

SWITCH-GEAR

An Indispensable Component of the
Power Automation Industry

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With automation gradually taking over industries like manufacturing, construction, gas and water supply and mining, the power sector hasn't been left behind. Adoption of equipments like switch-gear is just a part of it. With the India's demand for power likely to soar from the present 120 GW at present to 315-335 GW by the year 2017, the need to have such equipments is definitely going to be on a high.

So, what exactly are switch-gears?

Switch-gears are electrical

equipments that have the ability of regulating the flow of electricity within an electrical system. The entire set-up comprises of a combination of electrical disconnect switches, circuit breakers or fuses which are extensively used to control, protect or even isolate electrical equipments. The switch-gear industry comprises of equipments like contractors, switching relays and protection relays and push buttons which have found extensive usage in motor controls. The most common type of switchgears is however fuses or circuit breakers which have the ability of interrupting the flow of electricity to a particular circuit when it's current become too high.

Switchgears are basically categorized according to their interruption technology, which is the technique by which it extinguishes its electrical arc. There are five types of switchgears available in the market today. These are:

- » Oil circuit breaks
- » Gas breaks
- » Vacuum breaks
- » Air breaks
- » Hybrid breaks

Oil circuit breaks : Mineral oil is used here because it has better insulating property. In the Oil circuit breaker the fixed and the moving contact are immersed inside the insulating oil. Whenever a difference is noticed in the current carrying contacts in the oil, an arc is initialized while contact is separated and as a result of the formation of this arc oil is vaporized and decomposed in hydrogen gas mostly and finally creates hydrogen bubble around the arc. The highly compressed hydrogen bubble formed around the arc prevents re-striking of the arc once the current reaches zero crossing of the cycle. This is in fact one of the oldest forms of circuit breakers.

Gas breakers : This type of circuit breaker uses Sulfur Hexafluoride (SF6) as one of the current carrying contacts. SF6 is commonly used as excellent gaseous dielectric for high voltage power applications. It has found extensive applications in high voltage circuit breakers and various other switchgears available and employed by the power industry. Due to the gas's high electro-negativity, it can absorb free electron. The electron attachment is done in the following ways:

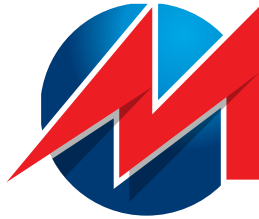


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➤ Installation of switchgear enclosure

1. $SF_6 + e = SF_6^-$
2. $SF_6 + e = SF_5^- + F$

The negative ions thus released are much heavier than the free electron. As a result, the overall mobility of the charged particle in the SF_6 gas is lesser compared to other common gases. Obviously the mobility of the charged particle is responsible for conducting current through the gas.

Vacuum breaks : Vacuum breaks extinguish their comparatively small arcs by stretching them. These circuit breakers have minimum arcing characteristics due to which the arc quenches whenever it is stretched by even the smallest amount. Somewhere near the zero current the arc is not hot enough to maintain plasma and the flow of current ceases. Such circuit breakers are widely used in medium voltage switchgears. Unlike other switchgears these are not really useful for DC faults.

Air breaks : Air break switchgears use air as insulation medium. The basic principle

behind such switchgears is that the heat generated by the arc is used to extend the length of it until it becomes too long to be maintained.

There is yet another variant to such switchgear which is air blast. Like air break air blast uses air as insulating material but under this system switchgear compressed air is used for blasting the arc causing it to extend and extinguish.

Hybrid breaks : The last but not the least, hybrid breaks use more than one type of breaking technology to extinguish the arc. The equipments used may vary from gas to air.

Switchgears can also be segmented according to their power carrying ability. The specific segments are:

- » High Voltage (HV) switchgear
- » Medium Voltage (MV) switchgear
- » Low Voltage (LV) switchgear

Industry overview

The switchgear industry in India is

responsible for manufacturing the widest range of circuit breakers from minimum oil, bulk oil, air blast and vacuum to SF_6 according to the industry specifications.

Secondary equipments related to the industry including relays and control gears used for different types of fault protection, have also made significant development due to advancement in fields of electronics. Digital relays are being used today to replace the conventional relays which are direct results of technology advancement, reliability and compact size. The recent pattern has shown that in addition to controlling and protecting power, switchgears are also becoming important for signaling and monitoring. While monitoring helps to predict the fault conditions, signaling helps to know about the status of switchgear at various locations.

Current industry trends

The electrical equipment industry in India consists of both large and small players who are well equipped in supplying and exporting a wide range of electrical equipments including switchgear and controlgear items. During the 2010-11 quarter the switchgear industry had grown by about 21 percent in terms of volume, rising to about INR 12,000 crore.

In terms of technology adoption however, the switchgear industry has been pretty slow, but as the automation industry has moved on, new concepts such as soft starters, intelligent relays, compact intelligence switchgear and energy efficient switchgears have been brought in. The primary technology factors that are being given optimal importance are safety, efficiency, reliability and optimization.

Market reports suggest that growing investment in the industrial sector, particularly the manufacturing sector bodes well for the switchgear industry.

Moreover, with the country concentrating on consistent power supply, the availability of such electrical equipments like switchgears is definitely going to be important. The Indian switchgear industry has also been benefitting from the nation-wide electrification of vil-

lages via centrally governed schemes like R-APDRP and RGGVY.

Reports are clear indicators of the growth that the industry has been witnessing. The rate of growth on a year-on-year basis is approximately around 3 percent and the market figures would be somewhere around INR 20,000 crore per annum within the next few years. Frost and Sullivan research report suggests the switchgear market revenue to reach around USD 1,735 million with the LV and MV switchgear market revenue expected to grow at a CAGR of 12.5 percent and 11.8 percent, respectively, within 2010 and 2017.

Major players

The key players dominating the Indian switchgear market include the likes of Larsen & Toubro Ltd, Siemens AG, Aрева SA and Schneider Electric SA, Crompton Greaves Ltd, Havells India Ltd, General Electric Co, HPL Group, BCH Electric Ltd, C&S Electric Ltd, Bharat Electrical Ltd, and



Jyothi Ltd, among others.

Hurdles for growth

The MV and HV segments of the switchgear industry are presently suffering from overcapacity due to lack of orders being received. The inadequacies in

demand can be attributed to facts like insufficient planning by the users and delays in finalizing critical tenders resulting in collating of orders which also create supply-delivery problems. Moreover, most utilities insist on repeated type testing products despite there being no change of design. This creates unnecessary delays adding up to the manufacturing cost. There are also inadequate type-testing laboratories in the country. Lastly the Lowest Quoted Price (L1) procurement systems in utilities, allowing procurement of products at lowest price, create major problems for bringing good quality material into the overall system.

During the first three quarters of FY12, the switchgear and controlgear industry had slid to the red projecting -1 percent growth. Except for Miniature Circuit Breakers (MCB), Earth Leakage Circuit Breaker (ELCB) and Air Circuit Breakers (ACB) all the other categories showed negative growth ranging between three to ten percent. The quarter-on-quarter basis growth is even more alarming.



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► Outdoor Switchgear : 380 kV switchgear on the dam

During Q3 FY12, the industry declined sharply to -6.6 percent growths from a constant growth of 2.5 percent witnessed both during Q1 and Q2 of FY12. The MV switchgear segment has been particular at loss, registering a decline of more than 10 percent while the HV and LV have continued to maintain their status quo.

Moreover, the large scale dependence on the financially weak electrical board has also hampered the growth of the switchgear industry. Other weaknesses affecting growth are:

- » Policy paralysis and lack of proper reforms
- » Macroeconomic challenges restricting the figures related to public and private funding
- » Threats from ever increasing number of unorganized players
- » Low cost of manufactured equipments and bad quality imports
- » Lack of proper investment in R&D and innovation
- » Problems regarding introduction and integration of new technologies for the development of new products in the sector

The plans of power sector expansion have worked wonders for the Indian switchgear industry. Both HV and LV switchgears are being used extensively for application in equipments like A.C. circuit breakers, designed both for indoor and outdoor purposes.

Moreover, the growing focus on the need to have renewable energy as an alternative source for power production has also contributed hugely to switchgear industry. India at present has limited availability of the conventional fossil-fuel based electric power which has helped to highlight the importance of power generated from renewable energy sources, particularly from wind and solar energy. The Jawaharlal Nehru National Solar Mission, launched in January 2010 looked to achieve an installed capacity of 20,000 MW of grid connected solar power by the end of 2022. This growing trend of investing in alternative resources is going to support the expansion of the switchgear market as switchgear products are required for general protection as well as for switching. The Miniature Circuit Breakers and Molded Case Circuit Breakers are going to benefit the most.

Market research reports also suggest

that the increasing replacement demand is acting as an additional source of revenue for the switchgear manufacturers. Renovation and modernization of the existing power plants have been considered as cost effective alternative to setting up new power plants which are meant to reduce power transmission losses. Moreover, a large number of power plants in India need complete overhaul as they have already completed or are about to complete their normal design life. This has naturally resulted in the replacement of the existing electrical equipments such as switchgears and transformers which have additionally contributed to the growth of the switchgear market. The government has also adopted various replacement and retrofitting programs which include Renovation, Modernization and Life Expansion of Thermal Power Stations and Renovation and Modernization, Life Extension and Updating of Hydro Electric Power Projects which are meant to upgrade the existing power stations, contribution to the growth of the switchgear market in the process.

Therefore, the future prospect of the sector remains quite optimistic. As the Indian electrical equipment manufacturing sector grows, the switchgear market is bound to follow the lead ■



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Opportunities