Passivating with Citric Acid

1) Make sure everything is completely, completely clean. Any soil or film will prevent effective passivation.

2) Decide if you are going to recirculate your passivation solution or completely fill your vessels with the solution, but the key is to ensure that there are no dry spots. If there are dry spots when you recirculate, you need to fill the vessels to ensure complete contact of the solution.

3) With that decision, you now know how much solution to make, and the solution is 4% citric on a weight basis (so 10 gallons of water = 83.3# water; you add 3.3# of citric acid).

4) Heat the solution to 140 F and either soak or circulate. Do this for 30 - 60 minutes. You don't want to go longer because there's actually a drop off in effectiveness the longer you hold the solution.

5) Drain the solution completely and leave everything open to air dry. You are not done yet, though...

6) Let the air-dried surfaces remain exposed to the air, because you now need the oxygen in the air to oxidize the exposed chromium (see further explanation below). 8 hours should be sufficient, but there's no time limit.

Here's what's happening:

The reason why stainless steel resists corrosion is that you have a chromium oxide layer covering the surface of the metal. That layer can get worn or damaged (or welded) and that will expose the iron in the allow. The iron can be oxidized (rusted or corroded). To prevent that, you passivate. Passivation is the removal or dissolution of the exposed iron, leaving the chromium layer completely behind. The fresh chromium layer is a little fragile, though, and needs to oxidize to harden up (thus the contact with air). There is a chemical way to treat the stainless that eliminates that need for air oxidation (dichromate), but it's really toxic and is only used in metal working shops now. You will occasionally find passivating products based on a nitric/dichromate combination, but I would give those a wide berth.