Building services are an integral component of a building that serves the needs of its occupants. A building will not function effectively without well designed and properly installed mechanical and electrical (M&E) services. After commissioning, the building has to provide its services continuously for the life of the building, interspersed by periodical maintenance. The M&E services start to ‘age’ and deteriorate immediately from first use. Such failures or breakdowns can be ameliorated by:

• Proper design and fittings selection
• Proper installation, and
• Proper maintenance

This chapter attempts to illustrate some examples of selection of materials, fittings and accessories that enhance workmanship quality during installation and minimize maintenance issues during operation.

13.1 RECESSED CEMENT BLOCKS FOR EMBEDDING M&E PIPES

Traditionally, solid bricks are used to construct wet areas partition walls. This is to ensure better water tightness. However, as there are a number of services in wet areas like bathrooms and kitchens, the brick walls often need to be hacked to embed the services for aesthetic reasons. This has the following disadvantages:

• A risk of over hacking the wall, which may weaken the structure.
• Hacking is labour intensive.
• Housekeeping is needed to clear the debris.

Fig. 13.1 – Hacking brick walls weakens the wall structure and is labour intensive.
An alternative to brick walls is to use concrete masonry blocks with recessed profiles. Masonry blocks are made of cement, water and aggregates such as sand, gravel or crushed stones. Two types are commonly available viz. cement brick (solid type) and hollow blocks. They are used to construct partition walls and are designed in modular shapes to ease the installation work. Solid cement bricks are preferred for use in wet areas.

13.2 CONCEALED FLOOR GRATING METHOD

A floor trap collects water or liquids discharged from a higher to lower level via gravity flow. The water collected is then discharged through the piping system. Traditionally, a pipe sleeve which forms part of the floor trap, is cast together with the slab concrete. A grating is then installed at the final stage after waterproofing, screeding and tiling on the concrete slab are completed. Generally, the gratings have 5mm perforations to allow water to discharge. This design often leads to tarnishing or discoloration of gratings due to regular contacts with water, perforation blockage due to trapped hair and wear of hinges when it is often lifted up for maintenance purpose. From the aesthetic point, the metal or plastic finish of the grating may not blend with surrounding floor finishes such as marble or tile.

Fig. 13.4 – A typical 100 mm floor trap sleeve cast together with concrete slab.

Fig. 13.5 – Tarnishing and blockage of grating are common after use.
To circumvent these issues, one method is to lay the same floor finish material (tile or stone) onto a stainless steel grating tray, which is then placed on top of the perforated grating insert. The top tray hides the grating perforation and yet allows water to be discharged through the 5mm gap between the tray and insert. This design also does not employ hinges that usually wear off or break over time. The cost of this method is higher than the conventional installation and one will have to weigh the benefits before deciding to employ this method.

The advantages of this design include:
- No sharp or protruding edges.
- No hinge mechanism.
- Accommodates other common inserts like mosquito or cockroach traps.
- Aesthetically pleasing, as it blends with the surrounding floor finish.

However, when using this method, consideration should be given to the design of the gradient or fall leading to the floor trap. If it is too steep, water will quickly rush down to a drainpipe and leave some solids next to the grating rather than carrying them along. This will result in a build up of solids over time and may cause blockage, if they are not removed periodically.
13.3 PPR-C (POLYPROPYLENE RANDOM COPOLYMER) PIPES

PPR-C pipes, an alternative to conventional metal pipes, are used mainly for interior water distribution systems in buildings and other services. The most significant feature of this non-metal pipe is that it can be used in hot water systems apart from sanitary work installations.

**Background and key features**

The raw material of PPR-C is thermoplastic resin which comes in pre-coloured granules. The raw material together with other components are heated which plasticizes the mixture and then extruded to form the finished product. The key attributes of PPR-C pipes are as follows:

- It can be used for potable hot and cold water supply as well as floor heating systems.
- It is corrosion resistant and scale free such that blockage due to water scales and yellow stains on water can be avoided.
- It has heat insulating properties when the pipes are utilized for hot water systems.
- The pressure resisting test strength is over 5 Mpa (50 kg/cm²) and it has good ductility and impact resistance.
- The joints and connections are done by hot-fusion method. Hence installation works can be finished quickly.
- PPR-C pipes can also be connected to other metallic materials by flange or metal adaptor.

Fig. 13.10 – Fusion welding expedites connection process.

Fig. 13.11 – Prefabricated fittings facilitate neat and tidy connections.

Fig. 13.12 – Possible to connect with dissimilar materials by flanges or adapters.
Limitations and considerations in PPR-C pipes

- Although fusion welding for PPR-C pipes is faster than conventional welding method, this requires skilled installers trained in using this material.

- Currently PPR-C pipes cost as much as metal pipes. However, if more connections and bends are required, there will be an additional cost implication on the supplementary fittings.

- Although PPR-C pipes can be used in hot applications, its use will also need to comply with high temperature test requirements imposed by local regulatory bodies (e.g. PUB) for all non-metallic materials intended for use in hot water applications.

- PPR-C pipes are intended for use primarily in sheltered environment. It is not advised for use where the pipes and fittings are exposed to sun light.

- For isolated hot installations, it may not be necessary to provide insulation as the thermal conductivity of PPR pipe is lower compared to metal pipes. However for centralized heating systems, to prevent heat loss and isolate the pipeline from other utilities, it may be appropriate to provide insulation.

13.4 END-CAPPING FOR FITTINGS & ACCESSORIES

The supply and discharge pipes leading to or from sanitary fittings are often embedded for aesthetic reasons. At the connection to the outlet fittings, the substrates such as plastered walls, tiles or boards have to be cut to allow pipe entry or egress. This has to be done manually and is often time consuming, particularly in large projects where there are many such fittings. Moreover, when the cutting and filling are not carried out properly, it often leaves untidy and unsightly marks which mar the general appearance of the wall or floor surfaces.

Fig. 13.13 – Examples of untidy pipe protrusions from tiled surfaces.

Fig. 13.14 – Untidy water supply inlets through vanity cabinet.
This untidiness can be overcome by choosing fittings and accessories with proper end capping. Permanent end caps are often part of the accessories. However, in cases where it is not part of the standard accessories, it is possible to use some other universal caps that match the fittings.

![Fig. 13.15 – Permanent end caps for bottle trap and supply pipes conceal untidy work.](image1)

![Fig. 13.16 – Rubber based universal end cap for sanitary discharge pipe.](image2)

### 13.5 CLIP-TYPE ELECTRICAL SOCKETS

Electrical boxes also known as “knock out” or “KO” boxes serve as end or transition points for electrical wires, which are often run in embedded conduits. Outlet points, such as light switches, TV switches, heater sockets, etc are connected to the KO boxes and allow end-users to access and operate the services. However, there are some issues that are likely to be encountered during construction:

- When the KO box level sinks below or protrudes from the wall level due to differences in the plastering thickness or other reasons, it requires modification to the box. This involves hacking and touching up around the boxes and often leaves a messy and untidy finish.

- Typically, a socket (also called face plate) is connected to the KO box (which is embedded in the wall) by screws. If the wall level is not flat, inconsistent gaps can be observed between the face plate and the wall.

- In typical construction sequence, sockets are usually installed before the final coat of wall paint so as not to disturb the finished surface. Consequently, they have a high possibility of getting stained if they are not protected properly.

![Fig. 13.17 – Adjusting position (after plastering and painting) leads to unpleasant consequences.](image3)
These issues can be eliminated by using clip-socket method which has three stages in installation instead of two i.e. installation of KO box, base plate and the final socket. In this method, the base plate is installed on the KO box before wall painting. Thus, if there is any undulation discovered on the plastered surface, it can be levelled with putty or other materials before fixing the face plate. As a better level surface can be achieved on the wall, gaps between the face plate and wall if it does occur are often slight and do not require filling with materials like silicone sealant.

Moreover, the final socket can be clipped on to the base plate before testing and commissioning or handing over. This reduces the chances of it being damaged by other trades. The cost of this method is higher than the conventional method of installation but consideration should be given to the better workmanship quality that can be achieved.
13.6 SUMMARY
Each type of fitting and method of construction has its own merits and limitations. The choice should be based on its function that meets end-users requirements. At the same time, other factors like regulatory requirements, integration with other trades and maintainability during use should also be considered. It is highly recommended that product specialists be consulted to determine a product’s suitability before use.