



African Solar Success Series

A Pump That Works

Once in a while, a product comes along that is so natural and simple that it makes you look smart. The Grundfos SQFlex range is one of those.

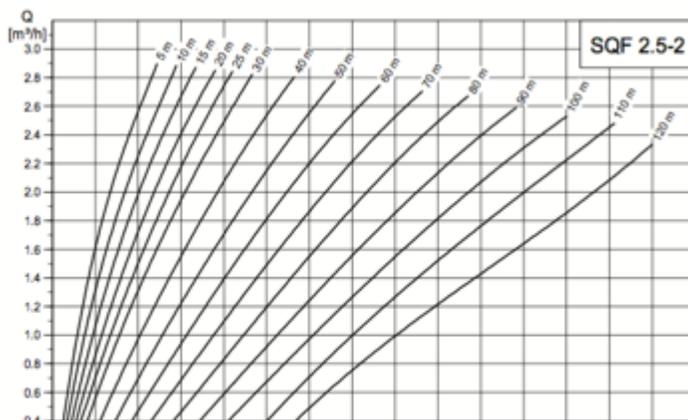
I remember the day that my colleague walked into my office and handed me the first data sheet for the SQFlex line. We were both working for a well-known solar company that was trying to make solar pumps. The pumps we were making were like most on the market today – high quality DC motors bolted to standard wet ends and run at specific voltages by configuring the solar array just right. They were functional and even good. But as we looked at the data sheet, we realized that they were no match for what the SQFlex had now brought to the game. Within a few years, our pump development project was closed and the company gave up trying to build pumps....mostly because of the SQFlex.

What makes the SQFlex so special? It is the insertion of an electronic gearbox (a variable frequency drive) between the motor and the solar modules. This gearbox or drive can accept AC or DC power in a wide range of voltages and amperages and run the motor on that power. When the sunlight is weak, it simply slows down the motor – when the light is bright, it increases the speed. As long as it receiving at least 30vdc or 90vac, it will pump water. This allows you to use any modules you have on hand and simply connect them in series.

These days, traditional DC pumps are sold with control boxes that integrate a MPPT controller and protections for the motor in low light conditions. Because the SQFlex controller is integrated into the motor, there is no need for a control box on the surface. All of the electronics are in the motor casing down the borehole. This means that you can connect the wires directly to the solar array or to your generator, and the pump will run. And because the power is controlled by that gearbox or drive, the wires are not polarity sensitive – so they will work just as well in any position.



SQF 2.5-2



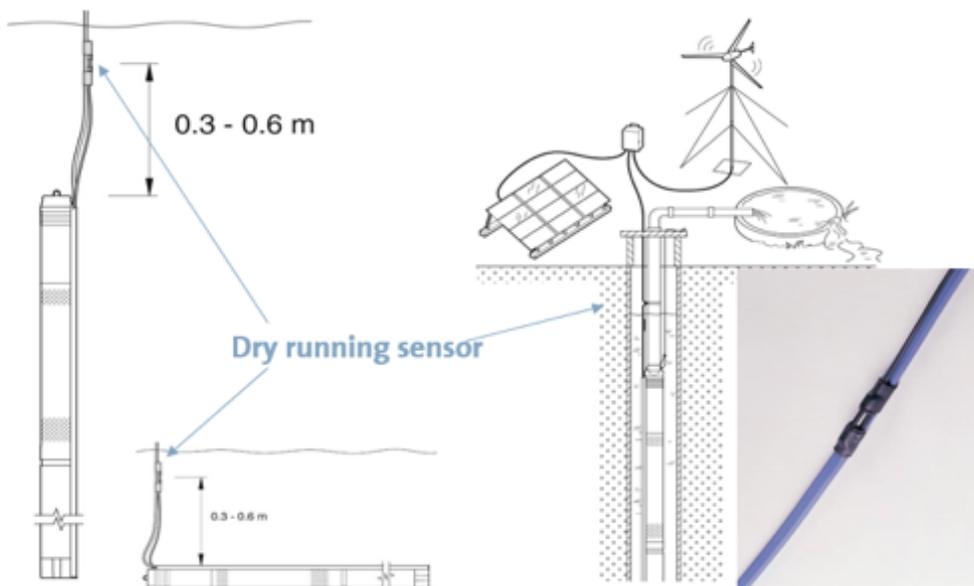
To appreciate the simplicity of sizing with the SQFlex pump, take a look at the chart below. How long did it take you to determine the amount of solar required to pump 2 cubic meters per hour at 70 meters? And you can configure those 650 watts in almost any way,



depending on what you have on hand.

Compare that with sizing a traditional solar pump – the brain damage is immense! Some manufacturers would want you to log on to their software to even see the chart. And then you have to select an operating voltage and start calculating how many modules and the size of modules you would need. If you did not have the specific modules on hand, you would need to import them. And there are so many traditional pump models that you would probably have to import the specific one you needed. In comparison, we find that 70% of pump jobs in Africa can be accomplished with the SQF2.5-2 and another 20% with the SQF1.2-3. Module configuration is easy – just get to the highest voltage possible but don't exceed 300vdc. In the example above, you could use 2 x 320w modules, 3 x 250w modules, 4 x 150w modules, 7 x 100w modules, or 8 x 85w modules, all connected in series. This means no combiner boxes and no ends cut off the module wires.

I installed several SQFlex pumps on my ranch in Arizona. Even a relative idiot like me can do the installation. We set some as deep as 200 meters and they are performing exactly as promised in the pump curves. At 200 meters I especially appreciated the low water level sensor that is built into the power line. Instead of the traditional method of dropping sensors into the borehole alongside the pump (at 200 meters!) the SQFlex has a small metallic electrode integrated into the power wire about 30 – 60cm above the pump. As long as that electrode is under water, there is electrical continuity with the pump and it will run – once the water level drops below that button, continuity breaks and the pump will stop and wait for the borehole to recover.





Several times during the rainy season, there was not enough sun to pump water at one of our cattle watering points. I simply carried up a 5kW portable generator, pulled the wires from the array, connected them to the generator and started it. The pump started immediately and ran all night from the generator to refill my tank. How could I tell which wire was phase and which was neutral? It doesn't matter at all! The beauty of the gearbox (drive) is that it can take any mix of power and make it work. I can switch the wires and it makes no difference.

The SQFlex line uses two kinds of pump ends – the traditional centrifugal and the helical rotor (think of Archimedes screw). The helical rotor is the most popular one, because whenever there is even a bit of light, the pump is normally moving and even if it moves very slowly, it pumps some water. This is great advantage when you are pumping drinking water, meaning you will get at least some water even on a cloudy day when there would not have been enough power to start a centrifugal pump. The centrifugal pump end is capable of pumping more water instantaneously than the helical rotor.



The SQFlex has a non-return valve at the top of the pump, which prevents the water from draining back into the borehole when the pump is off. But it is a good idea to reduce pressure on your pump and line by installing in-line non-return valves at every 50 meters of your riser pipe. Also, be sure to attach a good safety rope or cable to your pump, so that you don't rely on the riser pipe to pull your pump to the surface. And be sure not to over-pump your borehole, because cavitation will cause pitting on your pump surfaces and will result in early failure. Reduce your array or choke the water output to eliminate cavitation.

As with all pumps, dirty or aggressive water will shorten the life, either through corrosion or pitting, but in good water a SQFlex should run about 7 years. A customer once installed a SQFlex where it was powered by AC and running non-stop. It ran for 2 years continuous, or about 17,500 hours and Grundfos acknowledged this was the approximate design life. This equates to about 8 years in a place that averages 6 sun hours per day.

I consider the SQFlex pump as God's gift to Africa. It is simple, robust and useful. It provides that which is most necessary to life. It is easy to size, easy to use, and easy to install. Two pump models fit 85% of the applications and it can run on whatever PV you have on hand. It is easy to sell and easy to stock. We have plenty of SQFlex at all times and can provide the best distributor price in the world. So move ahead with confidence – this pump will make you look smart!