Plc programmable logic controller

AUTOMATIC CONTROL OF HYDRAULIC SYSTEM USING PLC * Company Products & Services * Abstract * Hydraulic System * Bow Compression Machine * Circuit Diagram * Description * Chiller Unit * Solenoid valve * Introduction To PLC * Software * Advantages Of PLC * Introduction To PLC * Existing System * Proposed System * Ladder Logic Diagram * Ladder Logic Description * Energy Saving Calculation * For Existing Method * For Proposed Method * Advantages & Applications * Conclusion * References ABSTRACT :

One of the challenging factor in factories, for the proper functioning of the machine for the long duration with efficiency is to keep certain parameters within a specific range. Thus, in this paper, we have designed a ladder diagram for running PLC with the objective to automatically control the hydraulic system. Our main requirement is to design a PLC which can be connected to hydraulic system to implement the parameters and operations like Temperature detection, Pressure detection, Lubrication, Automatic machine operation and Oil level detection.

The mentioned parameters and operations can be sensed and operated through PLC without any manual checking and operation. This saves more power to industries by reducing the power consumption. INTRODUCTION In the last decades, the machines used in the industries were operated manually. So keeping its certain important parameters in a specific range was difficult. Also they can not be checked out frequently. This results in improper functioning of the machine. Also, the machines cannot work efficiently for a long time.

For example, if the temperature of the oil goes beyond the desired value it will affect the machine function. Hence the machine accessories cannot withstand this high temperature. This leads to the damage in machine and the durability of the machine also gets reduced. Thus, the working machine requires frequent checking of certain parameters to maintain the value within the specified range for proper operation. The various parameters to be checked frequently are: 1. Temperature detection 2. Lubrication 3. Automatic machine operation 4. Oil level detection . Pressure Thus we are using a PLC to control all these parameters. We are designing a ladder diagram to control all the parameters automatically. In this paper, we are describing about the hydraulic drive system in which PLC is used to control its working. An introduction of PLC is provided and also the ladder diagram overview. We will be discussing about the advantages of PLC and also the power saving estimation in the industries by using PLC. The machine which we have taken under consideration for implementation is BOW CORRECTION MACHINE.

Also, the chiller unit is described as it plays a major role for the power saving purpose. HYDRAULIC DRIVE SYSTEM : A hydraulic drive system is a drive or transmission system that uses pressurized hydraulic fluid to drive hydraulic machinery. The term hydrostatic refers to the transfer of energy from flow and pressure, not from the kinetic energy of the flow. Principle of a hydraulic drive Pascal’s law is the basis of hydraulic drive systems. As the pressure in the system is the same, the force that the fluid gives to the surroundings is therefore equal to pressure ? rea. In such a way, a small piston feels a small force and a large piston feels a large force. For an understanding of how a hydraulic system works, we must know the basic principles, or laws, of hydraulics, that is, of confined liquids under pressure. This will be made easier, however, if we first examine the somewhat simpler laws governing the behavior of liquids when unconfined, that is, in open containers. 1. Liquids in open containers. a. Density and specific gravity. The first characteristic of an unconfined liquid which interests us is its density.

The density of a fluid is the weight of a unit volume of it. The unit of volume normally used in this text is the cubic foot; the unit of weight normally used is the pound. The standard of density, to which the densities of all other liquids are referred, is that of pure water at zero degrees centigrade (32 degrees Fahrenheit), and at sea-level atmospheric pressure. b. Force and pressure. A liquid has no shape of its own. It acquires the shape of its container up to the level to which it fills the container. However, we know that liquids have weight.

This weight exerts a force upon all sides of the container, and this force can be measured. Therefore, for unconfined liquids, that is, liquids in open containers, the pressure in pounds per square inch exerted by the liquid on the bottom of the container is equal to the weight of the liquid on each square inch of the bottom of the container. It must be emphasized that the weight of the liquid is here thought of as a forceexerted on the bottom of the container. Expressed as a formula, we have: Pressure = Force per unit area

It is understood that the word pressure, when not otherwise qualified, means pressure in pounds per square inch. This is called the total force and is obtained by the formula: Total Force = Pressure X Area The pressure exerted by a liquid on the bottom of a container is independent of the shape of the container, and depends only on the height and density of the liquid. 2. Liquids in enclosed systems. a. Liquids are practically incompressible. The following two basic principles will help to explain the behavior of liquids when enclosed: a) Liquids are practically incompressible.) The applied pressure is transmitted equally in all directions at once. b. Increase of force with area. The ratio between the force applied to the smaller piston and the force applied to the larger piston is the same as the ratio between the area of the smaller pistonand the area of the larger piston. Expressed as a proportion, then, we have: Force on larger piston/Force on smaller piston = Area of larger piston/Area of smaller piston This means that the mechanical advantage obtainable by such an arrangement is equal to the ratio between the areas of the two pistons.

Since the area of the larger cylinder is 10 times as great as that of the smaller cylinder, pushing the smaller piston downward a distance of 1 inch will move the larger piston upward only 1/10 of an inch. The ratio between the displacement of liquid in the smaller cylinder and the displacement of liquid in the larger cylinder is once again equal to the ratio between their areas. so that the amount of work (force X distance) done by the larger piston is exactly the same as the amount done by the smaller piston. c. Multiple units.

It is not necessary to confine our system to a single line from the source of hydraulic power. Hydraulic power may be transmitted in many directions to do multiple jobs. PUMP – In practice we usually need some device which will deliver, over a period of time, a definite volume of fluid at the required pressure, and which will continue to deliver it as long as we desire it to do so. Such a device is called a pump. Basic principles of pumps. A hydraulic pump is a mechanical device which forcibly moves, or displaces, fluids.

Various pumping principles are employed in the different types of hydraulic pumps, but one fundamental principle applies to all: a volume of fluid entering the intake opening, or port, is moved by mechanical action and forced out the discharge port. Hydraulic fluids. Almost any free-flowing liquid is suitable as a hydraulic fluid, as long as it will not chemically injure the hydraulic equipment. For example, an acid, although free-flowing, would obviously be unsuitable because it would corrode the metallic parts of the system. a. Basic units of a hydraulic system. 1.

A reservoir, or supply tank, containing oil which is supplied to the system as needed and into which the oil from the return line flows. 2. A pump, which supplies the necessary working pressure. 3. A hydraulic cylinder, or actuating cylinder, which uses the hydraulic energy developed in the pump to move the door. 4. A cut-out valve, by means of which the pressure in the actuating cylinder may be maintained or released as desired. 5. A check valve, placed in the return line to permit fluid to move in only one direction. 6. “ Hydraulic lines,” such as piping or hose, to connect the units to each other.

The supply tank must have a capacity large enough to keep the entire system filled with oil and furnish additional oil to make good the inevitable losses from leakage. The tank is vented to the atmosphere; thus atmospheric pressure (14. 7 pounds per square inch) forces the oil into the inlet, or suction, side of the pump. The tank is generally placed at a higher level than the other units in the system, so that gravity assists in feeding oil into other units. The pump is the hand-operated, reciprocating piston type. SOLENOID VALVE : A solenoid valve is an electromechanically operated valve.

The valve is controlled by an electric current through asolenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold. Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design.

There are many valve design variations. Ordinary valve can have many ports and fluid paths. A 2-way valve, for example, has 2 ports; if the valve
is closed, then the two ports are connected and fluid may flow between the ports; if the valve is open, then ports are isolated. If the valve is open when the solenoid is not energized, then the valve is termed normally open (N. O.). Similarly, if the valve is closed when the solenoid is not energized, then the valve is termednormally closed. [1] There are also 3-way and more complicated designs.

A 3-way valve has 3 ports; it connects one port to either of the two other ports (typically a supply port and an exhaust port). Solenoid valve are also characterized by how they operate. A small solenoid can generate a limited force. If that force is sufficient to open and close the valve, then a direct acting solenoid valve is possible. An approximate relationship between the required solenoid force Fs, the fluid pressure P, and the orifice areaA for a direct acting solenoid value is: Where d is the orifice diameter. A typical solenoid force might be 15 N (3. lbf). An application might be a low pressure (e. g. , 10 pounds per square inch (69 kPa)) gas with a small orifice diameter (e. g. , 3? 8 in (9. 5 mm) for an orifice area of 0. 11 sq in (7. 1? 10? 5 m2) and approximate force of 1. 1 lbf (4. 9 N)). When high pressures and large orifices are encountered, then high forces are required. To generate those forces, an internally piloted solenoid valve design may be possible. [1] In such a design, the line pressure is used to generate the high valve forces; a small solenoid controls how the line pressure is used.

Internally piloted valves are used in dishwashers and irrigation systems where the fluid is water, the pressure might be 80 pounds per square inch (550 kPa) and the orifice diameter might be 3? 4 in (19 mm). In some solenoid valves the solenoid acts directly on the main valve. Others use a small, complete solenoid valve, known as a pilot, to actuate a larger valve. While the second type is actually a solenoid valve combined with a pneumatically actuated valve, they are sold and packaged as a single unit referred to as a solenoid valve.

Piloted valves require much less power to control, but they are noticeably slower. Piloted solenoids usually need full power at all times to open and stay open, where a direct acting solenoid may only need full power for a short period of time to open it, and only low power to hold it. A direct acting solenoid valve typically operates in 5 to 10 milliseconds. The operation time of a piloted valve depends on its size; typical values are 15 to 150 milliseconds. Solenoid valves are used in fluid power pneumatic and hydraulic systems, to control cylinders, fluid power motors or larger industrial valves.

Automaticirrigation sprinkler systems also use solenoid valves with an automatic controller. Domestic washing machines and dishwashers use solenoid valves to control water entry into the machine. Solenoid valves are used in dentist chairs to control air and water flow. In the paintball industry, solenoid valves are usually referred to simply as “ solenoids. ” They are commonly used to control a larger valve used to control the propellant (usually compressed air or CO2). In addition to this, these valves are now been used in household water purifiers (RO systems).

Besides controlling the flow of air and fluids, solenoids are used in pharmacology experiments, especially for patch-clamp, which can control the application of agonist or antagonist. Many variations are possible on the basic, one-way, one-solenoid valve described above: * one- or two-solenoid valves; * direct current or alternating current powered; * different number of ways and positions; INTRODUCTION TO PLC : A Programmable Logic Controller, or PLC, is more or less a small computer with a built-in operating system (OS). This OS is highly specialized to handle incoming events in real time, i. . at the time of their occurrence. The PLC has input lines where sensors are connected to notify upon events (e. g. temperature above/below a certain level, liquid level reached, etc.), and output lines to signal any reaction to the incoming events (e. g. start an engine, open/close a valve, etc.). The system is user programmable. It uses a language called “ Relay Ladder” or RLL (Relay Ladder Logic). The name of this language implies that the control logic of the earlier days, which was built from relays, is being simulated.

The PLC is primarily used to control machinery. A program is written for the PLC which turns on and off outputs based on input conditions and the internal program. In this aspect, a PLC is similar to a computer. However, a PLC is designed to be programmed once, and run repeatedly as needed. In fact, a crafty programmer could use a PLC to control not only simple devices such as a garage door opener, but their whole house, including switching lights on and off at certain times, monitoring a custom built security system, etc.

Most commonly, a PLC is found inside of a machine in an industrial environment. A PLC can run an automatic machine for years with little human intervention. They are designed to withstand most harsh environments. When the first electronic machine controls were designed, they used relays to control the machine logic (i. e. press “ Start” to start the machine and press “ Stop” to stop the machine). A basic machine might need a wall covered in relays to control all of its functions. There are a few limitations to this type of control. * Relays fail. * The delay when the relay turns on/off. There is an entire wall of relays to design/wire/troubleshoot. A PLC overcomes these limitations, it is a machine controlled operation. PLCs are becoming more and more intelligent. In recent years PLCs have been integrated into electrical communications networks – i. e. , all the PLCs in an industrial environment have been plugged into a network which is usually hierarchically organized. The PLCs are then supervised by a control center. There exist many proprietary types of networks. One type which is widely known is SCADA (Supervisory Control and Data Acquisition).

The PLC is a purpose-built machine control computer designed to read digital and analog inputs from various sensors, execute a user defined logic program, and write the resulting digital and analog output values to various output elements like hydraulic and pneumatic actuators, indication lamps, solenoid coils, etc. Scan cycle Exact details vary between manufacturers, but most PLCs follow a ‘ scan-cycle’ format. Overhead Overhead includes testing I/O module integrity, verifying the user program logic hasn’t changed, that the computer itself hasn’t locked up (via a watchdog timer), and any necessary communications.

Communications may include traffic over the PLC programmer port, remote I/O racks, and other external devices such as HMIs (Human Machine Interfaces). Input scan A ‘ snapshot’ of the digital and analog values present at the input cards is saved to an input memory table. Logic execution The user program is scanned element by element, then rung by rung until the end of the program, and resulting values written to an output memory table. Output scan Values from the resulting output memory table are written to the output modules. Once the output scan is complete the process repeats itself until the PLC is powered down.

The time it takes to complete a scan cycle is, appropriately enough, the “ scan cycle time”, and ranges from hundreds of milliseconds (on older PLCs, and/or PLCs with very complex programs) to only a few milliseconds on newer PLCs, and/or PLCs executing short, simple code. ADVANTAGES OF PLC: * PLC's have flexibility (i. e.) it is possible to use just one model of PLC to run any one of the 15 machines. * In a PLC program circuit the PLC program can be used from any keyboard sequence in a matter of minute and rewriting is required. PLC has a large number of contacts for each coil in its programming. * Increased technology makes it possible to compact move functions into smaller and less expensive packages. * A PLC programmed circuit can be pre-un ad evaluated in the officer or lab. The program can be typed in tested observed and modified if needed. * PLC circuit operation can be seen during operation directly on a CRT screen. * The operation speed for the PLC program is very fast. * PLC is more reliable. * A PLC programmer who works in digital or Boolean control system can easily perform PLC programming. PLC's program can't be made unless the PLC properly unlocked and programmed. LADDER LOGIC DIAGRAM : What is a Ladder Diagram? A Ladder Diagram is one of the simplest methods used to program a PLC. It is a graphical programming language evolved from electrical relay circuits. Each program statement is represented with a line, called the rung, that has all relevant inputs to the left and the output to the right. The output device of a rung is energized if electric power can conceptually flow from the left side of the rung to the right side.

Input devices are assumed to block the flow of power if they are not activated. During the execution of a ladder diagram, the PLC reads the states of all inputs, then determines the states of all outputs starting from the rung at the top side, going down to the last rung, and finally updates the state of the output devices. * Naming Convention During the development of a PLC program, we must use specific names to identify the inputs, outputs, memory flags, timers and counters. PLC manufactures use a variety of approaches in naming the inputs, outputs and other resources.

A typical naming convention is to identify inputs with the letter " I" and outputs with the letter " O", followed be a 1-digit number that identifies the slot number and a 2-digit number that identifies the position of the input or output in the slot. For example: I1: 00 refers to the first input of slot 1 O2: 00 refers to the first output of slot 2. Some manufactures number the inputs or outputs starting from 00, while others use the number 01 to identify the first input or output. It is also common to use numbers like 400 e. t. c. The state of an output can be also used as an input in a ladder diagram.

In such a case the PLC uses the state of the specific output device that is stored in the output image memory. * Relay Logic Instructions (XIC and XIO) Examine if Closed (XIC) —–[ ]—— Use the XIC instruction in your ladder program to determine if a bit is On. When the instruction is executed, if the bit addressed is on (1), then the instruction is evaluated as true. When the instruction is executed, if the bit addressed is off (0), then the instruction is evaluated as false. Examine if Open (XIO) ——-[/]—— Use the XIO instruction in your ladder program to determine if a bit is Off.

When the instruction is executed, if the bit addressed is off (0), then the instruction is evaluated as true. When the instruction is executed, if the bit addressed is on (1), then the instruction is evaluated as false * Relay Logic Instructions: Input Transition Sensing Positive Transition Sense (PTS) The condition of the right link is ON for one ladder rung evaluation when a change from OFF to ON at the specified input is sensed. Negative Transition Sense (NTS) The condition of the right link is ON for one ladder rung evaluation when a change from ON to OFF at the specified input is sensed. * Output Instructions Output Energize (OTE) —-( )—– If the condition of the left link of the OTE is ON then the corresponding bit in the output data memory is set. The device wired to this output is also energized. Negative Output Energize (NOE) ——(/)—– If the condition of the left link of the OTE is OFF then the corresponding bit in the output data memory is set. The device wired output is also energized. Output Latch/Set (OTL) and Output Unlatch/Reset (OTU) If the condition of the left link of the OTL is momentary ON then the corresponding bit in the output data memory is set, and remains set even if the condition switches to the OFF state.

The output will remain set until the condition of the left link of the OTU is momentary ON * Basic Logic Functions (OR, AND) Two Input OR Function The output is ON only if the two inputs are OFF. Two Input AND Function The output is ON if both of the two inputs are ON. * Basic Logic Functions (NAND, NOR) Two Input NAND Function The output is ON if any of the two inputs is OFF. Two Input NOR Function The output is ON if both of the two inputs are OFF. * Basic Logic Functions (EXOR, EXNOR) Two Input EXOR Function The output is ON if any of the two inputs is ON, but not both. Two Input EXNOR Function

The output is ON if both of the two inputs are either OFF or ON. * Set/Reset Latch Set/Reset Latch using a Hold-in contact Set/Reset Latch using Latch/Unlatch outputs Notes: O1: 00’ means that the output is unchanged If both inputs are ON then normally the output is OFF, since the Unlatch rung appears last in the ladder diagram. * Timer Instructions Timer Instructions are output instructions used to time intervals for which their rung conditions are true (TON), or false (TOF). These are software timers. Their resolution and accuracy depends on a tick timer maintained by the microprocessor.

Each timer instruction has two values (integers) associated with it: Accumulated Value (ACC): This is the current number of ticks (time-base intervals) that have been counted from the moment that the timer has been energized. Preset Value (PR): This is a predetermined value set by the programmer. When the accumulated value is equal to, or greater than the preset value, a status bit is set. This bit can be used to control an output device. Each timer is associated with two status bits: Timer Enable Bit (EN): This bit is set when the rung condition to the left of the timer instruction are true.

When this bit is set, the accumulated value is incremented on each time-base interval, until it reaches the preset value. Done Bit (DN): This bit is set when the accumulated value is equal to the preset value. It is reset when the rung condition becomes false. * Timer On-Delay (TON) Instruction The TON instruction begins count when its input rung conditions are true. The accumulated value is reset when the input rung conditions become false. Timer ladder diagram example. Typical timing diagram (Assume that Preset = 07). * Timer Off-Delay (TOF) Instruction

The TOF instruction begins count when its input rung makes a true-to-false transition, and continues counting for as long as the input rung remains false. The accumulated value is reset when the input rung conditions become false. Timer ladder diagram example. Typical timing diagram (Assume that Preset = 07). * Retentive Timer (RTO) Instruction The RTO instruction begins count when its input rung conditions are true. The accumulated value is retained when the input rung conditions become false, and continues counting after the input rung conditions become true. * Counter Instructions

Counter Instructions are output instructions used to count false-to-true rung transitions. These transitions are usually caused by events occurring at an input. These counters can be UP (incrementing) or DOWN (decrementing). Each counter instruction has two values (integers) associated with it: Accumulated Value (ACC): This is the current number of the counter. The initial value is zero. Preset Value (PR): This is a predetermined value set by the programmer. When the accumulated value is equal to, or greater than the preset value, a status bit is set. This bit can be used to control an output device.

Each counter is associated with two status bits: Counter Enable Bit (EN): This bit is set when a false-to-true rung condition to the left of the counter instruction is detected. Done Bit (DN): This bit is set when the accumulated value is equal to the preset value. It is reset when the rung condition becomes false. The maximum count value is 9999*. After a maximum count is reached, the counters reset and start counting from zero. * Count-up (CTU) Instruction The CTU instruction increments its accumulated value on each false-to-true transition at its input, starting from 0. Counter ladder diagram example.

Typical timing diagram (Assume that Preset = 10). * Count-down (CTD) Instruction The CTD instruction decrements its accumulated value on each false-to-true transition at its input, starting from 0. Counter ladder diagram example. Typical timing diagram (Assume that Preset = -10). * The Reset (RES) Instruction The RES instruction resets timing and counting instructions. When the RES instruction is enabled it resets the following. Counters: Accumulated value, Counter Done Bit , Counter Enabled Bit. Timers: Accumulated value, Timer Done Bit, Timer Timing Bit, Timer Enable Bit.

Reset ladder diagram example. ADVANTAGES ; APPLICATION: * Automatic control of machine. * Free from manual operation and frequent checking. * Machine fault is reduced. * Energy consumption is reduced. * This method can save more power. * Industrial application mainly used for boiler production. * Drilling and boring applications. * This applications can be implemented for all machines in BHEL. BOW CORRECTION MACHINE : These are the specifications of the bow correction machine currently in use. MACHINE| BOW CORRECTION MACHINE| CAPACITY| 600 TONS| CYLINDER BORE| 550 MM| RAM DIAMETER| 520 MM|

DAYLIGHT| 3000 MM| THROAT| 1700 MM| STROKE| 500 MM| CONNECTED LOAD| 60+1+5 HP| TOTAL WEIGHT| 80 TONS| BOLSTER SIZE| 1500*2000*200 MM| SPEEDS OF OPERATION| 15mm/sec – APPROACH6mm/sec – PRESSING60mm/sec – RETURN | PURPOSE. In the pipes used in boilers, small pipes are attached using welding. This welding makes the pipe to bent. Thus its surface becomes uneven and makes it imperfect to be used in boilers. In this case this machine is used. Using this machine the bents and bows can be straightened and makes the pipes perfect to be used in the boilers. CIRCUIT DIAGRAM : OPERATION.

The hydraulic circuit is designed to achieve fast approach speed, slow pressing speed and fast return speeds by use of a single pump. The fast approach speed is achieved by ensuring that the cylinder ram moves down through its self weight or what is termed as gravity fall. To achieve gravity fall of the cylinder of the cylinder it is important to ensure that at all times the pressure in return line is minimum 5 kg/ cm2. On starting the motor the pump delivery is directed to the tank through unloading type relief valve no. 4. The same flow is directed to the Z1 lines of catridge valves 5 ; 7, which ensures that the valves are closed.

On operation of solenoid S1 of main relief valve the pump flow is directed to the catridge valves, however due to differential areas the catridges are still closed and pump reaches system pressure and unloads to tank through relief valve 4. On operation of solenoid S2(valve 6) along with S1, Port A of solenoid valve no. 6 is connected to tank Y1 which facilitates opening of catridge valve 5 and hence the oil flows into the forward line of the cylinder resulting in downward movement. At the same time the oil in the return line of the cylinder is connected to tank at the set pressure through valve no. 11.

Hence the cylinder moves down with slow pressing speed. On operation of solenoid S4 (valve 8) along with S1 ; S2 the X port of catridge valve 10 is connected to tank through valve 8, 6 and port Y1 that ensures the opening of the catridge valve 10. Opening of the catridge valve ensures that the return line is connected directly to tank and hence the cylinder oves down with its self weight and fast approach speed is achieved. At the same time prefill valve 14 opens to fill the cylinder forward area with oil. To set the maximum fast approach speed valve 10 is provided with a stroke adjustment setting.

On operation of solenoid S3(valve 6) along with S1, port B of solenoid valve no. 6 is connected to tank Y1 which facilitates opening of catridge valve 7 and hence oil flows into the return line of the cylinder. At the same time since A port of solenoid valve no. 6 is connected to pump port X4 is also connected to pump, ensures the opening of prefill valve no 14 and that the forward line of the cylinder is connected back to tank. This results in reverse movement of the cylinder. Pressure relief valve 9 is provided to ensure smooth deceleration of the cylinder from fast approach to pressing.

The valve ensures that the pressure in X port of the cartridge valve does not exceed set pressure therby ensuring that the valve closes slowly reducing jerks. The hot oil from the machine is then sent to the chiller unit to reduce its temperature. CHILLER UNIT: In the chiller unit, the refrigerant is used to cool down the hot oil from the machine. REFRIGERATION: A liquid whose Saturation temperature at normal atmospheric pressure is below the temperature that is to be produced by refrigeration is chosen as the working liquid in the refrigerant.

Such a liquid will evaporate at lower temperatures and will absorb hear as it does so. This heat is extracted from the surroundings. The vapour formed in this way is compressed in a compressor. After compression the refrigerant may be in the vapour state or, in the liquid state if its temperature after compression is not greater than the saturation temperature at that increase pressure. The low temperature vapour is condensed in a condenser, in doing so it lowers its temperature below the surroundings . Now the condensed liquid is expanded to a lower pressure and the cycle of refrigeration is repeated.

REFRIGERATION CYCLE: * Compressors are used in vapour compression cycles. It is the heart of the system and it sucks low-pressure refrigerant vapour from the evaporator and compresses it to a pressure corresponding to the saturation temperature that will be higher than continuously re-circulate the refrigerant through the system. * Air-cooled condensers are heat exchangers, which reject heat from the condensing refrigerant to the atmosphere. * The function of condenser in a refrigerated system is to de-superheat and condense the compressed discharge refrigerant vapour.

High-speed fans are mostly used to speed up the process. * At the exit of the condenser the refrigerant loses temperature but still is in high-pressure state. The temperature falls down a little high to the ambient. * Dryers are mainly used to capture the moisture content if any mixed with the refrigerant. When the refrigerant passes through its thin filter mesh the moisture gets trapped on the silica gel and clean refrigerant flows through. * Throttle valve(also called as Expansion valve)is also a very important component of the vapour compression refrigeration system.

The function of an expansion device is to expand the liquid refrigerant from the condensing pressure to the evaporating pressure. Also it throttles the required flow into the evaporator depending on the load conditions. Commonly used expansion devices are capillary tubes, thermostatic expansion valves and constant pressure expansion valves. * Any liquid when evaporate creates a cooling effect. Same applies here, when the refrigerant exists expansion valve it is partly in vapour state at low temperature and pressure. It flows through the evaporator and exchanges heat with the surroundings. After existing the evaporator it has gained heat from the surrounding media, thus lowering the temperature in the freezing compartment. This superhead vapour passes further and is drawn by the compressor, which compresses it, and delivers to condenser, thus, completing the refrigeration cycle. The ladder diagram used in this machine is : CNT_ON CNT_OFF MEM_1 MEM_1 MEM_1 MOT_ON MOT_ON MOT_OFF VAL4_ON

VAL4_ON VAL4_ON MEM_2 MEM_2 S1 S2 S3 S4 S5 FAST_APP FAST_APP S1 S2 S3 S4 S5 PRESS_ON TIMER T1 PRESET 15 ACC 0 PRESS_ON S1 S2 S3 S4 S5 HOLD_ON HOLD_ON HOLD_MEM HOLD_MEM S1 S2 S3 S4 S5 RET_ON

RET_ON VAL4_ON COMPARE TEMP_ON; 45 TEMP_ON MEM_4 MEM_4 CHILLER_ON TEMP_ON CHILLER_OFF COMPARE TEMP_ON; 45 LOW_SEN ALARM_ON V_LOW_SEN TANK_ON

PRES_ON VAL14_ON EXISTING SYSTEM : * There is no temperature detection system. Hence, the chiller unit has to function continuously irrespective of hydraulic oil’s temperature. * Possibilities of machine can run due to friction since there is no Indication of oil in tank. * The chiller unit is running continuously hence there is a possibilities of lot of Energy consumption losses. * There is no automatic control for the whole machine. * There is no automatic function for declamping and lubrication. There is no oil level sensor in the hydraulic tank to sense the oil level in the tank. * Relays are used which is not automatic and inefficient. HORIZONTAL BORING MACHINE HYDRAULIC TANK CHILLER UNIT PUMP SOLENOID VALVE PROPOSED SYSTEM: * In this method there is a temperature sensor which is used to sense the temperature of the oil in the hydraulic tank. * The chiller unit will be turned on only when the oil temperature gets increased with the specified value of oil temperature * Friction of the machine can be reduced by implementing the lubrication function. Oil level in the hydraulic tank can be detected by using an oil level sensor . * Two types of oil level sensor is used. I. Low level sensor II. Very low level sensor So that we can avoid the machine running in dangerous condition. * All the operation in one axis (x or y or z) can be operated by a single push button switch. * Declamping and lubrication function takes place automatically. ENERGY SAVING CALCULATION: * WITH CHILLER UNIT WORKING CONTINUOUSLY: For continuous running of chiller unit the motor consumes 18KW. Per day: morning -4hrs night -8hrs so chiller unit runs totally 12hrs a day. 8KW*12hrs= 216 KWhr The chiller unit consumes 216KWhr per day. For electricity: 1unit= Rs. 5 Therefore 216*5= 1080 So for 216 unit it costs Rs. 1080 per day. 1080*30= Rs. 32, 400 For 1month it costs Rs. 32, 400 32400*303= Rs. 98, 17, 200 For 1year it costs Rs. 98, 17, 200. * WITH PLC: For automatic on/off of chiller unit the motor consumes 10KW. Per day: morning -4hrs night -8hrs so chiller unit runs totally 12hrs a day. 10KW*12hrs= 120KWhr The chiller unit consumes 120KWhr per day. For electricity: 1unit= Rs. 5 Therefore 120*5= 600 So for 120unit it costs Rs. 600 per day. 600*30= Rs. 8, 000 For 1month it costs Rs. 18, 000 18000*303= Rs. 54, 54, 000 For 1year it costs Rs. 54, 54, 000. CONCLUSION : This project mainly focuses the oil temperature and oil level detection and also the automatic control of machine. Implementation of this project is simple and very economical. This applications can be implemented for all machines in BHEL. All the functions can be achieved through a single PLC program. The advantage of our project is used to eliminate manual checking and operation. The above mentioned parameters and operation can be sensed and operated through PLC.

This project saves more power to industries by reducing the power consumption. REFERENCES : 1. “ Allen bradely Instruction Set user manual” by Rockwell Automation. 2. Programmable Logic Controllers: Programming Methods and Applications by John R. Hackworth and Frederick D. Hackworth, Jr 3. “ Ladder logic fundamentals” industrial control system fall 2006. 4. DOE FUNDAMENTALS HANDBOOK “ INSTRUMENTATION AND CONTROL Volume 2 of 2”- U. S. Department of Energy Washington, D. C. 20585. 5. “ Automating Manufacturing Systems with PLCs” (Version 5. 0, May 4, 2007) -Hugh Jack