Step by step pump calibration checklist for 20|20 Gen3

If the system is existing, worked well last season and has had no changes, then it is not necessary to perform this process. In that case, ONLY perform steps 1 and 6 below.
For new systems or systems that have not worked well in the past, follow the steps listed below. There are videos outlining this process available in the support resources at cloud.precisionplanting.com.

Step 1 – Flush the lines (both new installs and existing systems)

- Disconnect the supply lines from the vApplyHD modules
- Enter the vApplyHD manual test on the 20|20
- Set the "Duty Cycle Adjust" to manual and a PWM % that will run the pump smoothly
- Flush until clean, clear fluid is achieved on all rows
- Stop the pump and reattach the supply lines to the vApplyHD modules
- If row strainers are installed, verify the screens are clean

Step 2 – Set the pressure relief bypass valve

Explanation of this step – In this step you are setting the spring pressure on the bypass valve. This will result in setting the maximum system pressure that the system will have, assuming the plumbing for the return is sized so that it is not a significant restriction.

- Turn the bypass valve all of the way out
- Enter the vApplyHD manual test for this product
- Make sure the "Rate Adjust" is set to a rate of 0.00 gal/acre
- Change the "Duty Cycle Adjust" to manual and a PWM % that will run the pump at a reasonable speed to run smoothly and output flow. This needs to be a fairly fast speed but not excessive (hydraulics to the pump on and Master/Section switches must be up to run the pump). **NOTE: Centrifugal pumps** the procedure is a bit different. Run the pump up to the highest PWM % you may need (while making sure it does not build over 100psi).
- Adjust the bypass valve until the pump pressure reaches your desired setpoint – Make a note of the pressure that you set so you can refer to it later _____psi.
    - Electric pumps generally 20-30 psi
    - Most hydraulic pumps 50-60 psi is sufficient
    - **Centrifugal pumps only** – set the bypass to the maximum pressure that you want to ever have. You will have less pressure than this when running the pump at slower speeds so set this pressure HIGHER than you want system pressure to be when running
    - Very high volume systems may need 80 psi.
    - FurrowJet systems should be more than 30 psi as it is desired to have 30 psi at the orifice plate – so system pressure should be 40-50psi or more.
    - Always set below 100 psi. Above this pressure fittings may leak.
    - The setting for maximum pump pressure in the vApply rate control module settings should be at least 10-20 psi above the pressure you set at the bypass
- Check that the bypass is sized to handle the full volume of the pump output

- Increase “Duty Cycle Adjust” by 5-10% at a time and observe the pump pressure does not climb substantially (up to 10 psi higher is ok)
- Continue this until you reach the maximum PWM % that you are comfortable running the pump (not exceeding max pump RPM) or until you reach 100%
    - If the pump pressure increases dramatically, then a change to the bypass system is needed
        - First check that there is not a restriction in the return system. *This could be an agitation bar in the tank on the return port
        - Option 1 - if pump is 35 GPM or less, increase the size of the return line
        - Option 2 - if the pump is 35 GPM or more, add a second bypass valve and line
        - Option 3 – Set the “maximum PWM” setting in the vApply rate control module settings at a PWM % that will not cause pressure to exceed 100 psi.
- The bypass is now set and should not need to be adjusted further for most pumps.

Step 3 – Find maximum PWM % for the pump calibration – The goal in this step is to check the health of the system and find the best setting for the maximum PWM %.

- Continue with the manual test
- Change the “Rate Adjust” to the maximum rate the system will need to apply
- Change the “Speed Adjust” to the maximum speed that the tractor will go in field
- Change the “Duty Cycle Adjust” to a speed that the pump will run smoothly
- Verify that all rows are outputting “Flow”
    - If not, stop the test and investigate the problem on that row
- Check all rows have healthy encoder readings
    - If not stop the test and clean the affected turbines
- Check all rows the “Flow” matches the “Flow Command”
    - If it does not, observe if there is sufficient pressure, generally 20+ psi is enough, but higher flow systems may need more to achieve the needed rate. If there is not good pressure, increase the “Duty Cycle Adjust” until you have good pressure.
        - Note: Centrifugal pumps will likely have much less pressure than set in step 2.
    - If there is good pressure at the row and you cannot achieve the commanded rate, then there is a restriction after the vApplyHD module preventing the rate from being achieved. If there are orifice plates after the vApplyHD increase the size of the orifice plate (or orifice tubing).
    - Note - if the system is unable to achieve the command rate once you have reached 100% PWM, then you must investigate why the pump is not producing enough flow (also indicated by very low pressure at the vApplyHD module). This could be due to too small of a pump for the maximum rate, insufficient hydraulic flow to the pump, insufficient product flow to the pump, worn or damaged pump, plumbing restriction.
- Once you have the “Flow” matching the “Flow Command”, then you want to optimize the PWM % for the maximum rate. Try various settings for the “Duty Cycle Adjust” to find the optimum PWM %.

        - Check the "Ball Position" is not too high – 75 degrees is the maximum position, if ball position is over 50 degrees there is not much extra flow available. Increase the "Duty Cycle Adjust" and see if "Ball Position" can be lowered. If any ball positions are at 75 degrees, this is a problem as this is maximum position and the rate is not likely to be achieved. Generally lower ball positions are better.
        - Observe the "Flow Stability" on the rows (if "Pressure Stability" is shown click on the heading to change to "Flow Stability"). Higher is better. It should be greater than 85%. If you can change "Duty Cycle Adjust" up or down and increase the "Flow Stability" this is better. Also check "Pressure Stability" and try to have it greater than 85% as well.
        - Centrifugal pumps **only** – You may need to optimize the PWM % in combination with the pressure relief bypass valve setting. To accomplish this, adjust the speed of the pump and if needed increase the bypass valve spring tension to get additional pressure at lower pump speeds. It is very important to check once you are done that the system cannot build too much pressure with a "Rate Adjust" of 0 and "Duty Cycle Adjust" at your maximum PWM %.
    - If you are comfortable with the speed of the pump and all of the above settings, the value in the "Duty Cycle Adjust" is your value for the Pump Cal Max PWM
        - You may want to exit the tractor and listen to the pump for "hammering" or cavitation.
        - You may want to check the speed of the pump against the pump manufacturer recommendations to ensure you are not exceeding the maximum pump RPM specification.
        - If other hydraulics are tied into the hydraulics for the pump, you may want 10% higher "Duty Cycle" to account for changes in hydraulic flow when in the field. Also if system voltage is lower in field than during the test this can result in a pump running slower than the calibration in field. You must use your best judgement to decide if this system can/should have a higher duty cycle – if pressure stability is negatively affected or pump is running very fast, then you may not want a higher duty cycle. You can always adjust the pump calibration values in the monitor when in the field.
    - Observe the final "Duty Cycle Adjust" percentage that you have chosen. Write down this number as the Pump Cal Max PWM here_____. You will enter it during step 5 in settings.
    - Find the total flow rate for the planter by taking the "Flow Command" for the row and multiply by number of rows – Write down this number down here _____as Pump Cal Max Rate. This can also be found by math by (GPA X row spacing X max speed) / 5940 then multiply by the number of rows.

Step 4 – Find the minimum PWM % for the pump calibration

- Continue the manual test.
- Change the "Rate Adjust" to your minimum intended application rate
- Change the "Speed Adjust" to your minimum intended planting speed
- Lower the "Duty Cycle Adjust" by 10% at a time
    - Watch the "Flow" still matches the "Flow Command"
    - Observe the "Ball Position" is not above 50 degrees – lower is generally better
    - Observe the "Flow Stability" – try to have as high as possible, over 85% is preferred
    - Observe the "Pressure Stability" – try to have as high as possible, over 85% is preferred

        - Observe the “Pump Pressure” it should not fall too far. Generally it should be 20+ psi, but higher flow systems may need more to achieve the needed rate. Some systems may have lower pressure and this is ok of the above three items are optimized. Note: Centrifugal pumps the pressure could be significantly lower than the pressure set in step 2.
    - You can continue to lower the “Duty Cycle Adjust” until the items above are negatively affected. Try various settings for the “Duty Cycle Adjust” so that the above items are optimum. Once you are comfortable with these values and the speed of the pump, this is your minimum PWM %, record this number here _____.
        - If other hydraulics are tied into the hydraulics for the pump, you may want 10% higher “Duty Cycle” to account for changes in hydraulic flow when in the field. If system voltage tends to be lower in the field than it is now, that would also mean a higher duty cycle for the pump cal will be better. You must use your best judgement to decide if this system can/should have a higher duty cycle – if pressure stability is negatively affected or the pump is running very fast, then you may not want a higher duty cycle. You can always adjust the pump calibration values in the monitor when in the field.
        - You may want to check and make sure the pump is not turning too slowly or seem to be laboring. It is ok to run the pump faster if desired and it doesn’t negatively affect pressure stability.
    - Find the total flow rate for the planter by taking the “Flow Command” for the row and multiply by number of rows – Write down this number as Pump Cal Min Rate here_____. This can also be found by math by (GPA X row spacing X max speed) / 5940 then multiply by the number of rows.

Step 5 – Enter the numbers for the pump calibration into the 20|20 settings

- Turn the pump off by moving the Master and Section switches to the down position.
- Click “Done” on the manual test
- Navigate to the Setup – systems – (name for this system) – vApply Rate Control – Continue – Settings and scroll down.
    - PWM Control Style - set to “Pump Cal” or “Pump Cal w/ Hold”
    - “Pump Cal Max PWM” – input the max “Duty Cycle Adjust” percentage that you chose earlier when running at the maximum application rate and speed
    - “Pump Cal Max Rate” – input the total rate for the planter that you calculated earlier when running at the maximum application rate and speed
    - “Pump Cal Min PWM” – input the “Duty Cycle Adjust” percentage that you chose earlier when at the minimum application rate and speed
    - “Pump Cal Min Rate” – input the total rate for the planter that you calculated earlier when at the minimum application rate and speed

Step 6 – Verify your pump calibration

- Navigate back to the manual test
- Ensure “Duty Cycle Adjust” is now set to “Automatic”

- Change the “Rate Adjust” to the maximum rate the system will need to apply and the “Speed Adjust” to the maximum speed that the tractor will go in field
    - Verify all rows are able to achieve the Flow Command with good ball position and pressure stability
- Change the “Rate Adjust” to your minimum intended application rate and the “Speed Adjust” to your minimum intended planting speed
    - Verify all rows are able to achieve the Flow Command with good ball position and pressure stability