# Enclosure Design of Electronics Equipment

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## Lecture – 39
## Gasketing Basics

Hello, allow me to continue where I had left off yesterday. Both my apologies and also what you call accepting reality that this EMI-EMC shielding has a tremendous very wide both the implication and theory and practice. So, theory has been developed such that probably along with the communication and along with radiation and along with the antennas and all. So, if you had look for a simple search on the internet, you will find tremendous amount of data and also there are text books and text books and text books.

And on the other hand, the actual practice has been going on parallelly; saying somebody has been developing gasketing, somebody has been developing windows means that small openings through which you have to take things and this also has will be going on very very in a parallel course like so many other things. Sorry for being judgmental here, practices continue irrespective whether the theory has developed or not; whether it is fully understood are not. So, on the other side; by using simple reducing things to manageable level theory also been developed and now with competition and all with a reasonable prediction; they can make out how to solve problems and because of the complexity any number of fire fighting design services are available. So, that they can implement the theory and then the practices they have been following for a long time.

So, you too have gain an example of how at home if you are an audio enthusiast you will see that hum is real. It could be 50, 60, 100 or 120 hertz hum and if you touch somewhere, there will be something and then grounding also is real with respect to this humming noise. This apart somewhere we have to make a beginning that we should start. So, I started this where I would like to apologize saying am I reading output from commercial trade; what you call literature; yes and no because it is more like a white paper and somebody has got down to do it and written things in a concise manner with examples and partly taken from probably (Refer Time: 03:19) books and partly taken from their own field studies. So, in all these I will get back you to for this thing which I have left yesterday.

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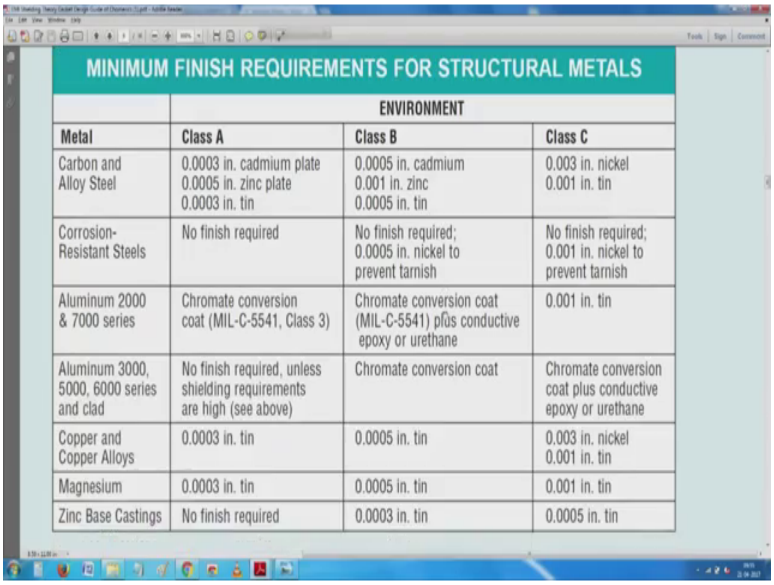

MINIMUM FINISH REQUIREMENTS FOR STRUCTURAL METALS

| | ENVIRONMENT | | |
|---|---|---|---|
| Metal | Class A | Class B | Class C |
| Carbon and Alloy Steel | 0.0003 in. cadmium plate 0.0005 in. zinc plate 0.0003 in. tin | 0.0005 in. cadmium 0.001 in. zinc 0.0005 in. tin | 0.003 in. nickel 0.001 in. tin |
| Corrosion-Resistant Steels | No finish required | No finish required; 0.0005 in. nickel to prevent tarnish | No finish required; 0.001 in. nickel to prevent tarnish |
| Aluminum 2000 & 7000 series | Chromate conversion coat (MIL-C-5541, Class 3) | Chromate conversion coat (MIL-C-5541) plus conductive epoxy or urethane | 0.001 in. tin |
| Aluminum 3000, 5000, 6000 series and clad | No finish required, unless shielding requirements are high (see above) | Chromate conversion coat | Chromate conversion coat plus conductive epoxy or urethane |
| Copper and Copper Alloys | 0.0003 in. tin | 0.0005 in. tin | 0.003 in. nickel 0.001 in. tin |
| Magnesium | 0.0003 in. tin | 0.0005 in. tin | 0.001 in. tin |
| Zinc Base Castings | No finish required | 0.0003 in. tin | 0.0005 in. tin |

So, you see here finish requirement for structural metals. So, we have the saying no, what type of coating and all you give and then it seems to be common compactable coating seems to be this chromate passivation or chromate conversion.

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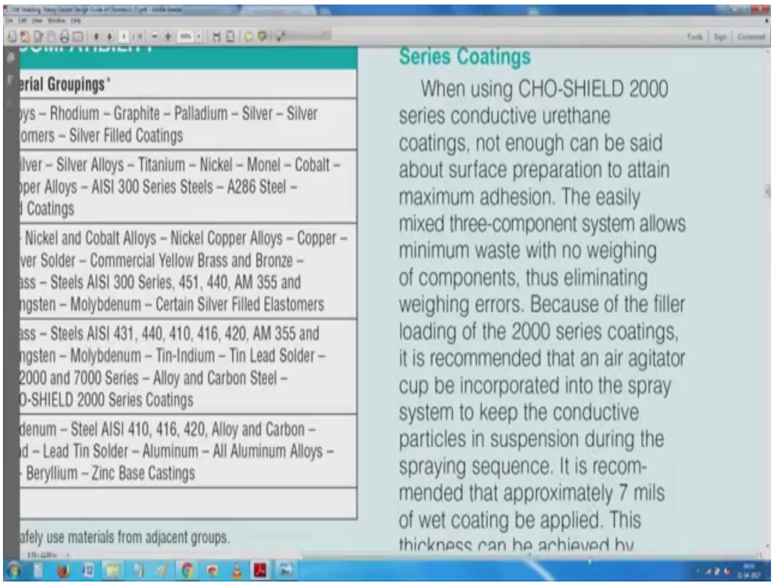

erial Groupings*

ys – Rhodium – Graphite – Palladium – Silver – Silver omers – Silver Filled Coatings

lver – Silver Alloys – Titanium – Nickel – Monel – Cobalt – pper Alloys – AISI 300 Series Steels – A286 Steel – l Coatings

Nickel and Cobalt Alloys – Nickel Copper Alloys – Copper – ver Solder – Commercial Yellow Brass and Bronze – ass – Steels AISI 300 Series, 451, 440, AM 355 and ngsten – Molybdenum – Certain Silver Filled Elastomers

ass – Steels AISI 431, 440, 410, 416, 420, AM 355 and ngsten – Molybdenum – Tin-Indium – Tin Lead Solder – 2000 and 7000 Series – Alloy and Carbon Steel – O-SHIELD 2000 Series Coatings

denum – Steel AISI 410, 416, 420, Alloy and Carbon – d – Lead Tin Solder – Aluminum – All Aluminum Alloys – Beryllium – Zinc Base Castings

afely use materials from adjacent groups.

Series Coatings

When using CHO-SHIELD 2000 series conductive urethane coatings, not enough can be said about surface preparation to attain maximum adhesion. The easily mixed three-component system allows minimum waste with no weighing of components, thus eliminating weighing errors. Because of the filler loading of the 2000 series coatings, it is recommended that an air agitator cup be incorporated into the spray system to keep the conductive particles in suspension during the spraying sequence. It is recommended that approximately 7 mils of wet coating be applied. This

As you go down this each company has its own trade name and compatibility.

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METALS COMPATIBILITY

| Group | Material Groupings* |
| --- | --- |
| 1 | Gold – Platinum – Gold/Platinum Alloys – Rhodium – Graphite – Palladium – Silver – Silver Alloys – Titanium – Silver Filled Elastomers – Silver Filled Coatings |
| 2 | Rhodium – Graphite – Palladium – Silver – Silver Alloys – Titanium – Nickel – Monel – Cobalt – Nickel and Cobalt Alloys – Nickel Copper Alloys – AISI 300 Series Steels – A286 Steel – Silver Filled Elastomers – Silver Filled Coatings |
| 3 | Titanium – Nickel – Monel – Cobalt – Nickel and Cobalt Alloys – Nickel Copper Alloys – Copper – Bronze – Brass – Copper Alloys – Silver Solder – Commercial Yellow Brass and Bronze – Leaded Brass and Bronze – Naval Brass – Steels AISI 300 Series, 451, 440, AM 355 and PH hardened – Chromium Plate – Tungsten – Molybdenum – Certain Silver Filled Elastomers |
| 4 | Leaded Brass and Bronze – Naval Brass – Steels AISI 431, 440, 410, 416, 420, AM 355 and PH hardened – Chromium Plate – Tungsten – Molybdenum – Tin-Indium – Tin Lead Solder – Lead – Lead Tin Solder – Aluminum 2000 and 7000 Series – Alloy and Carbon Steel – Certain Silver Filled Elastomers – CHO-SHIELD 2000 Series Coatings |
| 5 | Chromium Plate – Tungsten – Molybdenum – Steel AISI 410, 416, 420, Alloy and Carbon – Tin – Indium – Tin Lead Solder – Lead – Lead Tin Solder – Aluminum – All Aluminum Alloys – Cadmium – Zinc – Galvanized Steel – Beryllium – Zinc Base Castings |
| 6 | Magnesium – Tin |

So, you will see here, the first group one talks about this various things including gold and silver and so on and all the way down you have magnesium and tin and all that with a each of this group overlaps making it possible to safely use materials from adjacent groups. So, the issue being here is that.

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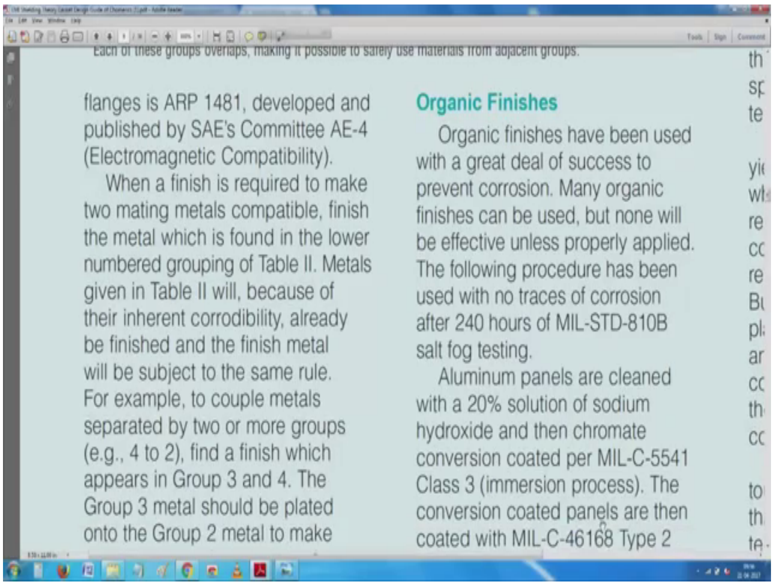
Each of these groups overlaps, making it possible to safely use materials from adjacent groups.

flanges is ARP 1481, developed and published by SAE's Committee AE-4 (Electromagnetic Compatibility).

When a finish is required to make two mating metals compatible, finish the metal which is found in the lower numbered grouping of Table II. Metals given in Table II will, because of their inherent corrodibility, already be finished and the finish metal will be subject to the same rule. For example, to couple metals separated by two or more groups (e.g., 4 to 2), find a finish which appears in Group 3 and 4. The Group 3 metal should be plated onto the Group 2 metal to make

**Organic Finishes**

Organic finishes have been used with a great deal of success to prevent corrosion. Many organic finishes can be used, but none will be effective unless properly applied. The following procedure has been used with no traces of corrosion after 240 hours of MIL-STD-810B salt fog testing.

Aluminum panels are cleaned with a 20% solution of sodium hydroxide and then chromate conversion coated per MIL-C-5541 Class 3 (immersion process). The conversion coated panels are then coated with MIL-C-46168 Type 2

Depending on the type of materials; you use and depending on type of contact surfaces you use when plate something here is to make a contact this is where the dissimilar materials thing come and as if it were not sufficient we have the problem of moisture and other I will say electrolyte type chemicals in the atmosphere.

So, it in everything forms a nice cell I have given in a example of how nickel cadmium batteries are made so; obviously, nickel and cadmium do not go together. So, kindly read it with me here. So, we have here you know big list of chromate conversion coatings iridite and can be considered as this thing and then they have given from their own characteristic; this thing saying, we try to conductive urethane coatings. This coating sticks to the surface where you want to make a seal. It is a very positive thing. So, they have given here saying no, I think you should remove all the double negatives and all not enough actually as lot can be said about surface preparation need to said about it. So, they have given about you know how much and so on and so on.

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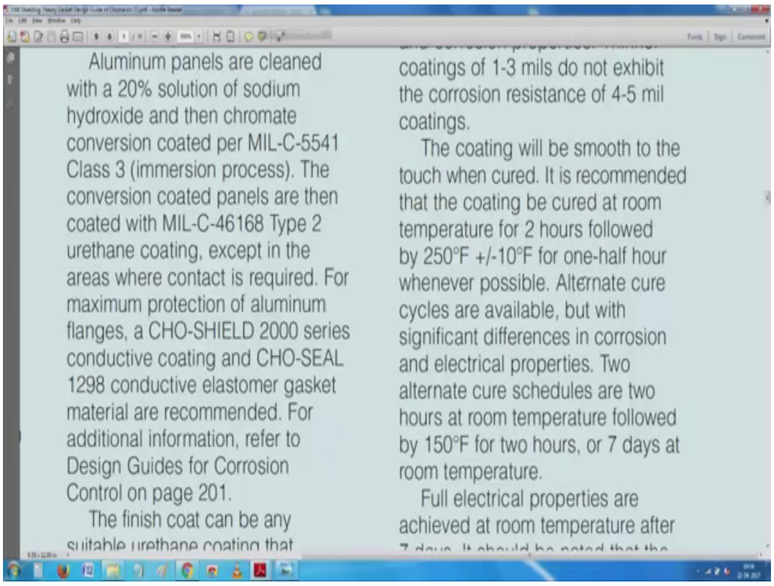


Smooth should I even touch; even cured recommended de coating make may cured at room temperature 2 hours followed by their thing you know you should probably comes around one twenty degree centigrade one and half hour whenever alternate cure cycles are available and so on and so on.

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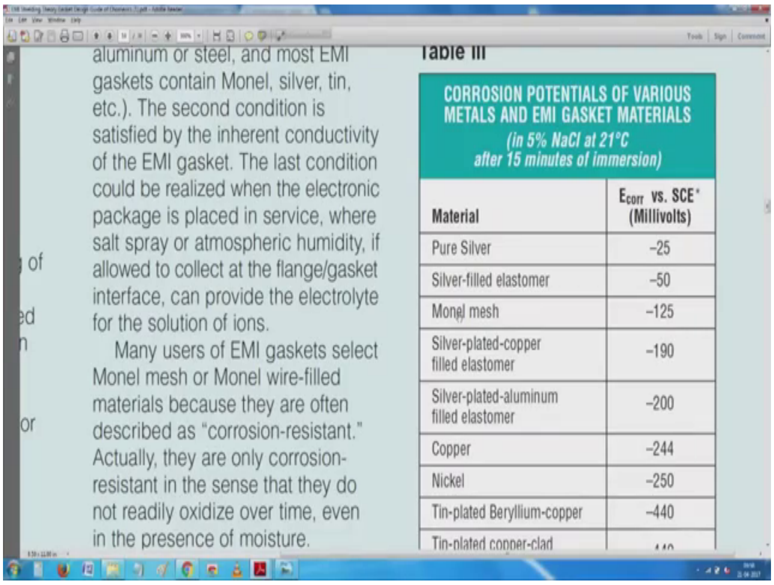


The thing is all this have been developed saying; how to apply these materials. So, you have here saying corrosion potentials of various metals and EMI gasket materials.

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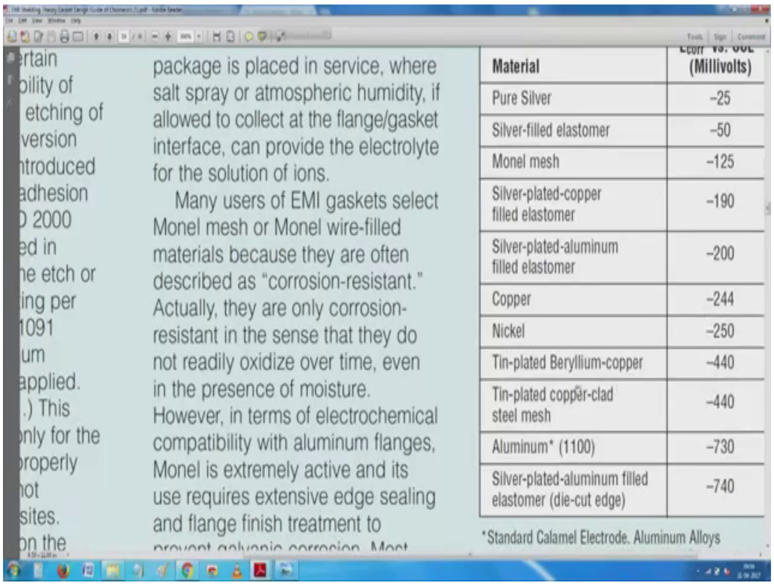


So, we have this you know if you take silver plate at copper and so on and all that know aluminum filled elastomer, copper and nickel and so on they have large number of numbers like this. So, I suggest you read up more about it.

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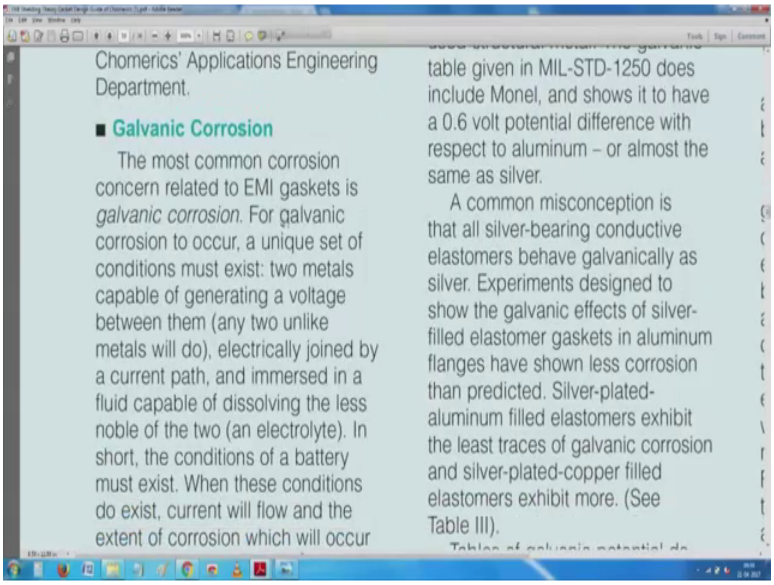


What is galvanic corrosion? For galvanic corrosion, a unique set of conditions; 2 metals capable of generating a voltage electrically joined by current and immersed in a fluid capable of dissolving the less noble of the 2 an electrolyte.

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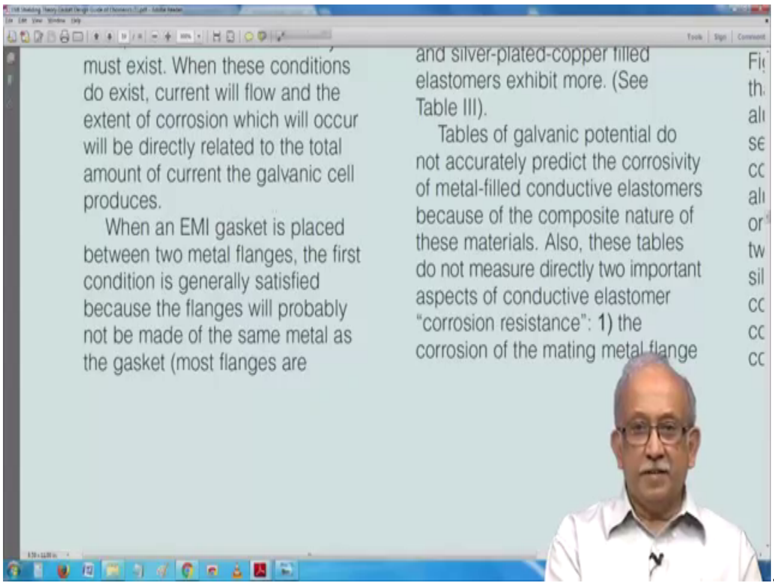


In short, the conditions of a battery must exist is exactly what a few sentences ago I had shown you.

So, whenever you have any of these 2 things you have a liquid which forms electrolyte and then you have to dissimilar metals it is almost like a battery. So, you know what happens when you do not want it is become a battery when you want it.

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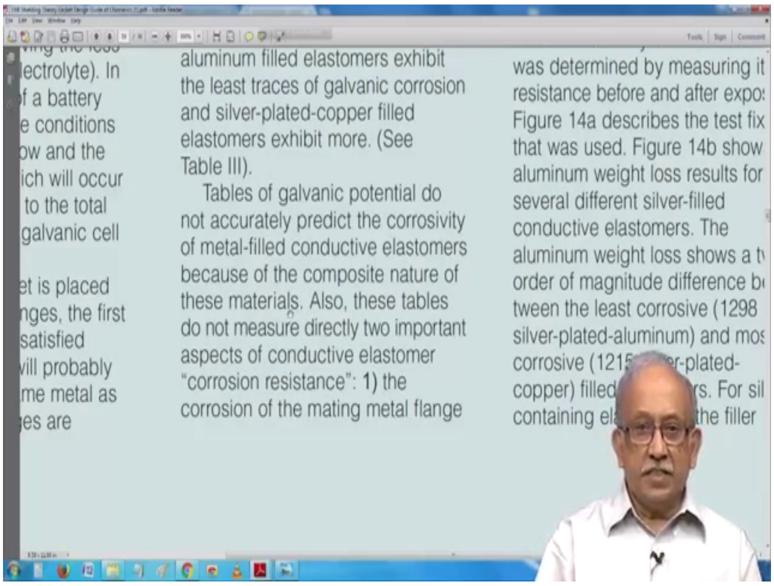


It does not that is the reality of; so there is something called galvanic potential that, but in spite of it a caution is been given here tables of galvanic potential do not accurately predict the corrosivity of the metal filled conductive elastomers because of the composite nature of these materials these tables do not measure directly 2 important aspects saying corrosion resistance the corrosion of the mating surface flange and so on and so on and so on; if you go down you will see that few the amount of data is generated allow me to move on to the next slide.

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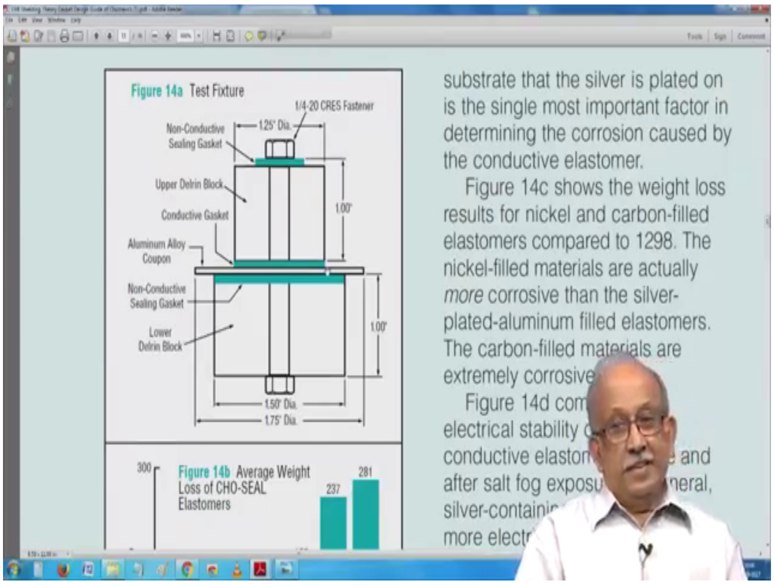


So, like all other including IP 67 test for immersing something for long periods and also for drop test and all that there is no simple easy way to predict behavior covetic I have told you the joke about raining on my picnic.

So, either way, we have a problem. If I carry umbrella; it will not rain. So, looking funny; if I do not carry an umbrella it will rain getting wet same thing in the case of this EMI also; after the EMI, all the precautions are taken everything is tested using text fixtures like this you understood. So, lot of stuff about; how the weight loss is there over the time; how corrosion takes away the material and so on and so on like this.

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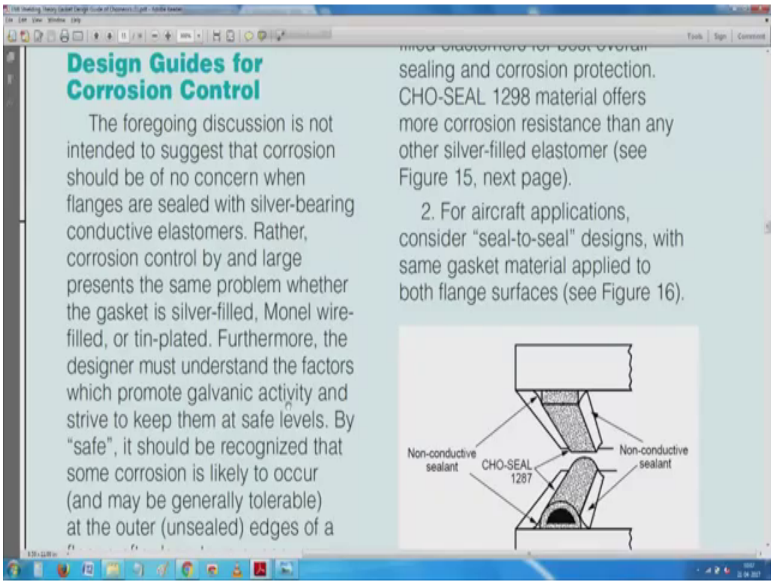


So, we have this very important thing corrosion control by and large present the same problem whether the gasket is silver filed monel; wire filled or tin plated furthermore designer must understand the factors which promote galvanic activity strive to keep them at safe level should be recognized some corrosion is likely to occur. So, seal to seal and so on nonconductive. So, on huge amount of data is available.

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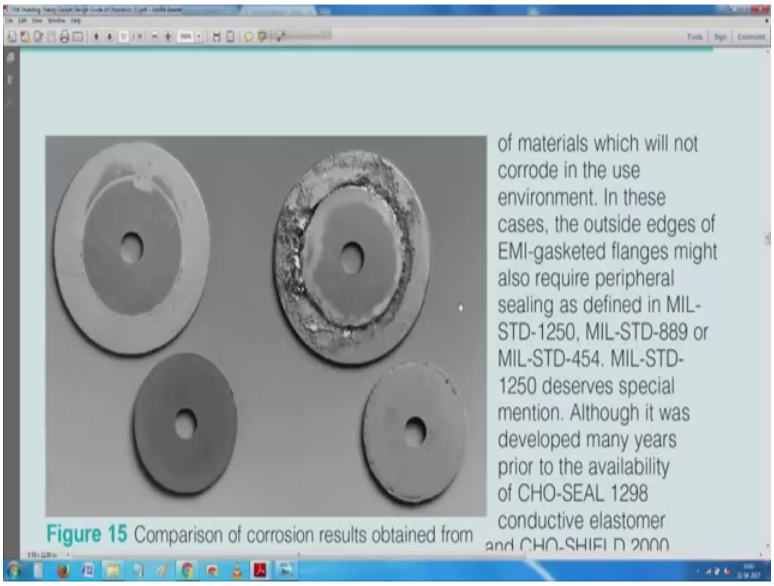

And then here pictures are shown or the test results is around the edge where is exposed to the atmosphere and it can get all the necessary moisture you will see that it is corroded all around it at the edge the centre does not seem to be so bad.

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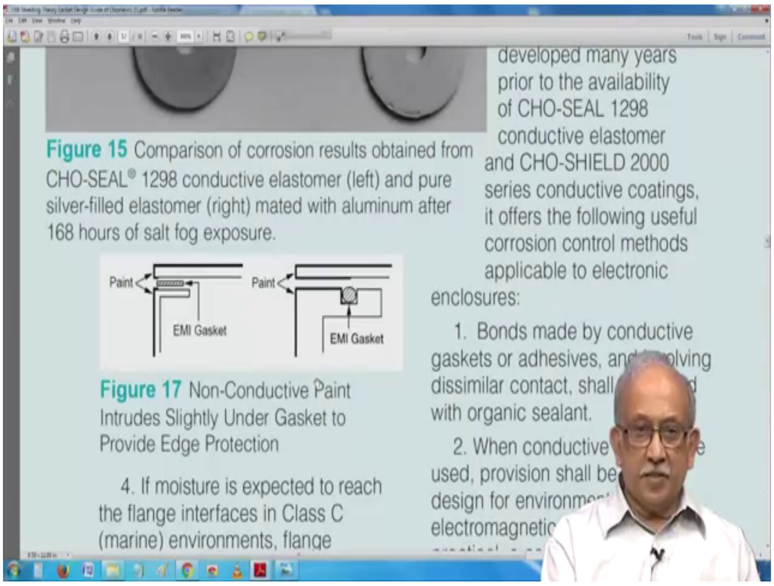


Comparison of corrosion from CHO-SEAL and pure silver filled elastomer with aluminum. This well, I will not say it is not real it is individual case specific.

Individually case specific; every time minor variations including the clamping pressure including the ambient conditions, we have this problem.

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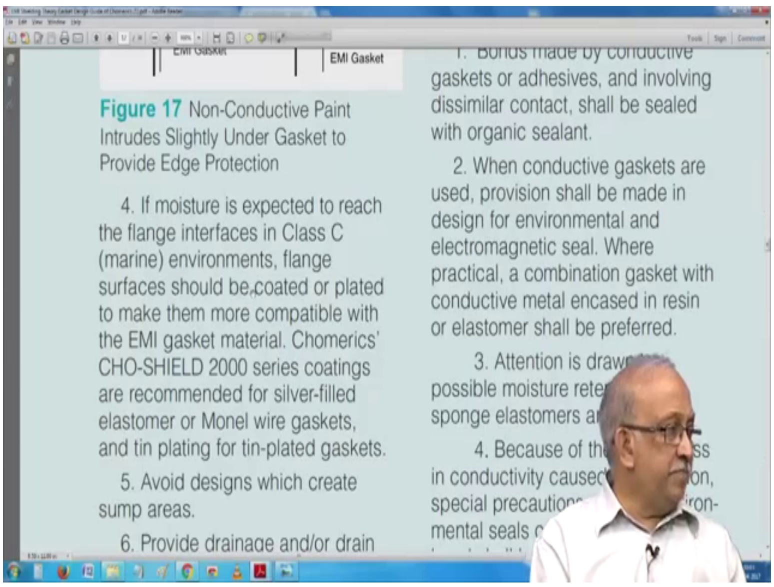

So, we have this class (Refer Time: 11:48) and if moisture is expected to reach the flange interfaces in class C marine; flange surfaces should be coated at to make them more compatible EMI and so on and so on there is a huge amount of how to deal with all these situations.

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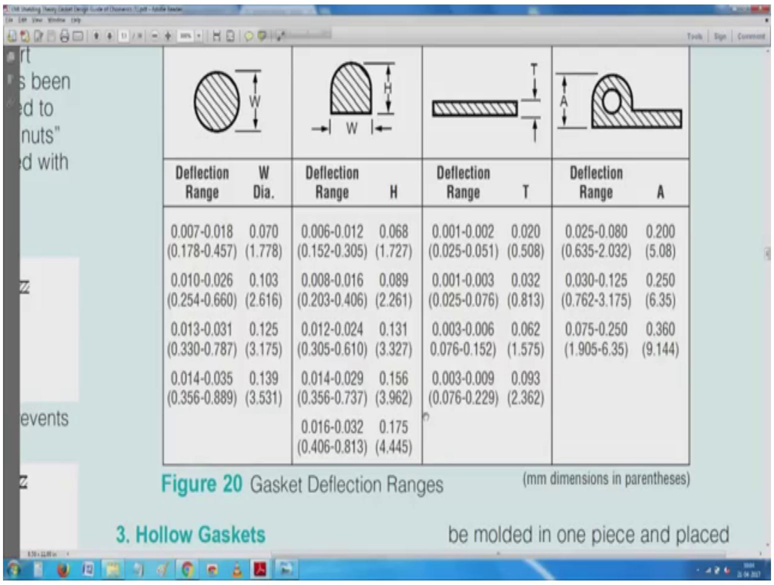


So, if you move on a little to the right side, the; you see here, the correct pressure and how much of deflection know is allowed in these things because that is a very critical thing it is down somewhere here because it is a PDF file. So, I have to need to go back.

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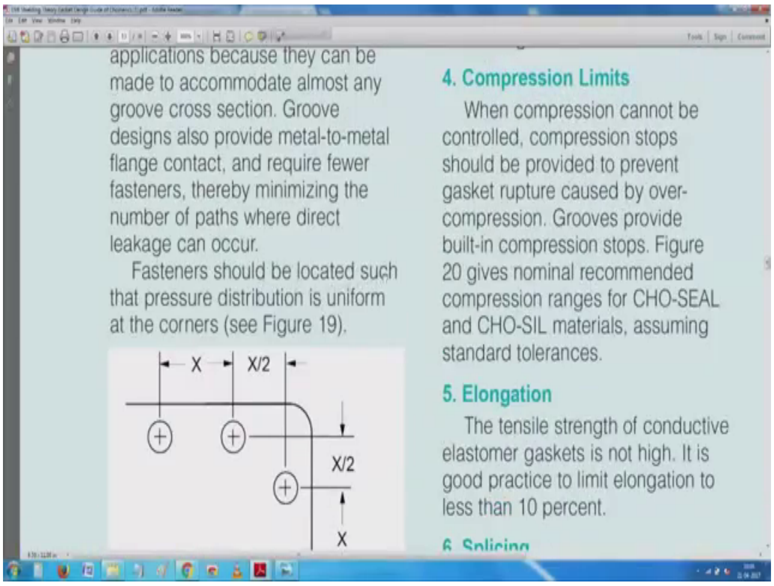

So, you will see here fasteners should be located such that pressure distribution is uniform at the corners groove designs and so on; so, on as you go down. So, you will see here gasket deflection ranges have been given saying typically things like this solid very small and you see here is especially thin ones negligible. It is only 25 microns; however, you have a lip like thing which makes it more flexible, it is hollow inside will have the advantage is better this thing for a 5 mm build up you get a tenth of a quarter inch you know small thickness like that.

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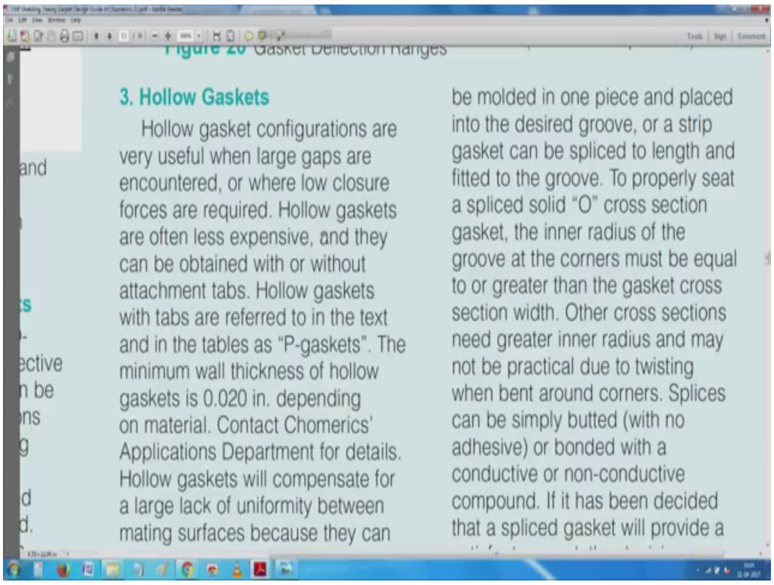


Hollow gasket configuration are useful when large gaps are encountered are where low closure forces are required. So, again if you remember IP 67; so, if you remember IP 67, you need to apply force on all the sides. If this have to be thing that needs to be sealed; obviously, it starts with 1, 2, 3, all this round almost like an automobile crankcase large force are allowed.

But you cannot do it every time, if you have a simple power control panel like what I have showing you; you cannot afford to take a ring spanner and tighten everything or in fact, use a torque wrench and tighten because there are some issues about frequently being and you should be able to do it and then doing something like that is expensive. So, invariably they have large gaps or where low closure forces are required. So, low closure force means; we just need to shut and then turn one lever and the things taken place that is what I had shown you and the outdoor camera are there.

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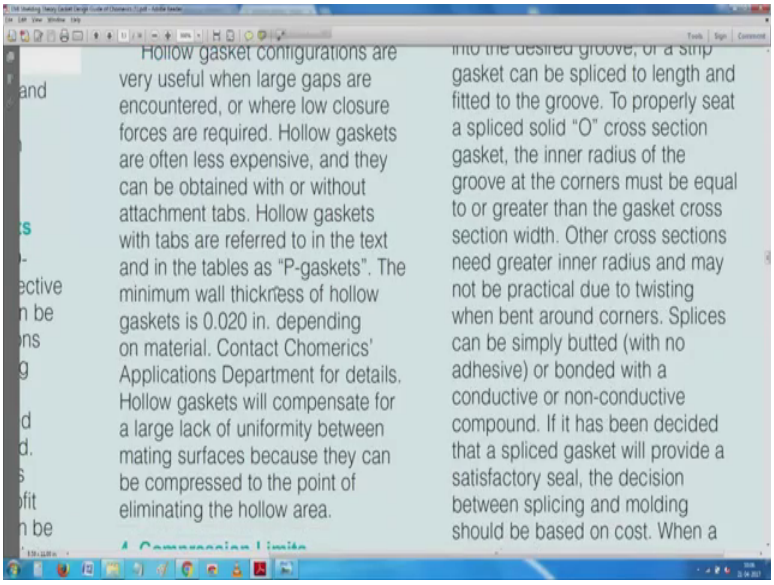


So, hollow gaskets and tabs in the table are referred as P gaskets because they are little like then minimum wall thickness of hollow this thing is are about you know 0.5 millimeters and then up to typically 1 to 2 millimeters it will be there .

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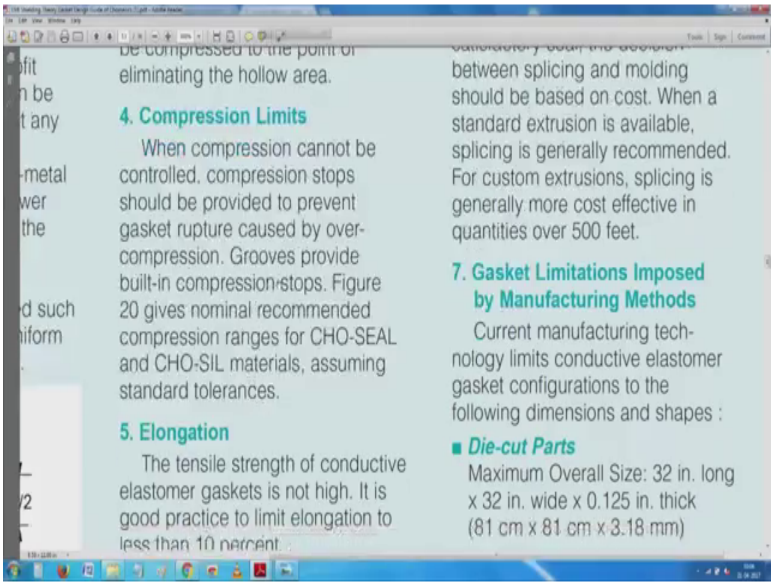


So, there are compression limits also saying a compression stop should be provided in the next coming few pictures they will show you saying if this has to meet here. It is not just enough if you put a little bit of gasket here you have to make sure that you cannot squeeze it. That is what the table talks about saying you put a stopper to ensure that beyond it, it cannot be squeezed.

And then; so, we have the stuff about manufacturing technology how do you die cut and so on.

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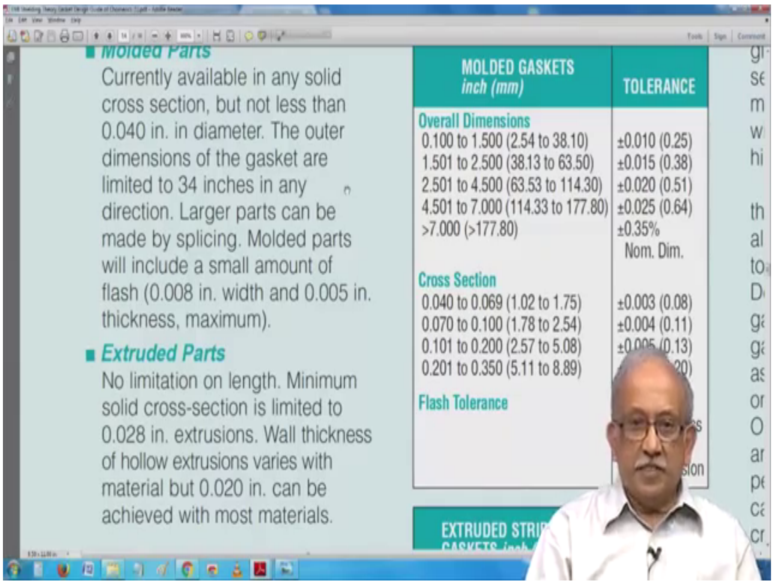


So, based on this because exactly because of this when I told you about its a specific case specific meaning every time we need to find out how the things work. So, we have here saying depending on how will the tolerances are held during when you blank them out fully mold them or when you punch them out or you have an extruded strip die cut gaskets and so on. Now this is more a detail of the see here this; what I was talking to you about. So, you have you know forces and audio thickness and all that I will just go through quickly.

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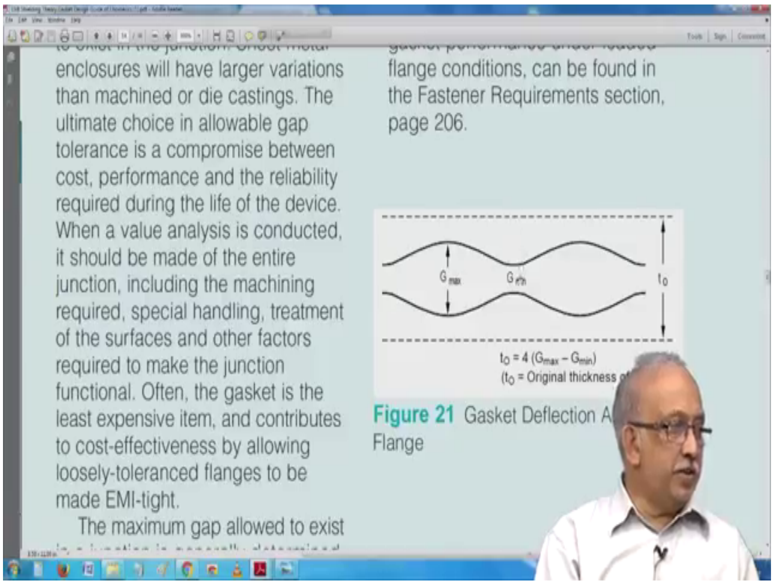


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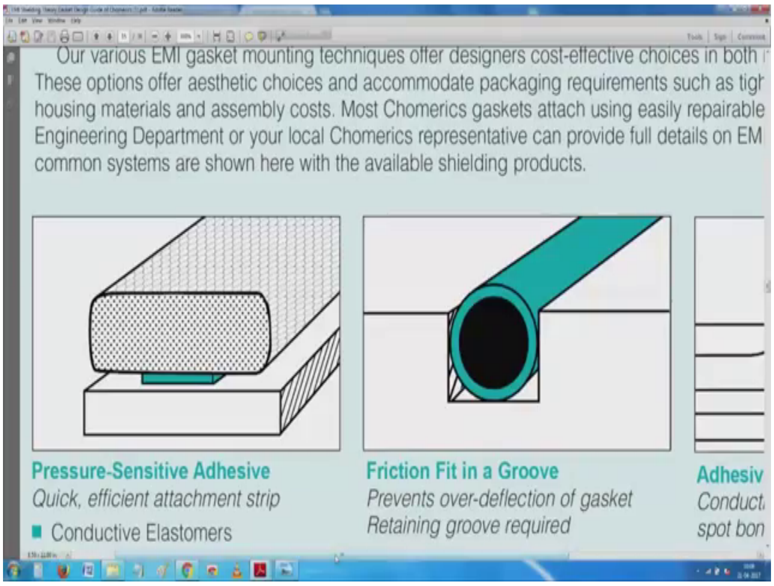


Now, you have see here that it is just not enough you have pressure sensitive adhesives and how to attach it no friction fit in a groove. So, some of you who enjoy or who watched people cooking using a pressure cooker you see they all the pressure cookers come with a gasket in this parts of the country it is common and we cannot afford to have very hard gasket in; you know which you tie things; I am sorry, you have wing nuts are all the sides are levers and you clamp it with large force that is only used in places like our laboratories where we have autoclaves and then we have vacuum and we have pressure and all that all other places you have just a split gasket like this small gasket it sits on 2 things and then you close the lid and then you slide the lid and we expected to stay in place.

It does not matter a gasket probably costs 50 rupees or little more than that I will call it a dollar. So, you can change it once in a while. In fact, I am one of the person. So, keeps a spare gasket at the first sign of any leakage or any moment which is too smooth. We discard the old one and then start using the new one which is probably quite a bit to do with.

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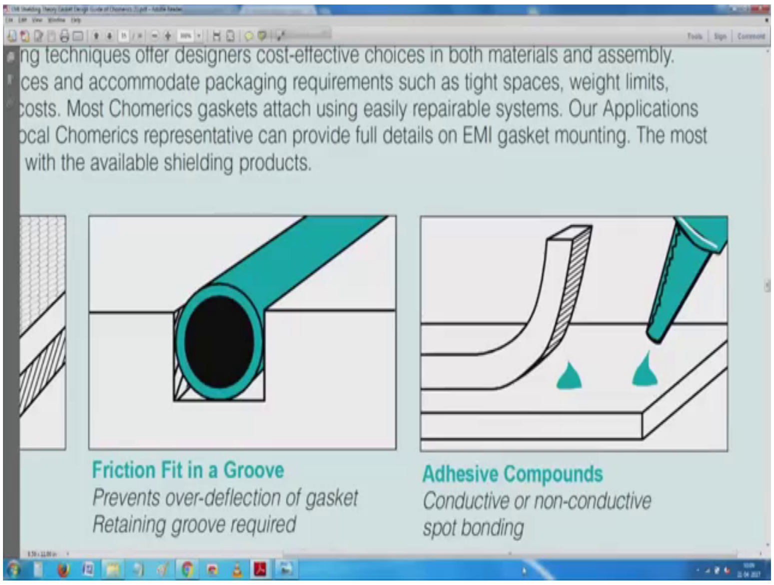


You see this know; we have adhesive non conductive spot bonding and friction fit in a groove and you see any number of robotically dispensed form in place conductive elastomer.

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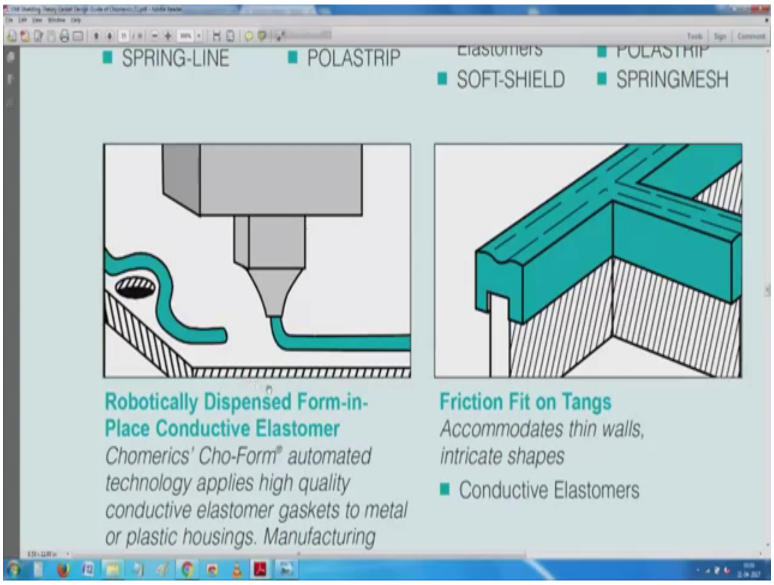


You would have seen this as you are cocking which is used for windows you have the RTV compound room temperature vulcanizing; some rubbery material advantage of it is for quite some time is expected to continue to be soft and should not become hard if its hard it has some problems.

So, just before the arrival of winter probably people seal all the windows with this with a window sill end and afterwards they will peel remove all the accumulated dust and other stuff and then we are back in business; however, in the case of professional equipments. It is not that easy means once you keep it in place until something functionally fails it is unlikely that you will (Refer Time: 19:23) to this in a periodic way of replacing the gaskets every time; however, to prevent generally people have a little this thing. So, routine inspection is carried out to make sure that especially water born or underwater IP 67-68 somebody examined said that they are cracking in the all the elements here.

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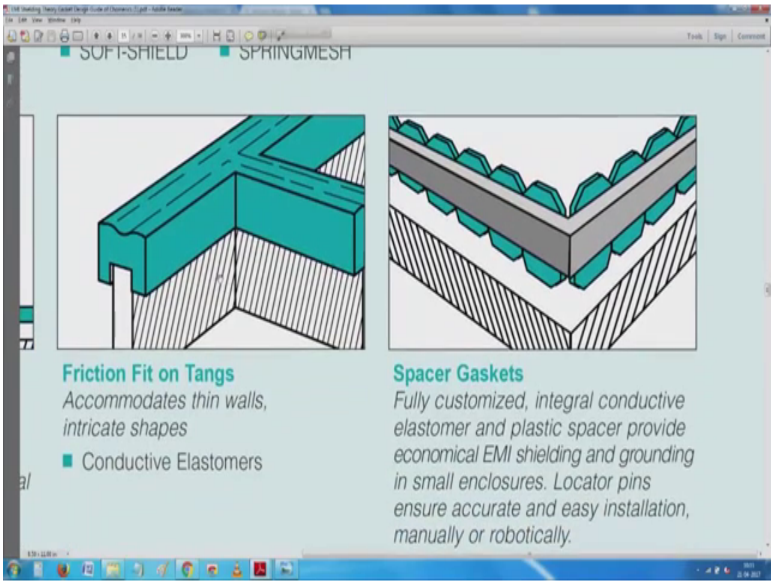


So, we have here friction fit friction fit means nothing, but just push it and then it squeezes itself on that on the edge of the enclosure then fully customized integral conductive elastomer plastic spacer and so on blah, blah, blah, all the stuff is available from multiple manufacturers. So, it is for you to decide what you would like to have and seen this you have clips to hold it and place and so on.

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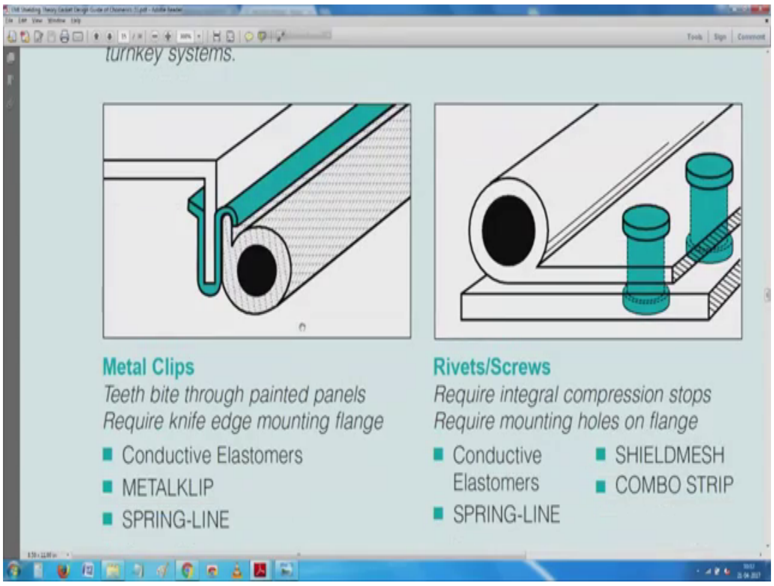

If I get a chance, I will try to show a faraday cage, we have anode flanges, I need to access it by taking permission there you see that all these; what all have been done here have been taken care of.

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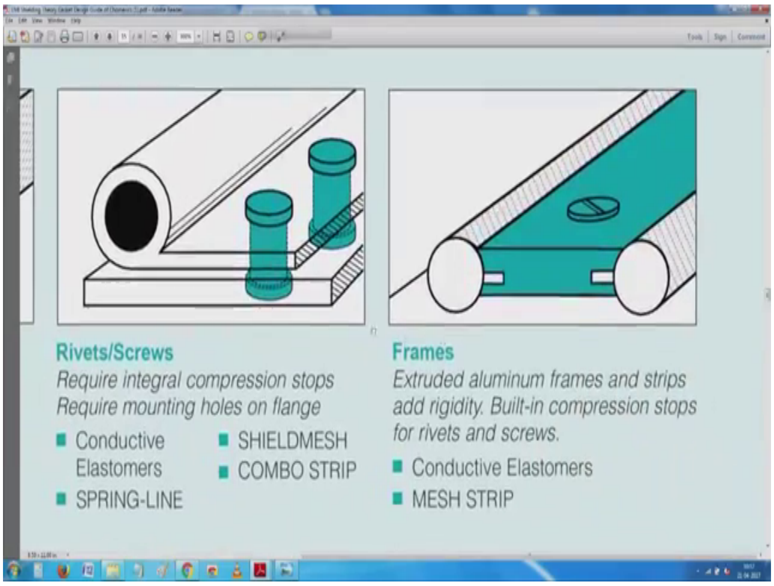


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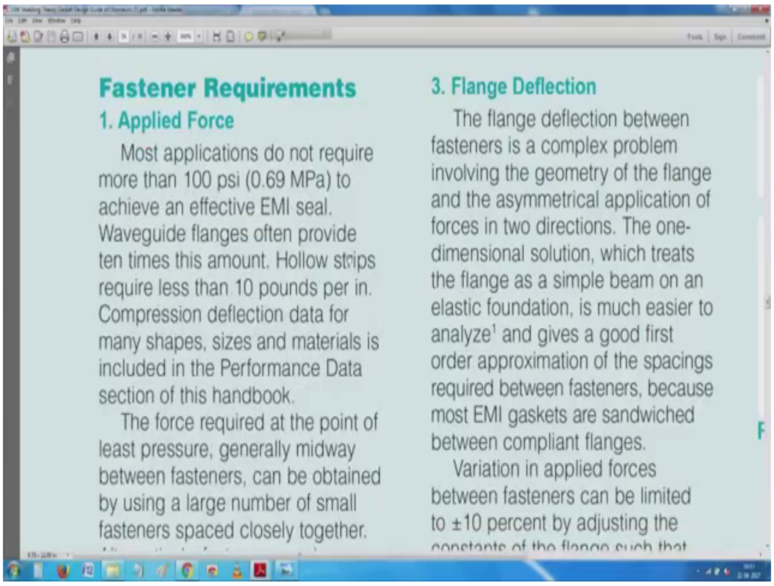


So, we have all this nice, slowly, we are coming back to applied force most applications do not require more than 100 psi to achieve an effective EMI sill. So, I have a gasket, it has to be pressed hard any anything more than that as I said no as they have indicated it likely to damage it; anything less than that tangential forces can come and corrosion can also start somewhere when optimum saying around 50 to 70 psi that is area square inch and then we have all this.

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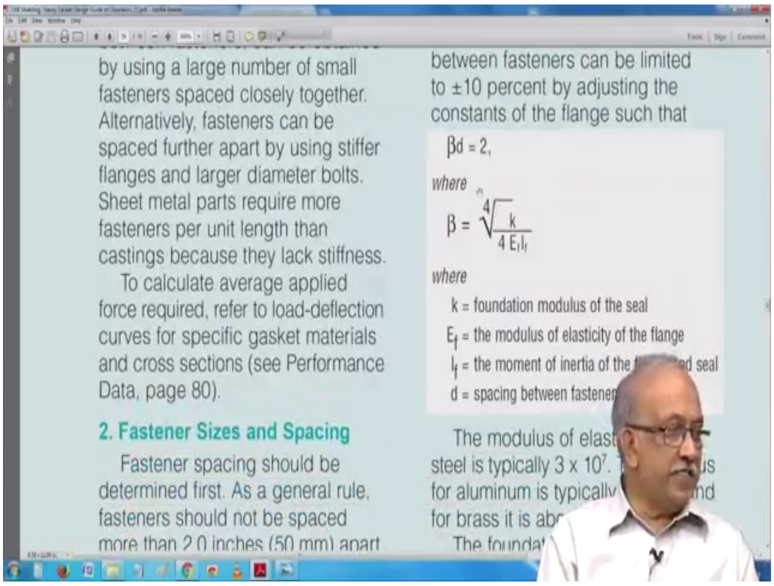


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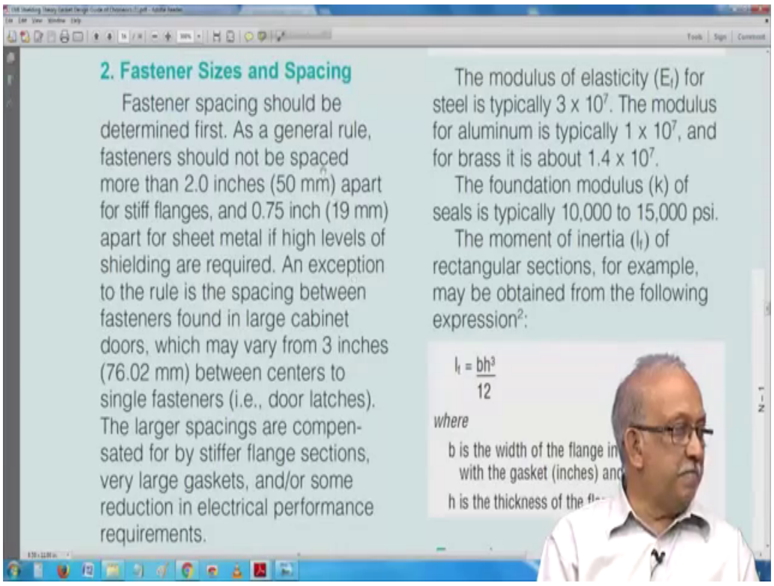


This is fortunately you know this equation does not look. So, threatening saying how much does the flange deflect fastener sizes spacing as a general rule should not be spaced more than 2 inches for stiff flanges more than twenty mm for sheet metal if high level of shielding are required.

The moment you live any gab at the time of insulation there is no problem, but the slightest deflection or slightest change often caused by temperature with combination of changing in humidity will compromise the bonding continuity and connection between them. So, that is the reason the; I will see if I can get some pictures before the video. So, we have our faraday cages. So, that in the cage when the door is closed all along with a pitch of 15 or 20 mm; there are fingers which make a continuous contact top to bottom and after some time that fingers have a tendency to set. So, somebody comes and I think once you are allowed re align it or something afterwards they replace it and the important thing is that you must conduct a test every time like if you have a balance let us say you need to take a weight of something you do a tare reset same way whenever any professional test and all are required before they start the test they also try to make sure that the whole equipment is calibrated.

So, other than that the chances are; so, here now they have given examples of saying you know how to calculate the bolt spacing.

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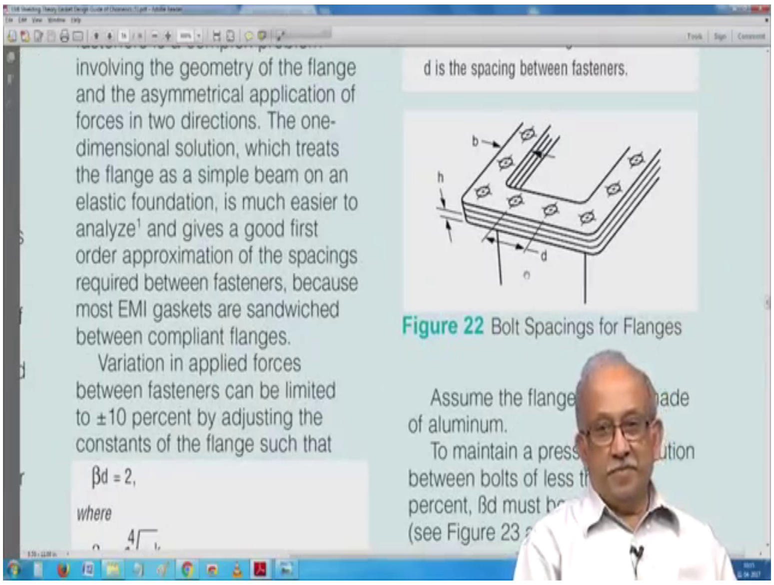


In case, you want and all that I think you can read it yourself I will give you the link and otherwise the material will be available. So, you can easily find out about the array factor spacing and all that actual deflection and so on and so on and so on.

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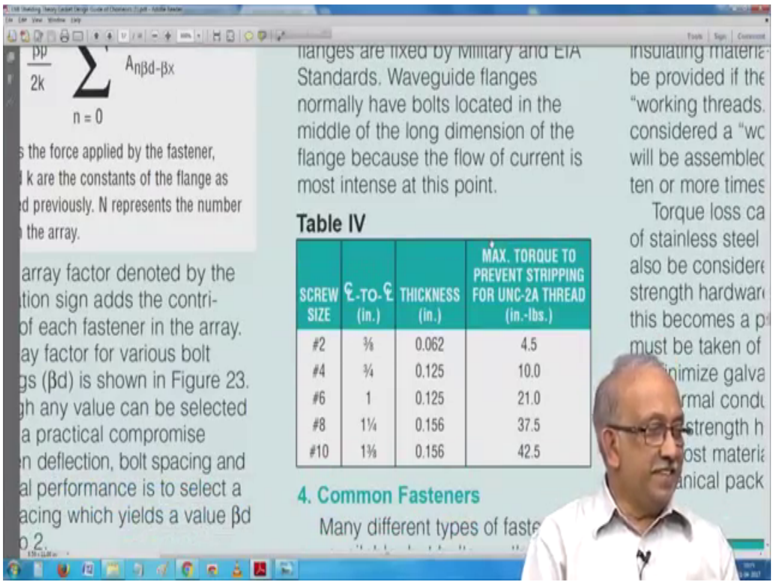


And we have a little problem about wave guides. Wave guides are again a very very special case of this thing. It is not connected with this at all except that all; I would like to say is any slightest error you may completely lose your signal. So, the I what you call the UH of I am; I do not know microwave thing does not go at all inside, but you see that this have been compounded or something by other way. So, all that plumbing know gets seriously affected in case no we over tighten things and all that.

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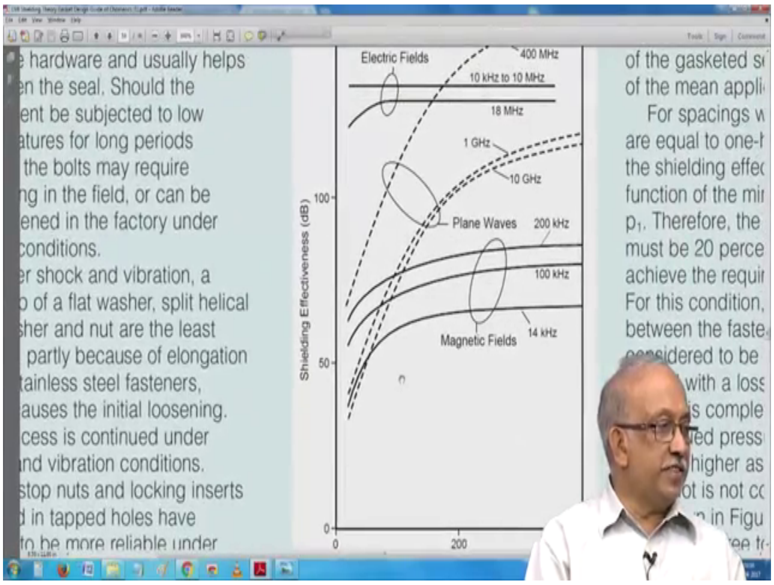

So, there is a lot of little more theory and shielding effectiveness versus pressure and so on and so on is given like that if you apply more than certain pressure it does not improve the shielding in anyway understood know I leave it here un to counts because it is not immediately relevant or packaging and. Secondly, I am no expert it, but it is for you and most of this companies give you enough protocol data background data on how to continue with this say 200 page note.

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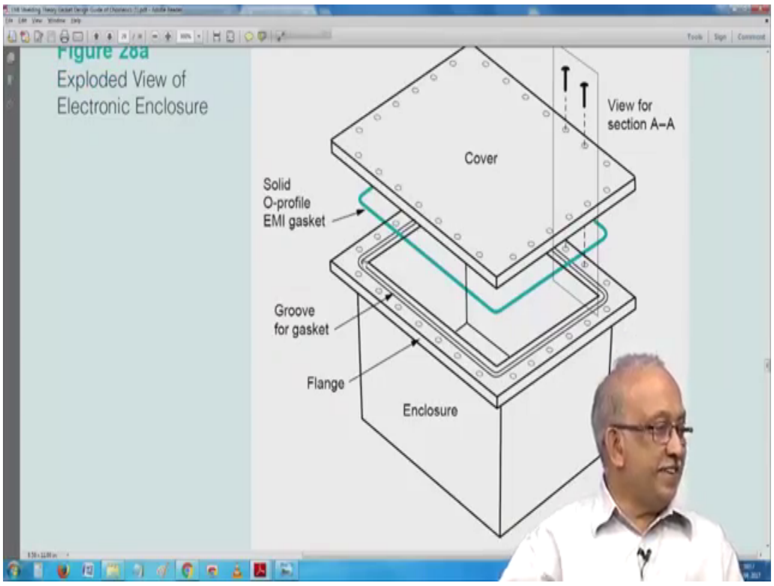


So, in order to produce a gasket in a groove which will not fail and so, all no; you see huge amount of data has been given; this I thought know why I was going is you see here this is an interesting thing. Now we will notice exploded view of an electronic enclosures in this case because of a little because of the ease of analysis and ease of illustration they have taken an enclosure which has a nicely mild flat flange similarly there is a cover though it is not seen here very rarely a cover will set directly. So, just under that this; this much part which is meeting with this also will be mild clean make sure that it is level. So, it is probably kept on a special clamp on a milling machine and a small furnishing cut is there then after this if you now try to clamp things and then if this green is a gasket.

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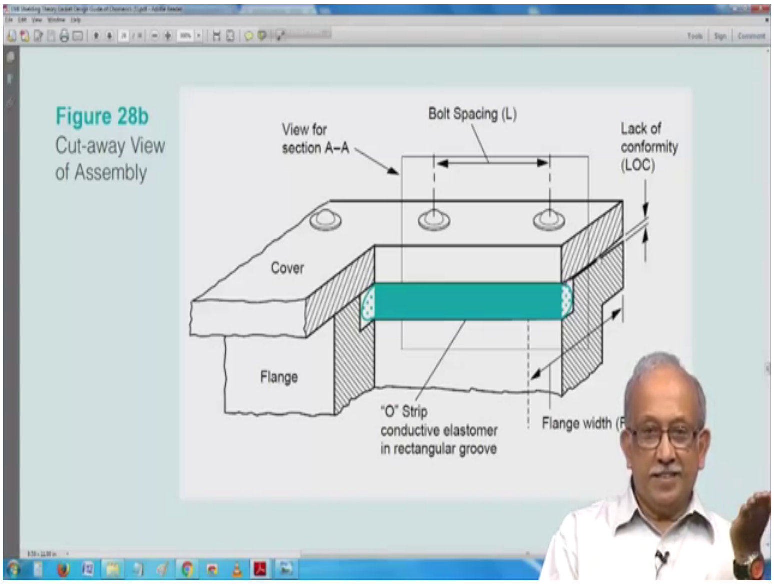


See here; so, you have bolt spacing and then you have an O strip conductive elastomer in a rectangular groove is a small errors can happen here lack of conformity to avoid this lack of conformity they will try to give the milling cut.

So, that generally they sit together there is only in extreme cases; it is can be done if you recollect in the video I was trying to show you the water cold inverter I do not know whether it is called an inverter or a drive where because of the high current density we have actually water pipes running inside the electronics in spite of our using good. I will use the word good coolant we still have issues most coolants still have a problem if it is a pure good water; obviously, water has the best specific heat anything else you do for improving some other thing including the boiling point including the antifreeze including everything part of that conductivity comes down marginally.

How well it can take away heat from the adjoining parts and coupled with this any of this inequities we end up with flooded something I have already talked about how flooded gasket.

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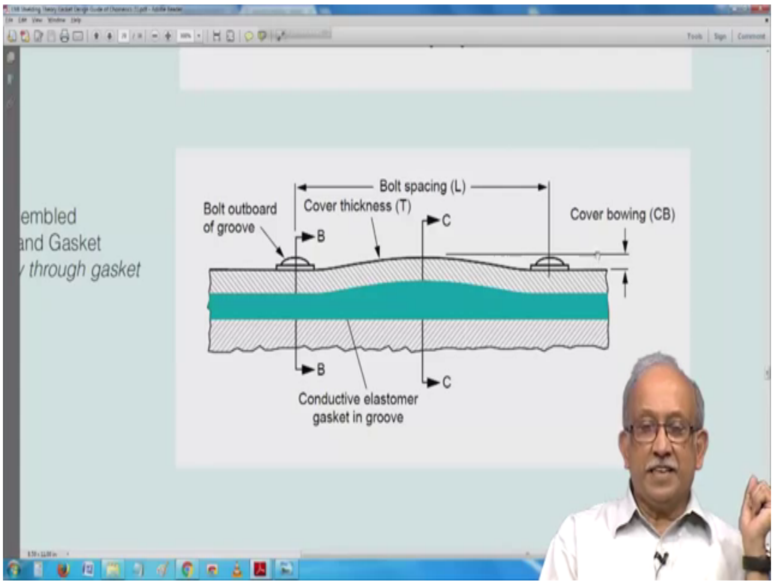


I mean a failure in a gasket ends up with a flooded crank case. So, a water ends up with you know small leakages will be there which go into crankcase and these will get circulated and then normal cases, there is no problem because once in a while I think routinely you check these things. So, as you go down you see you have this beautiful thing know where the bolt is spaced where it full force is there is, but in between we have the problem of things failing a little.

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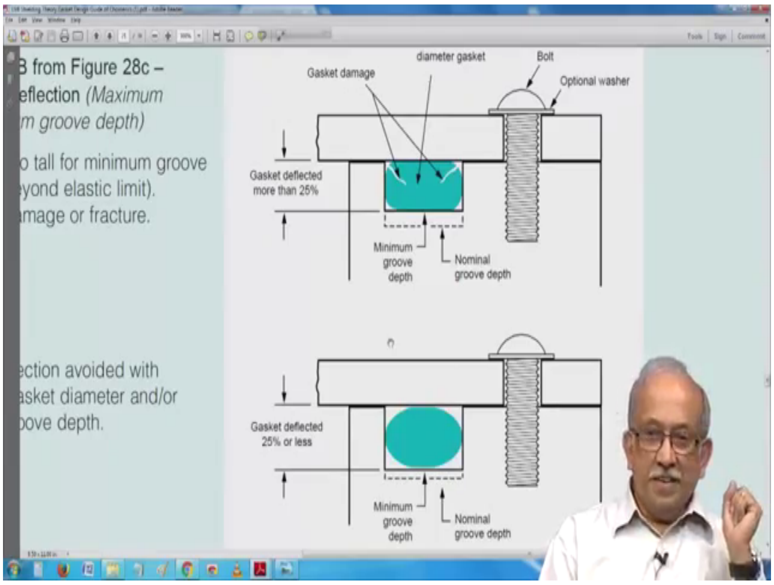

So, further I will go down maximum gasket diameter minimum groove depth. So, you see here these are simple cases no by which how you will pack a gasket in a groove, but these are matter of detail and if you were to design any of this things most likely. It is enough for you to sensitize yourself that such things exist you will not be an expert in it because first of all; you have to locate the materials find out all this practices. Secondly, after populating or packing the whole thing you have to ensure that you put it through some tests.

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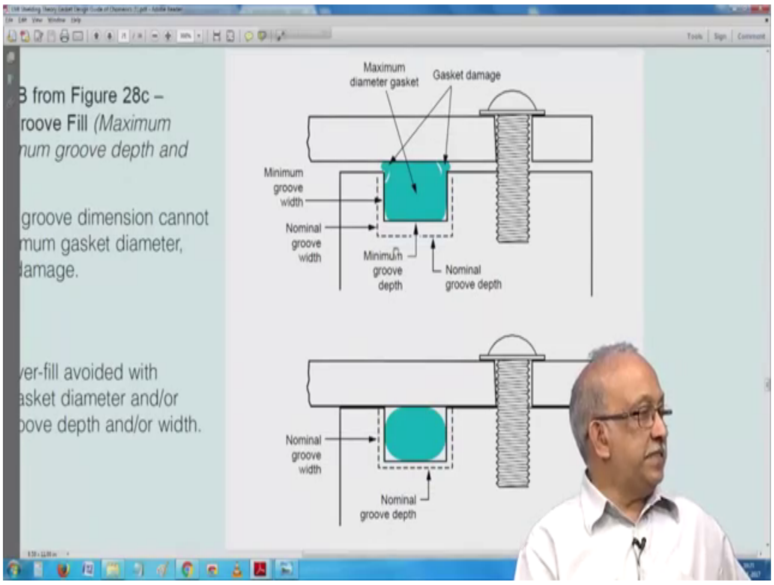


So, these are all part of the testing thing and how if you over pack it chances are see there is a little bit of creep which you have set in here in this case no; normally, I will groove it they does not matter. So, we have you know so many of this you know nice pictures and all.

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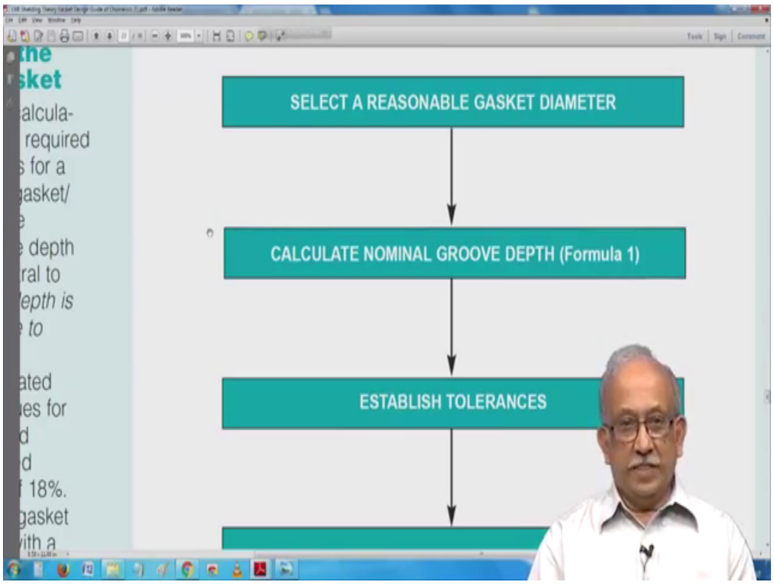


Maybe, this flow chart give an idea you have seen very clearly there is no an automatic converging set of rules which will pick one of them, it still I wants a completely trial and error and completely what do you call blow something and find out it is a little to do with I iterative saying select start with something and then build on it.

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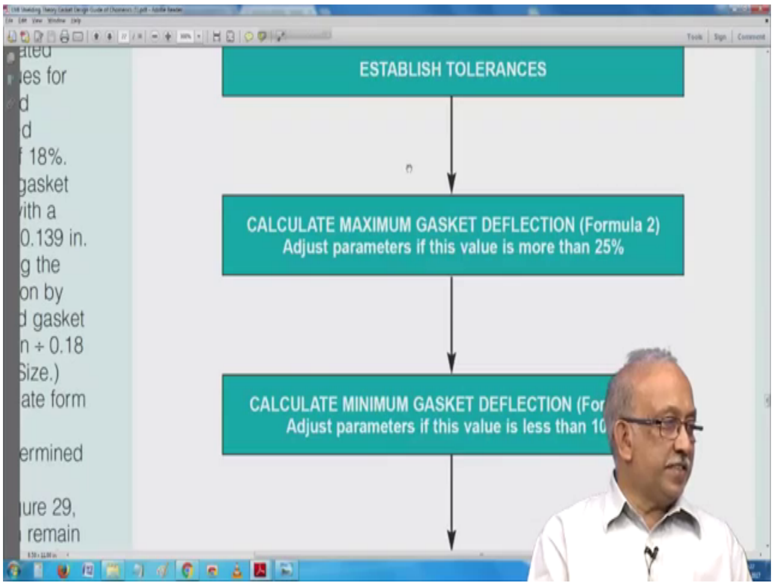


So, it is given here saying select a reasonable gasket diameter calculate groove depth establish tolerances here is the problem normally most of this gasketing; if it is molded it will come in a fix size with probably some blister pack in the blister pack. They will probably include already some adhesive if it is not come with it sometimes; it will be a dry powder sometimes it is a wet to this thing and then if it is around or a square no it is usually folded and packed such that its sits nicely. So, a circle no if you fold it you can reduce the whole thing into a one fourth of the diameter, but it will end up with 3 or 4 thing.

So, once you open it somebody has to measure the things saying are these valid tolerances especially something which is stored both things can happen gaskets will they become bigger than nominal and also they become brittle and sometimes they shrink shrinking in the thickness is not so bad, but shrinking in the overall material the whole size thus cause a problem which happens in the case of the cooking gaskets you start with an 8 inch sheet yeah I think eight inch looks big 200 mm is big probably; they are all 180 mm.

A worn gasket you will notice that it will would have shrunk to about 5 millimeters and then just that 5 millimeter sufficient for it to absolutely unusable. So, here we talk about gasket deflection minimum gasket deflection formula 3.

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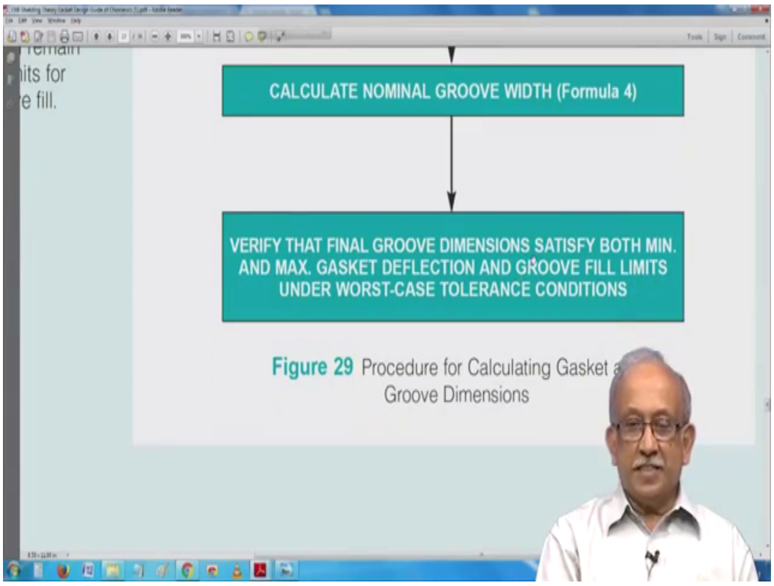


Calculate nominal groove width verify that final grove dimension satisfy both minimum and maximum deflection and groove fill limits under worst case tolerance conditions this is for only calculating the groove dimensions, but I said it is a professional specialist job normal electronics people need not worry too much about it.

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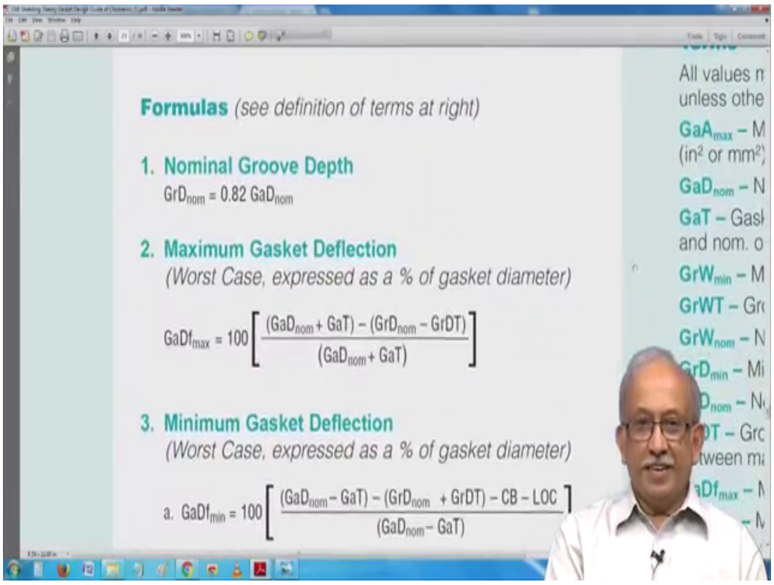


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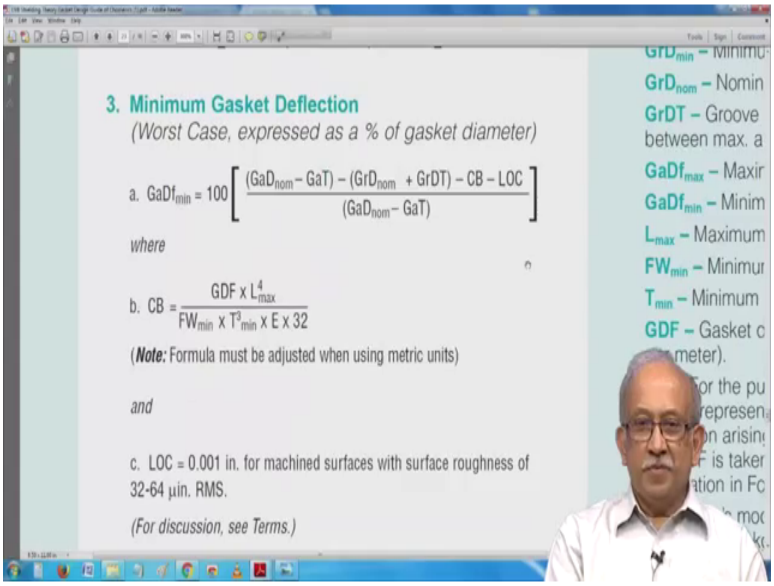

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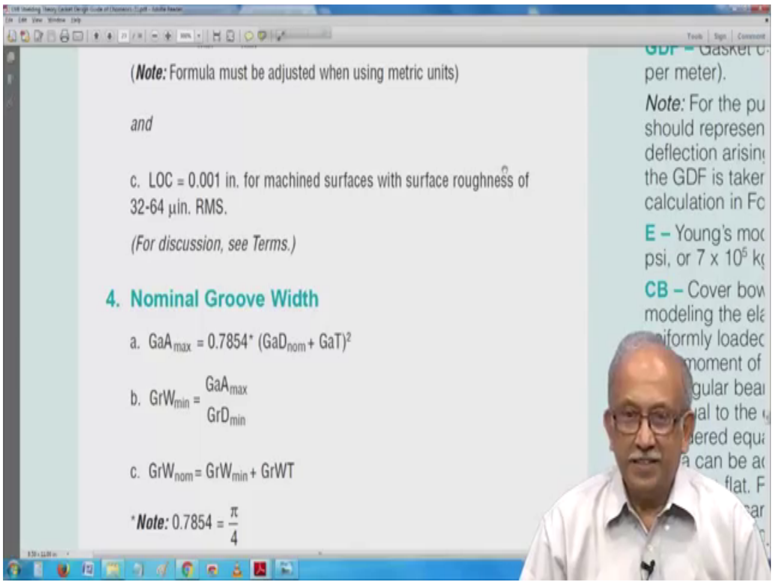


So, there are so many of these formulas and fortunately this formula are easy to use it because next level of maths is not involved there. No integrals, no differentials, no summation, no matrix multiplication and so on; oh, we are coming into porous region.

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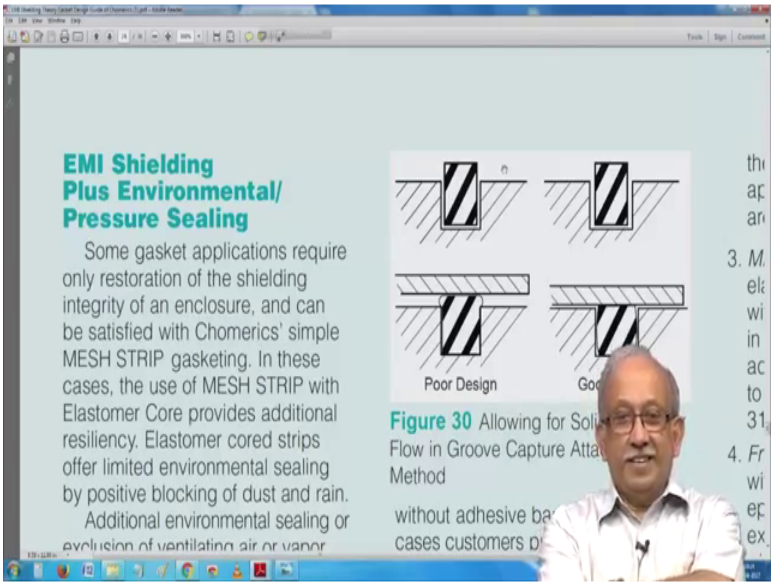


So, far there were solid though the elastomer may have some small cells inside either open or closed, we come to a very nice interesting thing is a mesh gasket anyway advantage of a mesh gasket to start with overall weight is less. Secondly, again going back by the original theory the amount of depending on the frequency the lower the frequency the smaller the holes are there higher frequency might do not I am do not able to make out all I know is 2.2 and half mm is sufficient for thirty megahertz which was the earliest communication designs I have done.

So, you see that the advantage of a mesh is they can be spaced close together and if you just pack in area within over all the amount of material content is small the moment material content is small because a mesh is made of wire string you can use the highest quality material and during the manufacturing they have perfect contact reasonable example is your co axial cables are even shielded wire which is used for audio seen that know it has a nice breed like this crisscross breed imagine a same breeded thing, but much more closely control and much more thicker.

So, you have crisscross thicknesses of not just one maybe a dozen layers and so on here what they have done is mesh strip gasketing.

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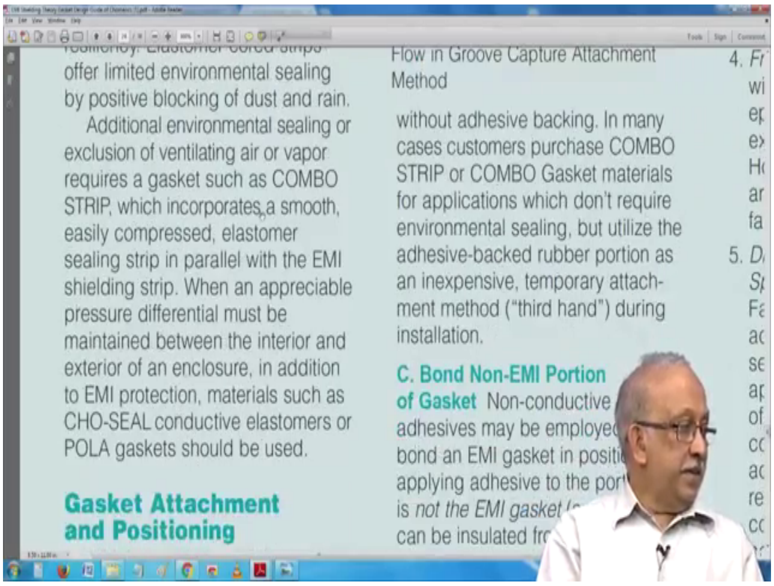


The use of mesh strip with elastomer core provide additional resiliency little problem with the earlier thing is that is something can be made porous chances are it may not do the thing properly.

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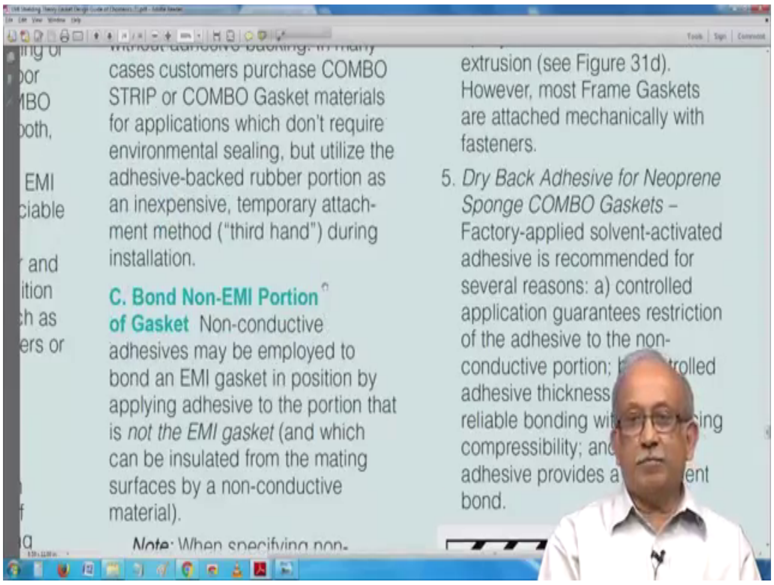


I would call it as F. The function of isolating or shielding it may not done properly; if it is very porous and it is very dense it is not flexible anymore. So, they have tried to give here and you know.

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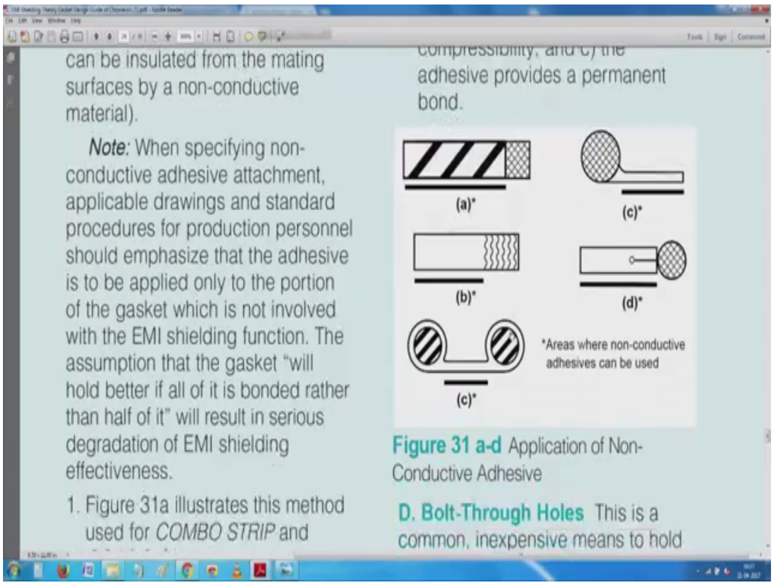


They have given with all this things you know saying what is packed with; obviously, inside know is where the mesh is there this part is the other what we call backing up thing which can be held together. So, things can be pushed inside then we have a simple non conductive adhesive is sufficient and subsequent pictures.

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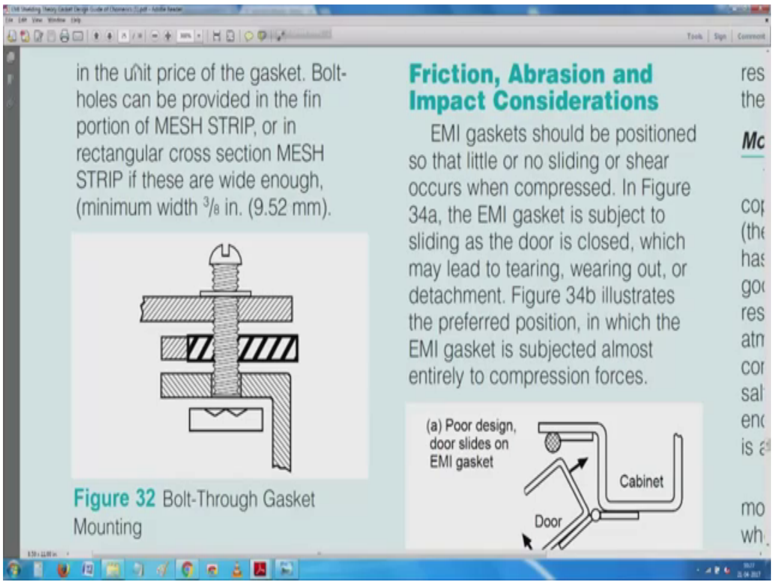


We will show you more and more about. So, you have the mesh portion itself can be punched you have the mesh portion that is punched it sits properly and you see here; then large amounts of specific cases on how to take care of most cases. So, you see here there are gaps unwanted gapes are there. There are gaps there are places we seeing stuck each other.

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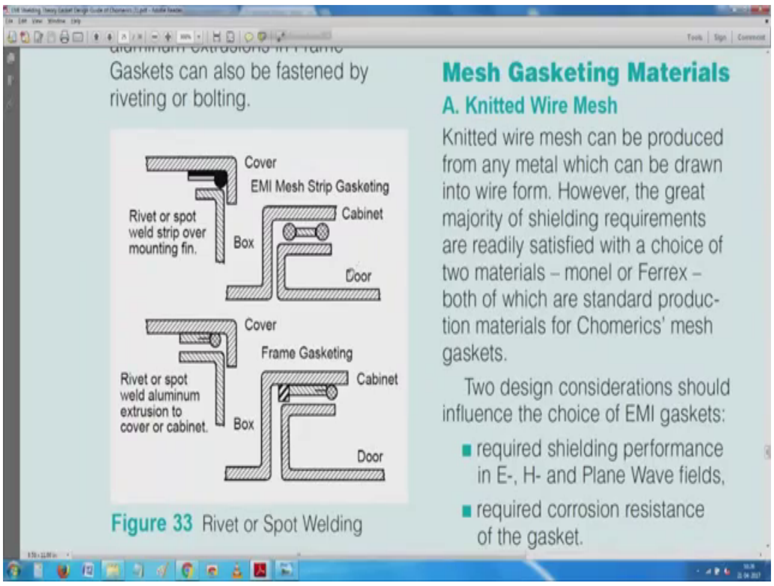


So, we can see here rivets spot weld strip or mounting fen so on and so on; know large number rivet; rivet or spot weld aluminum extrusion to cover or cabinet a door; it is a little like is it not common sense of course, it is common sense, but in the rush of things are something or are trying to concentrate on other thing chances are we will miss it. It is a little like proofreading when you write first time I do not think I know you can really read what you have written. So, you notice that if somebody else reads it know he will notice that it does not seem to sound well forget idiom normal typos are full expansion of the printers devil comes in.

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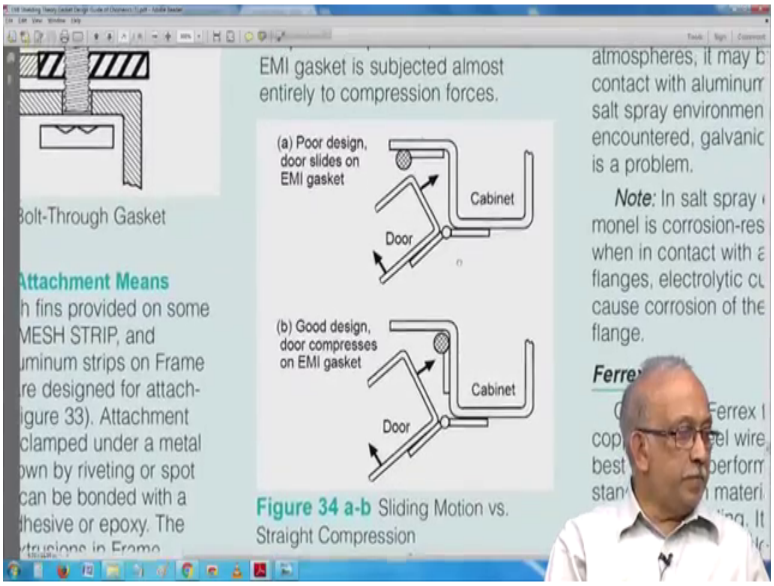


Same thing happens in the case of this. How we implement small detailing while the doors are closed and how we implement small detailing about how to clamp things, yes, it is a lot of common sense. In this case, common sense being tried and tested method as compared to hit and miss this is; obviously, I think you can see for yourself when you try to close the door on the top section is a mild amount of rubbing after it hits and in this case it compresses automatically while in this condition is rubbing is considered banned some other conditions it is considered desirable.

Whenever you are trying to make a pressure contact which I shall connect in which I will repeat in the connectors class, but and wipe seems to be the best way of ensuring contact. So, when even in case something is not used for some time a little bit of corrosion or something forms if you touch something. And then now squeeze in that surfaces gets scraped as connected I mean as compared to a simple silver button in a contactor which keeps going patt, patt, patt like that know millions of operations, but in the case of our industrial connectors that 3 pole and 4 pole which used for our machine; all that we have a completely metal clad enclosure. So, something goes inside and then slight amount of twist is given that twisters double advantages you have a holder and then something scrips here.

So, from that point of view in this case they are saying door slides on EMI gasket. So, it is for you to take a call on it saying would you wanted to slide or not. So, depending on the material depending on the chances of corrosion and all that know and how frequently do use the problem is if you want to put it into this corner. It is not easy this corner it looks like no it is relatively easy. So, we go on mesh gaketing materials.

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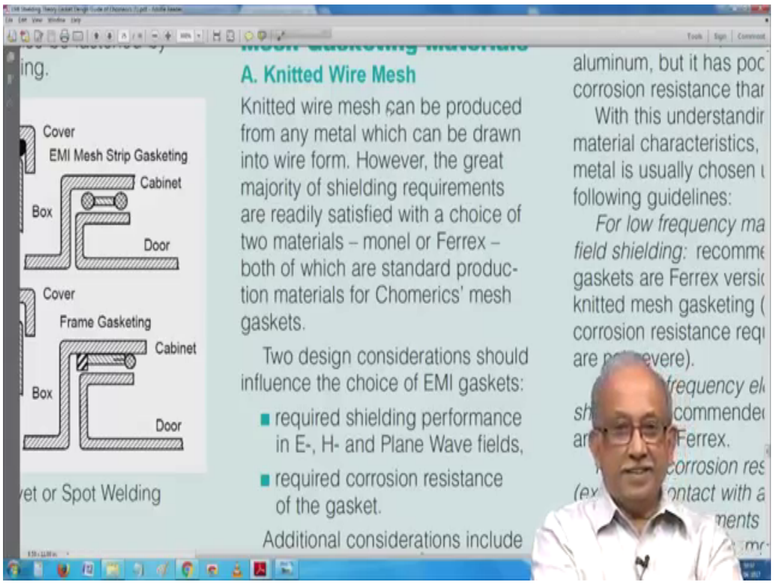


So, we come back to knitting. Knitting is it is oven we have a knit and like this; some a series of gammas which are there and then next one goes into it and that is how knitting is done as compared to a simple mesh clock.

Knitted wire mesh can be produced which can be drawn into wire form great majority of shielding requirements are satisfied with the choice of 2 materials monel or ferrex are standard production materials to design required shielding; required corrosion resistance of the gaskets. So, you see here; 2 things are given here.

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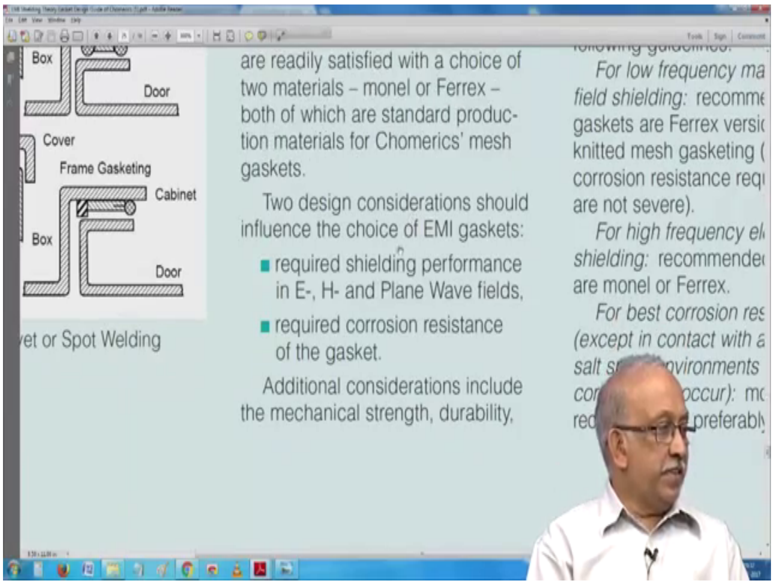


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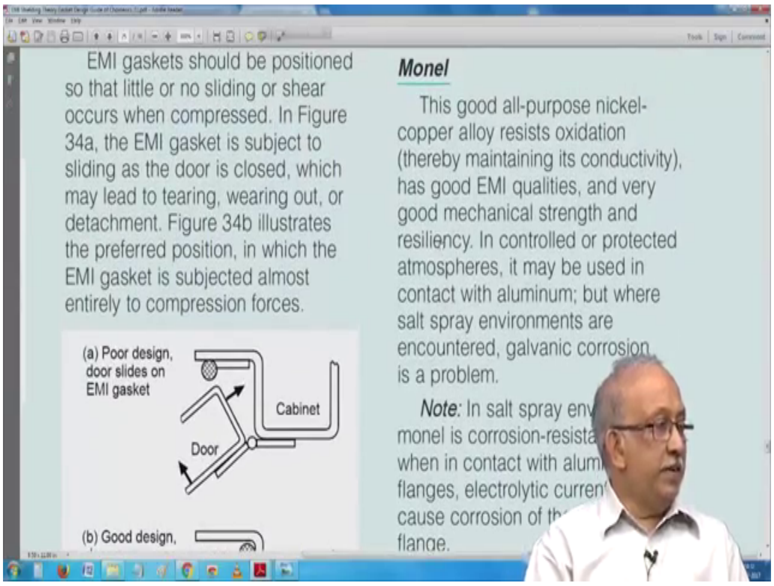


One is Monel is all purpose nickel-copper alloy resists oxidation maintaining its conductivity good EMI qualities and very good mechanical strength and resiliency in controlled or protected atmospheres it may be used in contact with aluminum also.

Where can we say this next time you get a chance and we do not destroy anything because it is not like one of that popular TC and series have a look at your microwave oven that front glass? It is a small you know a cover with small openings that is the one that ensure in the unlikely case with all the internal reflections a ionizing radiation does not get out ionizing. The one is the one that causes burns and suspected to cause cancer and so on non ionizing; it is fine, I do not know the difference, but let me leave it at that and an all along where they mounted because that itself; it is either a sheet which is punched carefully or edged in that case or it is a coating directly on the glass the way this is attached to the outside panel is vary or likely to see this.

Similarly, when you close the door of the micro oven one of the things is you may gasket there I expect that it has some of these things are you know taken care of a little I cannot watch for that, but thing is the total exposure time and all that I thing the largest cooking maybe around 25 minutes to half an hour typically everything was order of 3 or 4 minutes and 2 other things you will notice; it is very different from the refrigerator gasket refrigerator gasket has some other function in this case both it has to seal against the heat and what you call steam that I can escape from inside plus ionizing radiation.

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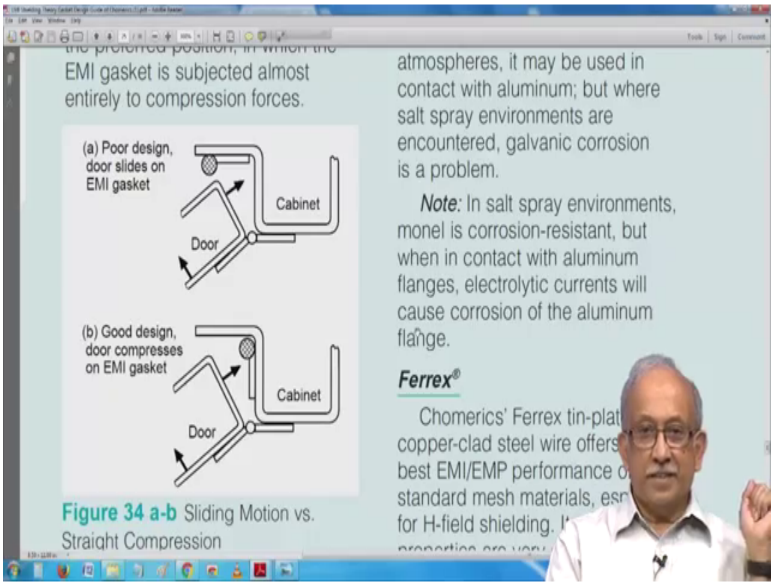

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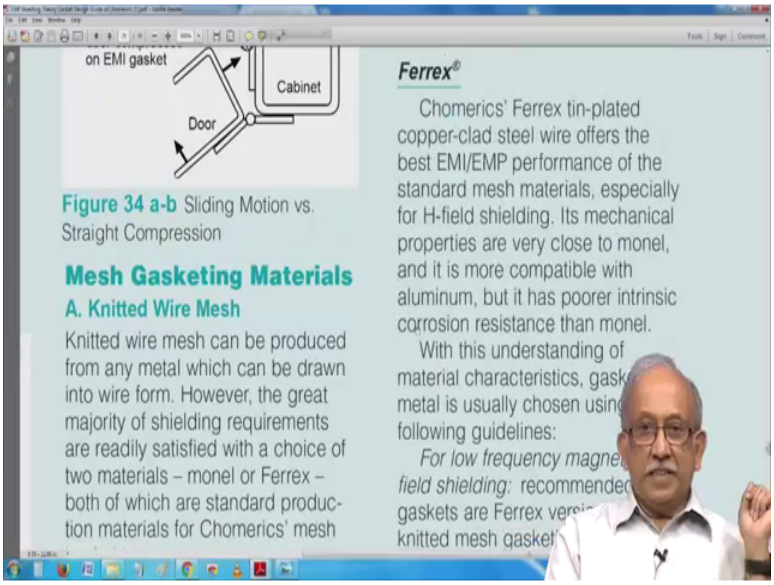


So, typically you are likely to see all this. So, ferrex tin plated copper clad steel wire offers a best EMI performance.

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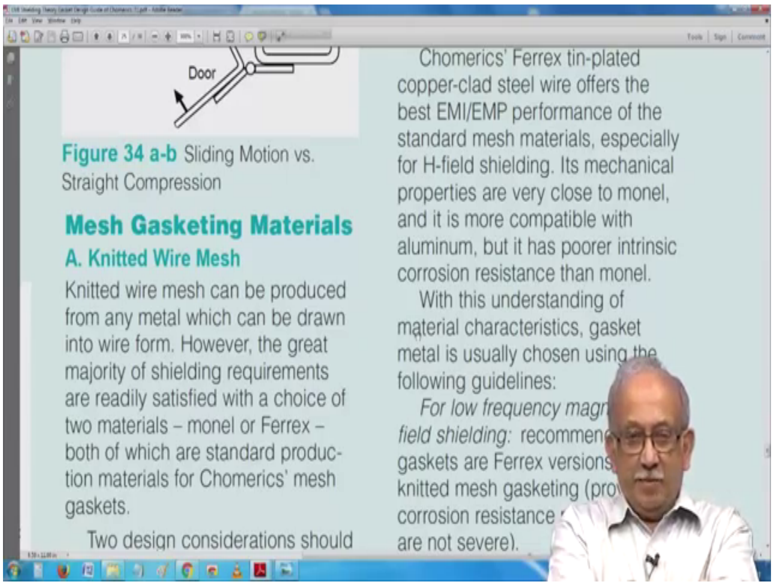


Leave the commercial or trade notices most of them know with undisclosed manufacturing process we have these materials; there are I think as I seen no about a dozen major manufacturers are there; who give all these gasketing materials other than that lot of contacts are there finger contacts and ferrules which will go and make contact here.

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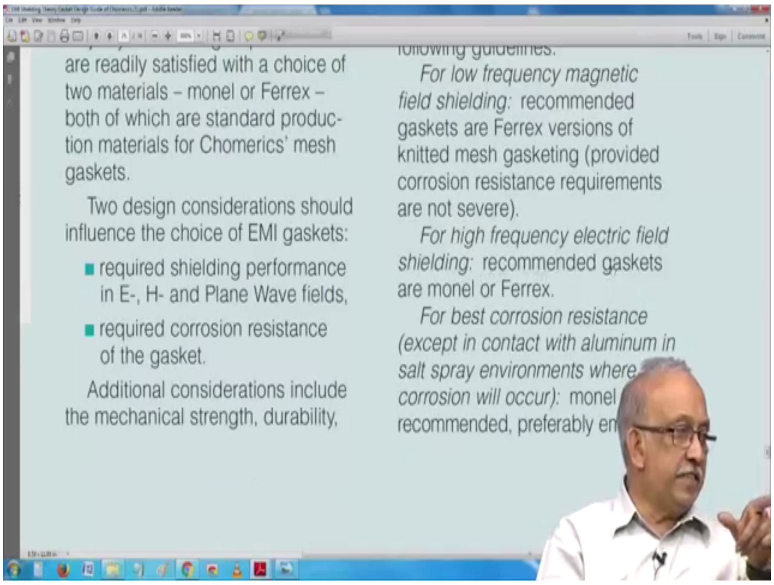


For low frequency magnetic field shielding recommended are ferex versions of knitted mesh high frequency electric field and so on first best corrosion resistance because who meant to have gasket we all this.

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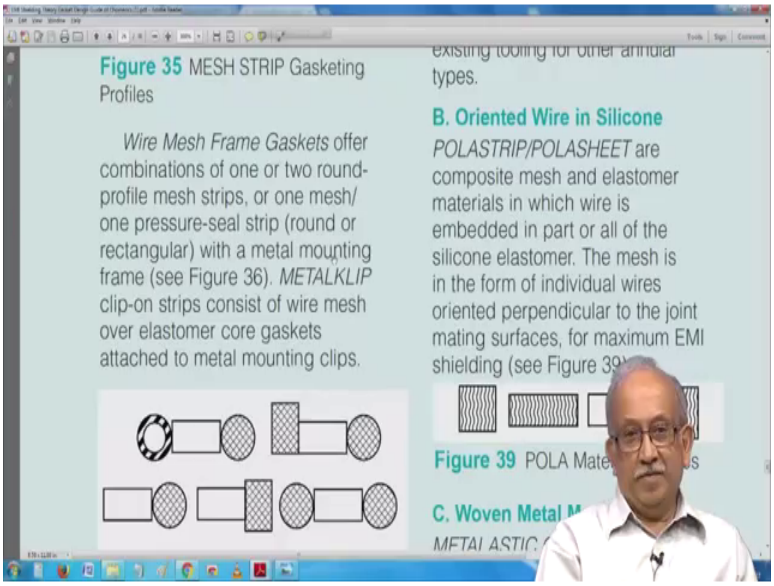


So, we have large number of commercial their listing in the catalogue it has again 2 3 things; one is how do you attach there or assemble to your various parts. Another is how do you how effective is it in the shielding we are need to worried only that part about it which is there. So, I will just go through quickly hopefully no.

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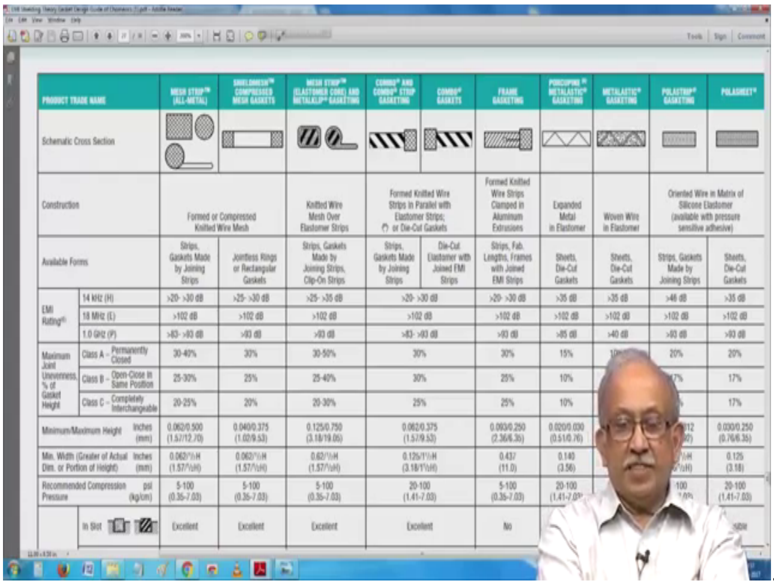

Oh, we have so many of these things; no oven wire and elastomer and huge. This thing is there; I will see if I can rotate it clockwise. So, you have the trade names and characteristics and so on. And of course, there are tested and proved certifying agencies which guarantee the whatever claims they have made you have seen here important thing is this EMI ratings mil STD 285 is only a test method it does not guarantee or it is not a normative procedure saying something should have this much, but if you specify whatever measured values are all reported there.

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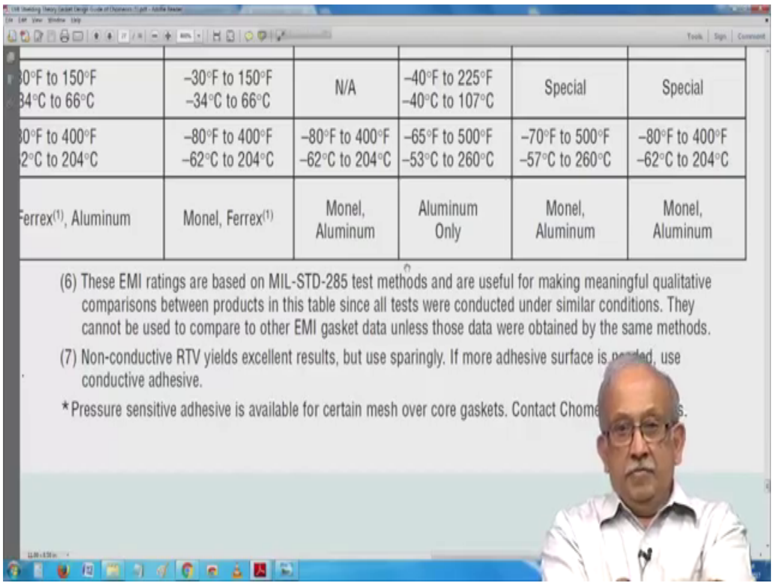

So, you have all these various products and like just like a mil std because these are all evolved from military applications you will see that often cross reference is given to them.

But when that thing was going on; what you call when the standards and all were being prepared. It was a little to do with how testing was carried out. So, that it is field deployable or field worthy not so much as the analytical part; probably analytical are also carried out, but because this speed and all that it was done by practice more than preaching. So, later on I think it move to the academics and we have all this. So, we are almost coming to the end of the I will say book reading session; it just mentions, what all I have I know degradation and so on and so on conductivity mechanical abrasion resilience. So, my own suggestion for you is kindly go look at this particular this thing.

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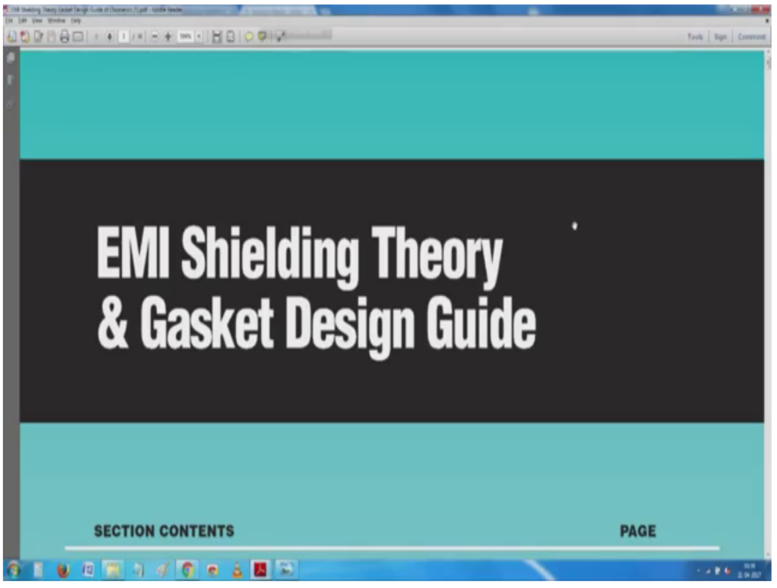


Saying EMI shielding theory and gasket design guide from chomerics by companies name also is given parker I think it is called chometics or chomerics; I do not know and read this book.

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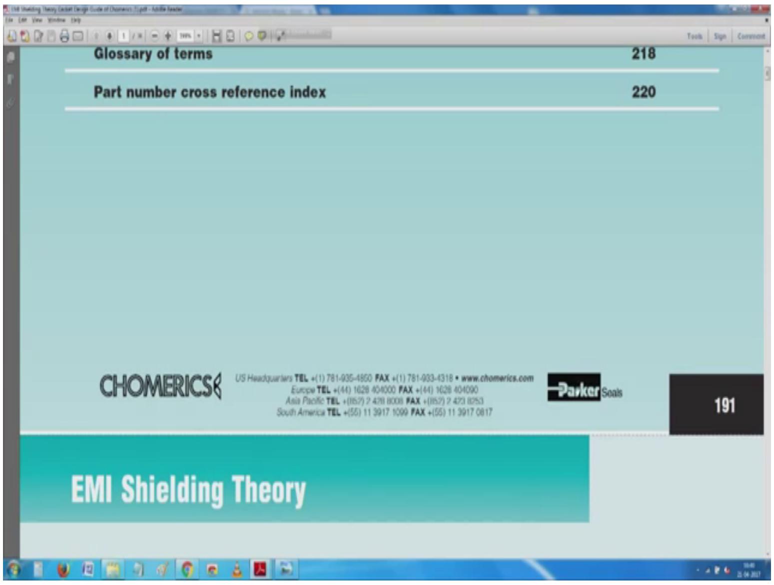


I mean it is just a note its very small it is the full thing is around 300 pages, but this section is only around 120 pages I find it authoritative with both design guidelines as well as little bit of theory which is backing up; however, if you give a simple search you will find multiple hits. So, yes, I thought I will anyway, next one; I will try to do see this particular hearing aid; what I have is the in the canal hearing at what I have earlier; we had a problem with trying to converse on the phone with it. So, earlier behind the ear and then the pocket hearing aid had to use to have what is called a t coil telephone coil system.

So, inside the hearing aid there is a small pickup which magnetically pick up picks up whatever is provided in the that hearing; what you call telephone old telephones are based on a magnetic speaker you have a coil and then very surprisingly, there will be a strong magnet inside. I had to contact somebody in the communication industry explain to me; why it is you also check up; what it is; why the magnet is needed and then you have a disc. The thing is whenever any voice is you know excited I mean whenever voltage excites the coil you get the sound and then the stray magnetic field is enough for the hearing aids to pick up this thing. So, they were all built with a T coil.

Then subsequently it was found out that while it is a blessing in some conditions. It is not such a big blessing condition. So, there is to be a switch you can switch on or switch off the T coil, if any of you are about my age or already suffer from loss of hearing or somebody says know failure to pay attention when people are talking you look up on that.

So, thank you I will take I mean; I will stop it here. Maybe we will continue in the next this thing mean while I will try to go to that place where the pictures are for EMI room and see what best I can do.

Thank you.