Enclosure Design of Electronics Equipment
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Lecture – 33
Testing for IP class

The second thing talks about the second digit talks about water.

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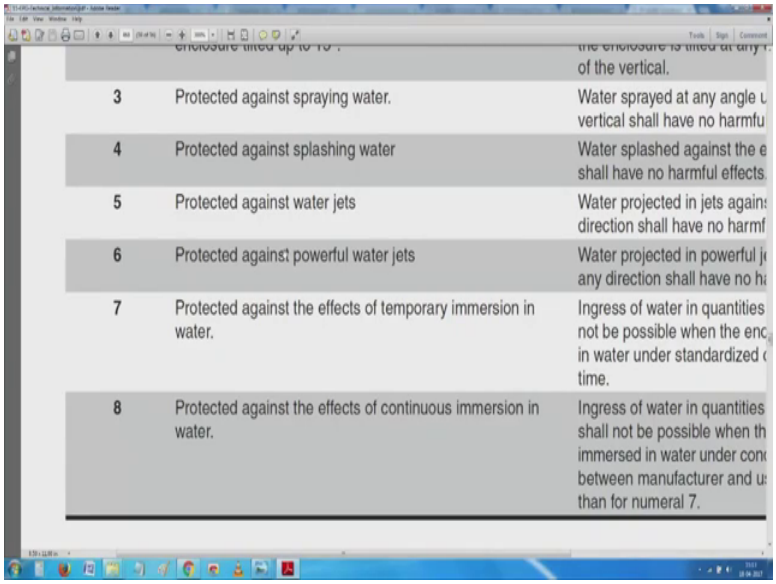

Protected against powerful jets of water is what you have seen just now, that was a IP 66 enclosure being tested an outside things. Do ever faces situation like this yes if you see your car, the car has a engine management unit. So, that engine management unit needs all this testing and two things are happening there. It has not just about water during cleaning accidentally things can gets plashed remember it has rotating machinery inside, you have belts and you have an electrical fan, and imagine there is a leakage from the either the coolant leakage from the so called radiator is instantly does not radiate it is just a heat exchanger. Now there is it a condenser it is a simple heat exchanger.

However if you have a air conditioner that second part is a condenser with what you call circulation. Imagine by some error if any of those things get out into the atmosphere leakage and all that and then it sprayed by this. So, all this spray is real. So, it is not a while is not a directed jet of water, for various practical reasons you do not have an under (Refer Time: 01:56) cover in the engine bay for any of the cars except my very expensive

cars. So, when you are going underwater anything, any splash puddles everything all of it gets sprayed into the engine. Bay engine bay is not very much protected because I said it is not an easy way of protecting it. So, the second I am sorry here the second thing here is one is about the temporary immersion in water continuous immersion in water which is likely to happen for various things. So, I would like you to have a look at my watch.

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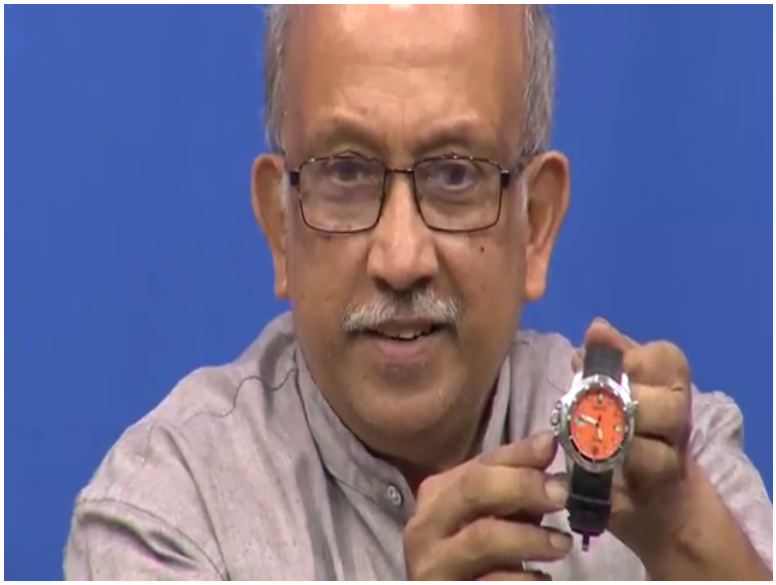

Good if my operator can zoom you have seen this except for that weird color this actually a waterproof watch. One of the first thing is there is a bezel here which tightened from top and you see there is a protected for this what you call time setting knob, the small protection given and you need to unscrew it pops out only then it up min the operation start, after that I kit it back and then I turn it over. I will see if I can show it to you here, but I suggest you go to the any catalogue of any other manufacturers and then you will see here. Now see here if I turn it pops out once it is in this condition I can further pull it out, and then it just all the thing I want to put it back I just tighten it there is a gasket here which ensures that it sits perfectly. To fit this crown or front bezel I mean front glass they have put a separate ring and this is standard thing, every where you seen any of your watches have this is back cover, and then this back cover has the other stampings and so on.

So, very routine what we use at home all the time why I am saying it, it comes under be IP 57 category. If it accidentally falls in water nothing is likely to happen and by mistake

if you walk in the rain it is not stop working, it will continue to work; however, you cannot use it for diving or staying underwater. So, dievas watches are different though people like to show a fashion statement by wearing mariners watches and aviators watches and dievas watches, a dievas watch is specifically designed such that even if you are to throw it under water and keep it there for quite some time nothing will happen. It may another battery there is a separate problem may stop working when you should bring it out and clean it probably it will start working I think you know about that shipwreck movie know.

So, unless you shutter it you can get that watch working. So, we continue immersion in water typically relates to underwater equipment, that is much much much stricter and higher imagine you have a underwater cable which runs all the way almost at the bottom of the ocean. We have repeat us once in awhile what is normally done is to employ this thing is, if you do not need to touch it just throw it on the sea bed if you need to do something make an arrangement by which you can bring it out as an extra looped cables and all mentioned you can take it out easiest thing what you can see is they immersed lighting which you find in swimming pools, ponds and lighted fountains. So, there it stays underwater, two or three things you will notice about it saying it should not be costly. If it is military equipment though no issue they can do whatever you want and I will show you another instance where how it is handled. It is a non military this thing once in awhile when the lamp burns out or anything you should be able to take it out repair it again.

And when you attempt the repair original condition for which it was designed the is if IP 67 it should continue to be in IP 67. So, related very much to this is the stuff about

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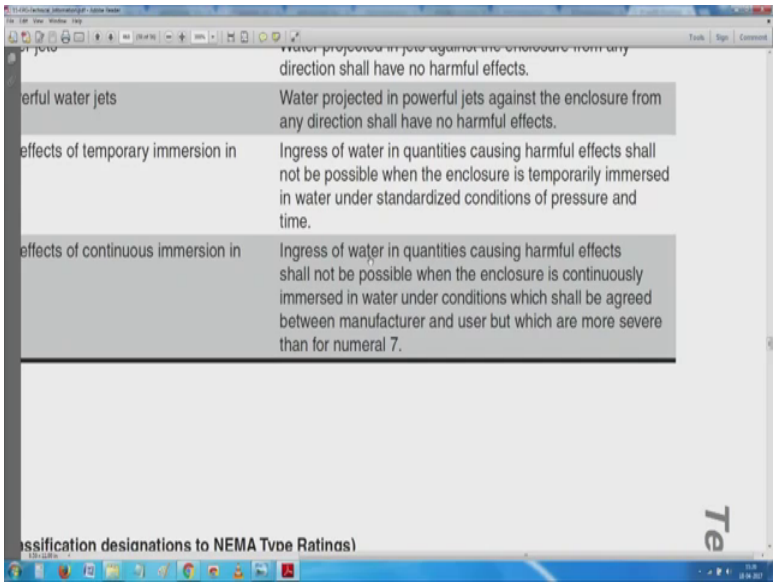

how does it standard water and how will do you see the about the harmful effects shall not be possible when the enclosure is continuously immersed in water under conditions blah blah blah and so on So, we have here something is which are 68 you have seen this know temporary and this is where I was trying to elaborate and what I spoke to you a little while back.

So, not easy, but it is done yet now one of the things.

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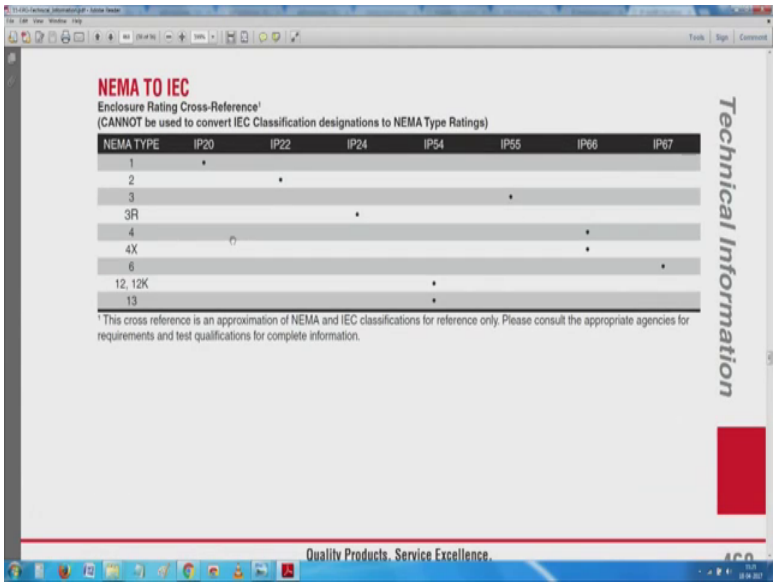

You see that they are seems to be some correlation if you see non diagonally moving down at one type IP 2 0 has nothing and then if you come to here IP 67, you have seen this no for x type of enclosure have this and then we also have explosion proof, you have gas proof which are special details.

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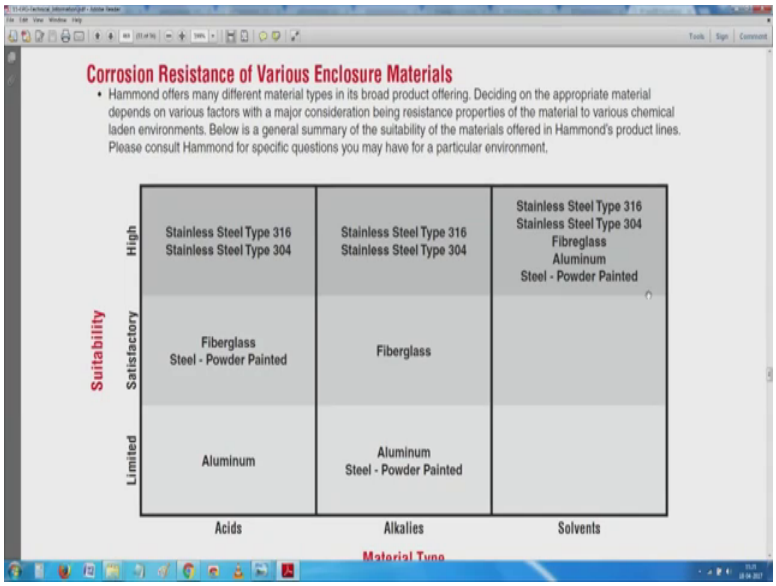

We come to actually an important not mentioned issue about long term. When we talk about long term we talk about the material verses suitability for a period of immersion. At home you would have seen various things like your coffee kettle, coffee kettle the water has to boil. So, it has to be just a little about the boiling point. So, at sea level at least nominal it is a I have 100 degree centigrade, and the water continues to boil at 100 and then anything related to that including the heater the enclosure the lid everything supposed to withstand that and by mistake if any water leaks into the equipment the electronics nothing should happen. So, I have two of these devices next in the next lecture I will try to show you that devices next tomorrow which is from this thing.

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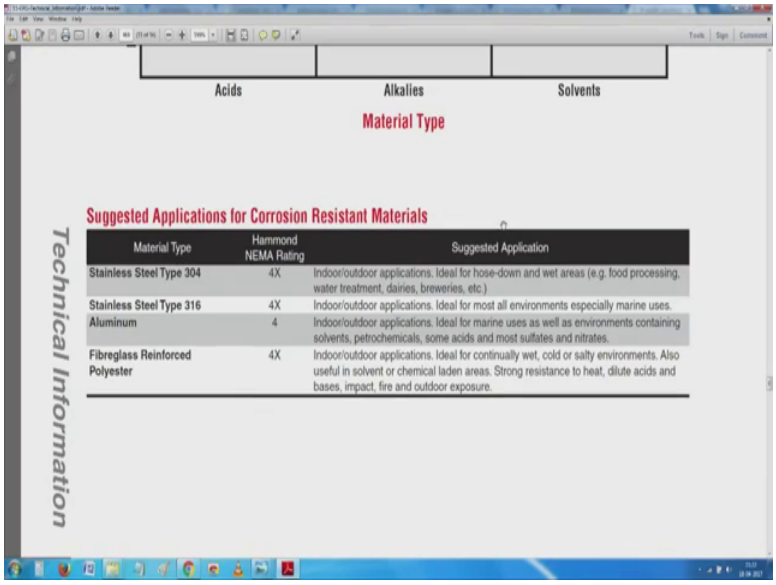

Now, if you go down here obviously, there is numerating associated with you have seen this material attack by acids, alkalis and solvents. Obviously, basic material is not affected that much by solids, but then see about the various types of coatings which we put on top of it and gaskets; gaskets a serious business the slightest problem the first thing that is likely to give is affect to the gaskets some of you have had automobiles in the past will notice swelling of old natural rubber with patrol. So, wherever there used to be a petrol cap, it came with you have this petrol cap underneath that you have sill like thing, which is actually punched from a rubber sheet.

So, this the rubber sheet once you put it on the petrol cap and then you fix it overtime you will notice that two things happen one of them is it turns add otherwise it swells. Swelling is it becomes a little bigger. So, you need to change it fortunately now we are in the what you call plastic sage. So, you have some or the other polymer materials including silicon, including butyl rubber, nitrile butyl rubber all this materials so, not swell as much under standard conditions.

So, while if it is a external thing like a petrol tank you may lose a little bit of petrol is evaporation or anything imagine when you have to work with body worn things they say hearing a did is molded auto special material.

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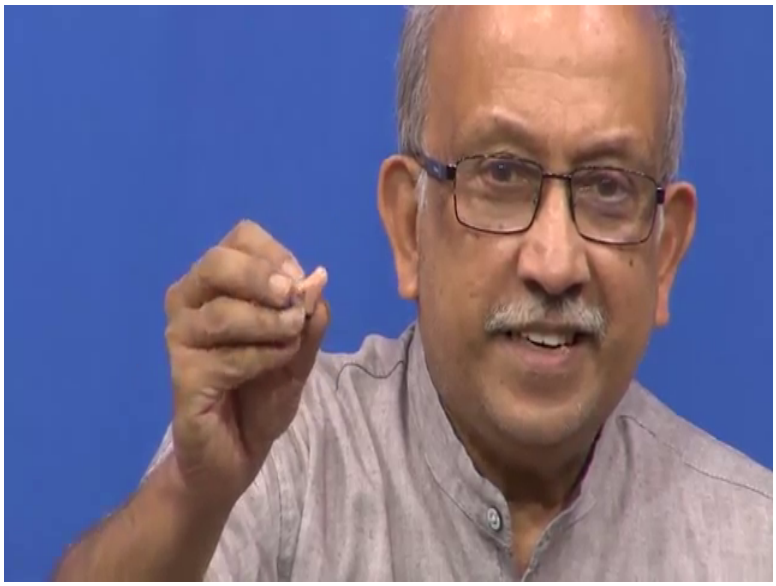

I do not know what material it is, and it has to follow strictly the contour of the ear canal, outer the ear canal it does not go to the inner ear canal and then it has tremendous amount of electronics and things built onto, it cost money of course, it cost 999 dollars, but it is good and electronic and enclosure body warn, I should not be allergic to it neither it should get allergic to me. So, see here we coming back to here we come to paint finishes and powders how to deal with all these nuisance over a long time.

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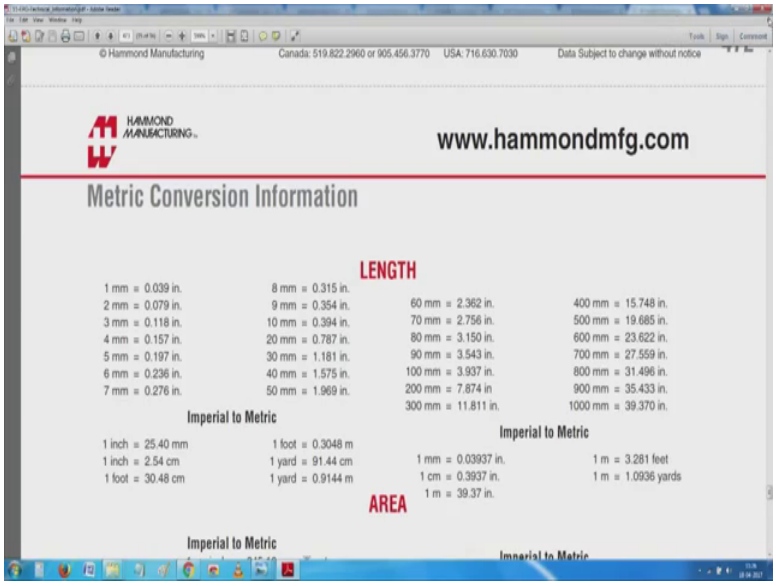

So, we have here touch up spray can and all that there is not anymore relevant for this discussion. So, I will just close this here.

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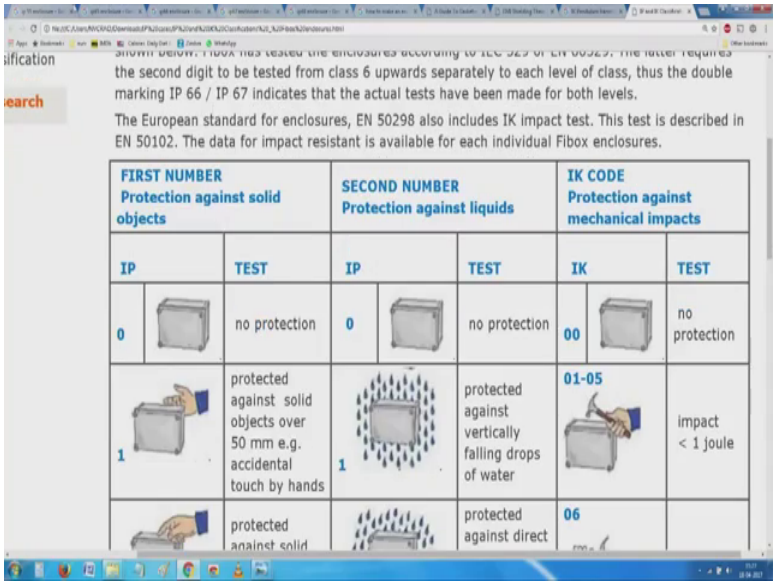

There is a EN 50298 which also covers mechanical impacts of equipment, that is the reason we still have metal in place and so, is the reason we also have plastic also in place plastic meaning all the impact resistant things. Please have a look at this old thing what I wanted to show you.

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Remember this l e d home light no issue with it at all except that this is not made as an outdoor equipment. So, as such no Indore even if accidentally something falls inside it will not create much harm, let say you keep it for reading or you keep it as a night lamp and I do not know normal water or may be fruit juice and anything falls, nothing will happen and this seems to be reasonably protected. There is a leap here between these two that leap ensures that nothing will go inside except for a small are no this is all even the hook to be kept inside does not affect it seriously; however, what comes with it is the solar panel.

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This solar panel by definition has to withstand solar heat and then radiation all possible radiation wherever useful energy can be what you call recovered. So, it has a glass in the front not glass actually it is a special filter and then we have the silicon cells and the normal condition they have provided sufficient protection.

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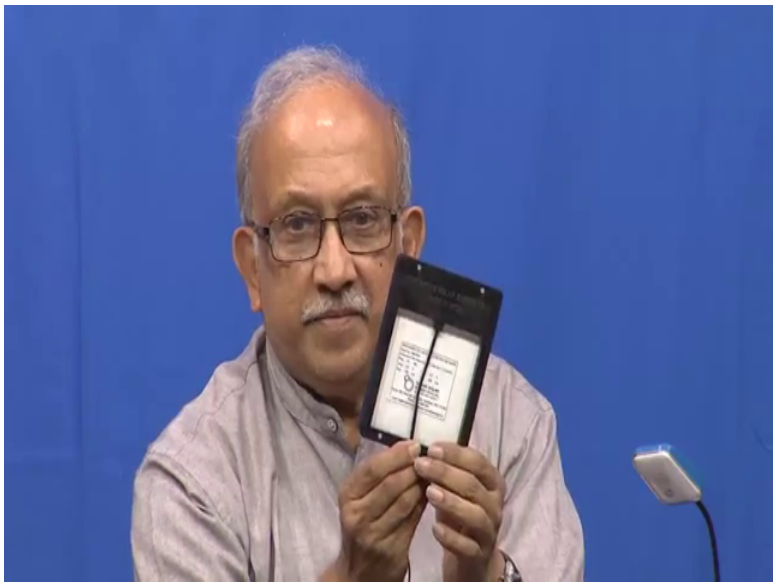

So, that if you are to keep it flat even accidentally if it gets flooded with water nothing will happen it also comes with a small rubber case to make it next level of protection that rubber cases a little like what you are likely to find on top of your mobile.

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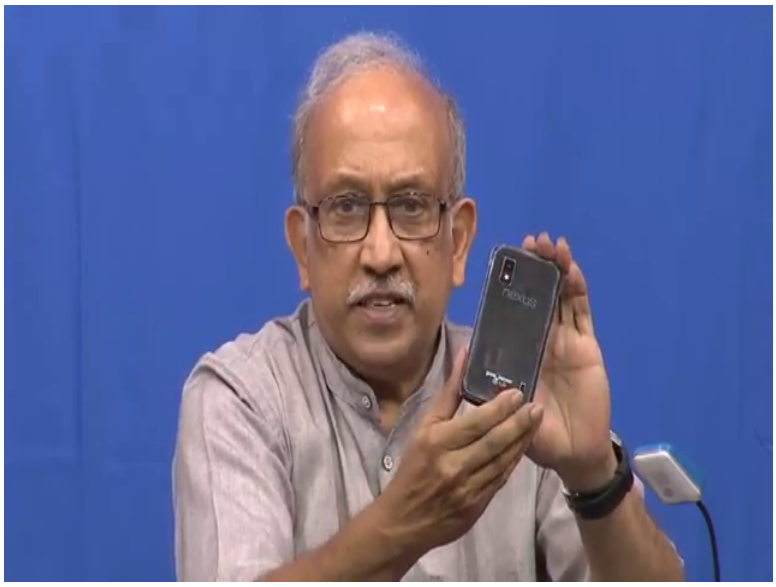

I had removed this last time when I have showed you I had removed this case now you see that this right now is not flexible. But you have to make something a little more flexible and something which grips hard, you can make it practically IP 55 rating and if it is next level we can even make it higher. So, if you see part of this equipment Indore has

the normal I will say IP say 43 or 42 or 44 no harm. Even if it were to accidentally fall into your bathtub no problem, we suffer from power outages here. So, you can even put it in your bathroom no problem. So, in your toilet when power fells you can still use it this can go on top of your house with it full protection or in a wall with oriented towards the latitude of your place.

So, in our case Bangalore is thirteen degree. So, if you oriented at thirteen degrees and generally leave it little enough of energy is there which will charge the battery. But however, you said it is a two piece thing and then well it was nice talking to you about how to make it whether proof and all that you see here we still end up with a funny grommet probably the weakest point in the whole leg as if the chromate were not sufficient other end of it.

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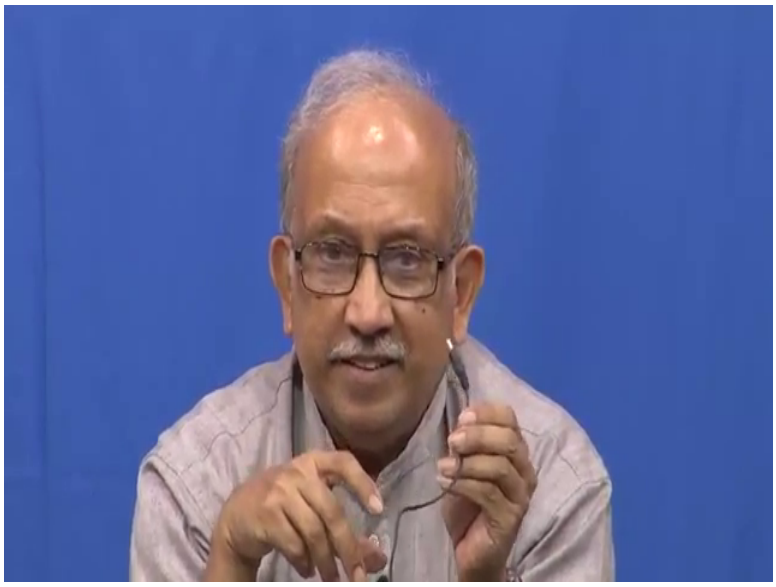

We have the classical I think it is a two and half mm or something socket best way of describing it is cheap if you look at it will stop working good ones are made with proper molding here and proper materials. So, at both conditions even if you leave it outside or when you plug them inside in the presence of moisture and water they do not corrode.

That is the reason why all our professional equipment or XLR connectors and all little costly, gold has two properties one is purely decorative when you buy a gold plated audio plug, I do not think it really makes a lot of different towards more of decoration.

Good part is the electrical conductivity is stable for a very very long time all you need to do is may be wipe it and then put it back it works without any problem.

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The same equipment in this case now one child one light somebody one this is I mean it is not as fashionable as vitamin d or other vitamins, people are there trying to help. So, they give it to the children as an incentive so that it has a there is a little bit of novelty in it. And the other thing is people can carry it home at the back you have a full lake molded and embedded solar panel, it does not have the filter what I am talking to about instead this comes with an epoxy.

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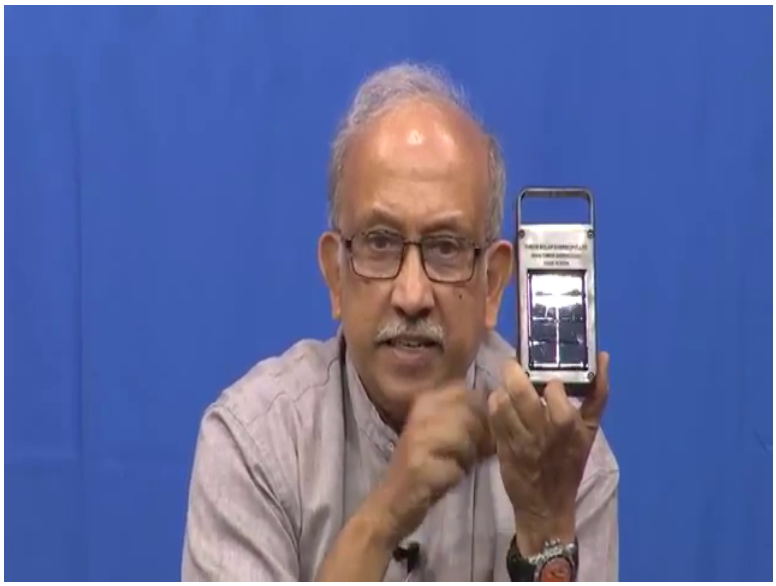

This whole thing can you see I am showing the shining. It is embedded in an in a special epoxy which of course, compromises a little of the total light gathering capacity maybe the light gathering comes of wave around 70 percent.

Practically anything proof. So, child can take it may fall into a puddle or at home it may get flooded, but you have an example of a beautiful equipment and then even here there are four screws before fitting the screws there is a stand of there is another point which goes into that which there is as got a taper. So, once you tighten it no chance of any water going through any of these things, and intentionally they have avoided any levers any threads anything at all from this such that it works and this I will put it in the category of a genuine useful IP 57 equipment, except that under the I K classification it will not pass this third digit it may not pass understood no this hammer here is shown more as an allegorical representation.

Saying if you were to take a hammer and heated they have given a joules this hammer is not the what you call oh it is not a ball pinup ball, it looks like a claw hammer standard claw hammer it does not look like this actually because the test conditions are to specified, but then this whole picture no nice to see have a just have a look at it, I am sure you will appreciate first this thing no protection at all from your hands protected against solid objects, second about the water up to 15 degrees from the vertical you will see here it straight it is and here 60 degrees from the vertical limited ingress protected

against water spread from all directions limited ingress meaning it does not lead to a harmful condition.

This third one is not immediately related to that, but it is specified occasionally is a standard hammer just for you have a look at that hammer. This starts with a what you can average hammer and somebody can you know hit between two joules after that it is getting into bigger and bigger hammer see this is standard 1.500 gram hammer and it become a big hammer 1.7 kg.

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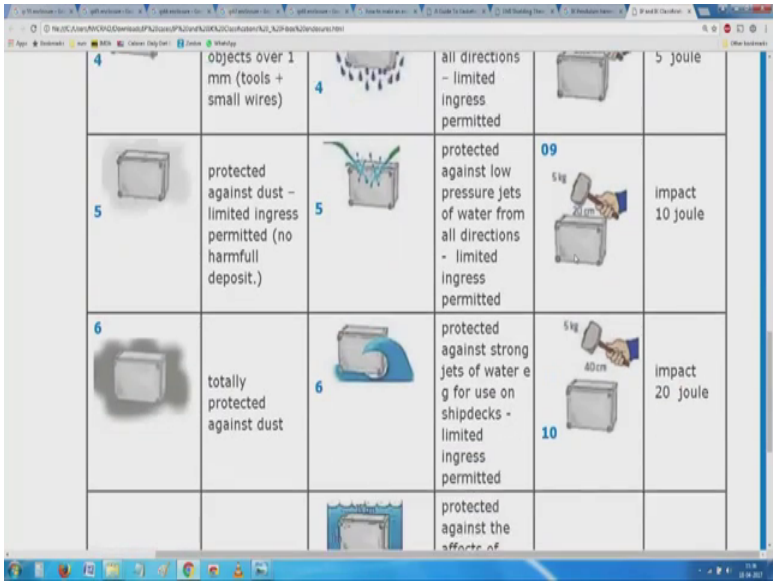

It becoming 5 kg and then the height width wage it falls.

So, like our helmet test there is actually a standard hammer, it has a given mass and there is a machine which uses this for testing.

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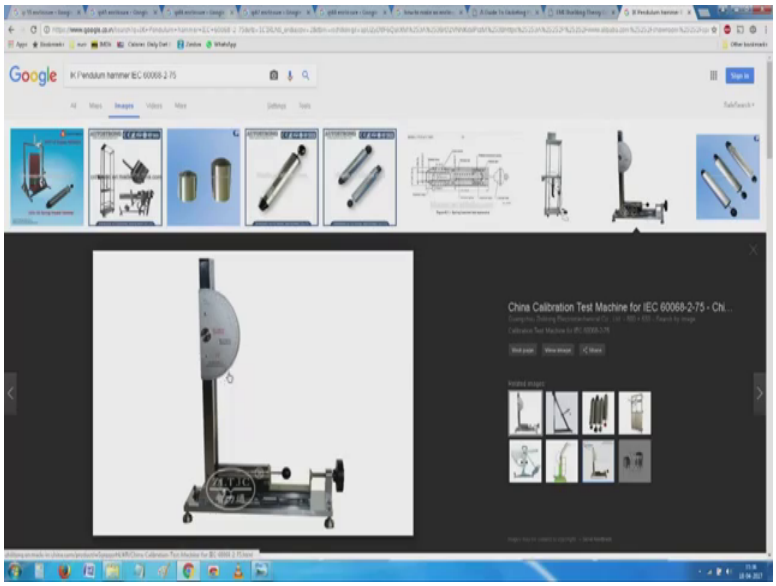

So, as you go down we have all this beautiful way of checking the thing so this is typically an equipment manufacturer you have seen that there is a vertical plate.

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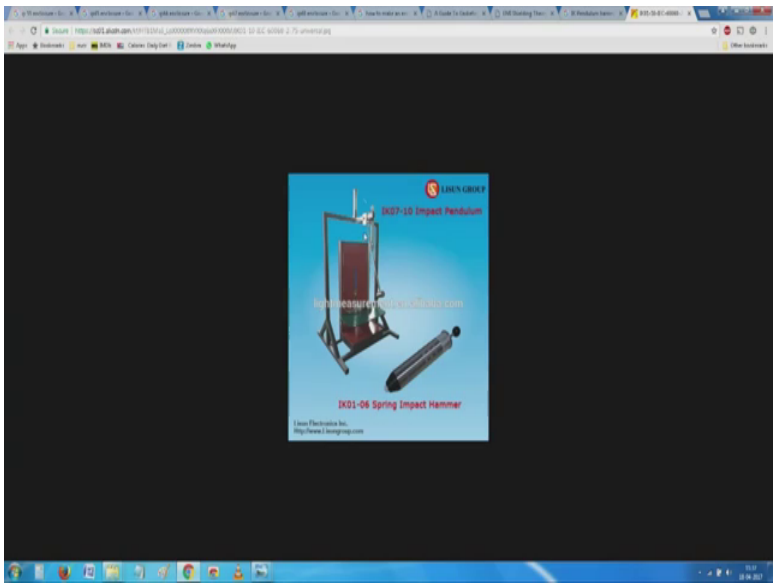

And this is the device it shall go and impact against it in contrast we have the impacting hammer.

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So, actually does not fall vertically at the bottom you have seen the mechanism this one is something which holds a hammer from falling. So, this is a release mechanism this goes and hits the vertical plate and then there are sensor which will ensure that the total energy that is transferred is fully controlled.

So, I have large number of these practices and there is a test being conducted here.

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And you know what is being tested there it is an led panel, does an led panel need a impact test? Yes if it is industrial and if it is a commercial and it is not like what you

recap in your lab and it is not as easy as just providing a poor carbonate sheet it needs to be tested to ensure that so many amounts of joules of energy it takes and so on So, we have all these equipment which I will tried to I will tried to cover in some other some other location.

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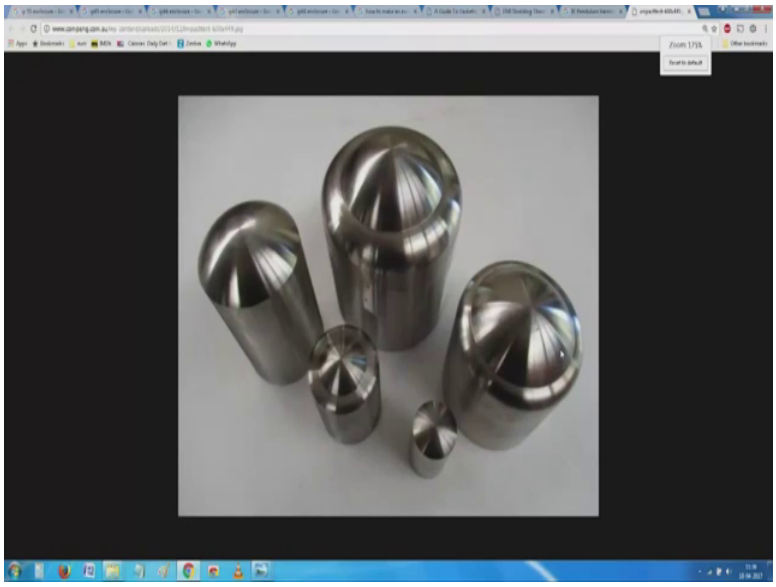

You have seen that the diameter is fixed amount of joules can be controlled by increasing the weight or mass of the hammer. So, we have all the standard hammers with which you make or make sure that is from a 40 centimeter height if I have 5 5 kg hammer falls it should withstand a very large number of hits may not be at the same place, but it does that is the reason why we have all these beautiful testing equipment then we have all these testing situations.

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I think I will stop here because it is saturated two things; first things is you will probably anyway stop it and people have verified that around 20 minutes is a normal attention span, what you can learn something then after 20 minutes anyway you are probably giving it a spot and then many pause and trying to make it back again. So, in how to make something a IP 55 or 65 enclosure is not that easy I will repeat it again next time, it has been coming through the industry for very long time. So, that is how very safely you can take your mobile and drop it now my mobile I will not drop, chances are nothing will happen and you would have seen this about your remote control also. When the remote control falls it is not as if the end of the world has come.

Two things happen first thing is the battery cover snaps because that is not you know made so well and then this cells spill out. Now you put this cells back and somehow put the battery cover drop it again second time it does not snap in place. So, depending on your profession you can use a simple rubber band or you can use a metallic wire and doctors use zinc oxide plaster to keep the battery case in place battery cover in place. You drop it again this time chances are they box splits the outside case still if you put it back and somehow snap it in place it will continue to work. So, well routine things like a cordless in our hand electric toothbrushes hair driers and remote controls are expected to take a drop test hard surface one meter by it is own weight it falls and verses probably in the corners it should withstand.

So, thank you I will continue next time with a few of the examples what I am talking about I will see if I can bring a coffee filter a water bottle what you call kettle, and then maybe a couple of hair dryers and TV remote and cordless and see whether we can do something.

Thank you.