Enclosure Design of Electronics Equipment
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Lecture - 48
Numerical – Pitching Moment

Welcome back. I hope you had a chance to watch the other two videos relating to electronic connectors. As I said before we love them at the and also know we held them at the same time. We love them because of their features that you can connect to related subassemblies and independently you can disconnect them and then test them or inter change them and so on. It is little like your headphone cables.

So, if you see your head phones: headphones come in various types know, like fully covering the ears close, some are open, some are behind the ears, some are through the ear, and then the standard whatever you like, plus at that end you have a termination. So, at this point the termination is very convenient for us, because we can change the things what we want carry when we are walking it will be a little different from what when you are listening to more serious audio somewhere else and with ambient noise, noise canceling and so on. The critical thing here is the connector at the end.

I hope you have watch the first two videos relating a little this. Why we hate them is that they are just too many of them and they gave problems. One of the simple problems are as explained before the total number of insertions is fixed, and unless you really engine at very very carefully they do not work un interpreted, they gave unintentional drop and then lot of miss match and impedance in case or if something called VSWR keeps increasing. And then at one extreme you would rather not have them you should have a continuous connection. At the other extreme we should able to remove them.

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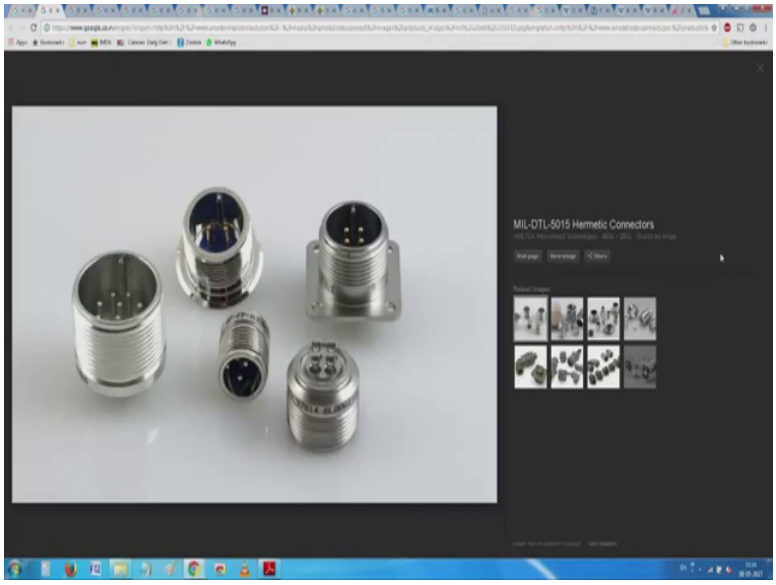

So, today I will now try to move on to the military style of connectors. If you just give a search for mil standard ms shell connectors we end up this beautiful collection of; I mean really you know large number of connectors I hope fine. I will go back to the original. You see here the basic thing is a contact interface: you have pins, and then you have shell on the outside some way of mounting it and lot of threading arrangements.

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And somewhat related to it is the various types of assemblies and subassemblies which, is you seen this. Main advantages being unlike the other places where you can easily access them and you can quickly do some repair with these. In the case of this military standard connectors raggedness is important. And raggedness on normal what you called

dropping or anything and once you attach two of them and then either you screw them or put a bonet it should stay attached. And that interface electrically should not degrade with various type of thing. So, you see here a very large number of options.

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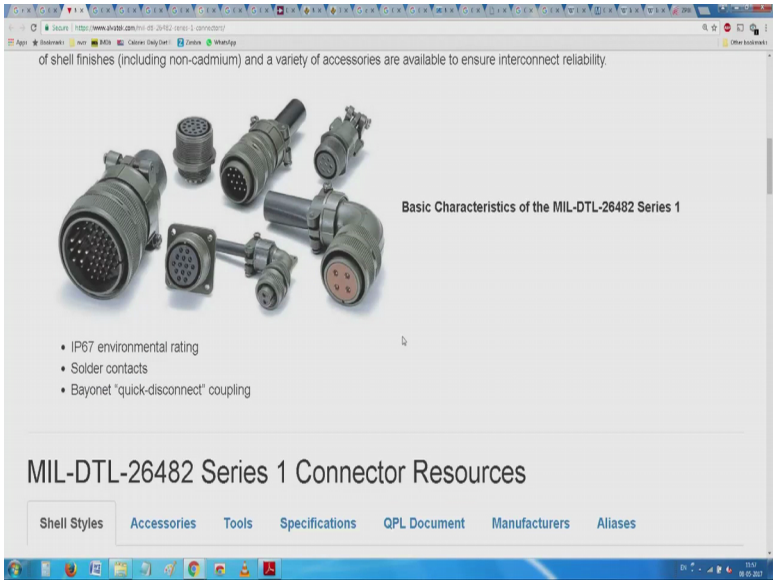

You have seen this, anything you can think of this one is the simplest flange mounted socket or female this thing. Similar one we can also have male sockets also. And you see the mating point for it could be, of course the number of pins and all should be match. Aomething like this is probably mades with it, which is the end of a cable.

And then if you see the anatomy of the whole thing at the back you have strain relief mechanism and then you have something which a shell as all the necessary connections to see that.

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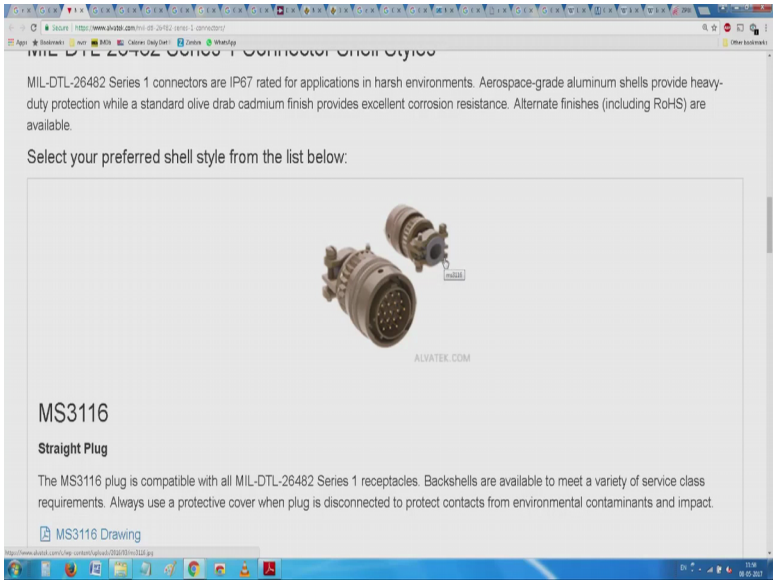

It makes 100 percent, and something here have you notice most important part of it is you have a boot which you can plug it in; I mean after remain you can release these strain relief afterwards you can squeeze it and sits neatly here.

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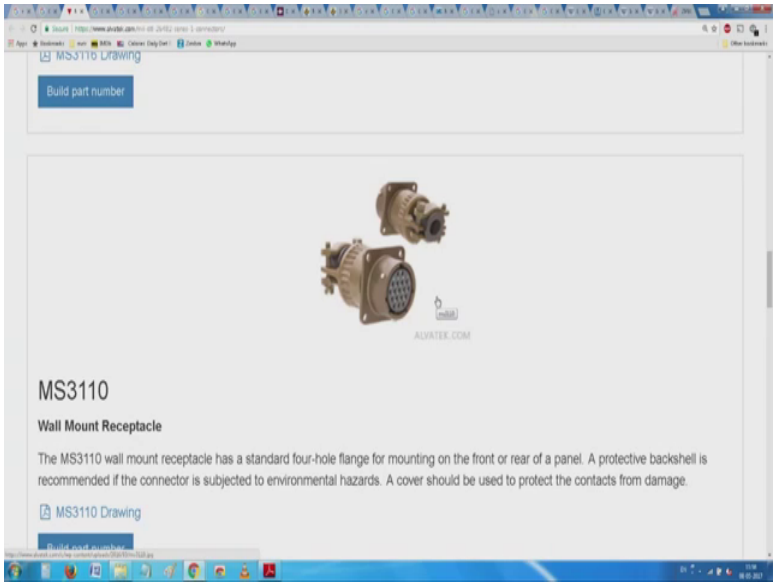

Can you see a small difference here, there is no flange here. Say it could be end of a cable. In contrast this one is a very similar to that accept that it is a wall mount receptacle. The front of it as flanges then we have four holes and all the further is if you see the small dot here it is a benet mount. You see here there is a small grow here and all that. And then there is also usually a mating our something which ensures that misalignment as well as mismating will not happen.

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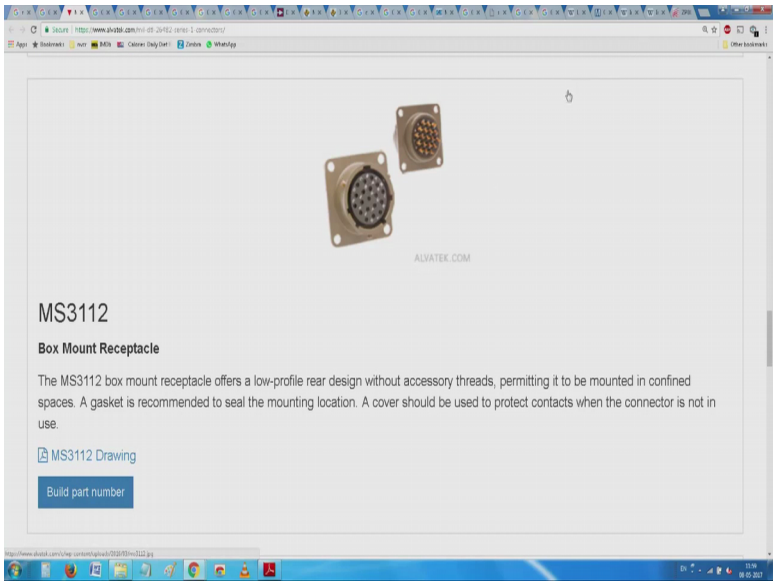

So, you have all these things you know called box mountable. In the case of box mountable this one side know goes and sits on the enclosure the other side you have a shoulder part and so on.

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So, if you go down further know instead of that simple box receptacle we have a proper nut here. This nut ensures that it sits properly.

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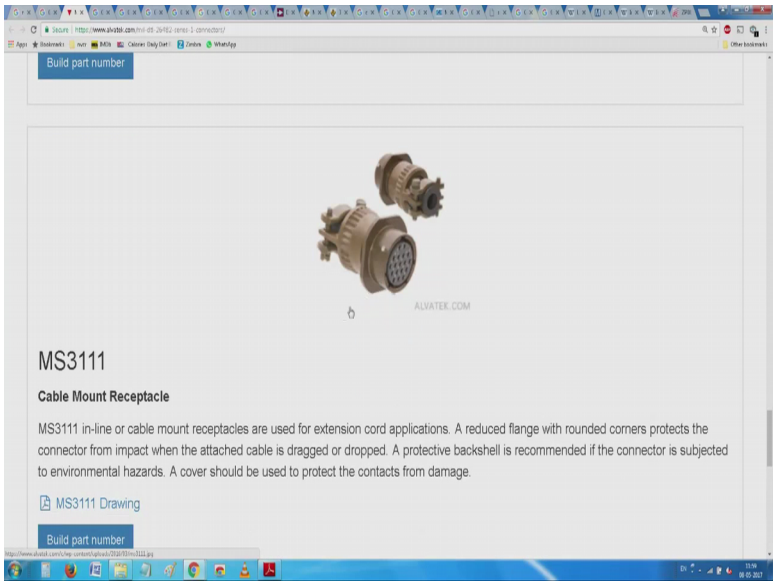

So, if you keep on going here know we have a cable mount receptacle and so on. I will now close this and probably this.

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Integrated closure look at it. You have seen this, this is directly you taken from Wikipedia. Things are little more clear while they are all benet mount this one is a screw mount. And you see here: end here is also a small color coded ring it is used for various purposes which we know will I will get into it later.

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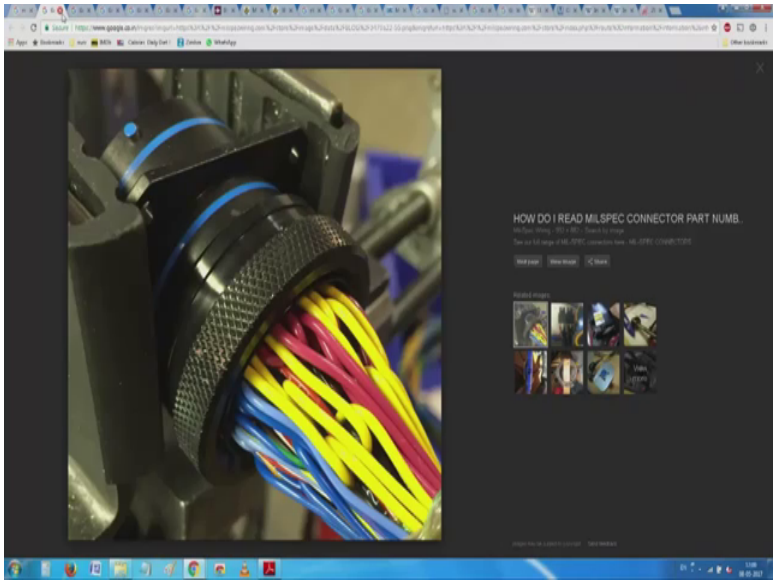

See this is a real beauty; real beauty I do not know there it is a crimping tooler what is it. And that many of these cables can be inserted into it. And wiring has been taken. If you got to the extreme here just now know I was trying to keep of you I am sorry may be here I met this you seen this know.

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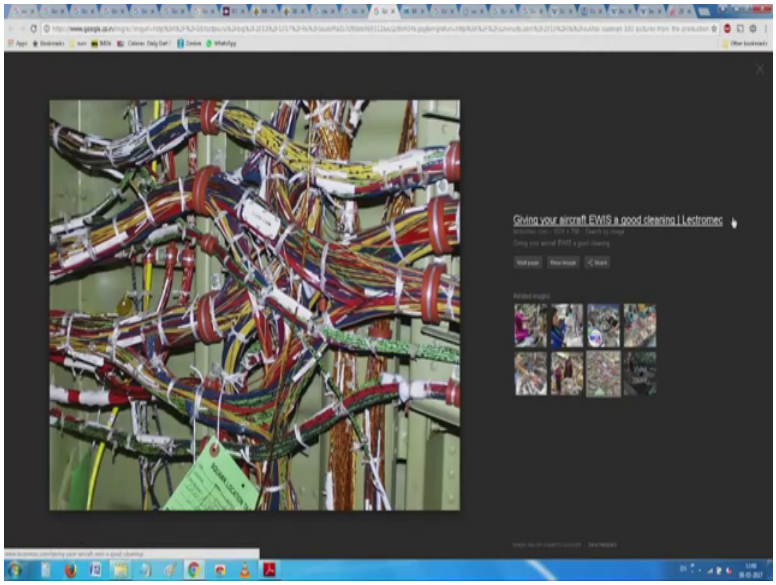

That is what you call a very very small portion of a aircraft harness. And if you take a very in a reasonably big aircraft harness it runs as a length of a the whole airplane and the airplane is so long and they will they have a whole bolt are a hardness bolt in which they need to check everything. And then their automatic testing machines and they will try to.

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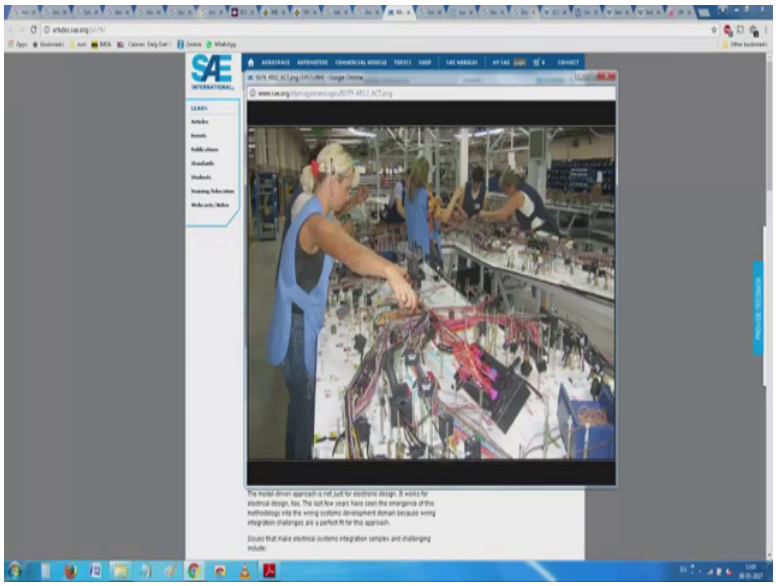

Now, these stages even this is what I have telling at the other day. Even this vehicle testing I mean vehicle things also their big. This is from the SAE society of automotive engineers this is a slightly not as complex system as we think about. Main thing is you seen that connections have to be perfect and usually there is a machine which checks the continuity of it. So, I will close this window just save a little bit of time.

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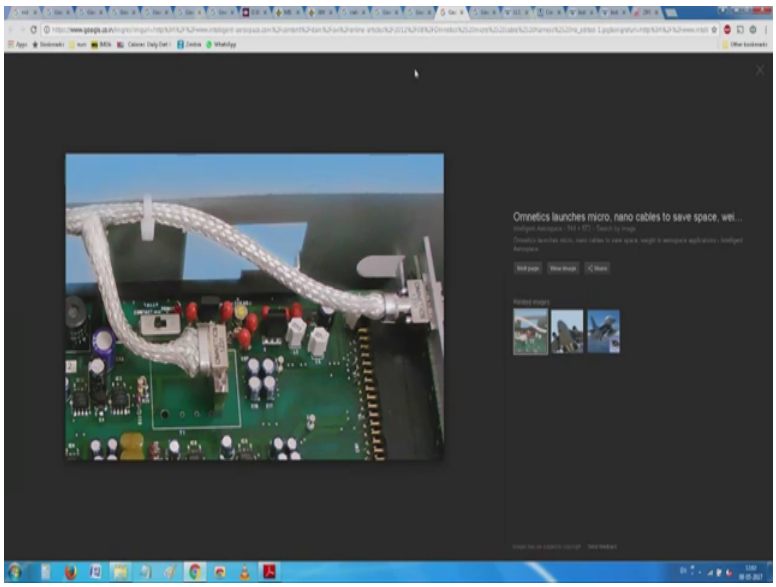

Shielded wires which I have an external shield here; eventually they get terminated into this type of small connectors. And this is the old, then four one of probably 617

connector and then things are getting only more and more complicated.

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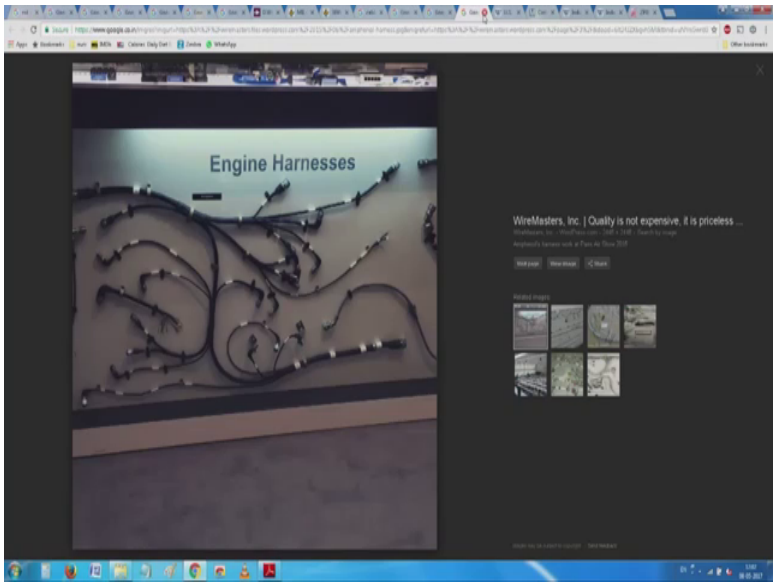

Looks very simple know it says engine harness; tough every point.

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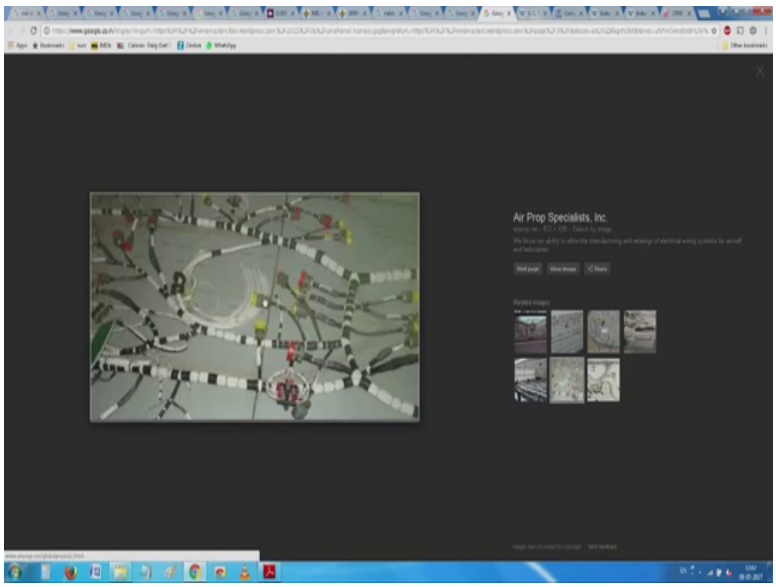

You seen this here typically this is from a aircraft attack of thing, as small part of it. Everything is terminated in a proper connector which will have to the job under all conditions.

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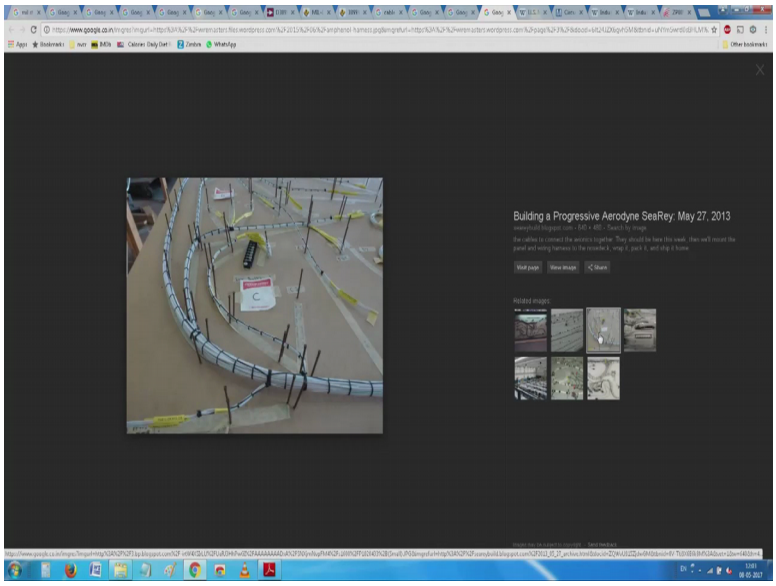

And this is while building it up you need to may call this things. Now I will come back to the starting point, we will close these windows. So, that it will not distract us anymore.

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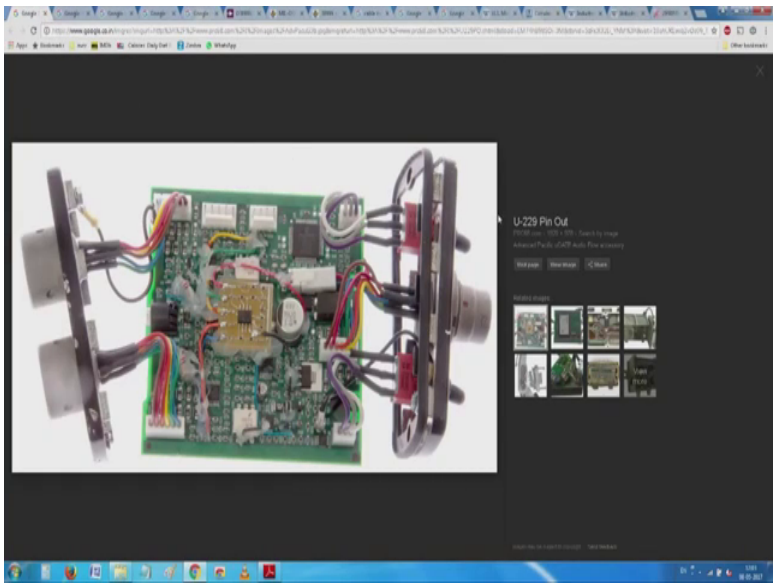

So, we have a equipment right now I am not very much in interested in what the equipment is are and what the function it is function it is. Only thing it will like to point out is an one and you have this beautiful connector here, then you have some switches here, other hand have you a connectors here, and then whole thing using various types of other connectors it seems to go on to the printed circuit board.

This is looks like a very simple audio device which probably as XLR other things. The beauty of it here is inside this is not required to be what you call open frequently, only at the time of testing are repair you do it and then number of insertions are less. At the outside the connectors like this XLR equivalent connectors are often used frequently. I am not intentionally unintentionally little extra load comes in this is the same it is not the same connector which meets with it every time.

It may be a different what do you call audio source or it may be some other thing, but the interfaces standard, but XLR is suppose go. Sometime it is sitting above the board sometimes it sits flush inside. So, the main of this thing order I wanted to tell you is.

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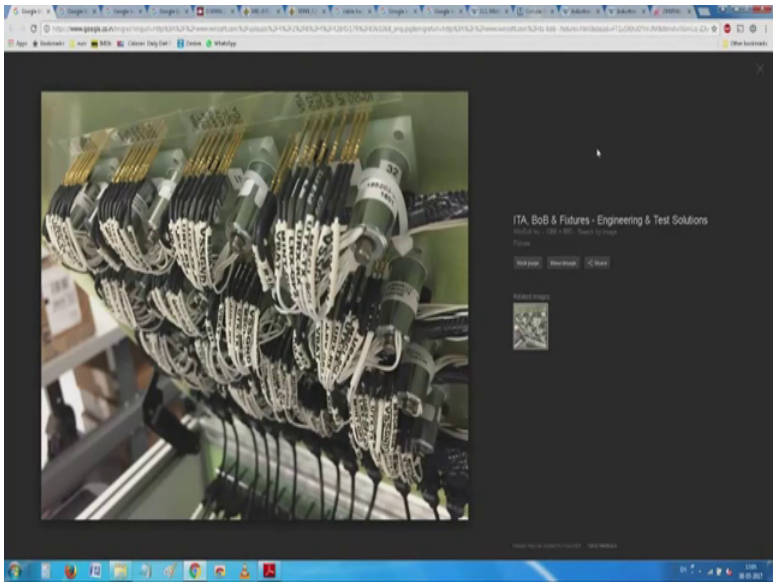

you see here, this is something. So, we have all these type of things know which will try to mat with each other and so on.

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And this is typically an old transceiver in my days that is 1970. They were very popular even today they continue to be popular except that if you see here now, while the packaging is outside and comfortable inside things have changed. So, this is at are r end as surrounded (Refer Time: 13:00) things of we have a various other thing. This one is basically a simple trans receiver, probably used in the high frequency range that is 1.5 to 30 mega hertz.

What is not changed is this connectors here, you have seen this. And what is not changed is these connectors and this is the (Refer Time: 13:25) type of thing you put a nut here and tighten it and then you see a small flat here they are all details to make sure the panel has been drilled to suit this and it sits in only one direction. This is the reality while in the military things are retested in their work in the case of the; while in the military things are verified and you have a test certificate. If you take a routine thing like a I will give you a dangling this thing.

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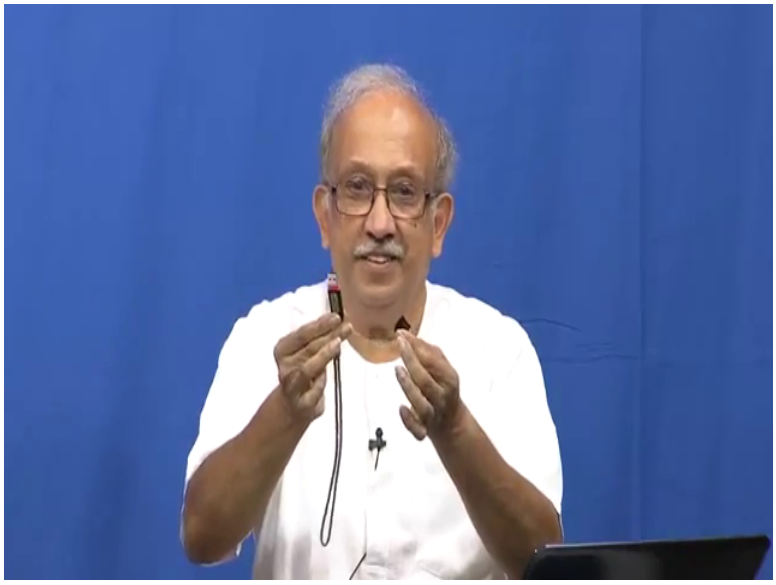

I am not sure because these are available for us know, costing very very small may be 5 US dollars; in my case know it will be around 200-300 rupees all the way to something else. But the beauty is while this is visible inside it is still a wonder in a way it works.

So, now I will move on to the next picture.

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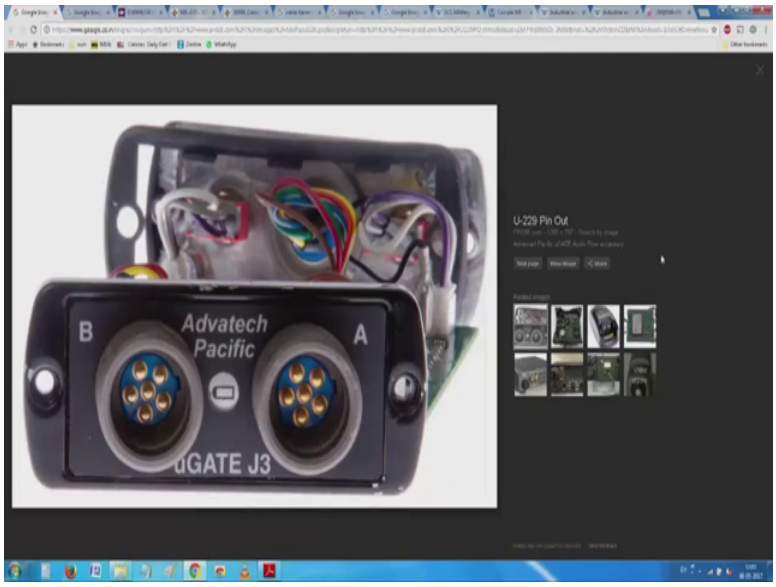

This is probably the inside view of the other connectors. So, you see here now you see the connectors; outside it is suppose to sit without the slightest.

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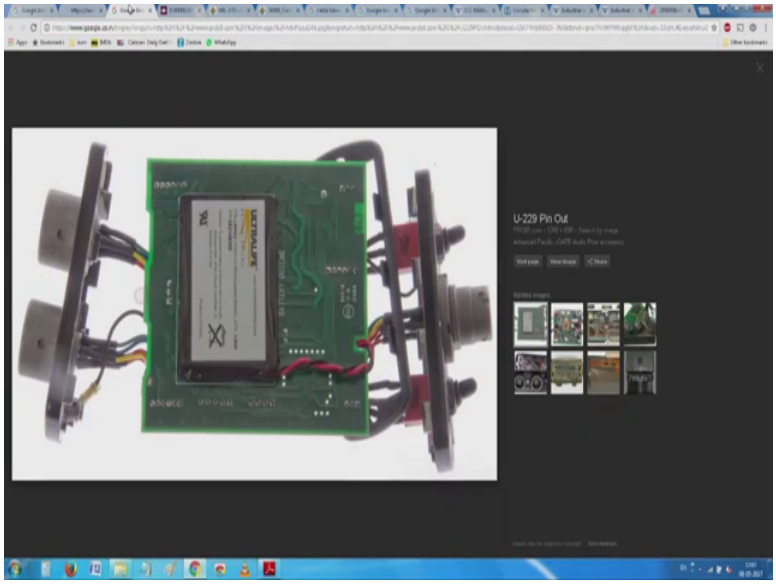

Misfire. So, this is probably that, I mean it is suppose to come up earlier from the thing at the behind. So, you see here we have I do not know what exactly probably it is a battery case and probably the battery case already comes with the some wiring and all that they wanted to show that this is reality; reality of this known. It does not load you are saved

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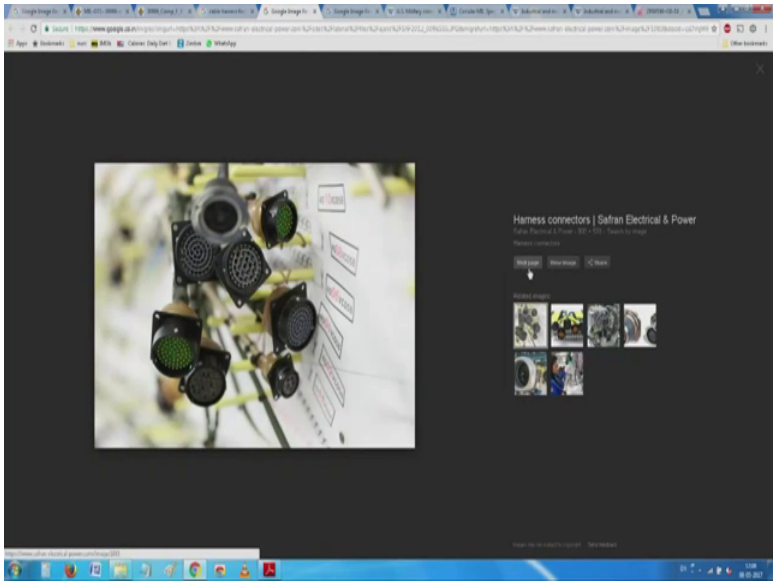

You have seen this, this is how typically industrial or signal connections or all given and terminated at the end of a long cable harness. Not easy I do not know if I can extremely interesting.

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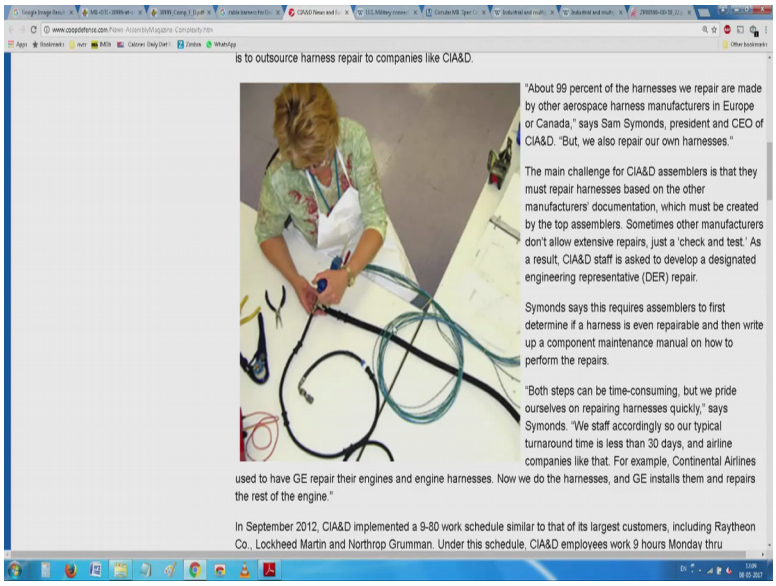

is to outsource harness repair to companies like CIA&D.

"About 99 percent of the harnesses we repair are made by other aerospace harness manufacturers in Europe or Canada," says Sam Symonds, president and CEO of CIA&D. "But, we also repair our own harnesses."

The main challenge for CIA&D assemblers is that they must repair harnesses based on the other manufacturers' documentation, which must be created by the top assemblers. Sometimes other manufacturers don't allow extensive repairs, just a 'check and test.' As a result, CIA&D staff is asked to develop a designated engineering representative (DER) repair.

Symonds says this requires assemblers to first determine if a harness is even repairable and then write up a component maintenance manual on how to perform the repairs.

"Both steps can be time-consuming, but we pride ourselves on repairing harnesses quickly," says Symonds. "We staff accordingly so our typical turnaround time is less than 30 days, and airline companies like that. For example, Continental Airlines used to have GE repair their engines and engine harnesses. Now we do the harnesses, and GE installs them and repairs the rest of the engine."

In September 2012, CIA&D implemented a 9-80 work schedule similar to that of its largest customers, including Raytheon Co., Lockheed Martin and Northrop Grumman. Under this schedule, CIA&D employees work 9 hours Monday thru

Design and a starting.

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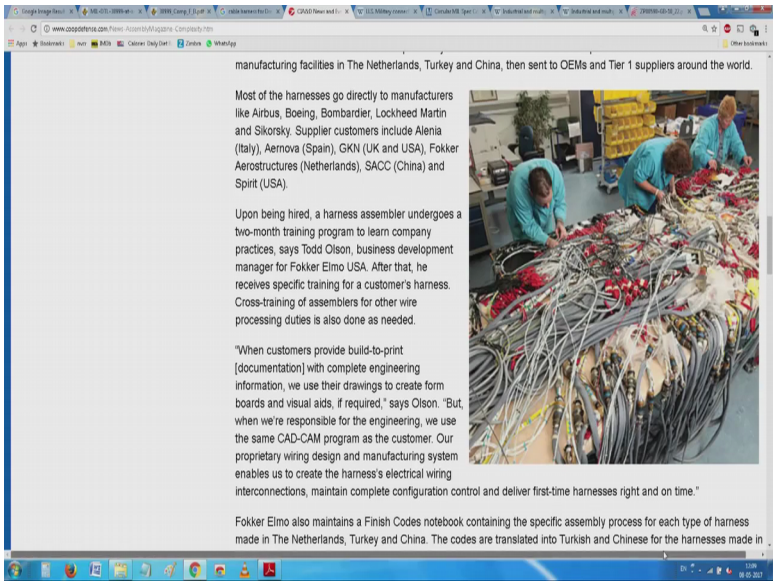

manufacturing facilities in The Netherlands, Turkey and China, then sent to OEMs and Tier 1 suppliers around the world.

Most of the harnesses go directly to manufacturers like Airbus, Boeing, Bombardier, Lockheed Martin and Sikorsky. Supplier customers include Alenia (Italy), Aernova (Spain), GKN (UK and USA), Fokker Aerostructures (Netherlands), SACC (China) and Spirit (USA).

Upon being hired, a harness assembler undergoes a two-month training program to learn company practices, says Todd Olson, business development manager for Fokker Elmo USA. After that, he receives specific training for a customer's harness. Cross-training of assemblers for other wire processing duties is also done as needed.

"When customers provide build-to-print [documentation] with complete engineering information, we use their drawings to create form boards and visual aids, if required," says Olson. "But, when we're responsible for the engineering, we use the same CAD-CAM program as the customer. Our proprietary wiring design and manufacturing system enables us to create the harness's electrical wiring interconnections, maintain complete configuration control and deliver first-time harnesses right and on time."

Fokker Elmo also maintains a Finish Codes notebook containing the specific assembly process for each type of harness made in The Netherlands, Turkey and China. The codes are translated into Turkish and Chinese for the harnesses made in

And eventually actually in the shop this is how I will say know very simple or complicated, this designs work about. Well it looks complex and you know common it looks like as if I am reading away some mumbo jumbo. The logical starting point continues to be still the schematic capture. And even if you take a thing like the cell phone obviously you have separate sections of it which can be separated. And subsystem to subsystem is where you need to specify a proper type of a connector.

Advantage of a connector is independently you can check the subsystem and replace it. If you know what is that fault quickly you can replace it and then down time the whole systems is very very small. If you are a hacker or a audio ethnologists part of the ownership experience is how to play around with all the things. But in the case of a serious machine critical thing the person who is doing the job the pilot or the what do you call astronaut or the industrial machinist or anything is least interested in the maintenance part of it; it has to work all time that is where in variably you end up with this connectors ok.

If you go down they have a large list of various things probably the next picture shows you.

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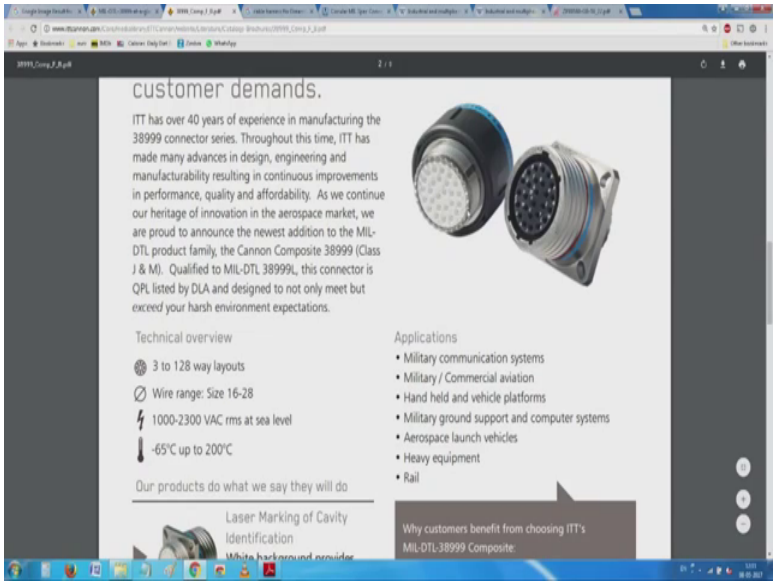

I just out of what you call choice, I wanted to just stop it here. You have seen here there is a small ferrule or some teeth like thing. The idea is one something measures and sits inside after that it should not rotate and create problems. So, we have all these things about how to mark the numbers and how to make it and military commercial aviation vehicle platforms and all these know invariably people use this type of connectors. So, I could not get a picture of it, I will just stop this here I will come back to something which is a.

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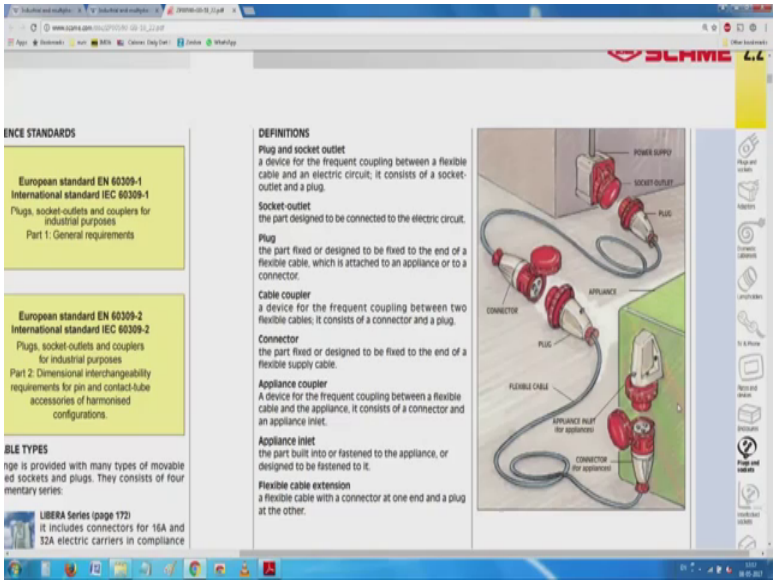

This industrial plugs and sockets: if you have to come out and see those huge public performances by bands then musicians singers, lip sinkers and all that one of the thing is here the equipment needs to be ragged, because we do not even know what environment it is. The very simple thing I have talk to you about the XLR connector XLR is related to the audio and mike and all that thing because that is the thing. Second thing is the video of vid; video of vids have their own you know type of you know type of connectors eventually now we have got into HDMI. Earlier we had the three pin of flat cables and so on.

Conveniently we have forgotten about the power and (Refer Time: 20:14) demands are only increasing. So, if you see my this thing here you have seen this fantastic we have wall mounted socket here, there is a plug again that old role which I have talked to you about saying generally power is taken out of his sockets why I plugged. So, this one is more like an extension cord. So, if I plug here, which plugs in here and then this is a connecterent plug which by definition have been made such they inter lock with each other.

And then other and again something which is very similar this and this are the similar again. We have a flexible cable goes back into a connector which goes to the inlet in this case loosely they have said appliance it can be anything. If it has to be removed regularly you will have this site of a wooded thing otherwise avoid in this pair directly this wire is probably taken into the equipment and wired inside. This is a must everywhere.

And what happens when you are not using these connectors, you have seen that each of these connectors come with a beautiful cap. That cap completely closes and shields the for supply from two things. Imagin, similarly here even the socket has a cap you have to press a button and open it, then once you push it inside this joint is guaranteed. Now unfortunately other hand becomes expose, so there is also a cover on this here. Same thing happens in the case of this plug also in here it is this unit does not seem to have it, even plugs you know usually come with a cover on the other side.

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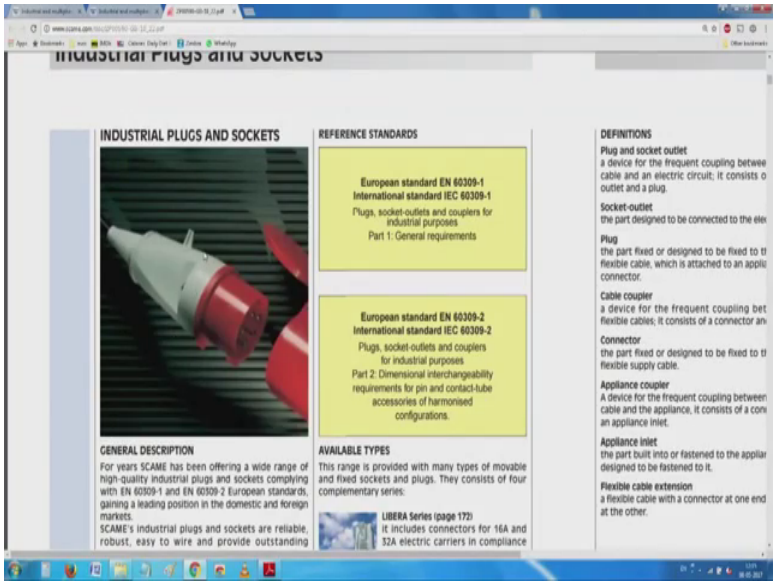

You seen this, this is typically how this industrial plugs and sockets come. And the core of it inside if you see is still a contact pin and a contact socket.

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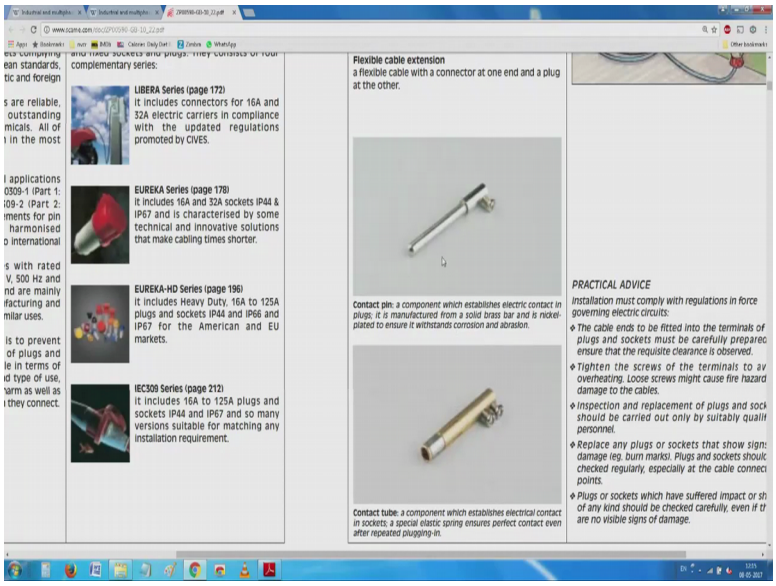

So, all options are there. One of them this is split and then it has a spring sometimes this is split and it as the various things here.

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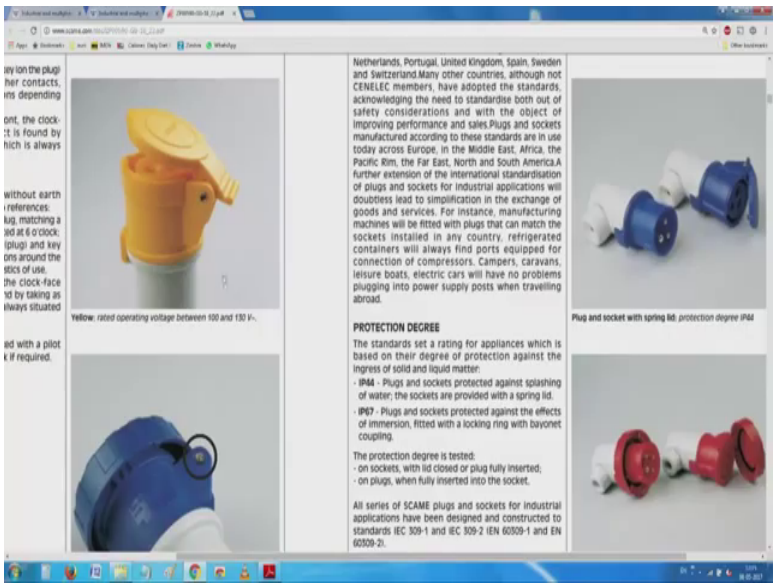

See here, as we go here we come into interest thing you see here the socket end has a cover and then there is a small button we press and open it. And here they have given know this is the plug and this is socket both of them met together. Once they met together they sit completely. So, here know even color coding lot of grand details how what mades with what and all that know they have been given here; in the right.

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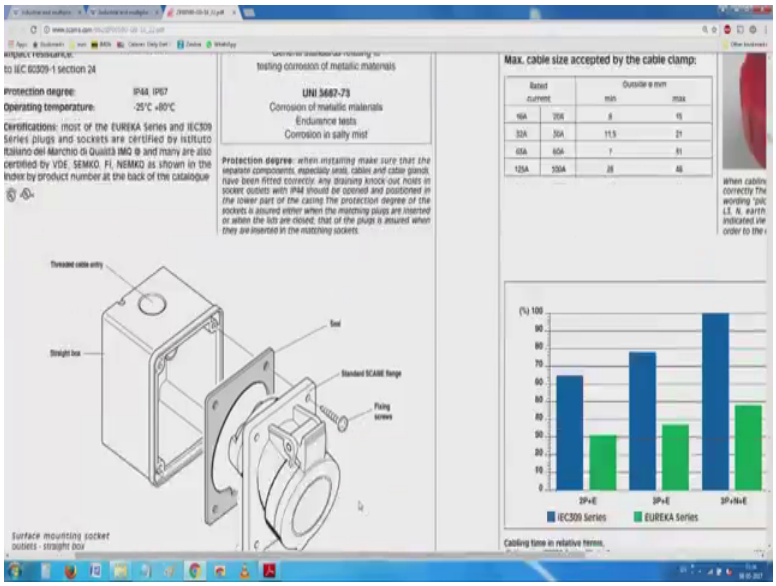

This is the drawing I was looking for you see here. So, we have a box then we have a flange.

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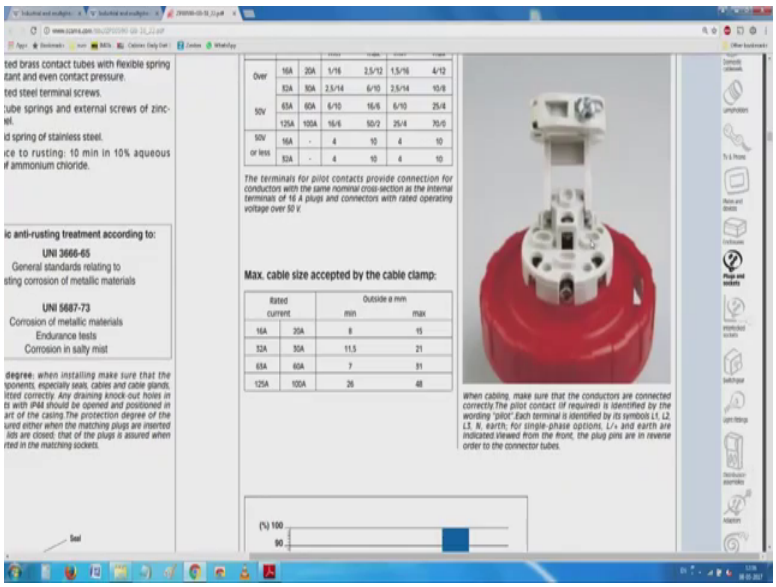

In the back all versions are available, some of them come with a wood which sits and top of it, conductors are connected, so there is a again second one strain relief. And then you see here these this contact blog is quite a lot like what you will find inside your other equipment; I mean they are household things know. I showed you various other things. So, you see here.

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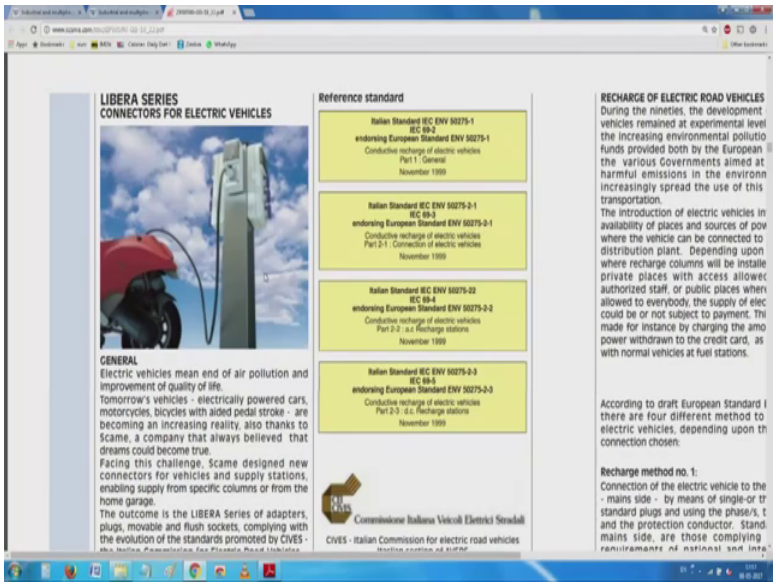

As you go down you seen this, time has come even for electrical vehicle. They have standardized those things. So, the cable end of your vehicle also is you know covered and then the one on the wall is covered you see here.

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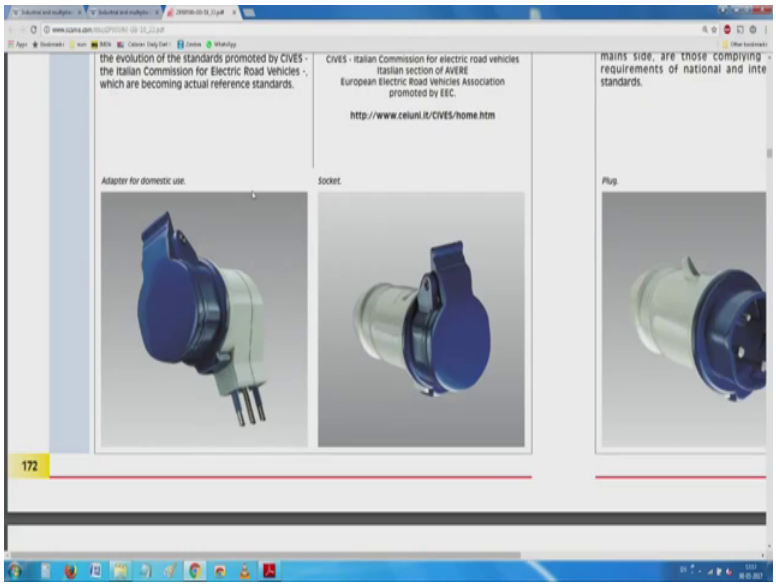

So, many things, domestic use adopter you see here: it could be cables here and then you see all of them knows a socket and then you have a plug system. Sockets which are flush sockets which it is a beauty know how to charge things and all these. So, it goes on and on and on like that. So, you have also you know right angle once, and then you have

straight once and there are combinations which are slightly at an angle which helps things and then you see here there is bolt it is a 90 degree bolt.

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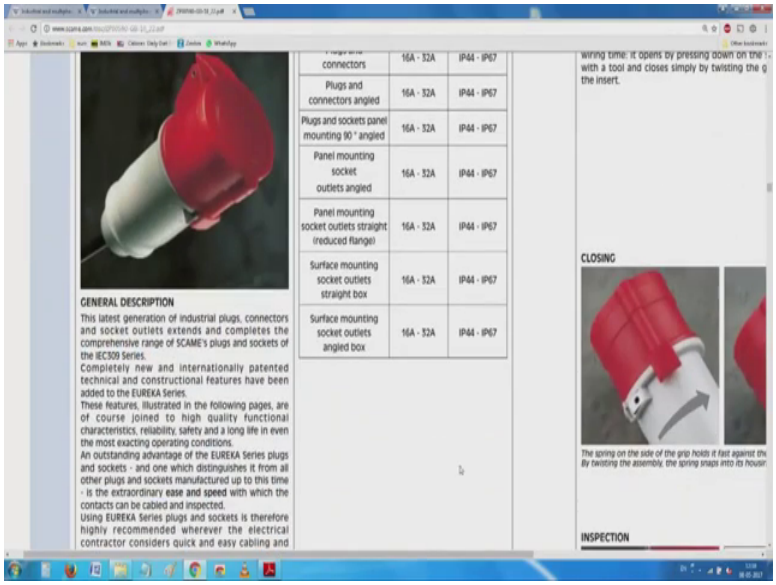

Then there are adaptors so. And in fact, if you see this, this mades with another plug or a socket depending on the contact arrangement inside and those covers do not come in the way which is one more feature depending on the manufacturers and all that which is somehow know something has gone into the manufacture of it the one variant t they was shown here. You see here you open it you attach to this here.

Why I am stressing in this is if you remember I showed you that very dangerous cloths iron press where the threads are exposed. You cannot effort to have it in an industry. One is obviously safety another is down time both the equipment down time as well as see here. Anything you can look for, anything you can think of probably it is available on the in the manufactures catalog. Only issues again you have to be patient, look in the catalog carefully and then make sure that you order the correct item.

So, I will just now mean allow me to go through a little faster. So, we have all sorts of normal flange, angled outlet, straight outlet. And then you see these ranges 32 amps very very large selections of these are available. Beyond this of course, generally you know let me just go through it. And main important thing is you have an angled box full nineteen degree little straight.

Occasionally you may even find them in professional setup like what we have here on the walls everywhere and the ubiquitous adaptor to make sure that this works very well. And in fact, this air conditioning people and all insist that we do not used on normal what you call 15 and 30 amps plug and socket that we actually use this I am with them avoid using the what you call domestic plugs and sockets.

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Now, you see here now this comes with pictures. Did you see? We have a beautiful remainder which we keep looking at all the time: 44, 66, 67. IP 44 is not even is splash proof, but if you direct I mean or in some angles know the water can get inside. But when you come to IP 66 and 67 even the contacts and sleeves are very carefully protected. So, that most industrial machine tools and all they are expected to come with these type of things here. This is what I was telling you, when it is not in use you have a cover which keeps it covered, and depending on various type of.

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Here you have seen this here, in this case they have just provided a gasket that gaskets seems to make sure. And then you see this we have a he calls it cable grip something which squeezes the whole thing and holds it hard which will prevent leakage and strain relief. So, along with strain relief you also get this sink here. You see here very you know nice beautifully. It is not even just safe just call it saves our lives. In the unlikely case of any time you trying to l pull something out of this socket it will not come out easily.

So, you have all these I think I should not spend except that you have seen this know.

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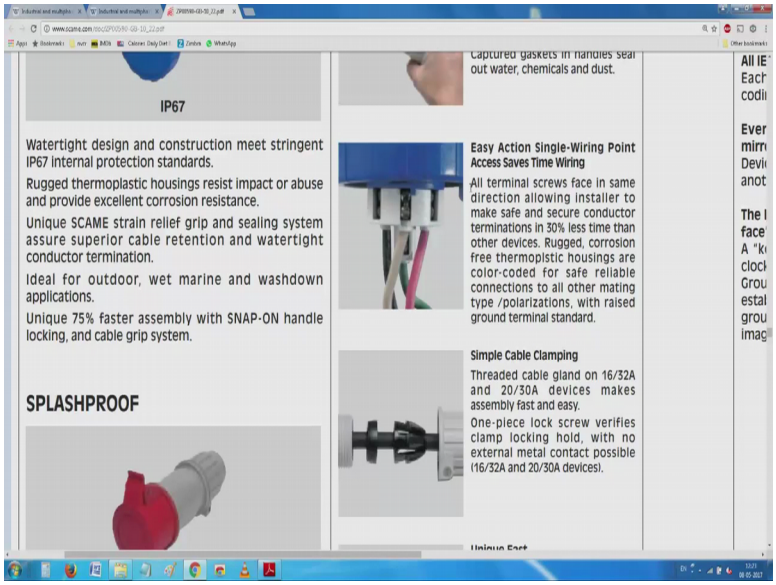

We can directly turn the what you call skin the wire push it inside and then assemble it

using a standard screwdriver. Alternatively, the ends of the wires can be crimped or even soldered with another small plug. If you put it inside normal course to make sure that connection is fast. You seen this is finally, when both of them are water tight spring loaded covers.

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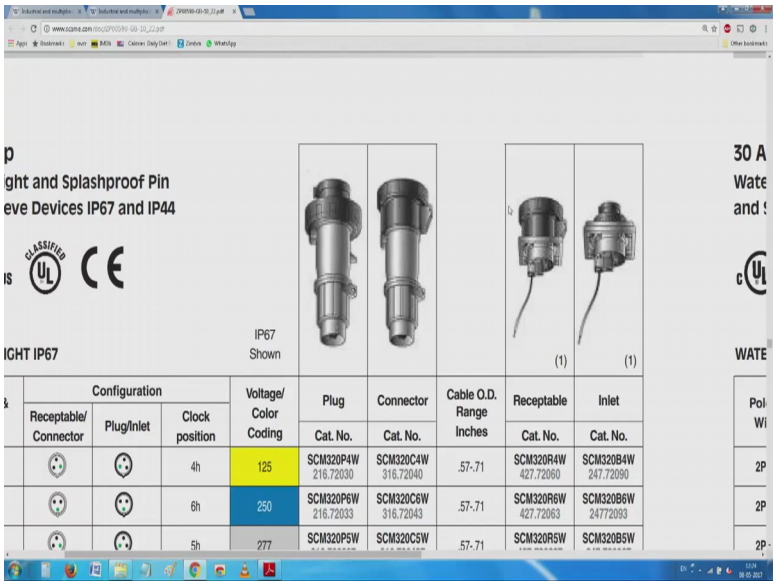

I suggest you take a look around next time when you go to a fabrication shop likely that you will find it at least the place I work here all of our machines comes terminated like this. So, we have plugs, we have connectors, and this is a very very long thing. Allow me to go through a little faster.

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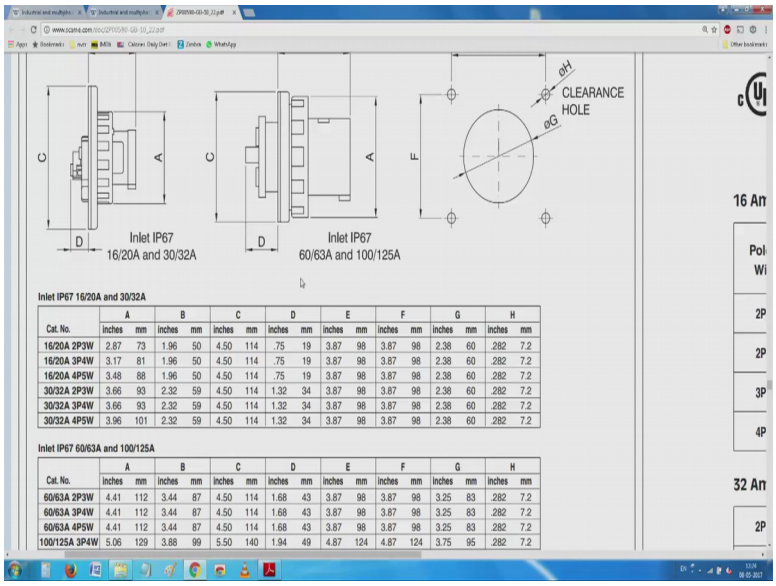

We are coming in to the critical part of reading a catalog. At first part of the reading the catalog was about what are all the contact arrangements and all. The second part of it is where each type of material what you order you have seen the dimensions what is the maximum depth from the front of the panel and then what is all this end more than anything else mounting holes.

These days like us if you are lucky, if you have a printer you can plot all these,what you call various type of the drilling detail here. Take a one is to one printout and you can check. In fact, you can use it like a marking template which we have been doing for a lot of times. So, if you go down you will see that the every detail what you want is already cataloged here you seen this here. What is the clearance hole, what is the diameter, and then the since we have become what you call metric you see that the moment it 5.5 it generally means that an m 5 screw or m five fashioner set will be ideal for these things.

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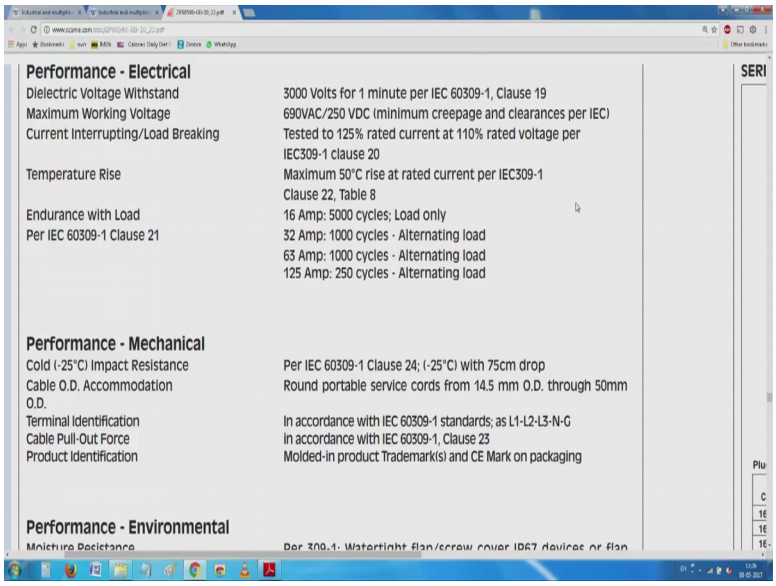

So, you seen this; electrical and mechanical performances are guaranteed, working voltage current interrupting a load breaking. 5000 cycles is directly endurance with some type of load alternating load means AC current haply we can break AC current. But there are little problem with a DC; DC tends to arc there is no arc quenching automatically.

So, normally things which are rated for AC need to be de rated or preferably not to be used. And then you see these even load break know they have given thousand cycles. But you should understand that a few 100 are already probably used up in the factory in testing and then during installation and so on. So, you need to de rate or make sure that this many times only we will be able to use it.

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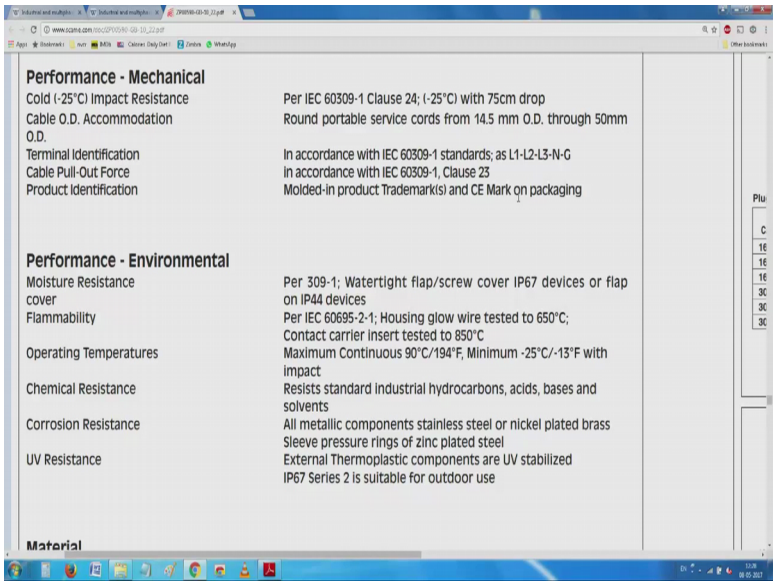

Performance - Mechanical

Cold (-25°C) Impact Resistance	Per IEC 60309-1 Clause 24; (-25°C) with 75cm drop
Cable O.D. Accommodation O.D.	Round portable service cords from 14.5 mm O.D. through 50mm
Terminal Identification	In accordance with IEC 60309-1 standards; as L1-L2-L3-N-G
Cable Pull-Out Force	in accordance with IEC 60309-1, Clause 23
Product Identification	Molded-in product Trademark(s) and CE Mark on packaging

Performance - Environmental

Moisture Resistance cover	Per 309-1; Watertight flap/screw cover IP67 devices or flap on IP44 devices
Flammability	Per IEC 60695-2-1; Housing glow wire tested to 650°C; Contact carrier insert tested to 850°C
Operating Temperatures	Maximum Continuous 90°C/194°F, Minimum -25°C/-13°F with impact
Chemical Resistance	Resists standard industrial hydrocarbons, acids, bases and solvents
Corrosion Resistance	All metallic components stainless steel or nickel plated brass sleeve pressure rings of zinc plated steel
UV Resistance	External Thermoplastic components are UV stabilized IP67 Series 2 is suitable for outdoor use

Material

So, mechanical: nice know, 75 centimeters drop impact resistance. Typically 75 centimeters is your work table height. So, a something should fall from the work table height no permanent damage can be allowed. Means say functionally should not degrade: minor chipping and minor what you call D figurement can there, but they can with stand probably and since IEC has been given here so obviously, the number of drops and all that is very very its all controlled carefully in this condition. What looks like very simple is not as simple as it comes down, ok.

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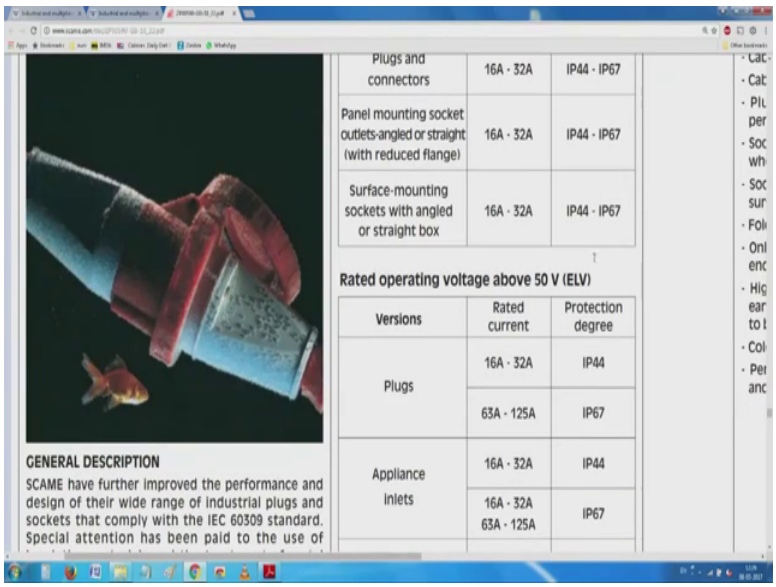

Plugs and connectors	16A - 32A	IP44 - IP67
Panel mounting socket outlets-angled or straight (with reduced flange)	16A - 32A	IP44 - IP67
Surface-mounting sockets with angled or straight box	16A - 32A	IP44 - IP67

Rated operating voltage above 50 V (ELV)

Versions	Rated current	Protection degree
Plugs	16A - 32A	IP44
	63A - 125A	IP67
Appliance inlets	16A - 32A	IP44
	16A - 32A 63A - 125A	IP67

GENERAL DESCRIPTION

SCAME have further improved the performance and design of their wide range of industrial plugs and sockets that comply with the IEC 60309 standard. Special attention has been paid to the use of

We have this IP 67, which will work under water the moment you connected it make sure that the things do not work; I mean I am sorry since do not degrade and continue to work as before.

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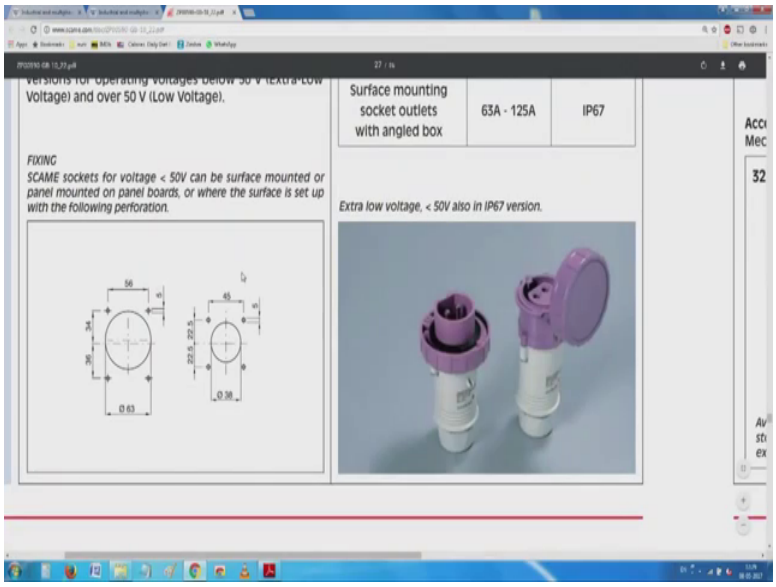

And as before you may be wondering why does something have to be underwater. I am sure some of you have seen all those water burn things this swimming pools and all are dangerous nobody normally uses these thing there, but any under water lighting. And in the case of industries, wet industry, chemical industry and all that even your food processing and most oil extraction everywhere liquids are real. So, as though these are expensive may be cost 3 or 4 time the standard thing people continue to use all these extensive things.

I will stop here, when you get a chance look through the catalog.

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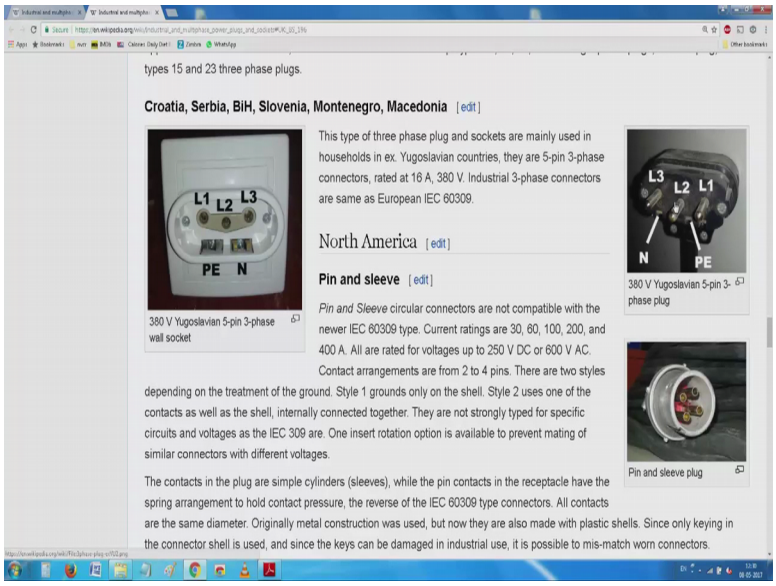

You remember that a cordless iron press which I would try to show you pressing iron which I showed you if you look at in these pins and all these now they look a little like probably taken from somewhere.

So, it is possible for us to have a socket is the end of cable and use that cordless device as a coded device. So, if you go down the way have know so many types of these configurations for these sockets. You have seen this: stage lighting, stage pin connector, stage lighting in the US. So, we have nonstop I can keep going down I think I will stop here, and show you typically lookup the Wikipedia and look at all these pins and sockets. Once upon a time these are all made in metal clad flush mounted, but now there is a little bit rare instead we have wall mounted sockets which are used extensively. This is what I have gone through.

What I thought I will do at this stage is that give a break here.