**Internship Report**

**Kohinoor Energy Limited 124MW Diesel Power Plant**

**35-Km Link Manga Raiwind Road Lahore**

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**Overview**

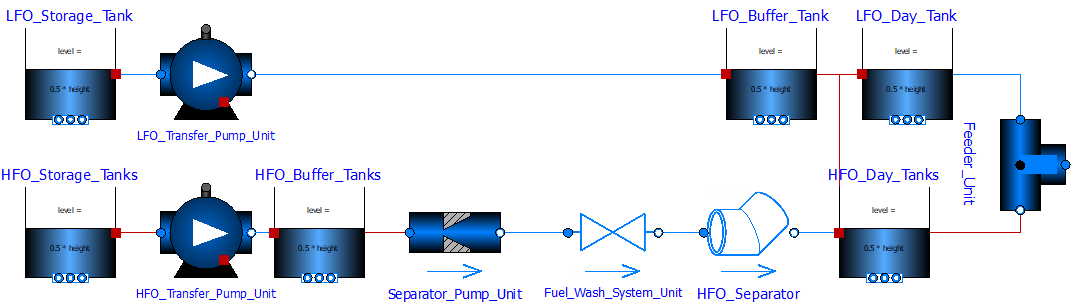
This report summarizes my experience of the three-month internship in Kohinoor Energy Limited 124MW Power Plant. The work is very tortuous, dangerous, exhausting and stressful. The workers carry out very dangerous activities. They are exposed to high currents, heavy power tools and machinery, biohazards, poisonous chemicals, dark work areas, long and exhausting work shifts etc. The company takes great precautions to make sure that the workers do not face any physical harm. I got to see the things that I had studied in Electrical Engineering but never saw.

**Power Plant Block Diagram**

**Electrical System**

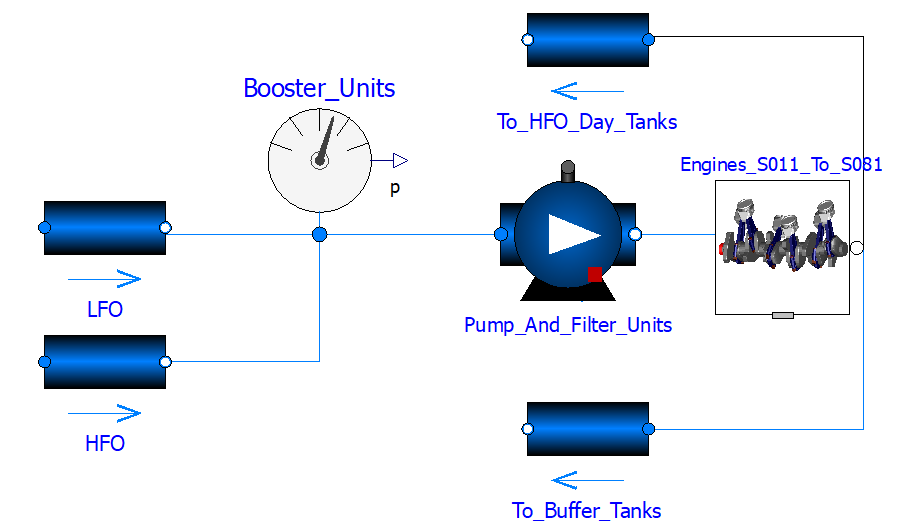
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| **1** | **DG-SET 1-8**  A diesel generator (also known as diesel genset) is the combination of a diesel engine with an electric generator (often an alternator) to generate electrical energy. This is a specific case of engine-generator. A diesel compression-ignition engine is usually designed to run on diesel fuel, but some types are adapted for other liquid fuels or natural gas.  Diesel generating sets are used in places without connection to a power grid, or as emergency power-supply if the grid fails, as well as for more complex applications such as peak-lopping, grid support and export to the power grid.  Proper sizing of diesel generators is critical to avoid low-load or a shortage of power. Sizing is complicated by the characteristics of modern electronics, specifically non-linear loads. In size ranges around 50 MW and above, an open cycle gas turbine is more efficient at full load than an array of diesel engines, and far more compact, with comparable capital costs; but for regular part-loading, even at these power levels, diesel arrays are sometimes preferred to open cycle gas turbines, due to their superior efficiencies.  Generators must provide the anticipated power required reliably and without damage and this is achieved by the manufacturer giving one or more ratings to a specific generator set model. A specific model of a generator operated as a standby generator may only need to operate for a few hours per year, but the same model operated as a prime power generator must operate continuously. When running, the standby generator may be operated with a specified - e.g. 10% overload that can be tolerated for the expected short running time. The same model generator will carry a higher rating for standby service than it will for continuous duty. Manufacturers give each set a rating based on internationally agreed definitions.  These standard rating definitions are designed to allow valid comparisons among manufacturers, to prevent manufacturers from misrating their machines, and to guide designers.  Generator Rating Definitions  Standby Rating based on Applicable for supplying emergency power for the duration of normal power interruption. No sustained overload capability is available for this rating. (Equivalent to Fuel Stop Power in accordance with ISO3046, AS2789, DIN6271 and BS5514). Nominally rated.  Typical application - emergency power plant in hospitals, offices, factories etc. Not connected to grid.  Prime (Unlimited Running Time) Rating: Should not be used for Construction Power applications. Output available with varying load for an unlimited time. Typical peak demand 100% of prime-rated ekW with 10% of overload capability for emergency use for a maximum of 1 hour in 12.[12] A 10% overload capability is available for limited time. (Equivalent to Prime Power in accordance with ISO8528 and Overload Power in accordance with ISO3046, AS2789, DIN6271, and BS5514). This rating is not applicable to all generator set models.  Typical application - where the generator is the sole source of power for say a remote mining or construction site, fairground, festival etc.  Base Load (Continuous) Rating based on: Applicable for supplying power continuously to a constant load up to the full output rating for unlimited hours. No sustained overload capability is available for this rating. Consult authorized distributor for rating. (Equivalent to Continuous Power in accordance with ISO8528, ISO3046, AS2789, DIN6271, and BS5514). This rating is not applicable to all generator set models  Typical application - a generator running a continuous unvarying load, or paralleled with the mains and continuously feeding power at the maximum permissible level 8,760 hours per year. This also applies to sets used for peak shaving /grid support even though this may only occur for say 200 hours per year.  As an example if in a particular set the Standby Rating were 1000 kW, then a Prime Power rating might be 850 kW, and the Continuous Rating 800 kW. However these ratings vary according to manufacturer and should be taken from the manufacturer's data sheet.  Often a set might be given all three ratings stamped on the data plate, but sometimes it may have only a standby rating, or only a prime rating.  Sizing  Typically however it is the size of the maximum load that has to be connected and the acceptable maximum voltage drop which determines the set size, not the ratings themselves. If the set is required to start motors, then the set will have to be at least three times the largest motor, which is normally started first. This means it will be unlikely to operate at anywhere near the ratings of the chosen set.  Many gen-set manufacturers have software programs that enable the correct choice of set for any given load combination. Sizing is based on site conditions and the type of appliances, equipment, and devices that will be powered by the generator set.[13][14]  Engine damage  Main article: Diesel engine problems  Fuels  Diesel fuel is named after diesel engines, and not vice versa; diesel engines are simply compression-ignition engines, and can operate on a variety of different fuels, depending on configuration and location. Where a gas grid connection is available, gas is often used, as the gas grid will remain pressurized during almost all power cuts. This is implemented by introducing gas with the intake air and using a small amount of diesel fuel for ignition. Conversion to 100% diesel fuel operation can be achieved instantaneously.[15]  In more rural situations, or for low load factor plant, diesel fuel derived from crude oil is a common fuel; it is less likely to freeze than heavier oils. Endurance will be limited by tank size. Diesel engines can work with the full spectrum of crude oil distillates, from natural gas, alcohols, gasoline, wood gas to the fuel oils from diesel oil to cheaper residual fuels that are like lard at room temperature, and must be heated to enable them to flow down a fuel line.[16]  Larger engines (from about 3 MWe to 30 MWe) sometimes use heavy oils, essentially tars, derived from the end of the refining process. The slight added complexity of keeping the fuel oil heated to enable it to flow, whilst mitigating the fire risks that come from over-heating fuel, make these fuels unpopular for smaller, often unmanned, generating stations.  Other possible fuels include: biodiesel, straight vegetable oil, animal fats and tallows, glycerine, and coal-water slurry. | **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\ENGINE HALL\DSC_0000564.jpg**  **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\ENGINE HALL\DSC_0000675.jpg**  **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\ENGINE HALL\DSC_0000514.jpg** |
| **2** | **Steam Turbine Generator 9**  A steam turbine Generator extracts thermal energy from pressurized steam and uses it to do mechanical work on a rotating output shaft. Its modern manifestation was invented by Sir Charles Parsons in 1884.[1][2]  Because the turbine generates rotary motion, it is particularly suited to be used to drive an electrical generator—about 85% of all electricity generation in the United States in the year 2014 was by use of steam turbines.[3] The steam turbine is a form of heat engine that derives much of its improvement in thermodynamic efficiency from the use of multiple stages in the expansion of the steam, which results in a closer approach to the ideal reversible expansion process. | **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\ENGINE HALL\DSC_0000698.jpg** |
| **3** | **LV/DC Auxiliary System** | **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\PANELS, DEVICES AND METERS\DSC_0000705.jpg**  **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\PANELS, DEVICES AND METERS\DSC_0000706.jpg**  **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\PANELS, DEVICES AND METERS\DSC_0000703.jpg** |
| **4** | Transformers MT1, MT2, MT3  A transformer is a static electrical device that transfers electrical energy between two or more circuits. A varying current in one coil of the transformer produces a varying magnetic flux, which, in turn, induces a varying electromotive force across a second coil wound around the same core. Electrical energy can be transferred between the two coils, without a metallic connection between the two circuits. Faraday's law of induction discovered in 1831 described the induced voltage effect in any coil due to changing magnetic flux encircled by the coil.  Transformers are used for increasing or decreasing the alternating voltages in electric power applications, and for coupling the stages of signal processing circuits.  Since the invention of the first constant-potential transformer in 1885, transformers have become essential for the transmission, distribution, and utilization of alternating current electric power.[3] A wide range of transformer designs is encountered in electronic and electric power applications. Transformers range in size from RF transformers less than a cubic centimeter in volume, to units weighing hundreds of tons used to interconnect the power grid.  Classification parameters  Transformers can be classified in many ways, such as the following:  Power capacity: From a fraction of a volt-ampere (VA) to over a thousand MVA.  Duty of a transformer: Continuous, short-time, intermittent, periodic, varying.  Frequency range: Power-frequency, audio-frequency, or radio-frequency.  Voltage class: From a few volts to hundreds of kilovolts.  Cooling type: Dry and liquid-immersed – self-cooled, forced air-cooled; liquid-immersed – forced oil-cooled, water-cooled.  Circuit application: Such as power supply, impedance matching, output voltage and current stabilizer or circuit isolation.  Utilization: Pulse, power, distribution, rectifier, arc furnace, amplifier output, etc..  Basic magnetic form: Core form, shell form, concentric, sandwich.  Constant-potential transformer descriptor: Step-up, step-down, isolation.  General winding configuration: By EIC vector group – various possible two-winding combinations of the phase designations delta, wye or star, and zigzag or interconnected star;[r] other – autotransformer, Scott-T, zigzag grounding transformer winding.[86][87][88][89]  Rectifier phase-shift winding configuration: 2-winding, 6-pulse; 3-winding, 12-pulse; . . . n-winding, [n-1]\*6-pulse; polygon; etc..  Various specific electrical application designs require a variety of transformer types. Although they all share the basic characteristic transformer principles, they are customized in construction or electrical properties for certain installation requirements or circuit conditions.  Autotransformer: Transformer in which part of the winding is common to both primary and secondary circuits, leading to increased efficiency, smaller size, and a higher degree of voltage regulation.[90][91]  Capacitor voltage transformer: Transformer in which capacitor divider is used to reduce high voltage before application to the primary winding.  Distribution transformer, power transformer: International standards make a distinction in terms of distribution transformers being used to distribute energy from transmission lines and networks for local consumption and power transformers being used to transfer electric energy between the generator and distribution primary circuits.[90][92][s]  Phase angle regulating transformer: A specialised transformer used to control the flow of real power on three-phase electricity transmission networks.  Scott-T transformer: Transformer used for phase transformation from three-phase to two-phase and vice versa.[90]  Polyphase transformer: Any transformer with more than one phase.  Zigzag transformer: Special-purpose transformer with a zigzag or "interconnected star" winding connection.  Grounding transformer: Transformer used for grounding three-phase circuits to create a neutral in a three wire system, using a wye-delta transformer,[87][93] or more commonly, a zigzag grounding winding.[87][89][90]  Leakage transformer: Transformer that has loosely coupled windings.  Resonant transformer: Transformer that uses resonance to generate a high secondary voltage.  Audio transformer: Transformer used in audio equipment.  Output transformer: Transformer used to match the output of a valve amplifier to its load.  Instrument transformer: Potential or current transformer used to accurately and safely represent voltage, current or phase position of high voltage or high power circuits.[90]  Pulse transformer: Specialized small-signal transformer used to transmit digital signaling while providing electrical isolation, commonly used in Ethernet computer networks as 10BASE-T, 100BASE-T and 1000BASE-T.  Transformer energy losses are dominated by winding and core losses. Transformers' efficiency tends to improve with increasing transformer capacity. The efficiency of typical distribution transformers is between about 98 and 99 percent.[38][39][n]  As transformer losses vary with load, it is often useful to tabulate no-load loss, full-load loss, half-load loss, and so on. Hysteresis and eddy current losses are constant at all load levels and dominate overwhelmingly without load, while variable winding joule losses dominating increasingly as load increases. The no-load loss can be significant, so that even an idle transformer constitutes a drain on the electrical supply. Designing energy efficient transformers for lower loss requires a larger core, good-quality silicon steel, or even amorphous steel for the core and thicker wire, increasing initial cost. The choice of construction represents a trade-off between initial cost and operating cost.[41]  Transformer losses arise from:  Winding joule losses  Current flowing through a winding's conductor causes joule heating. As frequency increases, skin effect and proximity effect causes the winding's resistance and, hence, losses to increase.  Core losses  Hysteresis losses  Each time the magnetic field is reversed, a small amount of energy is lost due to hysteresis within the core. According to Steinmetz's formula, the heat energy due to hysteresis is given by  {\displaystyle W\_{\text{h}}\approx \eta \beta \_{\text{max}}^{1.6}} W\_{{\text{h}}}\approx \eta \beta \_{{{\text{max}}}}^{{1.6}}, and,  hysteresis loss is thus given by  {\displaystyle P\_{\text{h}}\approx {W}\_{\text{h}}f\approx \eta {f}\beta \_{\text{max}}^{1.6}} P\_{{\text{h}}}\approx {W}\_{{\text{h}}}f\approx \eta {f}\beta \_{{{\text{max}}}}^{{1.6}}  where, f is the frequency, η is the hysteresis coefficient and βmax is the maximum flux density, the empirical exponent of which varies from about 1.4 to 1.8 but is often given as 1.6 for iron.[41][42][43]  Eddy current losses  Eddy currents are produced in the metal transformer core and cause heating of the core. The eddy current loss is a complex function of the square of supply frequency and inverse square of the material thickness.[41] Eddy current losses can be reduced by making the core of a stack of plates electrically insulated from each other, rather than a solid block; all transformers operating at low frequencies use laminated or similar cores.  Magnetostriction related transformer hum  Magnetic flux in a ferromagnetic material, such as the core, causes it to physically expand and contract slightly with each cycle of the magnetic field, an effect known as magnetostriction, the frictional energy of which produces an audible noise known as mains hum or transformer hum.[13][44] This transformer hum is especially objectionable in transformers supplied at power frequencies[o] and in high-frequency flyback transformers associated with television CRTs.  Stray losses  Leakage inductance is by itself largely lossless, since energy supplied to its magnetic fields is returned to the supply with the next half-cycle. However, any leakage flux that intercepts nearby conductive materials such as the transformer's support structure will give rise to eddy currents and be converted to heat.[45]  Radiative  There are also radiative losses due to the oscillating magnetic field but these are usually small.  Mechanical vibration and audible noise transmission  In addition to magnetostriction, the alternating magnetic field causes fluctuating forces between the primary and secondary windings. This energy incites vibration transmission in interconnected metalwork, thus amplifying audible transformer hum.[46]  Constructi | **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\TRANSFORMERS\MT3\DSC_0000221.jpg**  **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\TRANSFORMERS\MT1\DSC_0000218.jpg** |
| **5** | **Transmission Grid**  Electric power transmission is the bulk movement of electrical energy from a generating site, such as a power plant, to an electrical substation. The interconnected lines which facilitate this movement are known as a transmission network. This is distinct from the local wiring between high-voltage substations and customers, which is typically referred to as electric power distribution. The combined transmission and distribution network is known as the "power grid" in North America, or just "the grid". In the United Kingdom, India, Myanmar, Malaysia and New Zealand, the network is known as the "National Grid".  A wide area synchronous grid, also known as an "interconnection" in North America, directly connects a large number of generators delivering AC power with the same relative frequency to a large number of consumers. For example, there are four major interconnections in North America (the Western Interconnection, the Eastern Interconnection, the Quebec Interconnection and the Electric Reliability Council of Texas (ERCOT) grid). In Europe one large grid connects most of continental Europe.  Historically, transmission and distribution lines were owned by the same company, but starting in the 1990s, many countries have liberalized the regulation of the electricity market in ways that have led to the separation of the electricity transmission business from the distribution business.[1] | **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\GRID\DSC_0000381.jpg**  **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\GRID\DSC_0000386.jpg** |
| **6** | **PLC System and Control Room**  A programmable logic controller (PLC) or programmable controller is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis.  PLCs were first developed in the automobile manufacturing industry to provide flexible, ruggedized and easily programmable controllers to replace hard-wired relays, timers and sequencers. Since then, they have been widely adopted as high-reliability automation controllers suitable for harsh environments. A PLC is an example of a "hard" real-time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result. PLCs can range from small modular devices with tens of inputs and outputs (I/O), in a housing integral with the processor, to large rack-mounted modular devices with a count of thousands of I/O, and which are often networked to other PLC and SCADA systems.  They can be designed for multiple arrangements of digital and analog I/O, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory.  It was from the automotive industry in the USA that the PLC was born. Before the PLC, control, sequencing, and safety interlock logic for manufacturing automobiles was mainly composed of relays, cam timers, drum sequencers, and dedicated closed-loop controllers. Since these could number in the hundreds or even thousands, the process for updating such facilities for the yearly model change-over was very time consuming and expensive, as electricians needed to individually rewire the relays to change their operational characteristics.  When digital computers became available, being general-purpose programmable devices, they were soon applied to control sequential and combinatorial logic in industrial processes. However these early computers required specialist programmers and stringent operating environmental control for temperature, cleanliness, and power quality. To meet these challenges the PLC was developed with several key attributes. It would tolerate the shop-floor environment, it would support discrete (bit-form) input and output in an easily extensible manner, it would not require years of training to use, and it would permit its operation to be monitored. Since many industrial processes have timescales easily addressed by millisecond response times, modern (fast, small, reliable) electronics greatly facilitate building reliable controllers, and performance could be traded off for reliability.[1] | **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\ENGINE HALL\DSC_0000744.jpg**  **D:\UET\UET\Kohinoor Internhip\Photos\ELECTRICAL\CONTROL ROOM\DSC_0000231.jpg** |

**Common Fuel System**



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| 1 | Fuel Decanting Shed  Decantation is a process for the separation of mixtures of immiscible liquids or of a liquid and a solid mixture such as a suspension.[1] The layer closer to the top of the container—the less dense of the two liquids, or the liquid from which the precipitate or sediment has settled out—is poured off, leaving the other component or the more dense liquid of the mixture behind. An incomplete separation is witnessed during the separation of two immiscible liquids.  Decantation can be used to separate immiscible liquids that have different densities. For example, when a mixture of water and oil are present in a beaker, a distinct layer between the two consistency is formed, with the oil layer floating on top of the water layer. This separation can be done by pouring oil out of the container, leaving water behind.[2] Generally, this technique gives an incomplete separation as it is difficult to pour off all of the top layer without pouring out some parts of the bottom layer.  A separatory funnel is an alternative apparatus for separating liquid layers.[2] It has a valve at the bottom to allow draining off the bottom layer. It can give a better separation between the two liquids. | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\DECANTING SHED\DSC_0000349.jpg  D:\UET\UET\Kohinoor Internhip\Photos\FUEL\DECANTING SHED\DSC_0000321.jpg    D:\UET\UET\Kohinoor Internhip\Photos\FUEL\TRANSPORT\DSC_0000286.jpg |
| 2 | HFO Storage Tanks  Fuel oil (also known as heavy oil, marine fuel or furnace oil) is a fraction obtained from petroleum distillation, either as a distillate or a residue. In general terms, fuel oil is any liquid fuel that is burned in a furnace or boiler for the generation of heat or used in an engine for the generation of power, except oils having a flash point of approximately 42 °C (108 °F) and oils burned in cotton or wool-wick burners. Fuel oil is made of long hydrocarbon chains, particularly alkanes, cycloalkanes and aromatics. The term fuel oil is also used in a stricter sense to refer only to the heaviest commercial fuel that can be obtained from crude oil, i.e., heavier than gasoline and naphtha.  Small molecules like those in propane, naphtha, gasoline for cars, and jet fuel have relatively low boiling points, and they are removed at the start of the fractional distillation process. Heavier petroleum products like Diesel and lubricating oil are much less volatile and distill out more slowly, while bunker oil is literally the bottom of the barrel; in oil distilling, the only things denser than bunker fuel are carbon black feedstock and bituminous residue (asphalt), which is used for paving roads and sealing roofs.  A fuel tank (or petrol tank) is a safe container for flammable fluids. Though any storage tank for fuel may be so called, the term is typically applied to part of an engine system in which the fuel is stored and propelled (fuel pump) or released (pressurized gas) into an engine. Fuel tanks range in size and complexity from the small plastic tank of a butane lighter to the multi-chambered cryogenic Space Shuttle external tank. | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\STORAGE\DSC_0000285.jpg    D:\UET\UET\Kohinoor Internhip\Photos\FUEL\STORAGE\DSC_0000327.jpg |
| 3 | Transfer Pump Unit  A fuel pump is a frequently (but not always) essential component on a car or other internal combustion engined device. Many engines (older motorcycle engines in particular) do not require any fuel pump at all, requiring only gravity to feed fuel from the fuel tank or under high pressure to the fuel injection system. Often, carbureted engines use low pressure mechanical pumps that are mounted outside the fuel tank, whereas fuel injected engines often use electric fuel pumps that are mounted inside the fuel tank (and some fuel injected engines have two fuel pumps: one low pressure/high volume supply pump in the tank and one high pressure/low volume pump on or near the engine).[1] Fuel pressure needs to be within certain specifications for the engine to run correctly. If the fuel pressure is too high, the engine will run rough and rich, not combusting all of the fuel being pumped making the engine inefficient and a pollutant. If the pressure is too low, the engine may run lean, misfire, or stall. | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\PIPES\DSC_0000416.jpg |
| 4 | Fuel Wash System Unit |  |
| 5 | Buffer Tanks and Day Tanks | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\STORAGE\DSC_0000289.jpg |

**Booster System**



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| 1 | Booster Units  A booster pump is a machine which will increase the pressure of a fluid. They may be used with liquids or gases, but the construction details will vary depending on the fluid. A gas booster is similar to a gas compressor, but generally a simpler mechanism which often has only a single stage of compression, and is used to increase pressure of a gas already above ambient pressure. Two-stage boosters are also made.[1] Boosters may be used for increasing gas pressure, transferring high pressure gas, charging gas cylinders and scavenging. | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\PIPES\DSC_0000421.jpg |
| 2 | Fuel Pump and Filter Units  A fuel filter is a filter in the fuel line that screens out dirt and rust particles from the fuel, normally made into cartridges containing a filter paper. They are found in most internal combustion engines.  Fuel filters serve a vital function in today's modern, tight-tolerance engine fuel systems. Unfiltered fuel may contain several kinds of contamination, for example paint chips and dirt that has been knocked into the tank while filling, or rust caused by moisture in a steel tank. If these substances are not removed before the fuel enters the system, they will cause rapid wear and failure of the fuel pump and injectors, due to the abrasive action of the particles on the high-precision components used in modern injection systems. Fuel filters also improve performance, as the fewer contaminants present in the fuel, the more efficiently it can be burnt.  Fuel filters need to be maintained at regular intervals. This is usually a case of simply disconnecting the filter from the fuel line and replacing it with a new one, although some specially designed filters can be cleaned and reused many times. If a filter is not replaced regularly it may become clogged with contaminants and cause a restriction in the fuel flow, causing an appreciable drop in engine performance as the engine struggles to draw enough fuel to continue running normally.  Some filters, especially found on diesel engines, are of a bowl-like design which collect water in the bottom (as water is more dense than diesel). The water can then be drained off by opening a valve in the bottom of the bowl and letting it run out, until the bowl contains only diesel. Many fuel filters contain a water sensor to signal to the engine control unit or directly to the driver (lamp on dashboard) if the water reaches the warning level. It is especially undesirable for water in fuel to be drawn into a diesel engine fuel system, as the system relies on the diesel for lubrication of the moving parts, and if water gets into a moving part which requires constant lubrication (for example an injector valve), it will quickly cause overheating and unnecessary wear. This type of filter may also include a sensor, which will alert the operator when the filter needs to be drained. In proximity of the diesel fuel filter there might be a fuel heater to avoid the forming of paraffin wax (in case of low temperatures) inside the filtrating element which can stop the fuel flow to the engine. | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\PIPES\DSC_0000447.jpg  D:\UET\UET\Kohinoor Internhip\Photos\FUEL\WATER\DSC_0000776.jpg  D:\UET\UET\Kohinoor Internhip\Photos\FUEL\WATER\DSC_0000790.jpg |

**Common Sludge Oil System**

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| 1 | Sludge Water Tanks |  |
| 2 | Sludge Treatment Unit |  |
| 3 | Sludge Pits | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\TRANSPORT\DSC_0000754.jpg |

**Common Engine Cooling System**

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| 1 | Engine Cooling System  Internal combustion engine cooling uses either air or liquid to remove the waste heat from an internal combustion engine. For small or special purpose engines, cooling using air from the atmosphere makes for a lightweight and relatively simple system. Watercraft can use water directly from the surrounding environment to cool their engines. For water-cooled engines on aircraft and surface vehicles, waste heat is transferred from a closed loop of water pumped through the engine to the surrounding atmosphere by a radiator.  Water has a higher heat capacity than air, and can thus move heat more quickly away from the engine, but a radiator and pumping system add weight, complexity, and cost. Higher-power engines generate more waste heat, but can move more weight, meaning they are generally water-cooled. Radial engines allow air to flow around each cylinder directly, giving them an advantage for air cooling over straight engines, flat engines, and V engines. Rotary engines have a similar configuration, but the cylinders also continually rotate, creating an air flow even when the vehicle is stationary.  Aircraft design more strongly favors lower weight and air-cooled designs. Rotary engines were popular on aircraft until the end of World War I, but had serious stability and efficiency problems. Radial engines were popular until the end of World War II, until gas turbine engines largely replaced them. Modern propeller-driven aircraft with internal-combustion engines are still largely air-cooled. Modern cars generally favor power over weight, and typically have water-cooled engines. Modern motorcycles are lighter than cars, and both cooling fluids are common.[1] Some sport motorcycles were cooled with both air and oil (sprayed underneath the piston heads). | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\WATER\DSC_0000799.jpg  D:\UET\UET\Kohinoor Internhip\Photos\FUEL\WATER\DSC_0000775.jpg |

**Common Steam Turbine Cooling System**

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| 1 | Steam Turbine Cooling System  Heat engines generate mechanical power by extracting energy from heat flows, much as a water wheel extracts mechanical power from a flow of mass falling through a distance. Engines are inefficient, so more heat energy enters the engine than comes out as mechanical power; the difference is waste heat which must be removed. Internal combustion engines remove waste heat through cool intake air, hot exhaust gases, and explicit engine cooling.  Engines with higher efficiency have more energy leave as mechanical motion and less as waste heat. Some waste heat is essential: it guides heat through the engine, much as a water wheel works only if there is some exit velocity (energy) in the waste water to carry it away and make room for more water. Thus, all heat engines need cooling to operate.  Cooling is also needed because high temperatures damage engine materials and lubricants and becomes even more important in hot climates.[2] Internal-combustion engines burn fuel hotter than the melting temperature of engine materials, and hot enough to set fire to lubricants. Engine cooling removes energy fast enough to keep temperatures low so the engine can survive.[3]  Some high-efficiency engines run without explicit cooling and with only incidental heat loss, a design called adiabatic. Such engines can achieve high efficiency but compromise power output, duty cycle, engine weight, durability, and emissions.[citation needed] | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\WATER\DSC_0000799.jpg  D:\UET\UET\Kohinoor Internhip\Photos\FUEL\WATER\DSC_0000408.jpg |

**Common Water Treatment System**

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| 1 | Priming Tank |  |
| 2 | Pump House |  |
| 3 | Water Treatment Unit |  |
| 4 | Buffer Tank |  |
| 5 | Hydrophore Unit |  |

**Steam Heating System**

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| 1 | Trace Heaters |  |
| 2 | Settling Tanks |  |
| 3 | Condensate Water Pump Unit |  |
| 4 | Observation Tank |  |

**Starting Air System**

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| 1 | Starting Air Unit | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\WATER\DSC_0000794.jpg |

**DG-SET Lube Oil System**

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| 1 | Lube Oil Separator |  |
| 2 | System Oil Tank |  |
| 3 | Lube Oil Pumps |  |
| 4 | Safety Filter |  |
| 5 | Gravity Tank |  |
| 6 | Lube Oil Storage Shed | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\CHEMICALS\DSC_0000412.jpg |

**DG-SET Cooling System**

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| 1 | Cooling System |  |

**DG-SET Exhaust Gas and Charge Air System**

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| 1 | Exhaust Gas Boiler |  |
| 2 | Charge Air Filter Unit | D:\UET\UET\Kohinoor Internhip\Photos\FUEL\CHIMNEY\DSC_0000747.jpg |

**Steam Turbine Generator 9**

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| 1 | Steam Turbine Generator 9 |  |

**QEHS**

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| 1 | Employee Responsibilities  1. Place Safety and Health requirements as first importance in performance of work duties. Protect fellow Employees, Company Property and Public.  2. Notify violation or deficiency in working conditions to supervisor (injuries, accident, near miss etc.)  3. Participate in Environment, Health and Safety Program.  4. Obey Environment, Health and Safety instructions, policy and procedures.  5. Use Safety devices/ equipment.  6. Properly dispose all hazardous materials in acceptable manner.  7. working while drugged is forbidden. All prescription drugs must be reported to supervisor.  8. Failure to comply with or enforce Environment Health and Safety rules may result in disciplinary action or dismissal. Do not violate work rules. |
| 2 | General Safety and Health rules  1. Asbestos: Do not remove material suspected of containing Asbestos (adhesives, mastics, insulation, lab fume hoods, vented enclosures). If such material is damaged, inform EHS Department immediately.  2. Confined Space: Do not enter Confined Space (restricted means of entry or exit, unfavorable natural ventilation, not designed for occupancy) like tanks, manholes, sewers, trenches etc. as it can involve suffocation, oxygen deficiency, fire, explosion hazards, exposure to dangerous vapors or toxic gases, physical hazards etc. |
| 3 | Emergency Response Plan: In case of fire, chemical release, bomb threat etc.:  1. Locate local fire alarms or Emergency alarm systems and learn how to operate them.  2. learn location of all exits (exit stairs) from work area, primary and alternate exit routes.  3. Know your designated Assembly point outside the building for your accountability and coworkers.  4. immediately Respond by following Plans for appropriate Emergency Response.  5. If a continuous alarm sounds, immediately evacuate the building.  6. Do not run. Use stair wells.  7. Report to designated Assembly point outside the building immediately.  8. Escort visitors to Assembly point.  9. Do not enter building after evacuation until instructed by Management. |
| 4 | Electrical Safety  1. follow legal and Regulatory requirements and good industry practices. Work on Electrical circuits with power off.  2. A Safety warning, tagging and locking system will be used to ensure that all power is removed from the system. circuits will be checked by Proper equipment to make sure no voltage is present.  3. Non-current carrying metal parts of portable/ plug connected equipment shall be grounded or Protected by double insulation.  4. Keep working Spaces, walkways etc. clear of cords.  5. Worn, frayed or damaged Electrical cords or connectors shall not be used. Must be tagged DANGER, OUT OF SERVICE or DO NOT USE.  6. Extension cords, shall be Protected from damage by traffic, sharp corners, projections, pinching etc.  7. Extension cords are temporary (90 days of maximum use).  8. temporary lighting shall be de-energized when not in use. Guards must be used to prevent accidental contact with bulb. temporary lighting must not be suspended by Electric cords unless cords and lights are designated for suspension. |
| 5 | Fails:  1. Always use hand rail on staircase.  2. Use caution on surface containing water or oil etc.  3. immediately clean up spills.  4. Keep stairs, walkways, aisles clear of boxes, loose materials, wires or other objects.  5. Use Safety shoes that are compatible with work Environment.  6. Do not stand or climb on desk or chair to reach high. Use a ladder. |
| 6 | Fire prevention  1. Know the Emergency plan for your work area. Know location of fire equipment, Proper method of turning in a final alarm, using a fire extinguisher (portable Protected equipment)  2. Obey all rules, Regulatory and signs for fire Safety (Smoking, open flames, sources of ignition, storage, handling and use of flammable liquids and hazardous materials)  3. practice good housekeeping and fire prevention.  4. flammable liquids must be stored in approved Safety containers with flame arrestors.  5. Do not use acids, bases or oxidizers and reducers in same cabinet due to possibility of reaction.  6. Keep hand operated fire equipment in fully accessible, mounted and unobstructed at all times.  7. Notify supervisor before use of fire equipment so that it can be replaced.  8. If your clothing catches fire, roll on floor or ground. Do not run.  9. Do not clean clothing with gasoline, solvents or flammable liquids.  10. Do not use oil or grease on oxygen equipment (cylinders).  11. In case of fire, find location of fire, inform control room, shout FIRE three times, try yo put it out, evacuate area and report to respective Assembly point. |
| 7 | First Aid:  1. It is immediate Emergency treatment provided for injury or sudden illness before professional medical care is available.  2. Never minimize the seriousness of injury or illness. Seek medical attention.  3. In case of Emergency, call control Room EXT #222.  4. Use First Aid Kits for minor cuts and scratches. Get medical attention.  5. Routine Administration must be done by qualified First Aider. |
| 8 | housekeeping/ Sanitation  1. Maintain Safe working conditions.  2. Keep work area clean, materials Properly stored, keep walkways and floor areas clear of slip, trip and fall hazards.  3. Place all waste and debris in designated containers for Proper disposal.  4. Do not litter. Use containers or recycle.  5. clean up all water or beverage spills.  6. Barricade spills areas, Notify EHS Department or designated person for cleanup.  7. Store oily waste and rags and other flammable waste in Safety containers.  8. Maintain 3 feet clearance from all Electrical panels, switch boxes, switchboards. Switchgear rooms must not be used for storage.  9. Do not obstruct or block exit routes.  10. Do not block ladders, stairways, Electrical switches, firefighting, rescue or Emergency equipment.  11. Keep tools stored neatly, racked etc.  12. Wash hands before eating. |
|  | Standardized Chemicals:  physical hazards (Combustible, flammable, explosive, reactive, pressurized)  Health hazards (toxic, carcinogenic, corrosive, irritant, sensitizer)  carcinogenic chemicals are regulated by OSHA. |
|  | EHS Department ensures that  1. containers are Properly labeled  2. appropriate signs are posted.  3. material Safety datasheets are available.  4. Chemical Safety training is provided.  5. An inventory of hazardous chemicals is Maintained. Chemical Safety training must be received by all Employees. hazardous Communication training must be received by all Employees by EHS Department or supervisor. Contractors must submit list of chemicals to EHS. Note down all MSDs on work site. |
|  | Health hazards  1. Dusts: Asbestos, Lead, Silica, wood dusts.  2. Mists: acid, oil, paint, poisons  3. Gases: CO, waste anesthetic gases etc.  4. Vapors: Degreasing Vapors, trichloroethylene.  5. Fumes: Metal fumes from welding, cutting, soldering  6. Ingested, skin absorption, breathing of toxic gases. |
|  | Workplace precautions  1. Read labels  2. Do not mix cleaning compounds or chemicals.  3. Learn about excessive exposure to chemicals  4. Take precautions to Protect from exposure.  5. Do not work with hazardous materials until trained.  6. Report unusual symptoms to doctor or medical provider. |
|  | Biological hazards  1. Biological Agents or substances which may harm Health.  2. Infectious Organisms.  3. toxic Biological substances  4. Biological Allergens etc. |
|  | Laboratory Safety  1. Know all exits, Safety equipment and Emergency procedures.  2. Do not smoke  3. Do not smell chemicals  4. Do not use mouth suction in filling pipettes. Use suction bulb.  5. Do not force glass tubing into rubber stoppers.  6. Use Safety devices, PPE for handling hot items.  7. Label all waste containers.  8. Confine long hair and loose clothing.  9. Never conduct experiments alone in lab.  10. Wear eye Protection while handling chemicals  11. Use Laboratory hoods to control chemical fumes, mist, vapors, Biological hazards.  12. Turn off all hotplates, open burners, hazardous devices when leaving Laboratory  13. Decontaminate and clean work surfaces daily and after spills.  14. Minimize production of aerosols.  15. Do not store food with chemicals in fridge or Biological materials.  16. Decontaminate solid and liquid waste that contains Organisms.  17. Properly label hazardous waste for disposal. |
|  | Safe Lifting  1. Get Proper Excursive, maintain good diet and manage stress. Build up leg and abdominal muscles and keep off excess weight.  2. Do not place objects on floor if they must be picked up later.  3. Use a mechanical device if possible. Inspect device before use. Get help if object is too heavy, large or awkward.  4. Avoid lifting above shoulder height. Use ladder or step tool to move objects above shoulders.  5. Push rather than pull objects. Maintain lumbar curve and Push with your legs.  6. Wear slip resistant shoes and check to make sure that footing is firm.  7. Check the path before lifting and or moving a load so that path is clear.  8. Spread feet apart to keep wide base of support.  9. Bend at your knees instead of at your waist and Maintain lumbar curve at all times.  10. Hold lifted object as close to your body as possible. Avoid long reach.  11. Lift slowly, smoothly and without jerking.  12. Avoid unnecessary twisting. Turn your feet, not your hips or shoulders. Do not twist.  13. Take your time while setting the object down  14. Report work related back pain to supervisor |
|  | Lockout-Tag out-control of hazardous energy  1. Uncontrolled hazardous energy must be controlled e.g. flow of solids, liquids, gases into Confined spaces or Environments.  2. tag out: Placing tag on power source. Do not operate or Restore energy.  3. Tags must clearly state: DO NOT OPERATE  4. Tags must be applied by hand  5. Do not service or Maintain machine without disconnecting power and implementing Lockout-Tag out procedure. |
|  | machine Guarding  Safeguards on machines protect us from injury while operating machines  hazardous motions:  1. Rotating  2. Reciprocating  3. Transverse  hazardous actions  1. cutting, pinching  2. Shearing  3. Bending  precautions  1. Safeguard machine part, function or process to avoid injury.  2. Never start a machine unless you have been trained in the use of it.  3. Do not operate a machine without personal protective equipment (PPE) and appropriate clothing.  4. Do not wear loose clothing, neck ties, rings or jewelry.  5. Do not operate machine without Guards in place.  6. Treat unguarded machine as if it were out of order. Tag it: OUT OF ORDER-DO NOT USE  7. Report missing Guards to supervisor immediately.  8. Do not adjust or remove Guard barrier or enclosure of any machine |
|  | Motor Vehicles  1. Do not operate Company Vehicles without driver's license or driving privileges  2. Have knowledge of Company and Government rules  3. make sure Vehicle is in Safe operating condition (lights, horns, windshield, wipers, washer, brakes, tires, fuel gauge, rear view mirrors, seat belts, windows)  4. Drivers must report Vehicle defects and maintenance needs in writing to Administration Department. Vehicles with Safety deficiencies must be removed from service or repaired.  5. Do not drive in unsafe/ unlawful manner. Drive safe arrive safe. Follow traffic laws and regulations |
|  | Noise  1. excessive noise around equipment or machinery could result in gradual loss of hearing  2. If noise levels exceed limits of OSHA and WB, engineering control or hearing conservation (ear plugs, ear muffs, hearing tests) must be used  3. Contact supervisor/ EHS Department for noise control/ Protection |
|  | Office Safety  1. No running in Office  2. Walk to right of passageway  3. Do not stand in front of doors  4. Keep stairways, aisles, walkways clear of boxes, loose materials, wires etc.  5. immediately clean up spilled liquids.  6. Use handrails when using stairways.  7. Pay attention while ascending or descending stairs  8. Do not lean from a chair to pick up something from the floor.  9. Do not sit on edge of desks, tables, boxes, low filing cabinets.  10. Use staple remover. dispose broken staple removers  11. Keep fingers away from sharp edges of paper cutters  12. Wear shoes at all times.  13. Properly store Office supplies. |
|  | Computer Workstations  1. Sit with lower back against the chair, upper legs parallel to floor and feet flat on the floor or on a foot rest.  2. Adjust table and chair so that elbows are bent at right angles and your arms are approximately parallel to the floor.  3. Keep wrists neutral (straight) by using wrist rest that is the same height as the keyboard  4. Place mouse on a surface at the same height as the keyboard  5. Position monitor directly in front of you, at an arm’s length away, with the top of the screen at or slightly below eye level. Tip the monitor back at an angle similar to that used when reading a book.  6. Adjust lighting and monitor to prevent glare or use an antiglare filter.  7. When performing tasks involving repetitive motions or awkward positions, take periodic stretching breaks or alternate with other tasks. |
|  | Fire hazards  1. flammable solvents and cleaning solutions shall be dispensed only from approved chemicals containers.  2. solvent soaked or oily rags used for cleaning office equipment shall be kept in metal, self-closing metal cans and contents properly disposed of daily.  3. Smoking is only permitted at designated areas  4. Handle solvents carefully to avoid personal injury or damage to materials or equipment.  5. Do not throw matches, cigars, cigarettes etc. into waste buckets. Soldering butts can cause fires.  6. All Electrical appliances must be unplugged at end of work day.  7. Do not use extension cords or permanent wiring. |
|  | Lifting and Moving objects  Improper lifting would result in serious strains. Use hand truck or unpack and handle in small parcels. Do not obstruct view with bulky objects in handrails or stairways. |
|  | personal protective equipment  Annual hazard Assessment is used to identify PPE.  1. Head protection is used to prevent head injury from impact and falling or flying objects. Hard hats are required for construction, high voltage electricity.  2. Ear protection protects from noise.  3. Eye and face protection protects from flying particles, molten metal, dust, chemicals, gases, steam, vapors, objects, biohazards, glare, light or heat radiation etc.  4. Respiratory protective equipment protects from airborne contaminants measured above threshold limit of OSHA standards.  5. Foot protection protects from foot injuries due to falling or rolling objects, Electrical or chemical hazards.  6. Hand protection protects from physical, radiation, Electrical or chemical hazards.  7. Gloves protect from Electrical hazards.  8. Fall protection protects from falling from height of 6 feet or more not protected by standard guardrails when working in confined spaces. |
|  | Portable ladders and scaffolds  ladders  1. Ladders must be inspected frequently and rechecked for soundness and proper working condition prior to use.  2. Ladders which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as DANGEROUS, DO NOT USE.  3. Ladders must not be used near power lines or other electrical devices  4. Ladders must extend 3 feet above the point of support of gutters or roof line and should be tied off.  5. Ladders must have suitable safety feet positioned firmly on the floor, ground or concrete which provides a stable flat level surface.  6. Work facing the ladder with both feet o the rungs  7. Ladders must be Maintained free of oil, grease or other slippery hazards.  8. Straight and extension ladders must be tied off and secured to the upright structure against which they lean.  9. Raise and lower tools or equipment by a hand line and tool bag.  10. Do not stand on top step of a step ladder.  11. Ladders shall be maintained in good condition at all times. The joint between the steps and side rails shall be tight, all fitting and hardware tightly attached and the movable parts shall operate freely without binding or undue play.  scaffolds  1. Only authorized Employees shall erect scaffolds, platforms and staging. Scaffolds and their parts shall be sound, rigid and capable of supporting at least four times their maximum intended loads.  2. Footing and anchorage of scaffolds shall also be sound, rigid and capable of carrying atleast four times their maximum intended loads without settling or displacement.  3. Unstable objects shall not be used to support scaffolds or planks  4. Platforms shall be sufficiently wide and secured to prevent slipping.  5. Guard rails and toe boards are required on all open sides where the platform is greater than 6 feet above the ground or floor.  6. Scaffolds shall not be load in excess of the maximum workload for which they are intended.  7. Damaged or weakened scaffolds shall be immediately repaired and shall not be used until repairs have been completed.  8. Equipment shall be inspected prior to use and maintained in good operating condition.  9. Defective or damaged equipment shall be tagged GANGEROUS, OUT OF SERVICE, DO NOT USE. |
|  | Smoking policy  1. Smoking is only permitted in smoking cabins placed by Admin and HR Department at different areas of the plant away from hazardous areas. Rs. 500 fine will be charged for violation of policy. |
|  | Tools-Hands and power  1. Use PPE safety glasses, goggles, face shields etc. when operating near hand or power tools.  2. hand or power tools shall be Maintained in a safe operating condition.  3. Power operated tools and equipment guards shall be inspected before each use and shall not be removed or tampered with.  4. Portable Electric Power tools shall be double insulated or grounded using a 3-conductor cord and a three prong plug. Electric on/off switches will operate properly.  5. Any damaged, unsafe, defective plug, cord or tool shall be reported to the supervisor immediately. The tag out Program shall be used.  6. All Employees using abrasive wheels shall be protected by eye protection equipment and eye shield shall be Maintained.  7. All fixed power driven metal and wooden working tools and equipment shall be provided with labeled disconnect switch near the tool that can be locked or tagged in the off position.  8. Only trained Employees can use tools of certain make and model.  9. Power actuated tools must be in hands of operator, locked in container, removed from site, follow all safety instructions when using power actuated tools. |
|  | Workspace injuries and illnesses  immediately Notify supervisor if you are injured or sick so that medical procedure can be followed for medical treatment.  Workspace Violence  1. Safe Healthy Environment to all Employees and public.  2. Procedure for prevention and management of incidents and threats of violence. Provide violence free workspace by establishing preventive measures, holding perpetrators accountable and provide assistance and support to victims.  3. The Factory Act 1934, Punjab Factory Rules 1978, NFPA and OSHA require Employees to provide a safe and healthy work environment.  4. Victims of workspace violence must be provided by support and reasonable security measures must be taken. Talk to supervisor, Admin and HR for confidential assistance. |
|  | Off the Job Environment, Health and Safety  Do not leave this training at work. Follow same self-practice in outside environment as an extension of Company EHS Program. |

**Devices, Machines and Tools**

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| 1 | Pumps:  A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps.[1]  Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.  Mechanical pumps serve in a wide range of applications such as pumping water from wells, aquarium filtering, pond filtering and aeration, in the car industry for water-cooling and fuel injection, in the energy industry for pumping oil and natural gas or for operating cooling towers. In the medical industry, pumps are used for biochemical processes in developing and manufacturing medicine, and as artificial replacements for body parts, in particular the artificial heart and penile prosthesis.  When a casing contains only one revolving impeller, it is called a single-stage pump. When a casing contains two or more revolving impellers, it is called a double- or multi-stage pump.  Rotary lobe pump, Progressive cavity pump, Rotary gear pump  Piston pump, Diaphragm pump, Screw pump, Gear pump, Hydraulic pump, Rotary vane pump, Peristaltic pump, Rope pump, Flexible impeller pump, Air Compressor. | Image result for air compressor  Image result for pump  Related image |
| 2 | Lathe Machine  A lathe (/leɪð/) is a machine that rotates a workpiece about an axis of rotation to perform various operations such as cutting, sanding, knurling, drilling, deformation, facing, and turning, with tools that are applied to the workpiece to create an object with symmetry about that axis.[1] | Related image |
| 3 | Angle Grinder  An angle grinder, also known as a side grinder or disc grinder, is a handheld power tool used for grinding (abrasive cutting) and polishing. Although developed originally as tools for rigid abrasive discs, the availability of an interchangeable power source has encouraged their use with a wide variety of cutters and attachments.[1]  Angle grinders can be powered by an electric motor, petrol engine or compressed air. The motor drives a geared head at a right-angle on which is mounted an abrasive disc or a thinner cut-off disc, either of which can be replaced when worn. Angle grinders typically have an adjustable guard and a side-handle for two-handed operation. Certain angle grinders, depending on their speed range, can be used as sanders, employing a sanding disc with a backing pad or disc. The backing system is typically made of hard plastic, phenolic resin, or medium-hard rubber depending on the amount of flexibility desired.  File:Flex.ogv  A member of the Technisches Hilfswerk using an angle grinder  Angle grinders are standard equipment in metal fabrication shops and on construction sites. They are also common in machine shops, along with die grinders and bench grinders. | Image result for side grinder |
| 4 | Alligator Shear  An alligator shear, historically known as a lever shear[1] and sometimes as a crocodile shear,[2] is a metal-cutting shear with a hinged jaw, powered by a flywheel or hydraulic cylinder. Alligator shears are generally set up as stand-alone shears; however, there are types for excavators. The jaw size can range from 4 to 36 in (100 to 910 mm) long. They are generally used to cut steel members, such as rebar, pipe, angle iron, or I-beams.[3][4] | Related image |
| 5 | Air Blower  A blower, is a tool that propels air out of a nozzle to move debris. Blowers are powered by electric or gasoline motors. Gasoline models have traditionally been two-stroke engines, but four-stroke engines were recently introduced to partially address air pollution concerns. Blowers are typically self-contained handheld units, or backpack mounted units with a handheld wand. The latter is more ergonomic for prolonged use. Larger units may rest on wheels and even use a motor for propulsion.[1] Some units can also suck debris via a vacuum, and shred them into a bag. In that role it is called a blower vac. | Related image |
| 6 | Miter saw, circular saw, cold saw  A saw is a tool consisting of a tough blade, wire, or chain with a hard toothed edge. It is used to cut through material, very often wood though sometimes metal or stone. The cut is made by placing the toothed edge against the material and moving it forcefully forth and less forcefully back or continuously forward. This force may be applied by hand, or powered by steam, water, electricity or other power source. An abrasive saw has a powered circular blade designed to cut through metal or ceramic. | Image result for chop saw |
| 7 | Belt Sander  A belt sander or strip sander is a sander used in shaping and finishing wood and other materials.[1] It consists of an electric motor that turns a pair of drums on which a continuous loop of sandpaper is mounted. Belt sanders may be handheld and moved over the material, or stationary (fixed), where the material is moved to the sanding belt. Stationary belt sanders are sometimes mounted on a work bench, in which case they are called bench sanders. Stationary belt sanders are often combined with a disc sander.  Belt sanders can have a very aggressive action on wood and are normally used only for the beginning stages of the sanding process, or used to rapidly remove material. Sometimes they are also used for removing paints or finishes from wood. Fitted with fine grit sand paper, a belt sander can be used to achieve a completely smooth surface.  Stationary belt sanders are used for removing non-ferrous metals, such as aluminum. Non-ferrous metals tend to clog grinding wheels, quickly making them useless for grinding soft metals. Because the small grooves in the sandpaper are opened up as they go around the arc of the drive wheel, belt sanders are less prone to clogging.  Belt sanders can vary in size from the small handheld unit shown in the illustration to units wide enough to sand a full 1.2 by 2.5 m (4-by-8 foot sheet) of plywood in a manufacturing plant. Some belt sanders can be as large as 1.2 by 0.7 metres (3 ft 11 in × 2 ft 4 in). Sanding wood produces a large amount of sawdust. Therefore, belt sanders employed in woodworking are usually equipped with some type of dust collection system. It may be as simple as a cloth filter bag attached to a portable sander or a large vacuum system to suck dust particles away into a central collector.  Taut-belt sanders allow for adjusting the angle of the idler drum to keep the belt centered.[2] Slack-belt sanding is commonly used in the manufacturing process of guitars and other medium-sized wooden objects. It employs a long sanding belt which runs slackly over the object. The machinist then exerts pressure to it to sand down specific areas. | Image result for belt sander |
| 8 | Oscillatory Multi-tool  Multi-tool is a common name for an oscillating power tool powered by battery or mains. The name "multi-tool" is a reference to the many functions that this tool can perform with the range of attachments available. "Master Tool" is also a trade name used in North America, short for the original tool by Fein called the Multi-Master. So far there are tools available to saw, sand, rasp, grind, scrape, cut and polish.  Oscillating Power Tool  Use of an offset in a fitted blade allows the tool to cut flush with a surface. This is particularly useful when fitting flooring along a skirting board, cutting the skirting to allow the board to slide under for a neat finish. The small form of these tools and the ability to mount the blade/accessory in any orientation allows cutting in areas previously unreachable. The ability to cut a complex or precise recess without the need to remove the work piece from where is it fixed greatly increases productivity. Small and precise cuts are possible even on end grain, a small sliver can be easily removed from timber cut too long for a perfect fit.  The accessory is fitted to the tool by a mechanism which allows that accessory to be rapidly rotated back and forth (oscillated). This creates friction with the sanding attachments or rapid cutting motions with the saw and grinding attachments. The narrow angle of oscillation allows for precise control over the tool as it does not kick like a rotating tool can. The angle of oscillation creates increasing friction further from the center of the tool as these areas travel a greater distance. The increased friction is particularly apparent with the triangular sanding and grinding attachments which allow the operator to reach into corners and confined spaces, a feature unique to this type of power tool. The saw blade attachments use the angle of oscillation in the same way.  The oscillating blade will not clear swarf in the same way as a rotating blade so it is necessary to move the blade back and forth to clear built up sawdust and clear the blades.  Improvements in battery technology such as lithium ion have allowed for tools which can be small in size and weight but still perform well enough to compete with mains-powered equivalents while freeing the user from the restrictions of cables. | Image result for multi-tool |
| 9 | Nail Gun  A nail gun, nailgun or nailer is a type of tool used to drive nails into wood or some other kind of material. It is usually driven by compressed air (pneumatic), electromagnetism, highly flammable gases such as butane or propane, or, for powder-actuated tools, a small explosive charge. Nail guns have in many ways replaced hammers as tools of choice among builders.  The nail gun was designed by Morris Pynoos, a civil engineer by training, for his work on Howard Hughes' Hughes H-4 Hercules (known as the Spruce Goose). The wooden fuselage was nailed together and glued, and then the nails were removed.[1][2]  The first nail gun used air pressure and was introduced to the market in 1950 to speed the construction of housing floor sheathing and sub-floors. With the original nail gun, the operator used it while standing and could nail 40-60 nails a minute. It had a capacity of 400-600 nails.[3] | Image result for nail gun |
| 10 | Needle Scaler  A needlegun scaler, needle scaler or needle-gun is a tool used to remove rust, mill scale, and old paint from metal surfaces.[2] The tool is used in metalwork applications as diverse as home repair, automotive repair and shipboard preservation.[3][4][5] | Related image |
| 11 | Pneumatic torque wrench  A wrench or spanner is a tool used to provide grip and mechanical advantage in applying torque to turn objects—usually rotary fasteners, such as nuts and bolts—or keep them from turning.  In Commonwealth English (excluding Canada), spanner is the standard term. The most common shapes are called open-ended spanner and ring spanner. The term wrench is generally used for tools that turn non-fastening devices (e.g. tap wrench and pipe wrench), or may be used for a monkey wrench - an adjustable pipe wrench.[1]  In North American English, wrench is the standard term. The most common shapes are called open-end wrench and box-end wrench. In American English, spanner refers to a specialised wrench with a series of pins or tabs around the circumference. (These pins or tabs fit into the holes or notches cut into the object to be turned.) In American commerce, such a wrench may be called a spanner wrench to distinguish it from the British sense of spanner.  Higher quality wrenches are typically made from chromium-vanadium alloy tool steels and are often drop-forged. They are frequently chrome-plated to resist corrosion and for ease of cleaning.  Hinged tools, such as pliers or tongs, are not generally considered wrenches in English, but exceptions are the plumber wrench (pipe wrench in British English) and Mole wrench (sometimes Mole grips in British English).  The word can also be used in slang to describe an unexpected obstacle, for example, "He threw a spanner into our plans" (in U.S. English, "monkey wrench"). | Related image |
| 12 | Pressure Washer  Pressure washing or power washing is the use of high-pressure water spray to remove loose paint, mold, grime, dust, mud, chewing gum and dirt from surfaces and objects such as buildings, vehicles and concrete surfaces. The volume of a mechanical pressure washer is expressed in gallons or litres per minute, often designed into the pump and not variable. The pressure, expressed in pounds per square inch, pascals, or bar, is designed into the pump but can be varied by adjusting the unloader valve. Machines that produce pressures from 750 to 30,000 psi (5 to 200 MPa) or more are available.  The terms pressure washing and power washing are used interchangeably in many scenarios, and there is some debate as to whether or not they are actually different processes.  A pressure washing surface cleaner is a tool consisting of two to four high-pressure jets on a rotating bar that swivels when water is flowing. This action creates a uniformed cleaning pattern that can clean flat surfaces at a rapid rate.  Hydro-jet cleaning is a more powerful form of power washing, employed to remove buildup and debris in tanks and lines.[1] | Image result for pressure washer |
| 13 | Sander  A sander is a power tool used to smooth surfaces by abrasion with sandpaper. Sanders have a means to attach the sandpaper and a mechanism to move it rapidly contained within a housing with means to hand-hold it or fix it to a workbench. Woodworking sanders are usually powered electrically, and those used in auto-body repair work by compressed air. There are many different types of sanders for different purposes. Multi-purpose power tools and electric drills may have sander attachments.  Woodworking sanders include:  Flap sander or sanding flap wheel: A sanding attachment shaped like a Rolodex and used on a hand-held drill or mounted on a bench grinder for finishing curved surfaces.  Belt sander (hand-held or stationary)  Disc sander: A disc sander is most commonly implemented as a stationary machine that consists of a replaceable circular shaped sandpaper attached to a wheel turned by an electric motor or compressed air. The usually wooden work piece, (although other materials can be shaped and worked on such as plastics, metals and other soft materials), is sat on a front bench that can be adjusted to various angles. It can be used for rough or fine sanding depending on the sanding grit used.  Scuff sanding a KC-10 aircraft, before painting  Oscillating spindle sander: A sander mounted on a spindle that both rotates and oscillates in and out or up and down along the axis of the spindle. Good for sanding curves and contours that would be difficult with hand or orbital sanding.  Random orbital sander  Orbital sander: A hand-held sander that vibrates in small circles, or "orbits." The sanding disk spinning while moving simultaneously in small ellipses causes the orbital action that it is known for. Mostly used for fine sanding or where little material needs to be removed.  Straight-line sander: A sander that vibrates in a straight line, instead of in circles. Good for places where hand sanding is tedious or "blocking" is required. Most are air-powered, a few electric. The first pneumatic straight line sander was patented by Otto Hendrickson in 1969.[1]  Detail Sander: A hand-held sander that uses a small vibrating head with a triangular piece of sandpaper attached. Used for sanding corners and very tight spaces. Also known as "Mouse" or "corner" sanders.  Stroke sander: A large production sander that uses a hand-operated platen on a standard sanding belt to apply pressure. For large surfaces such as tabletops, doors, and cabinets.  Table Top Drum sander: A bench top sander that uses a rotating drum. Much like a jointer, the operator adjust the height of the grit, by changing the grit of sandpaper, to adjust the depth of cut. Wood is hand fed against the drum to achieve a flat, smooth surface. Can be used for surface sanding, edge sanding, stripping paint, cabinet doors, etc.[2]  Drum sander: A large sander that uses a rotating sanding drum. As with a planer, the operator adjusts feed rollers to feed the wood into the machine. The sander smooths it and sends it out the other side. Good for finishing large surfaces.  Wide-belt sander: A large sander similar in concept to a planer, but much larger. Uses a large sanding belt head instead of a planer's shaping head, and requires air from a separate source to tension the belt. For rough sanding large surfaces or finishing. Used mainly for manufacturing furniture and cabinets.  Profile Shaper/Sander: An industrial machine consisting of a powered transport with a series of workstations for performing shaping, sanding, or other finish operations on one or more edges of components in cabinetry, furniture, shelving, and other products. These machines create and finish decorative edges in an automated process using rotating 'shaping heads', 'sanding wheels', 'foil applicators' and other specialized equipment. | Related image |
| 14 | Drill  A drill is a tool primarily used for making round holes or driving fasteners. It is fitted with a bit, either a drill or driver, depending on application, secured by a chuck. Some powered drills also include a hammer function.  Drills vary widely in speed, power, and size. They are characteristically corded electrically driven devices, with hand operated types dramatically decreasing in popularity and cordless battery powered ones proliferating.  A Lightweight Magnetic Drilling Machine  Drills are commonly used in woodworking, metalworking, machine tool fabrication, construction and utility projects. Specially designed versions are made for medicine, Space, and miniature applications. | Image result for drill  Related image |
| 16 | Heat Gun  A heat gun is a device used to emit a stream of hot air, usually at temperatures between 100 °C and 550 °C (200-1000 °F), with some hotter models running around 760 °C (1400 °F), which can be held by hand. Heat guns usually have the form of an elongated body pointing at what is to be heated, with a handle fixed to it at right angles and a trigger, in the same general layout as a handgun, hence the name. A lighter duty heat gun is similar to a portable Hair dryer. | Image result for heat gun |
| 17 | Vacuum cleaner  A vacuum cleaner, also known as a sweeper or hoover, is a device that uses an air pump (a centrifugal fan in all but some of the very oldest models), to create a partial vacuum to suck up dust and dirt from floors and from other surfaces such as upholstery and draperies.  The dirt is collected by either a dustbag or a cyclone for later disposal. Vacuum cleaners, which are used in homes as well as in industry, exist in a variety of sizes and models—small battery-powered hand-held devices, wheeled canister models for home use, domestic central vacuum cleaners, huge stationary industrial appliances that can handle several hundred litres of dust before being emptied, and self-propelled vacuum trucks for recovery of large spills or removal of contaminated soil. Specialized shop vacuums can be used to suck up both dust and liquids. | Image result for Vacuum Cleaner |
| 19 | Hand Tools: Wrench, Plier, File, Screwdriver, Hammer, Vise, Snip, Knife, Clamp, Ratchet, Wire Stripper, Cable Cutter, Flashlight, Tape measure, Puncher, drill, nuts, nails, rasp, chisel, bits, sand paper, awl, nip. | Related image |
| 20 | 1. Relays: Electromagnetic attraction type relay, Induction type relay, Solid state relay, Numerical based/Microprocessor based relay, Hybrid Relay, Thermal overload relay, Insulation monitoring relay, Liquid monitoring relay, Gas actuating relay, Reed Relay. 2. Examples: Paralleling Relay, Under Reactance Relay, Over Voltage Relay, Under Voltage Relay, Under Frequency Relay, Over Frequency Relay, Differential Over Current Relay, Thermal Overload Relay, Earth Fault Relay, Excitation Loss Relay, Generator Protection Relay, Multimode Auxiliary Relay, PC Board Relay, Buchholz Relay. | Image result for relays |
| 21 | Circuit Breakers: Oil Circuit Breaker, Air Circuit Breaker, SF6 Circuit Breaker, Vacuum Circuit Breaker, HVDC Circuit Breaker, Miniature Circuit Breaker, Moulded case Circuit Breaker, Single Pole Circuit Breaker, Double Pole Circuit Breaker, Ground Fault Interrupter Circuit Breaker, Arc Fault Circuit Interrupter Circuit Breaker. | Related image |
| 22 | PLC  A programmable logic controller (PLC) or programmable controller is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis.  PLCs were first developed in the automobile manufacturing industry to provide flexible, ruggedized and easily programmable controllers to replace hard-wired relays, timers and sequencers. Since then, they have been widely adopted as high-reliability automation controllers suitable for harsh environments. A PLC is an example of a "hard" real-time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result. | Image result for PLC |
| 23 | Mechanical Switches: Push Lock Switch, DIP Switch, Push-to-make Switch, Rocker Switch, Rotary Switch, Slide Switch, Tact Switch, Toggle Switch, Limit Switch, Float Switch, Flow Switch, Pressure Switch, Temperature Switch, Joystick Switch. | D:\UET\UET\Kohinoor Internhip\Photos\Picture Book\ELECTRICAL\CONTROL ROOM\DSC_0000231 - Copy.jpg |
| 24 | Electronic Switches: Bipolar Junction Transistor, Power Diode, Metal Oxide Semiconductor Field Effect Transistor, Insulated Gate Bipolar Transistor, Silicon Controlled Rectifier, Bidirectional Triode Thyristor, DIAC, JFET, Gate Turn Off Thyristor. | Image result for electronic semiconductor switches |
| 25 | Cables: Coaxial cable, Direct-buried cable, Flexible cables, Filled cable, Heliax cable, Non-metallic sheathed cable, Metallic sheathed cable, Multicore cable, Paired cable, Portable cord, Ribbon cable, Shielded cable, Single cable, Structured cabling, Submersible cable, Twin and earth, Twinax cable, Twin-lead, Twisted pair | Related image |
| 26 | Energy Meters: Electromechanical Meter, Electronic Meter (Digital Meter, Analog Meters), Single Direction Meter, Bidirectional Meter, Smart Meter (Zigbee, GSM/ GPRS, RF, Wi-Fi, PLC based Meters), LT Meter, HT Meter, Three Phase Meter, Single Phase Meter.  Examples:  Ammeter, Capacitance meter, Curve tracer, Cos Phi Meter , Distortionmeter, Electricity meter, ESR meter, Frequency counter, Leakage tester, LCR meter, Microwave power meter, Multimeter, Network analyzer, Ohmmeter, Oscilloscope, Psophometer, Q meter, Tachometer, Signal analyzer, Signal generator, Spectrum analyser, Sweep generator, Transistor tester, Tube tester, Wattmeter, Vectorscope, Video signal generator, Voltmeter, VU meter. | Related image |
| 27 | Sensors: Active Sensors, Passive Sensors, Analog and Digital Sensors, Electric, Biological, Chemical and Radioactive Sensors, Photoelectric, Thermoelectric, Electrochemical, Electromagnetic and Thermo-Optic Sensors.  Examples: Temperature Sensor (Thermometer, Resistance Temperature Detector), Proximity Sensor, Accelerometer, IR Sensor (Infrared Sensor), Pressure Sensor, Light Sensor, Ultrasonic Sensor, Smoke, Gas and Alcohol Sensor, Touch Sensor, Color Sensor, Humidity Sensor, Tilt Sensor, Flow and Level Sensor, Oil Mist Sensor, Torsional Vibration Sensor. | Related image |
| 28 | DC Power Supply: Rectifier, Battery, Inverter  A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power. Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply).  All power supplies have a power input connection, which receives energy in the form of electric current from a source, and one or more power output connections that deliver current to the load. The source power may come from the electric power grid, such as an electrical outlet, energy storage devices such as batteries or fuel cells, generators or alternators, solar power converters, or another power supply. The input and output are usually hardwired circuit connections, though some power supplies employ wireless energy transfer to power their loads without wired connections. Some power supplies have other types of inputs and outputs as well, for functions such as external monitoring and control. | Related image |
| 29 | Actuators: Electrical/ Pneumatic Linear/ Rotary Actuators  Actuators offer continuous control with a virtually wear-free operation, as well as the highest positioning accuracy and stability available, regardless of positioning time.  Compact actuator for the operation of final control elements with rotary movement. For continuous positioning, rated torque 100 Nm (80 lbf-ft). The actuator thrust rod transfers the force directly to the final control element.  Compact actuator for the operation of final control elements with preferably linear movement. For continuous positioning, rated force 4 kN (900 lbf). The actuator thrust rod transfers the force directly to the final control element.  Type UP Pneumatic Universal Rotary Actuators regulate dampers, fan inlet vanes, lever-operated valves, turbine governors, fluid drives and other final control elements.  Type LP linear pneumatic actuators regulate dampers, inlet vanes, louvers, lever operated valves, turbine governors, fluid drives and other final control elements. The input signals provide modulating control to position the final control element in a linear motion or rotary motion via lever linkage. | C:\Users\Sony\Desktop\preview.jpg |
| 30 | Analytical Measurement Systems:  For over half a century, ABB has developed, manufactured, supplied and installed analytical instruments for the laboratory, process, environmental, steam and power industries.  Laser diffraction analysis, also known as laser diffraction spectroscopy, is a technology that utilizes diffraction patterns of a laser beam passed through any object ranging from nanometers to millimeters in size[1] to quickly measure geometrical dimensions of a particle. This process does not depend on volumetric flow rate, the amount of particles that passes through a surface over time.[2]  Laser diffraction analysis is based on the Fraunhofer diffraction theory, stating that the intensity of light scattered by a particle is directly proportional to the particle size.[4] The angle of the laser beam and particle size have an inversely proportional relationship, where the laser beam angle increases as particle size decreases and vice versa.[5]  Laser diffraction analysis is accomplished via a red He-Ne laser, a commonly used gas laser for physics experiments that is made up of a laser tube, a high-voltage power supply, and structural packaging.[6][7] Alternatively, blue laser diodes or LEDs of shorter wavelength may be used. Angling of the light energy produced by the laser is detected by having a beam of light go through a suspension and then onto a sensor. A lens is placed between the object being analyzed and the detector's focal point, causing only the surrounding laser diffraction to appear. The sizes the laser can analyze depend on the lens' focal length, the distance from the lens to its point of focus. As the focal length increases, the area the laser can detect increases as well, displaying a proportional relationship. A computer can then be used to detect the object's particle sizes from the light energy produced and its layout, which the computer derives from the data collected on the particle frequencies and wavelengths.[5] | Laser process analyzer    Isotope Analyzer    Trace Gas Analyzers    portable Analyzers |
|  | Continuous Gas Analyzers: Multiwave Photometer, Integrated Analyzer, Flue Gas Analyzer, Sample Gas Cooler, Continuous Emission Monitoring Data Acquisition System, Predictive Emission Monitoring Systems Dissolved gas analysis (DGA) is the study of dissolved gases in transformer oil.[1]  Insulating materials within transformers and electrical equipment break down to liberate gases within the unit. The distribution of these gases can be related to the type of electrical fault, and the rate of gas generation can indicate the severity of the fault. The identity of the gases being generated by a particular unit can be very useful information in any preventative maintenance program.[2]  The collection and analysis of gases in an oil-insulated transformer was discussed as early as 1928[citation needed]. As of 2018, many years of empirical and theoretical study have gone into the analysis of transformer fault gases.  DGA usually consists of sampling the oil and sending the sample to a laboratory for analysis. Mobile DGA units can be transported and used on site as well; some units can be directly connected to a transformer. Online monitoring of electrical equipment is an integral part of the smart grid.  Large power transformers are filled with oil that cools and insulates the transformer windings. Mineral oil is the most common type in outdoor transformers; fire-resistant fluids also used include polychlorinated biphenyls (PCB)s and silicone. [3]  The insulating liquid is in contact with the internal components. Gases, formed by normal and abnormal events within the transformer, are dissolved in the oil. By analyzing the volume, types, proportions, and rate of production of dissolved gases, much diagnostic information can be gathered. Since these gases can reveal the faults of a transformer, they are known as "fault gases". Gases are produced by oxidation, vaporization, insulation decomposition, oil breakdown and electrolytic action.  Evolved gas analysis (EGA) is a method used to study the gas evolved from a heated sample that undergoes decomposition or desorption. It is either possible just to detect evolved gases using evolved gas detection (EGD) or to analyse explicitly which gases evolved using evolved gas analysis (EGA).[1] Therefor different analytical methods can be employed such as mass spectrometry, Fourier transform spectroscopy, gas chromatography, or optical in-situ evolved gas analysis.  By coupling the thermal analysis instrument, e. g. TGA (thermogravimetry) or DSC (differential scanning calorimetry), with a fast Quadrupole Mass Spectrometer (QMS) the detection of gas separation and identification of the separated components are possible in exact time correlation with the other thermal analysis signals. DSC/TGA-QMS or TGA-QMS yields information on the composition (mass numbers of elements and molecules) of the evolved gases. It allows fast and easy interpretation of atomic/inorganic vapors and standard gases like H2, H2O, CO2, etc. Fragmentation, interpretation of organic molecules is sometimes difficult.  The combination with an FTIR (Fourier transform infrared spectrometer) has become popular, especially in the polymer producing, chemical and pharmaceutical industry. DSC/TGA-FTIR or TGA-FTIR yields information on the composition (absorption bands) of the evolved gases (bonding conditions). The advantage is an easy interpretation (spectra data bases) of organic vapors without fragmentation. Symmetrical molecules can not be detected.  An EGA instrument named the Thermal and Evolved-Gas Analyzer was flown on the Phoenix Lander probe that reached Mars in May 2008. Its purpose was to study Martian soil samples.[citation needed]  Gas Analyzers(Acetylene, Ammonia, Carbondioxide Carbonmonooxide, carbonyl sulphur, hydrogen fluoride hydrogen sulphide, emmisions, methane, nitric oxides, oxygen), portable Analyzers  Gas chromatography (GC) is a common type of chromatography used in analytical chemistry for separating and analyzing compounds that can be vaporized without decomposition. Typical uses of GC include testing the purity of a particular substance, or separating the different components of a mixture (the relative amounts of such components can also be determined). In some situations, GC may help in identifying a compound. In preparative chromatography, GC can be used to prepare pure compounds from a mixture.[1][2]  In gas chromatography, the mobile phase (or "moving phase") is a carrier gas, usually an inert gas such as helium or an unreactive gas such as nitrogen. Helium remains the most commonly used carrier gas in about 90% of instruments although hydrogen is preferred for improved separations.[3] The stationary phase is a microscopic layer of liquid or polymer on an inert solid support, inside a piece of glass or metal tubing called a column (an homage to the fractionating column used in distillation). The instrument used to perform gas chromatography is called a gas chromatograph (or "aerograph", "gas separator").  A spectrometer (/spɛkˈtrɒmɪtər/) is a scientific instrument used to separate and measure spectral components of a physical phenomenon. Spectrometer is a broad term often used to describe instruments that measure a continuous variable of a phenomenon where the spectral components are somehow mixed. In visible light a spectrometer can for instance separate white light and measure individual narrow bands of color, called a spectrum, while a mass spectrometer measures the spectrum of the masses of the atoms or molecules present in a gas. The first spectrometers were used to split light into an array of separate colors. Spectrometers were developed in early studies of physics, astronomy, and chemistry. The capability of spectroscopy to determine chemical composition drove its advancement and continues to be one of its primary uses. Spectrometers are used in astronomy to analyze the chemical composition of stars and planets, and spectrometers gather data on the origin of the universe. | Multiwave Photometer    Integrated Analyzer    Flue Gas Analyzer    Sample Gas Cooler    Continuous Emission Monitoring Data Acquisition System    Predictive Emission Monitoring Systems Inferential Modeling Platform    NOx analyzer    Gas Chromatograph    Vapor Pressure Analyzer    Spectrometers |
|  | Continuous Water Analysis: Aluminium, Ammonia, Chlorine, Color, Conductivity, Dissolved Organics, Oxygen, Fluoride, Hydrazine, Iron, Manganese, Nitrate, pH, phosphate, turbidity, silica, sodium Analyzers  Corrosion and erosion are major concerns in thermal power plant operating on steam. The steam reaching the turbines need to be ultra-pure and hence needs to be monitored for its quality. A well designed Steam and Water Analysis system (SWAS)[5] can help in monitoring the critical parameters in the steam. These parameters include pH, conductivity, silica, sodium, dissolved oxygen, phosphate and chlorides. A well designed SWAS must ensure that the sample is representative till the point of analysis. To achieve this, it is important to take care of the Extraction, Transport, Conditioning, Analysis and Hygiene.  Specific conductivity gives overall conductivity value of the sample and is the most generic measurement  Cation conductivity is conductivity measurement after the Cation Column. At the Cation Column, the H+ resins replace the positive ions of all dissolved matter in the solution. When this happens, the treatment chemicals, which are desired ones (and are of basic or alkaline in nature) get converted to H2O, i.e. water. (e.g. NH4OH + H(+) gives NH4+ and H2O). The impurities are nothing but salts of different natures These get converted to respective acids (e.g. NaCl + H(+) gives HCl and CL-). Thus masking effects of treatment chemicals on the conductivity value are eliminated, while the conversion of salts to corresponding acids has an effect of increase in their corresponding conductivity value to around 3 times its original value. Thus, in effect, cation conductivity acts as amplifier of conductivity due to impurities and eliminator of conductivity due to treatment chemicals.  De-gassed conductivity is the finest level of conductivity measurement. Here one removes the masking effects of dissolved gases, mainly CO2, on the conductivity measurement. In the De-Gassed conductivity system, there is a reboil chamber to heat the sample, so that the dissolved gases are liberated and then there is cooling mechanism, by which the hot liquid is cooled again. The conductivity measured after this process is indeed the 'real' value of conductivity because of 'dissolved' impurities after eliminating the dissolved gases. | Color Analyser    Turbidity and Total Suspended Solids Sensor    pH Sensor |
|  | Metallurgical Analyzers:  A Metallurgical analyzer is a device used to measure the hydrogen concentration in steels and alloys. It also has industrial applications for corrosion monitoring. It can directly monitor the dissolved inclusion content in liquid metals. | Metallurgical Analyzer |
|  | Arc fault detection system  A fast and selective arc fault mitigation for air-insulated low voltage and medium voltage switchgear is a natural constituent of modern switchgear panels and a safety and security investment for older switchgear panels to protect human lives and prevent or reduce material damage. |  |
|  | Cable Distribution Cabinets: Kabeldon Cable Distribution Cabinets are sustainable and fits well in most environments. They come in various design and sizes, all are doing extremely well even under very tough conditions.  The latest generation of enclosures was developed based on our long experience of systems for demanding environments. At the same time, they satisfy current requirements for long life with undiminished safety and low operating and maintenance costs. |  |
|  | Capacitors and filters: They improve the power quality of electrical networks by eliminating disturbances and improving power factor in line with grid requirements. ABB power quality products and solutions are available for low-voltage (LV), medium-voltage (MV) and high-voltage (HV) systems.  In transmission systems, reactive power is needed to maintain the voltage to deliver active power. A lack of reactive power leads to an inefficient use of the electrical network and results in voltage sags, overloaded transformers, lines, cables, etc.  In industry, motor loads and other electrical loads require reactive power to convert electrical energy into useful work.  Capacitors are very beneficial in power grids. They provide the reactive power needed by electrical motors, transformers, etc. This increases the transmission capacity and reduces losses thanks to higher power factors. They enable power factor targets of the utilities to be met.  Capacitors are also a key component in various filter solutions that reduce harmonic content. They reduce the risk of disturbances in production processes, metering errors and malfunctioning of relay protections. This extends the service life of connected equipment.  Power Quality of the low voltage network is an important challenge for today's industrial and commercial applications. Good Power Quality leads to trouble free and efficient operation of installations. |  |
|  | Circuit Breakers  Products that have been designed to increase efficiency in all installations: from industrial and naval applications to traditional and renewable power generation installations, buildings, data centers and shopping centers.  High quality, accuracy and reliability are key features for ABB low voltage circuit-breakers. High performances in any conditions, safe-to-use products and easy replacements of components are always guaranteed.  Across every market, ABB's circuit breakers occupy a leading position thanks to their proven reputation for reliability, performance and long life. CBs from ABB are available for original equipment manufacturers (OEM) to incorporate in their own installations or for use in repair, retrofit and upgrade projects. |  |
|  | Communication Networks: Optical, Power Line Carrier, Copper, Voice Networks, Wireless Networks  ABB’s communication solutions for optical networks offer a broad range of world leading products for local and wide area communication networks.  With the robust FOX family various real-time applications in wide area networks are possible. The FOX multiplexers offer a platform in which TDM (SDH/PDH) and latest packet-based technologies are combined. Designed and type-tested for harsh environments, the FOX multiplexers offer a broad range of services such as integrated teleprotection via IEC 61850 GOOSE messaging and Ethernet over SDH (EoS). With the easy upgrade path and the proven long-term commitment and support, ABB’s FOX family protects the investment of utilities to meet the requirements of today and tomorrow.  The increase of Ethernet based communication protocols, such as IEC 60870-5-104, paved the way for switches in local area networks of utilities. Critical applications such as IEC 61850 signals or SCADA data can be transmitted via fast and reliable Ethernet networks in the substation environment.  ABB’s AFS family includes a broad range of Ethernet switches, routers and firewalls which are designed for utilities environment. All products of the AFS family are compliant with IEEE standards and offer many features, such as fast protection schemes, redundant power supply and alarm contacts, which enable the stepwise introduction of smart grid applications.  In spite of the growing use of digital communication systems - especially those employing optical fibre links for which ABB produces a comprehensive line of equipment - PLC is still often the most cost effective, and reliable, solution to cover the operational needs of a power system. This applies particularly when only low volumes of data have to be transmitted over long distances.  An existing PLC network represents a considerable investment made over many years, and for reasons of cost and system operation it is seldom possible, or necessary, to replace it with a digital system in a short space of time. An existing PLC network can often be usefully expanded rather than replaced, and in such cases frequency allocation must be carefully planned to mitigate any channel shortage.  In other instances a PLC channel is used as a back-up to fiber-based digital channels, providing a dependable communication link in the most demanding of circumstances.  With decades of successful involvement in the PLC and transfer tripping field, ABB continues to prove its high technical standards and competence by remaining at the forefront of PLC development. ABB provides the latest technologies to PLC systems, with five-step variable bandwidth and flexible partitioning of digital and analog data, backed with a formidable capability in systems and applications engineering.  The EDS500 product family of rugged Ethernet/SHDSL managed switches and FSK-based analog modems has been specifically designed for critical infrastructure and industrial applications with enhanced, robust communication technology that ensures minimal downtime and enables predictive failure notification and encrypted management.  Depending on the model, data communication features two-wire copper lines, starting at very low baud rates (FSK-based analog modems) or SHDSL/EFM connections with up to 15 Mbps data rate, and ranges up to Ethernet (copper and optical). SFP slots and suitable SFP modules provide connectivity over optical multimode or single mode fibers up to 80 km, both for Duplex LC (two fibers) and Simplex LC (bi-directional over one fiber). Several models provide Power-over-Ethernet ports (IEEE 802.3at / PoE+ and above).  The EDS500 managed switches for optical and copper Ethernet are certified for IEC 61850. The Ethernet/SHDSL switches support a variety of useful, reliable and intelligent functions, such as MSTP/RSTP/STP (IEEE 802.1Q/w/D), VLAN, IEEE 802.1X, HTTPS, SNMPv3, SSH, QoS, rate limiting, ACL/packet filter, RMON, LLDP, L2TP, IGMP snooping, and many more, making EDS500 suitable for any harsh industrial environment. | Modem |
|  | Conduit & fittings  An electrical system is only as reliable as its conductors and conduit systems & fittings which provide unsurpassed protection for wire and cables in the most demanding applications: power generation, robotics, food processing, refining, waste water treatment, rail rolling stock & trackside, infrastructure, offshore drilling, mining, wind turbines, solar panels, off-road vehicles and many more.  Our conduit range is available in many different materials, ranging from lightweight to heavyweight with nominal conduit sizes from 10mm right up to the Jumbo size of 106mm.  For more demanding applications there is a wide-ranging high specification series of conduit with enhanced low fire hazard properties, EMI screening and incorporating high fatigue life. Overbraided options are available for use in abrasive environments.  Standard product is manufactured in a wide range of materials. The corrugated construction provides good flexibility and low weight. In addition a range of fittings are specifically designed to maintain system integrity.  Our range offers high-specification protective cable glands suitable for harsh conditions, including high or extreme temperature ranges, oil and UV exposure, food & beverage use or highly corrosive environments. Solutions are also readily available for a broad range of general purpose uses.  Carlon® offers one of the most complete line of non-metallic elbows and fittings in the electrical industry, with products designed for use above- and below-ground. |  |
|  | Connection Blocks: Terminal Blocks, Test Blocks, Distribution Blocks  Main benefits  High quality products: benefit from the best connection.  Simplification and acceleration of flows: reliable expertise in delivery times.  Innovating for tomorrow's solutions.  Perfect connection reliability in response to all connection challenges.  Main features  Connecting capacity from 0.22 to 300 mm² (22AWG to 1000kcmil).  Large offering covering all applications and functions.  Worldwide availability.  Exclusive solutions and technologies like ADO System® terminal blocks, ESSAILEC® test blocks, Interfast the pre-wiring system for PLC's. |  |
|  | Connection Devices: Overhead Connectors, Compression Connectors, Wire termination, Grounding Systems  Blackburn® stands for quality and reliability as a supplier of materials to connect overhead distribution power lines and equipment.  For a high-quality connection at a low installed cost, count on  Blackburn ® compression connectors and the reliability of the Color-Keyed coding system to make inspections and certified installations easier.  Blackburn® compression, mechanical and exothermic connectors and accessories represent the most comprehensive set of products in the industry for the creation of a safe, code compliant and reliable grounding system. |  |
|  | Control Panels  The CP600-eCo, CP600 and CP600-Pro control panels offer a wide range of features and functionalities for tailor-made operability. Our CP600 platform offers different performance levels including control panels for economic applications, robust standard operator panels, high end multi-touch human machine interfaces (HMIs) and control panels designed for reliable operation in harsh environmental conditions. |  |
|  | Control Room  Control room operators make hundreds of decisions - decisions that have a great impact on productivity, quality and safety. The more alert, stimulated and harmonious they are, the better decisions they make.  Our designs can be applied to any industry or utility. The reference list is extensive: from transport, oil & gas, power generation, mining and manufacturing process control to police, fire and ambulance services. |  |
|  | Power Diodes  Diodes can be subdivided into two main classes: Rectifier diodes (standard recovery) and fast diodes. Rectifier diodes are generally used for conversion of AC (alternating current) to DC (direct current). While optimized for low conduction losses, Rectifier diodes withstand only moderate dynamic stress in transition from conducting to the blocking state.  Fast diodes, on the other hand, are companion devices to switches in DC to AC conversion. Every switch (GTO, IGCT or IGBT) requires a complementary diode (e.g. for "free-wheeling" reactive power) in order to enable operation of the DC-AC conversion system with inductive loads.  Fast diodes are optimized to accept high dynamic stress (fast transition from conducting to blocking state). However, they generally have higher conduction losses than rectifier diodes. For every switch family (GTO, IGCT and IGBT), we offer fast diodes that are optimized for the switch application.  Welding diodes are designed for medium and high frequency welding equipment and optimized for high current rectifiers. The on-state voltage is very low and the output current is high.  ABB is selling both normal housed and housing-less welding diodes. The latter is becoming more and more important in high current welding applications for joining of high refractory materials. |  |
|  | Disconnectors  ABB offers a wide range of reliable and energy efficient disconnectors to meet the requirements of different sites and network conditions. The disconnectors range from 72.5 kV to 550 kV. ABB disconnectors are designed as per IEC 62271-102 and IEC 62271-1 standards. Also other standards and regulations (eg, IEEE, GOST, and GB) can be met on request. Accredited testing laboratories carry out type tests on the disconnectors in accordance with the latest regulations. World-class quality of disconnectors is ensured through comprehensive electrical and mechanical routine tests on the poles and operating mechanism of each disconnector. |  |
|  | Motor Drives  Whether you are looking to build new or retrofit an existing installation, our portfolio of state-of-the-art DC drives gives you design flexibility and the proven dependable performance expected from an ABB drive.  You can use our DC drives in almost any industrial application, either as part of a new installation or as a cost-effective retrofit. Our range is based on the latest control technology, and it gives you a complete selection of three phase DC drives starting at 9 kW (12 hp) and extending up to 18 MW (24,000 hp). With programmability, built-in control programs, communication and I/O options, you can integrate them no matter what your process needs are.  To boost the productivity of your processes, improve energy efficiency and cut maintenance costs, you can rely on our broad portfolio of low voltage AC drives to deliver just that.  The portfolio covers the complete spectrum of drives. From micro and machinery drives for machine building to industrial drives for controlling processing lines, all the way up to industry specific drives with purpose-designed features and functionality.  ABB drives are available directly from stock or can be built to order to meet more complex requirements. Our life cycle services ensure your processes run exactly as you expect, year after year. |  |
|  | Electrical Boxes, Covers, Housing and Enclosures  ABB provides the highest-quality, most versatile, innovative and comprehensive line of metallic, non-metallic, indoor, outdoor, weatherproof, and floor boxes from the Steel City®, Red Dot®, Carlon® and Iberville® brands.  The complete offering electrical boxes is engineered and manufactured in North America by Thomas & Betts which was acquired in 2012 by the ABB Group.  Electrical House (eHouse), also called Power House, is a prefabricated walk-in modular outdoor enclosure to house a medium voltage (MV) and low voltage (LV) switchgear as well as auxiliary equipment. It can be skid or wheel mounted and is ready to operate in the field with minimum installation, commissioning and start up time - as an alternative to traditional on-site building construction (concrete block, brick construction or similar).  Proximity to major suppliers during design / construction makes the changes and integration easier. The eHouse is tested before shipping including all its components, which minimizes risks in the field. Its mobility makes it easy and cost effective to install and relocate. eHouse can be installed close to the main loads which reduces the power and control cable size and length. By being close to the loads the energy cost is lower. |  |
|  | Enclosed Switches  Enclosed switches are used as main disconnects in many applications. Our offering includes high quality enclosed switch-disconnectors from 16 to 1600 A (IEC), in enclosures made of plastic, steel sheet, acid proof stainless steel and aluminum.  OTDCP from 16 to 32 Amperes (IEC 60947) offers various DC voltage ratings and a control of up to two circuits within the same footprint area.  High performance and energy efficiency  OTDC has very low power losses and is suitable for applications in high ambient temperatures.  Save installation space, time and cost  OTDC switches offer various DC voltage ratings up to 1000 V DC and a control of up to three circuits within the same footprint area. Three mounting options are available: door, base and DIN rail.​  Prevents electrical accidents​​  Features such as padlockable handles and cover interlock ensure safe maintenance and installation work.  Long-life and high resistance  The enclosures are made of high quality, UV resistant materials and the degree of protection is IP65. Suitable for indoors and outdoors.  ABB's heavy duty safety switches offer a complete range of fusible and non-fusible solutions from 30 to 1200 Amps. The range meets all relevant standards UL98, UL50, UL50E and NEMA KS-1 and CSA.  The enclosures are made of steel, stainless steel or acid proof stainless steel, covering all NEMA classes. |  |
|  | Energy storage solutions  The advent of volatile and decentralized power generation from renewable sources and unpredictable consumers like electric vehicles, as well as obstacles for reinforcing the grid infrastructure, accentuate the unbalance between production and consumption of electrical energy in the power system.  This results in grid instabilities, i.e., voltage and frequency deviations affecting consumers. Energy storage solutions can make a major contribution in alleviating these effects.  ABB offers turnkey energy storage systems that are ready for connection to medium- or high-voltage grids and cover a power range of hundreds of kilowatts to tens of megawatts. The optimized systems enable fast response times to variations in demand and supply, helping to maintain grid stability and ensuring reliable and high-quality energy supplies through a range of applications.  By choosing ABB as a system provider, the customer gains a reliable partner for the overall system. Our experience in implementing energy storage systems for more than a decade enables us to provide optimized solutions that are ready for grid connection. For turnkey systems, our project team acts as a single point of responsibility, thus minimizing project risk and complexity for the customer.  Single or three phase system in arc-proof enclosures up to 4 MW / 4 hours with output voltage range from 120 V to 40.5 kV.  An energy storage system is a packaged solution that stores energy for use at a later time. The system’s two main components are the DC-charged batteries and bi-directional inverter.  ABB’s Energy Storage Module (ESM) portfolio offers a range of modular products that improve the reliability and efficiency of the grid through storage. In addition to complete energy storage systems, ABB can provide battery enclosures and Connection Equipment Modules (CEM) as separate components.  It is used for load leveling, peak shaving, capacity firming, frequency regulation, power quality and spinning reserve. |  |
|  | FACTS: Flexible Alternating Current Transmission Systems technologies provide more power and control in existing AC as well as green-field networks and have minimal environmental impact.  With a complete portfolio and in-house manufacturing of key components, ABB is a reliable partner in shaping the grid of the future.  Fixed series compensation has long been the preferred solution for optimizing performance in very large bulk transmission corridors. Installing a capacitive reactance in series in a long (typically more than 200 km) transmission line reduces both the angular deviation and the voltage drop, which increases the loadability and stability of the line. Since the current through the transmission line directly "drives" the MVAr output from the capacitor, the compensation concept is "self-regulating”, and this straightforward principle ensures that series compensation is an extremely cost effective solution.  Series compensation provides increased transient (angular) stability of a power corridor and increased voltage stability of the grid. It also improves the voltage profile along the power corridor and optimizes power sharing between parallel circuits.  Series Compensation with Thyristor Control (TCSC) enables rapid dynamic modulation of the inserted reactance. At interconnection points between transmission grids, this modulation will provide strong damping torque on inter-area electromechanical oscillations. As a consequence, a TCSC rated at around 100 Mvar makes it possible to interconnect grids having generating capacity in the many thousands of megawatts. Often the TCSC is combined with fixed series compensation to increase transient stability in the most cost effective way.  The TCSC concept also enables inherent immunity against subsynchronous resonance (SSR), and thus allows for extended use of series capacitors in specific transmission grids comprising thermal generation. The immunity to SSR is a result of the ABB patented SVR control strategy.  Static Var Compensators (SVCs) are devices that can quickly and reliably control line voltages. An SVC will typically regulate and control the voltage to the required set point under normal steady state and contingency conditions and thereby provide dynamic, fast response reactive power following system contingencies (e.g. network short circuits, line and generator disconnections). In addition, an SVC can also increase transfer capability, reduce losses, mitigate active power oscillations and prevent over voltages at loss of load.  The SVC is customized to fit each customer with their specific needs. The SVC consists of a number of fixed or switched branches, of which at least one branch includes thyristors, and the combination of branches can be varied a lot depending on requirements. An SVC typically includes a combination of at least two of the given items below (e.g. TCR/FC or TCR/TSC/FC):  Thyristor controlled reactor (TCR)  Thyristor switched capacitor (TSC)  Harmonic filter (FC)  Mechanically switched capacitor bank (MSC) or reactor bank (MSR)  Most common topologies for SVCs are: TCR/FC or TCR/TSC/FC. The main advantage for using a topology with TSC branch(es) is to reduce the losses (by reducing the filter size). Mechanically switched banks can be included both on HV and LV side of SVC transformer to increase the total reactive power support outside the dynamic range. ABB SVC control system can be utilized for controlling new or existing external shunt banks.  Electrical loads both generate and absorb reactive power. Since the transmitted load often varies considerably from one hour to the next, the reactive power balance in a grid varies as well. This can result in unacceptable variations in voltage, including voltage depression or even voltage collapse.  Like SVC but faster, STATCOM continuously provides variable reactive power in response to voltage variations, supporting the stability of the grid. STATCOM operates according to voltage source converter (VSC) principles, combining unique PWM (pulse width modulation) with millisecond switching. STATCOM functions with a very limited need for harmonic filters, contributing to a small physical footprint. If required, switched or fixed air core reactors and capacitors can be used with the VSC as additional reactive power elements to achieve any desired range.  Installing a STATCOM at one or more suitable points in a grid will increase power transfer capability by enhancing voltage stability and maintaining a smooth voltage profile under different network conditions. Its ability to perform active filtering is also very useful for improvements in power quality.  ABB's offerings in the high power STATCOM field include SVC Light STATCOM as well as PCS 6000 STATCOM, where PCS 6000 STATCOM is applicable for unit ratings up to 40 Mvar and SVC Light STATCOM is applicable for ratings exceeding 40 Mvar.  ABB's high inertia rotating condensers support efficient and reliable operation of power grids, balancing voltage fluctuations through reactive power compensation and offering additional short-circuit power capacity and high power quality.  Using competitive standardized 50-75 MVA modules, ABB can tailor complete systems up to 350 MVA. The fast and compact solution, cutting-edge technology and fully compatible control equipment delivers the best performance and optimum cost efficiency with extremely low harmonic emission.  To ensure enduring and reliable operation, our synchronous condensers are designed for high reliability, durability and the capability to operate for long periods of time between recommended service intervals.  ABB's FACTS and Power Consulting departments, with extensive experience in solving power quality issues to different kinds of customers around the world, can support in defining the exact configuration and size of the required compensation system. Our delivery capabilities includes pure Synchronous Condenser Systems, as well as hybrid configurations with STATCOMs, which are optimal solutions when short circuit and inertia issues are combined with other power quality challenges.  Connecting industrial, utility and rail applications to the electrical supply with differing voltage and frequency is a complex task. ABB frequency converters are commonly used to interconnect 50 Hz, 60 Hz, 25Hz and 16.7Hz systems.  ABB manufactures a range of frequency converters with features to match the most demanding requirements with flexible converter based technology allowing seamless connection. The innovative design maximizes power availability and delivers continuous clean power.    The converters for grid interconnection demonstrate highly reliable performance and cost-effective operation. ABB’s grid interties offer efficient power system packages that are specifically designed to interconnect normally incompatible networks. | Series compensation    TCSC    SVC    STATCOM    Synchronous Condenser    SFC |
|  | Flow Measurement Devices  CoriolisMaster FCB400 series of compact Coriolis mass flowmeters feature low pressure drop, high capacity, intuitive ABB common display, five modular I/O`s and HART communication.  Proven to be tough, reliable and incredibly easy to work with, ProcessMaster FEP630 delivers the power to solve your most demanding process applications.  This innovative next generation of electromagnetic flowmeters provides a modular transmitter design combined with SmartSensor Technology and built-in Verification – technical advances that deliver a clear business and performance benefit.  ProcessMasters superior sensor design withstands harshest environmental conditions.  Industry optimized liner and electrode materials, and resistant to abrasion and corrosion, make ProcessMaster FEP630 the perfect fit for your application.  ProcessMaster FEP630 is the no. 1 choice in sectors such as chemical, power, oil & gas, pulp & paper and metals & mining.  VIS is a high-performing yet compact multiphase flowmeter, tailored for wet gas applications and able to provide outstanding accuracy also in the most challenging operating regions.  The SensyMaster FMT230 offers a high quality and cost effective solution for precise and dynamic direct mass flow measurements of gases in low and medium pressure conditions. The model comes preconfigured for the application, ready to be installed by OEM customers.  The FMT250 adds high accuracy and extended functionality for advanced applications.  SensyMaster’s concept comprises high grade thermal sensor elements with superior long-term stability, the ABB platform based electronics with comprehensive signal evaluation capabilities for a high degree of performance and reliability. The software offers the ApplicationSelector that allows to change application parameters and create new applications on site and VeriMass the fingerprint based thermal sensor element verification function.  Both models communicate via MODBUS Interface and follow the SmartSensor concept.  The SensyMaster FMT230 is ideally suited for all OEM applications, the FMT250 for advanced OEM application.  VortexMaster FSV430 is the basic meter for volume flow applications. It uses a two-wire transmitter with leading edge DSP-Technology with excellent vibration compensation and enables user friendly intuitive operation directly through the glass. It is available in flange-mount and wafer-type designs.  SwirlMaster FSS430 is the basic meter for volume flow applications. It uses a two-wire transmitter with leading edge DSP-Technology with excellent vibration compensation and enables user friendly intuitive operation directly through the glass. Flexibility in installation, due to low required inlet and outlet sections save 75% straight pipe run. |  |
|  | Fuses  Our product portfolio is the optimal solution for short circuit and overload protection in low voltage electrical distribution networks.  ABB Fusegear products are designed for an easy, safe and reliable installation and operation in substations, Cable Distribution Cabinets (CDC), distribution boards in Compact Secondary Substations (CSS) and distribution boards in industrial, commercial and residential applications.  Medium voltage current limiting and expulsion fuses suitable for the protection of distribution transformers, voltage transformers, capacitor banks, motor circuits and installations with other switching apparatus.  Key benefits  Capable to control full range of overload currents either in combination with switching apparatus or as sole protection  Economic protection devices for immediate interruption of high short circuit currents that significantly increase isolation life time  High mechanical and thermal resistance of housing materials  Key features  Special design optimized for type of application  Two fuse housing materials are applicable – porcelain and resin-fiberglass  Application: indoor and outdoor |  |
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