PURE-CHEM

PURE-COAT® WE 30

FOR

WIND ENERGY

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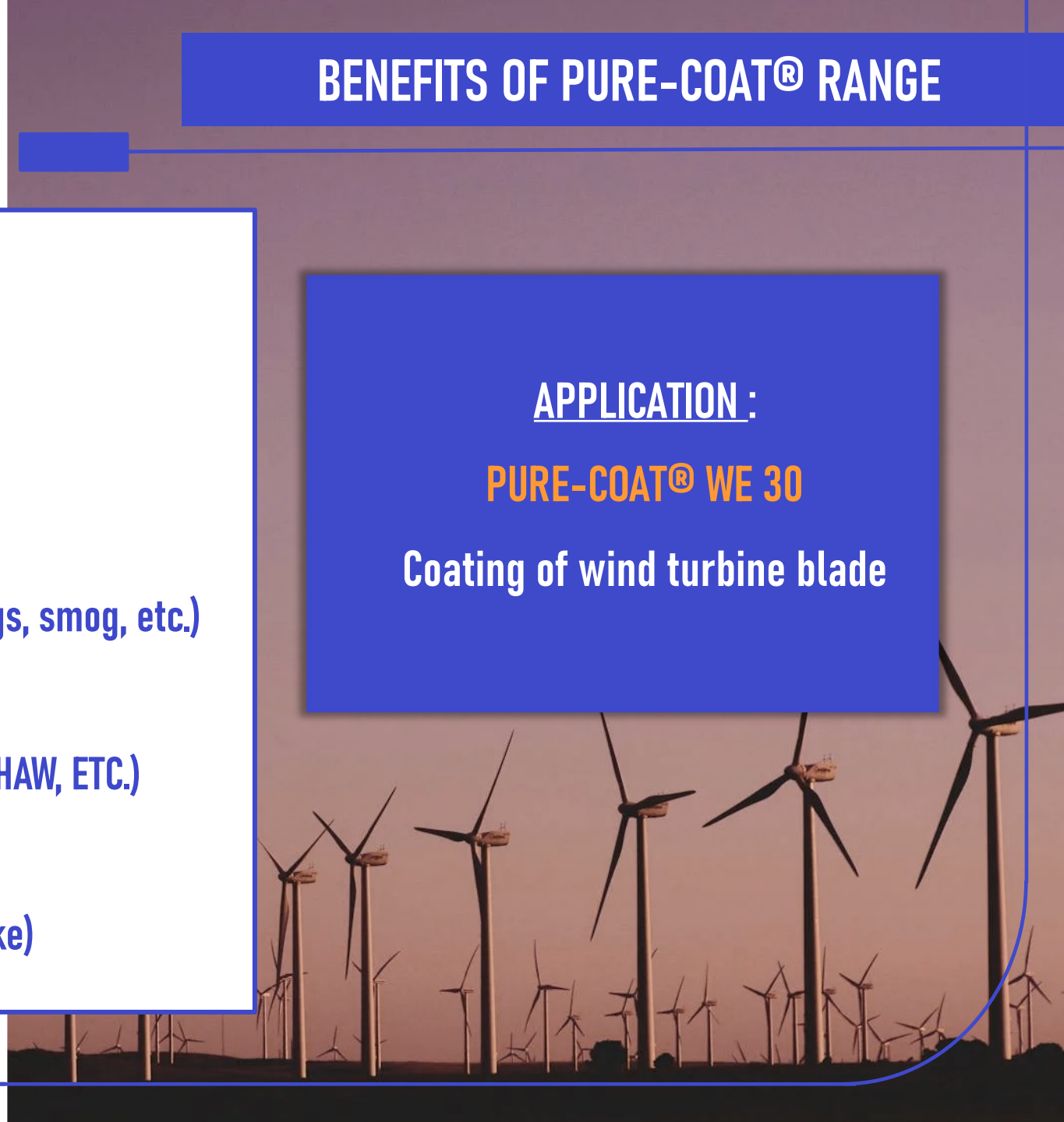
BENEFITS OF PURE-COAT® RANGE

- FRICTION REDUCTION (UP TO 7%)
- TURBOLENCE REDUCTION (UP TO 4%)
- ANTIFREEZE, PREVENT ICE STICKING
- MAINTENANCE COST REDUCTION
- REDUCTION OF SURFACE DIRT FORMATION (bird droppings, smog, etc.)
- REDUCTION OF EROSION
- WEATHERING RESISTANCE (RAIN, SUN, HAIL, FREEZING-THAW, ETC.)
- CORROSION RESISTANCE FROM SEA SALT AND WATER
- INCREASING OF IMPACT RESISTANCE (against birds strike)

APPLICATION :

PURE-COAT® WE 30

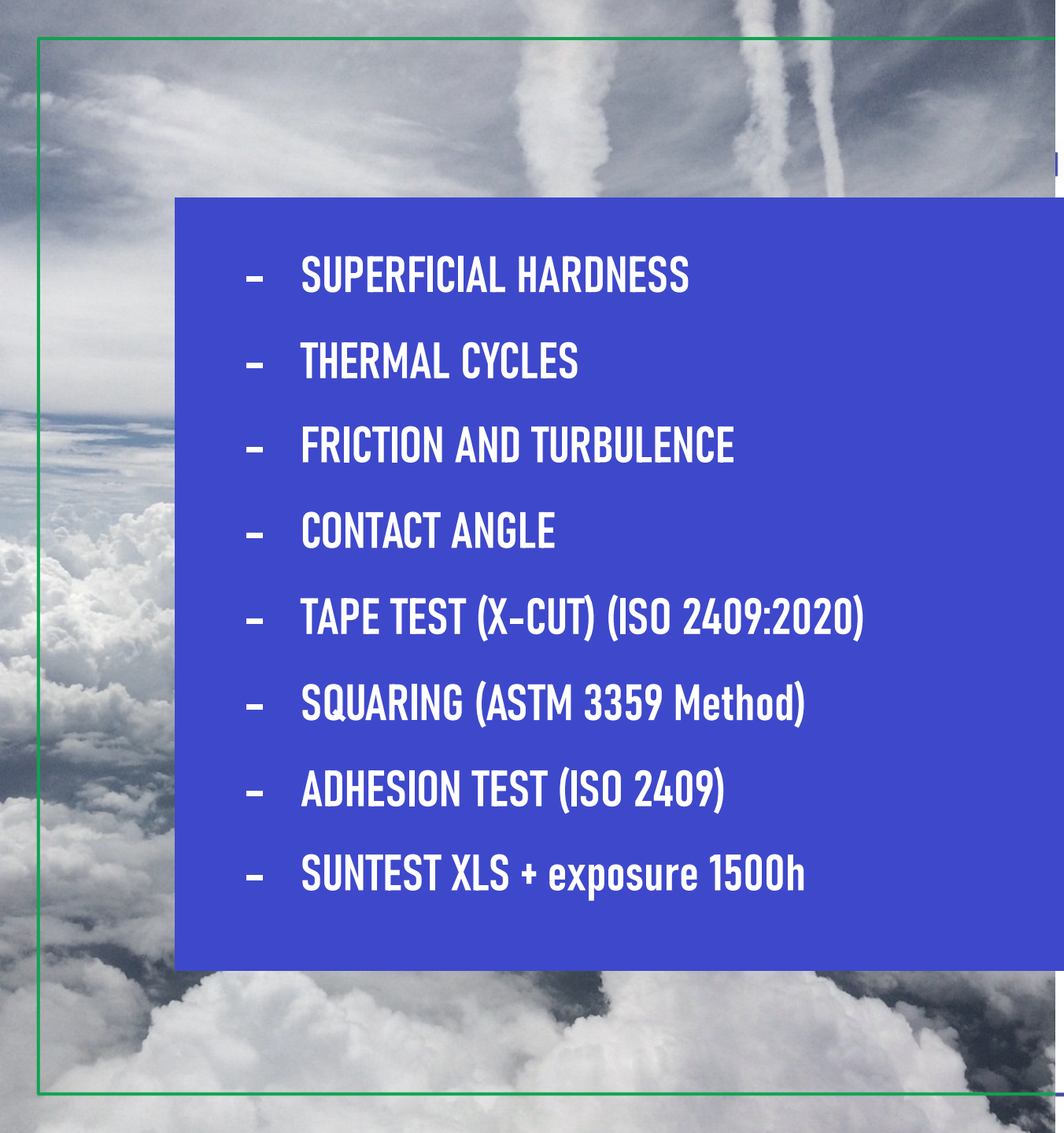
Coating of wind turbine blade



PRODUCT RANGE PROPERTIES

PROPERTIES OF PURE-COAT® WE 30:

- Excellent substrate adhesion
- UV and chemical resistant
- High hardness
- Excellent easy-to-clean properties
- Permanent barrier layer
- Good corrosion protection
- No weight impact of treatment
- Very good temperature stability up to 500°C
- Excellent weather resistance



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TESTS CARRIED OUT

- SUPERFICIAL HARDNESS
- THERMAL CYCLES
- FRICTION AND TURBULENCE
- CONTACT ANGLE
- TAPE TEST (X-CUT) (ISO 2409:2020)
- SQUARING (ASTM 3359 Method)
- ADHESION TEST (ISO 2409)
- SUNTEST XLS + exposure 1500h

SUPERFICIAL HARDNESS

The experimental hardness tests were carried out on carbon fiber panels with the following features:

TYPE OF APPARATUS	DUROMETER
PRODUCER	INNOVATEST
MODEL	NEMESIS 9000
TYPE OF INDENTER	BRINELL 2,5 mm
APPLIED LOAD [kgf]	62,5
LOAD APPLICATION TIME [s]	10

The testing machine is equipped with an optical microscope with magnification up to 10x and an indenter positioning sensor. For each slab, two rectangular-shaped specimens measuring 50x25 mm were cut, and 3 acquisitions were performed on each of them at different points, for a total of 6 hardness acquisitions for each slab

MATERIAL	BRINELL HARDNESS		
	AVERAGE	DEV. STD.	% VARIATION
Plate 1– PURE-COAT® WE 30	67,12	0,66	+ 14% RESPECT UNTREATED
Plate 2 – Untreated	57,99	1,34	-

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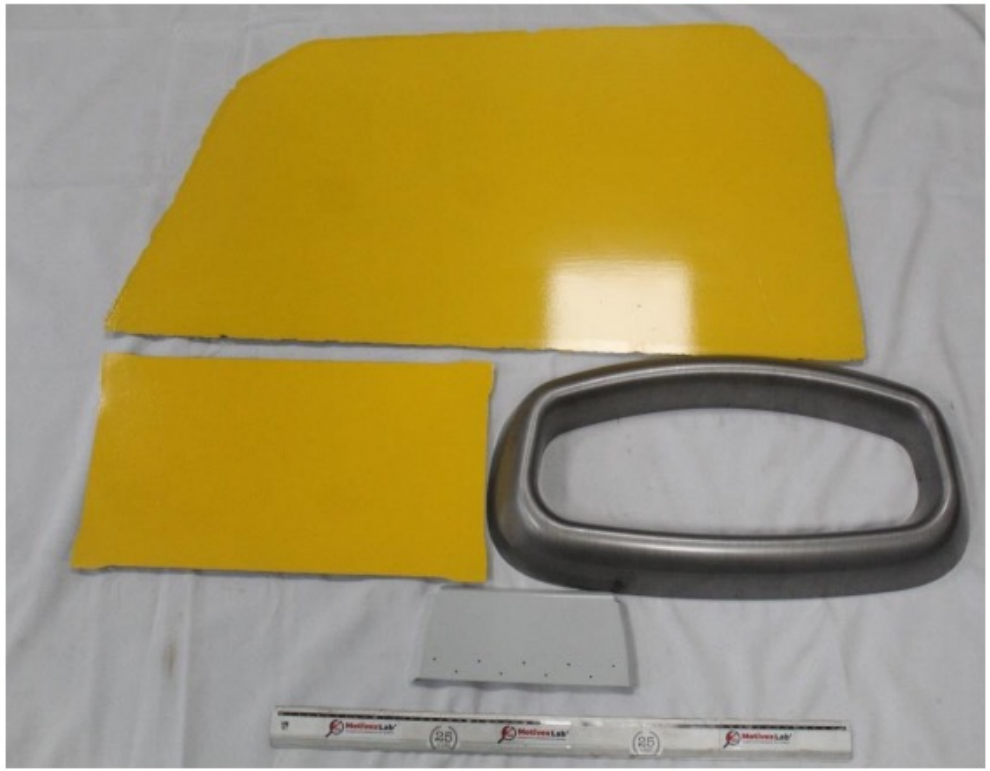
THERMAL CYCLES

The certified laboratory MotivexLab in Avigliana (TO) carried out thermal cycle tests on different fuselage materials painted and subsequently treated with the PURE-COAT® WE 30 product.

Titolo di Prova: RESISTENZA AI CICLI TERMICI
Title of Test: Thermal cycles resistance
Strumento: Camera climatica ID.281
Equipment: Climatic chamber ID.281
Metodo di Prova: MotivexLab
Standard

INIZIO PROVA: *Test start*	**13/06/2023**
FINE PROVA: *Test end*	**14/06/2023**
DURATA PROVA: *Test lenght*	**18 ore** *18 hours*
DESCRIZIONE DEL CICLO: *Cycle description*	**1. T0=23°C +/- 1°C** **2. -70°C a 2°C/min** **3. Stabilizzazione per 3 ore (-70°C)** **4. Da -70°C a -51°C a 2°C/min** **5. Stabilizzazione 1 ora e 30 min (-51°C)** **6. Da -51°C a +23°C a 2°C/min** *1. T0=23 °C +/-1°C* *2. -70°C at 2 °C/min* *3. Stabilisation for 3 hours (-70 °C)* *4. From -70 °C to -51 °C to 2 °C/min* *5. Stabilization 1 hour and 30 min (-51°C)* *6. From -51°C to +23 °C to 2 °C/min*

Dopo 3 cicli non si osservano difetti.
After 3 cycles no defects are observed.



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FRICTION AND TURBULENCE

Analysis of the effects of the surface coating treatment carried out with PURE-COAT® WE 30

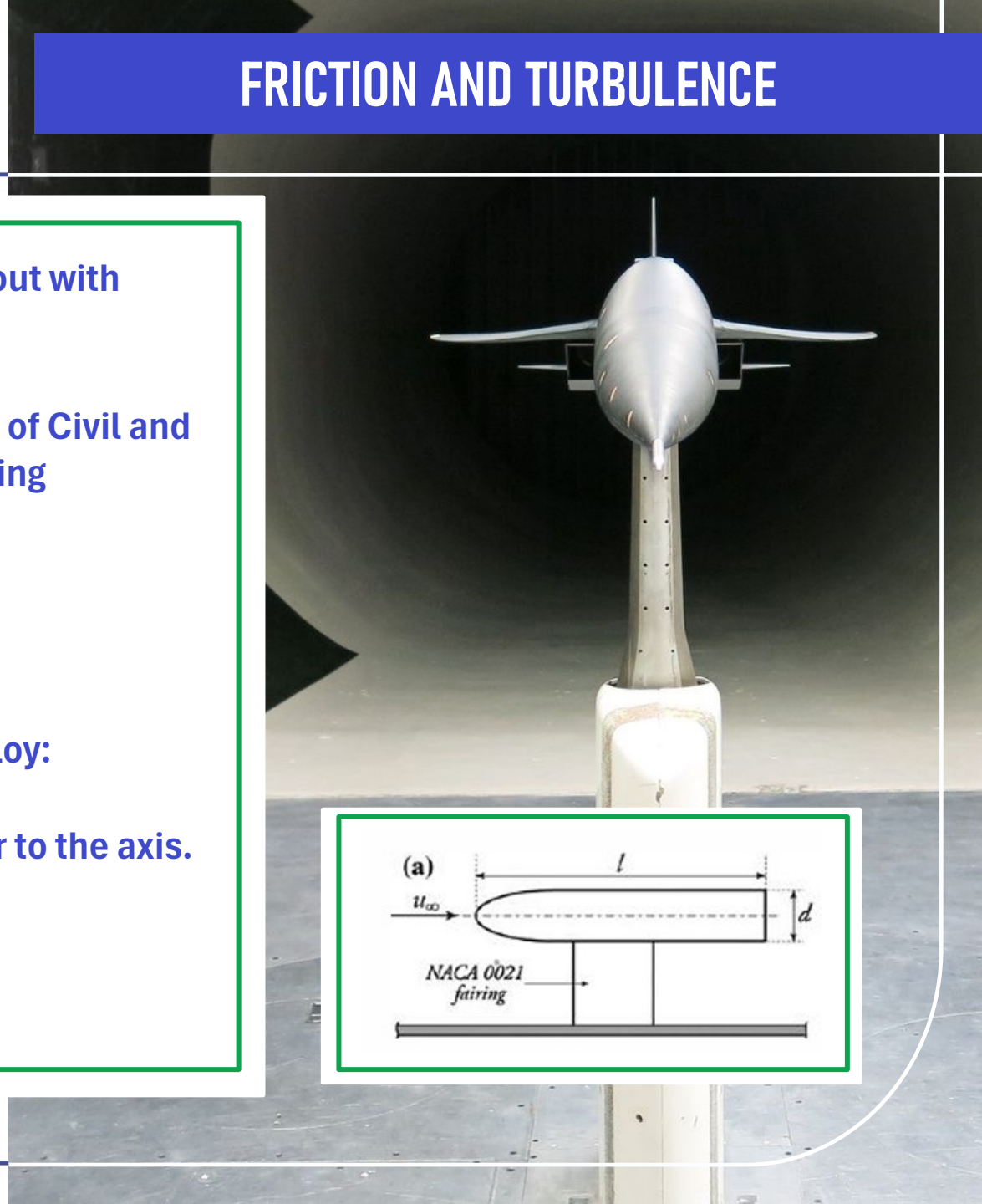
The tests were carried out in the Wind Tunnel of the Department of Civil and Industrial Engineering of the University of Pisa having the following characteristics:

- **Closed-circuit subsonic tunnel and open test chamber;**
- **Circular test section (1.1 m diameter and 1.42 m long);**
- **Free-flow turbulence level of 0.9%;**

The model is NACA 0021 composed of two parts in aluminum alloy:
- a front body with a 3:1 elliptical profile and
- a cylindrical main body with a sharp-edged base perpendicular to the axis.

The characteristic dimensions are:

- **Diameter d=70;**
- **Length l=400 mm.**



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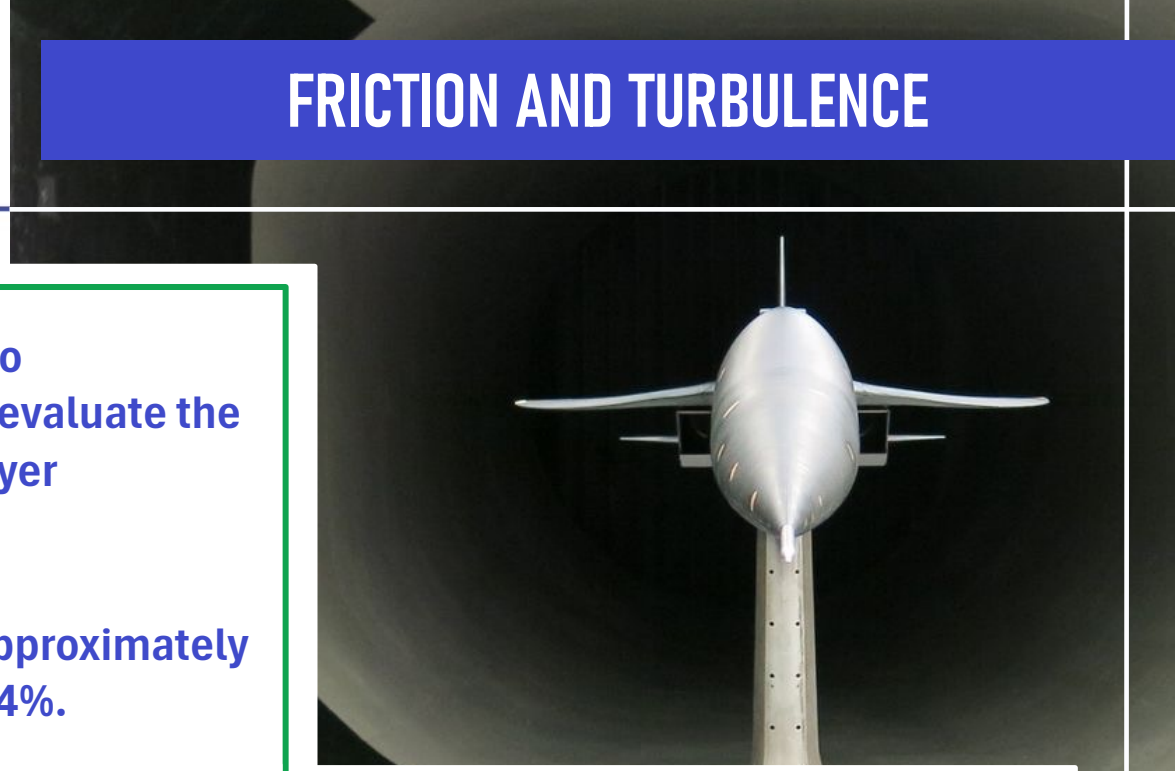
FRICTION AND TURBULENCE



Velocity and pressure measurements were conducted in order to characterize the flow around an axisymmetric body , in order to evaluate the effects of a surface treatment. The thickness of the boundary layer increases with surface treatment.

The model treated with PURE-COAT® WE 30 has a reduction of approximately 7.0% in surface friction and a decrease in turbulence of around 4%.

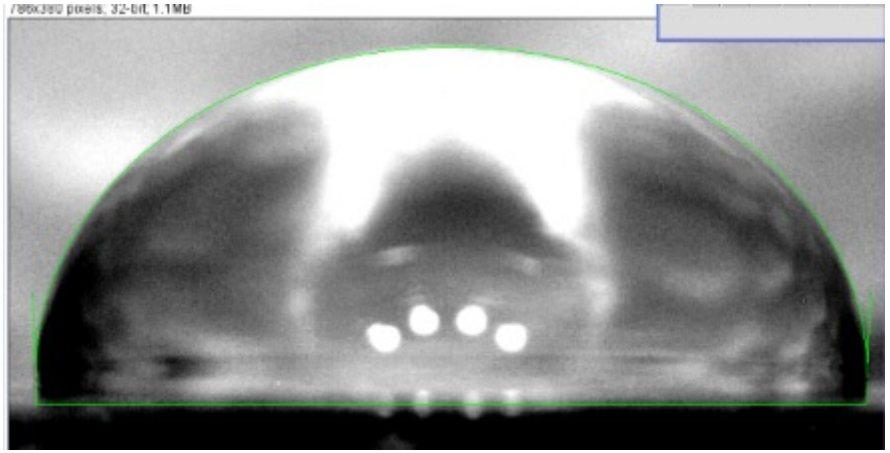
The table shows the slopes of the wall velocity profile, from which yes obtain the value of the friction action:

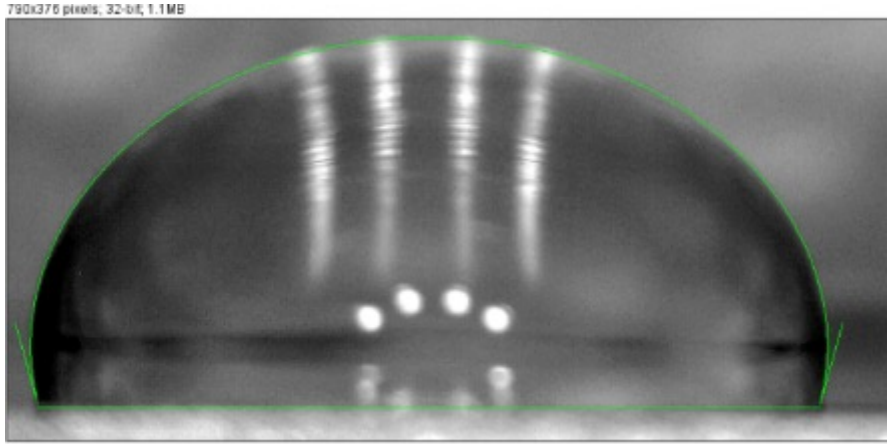
$$\tau_0 = \mu \left. \frac{\partial u}{\partial y} \right|_{wall}$$

s/d	du/dy PRE	du/dy POST	riduzione (%)
0.1	216.6	199.3	8.0
0.2	209.0	197.4	5.6
1.0	191.4	177.3	7.4

The pressure maps attest to less suction on the base, and therefore less pressure resistance.

CONTACT ANGLE





SAMPLE	CONTACT ANGLE	ROLLING ANGLE
Untreated sheet metal	92.3	15
Sheet metal with PURE-COAT® WE 30	105	13

The sheet metal treated with the PURE-COAT WE 30 product implements the contact angle value by + 14% compared to the same untreated one.

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TAPE TEST (X-CUT) & SQUARING

SAMPLE TYPE: EPOXY PAINT COATED WITH PURE-COAT® WE 30

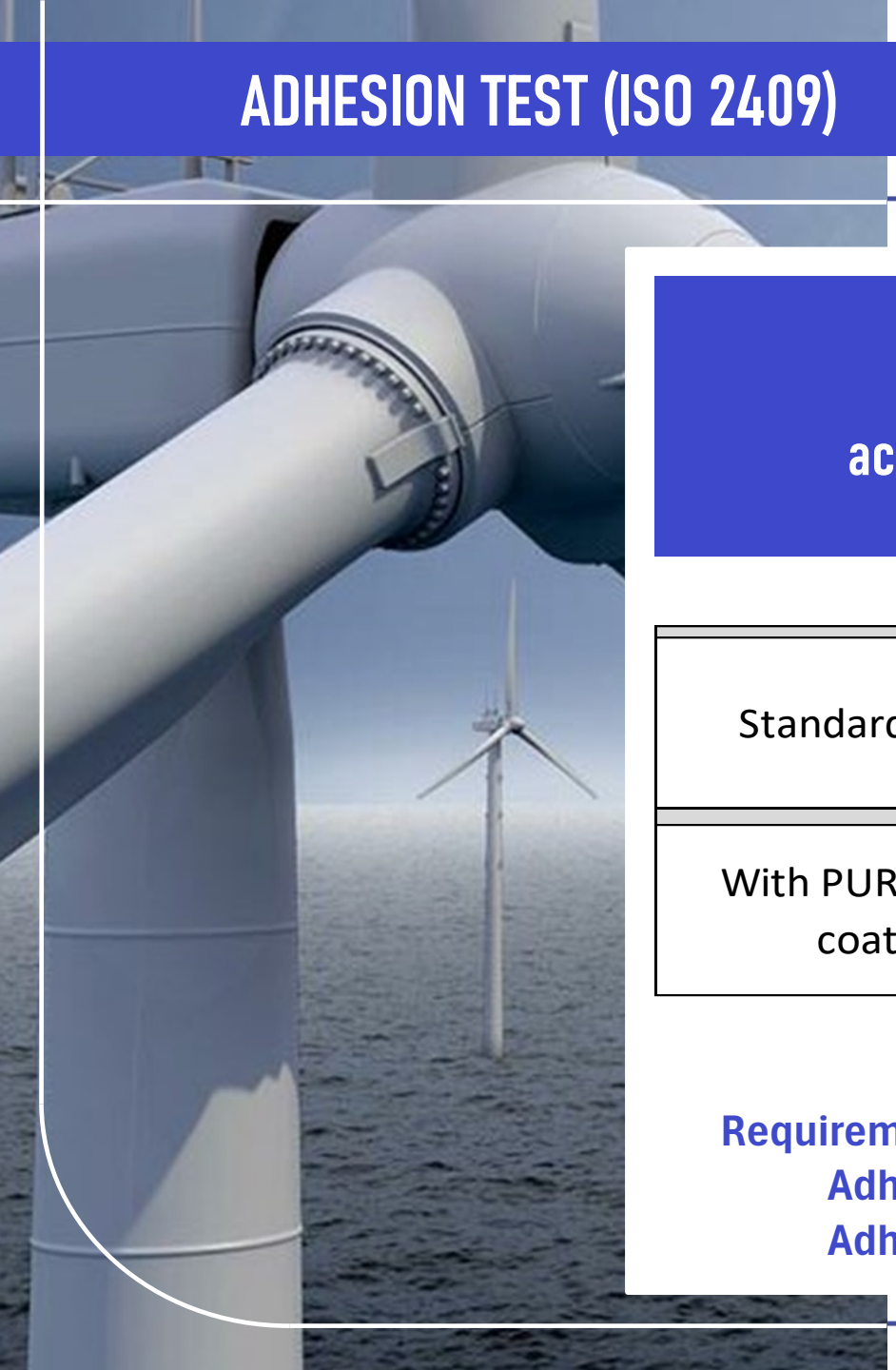
NORMATIVE REQUIREMENTS:
Squareness test (UNI EN ISO 2409:2020).

Level rating: 2
No detachment of the surface treatment

NORMATIVE REQUIREMENTS:
Tape Test (ASTM 3359 Method)

Level rating: 4A
No detachment of the surface treatment

ADHESION TEST (ISO 2409)



ADHESION TEST according to ISO 2409

Standard PAINT	sample 1	ST0
	sample 2	ST0
	sample 3	ST0
With PURE-CHEM coating	sample 1	ST0
	sample 2	ST0
	sample 3	ST0

ADHESION TEST after water immersion 14 days at RT according to ISO 2812-2 and ISO 2409

Standard PAINT	sample 1	ST0
	sample 2	ST1
	sample 3	ST0
With PURE-CHEM coating	sample 1	ST0
	sample 2	ST0
	sample 3	ST1

LEGEND: ST0 -> BEST RESULT - ST5 -> WORST RESULT

Requirements:

Adhesion test: ST0

Adhesion test after water immersion: ST0 or ST1

SUN TEST XLS + UV OUTDOOR EXPOSURE

SUNTEST XLS + exposure 1500h (300 to 800 nm)

Standard paint	No impact on color and gloss
With PURE-CHEM coating	No impact on color and gloss

Outdoor UV exposure 3 month

Standard paint	No impact on color and gloss
With PURE-CHEM coating	No impact on color and gloss

No impact of PURE-COAT® WE 30 coating compared with standard paint system