stage 2



Hitachi H25- Vane Stage 3

## MTB22(M701D)

In ISO conditions this turbine has an output of 144 MW. PARTO produces all stages of blades and vanes of the turbine.

Type	Material	Weight	Coat	Cooling	No .in row
Blade Stage 1	IN738	6.2 Kg	Yes	Yes	103
Blade Stage 2	IN738	6 Kg	Yes	Yes	93
Blade Stage 3	IN738	11.4 Kg	Yes	No	71
Blade Stage 4	IN X750	6 Kg	NO	No	72
Nozzle Stage 1	ECY768	6 Kg	Yes	Yes	60
Nozzle Stage 2	FSX – 414	20.4 Kg	NO	Yes	20
Nozzle Stage 3	FSX – 414	33.2 Kg	No	No	18
Nozzle Stage 4	FSX – 414	58 Kg	No	No	16



M701D - Blade Stage 1



M701D - Blade Stage 2



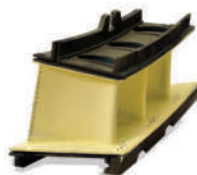
M701D - Blade Stage 3



M701D - Blade Stage 4



M701D - Vane Stage 1



M701D - Vane Stage 2



M701D - Vane Stage 3



M701D - Vane Stage 4



## Engineering and R&D

- Reverse-engineering and reengineering of turbine hot section components
- Product design, development and upgrading
- Product life cycle management and product technical service development
- Smart monitoring of global scientific and technological trends at PARTO's Observatory of Science and Technology to foster a long-term outlook



## Casting

- Investment casting of nickel- and cobalt- based super alloy components through DS (Directional Solidification) & SX (Single Crystal) technologies
- Casting capacity of over 4 tons per day
- Casting capacity of 22,000 pieces of industrial & gas turbine blades & vanes per year



## Machining

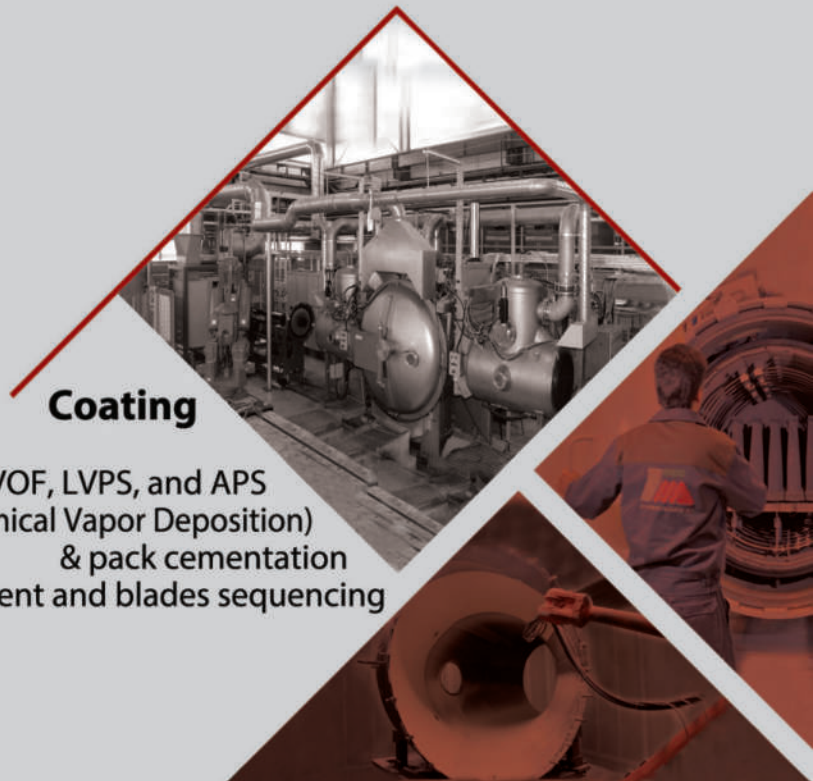
- STEM, Laser, FHD & EDM Drilling
- Creep Feed Grinding (CFG)
- Electro-Discharge Machining (EDM)
- Milling & Turning capabilities

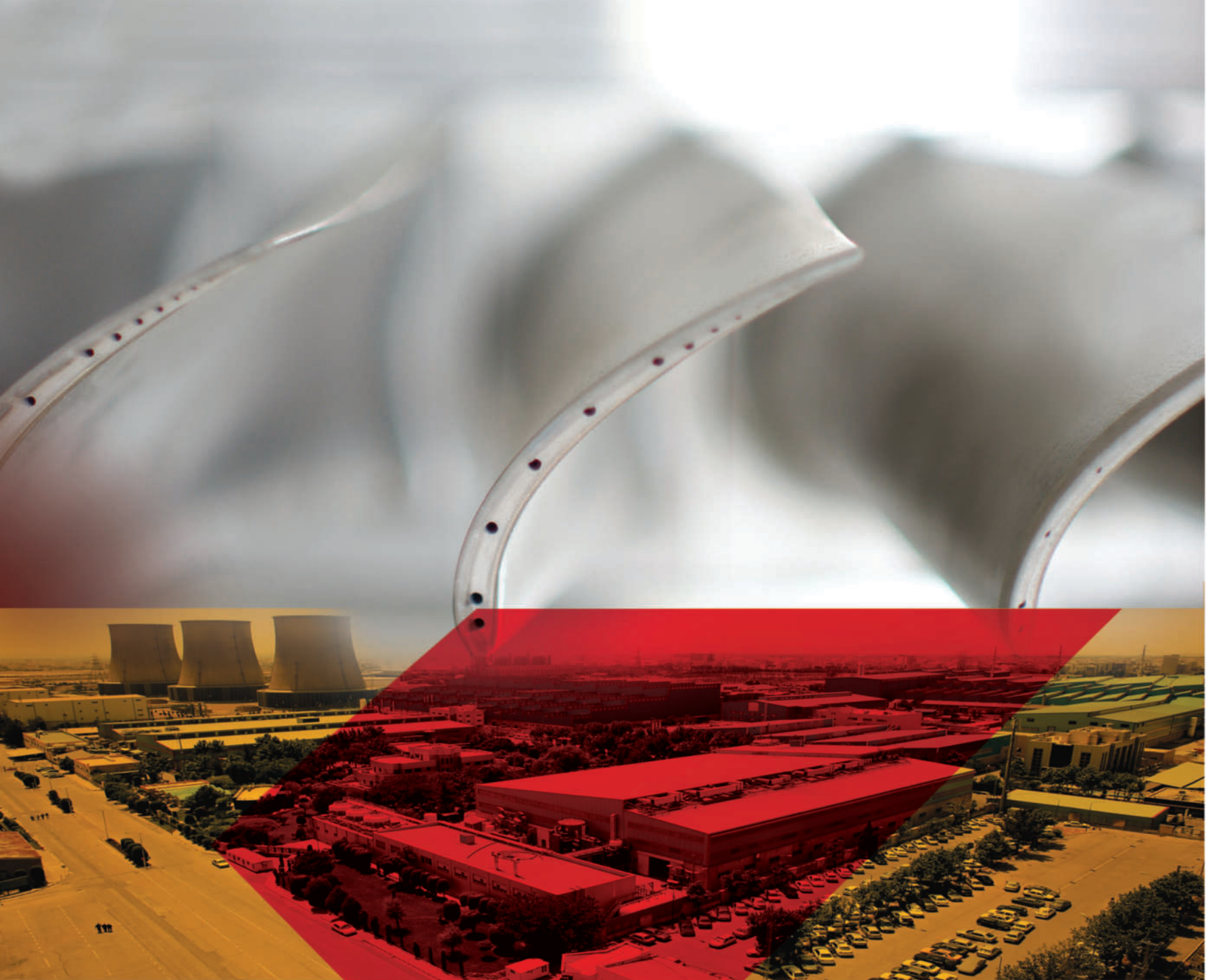


# Capabilities

## Coating

- Overlay coatings by HVOF, LVPS, and APS
- Diffusion coatings by CVD (Chemical Vapor Deposition) & pack cementation
- Moment weight measurement and blades sequencing





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