

BULLETIN No. 105

DO NOT USE BRACES FOR HIGH-SPEED OR HIGH-VIBRATION APPLICATIONS

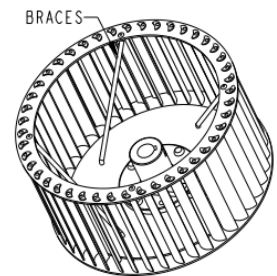
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Braces are not recommended for high-speed or high-vibration applications due to their susceptibility to vibration fatigue and increased stress concentrations on larger and/or faster impellers. New products at Jan-Air will be specified without braces unless specifically requested otherwise. Customers currently using braced products can continue to use the same products, or they can choose to use an unbraced product rated to an equivalent speed.

BACKGROUND

Braces have been used at Jan-Air for many years on steel and stainless steel forward-curved impellers. They were published in the original catalog as an improvement to prevent the work hardening of blades and eventual blade breakage when the impeller is subjected to rapid accelerations. At this time, the blades were designed in a weaker manner than the current product (see [Bulletin 101](#)), and the original braces were done as non-welded, eye-lit, rivet-on bracing. Jan-Air's standard bracing later switched to being bent and welded, but they were most commonly used for high-speed applications throughout this time. Using new technologies and destructive testing, Jan-Air has recently found bracing to be problematic for large, high-speed impellers as well as high-vibration applications.

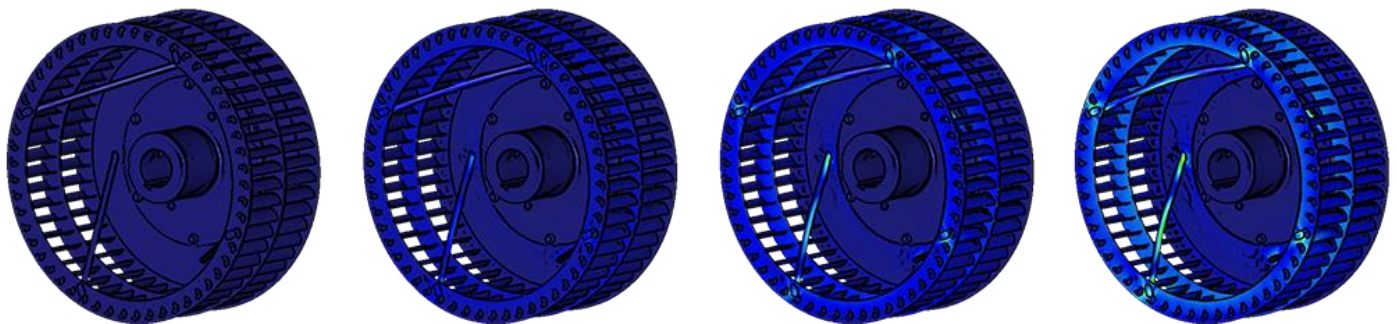


NEW FINDINGS USING DESTRUCTIVE TESTING – BRACES ARE NOT USEFUL FOR HIGH SPEEDS!

In 2012, Jan-Air invested in several rounds of destructive testing to help understand the usefulness of certain design features. One segment of the destructive testing compared braced items to non-braced items on a set of mild steel impellers from Jan-Air's F-Series. The unbraced item lasted to a higher ultimate speed than the braced item by about 100 RPM. Bracing helps to create a more rigid impeller, but they do not allow an item to run to a faster speed. Speed ratings for other larger diameter impellers will be much more limited by the brace feature.

POSSIBLE PROBLEMS WITH BRACES

At high speeds and with larger impellers, the brace is subject to a large outward centrifugal force which creates high-stress concentrations in the bend location of the brace. This bend location is also subject to surface irregularities from die forming, and together these create a higher likelihood for fatigue in these locations. Under normal circumstances, the brace does not fail, but increased vibration (usually from misuse or another external source) can cause this location on the brace to fatigue fracture. Using a larger diameter brace can help decrease brace breakage but it increases the centrifugal force acting on the brace which can shift the failure point to the front ring instead.



ALTERNATE REINFORCEMENTS FOR FATIGUE RESISTANCE AND HIGH SPEEDS

Customers currently using F-Series products with braces successfully can continue to do so. Customers currently seeing brace fatigue failures (most commonly from misuse) should switch to an alternative product reinforcement feature. Options such as peripheral rings, welded blades, brazed joints, or the use of high-strength materials are far more effective in reducing stresses in high-speed parts as compared to using bracing which can elevate stress concentrations in susceptible areas of the brace itself or the front ring. The improved single blade design also helps to create a more rigid impeller without the use of braces. In cases of structural doubt, finite element analysis can be used to ensure that a product is designed to meet the necessary speed rating without the use of braces.

AN IMPROVED BRACE DESIGN WHEN NEEDED

Jan-Air has developed an improved brace design for use in instances when bracing is requested but the normal bent-style bracing or front ring would be subjected to fatigue-level stressing. The improved brace is straight ¼" diameter fatigue-proof high-strength steel. It has no bends, and is welded on the outsides only to prevent any possible undercut from welding. This brace design is also commonly paired with a high-strength front ring. These features are to be used for extreme applications, whereas normal applications can use the other reinforcement features offered.

SMALL IMPELLERS WITH BRACES

Jan-Air's original catalog published braces in sizes 8-3/8" and greater, and bracing was not justified for the cost vs. benefit in smaller sizes. Smaller impellers are naturally more rigid and do not benefit significantly from the bracing feature. Alternatively when bracing is used on smaller impellers, the brace is shorter and the centrifugal force is relatively smaller. This combination results in a brace that is not at a high risk of fatigue. Jan-Air still does not recommend using bracing on smaller impellers since they do not offer a significant improvement in speed or rigidity. Also, the improved brace design is not available in smaller impellers due to interference issues with nearby blades.

BRACING IS NOT A DESIGN FLAW

Jan-Air has used destructive testing and finite element analysis to safely specify bracing for certain conditions or customers. Impellers using braces with stresses under the material's fatigue design strength will continue to be used in their current design. Instances of brace failure will be reviewed for misuse or excessive external vibration, and customers that experience issues from misuse have the option of removing the braces with the resulting impeller design having a better overall resilience to possible application-based abuse that sometimes cannot be avoided.

Also, fast/large/braced impellers that were deemed problematic have already been switched over to the improved design and destructive tested to ensure safe brace use. Failures specifically on the improved brace design will be deemed from misuse based on the third-party destructive data obtained. If a braced or unbraced impeller is failing due to misuse or excessive vibration, Jan-Air will work to address the misuse or offer alternate design improvements based on the failure mechanism observed.

QUESTIONS ON A CERTAIN PRODUCT (NEW OR LEGACY)

This bulletin is meant to be informative. It does not require customers to make any changes to products they currently use. Recommendations for legacy parts can be discussed on an application-specific basis, and as such, many customers are already using no braces or improved braces if needed. If you have experienced brace fatigue, please reach out to us for discussion on part improvements. For new product requests, Jan-Air will select features appropriate for your desired speed and application. Please reach out to sales or engineering for more information.