NWL
Transforming The Future Of Power Technology
312 Rising Sun Rd.
Bordentown, NJ 08505
phone: 800-742-5695
fax: 609-298-1982
e-mail: sales.caps@nwl.com
www.nwl.com
CONSULT FACTORY WITH DETAIL REQUIREMENTS OR REQUEST TECHNICAL DIALOG.

Sizing a PowerPlus™ Unit to Replace T/R Sets

PowerPlus™ represents a quantum improvement in electrostatic precipitator (ESP) power supply performance. It can deliver higher average output voltage for the same inlet power, thereby improving both ESP efficiency and reducing total power consumption.

Since PowerPlus is capable of providing more power into the ESP than a conventional T/R, it is very important to properly size the unit. The typical approach has been to select a PowerPlus with the same ratings of the existing T/R set. However, the T/R set may not be optimally sized for the precipitator, and new regulations may have rendered the current T/R inadequate to meet the particulate removal requirements.

The better method is to collect operational data from the existing T/R sets under actual gas load in order to better determine the two key parameters:

1. The output voltage (kVdc) rating of the PowerPlus
2. The output current (mAdc) rating of the PowerPlus

Each of these is described in more detail below.

Output Voltage (kVdc Rating)

There are several methods that can be used to determine the proper kV rating of the PowerPlus.

Method #1 – Existing T/R Rating
Use the kVdc rating of the existing T/R set to help determine the proper rating for the PowerPlus. Refer to the table below.

Existing T/R Rating	PowerPlus Output (kVdc)
≤ 55 kVdc	70 kVdc
≤ 65 kVdc	83 kVdc

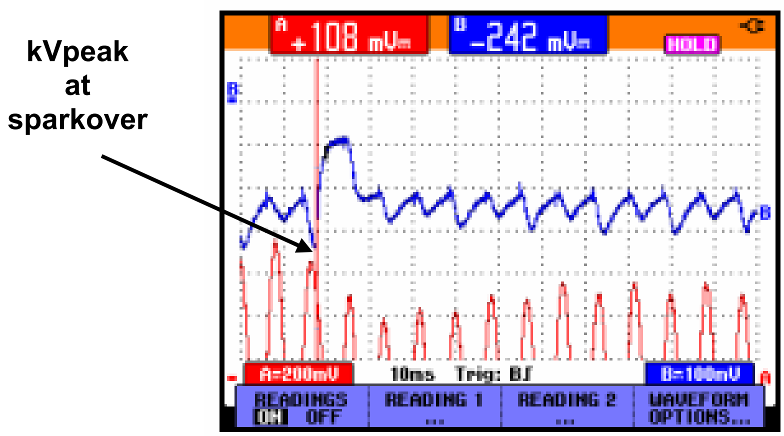
This method assumes the existing T/R set has been correctly sized. If the TR is operating under gas load, in a voltage limit condition, or at full conduction angle with no sparking, then higher voltages should be selected.

Method #2 – Plate Spacing within Precipitator
Another method that can be used is the plate spacing within the precipitator. Since the maximum voltage that can be obtained is determined by the sparkover distance, this spacing can also be used to determine the proper rating. Refer to the table below for guidance:

ESP Plate Spacing (in./mm)	PowerPlus Output (kVdc)
≤ 12/300	70 kVdc
≤ 16/400	83 kVdc

Method #3 - Peak kV at Sparkover
This method uses the actual operating peak kV that can be obtained in the precipitator section under gas load to determine the proper kV size.

An oscilloscope will be required to properly measure the peak kV at sparkover. The scope is connected across the kV feedback network of the existing T/R set. A typical waveform should appear as below.



The kV waveform is shown in blue. The kVpeak value is the value of the waveform just prior to the field sparking (shown by the vertical line in red). This is the actual sparkover value as determined by the precipitator section and gas load. The PowerPlus must be sized to supply this kV level **at a minimum** in order to ensure that sparking levels are reached. If the kV output of the PowerPlus is less than this value, sparking levels will not be reached and the collection efficiency will not be optimized.

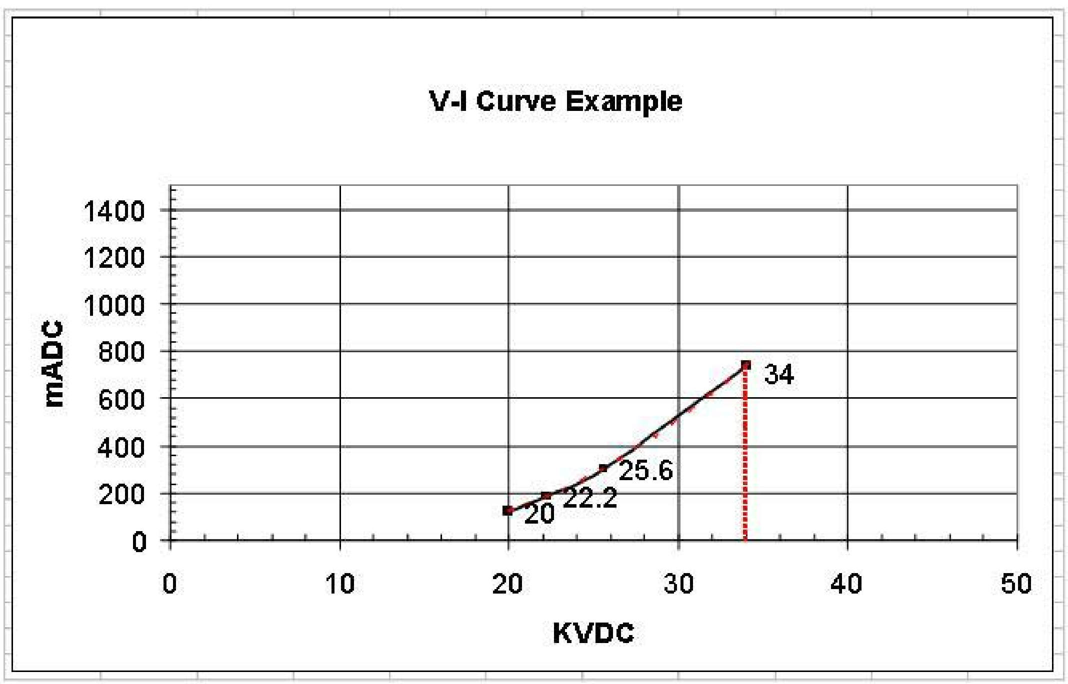
Care must be taken when using Method 3. If the precipitator is sparking at lower than normal voltage levels due to a temporary abnormal condition (clearance problem, ash buildup, etc.), lower kVpeak values will also be measured. If the PowerPlus is sized based on this value, and the condition is later corrected, an insufficiently rated kVdc value may inadvertently be selected.

Employing all three methods should result in very similar kVdc values. If any of the methods gives a very different result, please contact NWL for further guidance.

Output Current (mAdc) Rating

Since the PowerPlus will allow higher voltage levels to be applied to the precipitator section, it follows that the current levels will increase as well. This increase will depend upon the particulate load on the precipitator.

The best method for determining the approximate mAdc operating level is using a V-I curve of the precipitator section while under gas/particulate load. Record the V-I curve from the existing T/R set that is to be replaced. **DO NOT USE AIR LOAD DATA!** Continue the curve until sparking or a limit occurs. An example of a V-I curve is shown below.

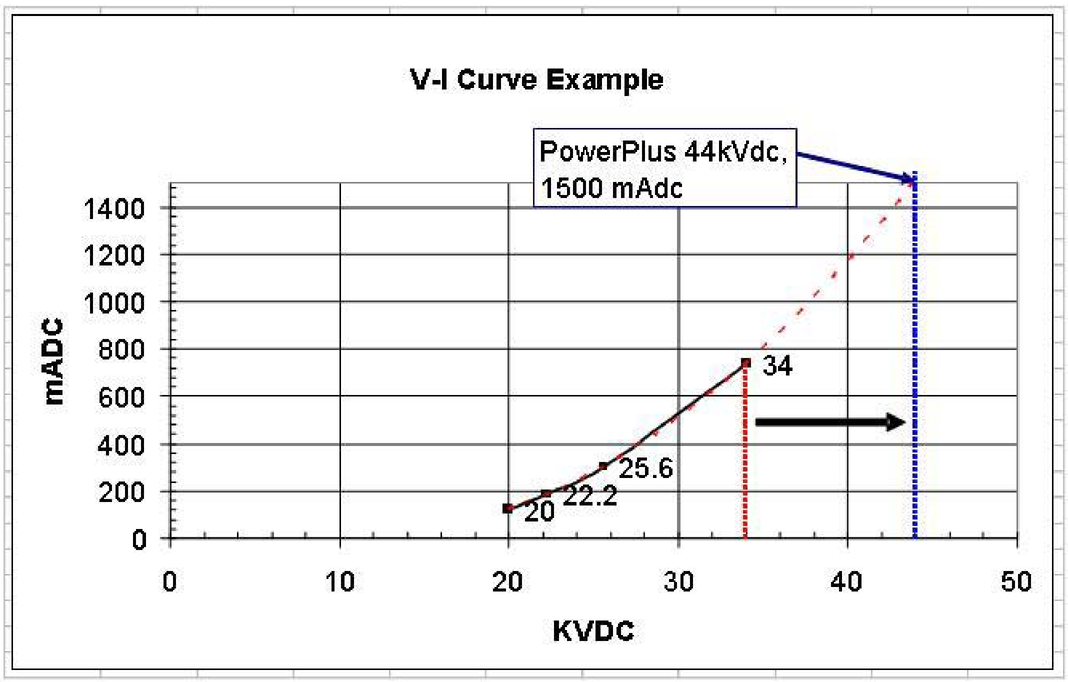


The slope of this curve will determine how much additional current will exist as the kVdc increases. If the V-I curve is very steep, large increases in mAdc will occur. If it is not steep, small increases in mAdc will occur. If the unit is sparking, it can be expected that that kVdc will approach the value of the kVpeak that was measured in

Method #3 described above. This is because the PowerPlus has a much lower ripple content than a conventional T/R set.

For example, assume that the kVpeak value measured from the oscilloscope in the Method #3 was 45 kVpeak. When the PowerPlus is connected to the same precipitator section, the output will ramp up to the same sparkover voltage of 45 kVpeak. But since the PowerPlus has very low ripple, the normal operating kVdc value will be approximately 44 kVdc.

If the above V-I curve is extrapolated it to the new operating value of 44 kVdc, a better estimate of the required mAdc can be made. Refer to the curve below:



The original T/R was operating at 34 kVdc and 750 mAdc. The replacement PowerPlus will be expected to operate at about 44 kVdc and 1500 mAdc. In this example the 70 kVdc, 1500 mAdc, 105 kW PowerPlus size should be selected.

There is greater uncertainty in selecting the mAdc rating of the PowerPlus if the existing T/R set is operating in either current limit or voltage limit. In these cases, the limitation is imposed by the T/R design and not the precipitator. Since the conventional T/R is hitting a rating limit (voltage or current), it is not known how much higher the kVdc needs to climb before reaching a sparkover value. In this situation, it is best to add mAdc margin above the value determined from the V-I curve.

This paper is intended to provide basic guidance to assist our customers in choosing the right model for their application. We strongly advise that you contact us to ensure that the right PowerPlus model is selected to meet your power supply needs.