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Extract from ENERGY FROM NATURE

The Basics of Extra Low Voltage Wiring

Many people living in rural areas will have discovered the high cost of connecting to the power grid. The only affordable option for you may be to have your own stand-alone power supply. Petrol and diesel generators may be seen as an immediate solution. But, per kilowatt hour of power, they are a more expensive way to meet your power requirements than being connected to the power grid.

In this kind of situation a Solar Electric power system becomes quite price competitive. The major costs of such a power system are primarily the capital expenses (ie purchase price of solar panels, batteries, wire, fittings etc.). One advantage with low voltage systems such as a 12 volt or 24 volt system is that it is considered not to be dangerous and hence a licensed electrician is not required.

If the walls of your house are not already lined, it makes good sense to design and install your electrical wiring before the walls are finished to avoid problems later on and unsightly wires being visible. Make sure the walls are vermin proof and cables are protected inside conduit as rats chewing through insulation can cause serious problems. Attempt to plan for future expansion of your electrical system by using a larger size of wire where necessary and allowing for extra connections in accessible areas.

Choose Correct Cable Size

On the previous page we have a very basic circuit diagram for a typical small home. We must stress the importance of using significantly larger wire than would be used in an equivalent 240 volt situation. With 12 volt wiring, the voltage drop resulting from resistance losses is comparatively twenty times higher than with 240 volt wiring. The voltage drop is much the same regardless of voltage, but a 2 volt drop at the appliance end of a 240 volt lead is quite insignificant (0.83%), whereas a 2 volt drop in a 12 volt situation is quite significant (16.67%).

The size of the wire should be increased when either the distance or the amps is increased. It is also important to make good solid connections everywhere and to guard against corrosion. The corroded surface on a strand of wire has an electrical resistance which could cause havoc in a low voltage installation.

Cable Connections

In an extra low voltage installation (eg 12V or 24V) it can save you against future corrosion problems by smearing some petroleum jelly on multi-stranded wire whenever the insulation is stripped back and slipping a snugly fitting cable end terminal (see page 45) over it before inserting it into a screw connection. You may now fasten the wire into screw connectors (in active and neutral links*, switches, power points etc.). Tighten the screw down, and be assured that you have adequate protection against corrosion.

Soldering

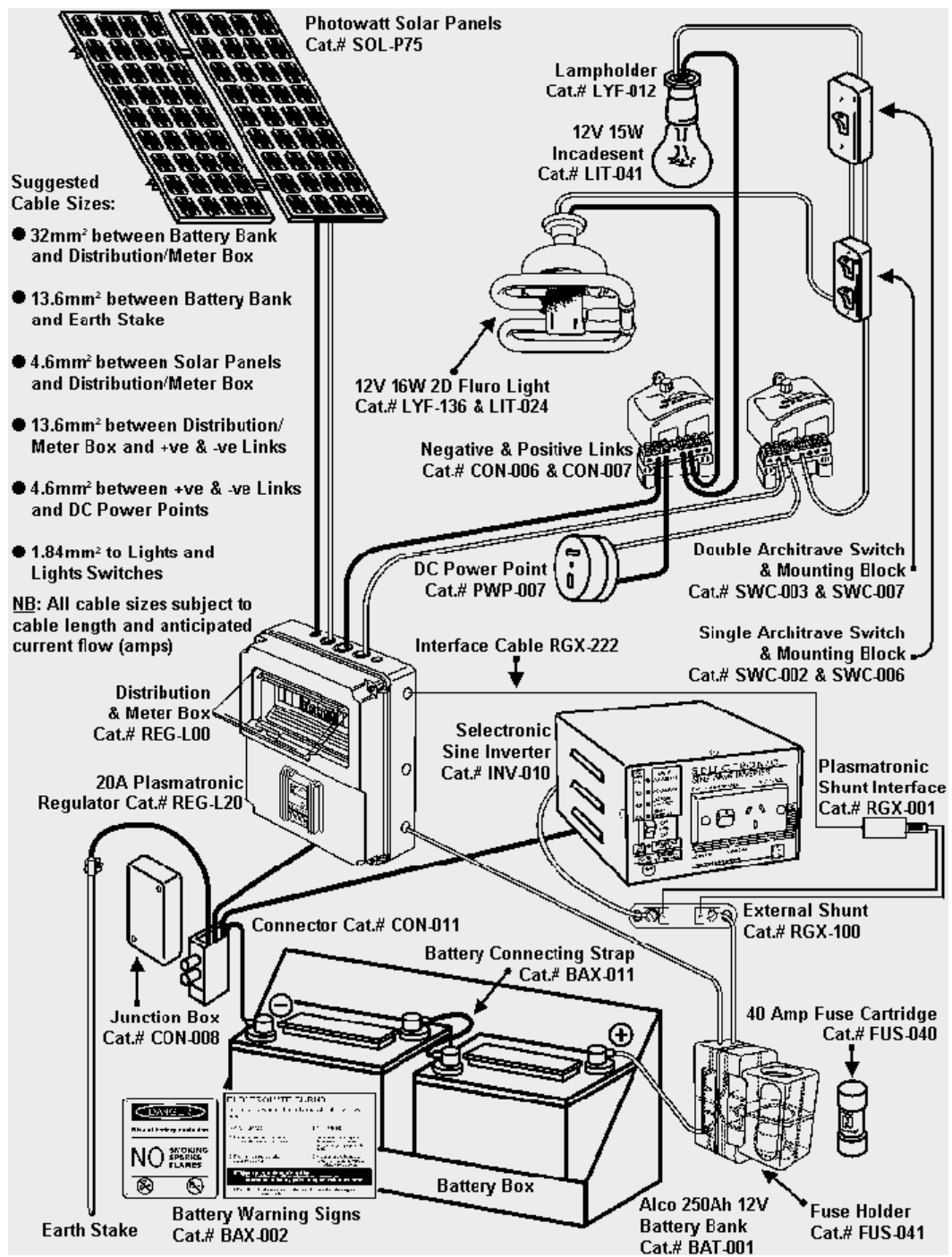
Where cables do not go into screw connections (eg into cable lugs) they can be soldered. Tarnished metal cannot be soldered. All metal surfaces must be absolutely clean, shiny and untarnished before any soldering is attempted.

Cable lugs can be soldered effectively with the stripped cable inserted by holding it over a gas flame and running the solder into it once its hot enough to melt solder. When a soldering iron is required, it is a good idea to use a soldering iron that can be heated over a clean gas flame and a fairly large tip to retain the heat. The tip must be 'tinned' over an area which is at least equivalent to the cross sectional area of the wire you intend to solder. 'Tinning' is the process of melting solder onto a metal surface so that the two metals bond to each other (ie the solder and the copper). If the tip looks black, flaky or generally dirty it may need to be cleaned up with a file so that a shiny metallic surface is exposed. Once the iron has built up enough heat over a clean flame, the solder should flow onto the tip very easily.

The solder that is normally used for electrical work is resin core solder, which means that it carries a special soldering flux mixture in the centre of the usually wire-like solder. For most of the work that we are going to describe we would recommend 1mm diameter resin core solder, although for some of the larger cables a larger diameter solder may be desirable.

The insulation should be stripped away from the cable cleanly without damaging the wire strands underneath and the wires twisted a little with your fingers. The hot soldering iron is placed against the exposed wire whilst carefully melting the end of the solder against the iron in such a way as to transfer some of the molten solder and the heat of the iron onto the wire. The wire should then acquire enough heat to melt the solder directly. The solder should cover the exposed wire completely so that the separate copper strands are bonded together and the exposed copper surface no longer visible. The solder should flow into the multi-stranded wire so that all the strands are bound together.

If there is any corrosion on the copper, the solder will not take. You may then have to dip the end of the wire into hydrochloric acid in order to clean it so the solder will take. A flat copper surface can be cleaned with a file or sandpaper, but this approach cannot be used with multi-stranded cable. Ideally, the solder should have flowed back into the insulation without having heated it to the point that the insulation has expanded. You may need to put in a lot of practice before you do it well.



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