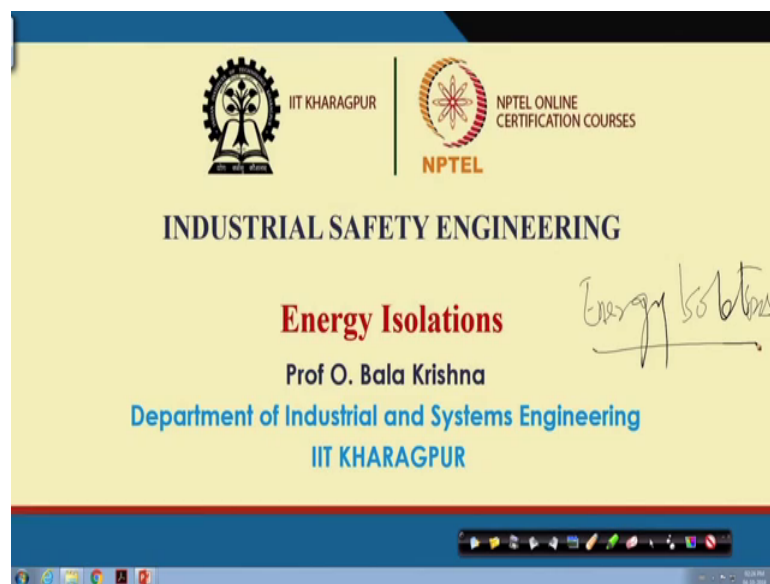


**Industrial Safety Engineering**  
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**Lecture - 56**  
**Energy Isolations**

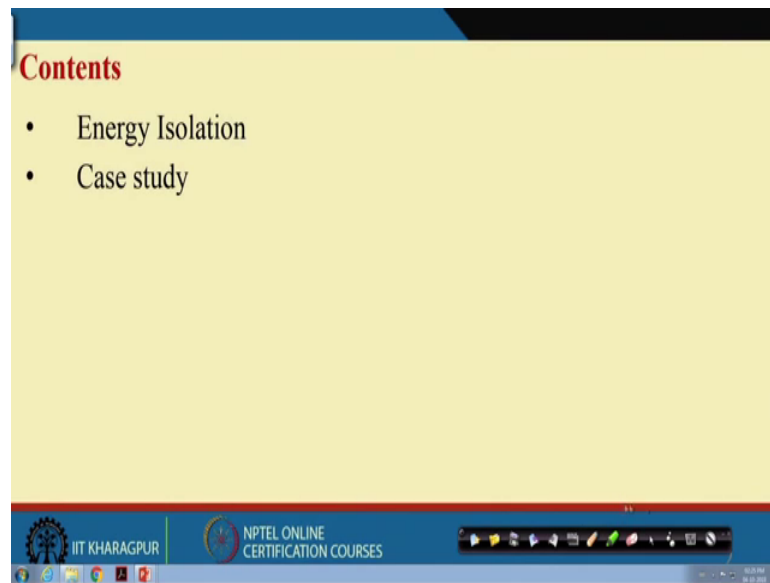
Hello viewers, last session I mentioned for the success of occupation health, and safety management system.

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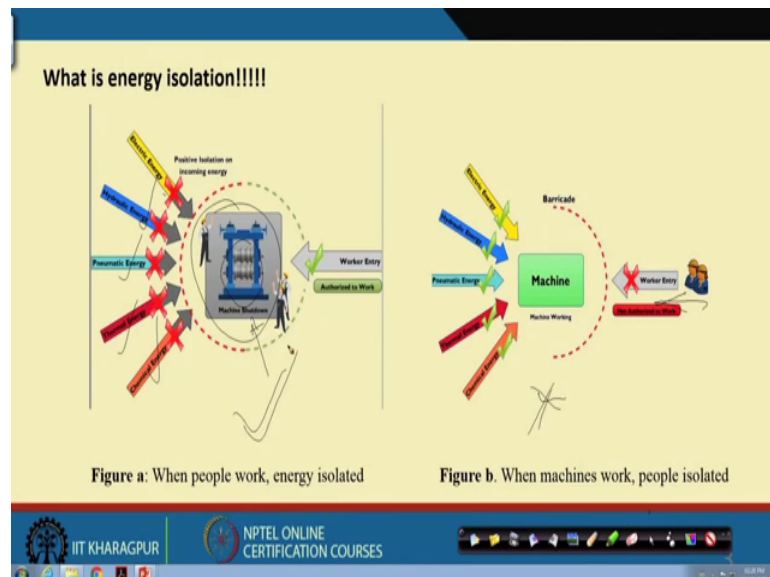
One activity is very very important that is Energy Isolations. I will tell you what is the energy isolations in the coming slides.

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In this session we will discuss in detail what is energy isolation? Why it is required? How it is done? In detail we will talk what are the statutory requirements for energy isolation? To make you more understand the whole concept I brought a case study also with that case study we must able to understand thoroughly.

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Look at the industrial scenario any scenario you have machines many times people have to work in the on the machines, or processes, or equipment people have to go and work, but this machines are processes may have many energies coming on that, that is why that

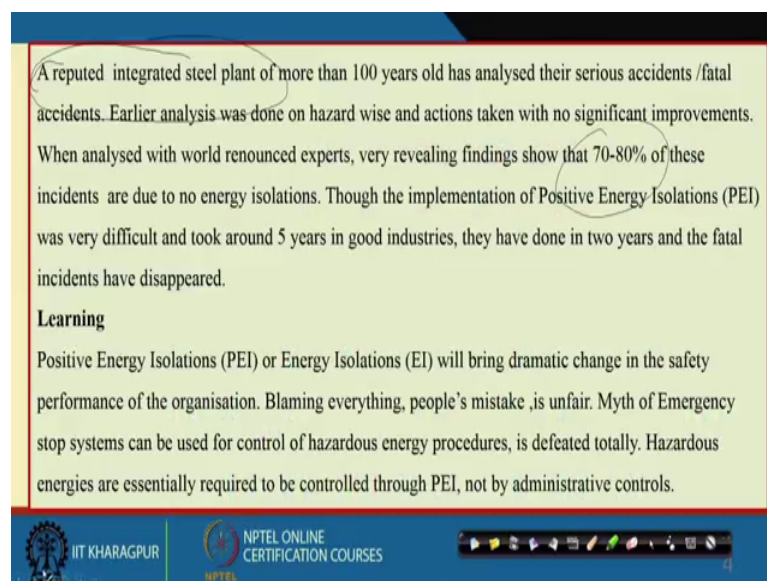
that have become machines. There could be electric energy, there could be hydraulic energy, there could be pneumatic energy, there could be thermal energy, there could be chemical energy and there could be gravitational energy.

If man what energy man has got? He has got brain, he has got ideas if you have to separate this machine first he has to make all these energies 0, otherwise if any of the energy opens up people will be killed. So, primary requirement for the occupational safety health is when people are going to work on the machines or processes or equipment which have got energy that energy has to be made 0, 0, 0, 0 this is one scenario. Other scenario, but why the machines and processes are there? They have to work otherwise how the output will come.

So, when the machines or processes are working people should not enter. If the machines are working, if people enter that there will be trapped in the energy and there will be died. Second case is very simple to stop people put the barricades through barricades so the people will not go.

So, this we will not be discussing in this session. We are discussing this when people are working going to work on the machines, how you make energies positively 0, that is called energy isolations, that is called positive energy isolations, that is called isolations. All these terms are same people talk about these terms different people talk differently.

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A reputed integrated steel plant of more than 100 years old has analysed their serious accidents /fatal accidents. Earlier analysis was done on hazard wise and actions taken with no significant improvements. When analysed with world renowned experts, very revealing findings show that 70-80% of these incidents are due to no energy isolations. Though the implementation of Positive Energy Isolations (PEI) was very difficult and took around 5 years in good industries, they have done in two years and the fatal incidents have disappeared.

**Learning**

Positive Energy Isolations (PEI) or Energy Isolations (EI) will bring dramatic change in the safety performance of the organisation. Blaming everything, people's mistake, is unfair. Myth of Emergency stop systems can be used for control of hazardous energy procedures, is defeated totally. Hazardous energies are essentially required to be controlled through PEI, not by administrative controls.

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Let me give an example a reputed integrated steel plant which has got reputation of work more than 100 years very very successful a benchmark steel plant. When the incidents happened for all these 100 years major incidents, fatalities were analyzed by a very reputed consultant.

Very revealing factors come around 70 to 80 percent of these incidents major incidents major fatalities are because of no energy isolations. People thought I am doing this job nobody will put I put on the put of the switch and started working somebody came put on the switch. I finish my job I told people do not put on the power I will go there and see after 5 minutes you do it, after 5 minutes you have put on the power. Mean while I could not come out of it and died such incidents are mean numerable.

So, the 70 to 80 percent of the incidents happen in the major hazard industries because of the no energy isolations. So, what is the learning? Positive energy isolations are energy isolations will bring dramatic change in the safety performance of the organization dramatic change.

See change blaming everything people make people make mistakes people are careless this statement making is very very unfair, or there is a myth we are got emergency stop system we can put the emergency stop when it is required that is also missed.

The purpose of the emergency stop is different. So, hazardous energies are essentially required to be controlled through positive energy isolations, not administrative controls, not warnings, not signages. They have to be controlled by positive energy isolation which is engineering way of doing the isolations, not administrative way.

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Control of Hazardous Energy, Lockout/Tag out, booklet, OSHA 3120-2002 (Revised) puts the following requirements for the above standard.

The standard specifies that employers must establish an energy-control program to ensure that employees isolate machines from their energy sources and render them inoperative before any employee services or maintains them.

**As part of an energy-control program, employers must:**

- Establish energy-control procedures for removing the energy supply from machines and for putting appropriate lockout or tag out devices or lock out and tag out (LOTO) on the energy-isolating devices to prevent unexpected energization.
- When appropriate, the procedure also must address stored or potentially re accumulated energy;
- Train employees on the energy-control program, including the safe application, use, and removal of energy controls; and
- Inspect these procedures periodically (at least annually) to ensure that they are being followed and that they remain effective in preventing employee exposure to hazardous energy.

The slide includes a diagram of a crane with handwritten annotations. A circle is drawn around the text 'prevent unexpected energization' in the first bullet point. Another circle is drawn around the text 'stored or potentially re accumulated energy' in the second bullet point. A line points from the text 'periodically (at least annually)' in the fourth bullet point to the crane diagram. The diagram shows a crane boom with a cylinder and a lockout device. The text 'IIT KHARAGPUR' and 'NPTEL ONLINE CERTIFICATION COURSES' are visible at the bottom of the slide.

This control of hazardous energy lockout, tag out, it is also there in the OSHA 3120 to 2002. What is OSHA? OSHA is Occupation Safety and Health Administration of the United States, this say OSHA statute says establish energy control procedures for removing the energy supply from all the machines. We should have energy control procedures to take out all these things. And putting appropriate lockout tag out devices or lock out tag out both which is called LOTO on the energy isolating devices.

So, this say you isolate the energy then you put the lock or tag or both. When appropriate, the procedure also must address stored potential potentially re accumulated energy. There are sometimes stored energies are there. What is stored energy? In a hydraulic system say you have a crane; it goes up and down with a cylinder, hydraulic cylinder. This hydraulic cylinder will take it up bring it down.

Suppose if you put off the energy still hydraulic power is there inside the cylinder, the boom is in the inclined position. So, there is a stored energy inside if you sent people to work here. While working if there is any leakage of the hydraulic fluid it will come down and it will kill the people.

So, stored energy means he says the stored energy also should made zero, and you put a mechanical stop here before people work. With the stored energy people cannot work. We have mechanical stored energy, we have electrical stored energy, we have hydraulic stored energy we will talk about those things. So, OSHA says that also should be made 0,

and you have to train the people and you have to inspect periodically whether these things are in position or not. This is the requirement of OSHA.

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So, it applies to unexpected start-up/ exposure from all types of energy source, i.e.:

- Power supply, e.g. electrical, hydraulic, pneumatic;
- Stored energy due to, e.g., gravity, compressed springs;
- External influences, e.g. from wind;

Three words require to be understood

- i. Lock out
- ii. Tagout
- iii. Isolation.

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So, what are those energy sources? What are those energies we are talking? Power supply; what is the power supply? Electrical, hydraulic, pneumatic, power supplies; stored energy due to gravity, compressed springs.

When you put the spring compressed, it has the stored energy. If people have to work that compressed springs have to made normal position then only people should work. External influences suppose some wind energy coming while working all those things also to be isolated before people go. Friends, there are three important words which we should remember in this whole session. One is lock out, tag out, isolation.

What is lock out? When electrical power is there you put off the switch put off and put a lock that is called lock out. You put off and put a lock that is called lock out. When the gas is moving in a pipeline there is a valve you close a valve, put a lock here, lock out. Tag out means you close it and put a tag warning sign I have closed it do not put on, that is a administration control that is called tag out who had locked who had closed it? So and so had closed I so and so closed do not put on that is tag out.

First is lock out, second is tag out, third is isolation. Isolation is putting off and separating it you have to put off the power and separate it, in no cases they will join. In

many cases if you do not separate, there is a chances of the getting join because of various conditions. So, isolation means you put off and separate then you put the lock. So, you put off separate and put the lock no where the energy can come that is called energy isolation.

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**What is "lockout/tagout"?**

"Lockout/tagout" refers to specific practices and procedures to safeguard employees from the unexpected energization or start-up of machinery and equipment, or the release of hazardous energy during service or maintenance activities. This requires, in part, that a designated individual turns off and disconnects the machinery or equipment from its energy source(s) before performing service or maintenance and that the authorized employee(s) either lock or tag the energy-isolating device(s) to prevent the release of hazardous energy and take steps to verify that the energy has been isolated effectively. If the potential exists for the release of hazardous stored energy or for the reaccumulation of stored energy to a hazardous level, the employer must ensure that the employee(s) take steps to prevent injury that may result from the release of the stored energy.

Lockout devices hold energy-isolation devices in a safe or "off" position. They provide protection by preventing machines or equipment from becoming energized because they are positive restraints that no one can remove without a key or other unlocking mechanism, or through extraordinary means, such as bolt cutters. Tagout devices, by contrast, are prominent warning devices that an authorized employee fastens to energy-isolating devices to warn employees not to reenergize the machine while he or she services or maintains it. Tagout devices are easier to remove and, by themselves, provide employees with less protection than do lockout devices.

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So, this is what we are talking the lockout tag out what I discussed with the same we have mentioned it here. So, tag out is a warning signs, lockout is a locking. Both cases we are putting off power putting off the energy that is all.

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**Examples of tasks which can require the presence of persons in danger zones**

- ☐ Inspection
- ☐ Corrective actions (clearing blockages, etc.)
- ☐ Setting, adjustment;
- ☐ Manual loading/unloading;
- ☐ Tool change;
- ☐ Lubrication;
- ☐ Cleaning;
- ☐ Decommissioning;
- ☐ Minor maintenance/repair;
- ☐ Diagnostic, testing;
- ☐ Work on power circuits;
- ☐ Major maintenance (works requiring significant dismantling)

**Steps in Energy Isolation**

**1. Isolation and energy dissipation**

A procedure which consists of all the four following actions:

- a) isolating [disconnecting, separating] the machine (or defined parts of the machine) from all power supplies;
- b) locking (or otherwise securing) all the isolating units in the isolating position;
- c) dissipating or restraining any stored energy which may give rise to a hazard.

**NOTE** Energy may be stored in e.g.:

- ☐ Mechanical parts continuing to move through inertia;
- Mechanical parts liable to move by gravity;
- ☐ Capacitors, accumulators; ☐ Pressurized fluids; ☐ Springs.

d) Verifying by means of a safe working procedure that the actions taken according to a), b) and c) above have produced the desired effect.

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So, when you require putting off the power? When you require lock out, tag out, or isolation? There are various activities if you want to do thorough inspection of the machines you have to go side and check various things. If you want to do corrective actions some adjustments you have to do, some blocks you have to put, some edges you have to put, you have to do adjustments, settings, or you have to load many things in the machine, unload by going to the machine, or if you want to change the tools, or you have to put the lubrications in the machines very very places which is if you do not put of the power you may you may get and trapped.

Cleaning, decommissioning maintenance, diagnostic work on the power circuits, major maintenance when you have to do all these things you required you are in the danger zone, you are in the danger zone. If you want to be not in the danger zone and do the job you it calls for isolation. What is isolation? Isolation is disconnecting, separating. You have to disconnect and separate two activities disconnecting, separating.

In lockout and tag out only disconnecting in lockout and tag out only disconnecting in isolation disconnecting and separating then you have to put the lock. And you have to dissipate, then you have to dissipate the energies. Isolation is not completed unless you dissipate the energies which are there at the in that.

So, energy storing means mechanical parts continued it to move through inertia; flywheels even if you put off it will keep rotating. The in the helical circuits capacitors in the gases accumulators, pressurized fluids springs they are all called they are having energies all these things are to be dissipated, deenergized.

It is over with that? No afterwards you have to see you have to see by means of various techniques whether isolations has happened 100 percent what you wanted you have to verify. Verify through procedures, verify through gauges, verify through testing then you have to start the job. This is the process of energy isolation.



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The slide is divided into two main sections. The left section, titled '2. The location and number of isolation devices', describes how these are determined by machine configuration and risk assessment, and lists specific requirements for identification and safety during isolation. The right section, titled '4. Locking [securing] devices', explains that isolating devices must be lockable and lists examples like padlocks and interlocking devices. Handwritten notes in blue ink are present: 'energy source' is written over the first section, and 'locking devices' is written over the second section. A blue circle is drawn around the list of locking devices. The bottom of the slide features the IIT KHARAGPUR and NPTEL ONLINE CERTIFICATION COURSES logos, a navigation bar, and a small video feed of the presenter.

**2. The location and number of isolation devices** are determined by the configuration of the machine, the need for the presence of persons in danger zones and the risk assessment. Each isolation device shall make it possible (e.g. by durable marking where necessary) to readily identify which machine or machine part it isolates.

**3. When, during isolation of the machine**, certain circuits have to remain connected to their power supply in order, e.g. to hold parts, save information or provide local lighting, special means shall be provided to ensure operator safety.

NOTE Such means include enclosures which can be opened only with a key or a special tool, warning labels and/or warning lights

**4. Locking [securing] devices**

The isolating devices shall be capable of being locked or otherwise secured in the isolating position.

Locking devices include:

- Facilities to apply one or more padlocks;
- Trapped-key interlocking devices (see annex E of prEN 1088), one of the locks of which is used to lock [secure] the isolating device;
- Lockable covers or enclosures.

Locking devices are not required when reconnection cannot endanger persons.

So, isolation the location of the number of the isolation devices, where is to be isolated, I know that I am working there, but where is to be isolated this is called energy source identification energy source identification. Where I have to put the locks energy source identification? When I have to put the locks and locking devices.

So, what are the locking devices? Padlocks, trapped key somewhere outside the external keys locks are key incorporated to the machine itself or lockable covers and enclosures. You cover the lockable covers and enclosures there all the various devices for the locking.

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**5.Devices for stored energy dissipation or restraint (containment)**

**i. General**

Devices for stored energy dissipation or restraint [containment] shall be incorporated into the machine where stored energy can give rise to a hazard. (E.g., Hydraulic crane boom, springs)

**NOTE** Such devices include, e.g., brakes intended to absorb kinetic energy of moving parts, resistors and relevant circuitry to discharge electrical capacitors, valves or similar devices to depressurize fluid

**ii.** When dissipation of stored energy would excessively reduce the availability of the machine, additional devices shall be incorporated to reliably restrain or contain the remaining stored energy.

**iii.** The devices for energy dissipation or restraint [containment] should be selected and arranged so that:

- ☐ Dissipation or restraint [containment] results from the isolation of the machine (of part of it) from the power supplies;
- ☐ The energy dissipation process does not give rise to hazardous situations.

**iv.** The necessary procedures for energy dissipation or restraint [containment] shall be described in the instruction handbook of the machine or in warnings on the machine itself.

**6.Mechanical elements**

- When mechanical elements can give rise to a hazardous situation by virtue of their weight and position (e.g. unbalanced, or raised, or in any situation where they could move under the effect of gravity), or as a result of the action upon them of spring load (whatever the spring may be), it shall be possible to bring them to the lowest energy state.
- When mechanical elements cannot be brought to an intrinsically safe state, they shall be mechanically secured by brakes or mechanical restraint devices locking or securing facilities for the restraint [containment] devices
- The devices for energy restraint [containment] shall whenever necessary be capable of being locked or otherwise secured in the restraining position

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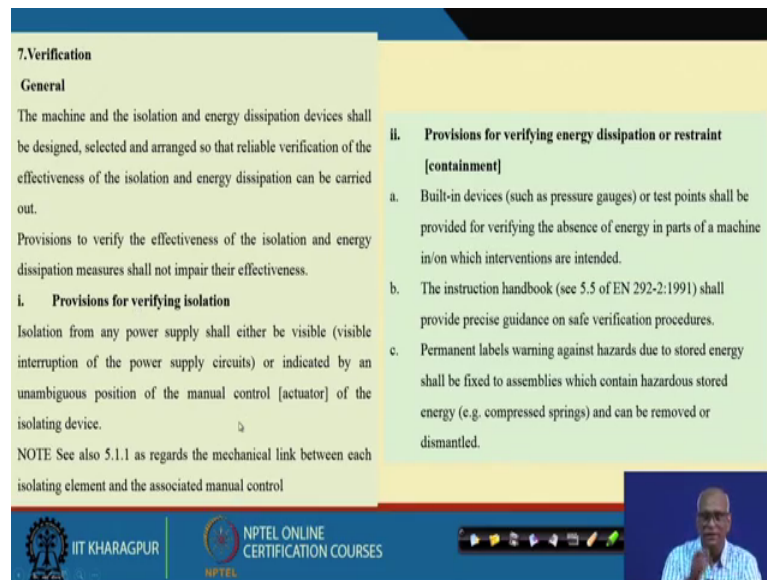
So, the devices which have got stored energy. The devices for the stored energy dissipation shall be incorporated into the machine where stored energy can give raise to hazard. Such devices includes brakes which absorb energy resistors.

When dissipation of the stored energy would be excessively sometimes you cannot dissipate because if you dissipate the energy for starting it will take lot of time. Then you should have separate devices the energy, without dissipation how could you hold the component in position you should put separate devices. But normally we avoid it.

The devices for energy dissipation or restraint should be selected and again you show that dissipation results from the isolation of the machine. The energy dissipation process does not give rise. See while dissipation the energy you should not trapped in the hazardous.

Suppose if the spring you want to release you should very carefully very through a procedure you have to dissipate. So, energy dissipation procedures are also should be there. There are there are many many energy dissipation of the flywheels, energy dissipation of the pressurized fluids I seen cases while dissipating the energy people have died especially in hydraulic circuits. High pressure circuit if you want to release the high pressure, that high pressure liquid hits the people; they will get injured and died.

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**7.Verification**

**General**

The machine and the isolation and energy dissipation devices shall be designed, selected and arranged so that reliable verification of the effectiveness of the isolation and energy dissipation can be carried out.

Provisions to verify the effectiveness of the isolation and energy dissipation measures shall not impair their effectiveness.

**i. Provisions for verifying isolation**

Isolation from any power supply shall either be visible (visible interruption of the power supply circuits) or indicated by an unambiguous position of the manual control [actuator] of the isolating device.

NOTE See also 5.1.1 as regards the mechanical link between each isolating element and the associated manual control

**ii. Provisions for verifying energy dissipation or restraint [containment]**

- a. Built-in devices (such as pressure gauges) or test points shall be provided for verifying the absence of energy in parts of a machine in/on which interventions are intended.
- b. The instruction handbook (see 5.5 of EN 292-2:1991) shall provide precise guidance on safe verification procedures.
- c. Permanent labels warning against hazards due to stored energy (e.g. compressed springs) and can be removed or dismantled.

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So, there are procedures where how to dissipate the energy? Verification there are verification is very very important. If everybody has said that you have put off the power, separated it, put the locks; put the tags, everything they have done. But it is very essential whether it is done properly, or not final place where people are working their issue you should be able to see that really it is done or not?

There are there are there are many ways of verification. There are visible verifications, there are built in verification pressure gauges, all these things if the pressure gauge is put. If the pressure is flowing 0; that means, pressure is there is no pressure instructions books; instruction hand book say that you check all these things if it yes then it is dissipated, or if you electrical thing you put the tester measure and see whether the power is there or not? So, you have to verify by different means to ensure yes isolation is done.

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**Description of the case**

The gases which come out of the blast furnace called blast furnace gas (BF gas) are having dust content of about  $20 \text{ g / m}^3$  and cannot be used directly in the down stream processes, and cannot be thrown to atmosphere (in the worst case scenario, when gas cannot be used and stored). Hence, the dust content is to be reduced as low as possible for efficient and reliable working of the downstream equipment. This is done in stages in the gas cleaning plant (GCP). Also design of the gas cleaning plant is critical as it processes BF gas at high pressure having high carbon monoxide (CO) percentage which is colour less and odour less, undetectable and treated as fatal gas. One of the best ways adopted for cleaning the dust particles is using bag filters in the bag house. It becomes necessary for the people to enter the bag filter chambers for maintenance and cleaning purpose, at regular intervals. They pose the hazards of confined space and hazardous gases like BF Gas and Nitrogen gas. They are to be isolated positively, before allowing people to enter bag house

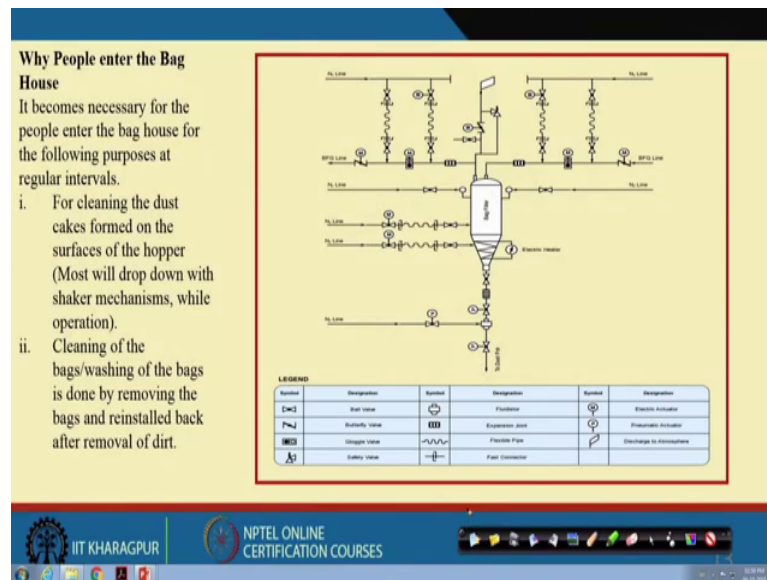
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Let us go through the case study. We are talking about the blast furnace case study. Blast furnaces generate gasses, blast furnace gas, very very hazardous colorless, order less. But very hazardous if it is more than 30 PPM, people will be people will die, it is more hazardous than LPG gases and all these things.

So, when from the blast furnace when the gases come out they will have some dust content in that. We have to reduce the dust content to minimum levels, because the dust will not be burnt anywhere; it will go through the atmosphere finally. If it goes to the atmosphere it will it will create atmosphere like hazards, or all the equipments we are this gas which we used to for burning those equipments will be gammed.

So, we have to reduce the dust content to allowable limit. So, this blast furnace gas is sent to the gas cleaning plant, where the dust percent is reduced this is the case study. So, blast furnace gas initially has got lot of dust content, it has to be it is having around 20 grams for meter cube. We have to reduce it to the allowable limits this is the case study. So how it is done? And why energy isolation is required?

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You all must be knowing by this time P and ID diagrams. The gases from the gas furnace blast line will come to a bag filter, or bag house where the gas will go to the bag filters and the dust is caught caught there something will go inside, something will go outside. And finally, the dust which it going outside taken out from these valves, inside the gas inside the filters whichever is whichever dust is contain periodically they have to be cleaned, washed. Those filters are to be taken out washed and put back.

How will you do that? People have to go inside takeout those filters wash it; clean all the hopper. So, people have to go inside a inside the bag house for cleaning the dust cakes, cleaning the bags all these things people have to work periodically in this. Can they go? Last one is gas is going. What you have to do? If a person is going there people are going there.

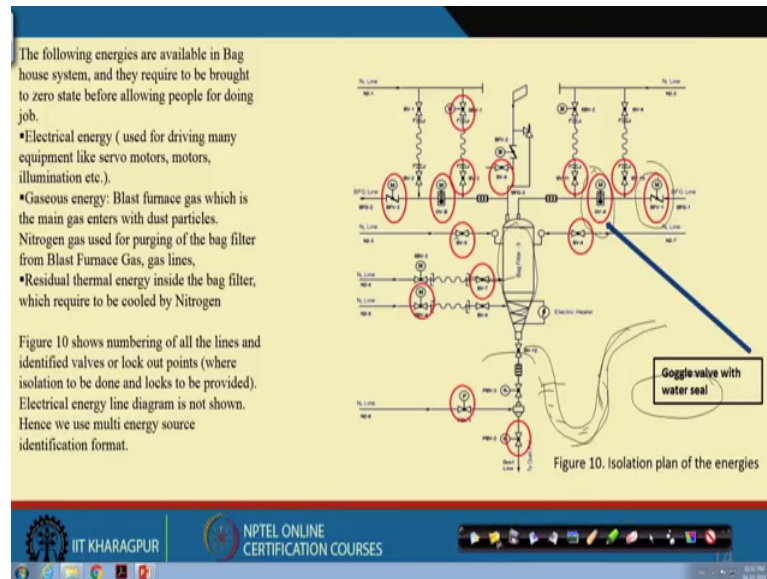
All the energies going inside this have to be made 0. What are the energies? Blast furnace gas blast furnace the input, gas blast furnace output, blast furnace input has to be made 0, blast furnace output valves also made 0. Why? Because in the reverse they should not any flow coming inside. There are lot of nitrogen lines all those lines are used once you take out the blast furnace gas you have to purge it.

So, that blast furnace traces of blast furnace gas also should not be there inside, you have to purge it, nitrogen purging we do. So, once the blast furnace gas is taken out close, then you have to purge it, then you close the gas furnish valves. Because nitrogen valves if

nitrogen valves are not close; if nitrogen is here then a process called as a fixation. People will not get the required amount of oxygen for the breathing.

So, all the nitrogen lines are to be stopped isolated; all the blast furnace gases are to be stop isolated that is the requirement for the people to go in to the bag filter.

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How it is done? First people have to isolate the electrical energies; there are powers all the valves are valves are operated with the power. So, those valves electrical energy also to be stopped; gasses energy also to be at seen and residual thermal energy also to be made 0. That means, once the blast furnace gas line this is the blast furnace gas line, this is better fly valve, this is the butter fly valve.

First people close the butterfly vale so that gas coming is become very very less. Butter fly valve a is not 0 leaf proof. Then this is the goggle valve then goggle valve mean they put up the goggle valve inside goggle valve normally now a days there is a water seal. Goggle valve closing is not isolations because you have to separate it for separation either you separate it or put the water seal if you put the water seal gas will go through the water seal.

So, if you put water here gas cannot go, it is almost like separation. So, put the goggle value off; again this goggle valve is put of delivery side, put of the butterfly valve. Then you put off the power to this they are made 0, then you purge it with all these nitrogen



valves. When thorough purging is done people check there what is the oxygen content? It is thorough purging is done then you isolate all these valves that is the process we have to see. Then this is totally isolated from all the energies, electrical energy, gaseous energy, nitrogen energy.

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All these lines connected to the bag filter are to be isolated, finally in the following steps.

**A. Isolation from Blast furnace gas**  
Close butterfly valve BFG-1-BFV-1 in the blast furnace gas line BFG-1 and put equipment lock.  
Close Goggle Valve BFG-1-GV-1 located on blast furnace gas line BFG-1 and put equipment lock.  
Similarly, close goggle valve BFG-2-GV-2 and close butterfly valve BFG-2-BFV-2, on blast furnace gas line BFG-2.

**B. Isolation from Nitrogen gas**  
Purge the bag filter using nitrogen lines 2-6 and when the residual blast furnace gas present in the bag filter become zero, close the corresponding ball valves and put the equipment locks.  
Keep the discharge to atmosphere lines open so that the purged out gases will go to atmosphere and keep them open.

**C. Isolate electric power coming to all the equipments of the bag filter and put the equipment locks.**

**Verification:**  
The isolating person has to verify whether actual isolation (disconnection) of power has resulted or not. After verification only, work should be allowed to start.

**D. Keep all the locks in the Isolation box and provide isolation lock (Black colour).**

**E. Now all the contractor supervisors/owners of contractor-A and contractor-B who responsible for their work will put their locks on the isolation box. This is to avoidance of giving locks to all the contractor employees, which used to create many problems, especially, they run in thousands.**

**F. Provide tags on the equipment locks for showing the details of isolating person, duration etc.**

**G. Once the job is over, the locks on the isolating box will be removed by the people after their work. When all the locks are removed, isolation box lock is removed by the isolating person, designated.**

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So, I written the sequence. How the valves are to be closed? Blast the lines have been given, names blast furnace gas line, blast furnace gas line one this valve you have to close blast furnace gas line goggle valve you have to close. Blast furnace gas line you have to close this then how to do the nitrogen line nitrogen closing? Then you have isolate the electric power, then you have to verify how do you do verification? By checking inside with a gas meters whether the gas is coming or not?

Then you put all the locks, the people whoever is working they have to put their locks. They have to takeout the keys. If the contractors are working say there are contractor A, contractor B. There are contractors working contractors say there are 10 people, 10 people contractor people are not so educated they do not know this locking and all these things.

So, the contractor supervisor he will put the lock. So, before contractor supervisors employees putting their lock. First lock has to be put by the equip the isolator the man who has got knowledge, isolating knowledge. See there are 3 activities; one is isolating planner, isolation planner that is those red circles where it is to be put? Locks all those things could be done by the man who has got total knowledge about the things, he is

called isolation planner. Then isolator, isolator is the person who will go and put the lock and the equipment.

So, first lock you will put in all the equipments you will put the locks nitrogen lines, blast furnace gas line, everywhere he will put the equipment locks. Those keys he will take and put it in a box put it in a box which is called isolations box. All the locks of the equipments you have put here, then you will put the isolations put his on lock, group lock. After putting this equipment locks; group lock then only others will put their on key, own locks and these on that particular lock.

The isolation box is closed and the one more lock isolation isolator will put. On that people will keep on putting the locks whatever people are working they will put the locks. If I complete my job, I will open out my job, if all the people open outs the lock isolator will come to know yes everybody has done their job, then he will open the lock. And he will open the equipment lock one by one.

If anybody has not open the lock then he isolator cannot open the lock. All the people you have put the locks then they open then only the isolation box can be opened, where the equipments, where the locks are provided the keys are inside that is why people say my life is in my hand.

Why? The person after isolation all the energies he has put it in the isolation box, he had put one lock; that means, all the energies isolated and this group isolation box is isolated it is there in these. Now if I to work, I am putting my lock here, if I and I keep my key inside my pocket, I keep do my work as long as I do not complete my job my key is inside my hand nobody can open the isolation box.

So, my life is in my hands, when all the people after doing the job when they open the their keys, when the isolator will open the isolation box, and one by one equipments he will open out. In this process do we think any time at any time a person can be effected by a energy. If I am a worker I am working on the equipment bag filter, I am very very comfortable. Because I feel nobody can open the open the gas as long as my keys in my pocket when I complete my job then I open then only others can the gas can come.



So, I am very very comfortable otherwise workers will have the fear. Anybody by mistake opens our management have the fear by mistake anybody opens the gases it will also like happened like that. So, in the positive isolation that is taken out.

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**Important note**  
Energy isolations are not replacement to permit to work (PTW). This will strengthen PTW and hence, PTW written procedure to be followed.  
Though, it may take some extra time, which may extend the shut down time; it is observed, finally, the shut down times are reduced.

*Energy Planner*

Table 1. Energy source identification for multi energy sources

| S.No | Department |           | Energy Source |     |       |          |           | Section | Type of Job   | Isolation details of energy sources & location of isolation locks  |                               |  |  |
|------|------------|-----------|---------------|-----|-------|----------|-----------|---------|---|--|-------------------------------|--|--|
|      | Name       | Number    | Electrical    | Gas | Fluid | Nitrogen | Any other |         |   | Electrical   |                               | Gas  |  |
|      |            |           |               |     |       |          |           |         |   | Method   | Panel no                      | Method   | Valve no   |
| 1    | Bag filter | BF-BAG 12 | Yes           | Yes | No    | Yes      | No        |         | i. Cleaning of hopper<br>ii. Removal of cakes from filaments<br>iii. Opening of the filaments<br>iv. Washing of the filaments<br>v. Assembling the filaments lock | i. Pull off power at MCC room<br>ii. 6.6 Kv breaker to be taken out and tagout<br>iii. Lock out and tagout | MCC 10<br>Panel 7<br>Panel 22 | Close butterfly valve and lock it<br>Close goggle valve and lock it<br>Close butterfly valve and lock it<br>Close butterfly valve and lock it<br>Purge the bag filter and close nitrogen valve and lock them | BPV-1<br>BPV-1<br>BPV-2<br>BPV-2<br>BPV-1<br>BPV-1<br>BPV-2<br>BPV-2 |

So, this is the energy isolation. So, what are the energy is coming? What are the activities we have to do? What is the method we will do? And how the locks are provided? Different locks, different valves.

If close the butterfly valves see people go inside and cleaning of the hopper, removal of the cakes, opening of the all the jobs. First he have to do the energy electrical isolations that is MCC 10, Panel 7, panel 22 you will put locks here. For a gas cleaning close the butterfly valve, close the goggle valve, close the all these valves people close then put the locks.

This is called energy source identification. Where you have to put the locks? Energy source identification it is done by a very very knowledgeable people, he is called energy planner, energy planner very important person. Lot of training is given to them. How to do this?

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**Types of Isolation Locks**  
Personal Lock (Red) – Company Employee.  
Personal Lock (Blue) – Contractor's Supervisors only.  
Equipment Lock (Yellow) – Attached at Isolator by Isolation person.  
Group Board Lock (Black) – For locking the group isolation box.

**Types of locks**  
Equipment Lock: A lock attached by an Isolating Person to an Isolator in the safe position to prevent accidental or inadvertent movement. Colour- Yellow.  
Group Isolation: when a number of people are involved and/or a number of Isolators are to be locked.  
Group Lock: A lock attached by the agency responsible for Isolation to a Group Isolation Box and to secure Equipment Lock keys. Colour-Black  
Group Isolation Box: A box that is used exclusively for Group Isolation.

Protected Person: Who will attach their Personal Lock to an Isolator or a Group Isolation Box for doing job on equipment.  
Isolating Person: Who performs Isolation and is authorized under this procedure.  
Isolation Planners: Shall be responsible for preparing and maintaining the isolation procedure for the Complex Isolation and Energy Source Identification document.  
Complex Isolation: Complex Isolation is when more than three Isolators or more than two Energy Sources are involved. All complex Isolation shall have a written procedure.

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So, types of lock people use there are personal lock by employees, there are personal lock by the contractors, supervisors. There are equipment lock, there is group board lock, there is isolation box. So, these are the different locks 4 types of locks people use and isolation boxes.

So what is equipment lock, group isolations lock, group lock all those things put it here. So, here isolating planners, isolating persons, protected person all these things are the names of various people involved in this.

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Blockino an Equipment Press Pipe Blindino Flange Support Stands used for Blocks Electrical Panels shown "Locked Out"

Piping shown "Locked Out" Locked Comp. Air Line Locked Globe Valve Locked Gas Cylinder Locked Gas Cylinder

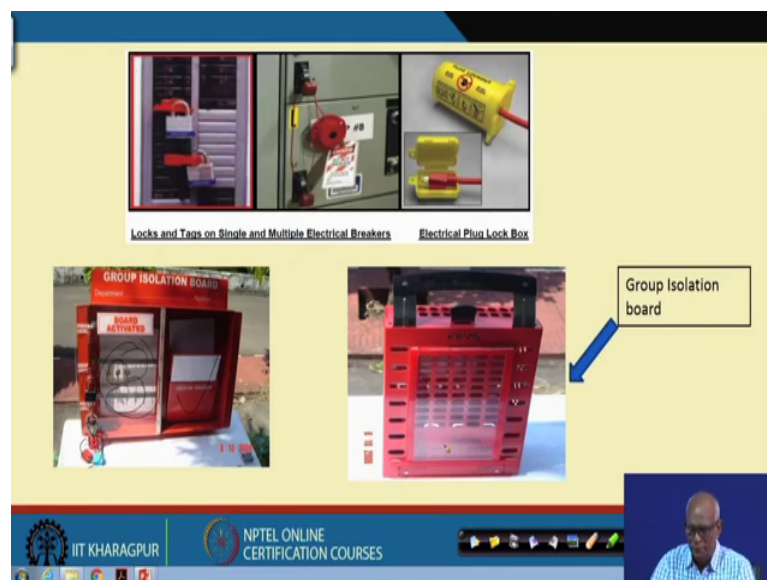
Typical Locks and Planners for use in Locking Out Equipment

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What are the various things we use in these? This is the blank the gas line if you isolate, separate, and put the plan. These are these are the blocks, stoppers for hydraulic cylinder when they lifted. Stoppers when the hydraulic cylinder, you lifted then you put the stock these are the locks.

See one person puts the locks, others can put on these, unless these locks are opened these cannot be opened. A seizers one lock seizer he had put the isolator, and he had put seizer lock then all these wholes others can put the locks. There are different ways how the valves handles are locked? So, different handles how do you lock?

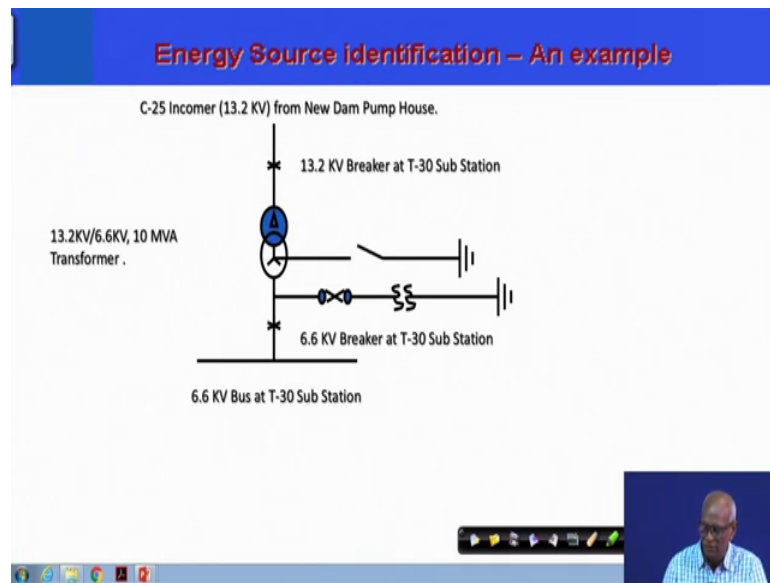
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This is isolation box, where the energy isolator he will put the equipment locks though the equipment locks keys are put inside. Then on this he will put this own lock, these are the seizer lock. Because if the people are more then he will put the seizer lock and all those people they put the locks here.

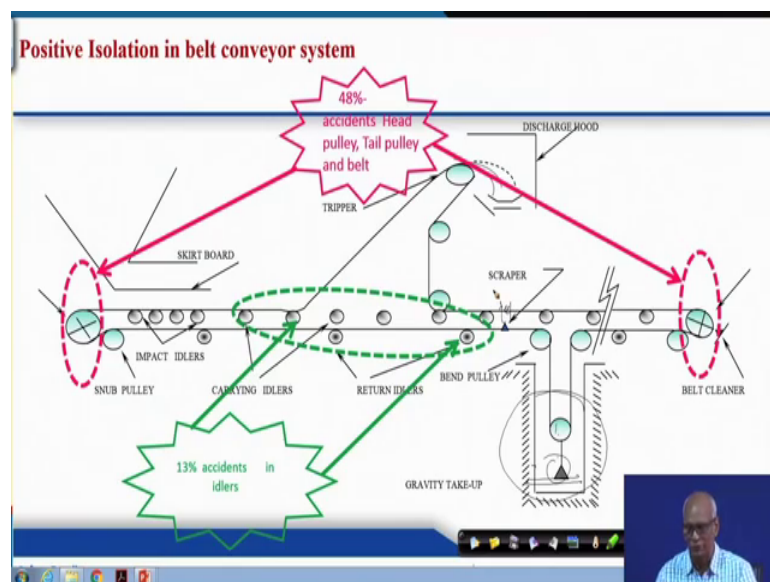
So, unless these things are opened if this cannot be opened, even if you open see cannot take it out. So, unless you open out these keys are inside they cannot be open. If you have more number of equipments, you put you used two isolating boxes and two are two are connected with the equipment lock. So, people will not put locks here, a equipment lock you put it here that key he will put it here and again equipments locks are there. So, they are connected two boxes are connected.

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So, some examples, how the electrical energy is isolated? Electrical energy which is coming here, coming here, coming here, they are put off their energies if the people are working here.

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Very important belt conveyors: belt conveyor is used for transporting lot of materials bulk materials, continuous materials. Suppose if you have to the belts are joined if they are the length is more they are cut and joined here. If you have to join here there is a

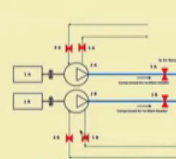
gravity take of fully always in the bend conveyer. The purpose of this is to give tension on the belt always.

Tension so if the gravity pulley is here with the weight, if you cut it will come down it will fall down people are working there will be damaged. So, this gravity contour weight has to be locked here. So, that there is no load on this then you have to do the work which are suppose to do. This is called this is called gravity isolations.


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**Procedure for Positive Isolation of Compressor:**

- Cut off power of prime mover and lock the respective electric panels by pad lock as per positive isolation procedure SS/ENG/26 revision4.
- Close the isolation valve at delivery side of particular Compressor.
- Lock the handle of isolation valve by a pad lock.
- Drain the pressure inside the air line using the various drain ports available.
- Always ensure zero pressure (read zero in the pressure gauge) in the line where work is being performed.
- Do not open any part of the compressor until unless the system is depressurized completely.
- For work in water line, close and lock the water inlet and outlet valve of intercooler and after cooler. Drain the water line to ensure zero pressure.
- Similarly for work in lubrication line, close and lock the inlet and outlet valve, depressurize the line and read zero pressure in the gauge.



(Fig. 1 Compressor at parallel Connection to Common Delivery Line)



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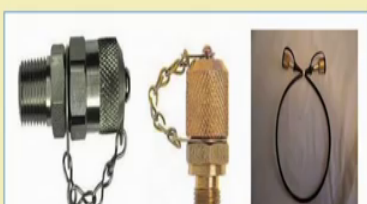

This is called compressor isolation.

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**Positive Isolation Guideline for Rail Track lines**

The derailer specification changes as per rail size.  
(For Reference UMC :  
0733A0077 of derailer is created by Engineering Services to be used for positive isolation of trackline.  
1154A0377 of derailer is created to be used for positive isolation in CP#1 IEM, CP#2 IEM & Batt 10 & 11 IEM )

A minimess test point to be installed after the isolating valve where ever applicable. The minimess hose to be attached and to that point and there the pressure should be always zero.



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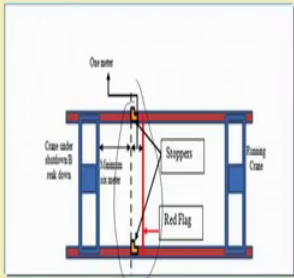
Railway tracks industries railway tracks are there. If somebody is working there people put the flags there not the energy isolation, they put the derailer, this is the derailer. When the when the any equipment comes it will come here and it will come get derailed. The equipment the railway engine will get derailed; on the derailer you put the lock.

So, that nobody can open it if I am working it working in this direction. Suppose if both the side rails come the two derailleurs in between I will be working. This is called minimax. In the hydraulic circuits this is put minimax is put. So, minimax by pressing this minimax, you can release the energy and finally, you can check whether the pressure is 0, or not with these connections.

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Inclusion of Track rail related Positive isolation of EOT cranes with photographs in existing Positive Isolation Safety standard

Trapping/hitting by Adjacent Cranes running on same track e.g. Charging cranes of LD#1



The diagram shows a crane on a track. A red flag is attached to the crane. The crane is positioned between two stoppers. The stoppers are labeled 'Stoppers'. The crane is labeled 'Crane'. The track is labeled 'Track'. The crane is shown in a position where it is about to hit the stoppers. The red flag is shown in a position where it is about to hit the stoppers. The crane is shown in a position where it is about to hit the stoppers.

Examples of Wheel stopper locking



Wheel Stopper Locking example 1

Wheel Stopper Locking example 2

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Cranes, EOT cranes; EOT cranes then they move, so they will have long travel. So, totally you need not block some length you will block other side people will be working.

So, people will put locks here. They put the stoppers and put the lock. Why lock? Otherwise stopper anybody can take out positive isolations. So, positive isolations for the EOT crane moment. What did we discuss? Why energy isolations is required when people are working on the machines? If you do not isolate the energies people will get killed that is what is to happened.

So, the energy isolations are separating energies and put in the blanks. Then you have to put the locks by putting by doing the energy isolation disconnecting, separating, putting

the lock. The people positively people are saved that is why these things are called positive isolations. The main motto of energy isolation is my life, my hand.

So, my life nobody can take out it is in my hand ok. So, this is how the energy isolations are ensured in the industries. And the industrious if you have put energy isolations in place, the safety performance has increased many fold drastically and safety performance come by design, this also a part of safety by design.

Thank you.