

# AIR CONDITIONING SCROLL CHILLER CONTROL PANEL

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**Abstract :** This is an introduction to air conditioning systems (frequently referred to as HVAC systems – heating, ventilating and air conditioning systems).It is intended for those engineers, architects and construction professionals who are only peripherally involved with HVAC systems in their professional activities, but would like to learn more about HVAC concepts, principles, systems and equipment. Give design and construction professionals a step forward in understanding this area of building technology

*IndexTerms - Switch fuse unit (SFU), HVAC (Heating, Ventilating And Air Conditioning).*

**1.Introduction** Samcon is pleased to introduce as a professional Group organization engaged as a manufacturer & supplier of Electrical Control Panels required for HVAC, Engineering, Power Distribution and Process Industries. Samcon is a professionally managed organization having well experienced manpower for designing and manufacturing of complete Control Panel Systems. Our company is having complete infrastructure to make the Electrical Panels & allied products to meet growing requirements of the customers. The main objective of the company is to provide high quality Control Panels to its customer and prompt after sales and Services. we are doing outhouse project in the SAMCON industrial control private limited. We are focus mainly on the assembly process of the different types of control panels.

## 2. TYPE OF CONTROL PANELS

### 2.1 SCROLL CHILLER CONTROL PANEL



Fig .1 Scroll Chiller Control Panel

Scroll chiller panel are basically use for industrial air conditioning. Range of this control panel starts from the 10 Tr (tonnage) to 100 Tr.

There are two types of scroll chiller control panel

- 1.Air cooled scroll chiller control panel
- 2.Water cooled scroll chiller control panel

#### 1.AIR COOLED SCROLL CHILLER CONTROL PANEL:-

Air cooled chillers utilize the mechanical refrigeration cycle to produce chilled water or a chilled water and antifreeze mixture. They reject the building heat to the ambient with an air cooled condensing coil. Chillers are heat of chilled-water air-conditioning system since they are serve pivotal function of creating the cooling effect required to maintain comfort conditions. Chillers are used in the variety of comfort air-conditioning and process cooling application .The chilled liquid is transported by pump and pipes that can be connected to literally hundreds of room fan coils and terminal. This allow chillers to be applied on application requiring many zones of control.

Air Cooled Scroll Chillers Blue Star is a pioneer in manufacturing air cooled scroll chillers. These systems are popular in many commercial applications such as offices, hotels, hospitals, industries, etc. due to their distinct advantage of multiple refrigeration circuits with hermetic scroll compressors, compactness and service-friendliness. These chillers comprise of DX cooler, air cooled condenser with fan and multiple hermetic scroll compressors.



Fig .2 Air Cooled Scroll Chiller Control Panel

Air-cooled chillers are common in modern system and have been growing in popularity since the 1980s, nearly doubling in the last ten years. Today, air-cooled chiller are applied on small to large commercial jobs and can be use in multiple to form system reaching several thousand tons of installed capacity.

The popularity is primarily due to the all-inclusive nature of air-cooled chillers and the reduction of costs associated with eliminating cooling tower. On some models even the hydrolic accessories, such as the pump and expansion tan may be included, assembled ,and tested from the factory ready to begin operation. Typical air-cooled chiller applications include schools. Hospitals retail environment, and off ices Additionally air-cooled chillers are popular for cooling process or manufacturing operations. This TDP will cover packaged single-piece. As well as split system air-cooled chillers.

#### FEATURE AND FUNCTION:-

##### 1.WIDE RANGE OF MODELS:-

Available in refrigerant options: R22, R407C and R410A

Air cooled: 10, 24, 36, 48, 60, 72, 80, 100 and 120 TR

Water cooled: 11, 26, 39, 52, 65 and 85 TR

##### 2.EASY AND QUICK INSTALLATION:-

These chillers are pre-wired, fully charged and run-tested at the factory thereby making it easy and less time-consuming for installation and start up.

##### 3.ENERGY EFFICIENT:-

The compressors used are reliable, time-tested and highly energy efficient.

##### 4.CAPACITY MODULATION IN STEPS:-

Multiple compressors are used in each of the models. In 'part load' conditions, the microprocessor ensures that only the required number of compressors operate to handle the load, thus saving power.

##### 2.WATER COOLED SCROLL CHILLER CONTROL PANEL:-

Wherever water can be provided, Blue Star's water cooled scroll chillers offer higher efficiency than air cooled systems as water is a superior cooling medium compared to air. These chillers comprise of cooler, multiple hermetic scroll compressors and Shell & Tube water cooled condenser. Because of their higher efficiency, water cooled chillers consume lower power compared to air cooled systems.



Fig .1.2 Water Cooled Scroll Chiller Control Panel

### Chilled water Air-conditioning System

Systems that employ water chillers are commonly called chilled- water systems. As its name suggest, this system makes use of water as its secondary refrigerant. Chiller is used to remove heat from the water which is then circulated through other components to absorb heat from the space.

Chilled water air conditioning systems are commonly used in applications that need large cooling capacity such as hypermarket, industrial process, commercial air conditioning such as offices and factories. More and more homes are using this system to air conditioned their entire house because of its cost-effectiveness and no hazard of having refrigerant piped all over the house.

The evaporator cools water to about 45 .That chilled water is pumped to cooling coils in the areas being cooled, and a fan draws the air in those areas through the chilled water coils, cooling the air.

In comparison, with standard air conditioning, the evaporator coil directly cools the air. The refrigerant flows all the way to the air handlers in the areas being cooled, and a fan draws the air in those areas through the evaporator coils, cooling the air.

Li With chilled water air conditioning, the compressor is usually mounted on a rack or frame, within a few feet of the evaporator that cools the chilled water. If the condenser is water cooled, it's usually mounted on the same rack. If the condenser is air cooled, it will be installed outside the building. One advantage of chilled water air conditioning is that if the chilled water piping leaks somewhere in the building, only water is lost, and repairs only require plumbing work.

In comparison, with standard air conditioning, a leak in a refrigerant line inside the building will probably require brazing, leak testing with nitrogen, evacuation of the system, and recharging with a refrigerant that is a lot more expensive than water.

U Another advantage of chilled water air conditioning is that if air stops flowing through the cooling coil, the chilled water will simply return to the chiller. Since the water will not have picked up any heat, it will still be cold, and the chiller will respond by unloading and turning off.

With standard air conditioning, if air stops flowing through the cooling coil, there is a possibility that liquid refrigerant will return to the compressor and damage it. as it leaves the compressor. The condensers Air-cooled condensers employ ambient air as the condensing medium and use a fan to move the air over the coil. For a given surface and airflow rate, the capacity of an air-cooled condenser varies with the refrigerant condensing temperature which is a function of the entering dry-bulb temperature. Shown in Figure 2 is a typical air- cooled condensing temperature based on 95° F dry bulb ambient air.

Water-cooled condensers employ water as the condensing medium and use a pump to circulate the water through the

Air-cooled chillers have a full load kW/ton of approximately 1.25 while water-cooled chillers have a full load kW/ton of between 0.55 and 0.8 kW/ton. The kW draw of the cooling tower fans and condenser water pump should be added to the water-cooled chiller kW/ton for an even comparison. Even after accounting for this added auxiliary energy draw, water- cooled chilled-water systems normally have an efficiency advantage over air-cooled.

A differentiating feature of the types of chillers is the method used to condense the refrigerant. Two methods involve using either air-cooled or water-cooled

Design Air Inlet Temperature 95° F

Air Rise 15°F

Leaving Difference° 15°F

Refrigerant Condensing Temperature 125°

condenser and out to a cooling tower that rejects the heat to the atmosphere. Operating cost is one of the primary factors when deciding between air-cooled or water- cooled chillers. Air-cooled chiller systems typically have a lower first and maintenance cost since they do not require a cooling tower, condenser water pumps, and associated condenser water chemical treatment. Operating costs, however, generally favor water-cooled chillers. This is because water-cooled chillers can take advantage of lower condensing temperatures than air-cooled chillers.

**FUNCTION AND FEATURES OF WATER-COOLED CONTROL PANEL:-**

**EFFICIENT SCROLL COMPRESSORS** These compressors come with a high efficiency in built motor and hybrid-wrap scroll design that helps reduce energy costs in normal operating conditions and delivers high capacity and an optimized pressure ratio for refrigeration applications.

**MULTIPLE COMPRESSORS** guarantees higher reliability and reduces starting current, making them ideal for small and medium industry applications without having to increase the installed grid power load, switchgear, transformers and generator rating hence saving initial capital costs. In part load conditions, only the number of compressors that are required to meet the load requirement are switched ON. All models except the ones offered with single compressor incorporate scroll compressors installed in tandem circuit.

**HIGH COP/EER** as a result efficient condensing of the refrigerant. These water cooled [scroll chiller](#) units are designed to meet the applicable requirements of Safety Code. Since the condensers are generously oversized, efficient condensing of the refrigerant leads to lower I KW.

**SHELL & TUBE EVAPORATOR** is built with copper tubes of than enables them to withstand hard water with PH greater than 8. The copper tubes contain patented star turbulate inserts that provide turbulence to the refrigerant flowing through the copper tubes. As a result of this turbulence these Shell & Tube evaporators have extremely efficient heat transfer with the copper tube. The shell is manufactured from high-grade steel.

**ULTRA EFFICIENT CONDENSING** using outer finned copper tubes results in efficient heat transfer as it increases the surface area of the copper tube in comparison to copper tubes without finning. The copper tubes are mechanically expanded in a torque controlled process on tube sheets.

**THERMOSTATIC EXPANSION VALVE** is provided as a standard part of the water cooled scroll chiller equipment.

**CONTROL PANEL** with IP-65 protection is provided as standard part of the water cooled scroll chiller equipment.

**MICROPROCESSOR BASED CONTROLLER** is a standard part of the water cooled scroll chiller equipment. The controller allows numerous set points that can be configured to particular set of values that may be considered within the safe operating range. In case of any breach in any of the set point value the controller will trip the chiller after the fed safety delay period has passed and display it on the LCD display. Besides, during part load operation the controller automatically adjusts the number of compressors that need to be switched ON ensuring power saving.

**AIR-COOLED CHILLER ADVANTAGES :-**

- Lower installed cost
- Quicker availability
- No cooling tower or condenser pumps required
- Less maintenance
- No mechanical room required

**WATER-COOLED CHILLER ADVANTAGES :-**

- Higher efficiency
- Custom selections in larger sizes
- Large tonnage capabilities
- Indoor chiller location
- Longer life

**TESTING:-****A.VISUAL TESTING**

1. Check component layout as per layout drawing
2. Check for proper fitment of all component, there should not be any loose fitments.
3. Check all switchgear ratings (i.e. CONTACTOR, MCB, SFU, FUSE LINKS etc.) as per legends given by BSL .
4. Check proper fitment of controller if it is SAMCON controller. In case of CAREL controller check fitment of DIN Rail channel.
5. Check all wire connection by hand pulling, and also check all connections as per wiring diagram.
6. Check all harness i.e. POWER HARNESS as well as CONTROL HARNESS with reference to harness chart given by BSL
7. Check powder coating of fabrication and its shade which should be FCBS LIGHT GRAY for all Scroll Chillers.

**B.FUNCTIONAL CHECK**

1. Connect all cable harness to the testing jig made for Scroll i.e. compressor 1,2,3.....etc
2. Connect supply R,Y,B,N to the SFU or INCOMER.
3. Short all HP/LP switch wires with 12 V.
4. Connect current source wire through CT and set current of source as per compressor model.

**TESTING**

1. Switch on 3 phase power supply from testing jig.
2. Set Max and Min current for panel as per compressor ratings given by BSL for different models of scroll chillers
3. Check CCH Output, it should be in ON state when compressor contactor is in OFF state
4. After setting of current, contactor will start in approx 180 Sec., there will be delay of 10 Sec for starting of next compressor after previous compressor.
5. Check Compressor output with help of SPPR for false phasing and phase failure.
6. Check Fan output with help of SPPR ( In case of Air Cool Models).
7. Remove one phase other than R phase to check SPPR fault.
8. Remove CT wire of each compressor one by one to check under load fault.
9. Remove all shorting link connected to HP/LP switch wire one by one to check HP/LP fault. Reconnect shorting link and reset faults.
10. After reset, compressor will be start in approx 180 Sec in FIFO manner , i.e. compressor that trips first will start first after clearing.
11. Prepare final check list which has to be given to customer.

**C. PREDISPATCH INSPECTION**

1. Check for all component stickering and for model name of respective panel.
2. Check powder coating of fabrication whether it is damaged during assembly or not.
3. Check that correct wiring diagram to be pasted on panel doors.
4. Check logo plate hole on the panel it should be 4mm.
5. After assurance of above points paste Quality Pass sticker along with serial no. sticker on the door from inside where wiring diagram is pasted.

**CONCLUSION :**

We are focus mainly on assembly process of various types of control panels which include the different panel sections with filter, fan, MCB (Miniature Circuit Breaker), MPCB (Motor Protection Circuit Breaker) contactor, SFU (Switch Fuse Unit), fuse, chiller after that assembly of scroll chiller material, cutting, and testing also the part of manufacturing process. Their respective applications not only in industrial but Commercial / Industrial Air-conditioning, Window / Split Air conditioners, Refrigeration Systems, mall.

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