ARIEL SUPASET™ RIVETS For AIR DRUM BRAKES

A totally new approach to rivet design has solved the problems of fastening modern friction lining materials to brake shoes.

The problems are due to the fact that modern linings, although not as tolerant to abuse as the old asbestos linings, are subjected to far more severe operating conditions due to increased vehicle speeds and extensive use of ABS.

Supaset™ Full-Roll Technology provides;

- **a roll set wherein the spring back is in the direction which holds the lining tightly against the shoe.**
- **a roll set without shank swell thereby eliminating the problem of cracked linings.**
- **a roll set which provides residual clamping forces at least double those generated by conventional rivets.**
- **a roll set which retains residual clamping forces at high brake temperatures preventing brake squeal.**
- **a roll set which is crack free thus eliminating sideways rivet collapse during the setting process.**

In the commercial vehicle brake- lining industry there is a growing consensus that attention must now be concentrated on the means by which the linings are secured to the brake shoes because most performance failures can be traced directly to shortcomings in the assembly process.

It is already becoming clear that the critical requirement is that the lining must be pulled down onto the shoe so firmly that it never moves. In other words, all the shear load on the lining during the operation of the brakes has to be carried by the frictional grip between the lining and the shoe. It follows from this that the principal function of the rivet is to apply clamping forces to hold the lining firmly against the shoe, and hence that rivet hole-fill is no longer necessary nor desirable.

Modern linings work well if they are correctly fastened to the shoes, but they are not as tolerant to abuse as the old asbestos linings were. For instance, if in operation the lining moves on the shoe until it is restrained by side pressure from the rivets, the force on the sides of the holes can, with the new materials, quickly lead to lining failure.

Even if the restraining force is shared equally by all the rivets, the areas of contact with the linings will be small and hence the localised forces will be high. In practice the restraining
force is not shared equally, and consequently the limited number of rivets which carry the load exert high localised forces on the lining.

Lining movement is by no means the only problem. Even if the lining is tightly secured to the shoe, high localised forces can be generated in a number of other ways:

1. if the pitch of the holes in the lining and the pitch of the holes in the shoe do not match accurately the rivets will press hard against one side of the holes in the lining;

2. if there is rivet shank swell when the rivet is set the swelling can exert dangerously high forces on the walls of the holes in the linings;

3. if the rivet splits when being roll-set the split may cause the rivet to collapse sideways causing even more dangerous forces on the walls of the holes in the lining.

If any of these problems occur when there is complete hole-fill the resultant cumulative pre-load on the lining may be such that it will fail in service when subjected to the normal operational shear stresses. To the extent that it contributes to these problems, hole-fill can be positively dangerous, and consequently there is now a move towards the use of a rivet which fits freely in the hole through the lining and yet can clamp the lining to the shoe so firmly that it never moves.

During the rivet setting operation using standard brake-lining rivets, about one-quarter of the setting force is carried by the rivet and three-quarters is carried by the lining. The worrying feature is that for every 1% variability in the setting force there is a 2% variability in the force transmitted to the lining. Because of this, relatively small changes in the setting force can cause the lining either to fail from excess pressure or to fail because it is insecurely fastened.

To solve these problems, Ariel Fasteners has developed it's range of Supaset™ brake-lining spring rivets. These are produced using Ariel's advanced technology which combines sufficient hardness to avoid excessive shank swell with sufficient ductility to allow a full-roll set without splitting.

Conventional brake-lining rivets suffer from shank swell which often leads to lining cracking and are restricted to a half-roll set, as shown in **Image 1**. When the setting force is removed, the spring-back of the roll is in a direction which reduces residual clamping force. With an Ariel Supaset™ full-roll rivet, as shown in **Image 2**, there is no shank swell and the spring-back of the roll ensures a high level of residual clamping force.

Image 1

Standard commercial Rivet

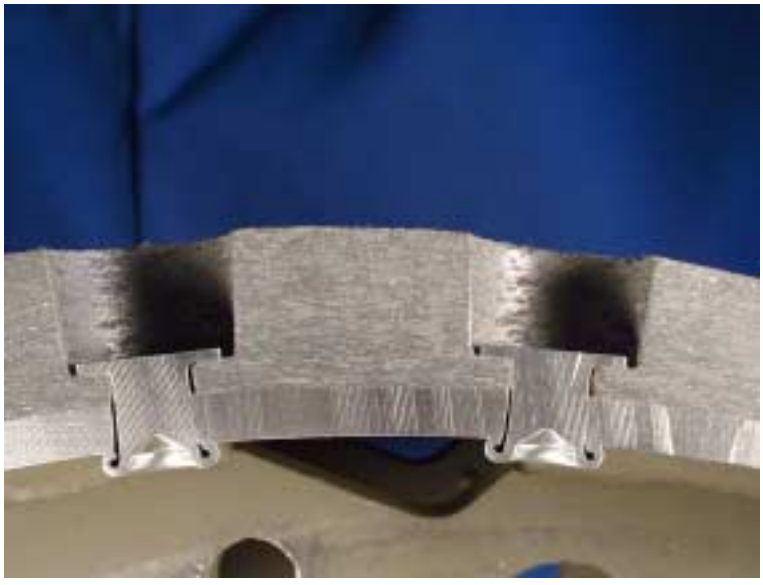
The rivet performs a half roll with shank expansion resulting in;

Rivet head not seating correctly

with

excessive tensile forces on the lining

Image 2



Ariel Supaset™ Full-Roll riveting

Rivet is a free fit in lining and saddle

Rivet head is firmly in contact with lining

Rivet has performed a Full-Roll, generating substantial residual clamping forces

Ariel Supaset™ rivets meet all the requirements of the brake-lining industry in that:

1. they can generate residual clamping forces which are at least double those generated by conventional rivets and hence can ensure that the lining is pulled down so firmly that it never moves;

2. they can achieve these increased clamping forces without increasing the peak compression load on the lining during the rivet setting operation;

3. they can achieve a full roll without rivet shank swell and hence do not expose the lining to side pressure during the riveting operation and permit easy de-riveting without damage to the holes in the brake shoe;

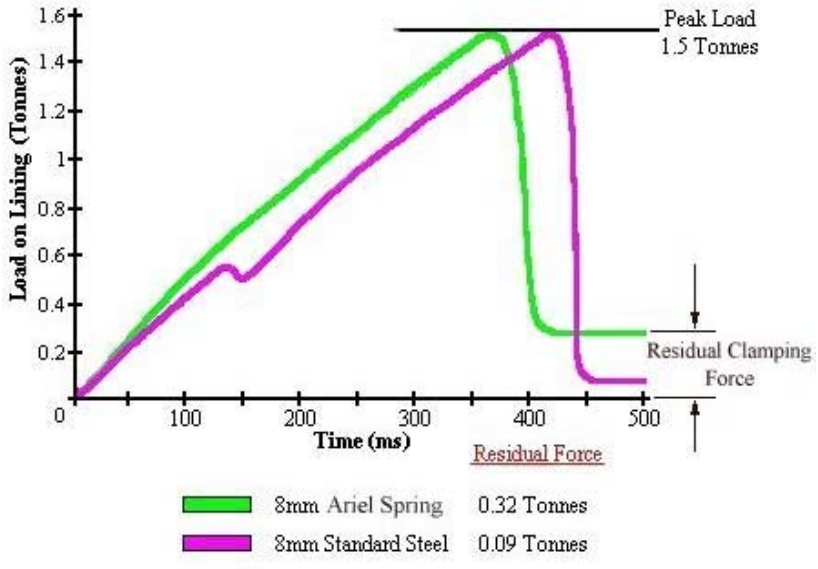
4. they can produce a crack-free roll thereby eliminating the danger of sideways collapse of the rivet during the setting operation;

5. they have an extremely wide grip range thereby:

- eliminating the need for machining operations where the thickness of the shoes and linings vary;
    - eliminating the need for more than one rivet length in any brake shoe;
- making it possible for only three lengths to cover the whole range of brake shoe requirements.

The following graph shows the compressive force to which the lining is exposed when being fastened with 8mm shank diameter steel brake-lining rivets.

As can be seen, ARIEL Supaset™ rivets can provide significantly greater residual clamping force without exposing the lining to any increase in peak compressive load.



Shown below are sections of some typical failings experienced when using conventional brake lining rivets.

Rivet Head Not Seated caused by the rivet starting to roll and swell before the head is seated on the lining.

No Roll-set Clench caused by tube collapsing against the shoe and lining.

Rivet Collapse with **No Roll-set Clench** is caused by the rivet starting to roll and swell prior to the head being seated.