

IVI SERIES 535 FRP FOR FANS UNTIL 40'

TECHNICAL CHARACTERISTICS



The innovative aerodynamic and structural features place the new IVI series 535FRP in a privileged position on the market of the large axial fans. The peculiarities of this new series provide lower power consumption and assure an exceptional structural reliability.



AERODYNAMIC CHARACTERISTICS

The excellence of the aerodynamic characteristics is based on three essential factors:

- high performance / high efficiency new profile
- blade geometry, designed to minimize the power consumption
- absence of reverse flow in the central area of the fan

AERODYNAMICS OF THE PROFILE



The profile of the 535FRP series, called "IW", is of the type "high lift – low Reynolds number", especially designed and optimized for large impellers blades.

In particular this profile shows the optimum characteristics in the

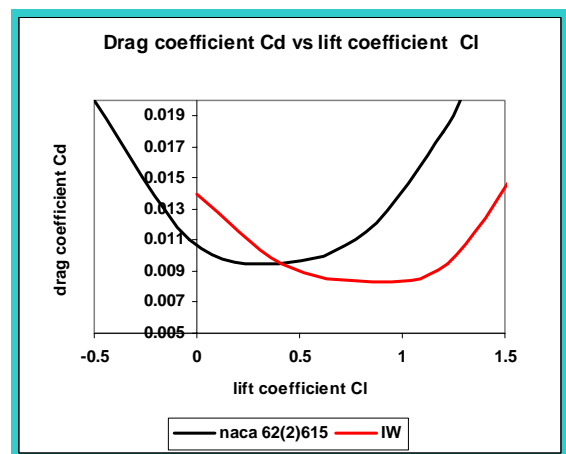
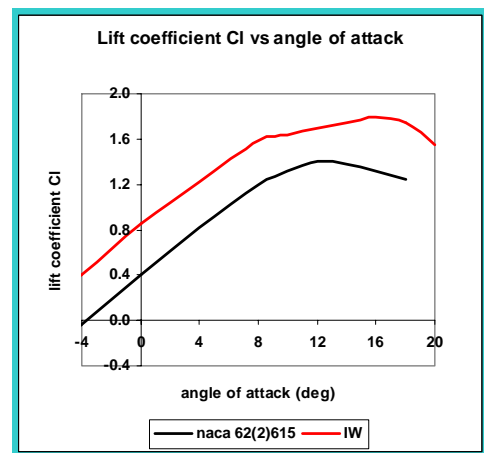
medium-high range of the aerodynamic angle of attack: in this range, which is typical of large fans, the profile efficiency is close to its maximum values. In other words, the IW profile is designed to operate in the zone of best efficiency for the majority of the applications.



The curvature of the profile mean line is accentuated towards the trailing edge to provide a high lift coefficient without utilizing a flap. This peculiarity turns out also in higher efficiency and lower sound emission. Compared to conventional profiles (for example NACA) the IW profile achieves the same performance with narrower blades.

Moreover the stall angle is higher than the one of conventional profiles: that means that the IW profile can operate in a larger pitch angle range.

The following diagrams show the typical C_l - α and C_d - C_l curves of the IW profile compared with a conventional NACA profile. The above-mentioned advantages are very evident.



Another important peculiarity of the IW profile is that the excellent performance and efficiency remain practically unchanged even at high profile thickness. This characteristic allows utilizing a large diameter blade shaft to connect the blade to the fan

hub without compromising the blade aerodynamics and assuring at the same time an exceptional structural strength.

The blade geometry



The blade geometry is characterized by :

- rectangular plan
- no twist

These peculiarities have been adopted on the purpose of optimizing the pressure recovery in the cooler plenum and consequently reducing the absorbed power.

The pressure recovery in the plenum is a well-known phenomenon: in FD coolers the air velocity is reduced from

the fan inlet to the cooler outlet. That means that in the plenum the air is subjected to a negative acceleration, and consequently a positive static pressure is generated (kinetic energy variation). In ID coolers the phenomenon is the same, only the sign of acceleration and pressure is the opposite. In both cases the recovered pressure “helps” the fan: the larger is the recovered pressure, the lower is the pressure the fan has to provide to overcome the bundle resistance, and the lower is the absorbed power.

Using untapered and untwisted blades increases the recovered pressure and consequently reduces the absorbed power.

Absence of reverse flow

The reverse flow in the fan center represents an energy loss that reduces the fan efficiency and must be avoided.

Installing a disk of proper diameter in the fan center (so that the aerodynamic pressure generated at the blade root is higher than the static pressure in the plenum) prevents this phenomenon.

For this purpose ILMED utilizes hub disks of diameter ranging from 1000 to 2000 mm, that, besides the primary structural duty, avoid the reverse flow and the consequent loss of efficiency.

STRUCTURAL CHARACTERISTICS

ILMED fans series 535FRP has been designed to guarantee the maximum reliability during its complete life cycle. The structural elements of the impeller are:

- hub
- pulltruded FRP profile
- blade shaft

- HUB



A steel hub boss connects the hub to the fan drive shaft. Two steel disks (thickness 10 to 15 mm, diameter 1000 to 2000 mm depending on the fan diameter and loading) are bolted to the top and bottom surfaces of the

hub boss. The blades, with the blade shaft located into extruded pillow blocks, are sandwiched between the two hub disks. The result is a monolithic structure characterized by an enormous stiffness and strength. Consequently the stress level is extremely low to guarantee infinite life to the components.

- BLADE PROFILE



The profile of IMED series 535FRP is made of pulltruded fiberglass reinforced plastic (FRP).

ILMED has a long experience in pulltruded FRP blades; we believe that pulltrusion, compared with other technologies, offers important advantages:

- better mechanical resistance: the glass content in pulltrusion is much higher than the one obtainable with other technologies. This

- guarantees superior mechanical and fatigue strength of the blade.
- homogeneity and consistency of the product, which is very important for the reliability of the blades: the absence of potential material discontinuities (dangerous for the blade integrity) is assured.
- lower production costs

- BLADE SHAFT

The blade shaft consists of a high quality steel round bar, which combines a very high structural strength to an optimum fatigue resistance.



This solution assures also:

- the perfect knowledge of the material mechanical characteristics in the most loaded area of the blade

- a very reliable clamping system of the blade shaft in the aluminum pillow blocks

A low thickness steel tube of proper length is then inserted into the blade shaft on the purpose of keeping the stress in the fiberglass profile at low level, to assure an exceptional strength to the blade assembly.