

## A Tricky PA System Fault: Luck Helps

An element of luck can sometimes help when it comes to tracking down problems, although you still need to have your wits about you. Here's how. A. H. of Evatt, ACT fixed a puzzling and elusive fault in a PA system . . .

One of the larger variety stores in our region recently encountered problems with a PA amplifier that was intermittently blowing 20A DC fuses. The amplifier in question was a TOA 240W 100V line series, which is known to be a very reliable model.

In this case, we were asked to investigate the problem as the local service agent had been unable to isolate the cause, despite many service calls over a period of months. At the time, our company was engaged full-time on the installation of studio broadcast equipment for a national broadcaster, so arrangements were made to visit the store after hours to investigate the problem. This after-hours arrangement ultimately proved to be quite fortuitous.

When we arrived, the amplifier was found to be dead with blown DC fuses. A new set of fuses was installed and the system sprang into life, with all microphones working correctly, the background music working and other auxiliary inputs working. Furthermore, the heatsinks on the back of the amplifier only became mildly warm (as expected), so the amplifier was not operating under undue stress.

The amplifier was then left running with no apparent problems. During this time, we took a closer look at the blown fuses and others that had failed earlier. They all

showed signs of heat stress, with a sagging fuse element rather than an element that had literally vaporised. This indicated a gradual failure rather than an instant failure.

This in turn suggested that the load on the amplifier had increased for some reason, causing increased power dissipation and an increase in current which led to gradual fuse failure. So my next step was to investigate the actual speaker load on the amplifier. As a result, the amplifier was turned off and the feed to the speaker lines was measured with an impedance meter.

This was found to be around 40 $\Omega$  which was well within the load limit of the amplifier. However, I did notice that the figure-8 speaker line was only 14/020 gauge cable, which was really too small for an amplifier of this power. This cable emerged from a conduit in the floor under the service desk.

The service desk was not far from the front wall of the store, which indicated that the conduit had probably been run from the floor up the inside wall and into the ceiling space. After further investigation, this proved to be the case. The feed cable was soon located running to the nearest speaker, where it joined with several other speaker lines. These ceiling lines used 23/020 cable, a size more appropriate for the amplifier.

While we were in the ceiling space, we checked each of the other lines and found that the total impedance added up to the previously measured 40 $\Omega$  or so. We then checked the feed line from the am-

plifier before reconnecting it and to our amazement, found that this now had an impedance of just a few ohms; way too low for the amplifier. Checking the feed at the amplifier end revealed the same very low impedance.

So the feed line was now effectively shorted but why; what had suddenly changed?

It was then noted that a bi-fold door that was previously open was now fully closed and the locking pins pushed into the floor. Could that be the source of the problem? It certainly was – lifting one of the locking pins immediately cleared the fault, while pushing the pin down again caused the short to reappear.

It's interesting to note that the store had been in operation for over 10 years and the PA system had previously worked without problems. However, it would appear that over this 10-year period, the bi-fold door and its locking pins had eventually caused the cable fault.

An attempt was made to replace the cable but it wouldn't move. As a result, a temporary cable was dropped from the roof space to the amplifier to keep the system operational until we could return to do a permanent repair.

I must admit that we were lucky to be in the right place at the right time for this job. However, looking at the clues (ie, how the fuses had failed), having the appropriate test equipment and understanding the significance of the impedance readings also helped diagnose the cause of the fault.