**Enclosure Design of Electronics Equipment**
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**Lecture - 36**
**EMI Sealing**

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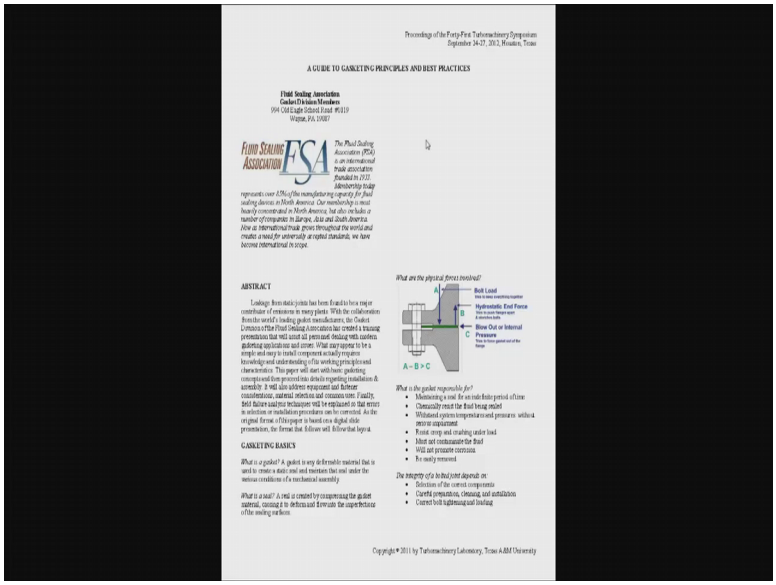


I will try to show it in detail later there is something about guiding principles for gas cutting in best practices.

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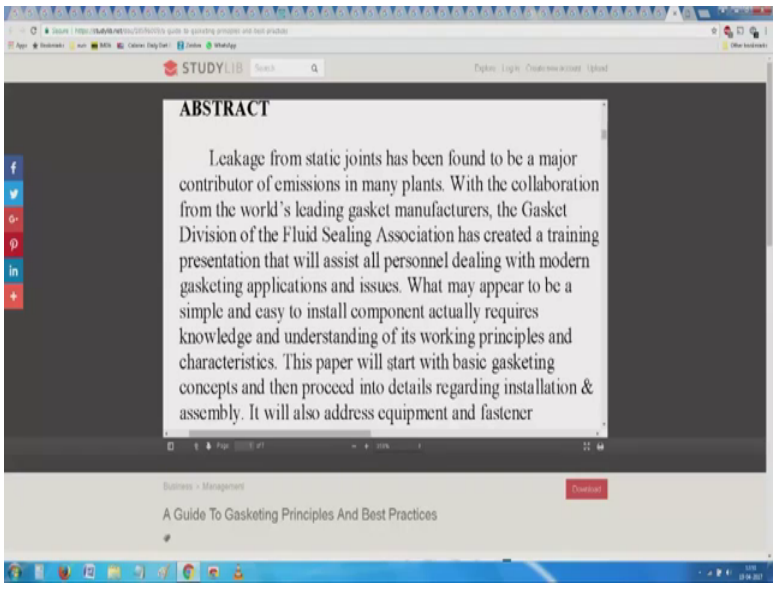

So, I will try to show the picture little closer. You will see hope you have read it ahead of me, but then what may appear to be a simple and easy to install component actually requires knowledge and understanding how it is working principles and characteristics. So, in the case of electrical, only two things happen. One of them is external fluids are dust my get inside or in the case of CNC equipment where the issue of metallic chips and sometimes cool and that is used while cutting can also carry the chips and then, damaging the machinery inside and alternatively things inside coming being you know speed out and operators getting stuck about it.

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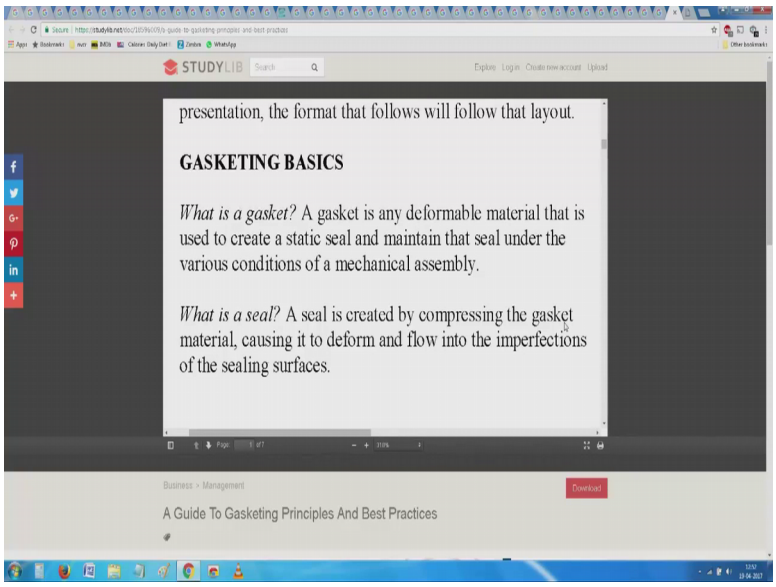


Read it for yourself. It will make slightly better understanding. Gasket is any deformable material that is used to create a static seal and maintain that seal under the various conditions of a mechanical assembly while a seal is created by compressing the gasket material causing it to deform and flow into the imperfections of the sealing surfaces. So, if you see our automobiles and several places, in principle metal to metal continues of the best. Anything else you join. Inside is a compromise up to a level if I go back, this seems to be the crux of the problem. We have a boat load, then hydrostatic and force tried to push the flanges a part. Well, it looks not so important as to why we need to follow it at all. It is very important that you should see the basics. Two other things you notice is there are clamping forces in world and every time you remove a gasket and stair in you to reapply the force .

If you see that street light boxes, when it first came, I am sure it work perfectly all right. Nobody will compromise other human safety and all that, but eventually when things started failing and people have to work under very unfavorable conditions, maybe it is in the middle of the night. It is raining. Quickly they have to restore power and probably it is somebody else duty and not the people are in the regular maintenance, people there in the emergency services. So, you notice that this very basic thing about clamping force bolt load is not thought of much. Then, you see other thing chemically resist the fluid being sealed. In our case, it is a little bit of water and maybe oil withstand system temperatures and pressures without serious impairment.

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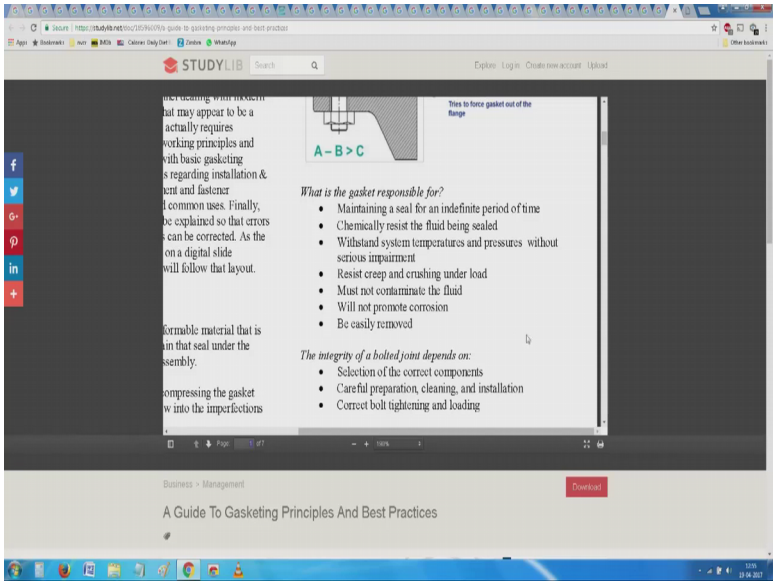


How can there be pressures in an ordinary box, ordinary enclosures? The simplest is one thing get hot inside pressure builds up, similarly when outside temperature is high or in the case of aircraft and other things where quick change in altitude is there, pressure keeps changing outside and pressure falls off.

So, if you are one of us people who carry kandar bottle pickles, you would have seen that whatever best action you have taken, now probably it would have leaked. So, the best what we call old practice of putting everything in a tin can does not really help somebody takes a lot of interest on making sure that these things were exported how liquids are done. So, if you see here gasket is supposed to resist creep and crushing must not contaminate. The fluid will not promote, corrosion be easily removed which probably

happens under all conditions or now the first thing is gasket creep is real. You cannot take two surfaces and jam some elastomer material directly in between them. If you jam them, chances are it will get permanently corroded.

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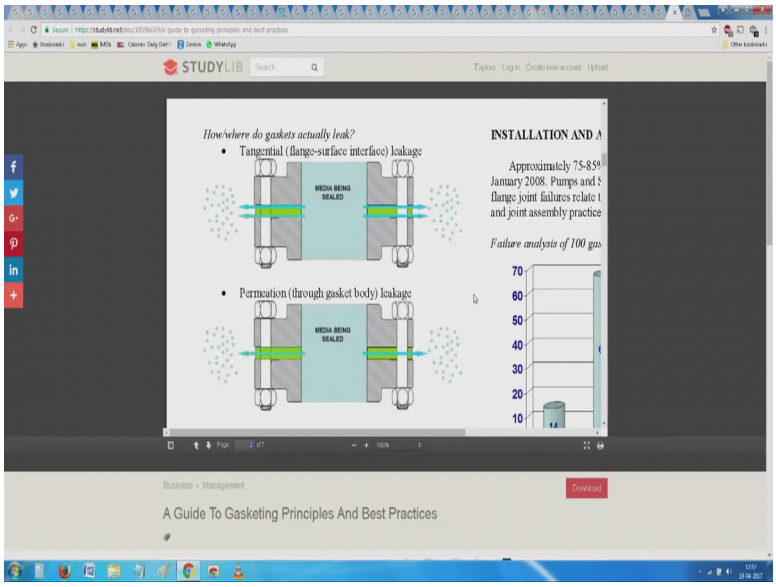


Two examples are given here. Tangential flange interface leakage and another is permission through the gasket body and leakage. This is taken from the fluid society, where there very much interested such that no leakage can happen at all under tremendous pressures also. Probably it belongs to the chemical industry, but still the reality is all this stuff. Why gaskets fail, I intentionally made it you know little bigger, so that you can see it not sufficient torque is applied.

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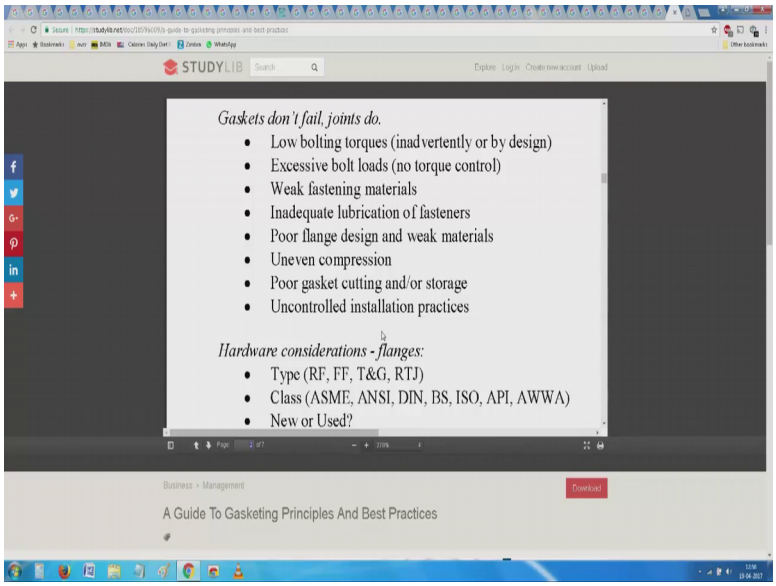


So, if we go back to the street light box outside in the previous picture what I have shown you one of things you will notice is that a small clip given on this side is not sufficient. It is really isolate.

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The external atmosphere to the internal atmosphere I will see if I can locate it here. There are just simple small clips which are mounted outside. I do not think they are sufficient to exert in a force to make sure that it stays bolted.

So, what started as a genuine interest in making this real? Still it suffers from the problem of gasket not having enough clamping force to make itself. There you see this side, there is no problem. There is enough leverage, but it leads to the other problem saying more force than required as when put and then, over the ambient temperature parts of the gasket have cracked here, the crack may or may not be dangerous because much earlier to that problem, the electrical failure has occurred, but still it is real. I will call it now saying it is for real. You have seen that last thing in that gasket do not fail. The joints do uncontrolled installation practice. I will modify it a little in our case saying in our case, it is uncontrolled repair during installation. There is no problem and eventually with during practice, during repair, it fails and then, you have seen this poor flange design and weak materials solve the leaping and all provided may or may not.

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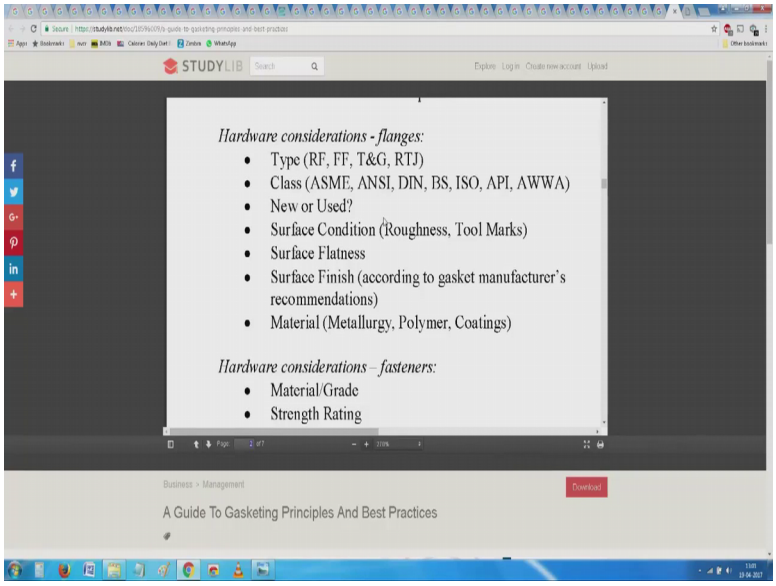


In this case, this is meant for probably hydraulic and other joints, but in our case it is equally valid for our enclosures design. You see here one of the first thing is surface flatness. So, if there is already tool marks and dents created, small imperfection things are likely to fail because the gasket was not designed for it. You understood? No. Any small imperfection what starts as a plane flat surface may just have one small dent in it. Good example you will notice is probably if your automobile, if your car has got into crash and you cannot remove the dents easily from the bonnet or the boot, adjust start for the first failure. The bonnet does not close anymore. Normally there is no problem

because from the visual point of view, you will probably adjust it, but then when you drive in a rain, the water channels get blocked.

So, I do not think you make a very regular practice of looking for how driving rain water gets empted from the roof top of your car, but still it is real. First smallest dent we have a little issue and then, if we live in the tropics like what we do, usually we have a windscreen or windshield which is also fitted with the gasket. Newer ones are all you know they use an engineering adhesive to practically stick the glass to the sheet metal. Even there after repeated use of temperature high and low eventually things cracked and a little sort of a leak starts forming.

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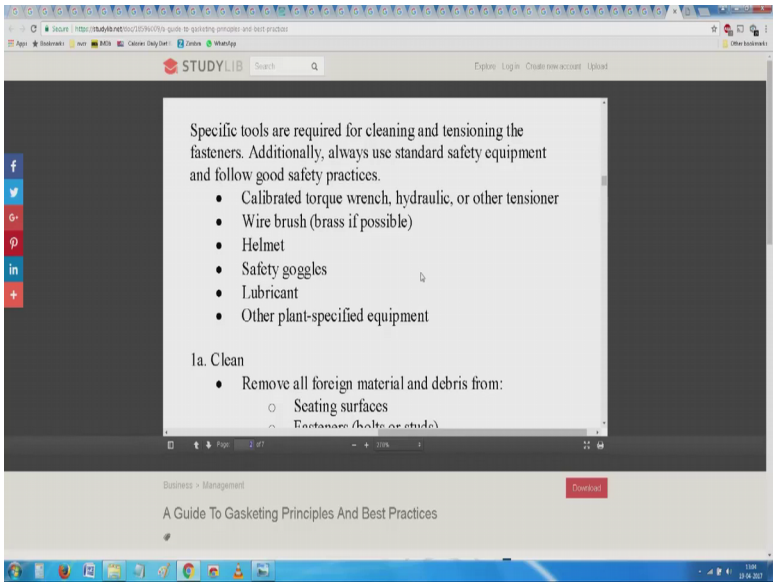


So, I will just I mean what you call I will see if I can this is general. So, you can use it as an obstruction. You need not worry too much about the helmet and safety goggles, but you need to make sure that you use the correct amount of forces and correct way of installing things and you have to see here a wire brush for cleaning the surface of any materials which have got in and most important is a small lubricant. You have a gasket grease that is usually applied and you need to reapply it. This I think know sufficient for us. From this at this point, I will now try to move on towards the end, where you know many practices and various types of materials are used.

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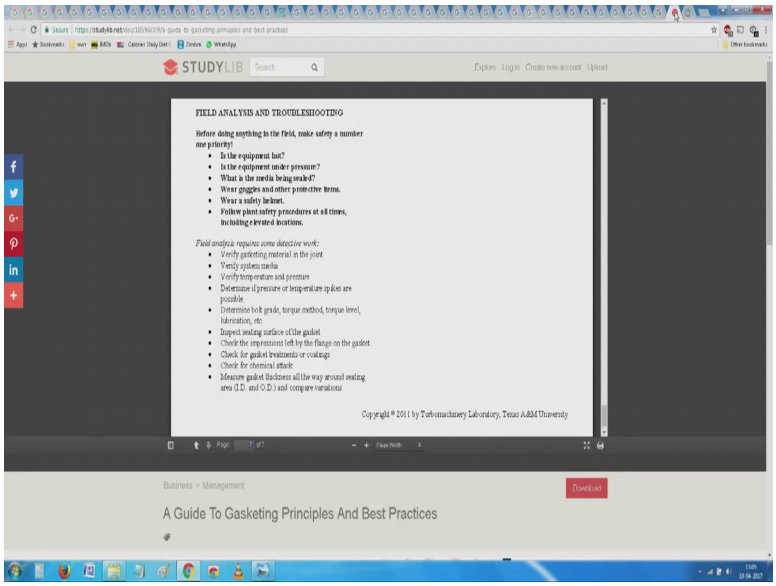


think we need not worry too much about it in our context except to say that yes gaskets are real and so on.

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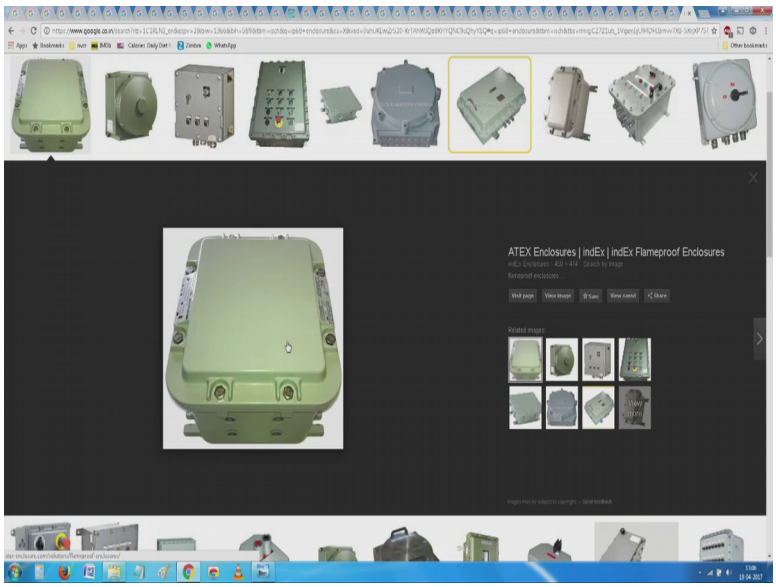


You see all this beautiful IP68 enclosures; they almost look a little like industrial equipment. I hope you agree with me because they are industrial equipment. So, you have all these fantastic flanges here and then, if you remember we are talking about the bolt load and how to install things and all that. All of it comes here and street light is not a very what you call I will say not a very dangerous thing, but imagine if you were to be

there in a industry, this way comes really risky same thing, but in this case it is a control panel. I am not able to access the image. I am not able to enlarge in. I tried as much as best I can do.

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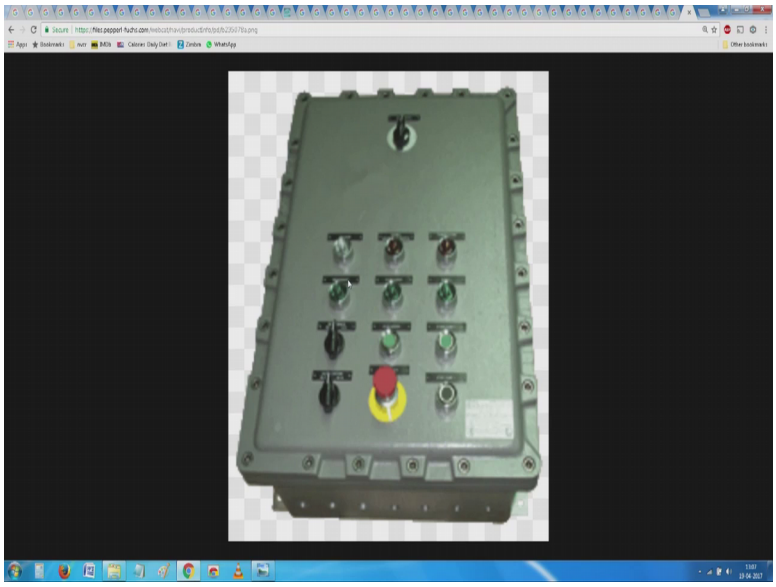

It looks a little like your IC engine crankcase or the top covers which has been bolted down. So, here it is very critical. It may be a flameproof enclosure, it may be used for other designations. Now, if I go back, things are pretty big and hard. All the things which I have been describing to you in the earlier catalogue of gasketing and safety will come all the more important.

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In the case of flameproof enclosures, fortunately for us always know a failsafe mechanism is there. Even the studio has some sprinklers and all that which do not need electronics. We just have a small capsule which bus in the whole thing is flooded. Looks nice is not it? The sad thing is I do not know how to get out of this place.

So, never put a big things ampush. Hopefully nobody is ever left here alone. There is some minimum of three people monitoring me I am safe, but in the case of industry if you go here to this, this thing you see here, it seems very simple.

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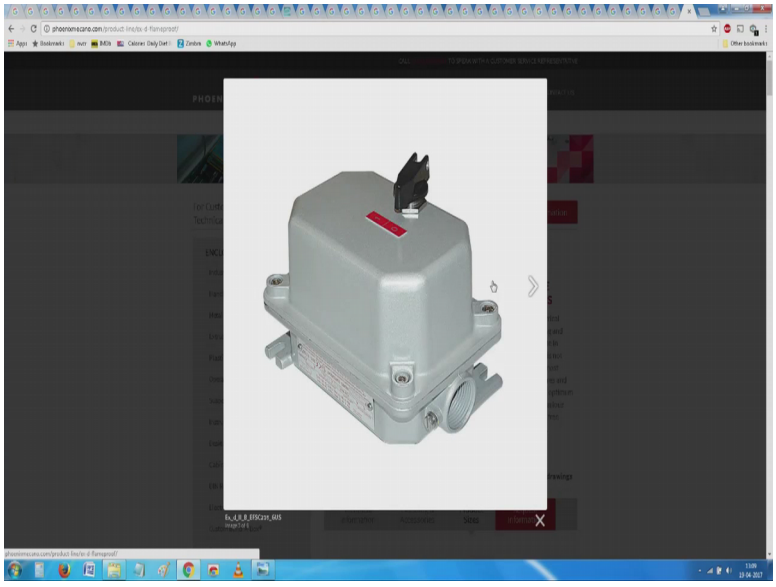

Now, to just start a pump and all that, do you have to do such a lot of this thing? Yes, it is real. If the slightest spark is induced here, it can go and trigger anything outside, not just for solvents. Even in the case of solids have given you example of dry milk powder that itself acts like a combustible material.

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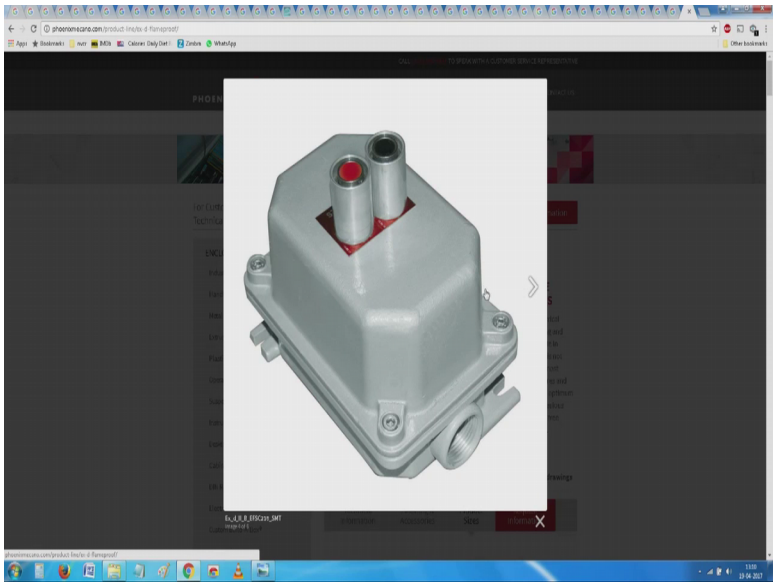

You see here extreme additional precaution has been taken even for the on/off switches to make sure that accidentally you do not switch on something. Similarly, accidently you do not switch off something and then, lot of tubes like thing and all I do not know maybe it goes into some other enclosure.

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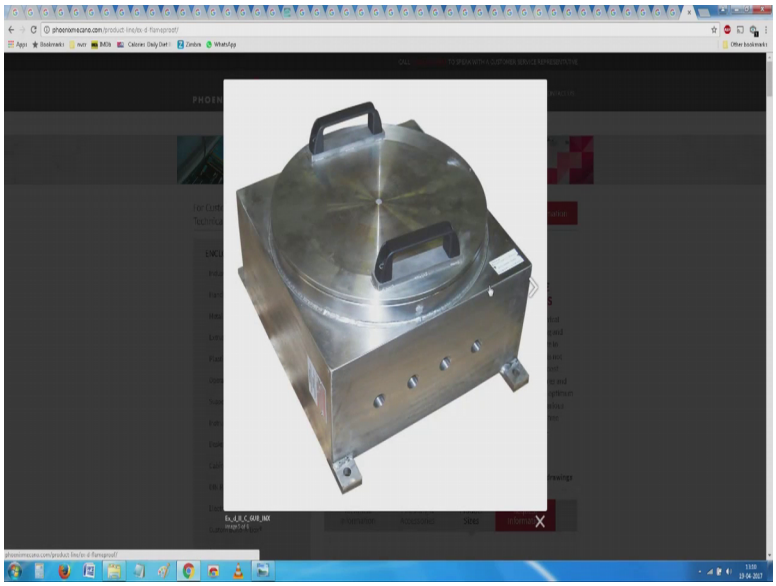

I have no clue what it is, but what I can say is by looking closely at it, the very fact that there is a closed welding. It looks like at some mechanize to welding. Obviously, it is very important equipment.

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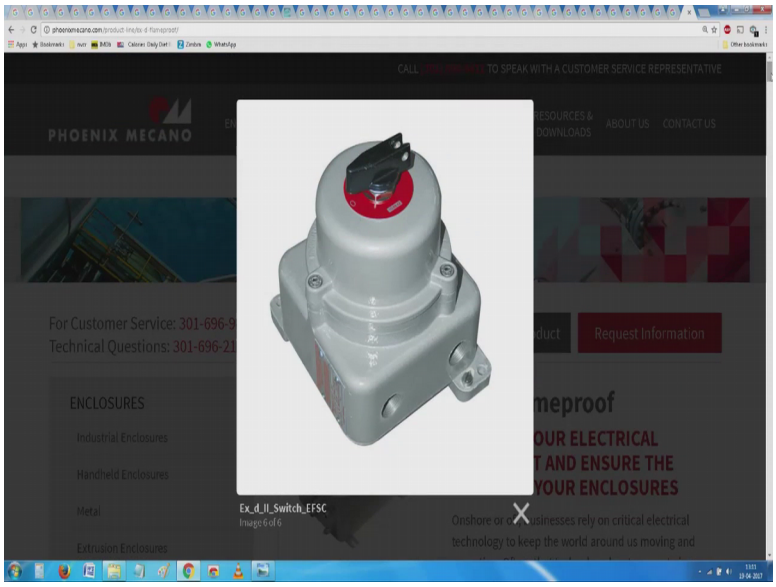


Only I can think of is you find these things and high vacuum which you have in our semiconductors facility downstairs, but gasketing and electrical is real. In all these things there is nothing you know I can ignore about it. Good see things are getting very interesting about it. So, we can keep looking at all these things. You have seen this here

while an electrical enclosure looked very convenient and easy for you. You have a look at it, even the stuff like motors.

So, normal course we do not expect a motor to cause much of damage. So, both ways neither should the motor get damaged nor that should be motor damage things outside. In general, you have all the necessary practices here. Further you see here the terminal box, the way the terminal box has been sealed, you cannot just take loose wires and then, force them into the terminal box. It has to have completely concealed conduits which themselves now have some special features that are built into it. So, I can go on like this.

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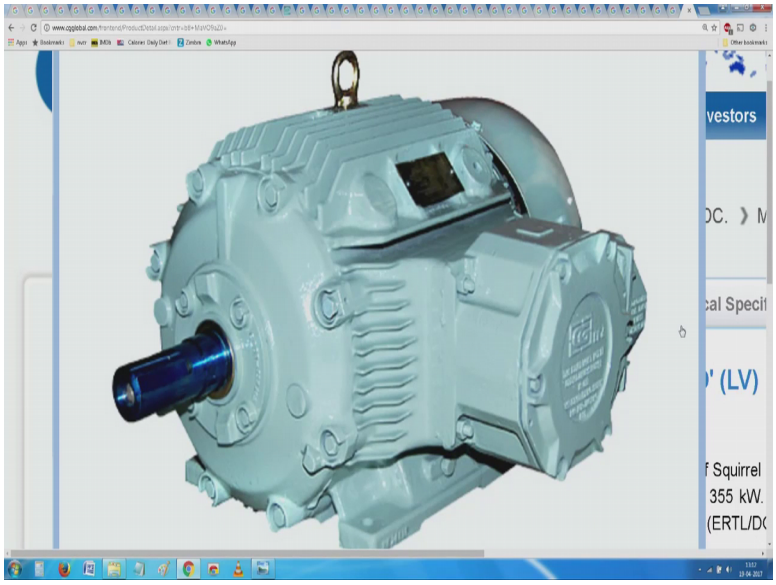


Now, when you are to select you see this beautiful, a proper way to do things.

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This is probably what was needed in that condition which I have shown you on the street lights, but these expensive probably it cause overall may be four times as expensive as the cheaper ABS enclosures and all which they have put outside, but you see that failure to its leads a little like the way lot of software companies make a living patch buggy code. I start with the boggy code, I had a patch and then, until the next build comes you know you can keep on adding patches. That is where probably you know we create jobs and lose them.

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So, you see here practices like this ensure that you never have a field failure. Understand now even everything inside is made properly installed, sits properly the first time.

So, it is unlikely that you need to redo things. No more patch up is required. If you end up with the patch up, you have a problem. Instead I know it is stupid and maybe out of contest, excuse me for saying. No, we know about the regular various types of operating systems versus the operating system which has less value, less chance of getting attacked because it is closed. In another ways, it is extremely open. We have the Linux. Linux survives and in between now they have so many things, people trying to attack us one way or the other. This is beautiful examples of IP67 enclosures. So, maybe I should take you here. So, it looks like our computers and internet you have seen this IP67.

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We may not have, we may not need these things in our normal switches and so on, but you see here it is other than closing it. You notice something else also at the bottom here. You have seen that two beautiful connectors because a lot of times this is left in the open.

So, we have IP67 enclosure and the bottom you see here, anything you can think of shock and vibration, usual dustproof anything.

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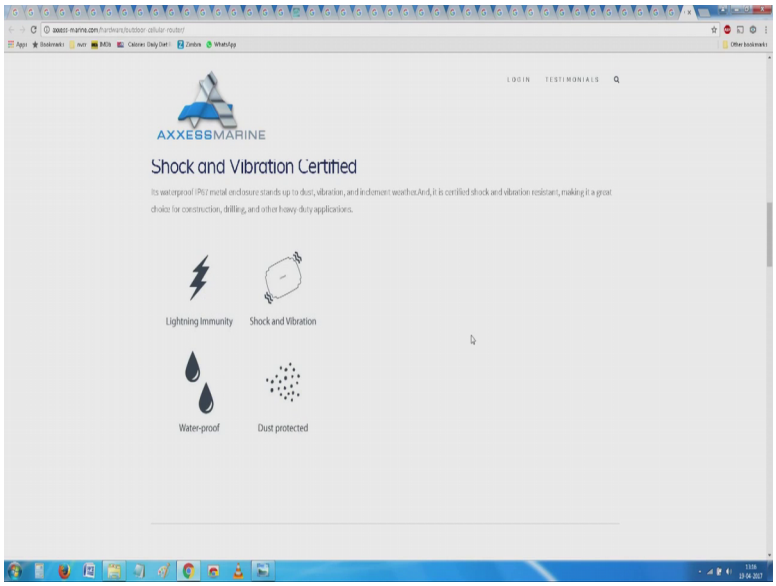


Then, one more thing here is something new has been added here called lightning immunity. Why? I do not know how it is achieved, but it is otherwise you do not have your communication equipment working in the case of a storm. These all look reasonably simple, but you notice that lot of data I mean, I am sorry there I have ended up with yeah, I think we will skip. Yes I was looking for a simple terminal box. A terminal box should not need such a lot of enalces as I am trying to do, but the beauty is unless you have this gland nuts, unless you have all these other hardware chances are, it will fail.

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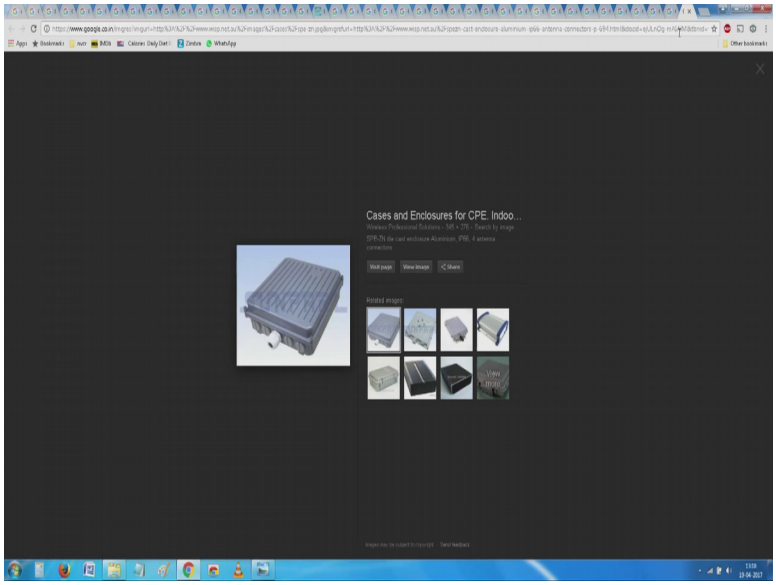

Now, maybe I should I think I will stop here. Thank you. I will continue the next time because two things that you will get saturated by this repetition and then, an important thing about actually how the implement EMC EMI gasketing in enclosures, big lecturers are there.

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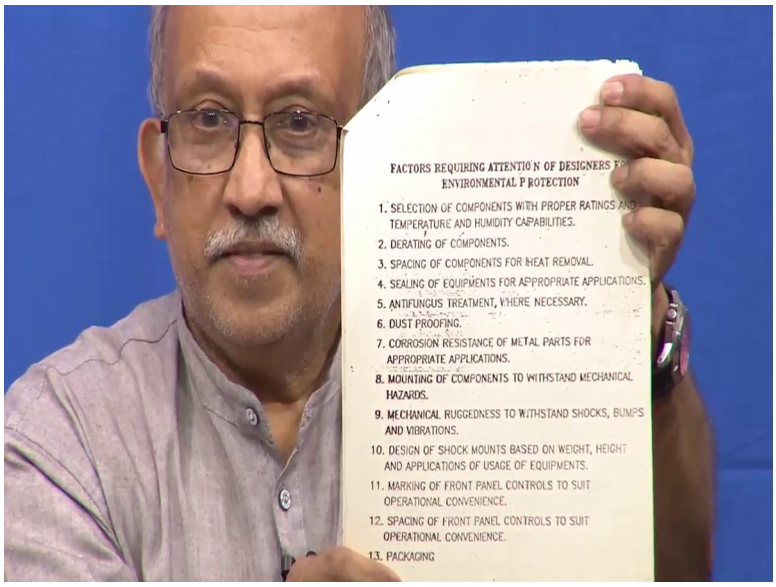


Then, before I go out I thought now I will continue to show you that the military has been using this for a very very long time. You have seen that from four onwards, no sealing of equipment, dust proofing as we go down number 9 8 and 9 mechanical ruggedness to withstand shocks bumps and vibration design of shock mounts and so on are all there. This will be scanned and put up, so that eventually you can read them, but I thought it is a good place to start.

So, I think I am thank you for this session. We will meet again next time with little more detail. It was a lot of detail. They show us only about how to make an equipment dust proof and also sell it and then talk about installation and talk about repair and after repair, how to get back to the original thing.

Thank you.