TEST REPORT

November 2007

Field study of performance and noise for TR7Z

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MULTI-WING™

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1.0 Test scope

Working in cooperation with OS PANTO, an Italian manufacturer of wood dryers, Multi-Wing conducted field tests to validate our new TR7Z blade performance.

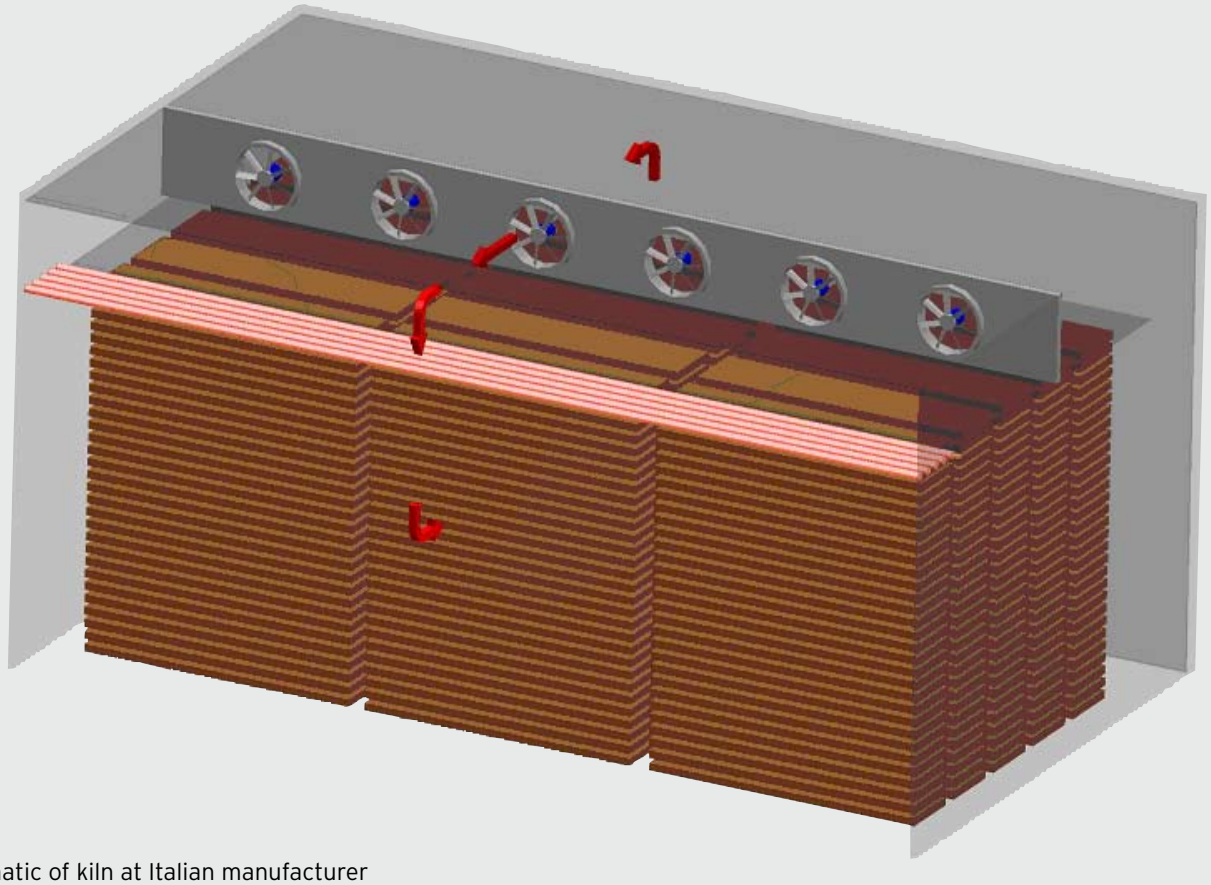
We wanted to compare the performance and omitted noise of the impellers currently mounted in kiln to the our new TR7Z impellers and an impeller from a competitor.

2.0 Test description

Our test model was a small kiln that utilizes six impellers (tip clearance 1%) running on 3kW 4-pole motors. We compared the performance of the existing fan selection against the new TR7Z impellers in 2 different configurations and an impeller from a competitor (tip clearance 1%).

The Multi-Wing impellers included in the test are:
· 790/7-7/40º/ZREV (impeller diameter/no. of blades - positions in hub/pitch angle/blade profile)
· 793/6-6/45º/TR7Z
· 793/9-9/45º/TR7Z

· 790/8-8/35º/competitor



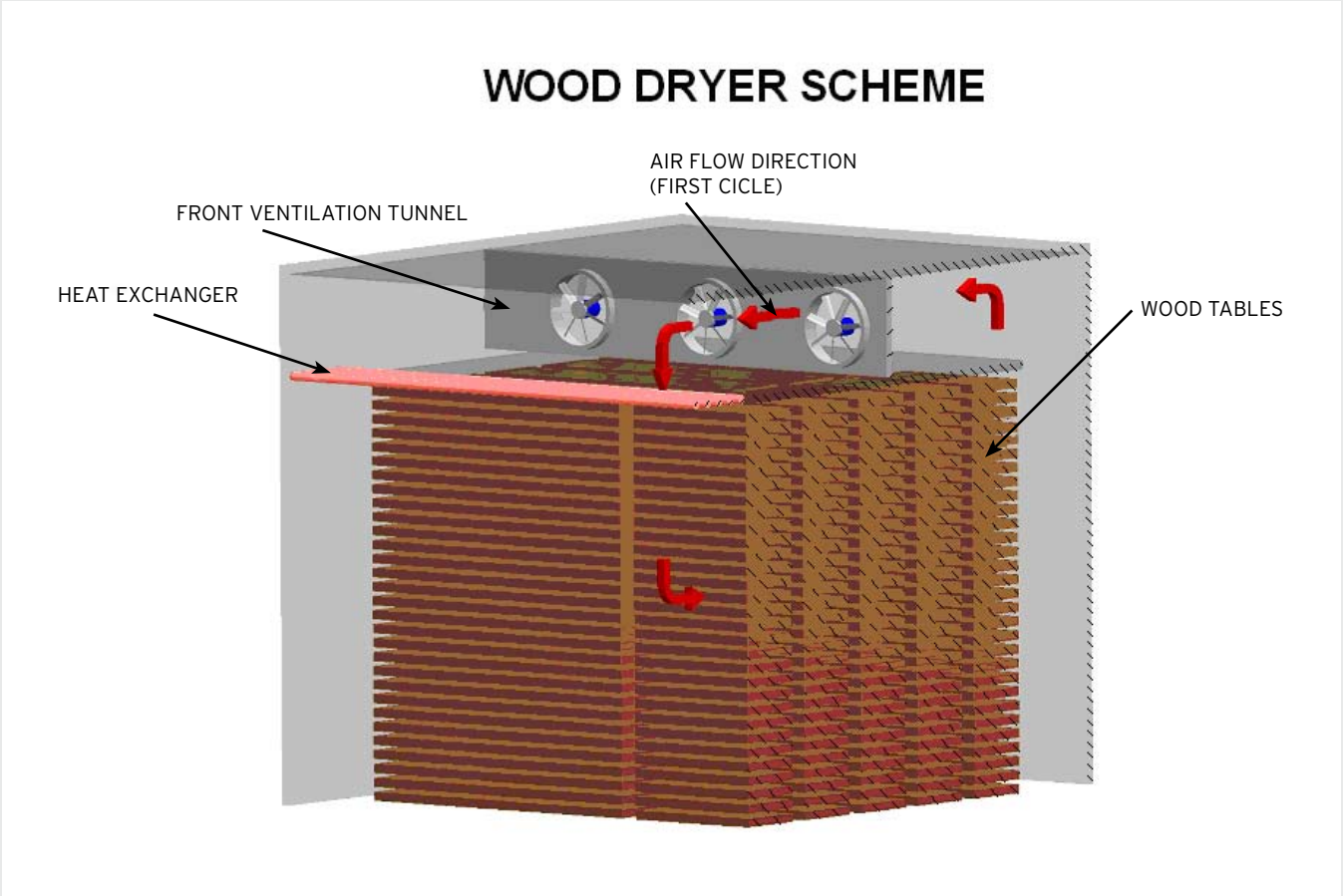
Schematic of kiln at Italian manufacturer

2.0 Test description - continued

For each impeller model we collected the following data:

- Air speed. Using a Testo 435" with helix probe diameter 60 mm anemometer, we calculated air speed by monitoring key points in the Front Ventilation Tunnel. From these measurements we calculated an average air speed.
- Amperage. We measured the amperage drawn from the motors.
- Sound pressure level in dB(A). Using a Testo phonometer model 815 microphone at a distance of 4 meters from the impeller inside the wood kiln, we measured the noise results. Results are specific to the relative location and measured point.

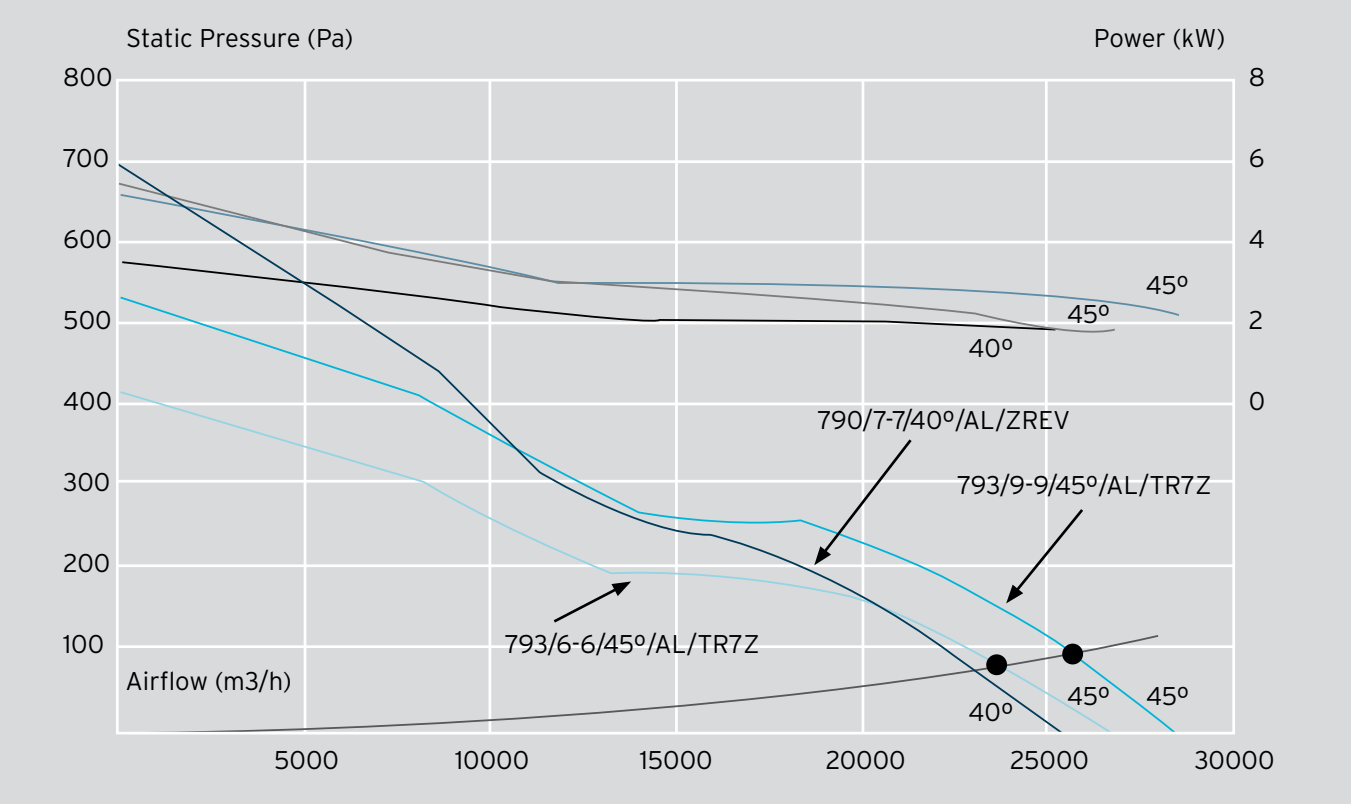
The purpose of this test is to define the relative performance results between different impeller models – not to measure absolute performance.



Standard wood dryer layout

3.0 Test thesis

Below is a chart from our selection software Optimiser showing the curves of the Multi-Wing impellers at 1440 rpm. We expect that this is the results we will get when we test the impellers in the dryer. We expect that the impellers will at least perform equivalent comparing them to each other.

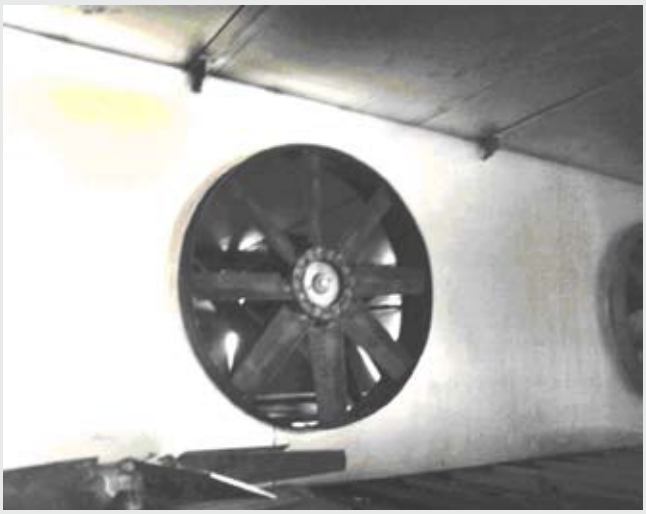


4.0 Test results

4.1 Performance and noise results of Multi-Wing impellers

Type	Air temp.	Electrical tension	Average air speed on Front ventilation tunnel	RPM	Absorbed current	SPL (sound power level)	Estimated single impeller air flow	Calculated mechanical power on motor shaft
790/7-7/40º/ZREV	18	386 V	5,05 m/s	1440	6,5 A	95,0 dB(A)	23000 m3/h	2,78 kW
793/6-6/45º/TR7Z	18	390 V	5,25 m/s	1440	5,6 A	94,3 dB(A)	23910 m3/h	2,42 kW
793/9-9/45º/TR7Z	18	391 V	5,43 m/s	1440	6,1 A	95,7 dB(A)	24730 m3/h	2,64 kW

We had the opportunity to test identical performance variables on the existing impellers in the same wood dryer application. The impeller from the competitor was an 8-bladed reversible profile with a 35º-pitch angle (pictured right).

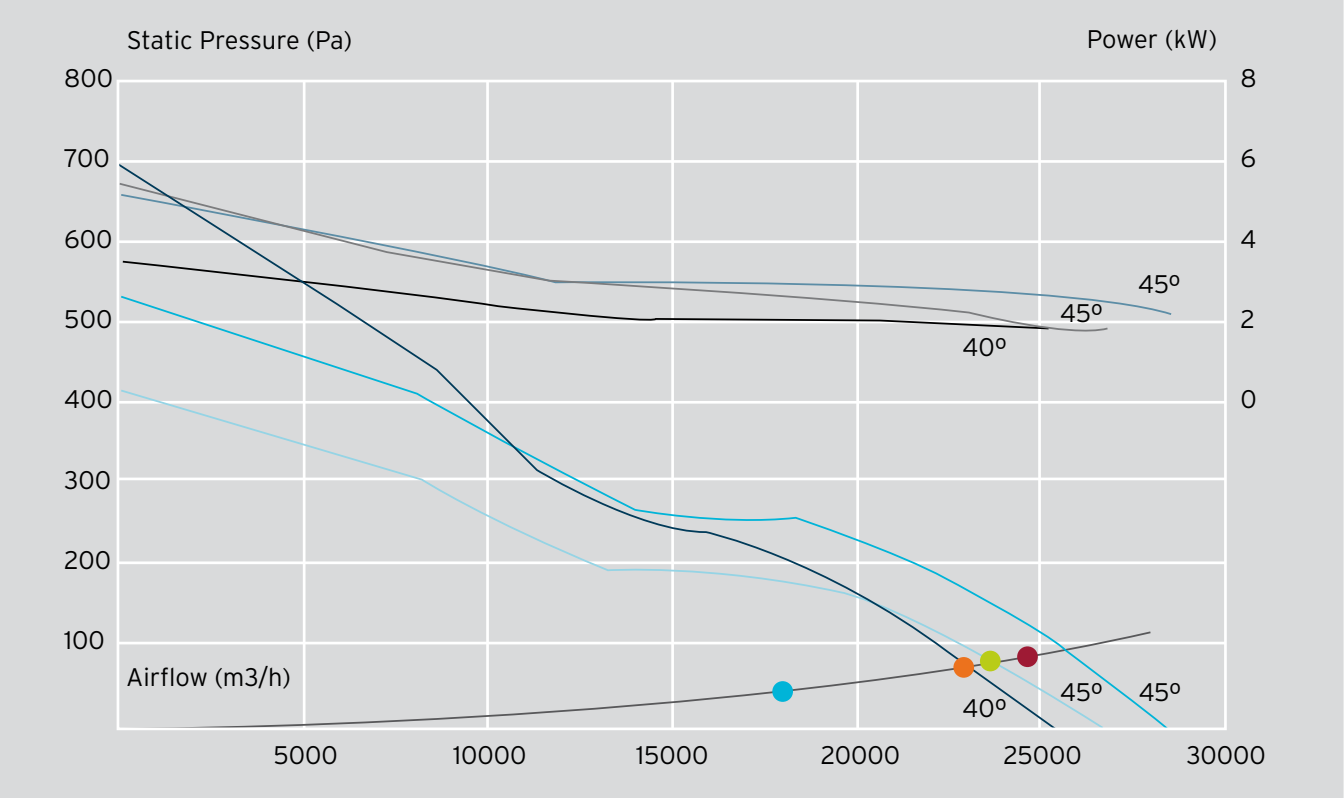


4.2 Competitor Test Results

Type	Air temp.	Electrical tension	Average air speed on Front ventilation tunnel	RPM	Absorbed current	SPL (sound power level)	Estimated single impeller air flow	Calculated mechanical power on motor shaft
790/8-8/35/ competitor	15	395 V	3,90 m/s	1440	5,7 A	94,0 dB(A)	17800 m3/h	2,49 kW

5.0 Test analysis

Plotting the new data on the Optimiser curves clearly illustrates the corresponding similarity between the airflow results measured in the wind tunnel and the results measured in the wood drying application.



- 790/7-7/40º/ZREV's estimated airflow
- 793/6-6/45º/TR7Z's estimated airflow
- 790/9-9/45º/TR7Z's estimated airflow
- 790/8-8/35º/competitor's estimated airflow

- The estimated airflow for the 793/9-9/45º/TR7Z was slightly lower than expected. This may be attributed to multiple variables including imprecise measurement.
- The test results indicated unexpectedly high power consumption for the ZREV impeller.
- The test confirmed the practical validity of the new TR7Z profile.
- In comparison to the defined standard for the 3kW motor, 790/7-7/40º/ZREV:
  - 793/6-6/45º/TR7Z has slightly higher performance with lower power consumption and lower noise
  - 793/9-9/45º/TR7Z has significantly higher performance with a slight reduction in power consumption
  - 790/8-8/35º/competitor performs much lower airflow with slightly higher power consumption. Noise is equivalent to the level of 793/6-6/45º/TR7Z.

6.0 Test conclusion

The tests show that the TR7Z impeller provides real efficiency advantages that can be translated into energy savings in wood drying applications.

Below is a calculation which illustrates the savings involved changing from ZREV impellers to the new TR7Z impellers.

This specific dryer has 6 identical impellers, a drying plant has between 2 and 50 dryers with between 10 and 18 impellers, that means potentially between 20 and 900 impellers in a plant.

Cost of impellers:
790/7-7/40º/AL/ZREV/28/8: Index 100
793/6-6/45º/AL/TR7Z/28/8: Index 92
793/9-9/45º/AL/TR7Z/28/8: Index 120

Power consumption of 790/7-7/40º/AL/ZREV/28/8: 2,78 kW
Power consumption of 793/6-6/45º/AL/TR7Z/28/8: 2,42 kW
Power consumption of 793/9-9/45º/AL/TR7Z/28/8: 2,64 kW

All of the impellers would require a standard 3kW electrical motor (bore/keayway is 28/8).

The dryers operate 24 hours/day for 350 days/year, equal to 7.000 hours/year
The average rate for electricity in Italy is 0,136 €/kWh

Energy saved on the dryer changing from 790/7-7/40º/AL/ZREV/28/8 to 793/6-6/45º/AL/TR7Z/28/8:
6 pcs x (2,78-2,42)kW x 7.000 h x 0,136 €/kWh = € 2.056,32

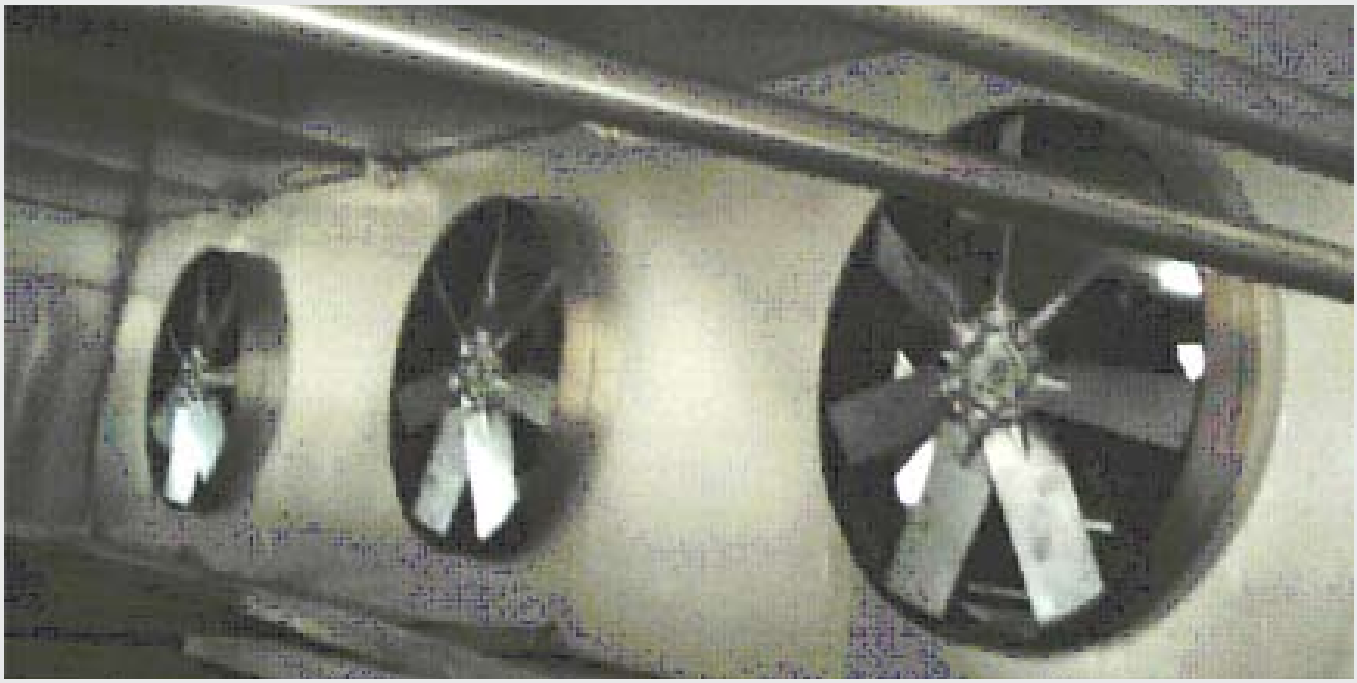
Energy saved on the dryer changing from 790/7-7/40º/AL/ZREV/28/8 to 793/9-9/45º/AL/TR7Z/28/8:
6 pcs x (2,78-2,64)kW x 7.000 h x 0,136 €/kWh = € 799,68

For a small plant with 2 dryers with 10 impellers each, the total operation cost that could be saved changing to 793/6-6/45º/AL/TR7Z/28/8 would be:
2 dryers: 20 pcs x (2,78-2,42)kW x 7.000 h x 0,136 €/kWh = € 6.854,40
793/9-9/45º/AL/TR7Z/28/8 would be:
2 dryers: 20 pcs x (2,78-2,64)kW x 7.000 h x 0,136 €/kWh = € 2.665,60

For a large plant with 50 dryers with 18 impellers each, the total operation cost that could be saved changing to 793/6-6/45º/AL/TR7Z/28/8 would be:
50 dryers: 900 pcs x (2,78-2,42)kW x 7.000 h x 0,136 €/kWh = € 308.448
793/9-9/45º/AL/TR7Z/28/8 would be:
50 dryers: 900 pcs x (2,78-2,64)kW x 7.000 h x 0,136 €/kWh = € 119.952

It is obvious that the 6-bladed version of TR7Z provides the highest cost save both in terms of energy saved and impeller cost. The 9-bladed version is a little more expensive than the ZREV impeller, resulting in a more moderate cost save. It is however worth noting that the 9-bladed TR7Z supplies roughly 7,5% more airflow, resulting in higher drying capacity.

Appendix A



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