Europa Tri-gear Brake Bleeding Procedure

This covers both the Jamar, and the Matco style brake master cylinders bleeding procedure. Every Europa kit comes with Matco main gear calipers and other types will not be discussed. Normally the Jamar or Matco brakes, when properly bled from the bottom up using DOT 5 or Mil 5606, are very stiff and barely can be moved 1/2 inch before very firm braking is achieved, that is, lock up. A light force of 5-10 pounds of pull barely moves the handle and makes for easy steering. Braking is excellent when using 9-10 inch long handles. Handles must be installed to allow full forward movement of the piston, and at least 90 percent of the aft movement of the master piston. Many problems occur in the construction of the handles which prevent the piston from moving all the way forward. If the piston cannot move full forward, the brake system will not work properly. Any movement of the brake handle beyond one inch during normal operation indicates air in the system. However, keep in mind, a poorly installed wheel pant(s) bracket assembly or pant itself, can push against the caliper acting as a spring which gives a spongy brake feel due to the caliper being pushed by the wheel pant or its brackets. Typically one can verify this by looking at the brake during operation on the ground and detecting movement of the pant or its supports, then remove the binding or contact and checking brake operation without the pant restriction.

First Checks, Installation:
Check the brake lines are on a continuous climb to the master cylinder. Loops or high spots can trap air. Make sure the master cylinders can be removed and rotated side to side and pivoted up and down. This applies to all types of master cylinders. It is rare to find master cylinders that can be bled as installed and firmly bolted when bleeding. Moving the air bubbles out of the master cylinder (like in the cups) is easily achieved by rocking the cylinder up and down and rolling side to side. The Jamar Brake is more difficult to bleed as the bleed hole for the reservoir is in the side of the cylinder making rocking the brake master side to side absolutely necessary.

During the bleeding from the bottom up, the caliper bleed port should be installed on the bottom to allow air in the caliper to be pushed up the line and out of the caliper into the lines.

Bleed Procedure:
Do not attempt to bleed the brakes as you would a pre 1990 auto from the top down. The thinner fluids used today (such as Dot 5) do not push the bubbles down and out.
Purchase from Walmart, or similar store, a syringe for filling/mixing two stroke oils and brake fluids. Do not use an oil can or similar type pump which induces air in the compression cycle. If you use an automotive pressure bleed system, keep the pressure low as the pumping action will induce air into the fluid and then the air will come out of the fluid when depressurized, spoiling your bleeding procedure.

Attach a hose to the caliper bleed screw. Ensure it is a tight non leaking fitting of the hose to the nipple. I use ¼ polyurethane tubing with a 1/8 inch ID. It is flexible and fits easily on to the nipple. If your syringe has a large exit, you will need to install a transition fitting to fit a proper hose to fit the syringe and provide a tight fit to the polyurethane tubing. Affix a ¼ inch wrench to the nipple then put on the polyurethane hose seems to work best. Dry run the opening, and closing of the bleed fitting with your assistant prior to filling with fluid and bleeding. One person will push the fluid up from the caliper and the other will hold the cylinder so the reservoir line is uppermost and drain the fluid out of the reservoir.

Jamar:
Unbolt the master cylinder. Set it on its side with the cylinder being bled on the low side.
Loosen the bleed valve on the caliper a 1/4 turn and push fluid from the syringe filled with DOT 5 brake fluid or Mil Spec 5606 up through the system at a smooth rate.
Once near the end of the syringe, tighten the bleed valve and stop the pressure.
Pull the syringe off and refill the syringe being careful not to induce bubbles into the feed line.
Holding it vertical assemble the syringe to the hose keeping the assembly vertical (hose side down).
This allows any air in the hose to rise to the syringe and fill the hose and lower syringe with fluid.
Continue filling. Have an assistant observe the reservoir. He will have to empty it a couple times.

Once the brake line is full to the master cylinder, have the assistant turn the master on its side. Continue to pressure fill and rock the master fore and aft or tilted up and down, left and right to eliminate the bubbles in the master. Be sure to note that the master must be turned on its side with the reservoir cylinder in the center, higher than the brake cylinder. There is a 1/16 inch hole drilled across the unit that is the refill hole from the reservoir to the master. This is where the air bubbles come out of the pressure side to the reservoir side allowing good fast bleeding... When the handle is very firm and has a very short throw, the first cylinder is bled properly. Once filled and bled on the one side, pull the now completed sides handle slightly aft to not allow the reentry of air into the newly bled cylinder (Use light pressure is all). Then repeat on the other side. If working alone or in tight spaces, use safety wire to loop through the handle hole to the brake fitting to hold the handle aft firmly.

Repeat the process on the other side. When the other side is complete, make sure all the air is out of the reservoir center cylinder hole by observing the air bubbles coming out of the cylinder. I use semi-clear tube for the reservoir line as there is no pressure in this line and I can monitor my fluid bubbles.

Cut the safety wire off the first side and Ops check the brakes. Operational check of the brake is to pull on the handle, with full force and you should not be able to move the handle beyond 1/2 inch with a very hard pull. Normal taxi only requires a small force of less than 5 pounds to activate steering braking and barely move the nearly stationary handle. Bolt your master back in. Be sure to use Loctite or similar on the pivot bolts for the handles and the hold down bolts. You will flex your system a lot, so the assembly bolts must be secured properly.

Matco:
The kit includes two separate master cylinders so no cross flow is possible as in the Jamar.
The Matco cylinders are installed nearly horizontal and, in the Europa, slightly higher on the reservoir end. Push fluid up from the caliper to the top using the same procedure above. This allows fluid and bubbles to move upward and toward the reservoir fitting. However, it is best to still rock the master with the reservoir end lower than the butt end to clear air bubbles out of the very top of the cup and cylinder.

Unbolt the master cylinder front support.
Loosen the bleed valve on the caliper a 1/4 turn and push fluid from the syringe filled with DOT 5 brake fluid or Mil Spec 5606 up through the system at a smooth rate.
Once near the end of the syringe, tighten the bleed valve and stop the pressure.
Pull the syringe off and refill the syringe being careful not to induce bubbles into the feed line.
Holding it vertical assemble the syringe to the hose keeping the assembly vertical (hose side down).
This allows any air in the hose to rise to the syringe and fill the hose and lower syringe with fluid.
Continue filling. Have an assistant observe the reservoir. He will have to empty it a couple times.
Air bubbles should be completely removed if the cylinder is held vertical (fittings up) but may still need to be rocked a bit.
Repeat for the other side.

Total time to bleed the brakes is 20-25 minutes per side start to finish. We do it in the shop in less than an hour routinely unless there is a leak in the system or we have to rerun the brake lines or components due to an installation error.

Problems:
Parking brake installations in some cases put the valve assembly higher than the master cylinder. This will surely trap air during the bleed. If at all practical, install the parking brake assembly vertically with the wheel caliper exit line at the lowest point.

Looping lines coming from the master cylinders will trap air. In really poor installations a bleed port must be installed in the gear support area to release any air trapped there.

Some installers prefer using DOT approved or automotive flare type fittings.
These flare fittings work well but are prone to loosening over time and are leak prone. Matco has instructions on the best type fitting to use for long trouble free lifetime operation.

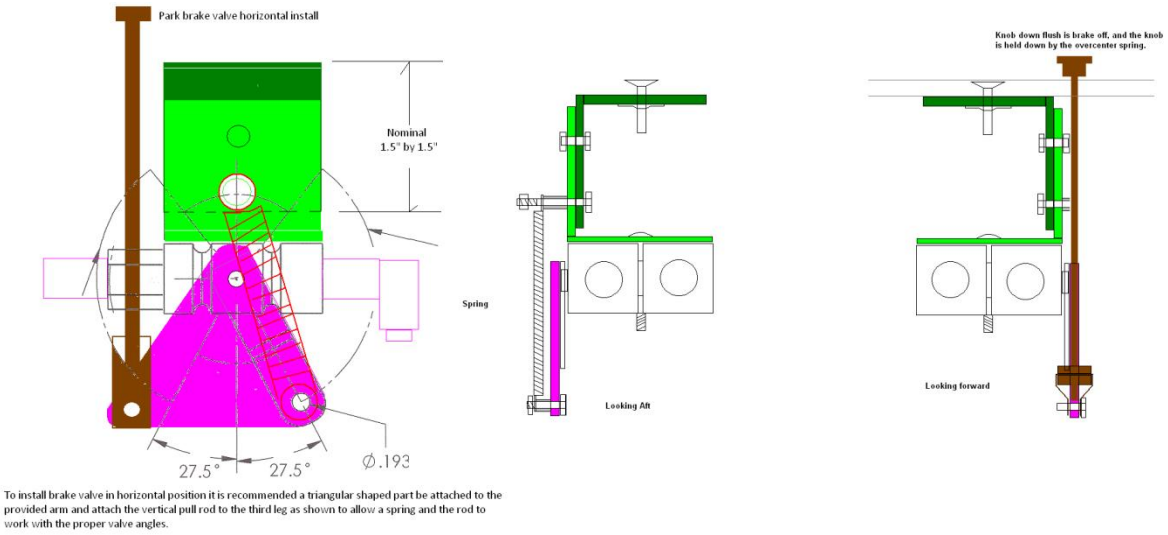
Matco Mfg. Parts: (see matcomfg.com for available parts and tech bulletins)
(Europa uses Matco Wheel and brake assembly: WHLW51L, W51L)
Components Normally Replaced or serviced :
Wheel bearings: WHLLM6700LA ROLLER BEARING; 1.25 $20
Brake pads:WHLBRL-1 BRAKE RELINE KIT $30
AXLE NUT; 1.25-16 (replaced by WHLAN1H) $15
Large washer on wheel: MSCTRA 1.25 washer Europa sells it as a Euro 14
Race: WHLLM67010 1.25 $8
BRASS ELBOW; 90 DEGR part MSC269P $3
(This fitting is 1/8 NPT to 1/4 inch OD tubing compression. To be used with MSCNNR4/035 Nylon II or similar tubing $1 per foot.)

Jamar Master Cylinder Parts:
US20R cylinder rebuild kit $30

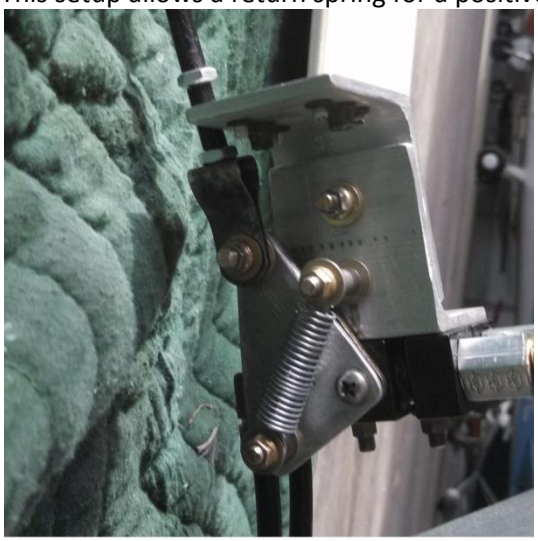
Bleeding Kit for owners to make/have in the hangar.

This is all that is needed to bleed the brakes other than cups, rags etc.
A can of fluid (remember, never use any other fluid than Dot 5 (not 3,4 or 5.1) or Mil 5606)
1/8 ID tube (I use clear)
¼ inch tube to transition from my syringe to the small tube
¼ inch wrench for the bleed valve.
A fuel /oil mixer available at any garden center or auto center such as Walmart.

Parking Brake push pull style to lower the park brake valve for easier maintenance and bleeding.



This setup allows a return spring for a positive on off.



Shown with a near horizontal installation. Again the valve is on an angle to allow fluid to flow from the outlet side (caliper side) to the master cylinder when installed.
Note that the triangle piece added to the park brake valve arm requires a bit of work to get the spacing and fasteners to work. This installation is very compact.

This is a vertical install to save space beneath the master cylinder and aid in bleeding. It also allows a direct hookup of the brake valve arm to the push pull arm without fabricating a triangle to allow an over center spring. The screws through the brake handles are attached to nut plates holding the unit in place.
Note the brake arms are relieved in the area around the fork on the end of the master cylinder to allow full forward extension of the piston and full compression of the piston.