Info	
Subject:	EU 327/2011 Comments with regard to “Not final assembly”
From:	P. Holkers

Introduction
Howden Netherlands [HNL] is a manufacturer of industrial low pressure axial cooling fans. These fans are mainly used in air-cooled condensers, air cooled heat exchangers and cooling towers to provide cooling for power plants and (petro) chemical industries. These fans will typically range in fan diameter from 3 meters to over 12 meters. The largest fan currently produced by HNL is 21 meters in diameter.

Current implementation of EU 327 within HNL
HNL sells nearly all of its fans as impeller only and as such HNL currently follows the guidelines for “not final assembly” fans as laid out in EU 327. HNL does this by applying the calculation rules from EU 327, Annex 2 paragraph 3.

$$\eta_e = \eta_r \cdot \eta_m \cdot \eta_T \cdot C_m \cdot C_c$$

The impeller efficiencies η_r required for these calculations have been experimentally determined by scale model testing on an ISO-5801 type A fan performance test setup (free inlet and outlet conditions). The impeller performance data obtained from these scale model tests is also used in the HNL fan selection program that allows our customers to select the optimal fan configuration for their specific application. This detailed and reliable knowledge of the performance of our fans has taken decades to acquire and constitutes a large amount of added value to our customers.

Consequences of removing “not final assembly” from the regulation
If the non final assembly option were to be simply removed from the regulation this would mean that the main product sold by HNL (bare shaft impellers) would no longer be considered a fan and as such would no longer fall under the regulation directly.

This would then put our customers in a very difficult position of then becoming the party that places a fan on the market, making them responsible for having to prove conformity to the efficiency criteria. Under the current regulation this would then mean that they would not be able to use a calculation method to determine the fan efficiency but would be obligated to experimentally determine the efficiency of the fan in their installation. Just imagine having to experimentally determine the efficiency of a 12 meter diameter fan in an air-cooled condenser positioned 20 to 50 meters above ground level!

HNL has a great deal of experience with on-site performance testing of our cooling fans and based on this experience we believe it to be unrealistic to require our customers to perform such on-site tests. The amount of time and cost required to perform this type of testing is quite severe and the overall accuracies that can typically be achieved on-site are limited, even when the test is conducted by highly skilled and experienced personnel.

Limitations regarding in-situ fan performance testing
The efficiency as defined by EU 327 is equal to the ratio of the fan gas power $P_{u(s)}$ and the power measured at the main input terminal P_e. The fan gas power is then defined as the product of the air volume flow rate through the fan q and the fan static p_{fs} or total pressure rise p_f depending on the measurement category (note that for low pressure axial cooling fans incompressibility is typically assumed).

It is the experience of HNL that the determination of the fan pressure rise, particularly in forced draft installations such as A-frame air-cooled condensers or forced draft air-cooled heat exchangers, is highly problematic and in many cases even practically impossible. One example of how problematic this measurement becomes can be found in ISO 5802 “performance testing in-situ” which dictates a measurement location for the fan pressure rise at a minimal distance of 5 times the fan diameter from the fan outlet. For a typical 12 meter ACC fan this would be 60 meters. To be able to perform an accurate, reliable, measurement of the fan pressure rise a measurement location with stable and uniform flow conditions and free of swirl is required. On a typically forced draft fan installation such a location simply does not exist. Flow conditions at the outlet of a typical low pressure axial cooling fan are non-uniform and turbulent and contain a substantial amount of swirl.

It is the view of HNL that it does not make sense to effectively discard the highly accurate and reliable fan performance data from fan performance test based on ISO-5801 in favour of full scale on-site testing.

HNL standpoint
It is the view of HNL that if “non final assembly” were to be removed from the regulation provisions should be made for fan applications were full scale fan testing is impractical. HNL believes that for such cases a calculation method similar to the current “not final assembly” should allow for calculation of the fan efficiency based on the specifications as supplied by the manufacturer of the parts used to assemble the fan such as the impeller, motor and transmission etc. For the impeller this would mean that the impeller supplier should provide the impeller performance as determined conform ISO 5801.