

## Crossed Wires in Maintenance Procedures

“Crossed wires” or “crossed signals” are colloquialisms often used to indicate confusion or misunderstanding in everyday conversation. When it comes to aircraft maintenance, however, crossed wires or other crossed connections may refer to actual errors in the placement of components or wiring. The following ASRS reports from Maintenance Technicians deal with aircraft components that have been improperly installed, leading to unexpected and unwanted results.

### Backwards Brakes: Crossed Hydraulic Lines

Two Maintenance Technicians reported on their involvement in a BE-400 brake procedure that resulted in a gate return for the aircraft. The Flight Crew discovered that the left pedal controlled the right brake and the right pedal controlled the left brake.

#### Technician #1

■ *I was assigned the Anti-Skid Control Valve Union Filter Cleaning Task Card on a BE-400 aircraft. I performed the task in accordance with the Maintenance Manual. When I was reinstalling the lines, I mixed up the aft hydraulic pressure lines to the valve. The lines were not hard to install this way and the installation seemed right to me. I had my Lead Mechanic buy-back (verify) the work. We ended up job-stopping the task, with the Brake Bleeding and Anti-Skid Control Checks still needing to be accomplished.*

*The lines got mixed up even though they were tagged. I could have taken a picture of the valve before I started the task. This would probably have prevented the lines from being installed wrong because I would have referenced the Maintenance Manual and the picture. The Anti-Skid Brake System Check in the Manual says to push both brakes at the same time during the check. A revision to the Manual that would require each brake to be checked individually and verify proper operation probably would have caught the problem in maintenance. The repair station could also adopt a policy of requiring a run/taxi after brake maintenance procedures.*

#### Technician #2

■ *It was reported to me that a BE-400 aircraft had an issue with the brakes.... The right pedal controlled the left brake*

*and the left pedal controlled the right brake. I was also told that the power brake anti-skid control valve lines had been installed to the wrong fittings during the power brake anti-skid control valve filter change.*

*I was involved in doing the [brake] bleeding procedure and anti-skid system test. Prior to us starting the procedures, all the equipment was already set up for us and all the steps seemed to have been performed as stated in the manual. It would not have even occurred to me that the brake system could operate backwards....*

*The hydraulic lines and valve connections should be permanently marked to ease the proper installation process.*

### Hot Brakes: Confused Color Codes

An A-320 Maintenance Technician reported mistaking a Yellow system hydraulic line hose coupling for a Green system hydraulic coupling resulting in an improper MEL deferral.

■ *Following troubleshooting procedures to determine the cause of a brake overheat, I determined that the anti-skid system was possibly not managing the brakes which was causing an overheat and not just a temperature reporting error. Maintenance Control agreed with my explanation allowing the deactivation MEL and subsequent procedure.*

*After retrieving the exact Maintenance Manual reference for deactivation, I entered it into [the computer] which displayed several subtasks. One of these was a specific procedure for deactivating only the Green, normal side. I chose this based on the previous Troubleshooting Manual task for complying with the Normal Brake System Tachometer Functional Test. The Troubleshooting Manual was referencing only the Green normal system with a possible fault. I misidentified the Green system and the Yellow system. Since the brake was still active, the high temperature condition reoccurred upon landing. I was working on the Normal braking system so I decided to only deactivate that side, but confused the yellow and green hydraulic hose couplings....*

*The MEL reference for the deactivation procedure should be updated to read the exact subtask that will link directly to deactivating the entire brake. Currently, when this task is entered, several other deactivation choices appear.*

## Faulty Fire Extinguisher: Crossed Wires

In this ERJ-170 Maintenance Technician's report, crossed wires didn't actually cause the problem, but they certainly contributed to it. The ability to cross two electrical connections in order to attach them to the corresponding engine fire bottle cartridges disguised the fact that the cartridges were actually installed backwards.

■ While performing the Fire Bottle Job Card, referencing the Aircraft Maintenance Manual, it was discovered that the fire bottle cartridges were installed in the incorrect locations allowing the left engine fire extinguishing agent to be discharged to the right engine and the right engine fire extinguishing agent to be discharged to the left engine in the event of an engine fire. This bottle had been installed on the aircraft [in this configuration] for several years. To compound the issue, the wiring on the aircraft has sufficient slack to allow the [electrical] connectors to also be installed incorrectly [to their matching cartridges] and the Maintenance Manual Task to replace the bottles and cartridges is not clear enough to prevent incorrect assembly.

The aircraft is assembled in a manner in which cross-connection of the electrical connectors for both the "A" and "B" engine fire bottles is possible. In a worst case scenario, if both bottles are affected, neither engine would have fire protection....

There is no labeling on fire bottles "A" or "B" identifying the left or right engine squib cartridge positions. The bottles are identical, interchangeable, have the same part numbers, and come new from the manufacturer or overhaul vendor with the squib cartridges and discharge nozzles already installed. Two discharge nozzle outlets are screwed into each fire bottle, they use a common thread, are interchangeable, and they can be installed on either fire bottle. There are two different part numbers. Two nozzles have coarse threads and the other two nozzles have fine threads that will only accept a specific squib with similar threads. There are also two different part numbers for the four squibs; two with coarse threads and two with fine threads. The electrical connectors are also keyed to a similar squib.

The wiring harnesses should be shortened, or zip-tied to prevent an electrical connector meant for bottle "A" from reaching bottle "B." The wire harnesses are routed to the fire bottles from different directions. The maintenance procedure should also be rewritten to emphasize the correct installation of the connectors.

The aircraft involved had gone through at least one C-Check without the discrepancies being noticed.

## Hydraulic System Blues: Crossed Pressure Lines

While troubleshooting the cause of two previous replacements of an A-319's hydraulic system reservoir pressurization manifold, a Maintenance Technician found that "criss-crossed" pneumatic pressure lines were preventing pressurization of the Blue hydraulic system.

■ After discovering that we were going to install [an A-319's] hydraulic reservoir pressure manifold for the third time, I decided to figure out why the...manifolds were not pressurizing the Blue hydraulic reservoir to 50 PSI. After a few hours of troubleshooting the problem, I found that the left engine [pneumatic] supply line in the left wheel well...was connected to a "tee" [fitting] in the line that supplies all three hydraulic reservoirs thereby bypassing the [pressurization] manifold completely and probably over-pressurizing the reservoirs. The Blue system pneumatic supply line (going to the hydraulic reservoir) was connected to a "union" [fitting], which is the manifold supply connection from the left engine thereby never supplying pneumatic pressure to the Blue reservoir. So the lines were criss-crossed. Both "B" nuts will fit on either connection and there is plenty of room for the lines to cross and not chafe on anything. It appeared that neither line had been replaced....

When an Airbus comes into the hangar, a low-pressure check of each Green, Yellow and Blue hydraulic reservoir's head pressure is performed using ground service air. Although the Blue reservoir's head pressure was above the 22 PSI that sets off warnings in the cockpit, it was not possible to increase the head pressure by applying service air to see if the reservoir pressurization manifold was functioning. When the Blue head pressure did not respond, the thought was that the manifold was again at fault.

The aircraft had been flying for some time with the lines crossed, but since the Blue hydraulic reservoir head pressure never went below 22 PSI, no discrepancies were noted. Maintenance history showed the aircraft did have hydraulic issues with the Green and Yellow systems oozing hydraulic fluid, but those discrepancies were probably caused by high reservoir head pressures from the crossed pneumatic supply lines.

ASRS Alerts Issued in May 2013	
Subject of Alert	No. of Alerts
Aircraft or Aircraft Equipment	8
Airport Facility or Procedure	10
ATC Equipment or Procedure	5
<b>TOTAL</b>	<b>23</b>

402  
A Monthly Safety Bulletin from  
**The NASA  
Aviation Safety  
Reporting System**  
P.O. Box 189  
Moffett Field, CA  
94035-0189  
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May 2013 Report Intake	
Air Carrier/Air Taxi Pilots	4,063
General Aviation Pilots	1,115
Air Traffic Controllers	661
Cabin	358
Dispatcher	292
Mechanics	150
Military/Other	86
<b>TOTAL</b>	<b>6,725</b>