Fundamental of Welding Science and Technology

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Module – 02
Lecture – 06
Welding power source 2

In the last class I, at last I discuss the duty cycle of a power source Welding Power Source and its rating. Depending upon the rating and power sources what were the different classification of welding power source that also I have discussed in details in last class. Today I am going to deliver a lecture on Welding power sources characteristics; that means, what is the characteristics of a welding power source is. Generally whatever the welding power source is we are using, it has some characteristics. What is that characteristic? The related to that characteristic, today I will deliver a lecture.

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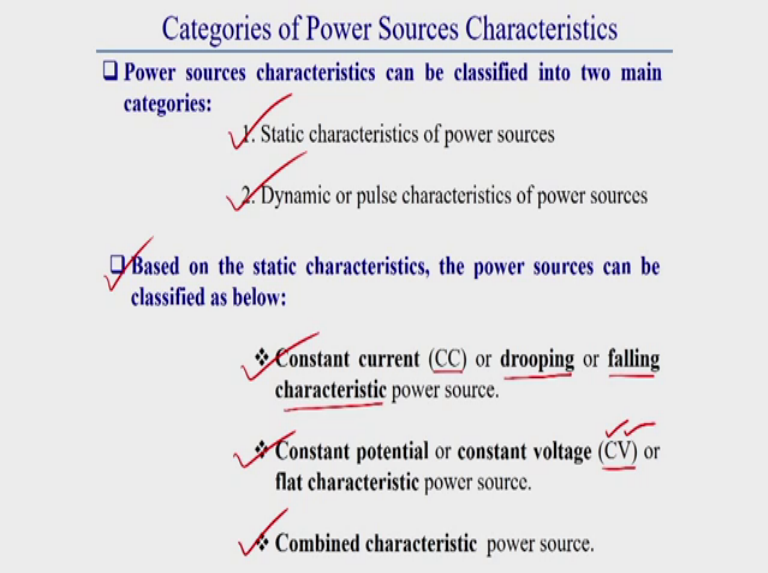

Actually power source characteristics can be classified into two different categories: one is a static characteristics of power sources and another one is dynamic characteristics. Now today's lecture, I will discuss in details about static characteristics and dynamic characteristics of power sources. First of all I will discuss about a static characteristics of power sources. Static characteristics means here the variation; that means, it is the

variation of variation of load; once we do the welding, then whatever the output we are getting that variation is not rapid; that means, variation is generally is not almost there; that means, the variation does not dependents on time. So, that is generally called a static variation, it is not time dependent output.

Dynamic or pulse characteristics means, here generally the variation or output is depends on depends on time which is a transient where there is a transient variation. So, first of all I will discuss in detail about a statistic characteristics of power sources.

Here generally here generally based on this a static characteristic power source. Generally this power source is categorised into 3 different categories. One is called constant current characteristics, that is represented in terms of CC, C for Constant and C another C for Current. And this is sometime called drooping characteristics of power source and this is also sometimes called falling characteristics of power source.

The wall the name has same characteristics, actually though it has different name, but this characteristics is in; that means, this characteristic had different different name, three different name. Another categories is constant potential or constant voltage characteristics. This is generally popularly known as CV characteristic power sources; that means, CV means here generally C is stands for constant and V is stand for voltage, that is why this is also called constant voltage power source characteristics. Depending upon this characteristics, this power source is categorised in that is called CV power sources.

And third categories which has a combination of CC and CV; that means, combined characteristic power source. This third category power source is called combined categories power sources, Now I will discusses in details about all thus characteristics of power sources, what are the different a static characteristics of the power source that I will discuss in details. Now before going to detail discussion about constant current, constant voltage and combine characteristic power sources, first of all here we should know the arc characteristics, what is the characteristics of arc.

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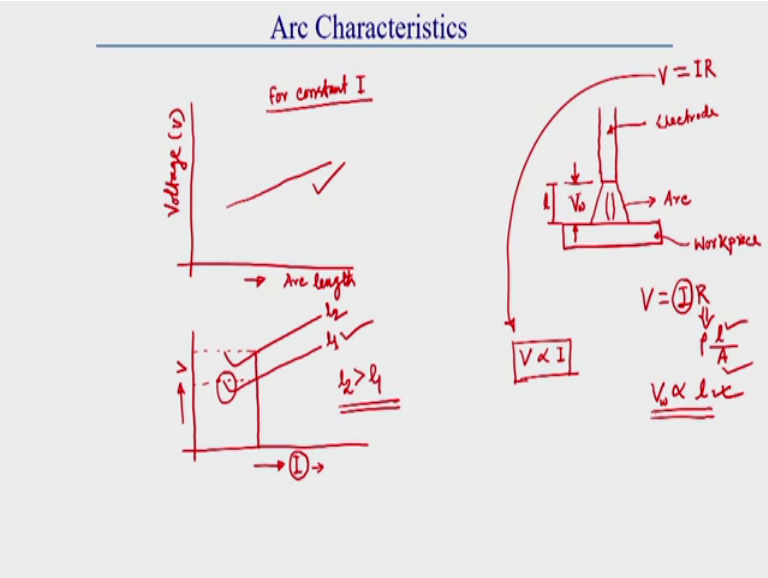

Generally arc means once we go for doing welding, then generally in between the gap there is generally developed arc; this is generally called arc. So, what is the characteristics of arc, which is very much important before going to detail about characteristics of power source. So, this arc means here in between this work piece and electrode, this is actually electrode and this is actually work piece. Generally a arc is generated these. Generally the welding voltage is called whatever the voltage available in this arc gap; that means, in this region in between electrode and work piece whatever the voltage we would got that is called welding voltage.

Generally this voltage generally depends on its arc length; length of the arc. So, this voltage generally depends on this length of the arc. How its dependent? The little bit I am just we know that we required to voltage is equal to I into R. So, voltage is equal to I into I, I is the current and r is the resistance. This V is equal to IR. This resistance generally so, voltage if the current is constant. If the current is constant generally this resistance is depends on rho l by cross sectional area; that means, generally this voltage depends on length and its cross sectional area; that means, this voltage is directly proportional to the length and its generally inversely proportional to the cross sectional area.

Now, if the all other parameter is constant; that means, a cross sectional area of the arc, then current; then what happen? It is voltage is directly proportional to length of the arc.

So, what we can get from here that if the length increase, then generally this voltage increase in case of its welding voltage increase. That means, this V w is proportional to length of the arc here; if other parameter is constant. So, here what we can get if the length increase then voltage will increase from here we get this idea. Now what is the characteristics of this arc in a due to change of voltage, due to change of current that you should know.

First of all we will see for a particular current how the voltage is changing, if the arc length is changing. Let this is your arc length versus then let this axis represents voltage V. Now here it has observed that generally if the arc length change, but I have already told you; that means, if the arc length change then for a particular current for constant current; that means, for constant current I; in a constant I, generally this arc length if arc length increase then voltage increase. So, here generally this is generally thus its depends on; that means, it depends on arc length. If the arc length increased, then voltage increased.

Now, what is the arc length characteristics or arc characteristics once current changes? This is generally the here we can represent the what is the characteristics of a arc in a voltage ampere diagram. Here what is observed that generally current is generally changing like this; that means, the for a particular arc length let this is for a particular arc length l 1, voltage is increases with increase of current from this curve we can see. But the at the initial position there is a variation, there is a little bit decrease of voltage with increase of current. Why this is, this I will discuss in details in case of in physics of welding.

Now, here what we observed that generally after that generally, it has observed that with increase of current, voltage is increases. From here also we get this relationship because V is also proportional to current; V is also proportional to current. From this Ohm's law actually we can get this thing; that means, V is equal to I. So, V is proportional to I. Now we will see generally let this is for l 2. So, for different arc length, different voltage we get. Generally in this case which one should have more voltage which one this is a which one should have more arc length whether l one is greater than l 2 or l 2 is greater than l 1.

Now, what we observe that voltage is also directly proportional to length of the arc. So, this is generally l 1, l 2 are length of arc. So, what we observed from here that if the sorry

here, what will be the things? Here generally l 2 should greater than l 1. So, here as l 2 is more that is why for a particular current for a particular current generally, for a particular current, its voltage magnitude also will be more for a particular current.

So, for a particular current if we change the arc length; if we change the arc length then voltage increase or decreases, how its behave from here what behaviour we are getting if the voltage is, if the current is increases first of all if the if the arc length is increases then generally voltage is increases for a particular current.

And another thing also you observe that for a particular arc length this voltage is increases with increase of current that that character this is very much essential once we go for decreasing the characteristics of a welding power sources.

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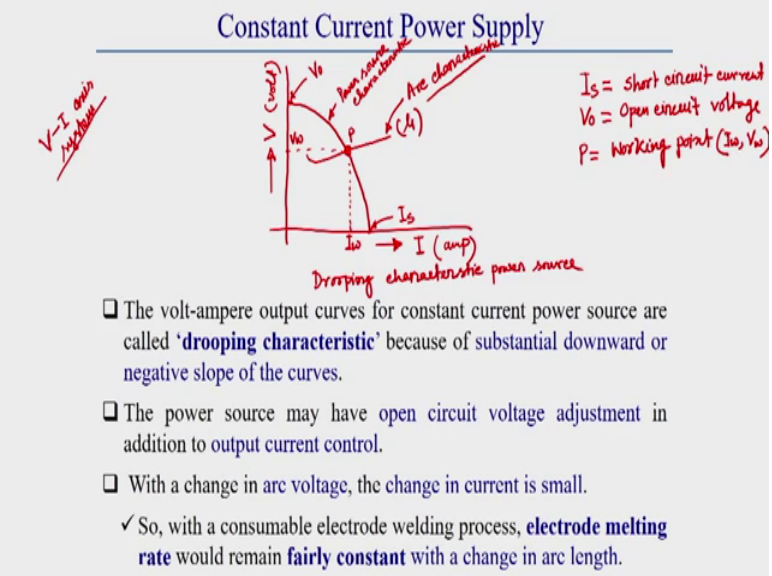

Now, we will go one by one about this a static power sources characteristics in details. So, first of all we will see what is constant current power supply characteristics, generally constant current power supply characteristics curve we can represented in terms of generally all the characteristics curve is represented in V-I axis system V-I axis system; that means, voltage ampere axis system generally all the characters generally voltage ampere axis system generally is used for representing the characteristics of power sources.

Here this horizontal axis represent the current which is in ampere and this axis represent vertical axis represent the voltage which generally in volt. Generally, this constant current power supply characteristics curve; that means, if the curve is represented in this V-I plot then that is generally called the characteristic curve. Now here generally in case of constant characteristics power supply generally voltage ampere relationship can be represented by like this.

So, it here generally a substantial downward or negative slope is there, what we can observe here generally if we draw tangent if we draw tangent. So, here what we got here generally this slope generally has this slope has this slope has generally negative sign; that means, here change of slope is negative. That is why this power source is also sometime because if we a draw tangent in this curve everywhere this slope is becoming negative in nature.

So, this is due to this substantial downward characteristic curve this is also sometimes called negative slope curve or this is this characteristics curves known as drooping characteristic curve. Because here generally substantial downward or negative slope of the curve is there, that is why this types of power source curve is also called generally drooping characteristics power source. This types of power source also called as drooping characteristics power source, drooping characteristic power this types of power source also called drooping power source because due to its substantial downward or negative slope in this curve is there.

Now, this curve have some interesting point generally, in this point this is called generally I s this point is represent I s; that means, when the voltage is 0 then whatever the current is there that is called generally I s. Here I s is generally represented as short circuit current short circuit current and this when this current is 0 then; that means, when there is no load in the output terminal then whatever the voltage is coming that generally voltage is called open circuit voltage. So, this V 0 is called open circuit voltage.

Now, generally let us for a particular for a particular arc length let us for a particular arc length we know this arc length characteristic curves is look like this in a V-I a space in a voltage ampere; that means, voltage current a space generally the arc characteristics generally I have already explained, arc characteristics can be represented as like this.

This is generally arc characteristic curve now for a particular arc length generally arc characteristic curve is represented like this. Now the cutting point of this characteristic curve of power supply are arc characteristic curve this point known as working point this point P is known as working point. What does it means?

Working point means whatever the current an voltage let this is V w and this let this is I w whatever the current and voltage we are getting this is the actually this crossing point represent the welding voltage and welding current. That means, during welding what will be the current is there in arc and what will be the what will be the voltage is there in arc. That means, what will be the welding voltage is there that represent the crossing point of arc characteristic curves and power source characteristic curves, this is generally called power source characteristic curve, this is power source characteristic curve, power source characteristic curve; power source characteristic curve.

This is generally called power source characteristics and this is generally called arc characteristic curve. So, this crossing point is called working point here generally represent the working voltage; that means, welding voltage and welding current; here point should be I w first of all horizontal axis then vertical axis. Here one things we keep it in mind; that means, here for remembering purpose generally characteristic curves the vertical axis is voltage which is exerted by V and in vertical tau also in vertical odd also the first term is V.

So, what will be the vertical axis; that means, its vertical axis should be generally vertical axis for remembering purpose you can think vertical axis should have V and also voltage is also exerted by V volts. So, generally in a vertical axis generally here how we can remember this thing vertical axis for a characteristic curve, vertical axis should have generally voltage V that way we can remember this thing. Now here why this is called constant current power source characteristic curve we should know this thing; why this is called constant characteristic power source curve?

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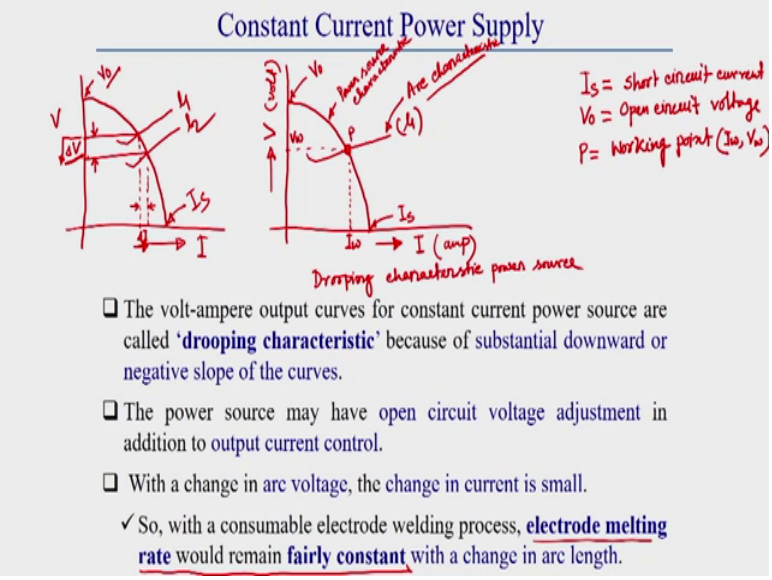

Because here one things we can observe from here; one things we can observe from here; that means, this is current and this is voltage one things we can observe from here from this characteristics. One things we can observe that with a small variation of arc length or arc voltage with a small variation of voltage here generally variation of current is very a small; that means, here variation of current is delta I let this is delta I. So, this delta I and let this is delta V.

So, what happens here what we can observe that within a variation of voltage the change of current is almost constant; that means, change of current is very a small that is why generally this characteristics curve is called constant current power source characteristics. Now, this power source may have open circuit voltage at just went here generally this whatever the open circuit voltage this power source generally open circuit voltage adjustment as well as these current adjustment is generally this power source may have open circuit voltage adjustment in addition to open current control also there.

In the here we can adjust this open circuit voltage as well as generally here generally output current control is possible in this power source. Now, here another things is very important here; here generally as here within a change of voltage, with a change of voltage actually change of voltage means change of arc length. What we can observe from here because if other thing is constant here change of voltage means change of arc length. So, here if there change of arc length is occur or due to this if the change of

voltage is occur then what happens as the current change is very a small; that means, current since is a marginal that is why what we can say here generally the power is remain all most constant, if some arc length change or voltage change is occur.

Due to this generally here generally melting rate of melting of filler material, generally in this case is almost constant because here generally change of voltage means let us this is a arc length and this is another arc length; now what happens? So, if this voltage is reduce from here to here if the voltage is reduced from here to here; that means, if this voltage is reduced from here to here then here generally current is increased also a small, it is not more current will increase from here to here. So, here if voltage is reduce at from this due to this characteristics if voltage is decreased then current is increased.

But the decreased decrement of this voltage magnitude an increment of this current magnitude is almost similar; that means, a small change of voltage a small change of current is occur. So, here generally change of current is very a small that is why what happen due to change of voltage change of current is very a small that is why it is called constant current power source. And due to decrease of voltage as some sort of increase of current is there; a some sort of increase of current is there that is why here generally power output remain almost constant.

So, that is why here generally electrode melting rate is fairly constant for this welding process that is why here I have retain here as electrode melting rate for this constant power source generally remains fairly constant with a change in arc length.

Arc length means if the means change of voltage arc length change means voltage will change. So, if this will change then there will be generally change of current will be marginal that is why what happens here melting rate will be almost constant; that means, it is fairly constant for this power source. Now here one things we keep it in mind generally so why it is the application of this power source.

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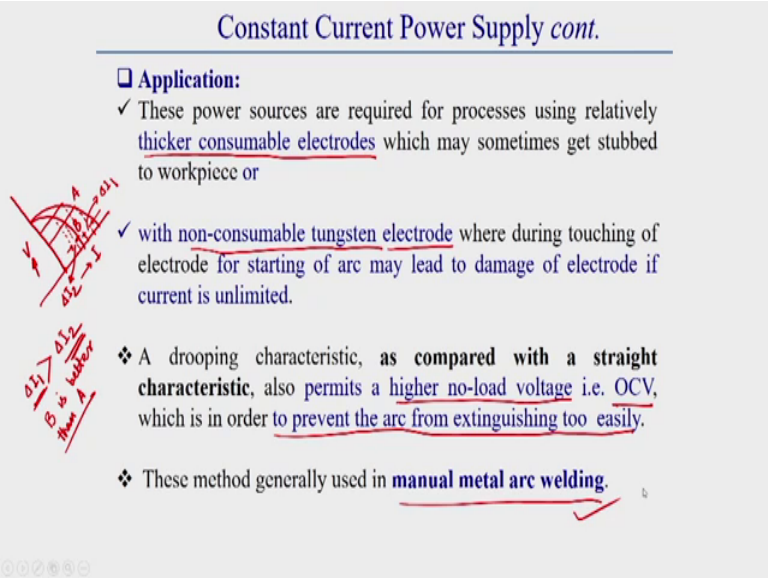

These power source have generally application especially where this power source are record for a process using relatively thicker consumable electrode, which may sometimes gets get stubbed to work piece.

Or this power source characteristics we can apply where with a no consumable tungsten electrode with non consumable actually with non consumable tungsten electrode where during touching of electrode for a starting of the arc may lead to damage of electrode if current is unlimited. So, here what happens during touching of the electrode during touching of the electrode especially for non consumable types of tungsten tig welding, non consumable tungsten electrode during a starting of the arc here I am just showing little bit then it will be very clear to you, generally this is V this is I voltage and this is I.

Now, what we observe here, what we can observe here what we can observe here generally one things here we can observe here generally during no load; that means, once its short circuited; that means, here what what it what its represent generally here this is good for thicker consumable electrode. Why this is good for thicker consumable electrode? Because thicker consumable electrode means if this thicker consumable electrode touch the work piece then there is a chance of short circuiting.

So, due to this short circuiting there what are the things can happen due to the short circuiting generally this voltage drop a voltage reduce substantially; that means, voltage reduction is very high. So, what happens due to this voltage reduction and due to this

high conductivity if it is shorted generally resistance reduce tremendously and voltage also generally in this case voltage also reduce tremendously. So, what happens if due to this voltage reduction if the current shorts is occur current rise is occur tremendously then there is a chances of work piece damage is there.

And another case is also. So, what happens here, this is that is why this is applied in case of the power sources this constant current power supply generally have void application in case of thicker consumable electrode. In case of thicker consumable electrode what happens here it may sometimes get a stuck to the work piece. So, if it gat a stuck to the work piece then this current rise will not be very high, that is why generally this power source have a use for thicker consumable electrode. As well as with non consumable tungsten electrode because non consumable tungsten electrode generally in case of non consumable tungsten electrode tungsten should not be melted or should not be degraded and it deposited to the work piece.

Because if tungsten will be deposited then this will create a defect this will be a inclusion. So, we should prevent this tungsten degradation, for that reason generally if you use this power source characteristics then once we start the arc then during starting the arc by using tungsten electrode. Generally, if we touch the tungsten electrode to the work piece then there will not be huge change of current because, if we use this types of power source then due to this touching of electrode tungsten electrode to work piece here the current rise will not be very high.

So, for that reason here generally this degradation or melting of the tungsten electrode will not be there, that is why these types of power source is generally used for thicker consumable electrode and with non consumable tungsten electrode power supply. If you use this thing, then generally for arc starting we can reduce the damage of electrode if the current is not unlimited because if we use this power source then we can reduce the chances of damage of the electrode.

Now, a drooping characteristics here another things you should keep it in mind I have not yet discuss about constant voltage power source characteristics. Because generally, here whatever the open circuit voltage used in case of constant current power source characteristics the open circuit voltage generally comparatively less in case of constant voltage power source characteristics. Why this is required? Generally this open circuit

voltage as, why this is required here generally drooping characteristic as compared with a \straight characteristics also permit higher no load voltage or open circuit voltage which is required because to prevent the arc from extinguish too easily.

Because, if the open circuit voltage is more then this arc ex transition arc extinguishing also will be less. Generally this method is widely used in manual metal arc welding; manual metal arc welding why this method is applicable more widely its used because generally in case of manual arc welding there is a chances of fluctuation of hand. So, if this fluctuation of hand will be there then there will change the voltage; so if change the voltage then there will be change of current.

So, if we use this types of power source characteristic then change of voltage corresponding to change of voltage here corresponding current change also will be marginal. So, here generally due to this vibration or shivering of hand generally here generally if the hand is oscillating or vibrating then this deposition rate will be more or less fairly constant. That is why generally because here if we change the in case of, that is why generally this types of characteristics is used for manual metalist arc welding process especially SMAW welding process generally this types of characteristic curve is widely used.

Now, here one things you should know, let us I am giving you some I am drawing some here one things let us I am drawing some curve let this is curve A this is curve B, two different characteristic power source I have drawn here. Now what happens here which one is good you should know this thing here generally in first A case, if due to change of voltage, here we see here due to change of voltage here due to change of voltage whatever the current change we are getting let delta I 1.

Whereas, in case of curve B in case of curve B, this let us this change of current is let this change of current is delta I 2. So, if the slope is more is steep generally this slope. So, here generally change of current due to curve A; that means, power source characteristic power source A is greater than change of current due to characteristic curve B.

So, here generally these; that means, as in case of curve B it is less changed by changing same amount of voltage as here less change of current is occur that is why generally this curve B we will give or the B will provide us better control of melting rate compared to

the curve A. So, here generally B characteristics is better than A, here generally B power source is greater than A; why it is greater? Because what happens. In case of B generally, we are getting by changing same voltage generally here we can get A less change of current. Now this constant current power supply generally widely used in case of manual metal or arc welding process.

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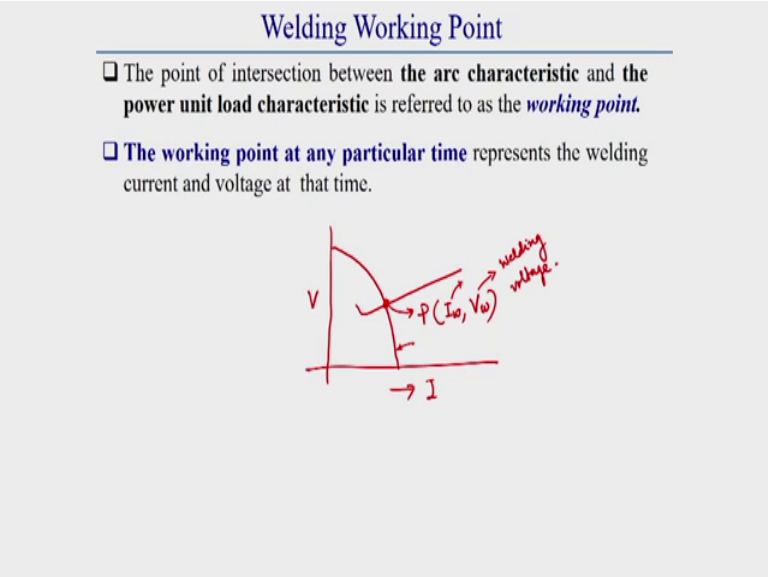

Now, this working point already I have told you because working point means I have already discussed about working point, working point means the cross point of power source characteristic curve and arc characteristic curve. So, this point is called generally working point in this point whatever the current and whatever the voltage we got this is called welding current and this is called welding current and this is called welding voltage at that time. That means, this crossing point of arc characteristic curve and power source characteristic curves is called is working point.

So, in this point represent this crossing point represent whatever the welding current is used during that welding time and whatever the voltage is used during that welding time.

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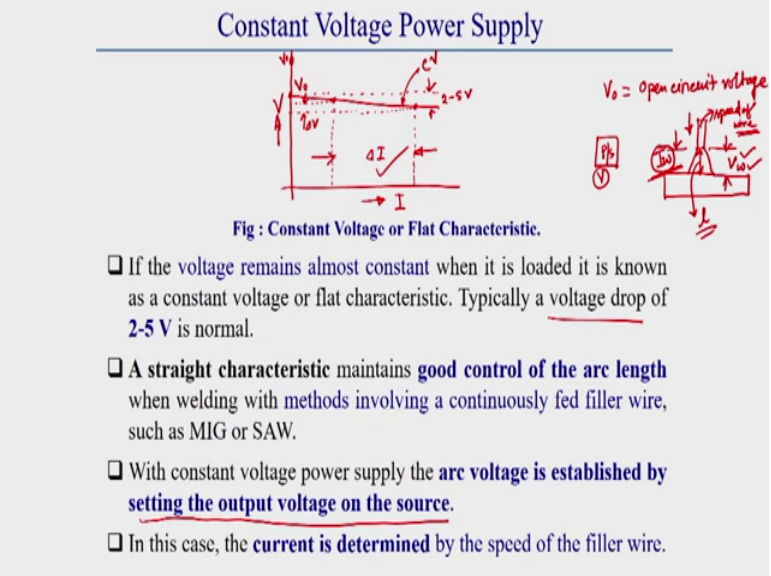

Now, we will go for constant voltage power source characteristics. Now constant voltage power source characteristics here generally voltage is remained almost constant; that means, with change of current here generally voltage will be remained almost constant when it is loaded generally. So, what we can say here, if the voltage remain almost constant when it is loaded it is known as constant voltage or flat characteristic curve because here the curve is representing by a almost horizontal line.

Generally, here typically a voltage drop we got is around 2 to 5 voltage normal the within this range generally this voltage drop we got here. How the constant voltage or flat characteristic curve is look like that I am showing here, generally this is always I represent this I told you generally this vertical axis represent voltage V and horizontal axis represents current. Now here generally this curve, this constant voltage power supply characteristic curves is look like this.

Generally, here the voltage drop; that means, here the maximum voltage drop here is around generally 2 to 5 volt within a within a this range. Why it is called voltage characteristic curve? Because here this characteristic line this is generally voltage characteristic line which is almost horizontal or where there is a normal variation of voltage is there where generally voltage is almost remain constant that is why this is called generally constant voltage power source curve.

This constant voltage power source curve is represent generally termed as actually I have told you this is called CV powers source of characteristic also. Now here a very interesting things we will get, generally here first of all we represent what is this point represent V 0. So, here generally what is V with 0 represents V 0 represents here open circuit voltage; open circuit voltage.

In case of constant current power sources what I have told you this V 0 value constant current power supply generally its look like this where V 0 is here. So, what I told that in case of constant current this is generally constant current power source; power source curve and this is generally constant voltage power source curve. So, instant in case of constant current power source characteristic I told you this open circuit voltage generally is higher than this constant voltage power source curve. So, that is that you can observe from here also that I have told you in constant voltage power constant current power constant current characteristic power source.

Now, here why this a straight characteristic where it is applied why how its look like what is the advantage, what is the drawback of this power source characteristic that I should tell you now. Generally, this state characteristic maintain a good control of arc length; that means, here generally in the constant current power source characteristics what we observe well there is a small variation; that means, a small decrease of voltage, there will be a small increase of current or if there is there will be a small increase of voltage.

Generally, there was what we observe there was generally a small increase of current was there. So, there generally changes of current and voltage was marginal that is why what we observed there they are generally melting rate; that means, curve in the arc was almost remain constant that is why there generally melting rate was fairly constant. So, that is why in case of constant current what we told that there is generally melting rate is constant.

But in this constant voltage power source characteristics here generally arc length remains almost constant, where the here variation of arc length is negligible here. That means, a straight characteristic maintain good control of arc length when welding with method in involving it continuously feed filler wire. Generally these characteristic power

source used for automatic welding process where there is a continuous feed of filler wire is there.

So, if there is continuous fed of filler wire then what happens if there will be variation of if there will be any fluctuation and if there will be any variation of arc length generally, if we use these power source characteristics then what happens this arc length remain almost constant; that means, there is a good control of arc length is there.

Why good control of arc length is there if we use constant voltage power supply that I will explain in details. Now with constant voltage power supply the arc voltage is established generally, if this for constant voltage power supply here this arc voltage. Whatever the voltage we are getting in arc, these arc voltage these arc voltage whatever the voltage we are getting in this arc these voltage generally controlled by or these voltage generally established by setting the output voltage of the power source. That means, in power source itself we generally receive that power source here generally we set the voltage we set the voltage here by setting this voltage we can adjust this arc voltage, that is why here what is written; that means, with constant voltage power supply.

The arc voltage is established by setting the output voltage on the source here generally output voltage we can set by setting the voltage in power supply by itself. So, in this category power source the current whatever the current we will during welding whatever the current will be welding current, this current generally determined by the speed of filler wire, these whatever the speed of that means, how much speed is there speed of wire.

So, this speed of wire determine what should be the current here. So, if the speed will be more then here generally automatically current will be more, if the speed will be less then current will be less because, if speed will be more then what happens here current will automatically generally control. Because more melting will be required because here generally this arc length generally this arc length whatever the arc length is there this arc length generally almost fairly constant. Here generally almost we keep a arc length generally fairly constant that is why what happens if the means speeding will increase to maintain the constant arc length or to control the arc length automatically our current will increase if the work decrease ok.

So, that is why in this current generally this welding current is determined by speed of the filler wire. Now, how it is happened that I will explain in detail why it is called constant current power or constant voltage powers. So, that also I will explain in detail in subsequent slide. Here one things we can observe that here generally in case of constant voltage power supply, what we can observe? With a small variation; with a small variation of voltage that delta V here what we got?

We got a delta I. We got a huge variation of voltage here generally change of current is high very high. So, that is why if here generally if there are they are generally due to if they if here a small variation of feeding rate is occur then this current generally automatically rise in such a way so that more metal will melted and its regained to its original arc length ok.

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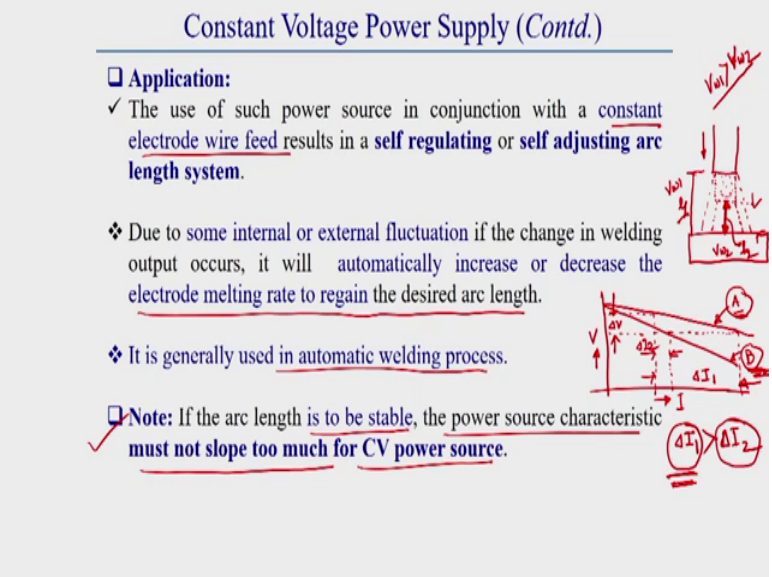

Now, for this characteristics; that means, for this characteristics this constant voltage power supply characteristics, power supply have some special name what is this special name that I will tell now you see here one things you can observe. The application of this now this power supply generally used where there is a constant feed of filler wire is there. That means, especially this is used for automatic types of welding pervious case constant current we used in case of manual metal. But these power source characteristics we generally we use in case of automatic types of, automatic types of automatic types of

filler wire control or we can we can say this is generally automatic welding process generally this power source characteristic is used.

The use of such power source in conjunction with constant electrode filler wire feed results in a self regulating or self adjusting arc length system. Actually due to this characteristics of power source and it has a generally control of arc length is there or here generally we can keep all feed rate constant. That is why what happens, how it is happened that I will tell in details in subsequent slides.

Here generally why this constant electrode wire feed is there for this power supply is accessed for this type of characteristic power supply is accessed this characteristic is called self regulating or self adjustment arc length system. What is self regulation and self adjusting arc length system? This power supply, why it is called self regulating power source characteristics or why it is called self adjustment arc length power source characteristics? That I will explain clearly in subsequent slides.

First of all due to some internal or external fluctuation if change in welding output is occurred then it will automatically increase or decrease the electrode melting rate and to regain the desired arc length. So, that is why it is generally used in automatic welding process, what I have already told you. Here one things we should keep in mind if the arc length is to be stable more stable the power source characteristic must not slope too much for constant voltage power source, why this is?

Here one things you keep it in mind why this is written here you see what does it means in this last statement; that means, here arc length to be stable; that means, this arc length remain constant what is this last statement tell the arc length to be in constant length.

Generally, here what are the things required? This is generally current and this is generally voltage. What I have told you if the arc length is to be stable the power source characteristic must not slope too much for constant voltage power source. What does it means? Here one things we can observe let us a power source characteristic which have a slope like this another have a slope like this.

Now, for this two case what you can observe you can easily see from here, let this is a for a particular power source A and this power source is for B. Now which have two different slope characteristics are there, now here what are the things we say a small

change of with same change of voltage here in fast categories. In fast categories generally current change you get let us current change let us you gets delta I 1, where as in second categories if the slope is more stiff then here this current change is left delta I 2. So, here generally delta I 1 is more than delta I 2.

So, from here what you can observe, if the slope is more which is observed in case of power source B, in case of power source B in this case here generally we get change of current is a small. Whereas, if the slope is less in this case this current is current change is very high, there are comparatively high generally current change is high.

So, if the current change is high then what happens here generally this arc length; that means, if here just I am just showing you little bit then it will be more clearer that this is a electrode; if this is a electrode. Now let us this is the wire feeding, this wire is continuously feeding here, now let us suddenly due to some internal or external disturbance let this wire feed rate increased let this wire feed rate increased.

So, in this case our arc length will become let us say initially this arc length was l 1 here let us say arc length is l 2. So, what happens in the first category that means, if this arc length changes to l 2; that means, if arc length reduce means your voltage here whatever the voltage will be there V w 1 whatever the voltage here will be V w 2 here generally in case of V w 1 is greater than V w 2; why? Because from here we can observe that generally arc this arc voltage depends on arc length as l 2 is small that is why what happens l 2 is small. So, what happens here generally l 2 is smaller than l 1.

So, generally in case of l 2 whatever the voltage here we will get this voltage will be generally less then this voltage whatever we will get for arc length l 1. So, due to this voltage changes what we observe from here? If this voltage changes occur if the power source have a less negative slope for if the power source have a less slope then generally these in case of shorter arc here one things you can observe from here. If here we use curve A instead of curve B then what happens here generally more current change will occur. So, if more current change will occur means more melting, more power will be here and what happens this mass of extra electrode will melt faster than whatever the things happen in case of curve B.

That means, here so, if the slope is less then chances of re resizes arc length is rapid if the slope is less generally. So, from here what we can conclude if the slope is less in a

power source that one in the constant voltage power source if the slope is less then what happens here generally a change of current will be more. So, change of current will more means what happens more rapid melting of filler metal will be there. So, more rapidly it can regain to its original position. So, here generally if the slope is less as the delta one is small delta 1 is more as the delta 1 is more for that reason melting will be more and it can regain to its original arc length faster than the power source B, from there we can easily got.

So, here generally which power source is good here, which power source arc length is stable here? Here power source 1 which have generally less slope than power source B. So, power source 1 have more stable arc length than the power source B, this is a very interesting things we should know. So, lesser stable lesser slope power source constant voltage power source characteristics is better than higher slope constant voltage power source character; why? Because generally lesser has higher change of current so, higher melting regain to its original length.

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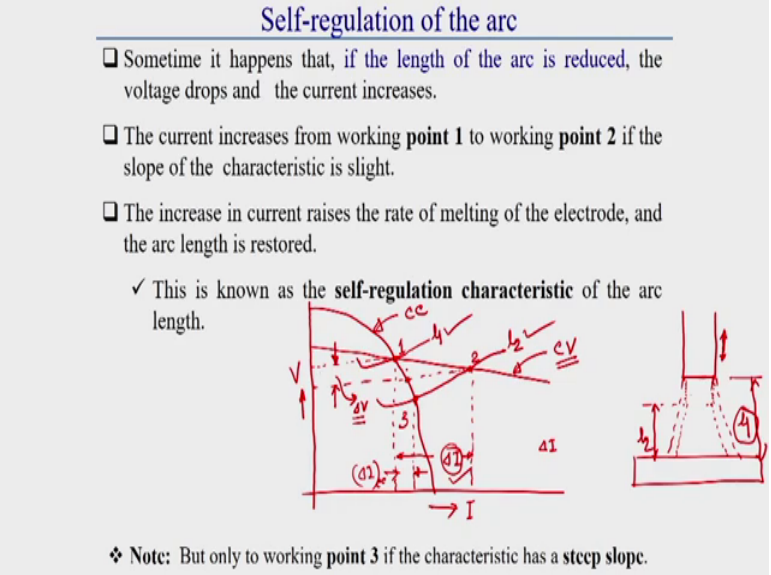

Now, this constant voltage power source characteristics also is called self regulation of arc characteristic; why it is called self regulation of arc? Self regulation of arc characteristic that we should know why it is called self regulation of arc characteristics because, I have already explained; that means, due to small change of voltage. Here I am explaining again in case of constant voltage power source characteristic what we have to

observe? In case of constant why you what we have observe just here I will explain little bit in clearly then it will be very clear to you.

Let this is constant voltage power source characteristic curve and this is constant current power source characteristic curve what happens let us this point is 1, this is point 2 and this is point 3. So, what happens let us this point was when there was a arc length l 1 and this point 2. So, let us this is point 1 this is point another arc length is let this.

So, let this is point 1, this is point 2 and this is point 3; that means, let this is arc this is initial working point and this is this is called arc length l 1 initial working point was 1, let this is l 2 where working point is 2. What does it means here? Actually I should explain why it is called self regulation of arc; that means, let us this is a electrode initially it has a arc length, let us initially it has a arc length l 1 let us it has a initially arc length l 1.

By some internal or external disturbance let the feed rate increase or decrease and what happens it has it has changes arc length from l 1 to l 2; that means, some arc length let us say it is reduced. So, if the arc length this is for l 1 curve l 1 characteristic curve and this is for this is for l 2 characteristic curve because, there are some sort of voltage drop is taken place. So, arc length is arc length variation is taken place, due to this arc length variation here what happens there is occur a change of voltage ok.

Due to this change of voltage in case of constant voltage power source characteristics in case of constant voltage power source what we got? We got huge change of current; that means, from here to here this much of change of current is occur from the here to here this much of change of current is occur. Due to this current change, due to this current change here generally more power will be there and more power will generally made due to this high current this extra electrode portion will rapidly melt and its generally regained to its original position; its generally regained to its original position due to this high change of current.

Now so, what happens as so, once this high change of currents or more melting of the filler material and its regain to its original length l 1 its regain to its original position l 1. So, here generally due to internal or external disturbance if there is a chances of fluctuation of arc length is there this arc length generally due to increase generally due to decrease of voltage there is occur increase of melting rate, why? Because due to increase of melting rate we is generally resize its arc length to its original position l 1.

So, what happens? If this arc length reduce and comes here then what happens here more melting will be taken place and its return back to its original arc length l 1 l 1 its return back to its original arc length l 1 due to what due to this high change of current. So, if the characteristic curve is constant voltage characteristics, but here if the characteristic curve is constant current then due to this change of voltage here change of current is, here change of current is generally constant current. Here the generally change of current is, here the change of current is generally change of current is very small.

So, what happens due to this change of arc length generally here this working point will be point 3, but if it is a constant voltage power source then generally this working point will shift from 2 to 1. Whereas, if it is a constant current power source characteristic then working point will be point 3; that means, in this case if the arc length decrease; that means, this arc length remains within that length that length only; that means, if it is decreased to l 2 in case of constant current the arc length will be l 1.

Whereas, in case of constant voltage power source characteristic, if the arc length decrease; that means, if the small amount of voltage decrease then more current will be changed and due to this more current change more melting of filler material will be taken place due to this more melting of filler material this arc length regain to its original length.

So, as here automatically melting rate is increasing by changing the high, changing the current range is higher level that is why this types of characteristic power source are this constant current constant current voltage characteristic power source is called self regulation characteristic of arc. So, here what we observe if the voltage reduce; if in a constant voltage power source if the voltage is reduce or arc length reduce then what happens due to this small reduction of voltage high increase of current is occur due to this high increase of current. Generally what happens this more melting of filler material will be taken place, due to this more melting of filler material generally its regained to its original arc length.

That is a in case of constant voltage power source characteristic generally this arc length remain almost same due to this arc length control characteristic this is also named as self regulating characteristic of arc. Now, now another last categories of this static characteristics power source is called combined characteristic power source.

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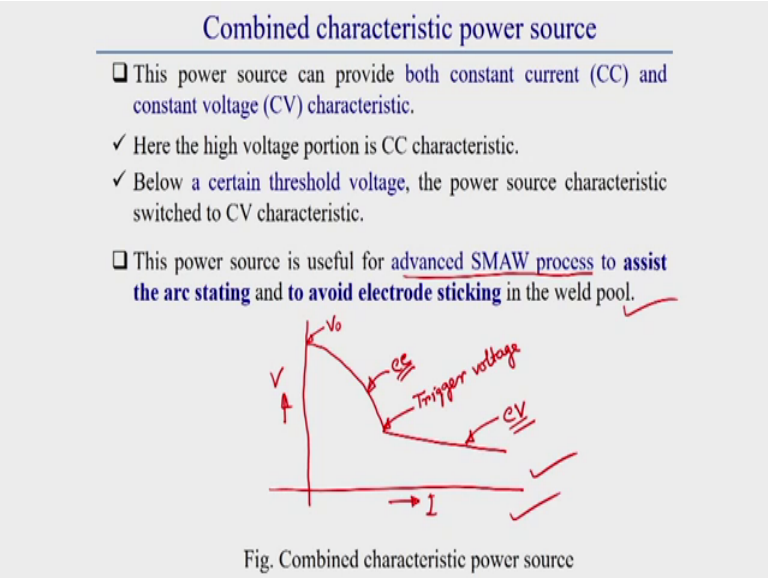

Fig. Combined characteristic power source

This combined characteristics power source have a, this combined characteristic power source consist both constant current and constant voltage characteristics. That means, here the generally the higher voltage this is generally open circuit voltage; open circuit voltage generally this higher voltage that here generally the higher voltage portion is constant current power source characteristics and lower voltage portion is constant voltage power source characteristics.

Generally, below a certain threshold voltage this voltage is called triggered voltage this voltage is also called triggered voltage this voltage is also called triggered voltage. Generally, it has this higher voltage portion is constant current characteristics and lower voltage portion is constant voltage characteristic; that means, below a certain threshold value the power source characteristics switch to constant voltage characteristic. These power source generally useful for advanced shielded metal arc welding or is advanced SMAW process why because to assist the metal arc stating and to avoid electrode sticking in the weld pool.

So, this generally power source characteristic, the power source characteristic have application in case of advanced types of SMAW process. If you use this types of power source characteristic it will assist the arc starting and it will avoid the electric sticking in the weld pool. So, this power source characteristics also popular for advanced types of SMAW process.

Now, next class I will discuss in details about dynamic characteristic power source and some other information on; some important other information on welding power source. So, next class sorry next class I will discuss in details about dynamic characteristic of power source and why are, what is the advantages and why are the generally the dynamic characteristic is important and some other fundamental knowledge on welding power source.

Especially what should be the insulation type, what should be the means wire type, generally then what should be the feeding mechanism, we should use feeding mechanism, generally we should use for power source. Let it to that things, next class I will discuss in details.

After that generally I will complete the power source categories and its characteristic and then switch to another topic that is called physics and principles of welding process.