Characteristics of Welding Power Source

UTA002

Electric Power

- The circuit voltage that comes into your home is a constant factor, but the amperage drawn from the utility company depends on the number of watts required to run the electrical appliance.
- The amperage used by an electrical device can be calculated by dividing the watts rating of the device by the primary voltage for which it is designed.
- For example, if an appliance is designed for the common household primary voltage of 115 and the wattage stamped on the appliance faceplate is 5, then the amperage drawn by the appliance when in operation is determined as shown:

$$5 \div 115 = 0.04 \text{ amperes}$$

1. Arc Welding – POWER SOURCES

- Two types:
  - ***a) Constant Current (Drooping)***
  - ***b) Constant Voltage***

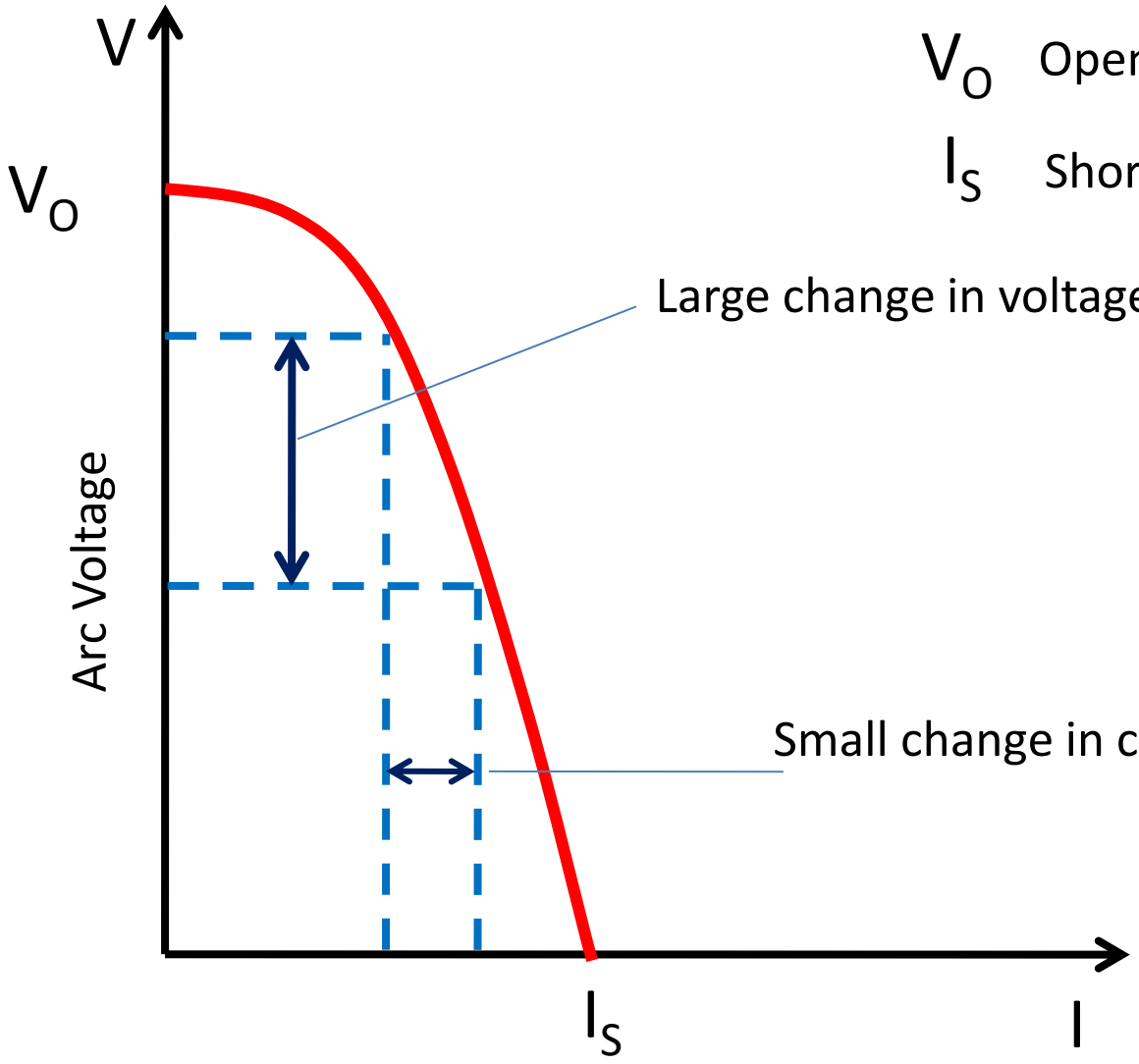
Why different Arc Welding Power Source

- Welding power sources are designed in many sizes and shapes. They may supply either AC or DC, or both, and they may have various means of controlling their voltage and amperage output.
- The reasons for this is that the power source must be capable of producing the proper arc characteristics for the welding process being used.
- A power source that produces a satisfactory arc when welding with coated electrodes will be less than satisfactory for welding with solid and flux cored wires.

a). CONSTANT CURRENT POWER SOURCE

- In ***Constant Current*** [***CC***] power source, variation in welding current with arc voltage (due to fluctuations in arc length) is very small.
- ***welding current*** remains more or less ***constant*** in spite of fluctuations in arc voltage/length.
- ***suitable for*** those welding processes where large fluctuation in arc length is observed like in *Manual Metal Arc Welding* (***MMAW***) ***and*** *Tungsten Inert Gas* ***TIG welding***.

a). CONSTANT CURRENT POWER SOURCE



V_O Open circuit voltage

I_S Short-Circuit Current

Large change in voltage **25%**

Small change in current **4%**

a). CONSTANT CURRENT POWER SOURCE

- The constant current (CC) welding machine is called a ***drooper*** because of this curve.
- A ***25%*** change in voltage results in only a ***4%*** change in amperage.
- The current change is so ***slight*** that the current is considered constant.

a). CONSTANT CURRENT POWER SOURCE

- Following points should be kept in mind regarding CC power source:
  - It has ***high OCV*** (open circuit voltage:- the voltage when the welding is not being performed).
  - High OCV ensure ***easy initiation*** and ***maintenance of arc.***
  - ***Low short circuit current.***

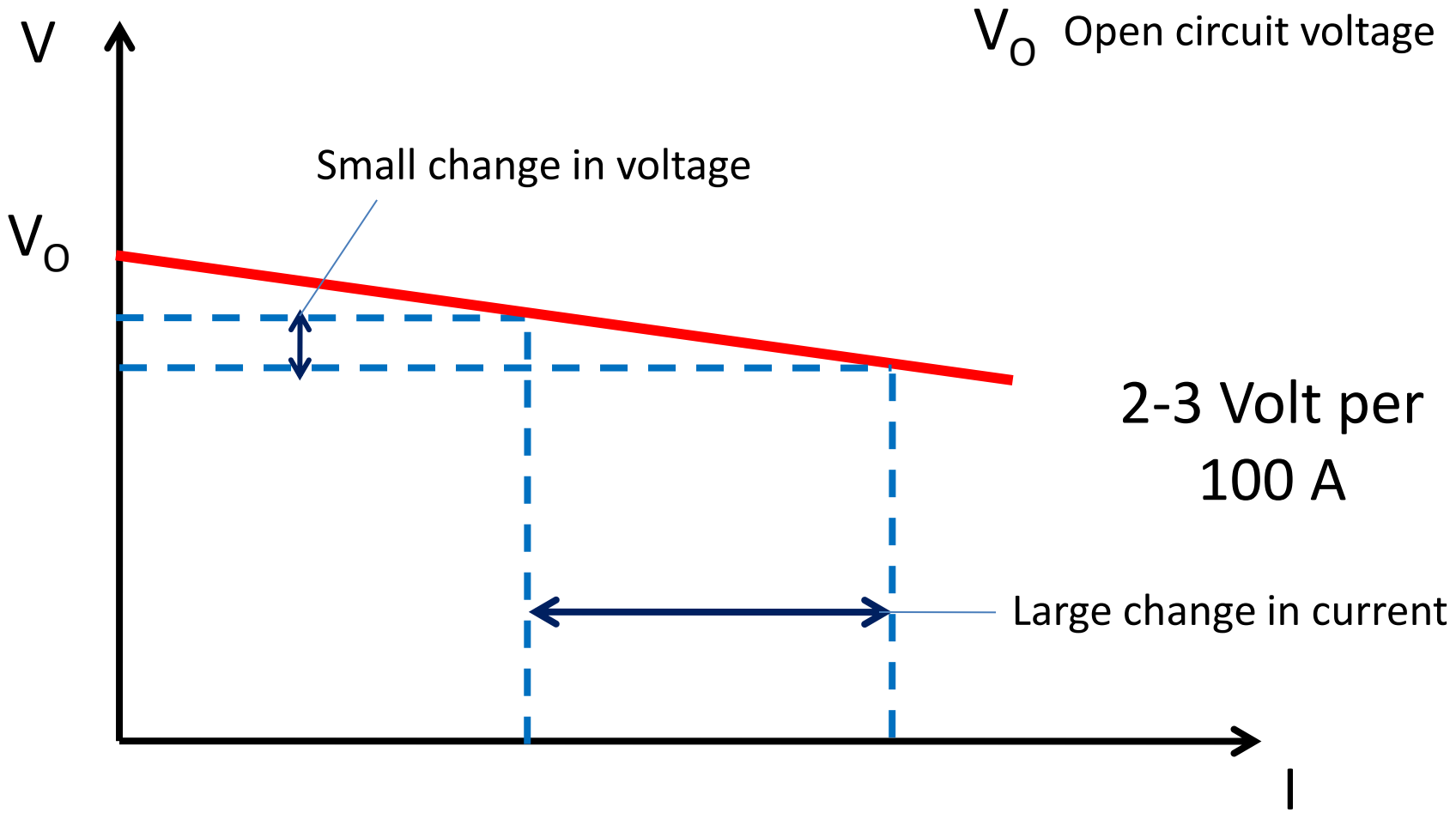
b). CONSTANT VOLTAGE POWER SOURCE

- In CV power source, very small variation in arc voltage (due to fluctuation in arc length) causes significant change in welding current.
- Since ***arc voltage*** remains almost ***constant*** therefore this type of power sources are called constant voltage power source.
- Constant voltage power source does not have true constant voltage output. It has ***slightly*** downward or ***negative slope***.

b). CONSTANT VOLTAGE POWER SOURCE

- ***suitable for*** all those welding processes where small fluctuations in arc length can take place, like in semi-automatic welding processes ***MIG & SAW*** .

b). CONSTANT VOLTAGE POWER SOURCE



b). CONSTANT CURRENT POWER SOURCE

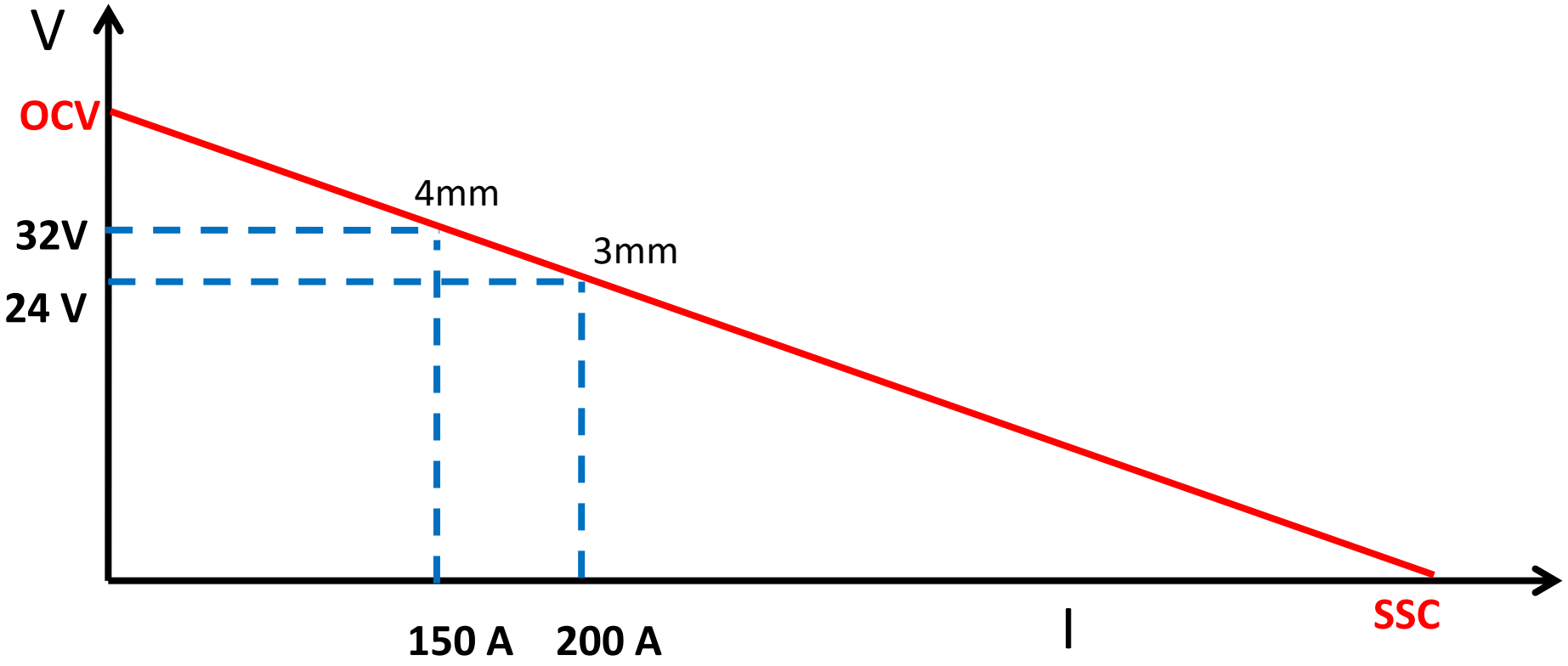
- Following points should be kept in mind regarding CV power source:
  - It has slightly ***low OCV*** as compared to CC power source.
  - ***High short circuit current.***

NUMERICAL

- Following data has been observed for a constant voltage arc welding machine
  - If the arc length changes from 3mm to 4mm
    - Voltage changes from 24 to 32 V
    - Current changes from 200A to 150A

- Find out the open circuit voltage(OCV) and short circuit current (SSC) of the power source.

NUMERICAL



NUMERICAL

- USING THE EQUATION OF STRAIGHT LINE

$$Y = mX + c \qquad (1)$$

Y = Voltage

m = slope = $\Delta V / \Delta I$ = 8/(-50) = -0.16

X = current

c = Open Circuit Voltage (Y-intercept)

NUMERICAL

- Therefore eq. 1 becomes

$$V = c - 0.16\ I \qquad (2)$$

- Value of “c” could be found by putting the values of V & I for any arc length (given)
- Therefore “c” = 56V

- Similarly Value of SSC could be calculated by putting the value of V=0 , c= 56 in the eq (2)
- SSC = 350A

NUMERICAL

- The voltage-length characteristic of a DC arc is given by V = 20+40L, where ‘V’ is the arc voltage and ‘L’ is the length of arc in cm.

  The power source characteristic is approximated by a straight line with an open circuit voltage 60V and short circuit current of 250Amp.

  When the arc length is changed from 3mm to 5mm, Calculate

  1) change in arc power,

  2) arc length at a maximum current of 100 Amp.

SOLUTION

V = 20+40L,

FOR 3mm Arc Length,

V = 32V, and I = 166.67 Amp

For 5 mm arc length

V2= 40V

I2 = 83.34 Amp

P1 = 5333.44W

P2 = 3333.6 W

Change in power = 1999.84 W

at I = 300 Amp

V = 36 volt, and arc length = 0.4 cm

Other sources: Quiz

- **Unit 5 - Week 03: Power source of welding – Nptel**

(https://nptel.ac.in/content/storage2/courses/downloads_new/112103263/noc19_me16_Assignment4.pdf)