Production News

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the year. Why not do it now? The information is printed on the newsletter's last page.

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A Report from MATCO Mfg.

George Happ (MATCO) recently wrote to let us in on the findings of a recent braking problem experienced by a Velocity owner. The information was enlightening – and we thought it might be of interest to everyone. What follows is a cover letter from George Happ along with a copy of the report.

[Letter from MATCO]:

Here is the inspection report that we discussed for the D6 disc from (Customer's name) Velocity. This is the first solid evidence I have seen of a brake that has exceeded the energy capacity of the disc. We have seen some evidence of lining overheating but it is not a easy to establish the temperatures that have been seen. With this disc, since it was fairly new, the blistering of the zinc plating gives a good indication of the temperature seen in operation.

The W600 or W600XT use the D6 disc and have an energy rating of 337932 ft-lb as determined by the mass of the disc. The brake serves as an energy conversion device, converting the kinetic energy of the aircraft to heat energy in the disc. With the kinetic energy (KE) of the aircraft being a function of the square of the velocity, additional speed at brakes on can have a significant impact on KE and therefore brake temperatures. For example, and aircraft weighing 2800 lbs with a brakes on speed of 73 knots would have a KE of 659141 ft-lb requiring 329570 ft-lb capacity per brake. If the same aircraft uses brakes with a speed of only 5 knots higher, the aircraft KE jumps to 752526 ft-lb and the per brake requirement of 376263 ft-lb would exceed the energy capacity of the D6 disc. It is important to note that the energy capacity assumes an initial disc temperature below 80 degrees. If the starting energy state of the disc (initial temperature) was high to begin with, the brake over temperature at the end of the high energy stop would only increase.

I hope this information is of use to your customers. Discs found to have similar conditions as found on the inspected disc in the report should be cleaned and linings inspected for cracking.
[End of Letter]

INSPECTION REPORT
George R. Happ
Date: 8/28/02
Part Number: WHLD6 Brake Disc
Reference: RMA 02-082
Aircraft: Velocity

BACKGROUND
Customer reported brake vibration and mechanic attributed it to 'hot spots' on the discs. Reported that discs had defect on both sides of disc at same radial and circumferential locations with raised spots. Theory was that there were hard spots in material that wore different and caused bumps. When wheel was turned slowly, the wheel would drag in at locations with bumps. Belief was that bumps caused drag that in turn caused brake vibration. New discs were sent and installed on aircraft with apparent relief of vibration. Disc from the aircraft were returned to MATCO mfg for inspection.

INSPECTION
Both D6 discs received had surface blemishes as described by the customer. The blemishes varied in diameter from .35 to .5 inch elliptical shape. The discs were very new with most surface grind markings still visible on the friction surface. The material blemishes had a very dark color and had heights of approximately .002-.005 inches. Blemishes were apparent on both sides of the disc in the same location as described by the customer.

The outer edge of the disc in a 40-degree arc was discolored with mild blistering of the plating. The arc section of the discoloration band encom-

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Calendar of Events

October 4-6 EAA Southern Regional Fly-In in Evergreen, Alabama. Nathan Rigaud will be there with a Velocity XL-RG

October 10-13 Copperstate EAA Fly-In. The SUV aircraft will be at Copperstate, complete with a new instrument panel featuring the Blue Mountain Avionics EFIS-One Package.

October 11-13 Branson, Missouri Velocity Fly-In. Sounds like great fun! Duane and Bonnie Swing will be at Branson.

October 24-26 AOPA Expo 2002 in Palm Springs, California. Scott Baker will be at AOPA this year. Chris Martin's XL-RG will be on static display; and the SUV will be available for demo rides.

November 2 Velocity Open House at Sebastian, Florida passed the blemished area of the friction surface.

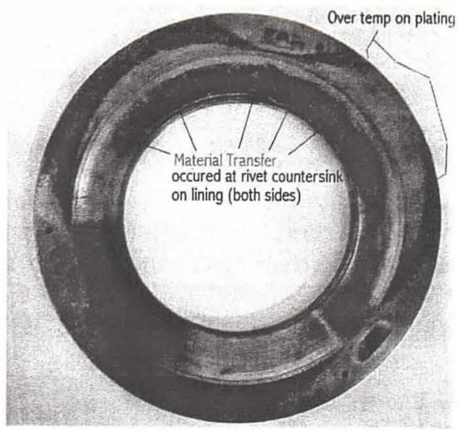
The blemishes did not appear to be disc material. An attempt was made to remove the blemishes and proved quite easy with a sharp edged knife. The blemish material was brittle and tended to come off in flakes. There was very slight deformation of the disc material under the blemishes that were visible but not measurable in height.

CONCLUSION

The brake disc had been severely over heated. Temperature estimates required to blister the plating are 650-700 F. The blemishes on the disc were wear material that had bonded to the disc. The wear material collects in the rivet holes during operation. The severe overheating of the brake caused the wear material trapped there to bond to the disc when the aircraft was parked. The linings on both sides of the disc exhibited these phenomena and caused the blemish pattern to be the same on both sides of the disc. After the aircraft cooled and was later moved, the wear material 'buttons' that had fused to the disc were snapped off. With the linings in a conditioned state, the fused material was not scraped off on subsequent passes with the lining but instead formed a hard barrier that caused the lining to 'skate' over the deposits. Additional wear debris was infused into the blemishes making them appear very smooth edged. The blistering of the disc edge occurred in the arc segment where the caliper stopped on the disc. This would be the hottest portion of the disc. A more severe overheat would cause blistering around the entire surface.

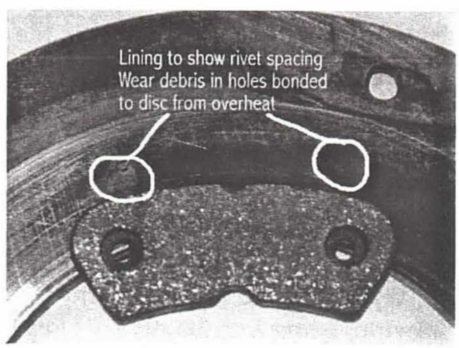
The following photo shows one of the discs with the material transfer areas highlighted. Both sides of the disc exhibited transfer in the same areas. The blistered area of the plating on the disc OD is also highlighted.

The next photo (below) shows the material transfer areas with a lin-



ing to clarify the spacing. In operation, the counter sunk area of the lining that is visible in the photo would be against the disc surface and serves as the collecting point for the debris.

The ramifications of this over heat condition are several. First, the linings can be overstressed at the rivet holes as the bonded material is sheared off on the initial rotation after the material transfer occurs. If the material transfer is evidenced on



the disc, the linings should be inspected for cracking at the rivet holes. It has been reported by other brake manufacturers that in severe conditions, entire sections of the lining surface can be transferred from a severe overheat requiring immediate lining replacement.

Second, the material deposits on the surface of the disc may cause some torque oscillation from the brake. The impact to the gear stability will vary with aircraft but a torsionally sensitive gear may suffer some loss of stability for the oscillation. The deposits can be easily removed with a metal edge and should be so removed if found. Both sides of the disc should be cleaned. Care should be taken so as not to gouge the surface of the disc.

Third, the loss of corrosion protection from the overheat may be a problem depending on the operating environment of the aircraft. Replating may be considered for some operators.

Care must be taken in the selection and operation of the brake on the aircraft. The energy limits are determined by the mass of the disc. The D6 has an energy rating of 337000 ft-lbs. This rating assumes a start temperature below 80 degrees. The energy state of the brake (starting temperature) affects the energy level of the brake at the end of the stop. It is important to bear in mind that the kinetic energy of the aircraft, which the brake will be required to convert to heat energy, is a function of the square of the velocity. Increases in landing speed by several knots on a configuration that is near the energy limit at a predefined speed can quickly lead to an over temperature situation. The same is true with repeated landings without sufficient cooling in between. Long taxi with residual engine thrust also adds energy to the brake and may be a consideration if the brake operation limits are close the landing energy alone.

[End of Report]

In other words – the starting temperature of the brake discs and the landing speed greatly affect how well the brakes are going to perform. Conserve braking action during taxiing – manage taxi speed with power (not brakes). Hot brakes will not make a lot of difference when beginning a flight – but they might if you need to apply brakes during an aborted takeoff. Manage approach speeds so that the aircraft touches down somewhere around 75 knots. If you are having trouble slowing the aircraft to 85 knots on final – consult with Velocity to find out why. It might be pilot technique or it might be the aircraft. If the runway is long enough, allow rollout speed to dissipate somewhat before applying brakes.

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