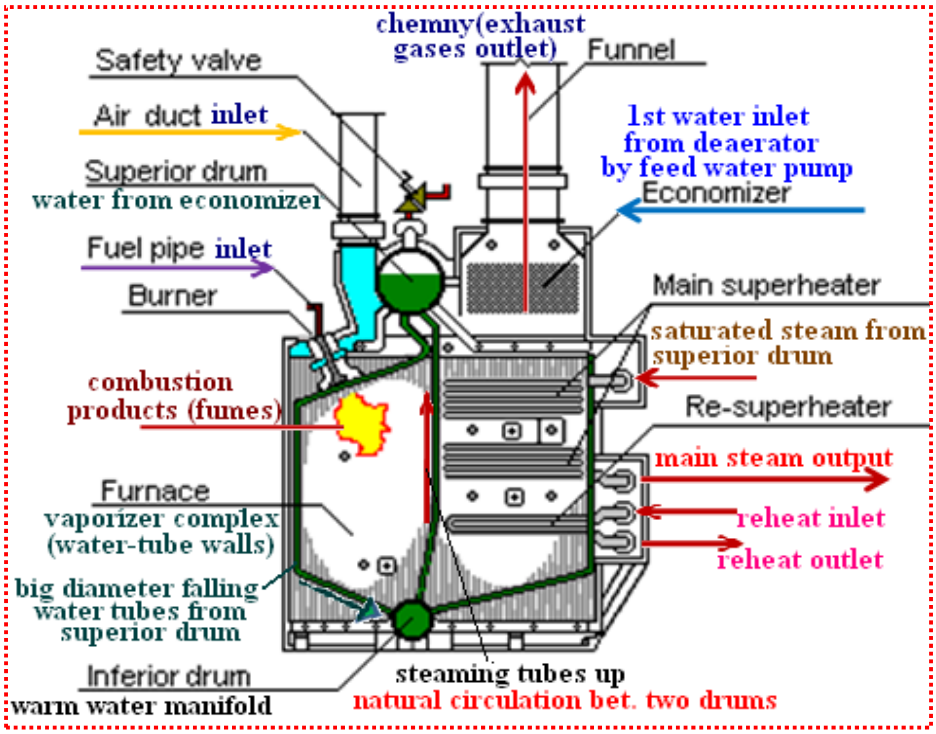
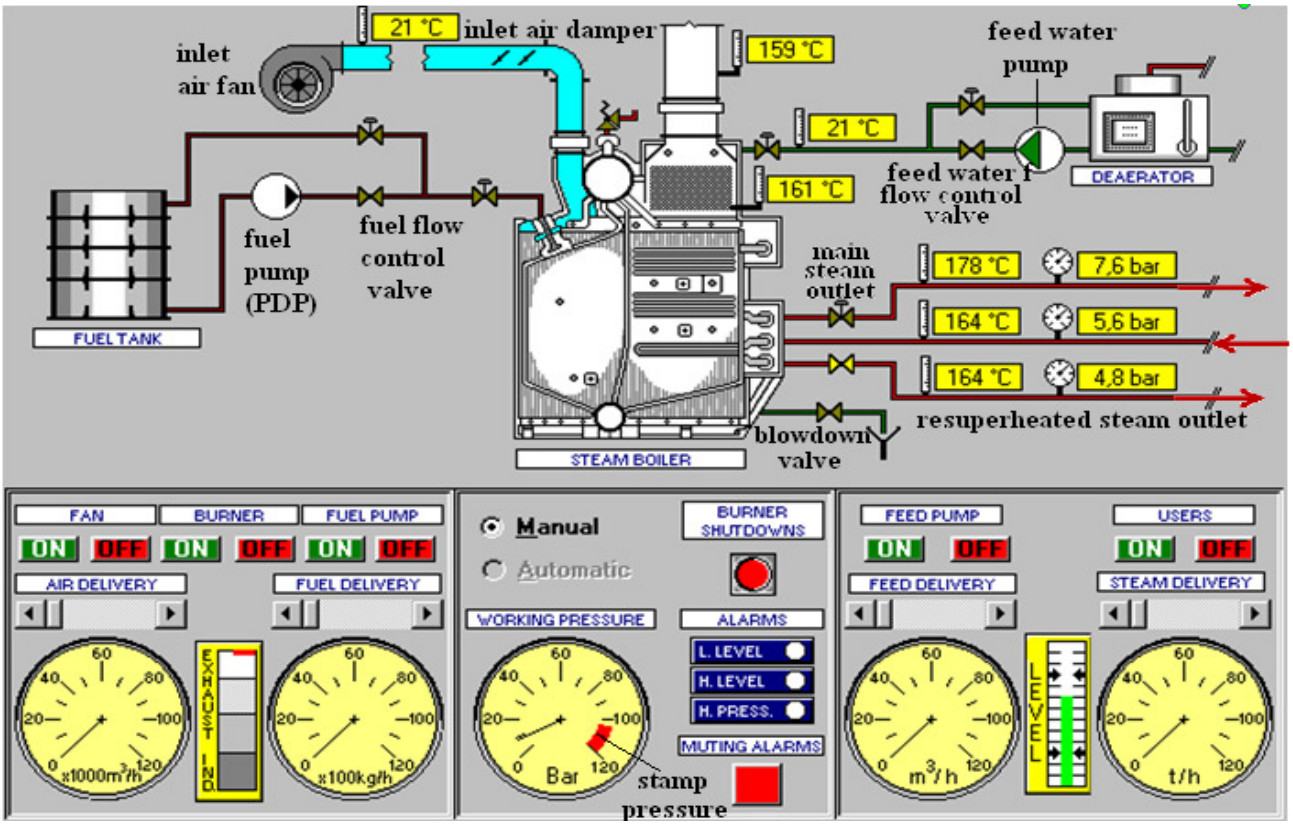
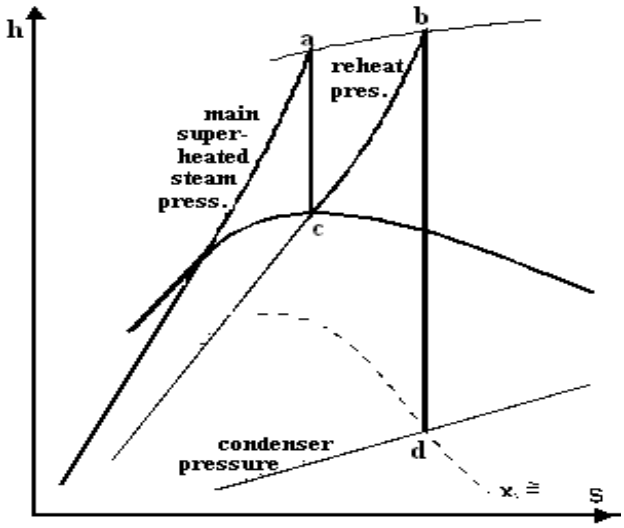
VirtLab-1: Interactive Automatic Control System for Industrial Water-tube Steam Boiler:



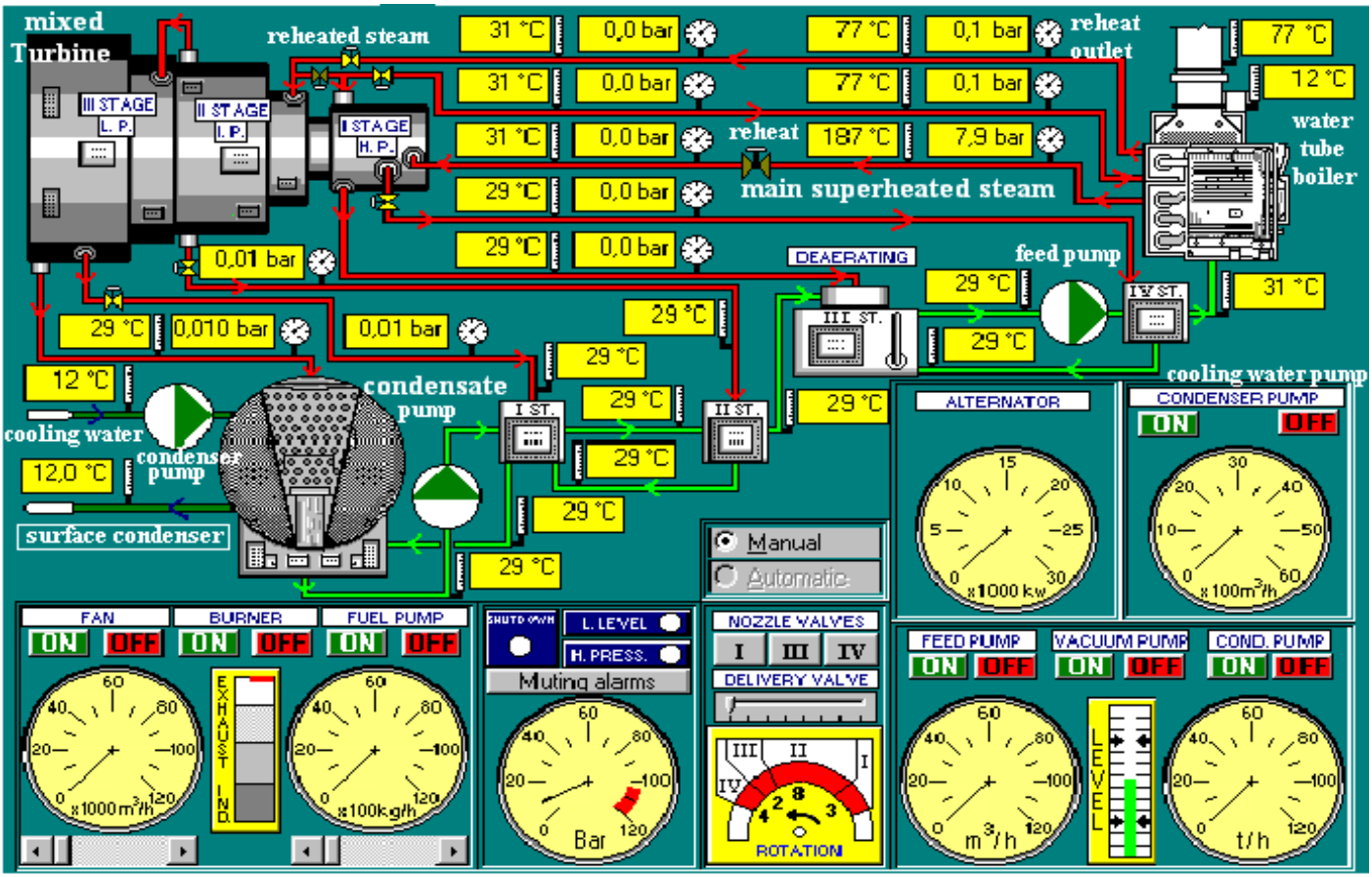
This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in an industrial Water-tube Boiler. Pressure and temperature gauges show various values at all critical points of the boiler system. The boiler has a maximum output of superheated steam and/or reheated steam flow of 120 ton/hr at 120 bar maximum pressure. Automatic control system includes: automatic burner shutdown, fuel pump on/off, air-fan on/off, adjusting optimum A/F ratio for minimum exhaust gases pollution, drum water level, boiler maximum pressure and many flow control valves. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic tools, error-report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.



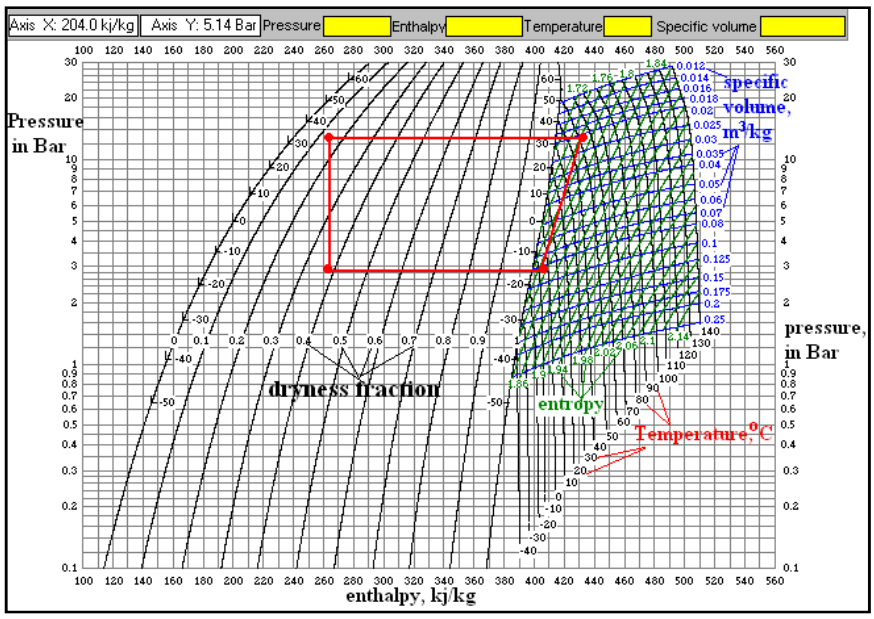
VirtLab-2: Interactive Automatic Control System for Industrial Steam-Turbine & Rankine Cycle Power Generation Plant:



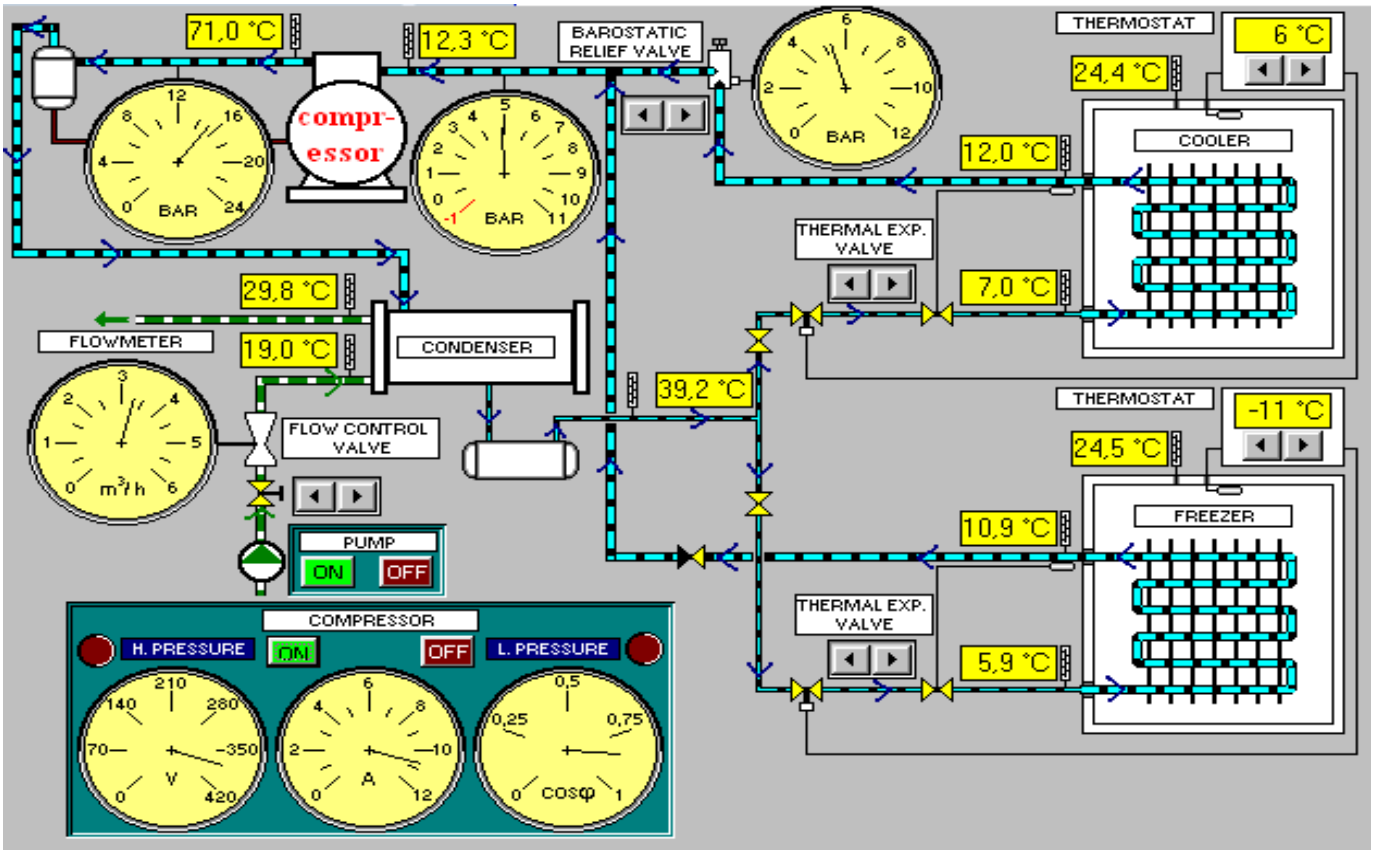
This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in multi-stage industrial Steam-Turbine & Rankine Cycle Power Generation Plant of maximum electric output of 30 MWatt. Pressure and temperature gauges show various values at all critical points of the plant.The steam-turbine unit includes one high-pressure part and two low-pressure parts. Steam may be extracted or not-extracted from those 3 parts for 3-feed water heat exchangers and also for a deaerating unit. The plant also includes: an industrial 120 ton/hr at 120 bar water-tube boiler (of virtLab-1) and a water-cooled vacuum condenser with 6000 m^3/hr condenser cooling-water pump and many flow control valves. The simulation includes all previous boiler controls of VirtLab-1. Additional control systems/boards are included for steam turbine and electric-alternator unit and for the vacuum condenser and the cooling-water pump. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic tools, error-report filling, help/trouble-shooting and Thermal Balance Calculations and Plotting tools.



VirtLab-3: Interactive Automatic Control for Industrial Refrigeration and Freezing Plant:

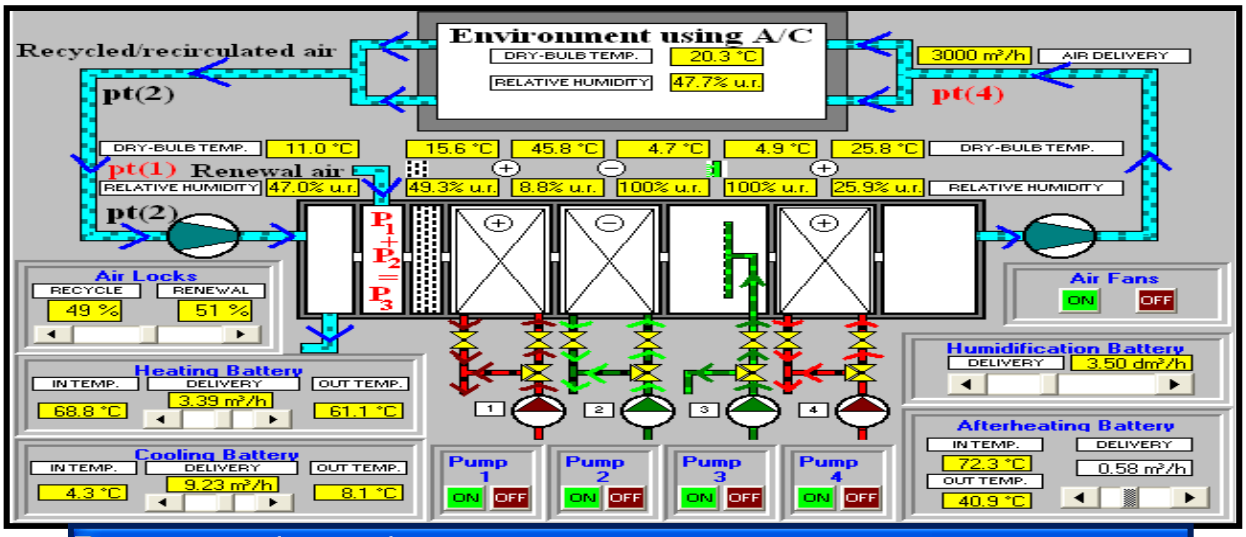


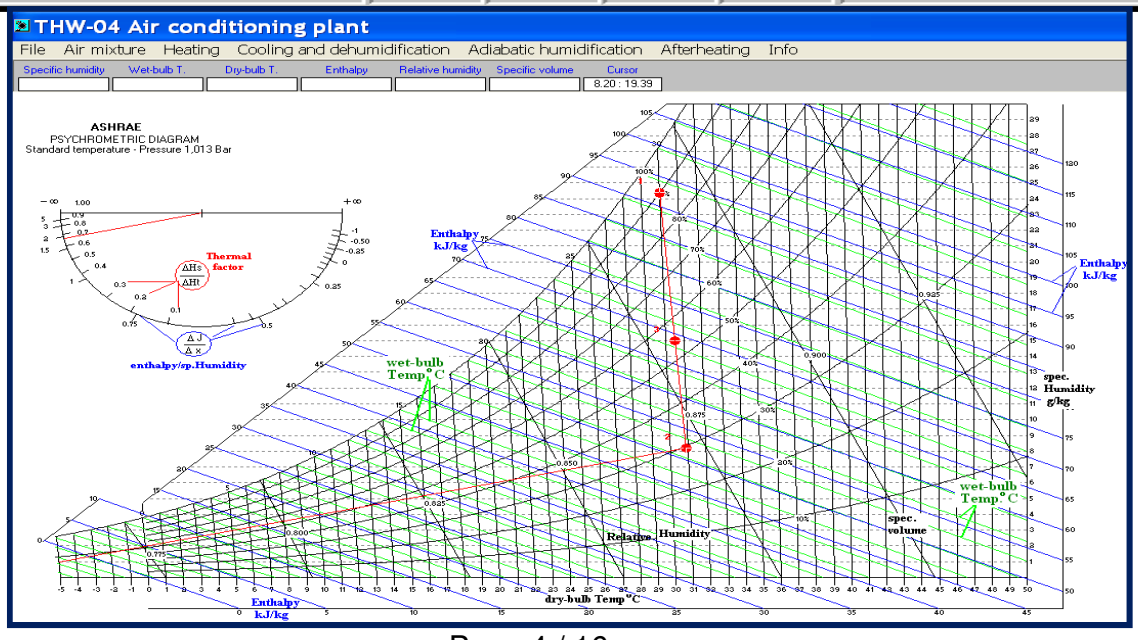
This is an interactive computer-based training course that includes an investigation, virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in industrial R22 compression refrigeration plant used for both freezing and cold storage of frozen products. Pressure and temperature gauges show various values at all critical points of the plant. The plant uses a 6 m^3/hr water-cooled condenser with adjustable inlet water-temperature. The reciprocating compressor runs at 1450 rpm and has a 377 cm^3 displacement volume. The plant has a freezing thermal load of 5 kW and a refrigeration thermal load of 3 kW with two adjustable thermostats for controlling refrigeration and freezing cells for different adjusted ambient temperature. On-line, and updated real R22 h-s diagram is plotted to show every point of the cycle. The h-s plotting is stored on a PDF file for further analysis. The simulation includes many flow or pressure control valves, many critical control alarms, input/output signals, operation &instrumentation parameter-boards, diagnostic tools, error-report filling, help/trouble-shooting and Thermal Balance Calculations and plotting tools.



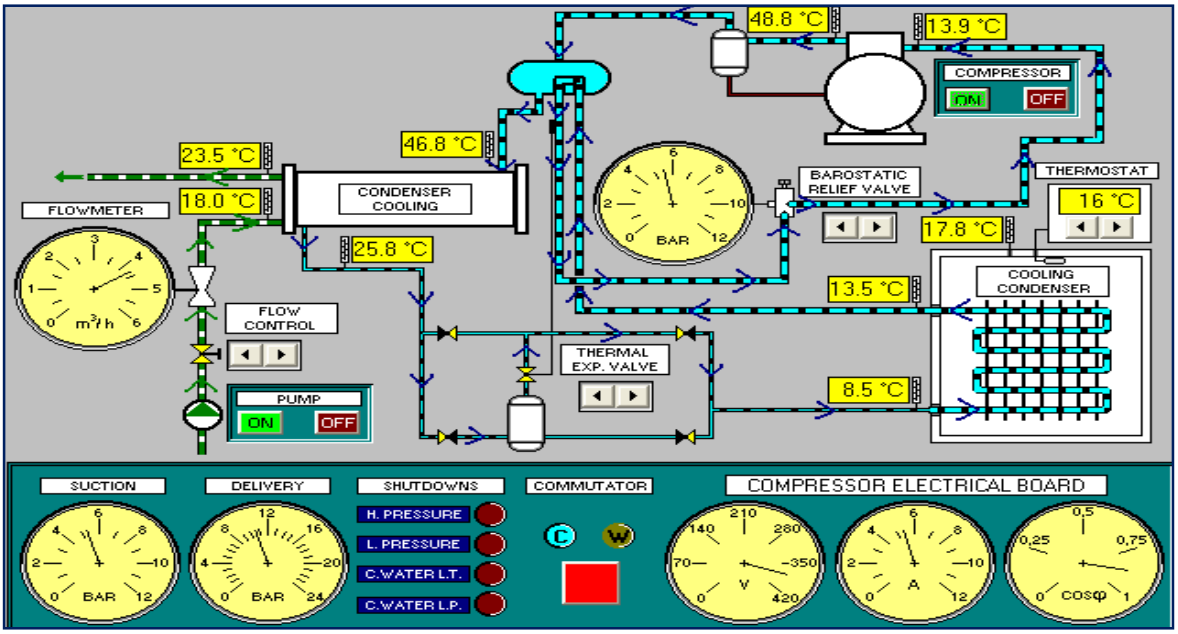
VirtLab-4: Interactive Automatic Control System for an Industrial Air-conditioning plant:

This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control & real thermo-fluid processes existing in an industrial plant used to air-condition a building to some pre-specified dry-bulb temperature and relative humidity. Air-locks are used to have different adjustable ratios of recycled air brought back to the building mixed with some renewal air. The plant includes 4 centrifugal pumps for the 4 battery cells for heating, cooling, humidification, and after-heating. Each pump has its on/off control board. Each battery cell has a control board that includes a pump flow rate-meter and both inlet and outlet cell temperature (except the humidification cell). The plant has an on/off air fans or ventilators control board and air locks control board. On-line, real psychometric diagram is plotted showing all performed processes. The diagram shows a point for Renewal air, point for Recycled air taken from inside the environment, a point for the mixture of Renewal and Recycled air, points for the air outlet from the various A/C plant batteries, and last point for the air going to the environment-building. The simulation includes many flow control valves and temperature read-out gauges. , many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic tools, error-report filling, help/trouble-shooting and Thermal Balance Calculations and Plotting tools.

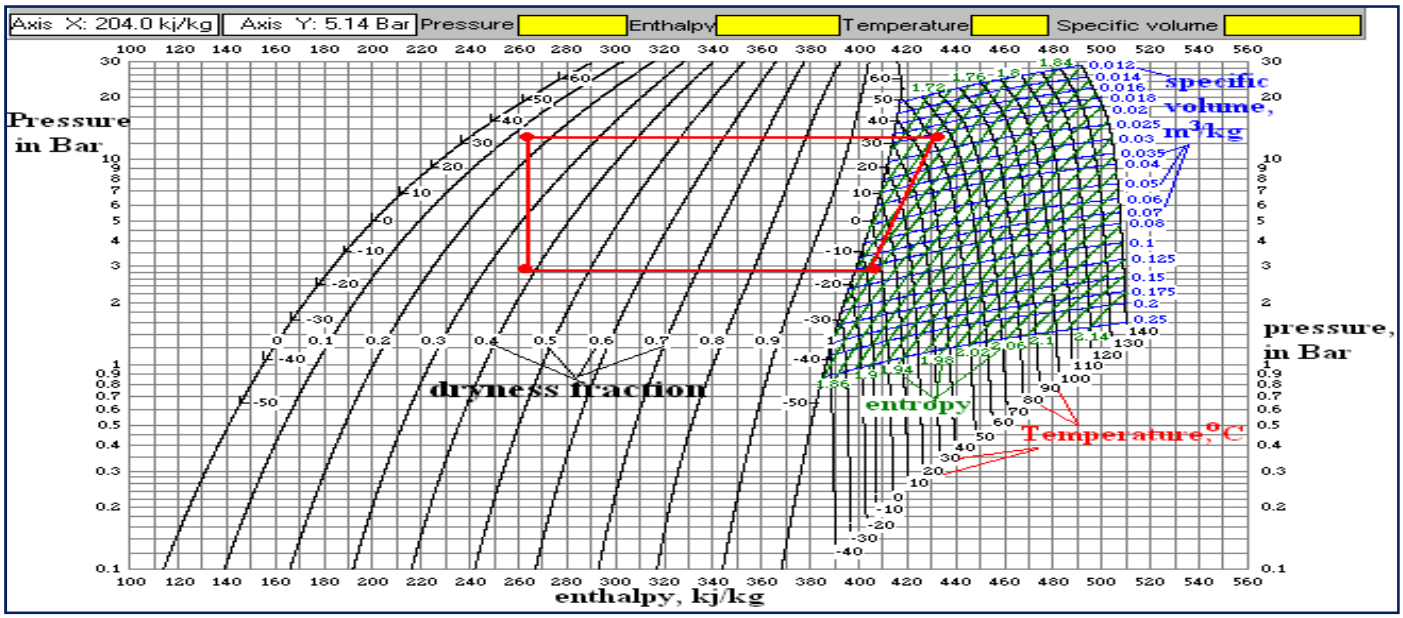




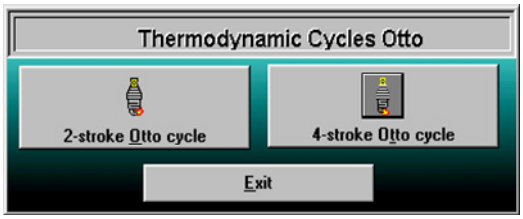
VirtLab-5: Interactive Automatic Control System for Industrial thermal plant with heat pump:



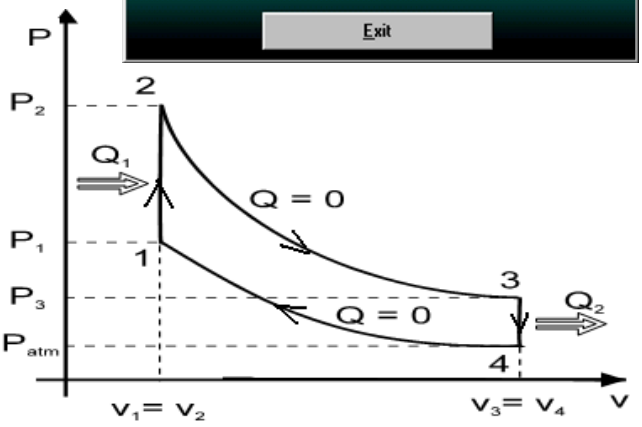
This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in industrial thermal plant with heat pump. The plant uses a R22 reversed vapor-compression cycle (reversed to that of previous VirtLab-3) used for ambient or environment air heating during winter and for ambient air-conditioning during summer. The plant has a water-air heat pump consisting of a compressor, a condenser cooling, a thermal expansion valve, and a cooling condenser in place of the evaporator or freezer in refrigeration machine. The plant has also all instrumentations, control boards, flow and temperature meters to facilitate its operation and performing thermal analysis. The program produces an on-line, and updated real R22 h-s diagram plotting to show every point of the heat-pump cycle. The R22 h-s plotting is stored on a PDF file for further analysis. The simulation includes many flow control valves and temperature read-out gauges, many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic tools, error-report filling, help/trouble-shooting &Thermal Balance Calculations & Plotting tools.

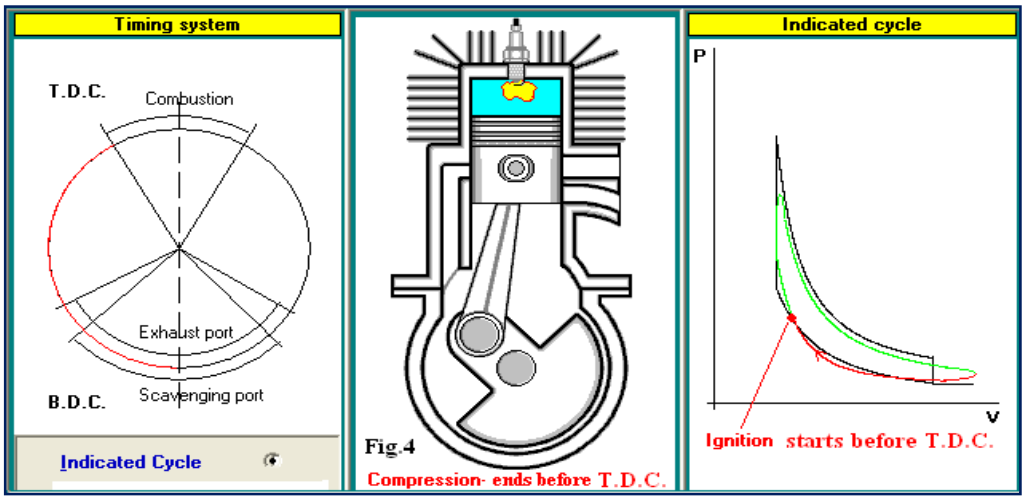


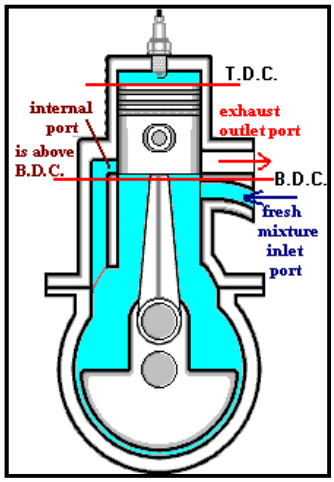
VirtLab-6: Interactive Virtual Simulation of 4 or 2 stroke Spark Ignition Otto Cycle engines:

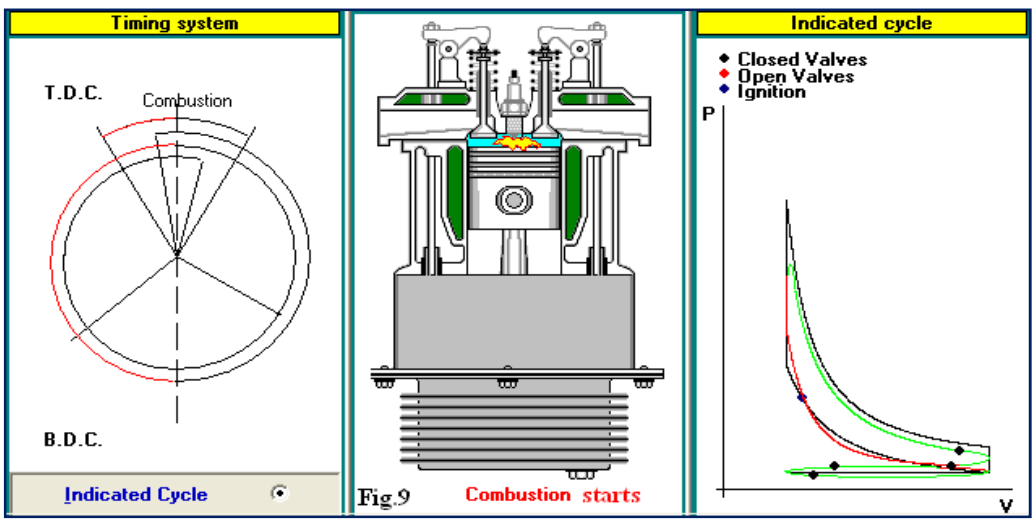


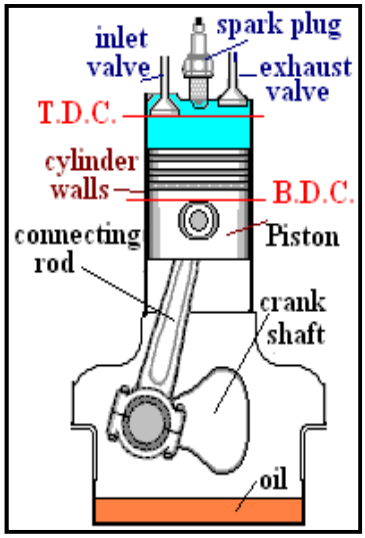
This is an interactive computer-based training Lab that includes an investigation, a virtual computer simulation and flow visualization. The Lab is designed to give the participant a broad based understanding of the most important theoretical concepts and real thermo-fluid processes existing in practical 4 or 2 stroke Spark Ignition Otto Cycle engines. The simulation shows and compares between both the theoretical and the indicated or actual P-V diagrams for the Otto cycle but does not do calculations for specific cycles or numerical values. The simulation shows on-line distribution diagram (Timing system) of the cycle different processes from top dead to bottom dead centers (T.D.C. to B.D.C.). The lab shows also visual animation for a cross-section, stylized, of the engine-cylinder motion up and down covering all the different processes of the cycle including the motion of the connecting rod & the crank shaft. The visual animation shows also the fluid flow motion through the inlet port for air-fuel mixture and the outlet port for products of combustion exhaust gases. The Lab discusses main reasons for variations and differences between ideal Otto cycle & real spark ignition Otto Cycle engines.



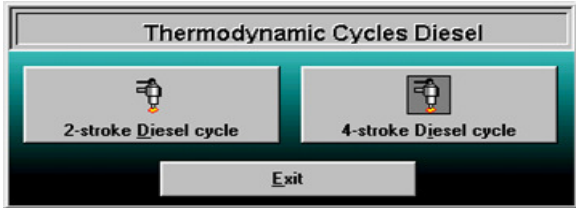


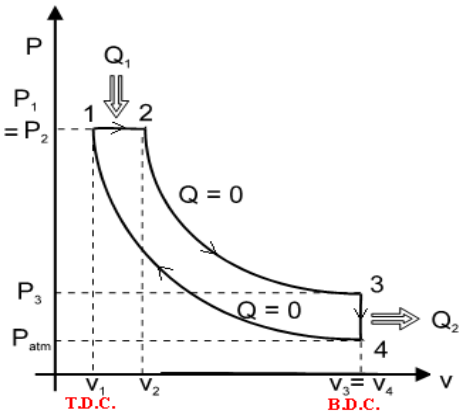


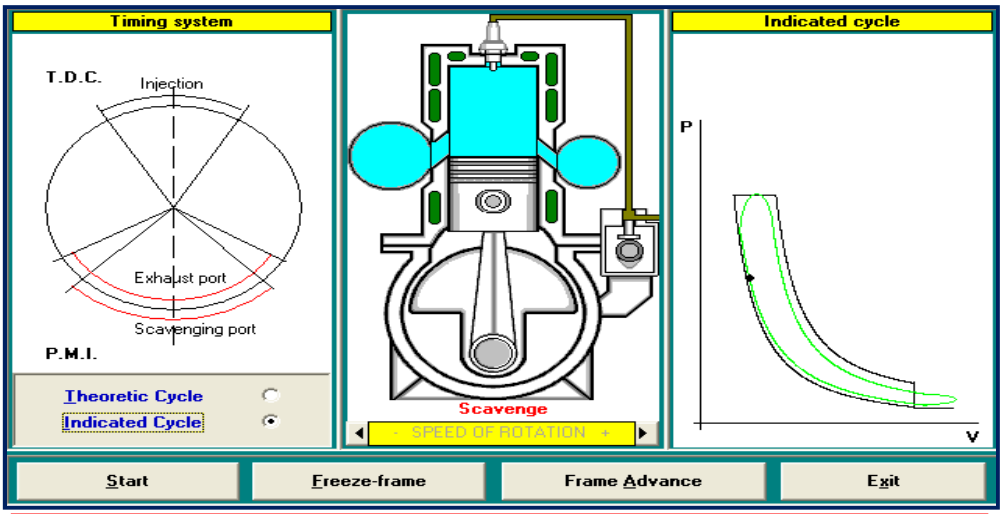


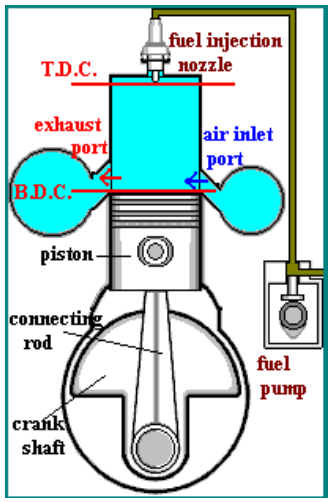


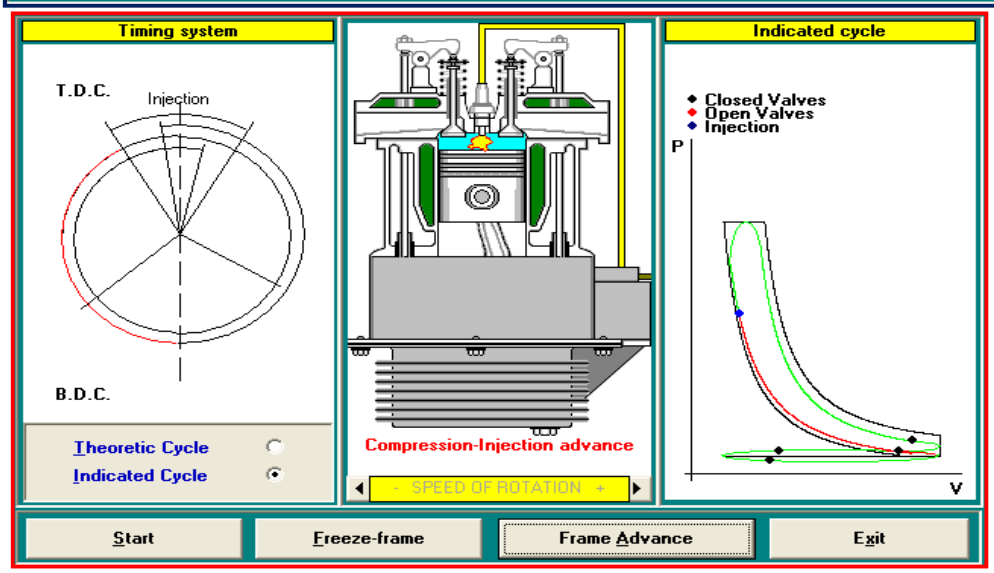
VirtLab-7:Interactive Virtual Simulation of 4 or 2 stroke Compression Ignition Diesel cycle engines: This is an interactive computer-based training Lab that includes an investigation, a virtual computer simulation and flow visualization. The Lab is designed to give the participant a broad based understanding of the most important theoretical concepts and real thermo-fluid processes existing in practical 4 or 2 stroke compression ignition Diesel cycle engines. The simulation shows and compares between both the theoretical and the indicated or actual P-V diagrams for the Diesel cycle but does not do calculations for specific cycles or numerical values. The simulation shows on-line distribution diagram (Timing system) of the cycle different processes from top dead to bottom dead centers (T.D.C. to B.D.C.). The lab shows also visual animation for a cross-section, stylized, of the engine-cylinder motion up and down covering all the different processes of the cycle including the motion of the connecting rod & the crank shaft. The visual animation shows also the fluid flow motion through the inlet port for inlet air and the outlet port for products of combustion exhaust gases. The Lab discusses main reasons for variations and differences between ideal Diesel cycle & real compression ignition Diesel Cycle engines.

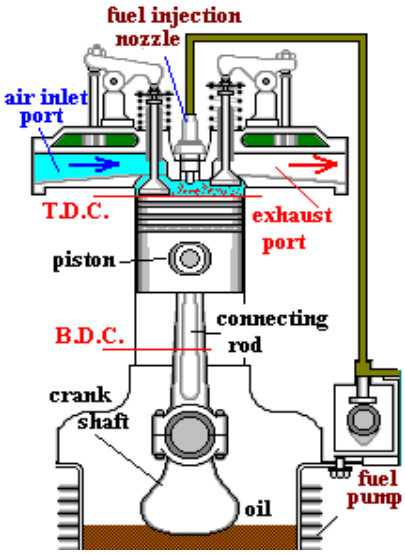






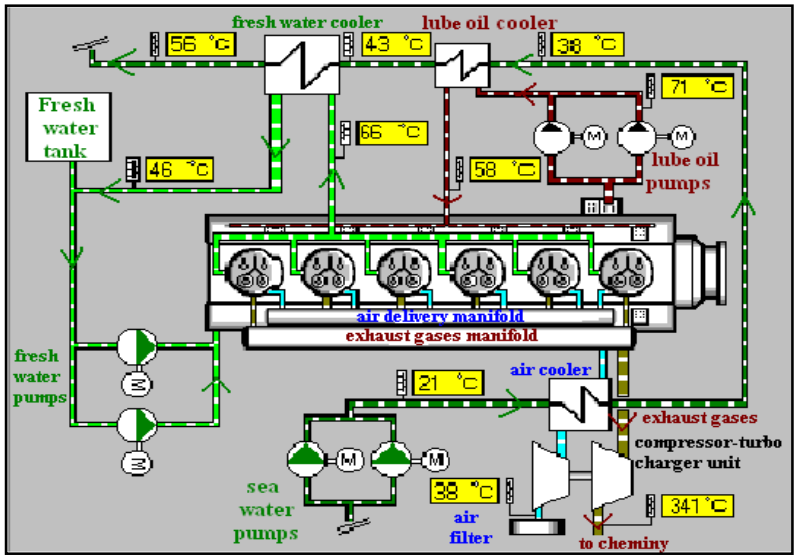


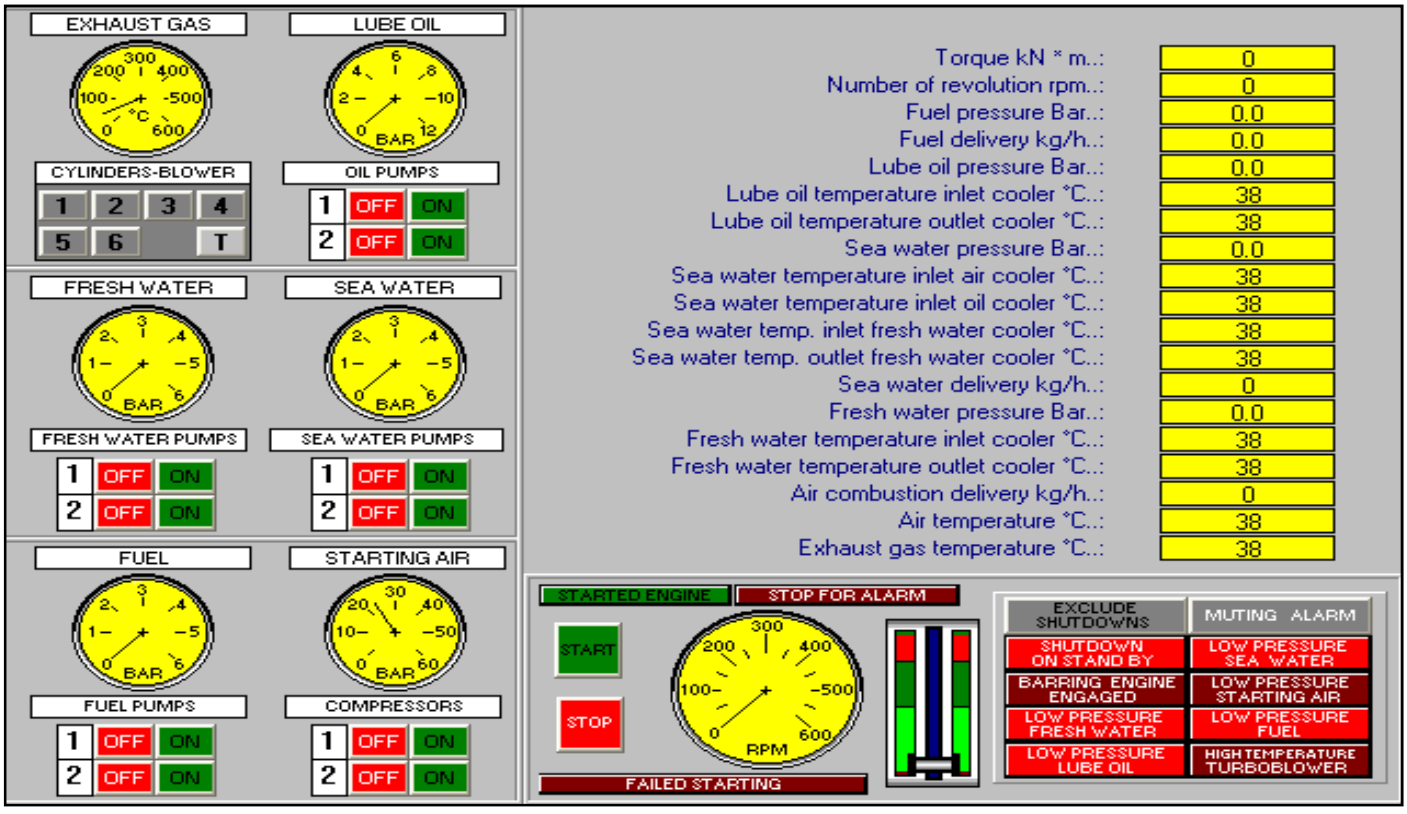




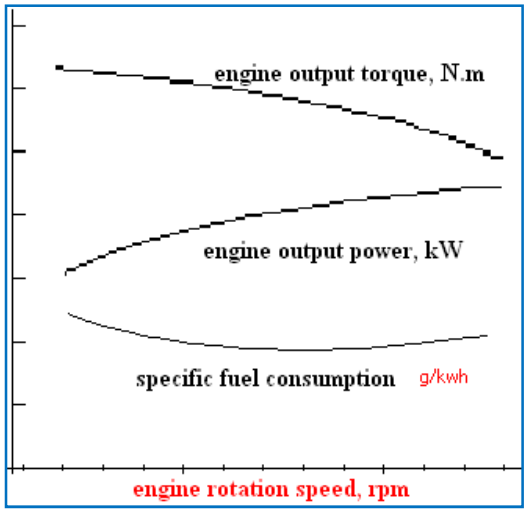
VirtLab-8: Interactive Automatic Control System for Industrial 6-cylinder, turbo-charger, 4 stroke Diesel engine drive with thermal balance calculations:

This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in Industrial 6-cylinder, turbo-charger, 4-stroke Diesel engine drive. The engine follows the actual indicated compression ignition Diesel Cycle diagram. The thermal balance of this mechanical Power system is also performed and presented for each working engine condition. The engine utilizes the hot-exhaust gases to drive a Compressor turbo -charger unit to pre-charge and increase the pressure of fresh air induced into the cycle. This unit has air-cooler & two sea water pumps. The 6-cylinders are jacket-water cooled using a fresh water tank & two-fresh water pumps. Fuel is pumped to the injectors using two-fuel pumps. The lube oil unit is driven by two lube oil pumps & a lube oil cooler through one of the two sea-water heat exchangers. The second sea-water heat exchanger is used to cool the fresh water used in the engine cooling circuit. Automatic control system includes both of the engine conductions section and auxiliary management section. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic page tools, error-report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.

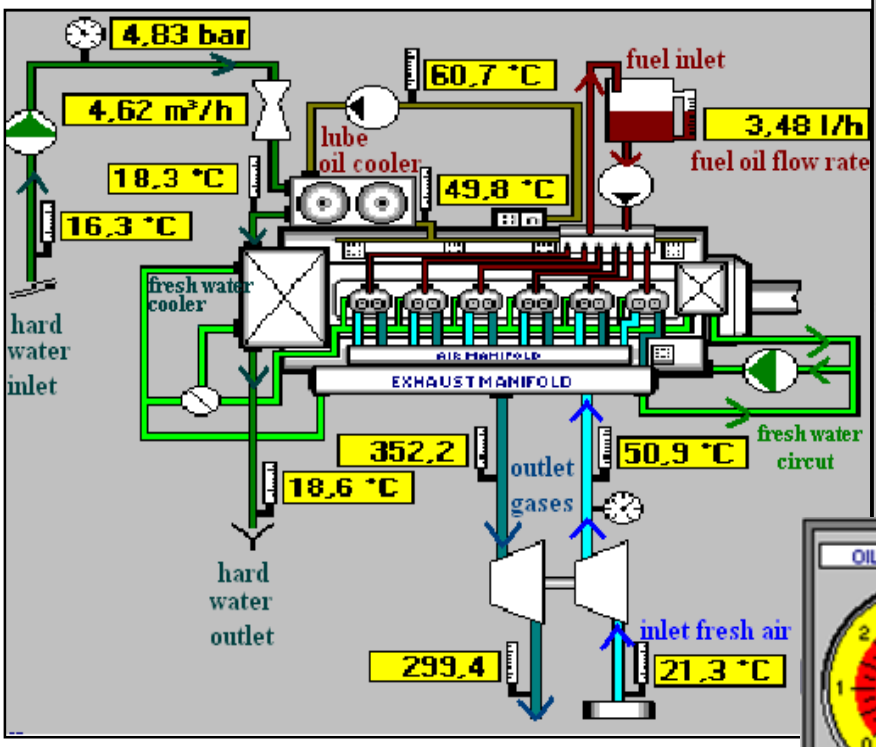


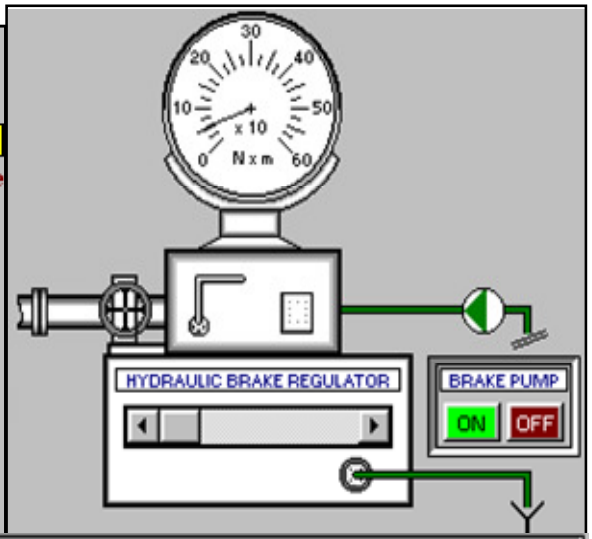


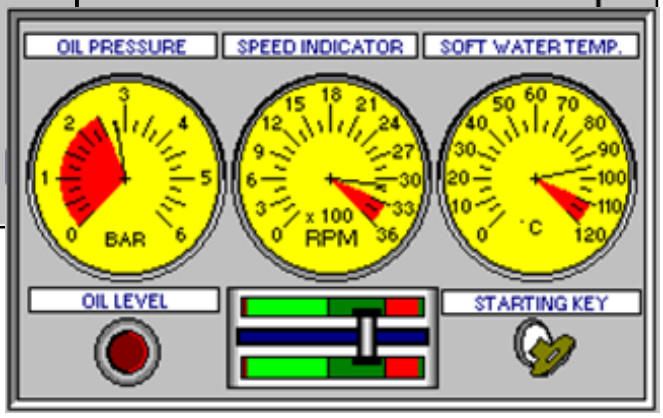
VirtLab-9: Interactive Automatic Control System for an Industrial 6-cylinder, turbo-charger, Diesel engine with a hydraulic brake unit:



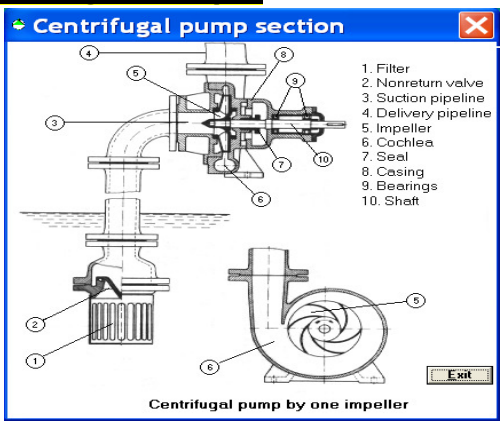
This is interactive computer-based training course that includes investigation, a virtual computer simulation& flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in Industrial 6-cylinder, turbo-charger, 4-stroke Diesel engine drive. The engine follows the actual indicated compression ignition Diesel Cycle diagram. The thermal balance of this mechanical Power system is also performed and presented for each working engine condition. This extension lab investigates all performance characteristics of the internal combustion engine of VirtLab-8 as a system with two degrees of freedom: during normal operation its output work is altered in two ways: (1) by changing its rpm for a fixed load on the engine shaft; (2) by changing position of hand-lever or accelerator to keep same rpm for variable load on the engine shaft. The engine characteristics are obtained at full torque load, power and fuel specific consumption. The engine is mounted on a bench and connected to a dynamometrical brake. All proper operation conditions are adjusted through the control boards. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic page tools, error-report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.

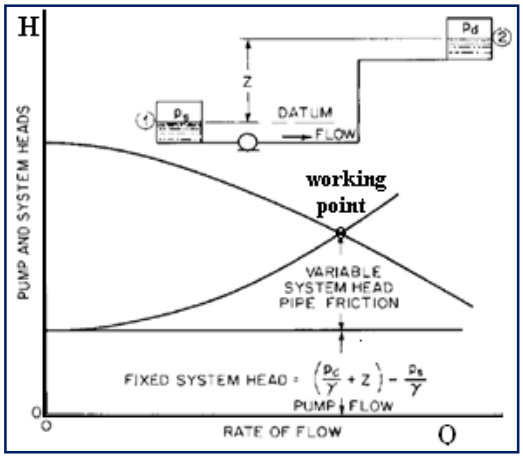




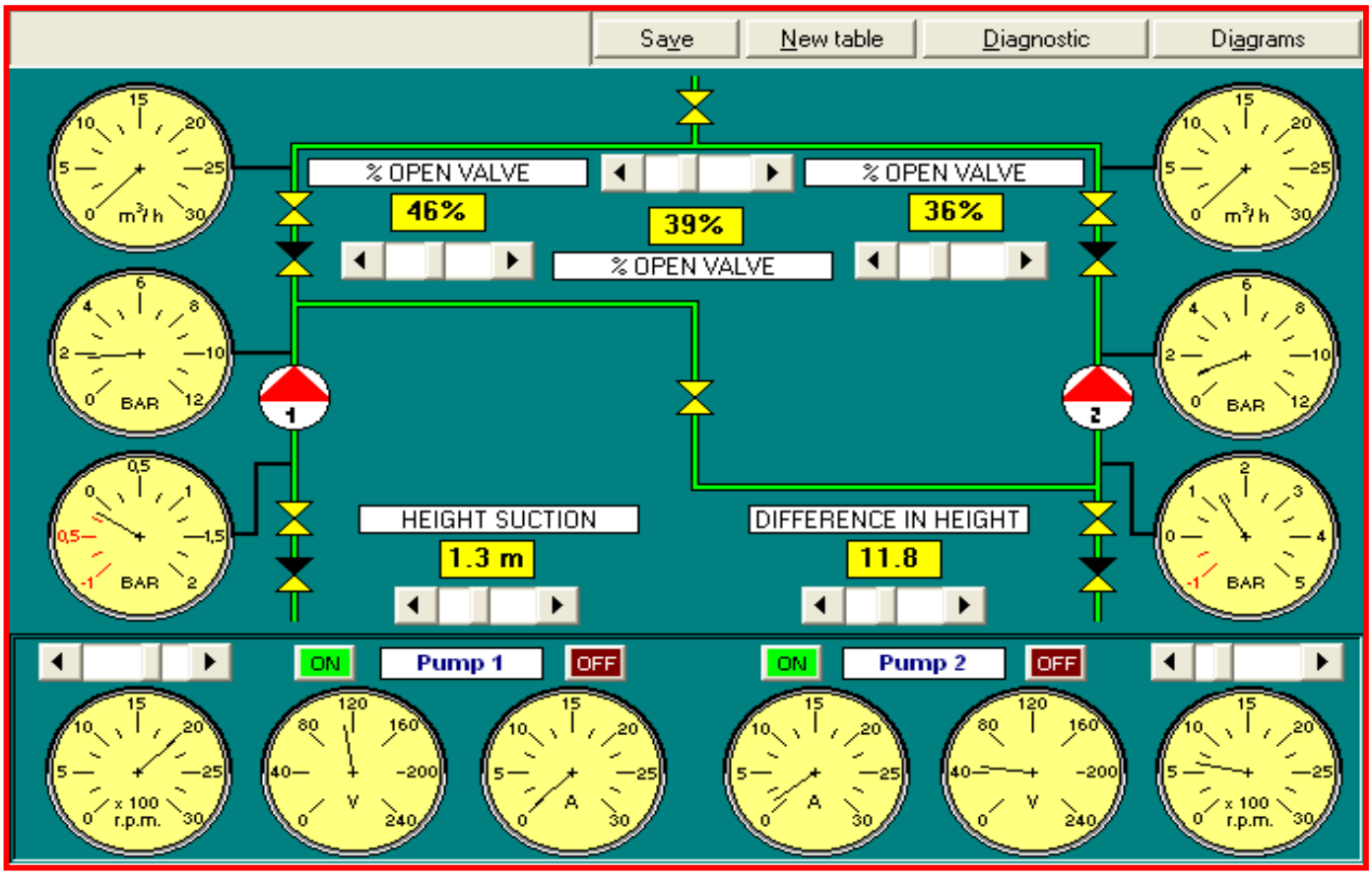


VirtLab-10A: Interactive Automatic Control System for an Industrial pumping plant with two Parallel or Series Centrifugal Pumps:

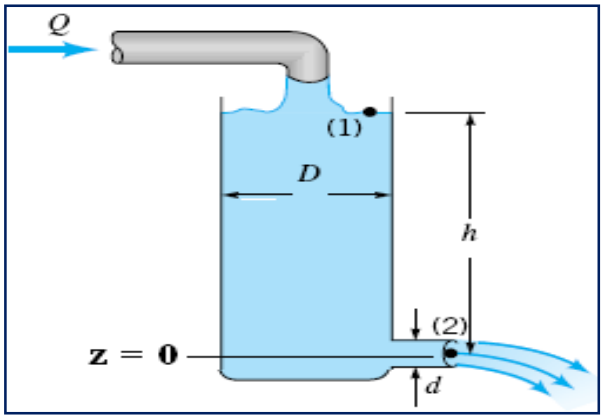




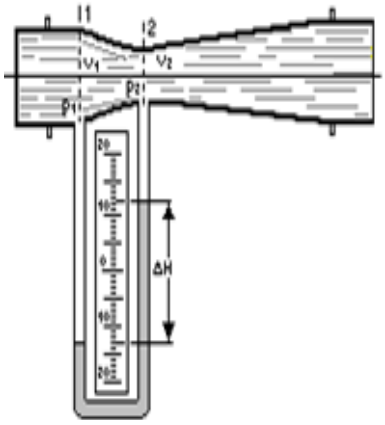
This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in Industrial pumping station. The station includes two centrifugal pumps which may work separately or work as pairs in parallel or in series. The pumps are provided with separated controls and instrumentation. Each of the two pumps can be operated independently from the other pump. The simulation allows changing all the operation conditions of each pump including the rpm, the inlet suction head, and the output discharge. This allows investigation of the H-Q curves of the plant for all possible different flow conditions. Also the characteristic H-Q curve of each pump can be obtained at full load conditions. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic page tools, error-report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.

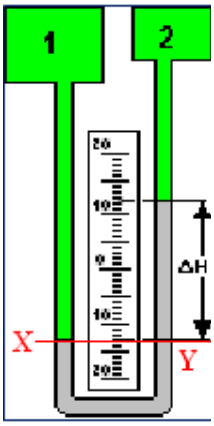


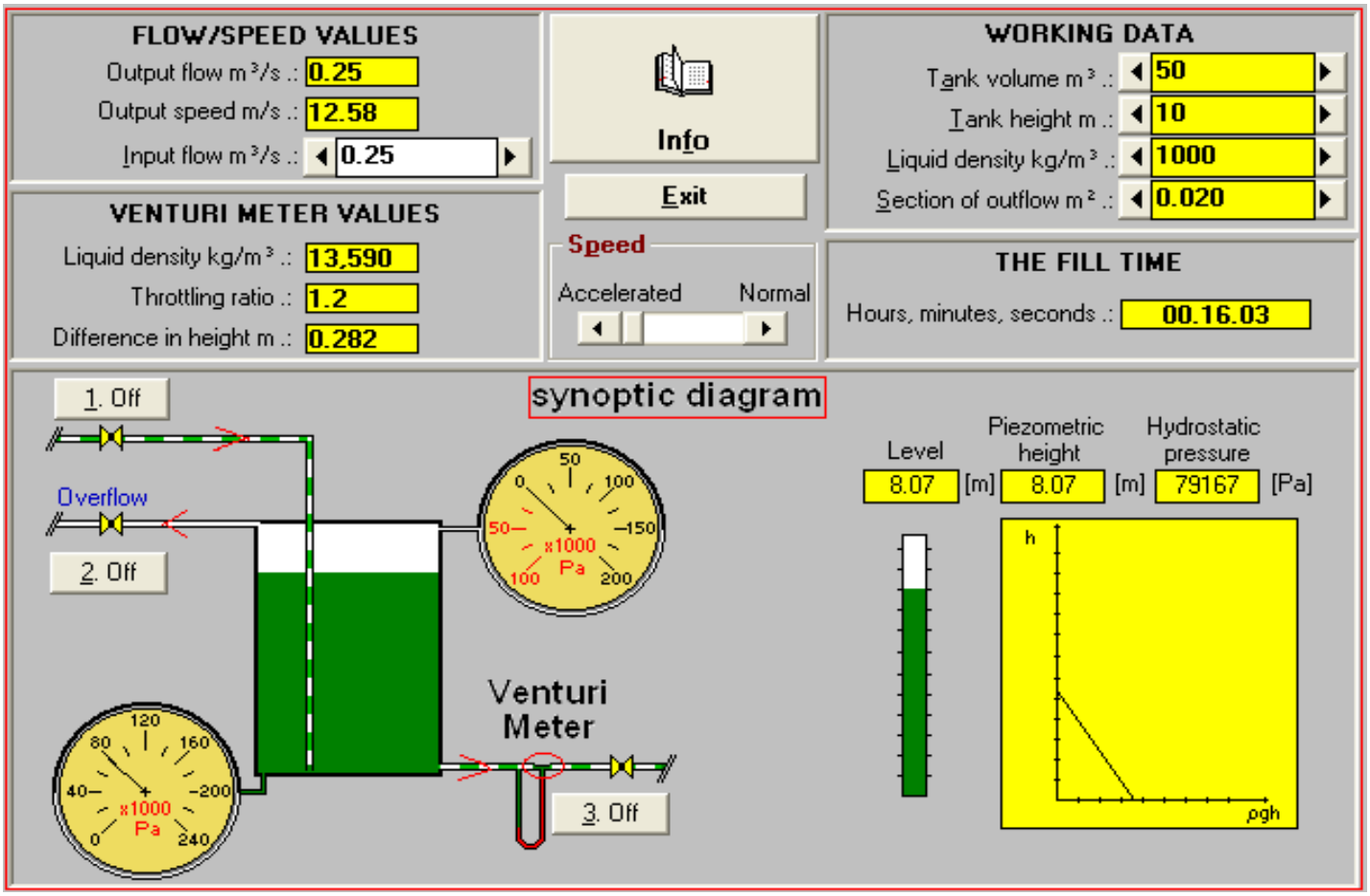
VirtLab-10B: Interactive Automatic Control System for filling different vertical tanks with liquids:



This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real fluid processes existing in filling different vertical tanks with liquids. The plant includes a venture-meter at output and flow control valve at inlet. The simulation allows adjusting flow/speed values, working data, and venture meter values. The tank filling time is calculated and the diagram of head-pressure is plotted, presented and updated instantaneously. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic page tools, error-report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.

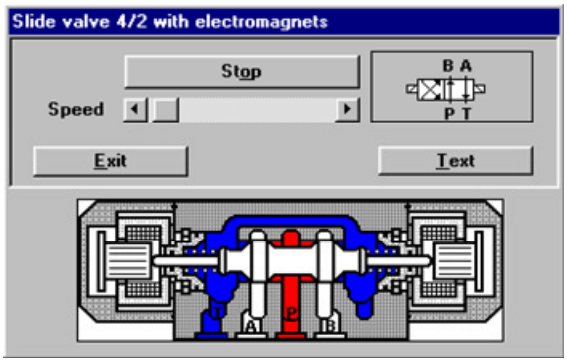


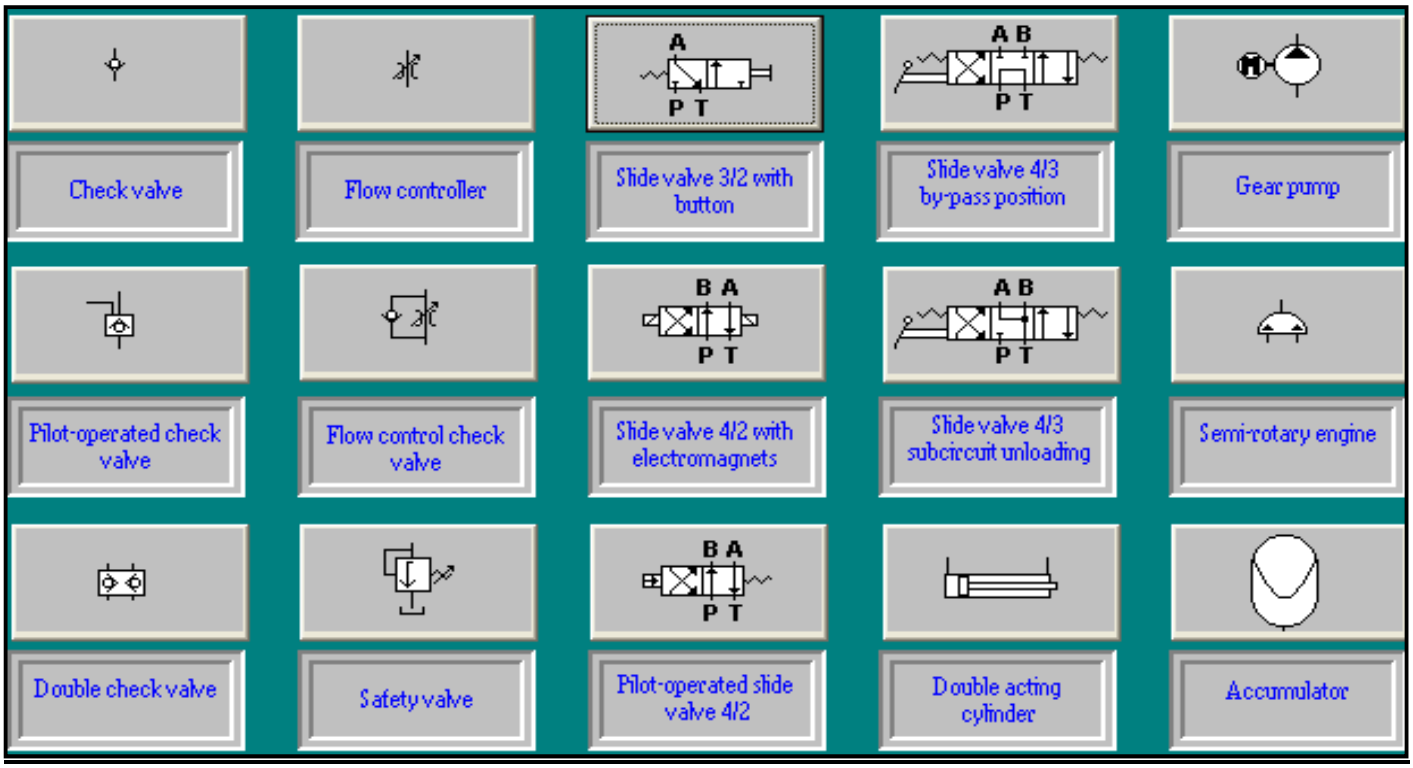


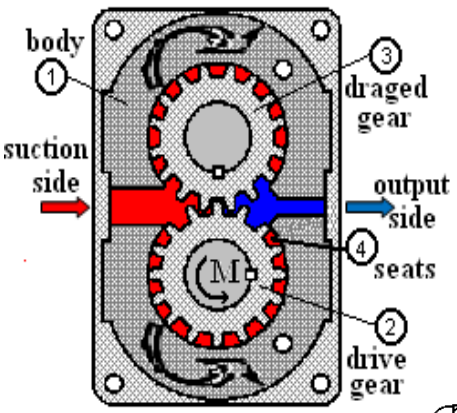


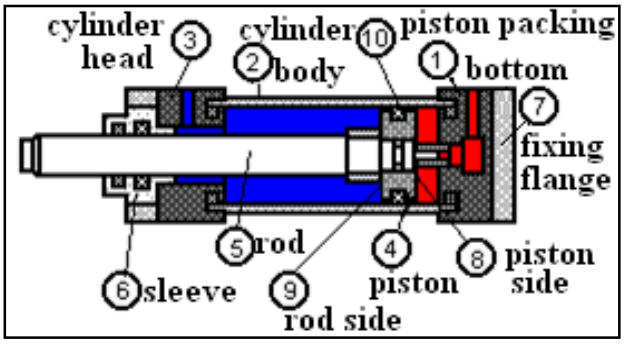
VirtLab-11: Interactive Virtual Simulation and Animated sections for 16-different parts of Industrial Hydraulic control Circuits:

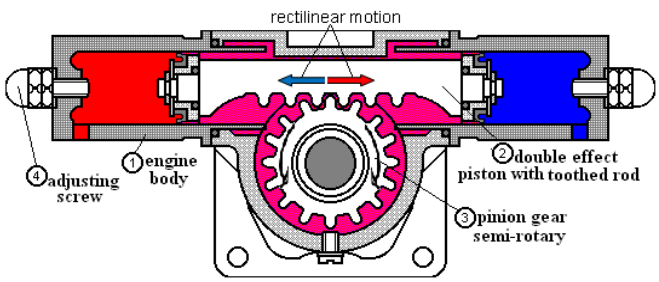
This is an interactive computer-based training course that includes animation, a virtual computer simulation and flow visualization for 16-different components of Industrial Hydraulic control Circuits. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control using Hydraulics systems.

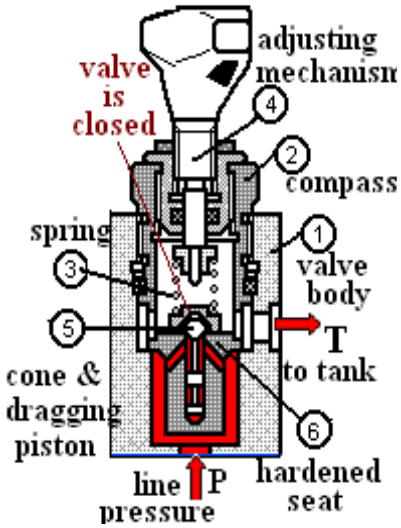






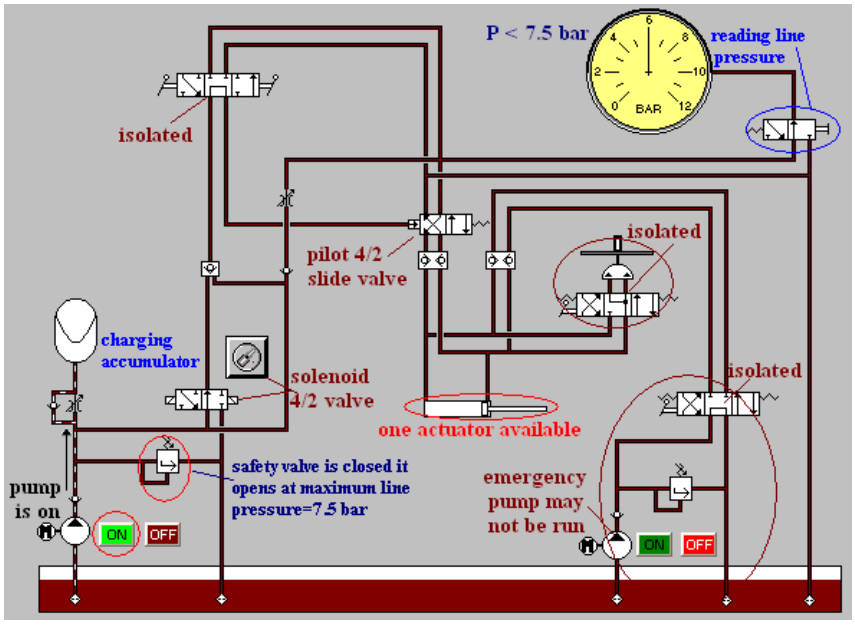


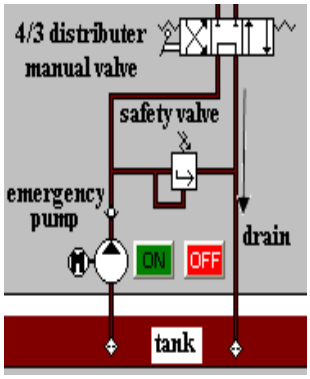


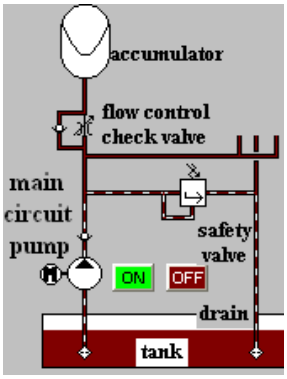


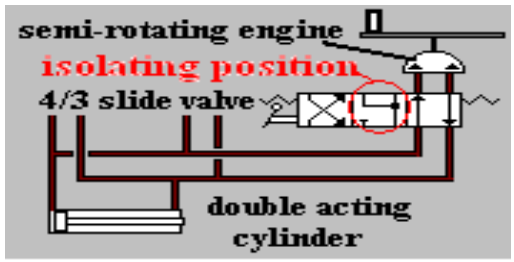
VirtLab-12: Interactive Virtual Simulation for an Industrial Hydraulic automatic control Circuit using the 16-different components of VirtLab-11:

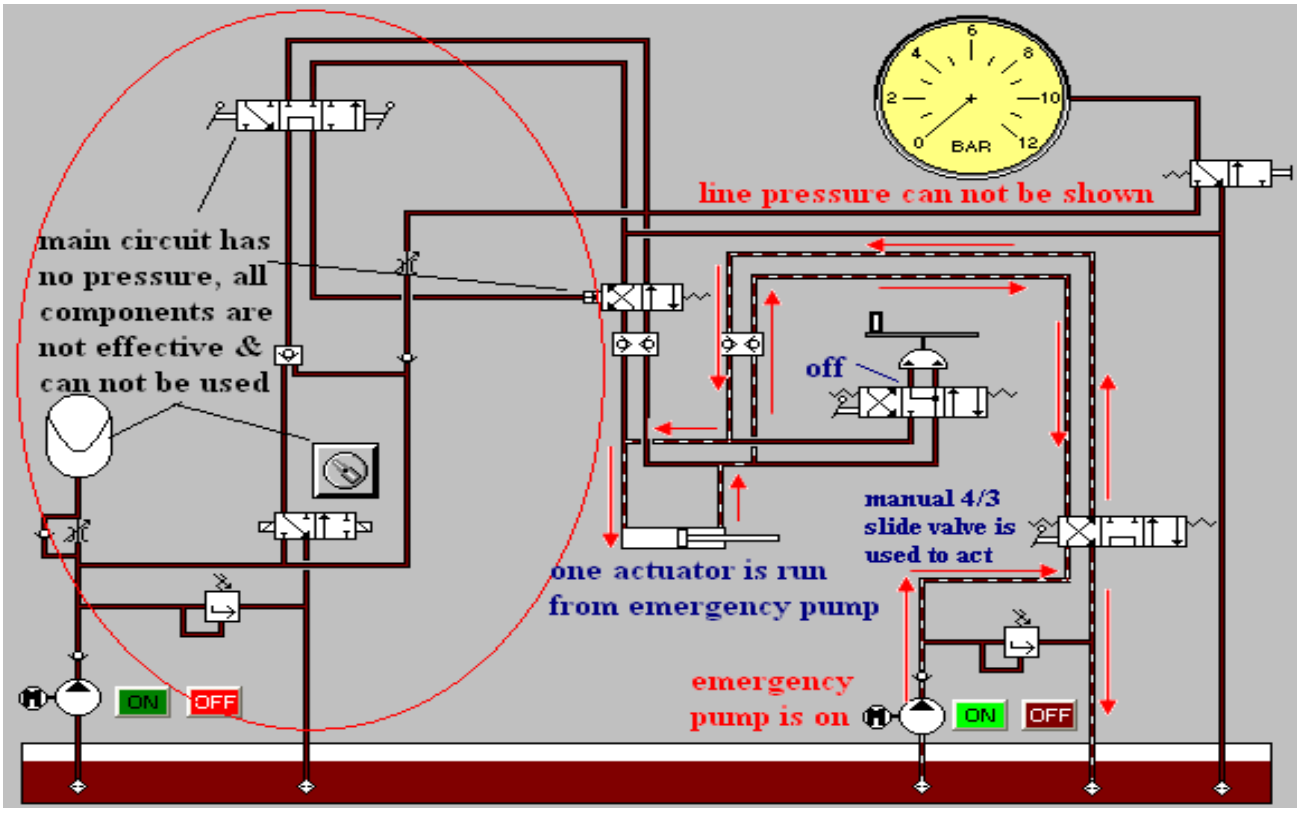
This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real fluid flow processes existing in an Industrial Hydraulic automatic control Circuit using the 16-different components of VirtLab-11. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic tools, error-reports, help/trouble-shooting menus and Plotting tools.



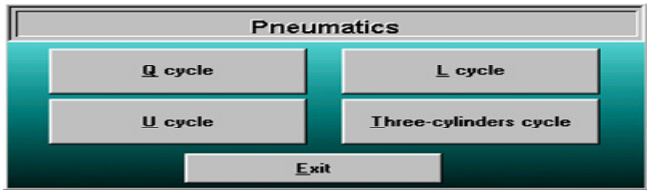




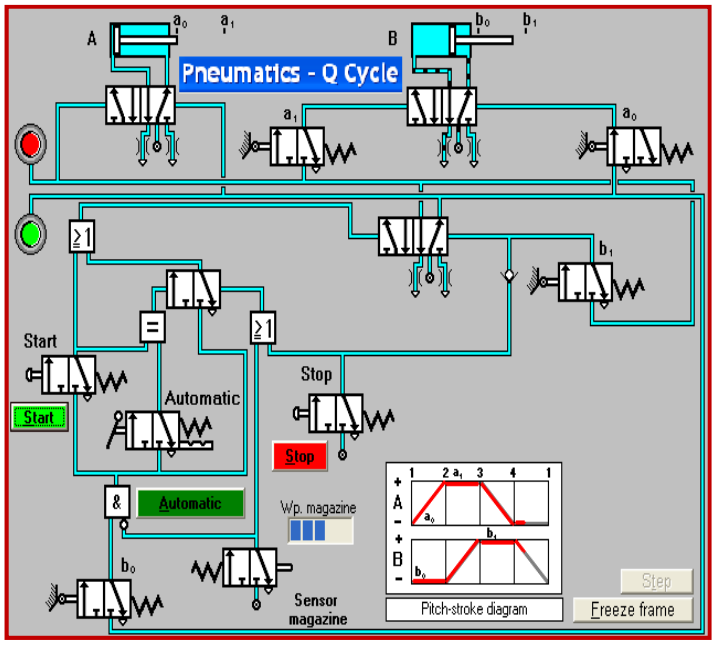


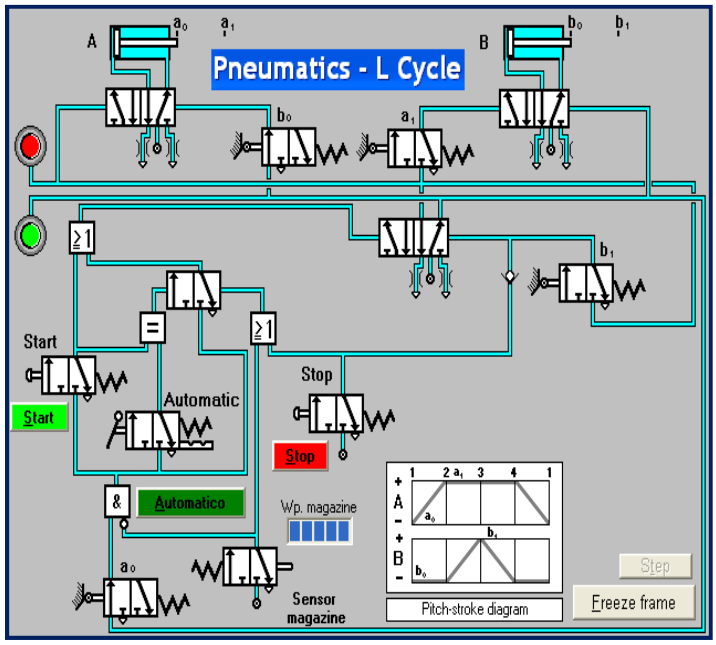


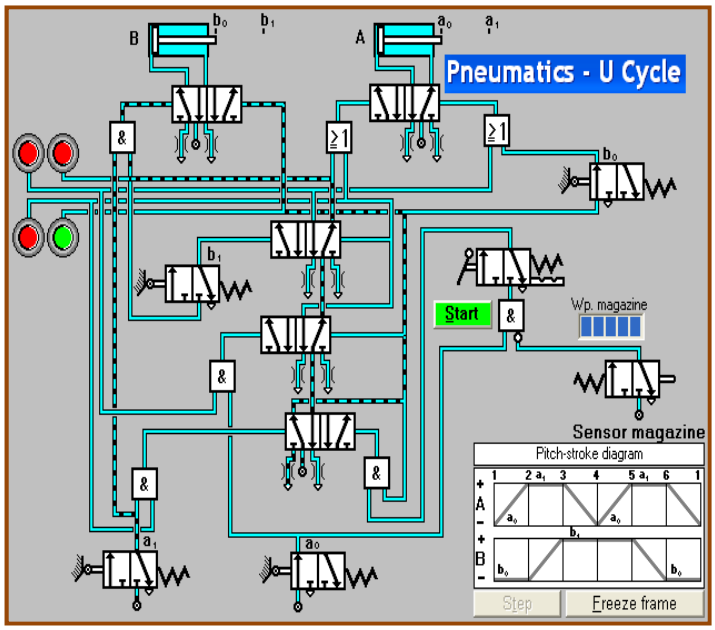
VirtLab-13: Interactive Virtual Simulation of 4-different Industrial Pneumatics automatic control circuits:

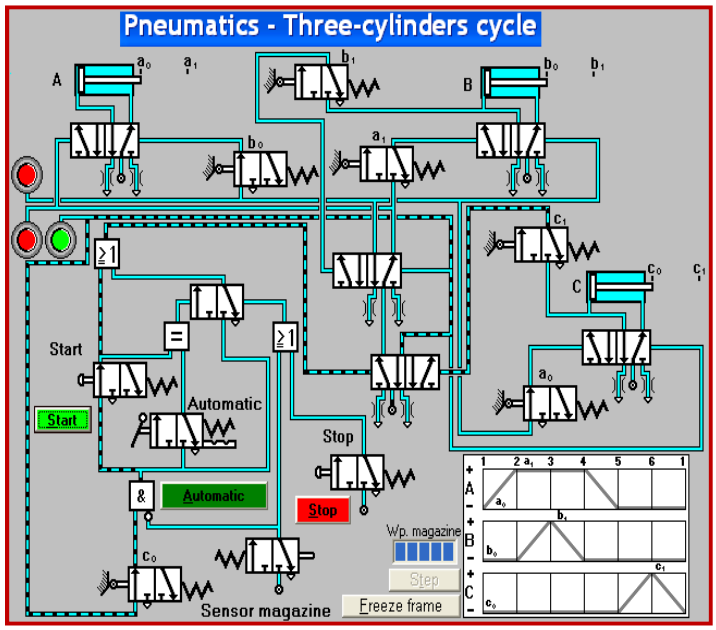


This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real fluic flow processes existing in 4-different Industrial Pneumatics automatic control circuits. These are Q-cycle, L-cycle, U-cycle, and 3-cylinders cycle. The simulation includes many critical contro alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic tools error-reports, help/trouble-shooting menus and Plotting tools.





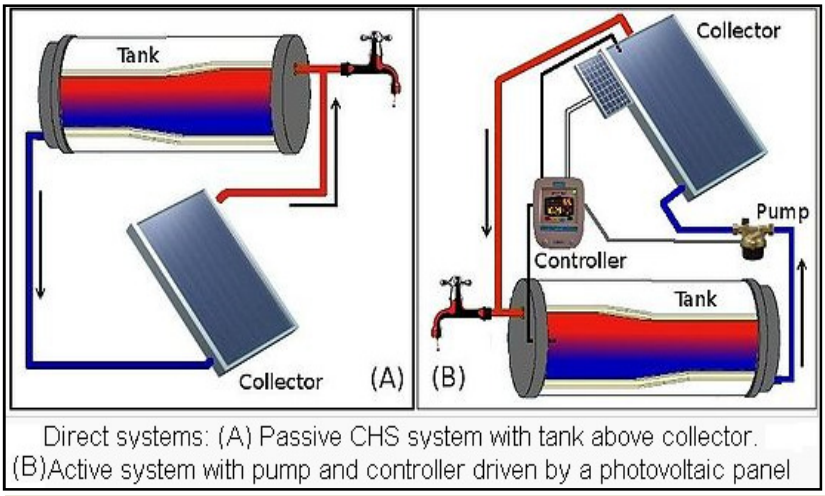




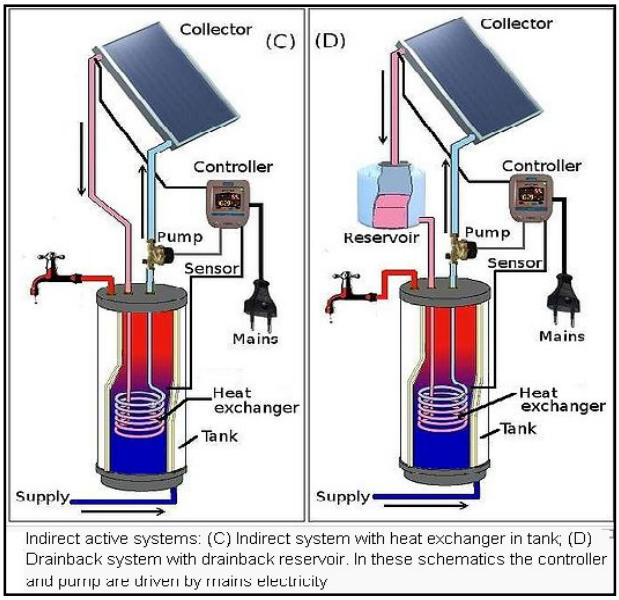
VirtLab-15: Interactive Automatic Control System for an Industrial Solar Heating Plant with 2-Flat Plate collectors and auxiliary boiler:

monobloc (thermosiphon) solar heater

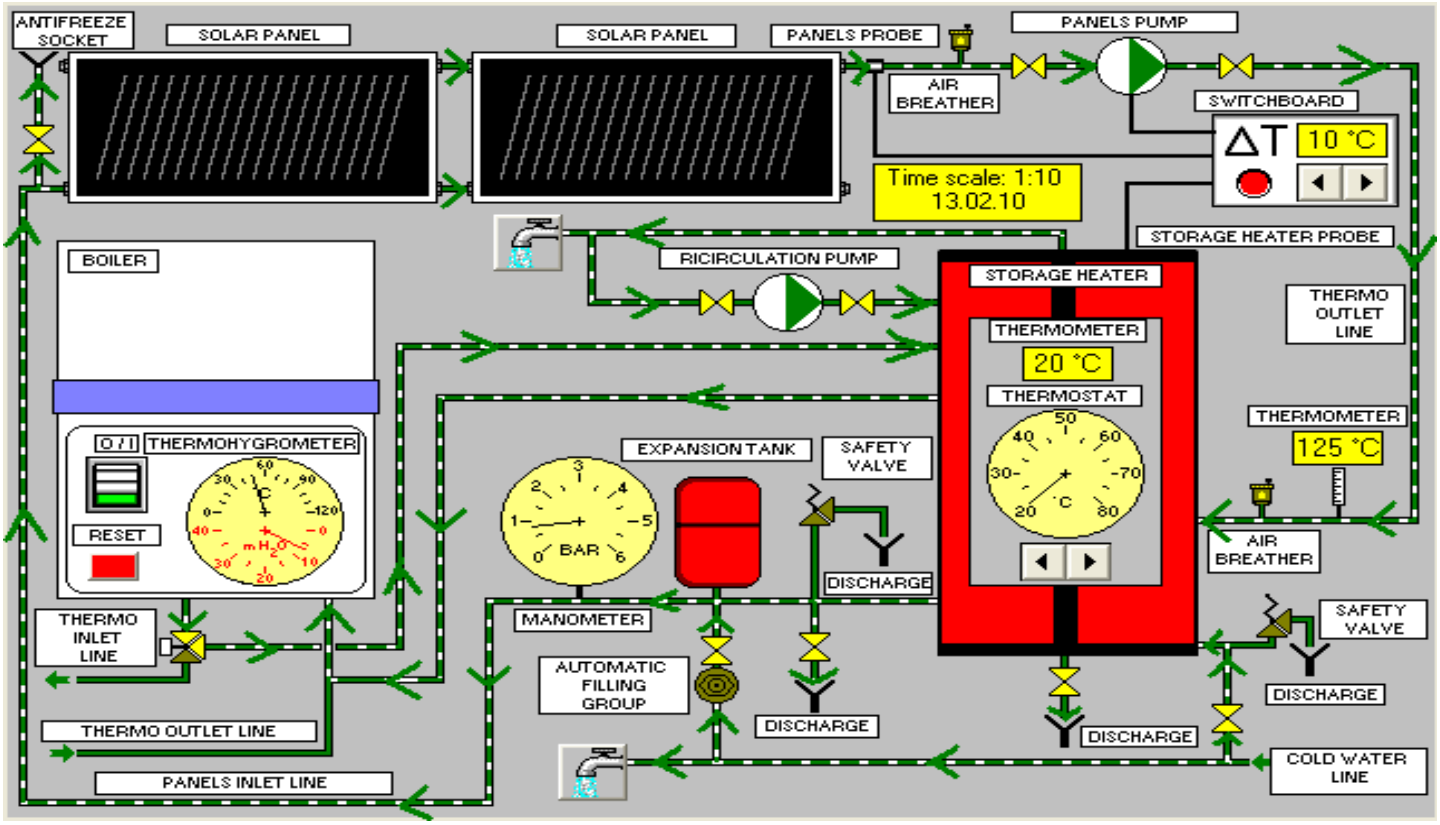
This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in an Industrial Solar Heating Plant with 2-Flat Plate collectors and an auxiliary boiler. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic tools, error-report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.



Direct systems: (A) Passive CHS system with tank above collector. (B)Active system with pump and controller driven by a photovoltaic panel

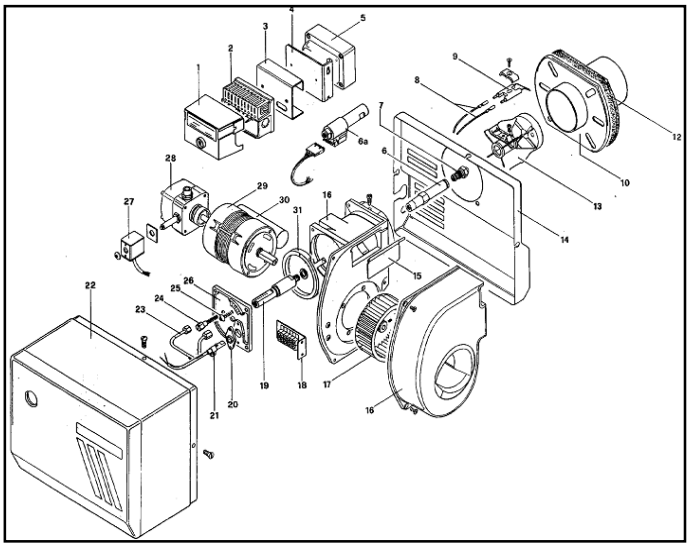


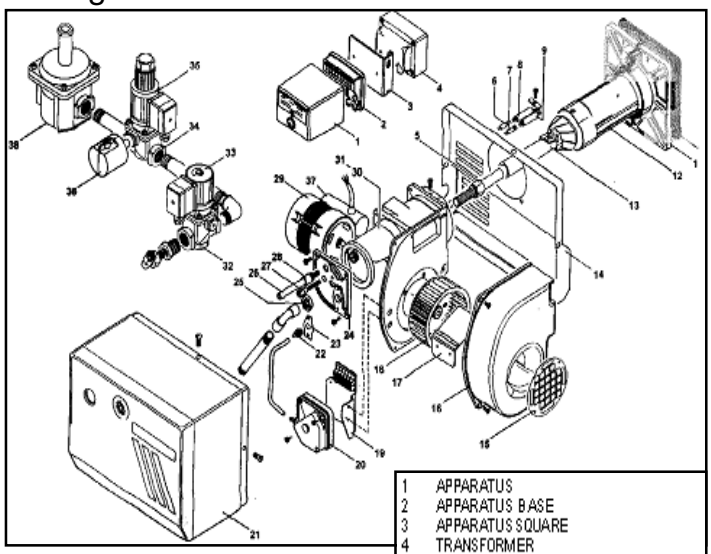
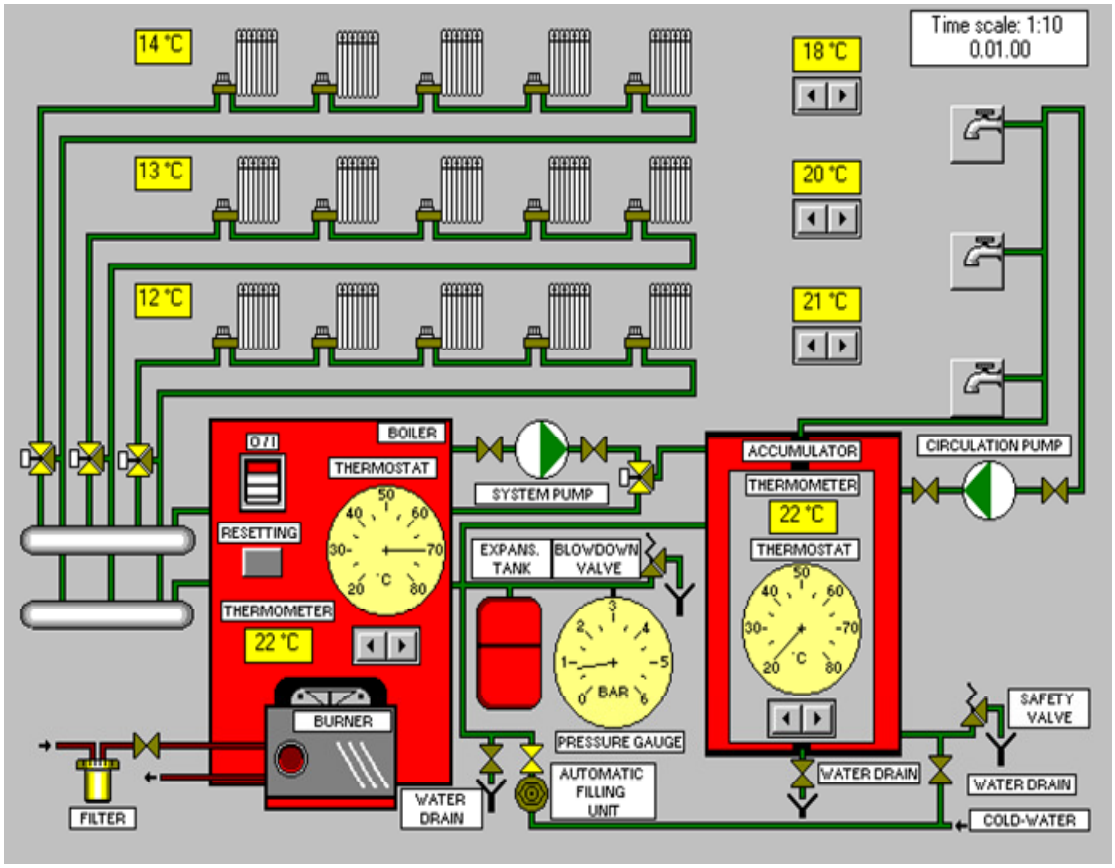
Indirect active systems: (C) Indirect system with heat exchanger in tank; (D) Drainback system with drainback reservoir. In these schematics the controller and pump are driven by mains electricity



VirtLab-16: Interactive Automatic Control System for a civil heating plant for hot water distribution:

This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in a civil heating plant for hot water distribution. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic tools, error-report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.





1	APPARATUS
2	APPARATUS BASE
3	APPARATUS SQUARE
4	TRANSFORMER
5	HEAD CENTRAL TUBE
6	DETECTION CABLE
7	IGNITION CABLE
8	DETECTION ELECTRODE
9	IGNITION ELECTRODE
10	PACKING
11	FLANGE
12	THROAT
13	COMBUSTION HEAD POSITION
14	BOTTOM
15	PROTECTION NET
16	COMPLETE CHUTE
17	AIR SHUTTER
18	FAN
19	JUNCTION BOX SUPPORT SQUARE
20	AIR PRESSURE SWITCH
21	HOOD
22	PRESSURE INTAKE
23	BRACKET PLATE
24	HEAD BRACKET PLATE
25	NUT
26	SHUTTER ADJUSTEMENT SCREW
27	HEAD ADJUSTEMENT SCREW
28	SEAT OF SHUTTER ADJUSTEMENT SCREW
29	ENGINE
30	AIR SHUTTER
31	AIR SHUTTER GEAR
32	GAS VALVE EG12
33	GAS VALVE BOBBIN EG12
34	GAS VALVE EG 12 L
35	GAS VALVE BOBBIN EG12 L
36	GAS PRESSURE SWITCH
37	CONDENSER