

# Endoscopy Center Construction: From Layout Design to Installation

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## Abstract

Endoscopy center is a layout mode of general hospitals in order to promote the coordinated development of various disciplines and coordinate the allocation of medical resources. The design and equipment installation of the endoscopy center area is a difficult point in the construction of the new hospital, because the endoscopy center comprises numerous functional zones, necessitating stringent infection control measures, houses a diverse array of medical equipment, and the installation requirements for some equipment are quite stringent. Taking the endoscopy center under new construction in our hospital as an example, this paper introduces in detail the key links of its layout design, construction coordination and equipment installation.

## Keywords

Endoscopy center; Medical equipment; Layout design.

## 1. Introduction

In 2020, the Endoscopy Center of Longwan Hospital of our hospital was opened. The Endoscopy Center of Longwan Hospital is located on the north side of the 3rd floor of the medical technology building, with a total area of about 2100 square meters. It is divided into five areas [1] : office area, waiting area, diagnosis and treatment area, cleaning and disinfection area, and anesthesia and recovery area. In the diagnosis and treatment area, there are 13 gastrointestinal endoscopy rooms, 3 endoscopic mucosal resection and stripping operating rooms, 1 VIP endoscopy room, 1 capsule endoscopy room, 2 hepatobiliary radiography rooms, 2 fiber-optic bronchoscopy rooms, 2 obstetrics and gynecology intervention rooms, 4 instrument decontamination rooms and 3 storage and distribution corridors [2] .

Considering the convenience of patients' visits and their need for humanistic care, the treatment process [3] of the endoscopy center in our hospital is as follows: patients wait for treatment → consult a physician according to the number → preoperative examination and anesthesia on demand → enter the treatment room for an endoscopy → postoperative resuscitation and rest → discharge. In order to ensure the smooth progress of endoscopy, the endoscopy center is equipped with crane tower, high-definition endoscopy system, anesthesia machine, monitor, APC instrument, X-ray machine for ERCP, water treatment system, automatic endoscopy cleaning machine, endoscopy cleaning workstation, ultrasonic cleaning machine and other equipment.

Table 1: Equipment List of Endoscopy Center

| The procurement of equipment during the design phase |                     | Quantity | The final brand |
|------------------------------------------------------|---------------------|----------|-----------------|
| Crane tower                                          | have been purchased | 20 sets  | Draeger         |

|                                           |                     |                                                                                                                                                           |                                       |
|-------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Full-automatic endoscope cleaning machine | to be purchased     | 10 sets will be installed at the time of opening, additionally, considering the needs of future development, it is necessary to reserve an extra 12 sets. | 7 sets of Medivators, 3 sets of JiHao |
| Endoscopic cleaning workstation           | to be purchased     | 4 sets                                                                                                                                                    | HUAXI                                 |
| Ultrasonic cleaning machine               | to be purchased     | 3 sets                                                                                                                                                    | Hefei Jinnick                         |
| C-arm machine for ERCP                    | to be purchased     | 1 set                                                                                                                                                     | SIEMENS                               |
| X-ray machine for ERCP                    | to be purchased     | 1 set                                                                                                                                                     | SIEMENS                               |
| Water treatment system                    | to be purchased     | 1 set                                                                                                                                                     | MALL                                  |
| Endoscopic system                         | to be purchased     | 8 sets                                                                                                                                                    | Olympus                               |
| Anesthesia machine                        | /                   | Moved from the old hospital area.the quantity is several.                                                                                                 | /                                     |
| Monitor                                   | have been purchased | Several                                                                                                                                                   | Mindray                               |
| APC instrument                            | to be purchased     | 6 sets                                                                                                                                                    | ERBE                                  |
| Hybrid knife flex                         | to be purchased     | 1 set                                                                                                                                                     | ERBE                                  |

## 2. Layout design stage

The crane tower equipment of the Endoscopy Center of Longwan Hospital has been purchased in 2019. After the signing of the equipment contract, according to the plane drawings given by the construction management department, the medical engineering department invited the equipment manufacturer and the head nurse of the endoscopy center to jointly determine the crane tower layout. Other equipment has not been purchased at the time of layout design, such as automatic endoscope cleaning machine, endoscope cleaning workstation, and X-ray machine for ERCP. See Table 1 for details. For this part of equipment, as the final manufacturer has not been determined, it is necessary to invite multiple manufacturers participating in the project to conduct on-site survey , combine the clinical needs, patients' demands for humanistic care, and the design experience of professional manufacturers, form written materials and design and construction drawings, and communicate with the infection management department, construction management department and other relevant departments to make the needs substantive and concrete [4] .

After the layout is confirmed, ask the equipment manufacturers for the installation site requirements, and sort out and summarize the equipment installation requirements. Due to different equipment manufacturers, the installation requirements also involve various aspects. See Table 2 for details. For the same kind of equipment, since the final manufacturer has not been determined and the construction is imminent, in order to ensure the normal operation of the equipment as far as possible, the medical engineering department shall summarize the installation requirements of each company, and the highest (most stringent) requirements shall prevail.

Table 2: Equipment installation requirements

|                                                |                                                                                                                                                                                                                                                                           |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Crane tower                                    | Consider the equipment layout, the number of power sockets, network ports, air sources and negative pressure interfaces of the tower body. Flange shall be installed before ceiling construction.                                                                         |
| Full-automatic endoscope cleaning machine      | Consider power supply (distinguish between 10 A and 16 A), network port, cold water, pure water and drainage. Some brands also require a ground terminal. The floor drain shall be set in the cleaning and disinfection room.                                             |
| Endoscopic cleaning workstation                | Consider power supply (distinguish between 10 A and 16 A), network port, cold water, pure water, hot water and drainage shall be considered. Some brands also require a ground terminal. The floor drain shall be set in the cleaning and disinfection room.              |
| Ultrasonic cleaning machine                    | Consider power supply (distinguish between 10 A and 16 A), cold water, drainage                                                                                                                                                                                           |
| C-arm machine for ERCP                         | It is necessary to consider equipment layout (coordination with crane tower and film bed), power supply (distinguish between 10 A and 16 A), and third-party equipment, including monitors and anesthesia machines.                                                       |
| X-ray machine for ERCP                         | Equipment layout (coordination with crane tower), distribution box, ground bearing, cable trench (bridge or wall hole) and access channel shall be considered. In addition, third-party equipment, including monitors and anesthesia machines, should also be considered. |
| Water treatment system                         | It is necessary to consider ground bearing, equipment layout, access road, power supply (generally 380V), cold water, drainage, pure water supply interface, pure water return interface and grounding terminal. The room also needs to consider the floor drain.         |
| Endoscopic system, anesthesia machine, monitor | Consider the power supply.                                                                                                                                                                                                                                                |
| APC instrument, Hybrid knife flex              | Considering the power supply, it is recommended that the power supply should be independent and not share the same power supply with the endoscope system, so as to avoid interfering with the operation of the endoscope system.                                         |

The layout of the endoscope center area is shown in Figure 1, which shows the layout scheme [5] of the cleaning disinfect equipment in the endoscope center, and designs the transportation

direction [6/7] of the clean endoscope (green arrow in the figure) and the transportation direction of the contaminated endoscope (red arrow in the figure) . The whole endoscope center is arranged in a rectangular shape, and there are 4 rows of endoscope consulting rooms. Horizontally, there are 2 clean endoscope corridors and 3 polluted endoscope corridors. According to the layout determined in Figure 1, Figure 2 shows the installation location requirements of each equipment in the main cleaning and disinfection room, including power socket (marked with 10 A or 16 A), hot water, cold water, pure water, grounding terminal, network port, air supply and drainage pipeline.

The installation requirements of the water treatment system are shown in Figure 3. It is worth mentioning that the water treatment system room was not considered in the initial design, and the floor structure of the endoscope center could not meet the weight of the water treatment system (its volume is 1500L and its pure water production capacity is 3000L/hour), so after repeated discussions, the water treatment system was placed in the -1 floor area.

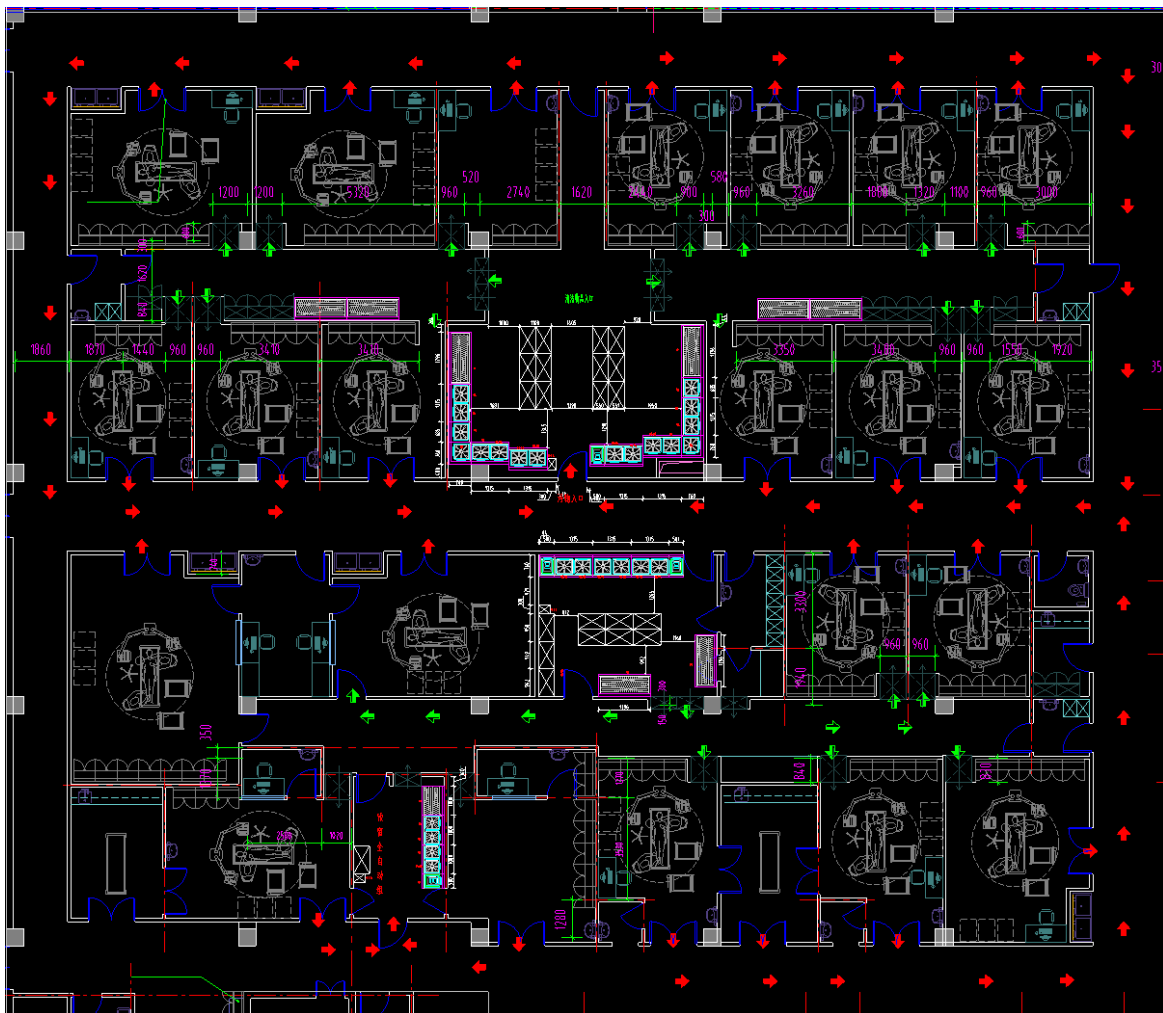


Figure 1:Layout of Endoscope Center

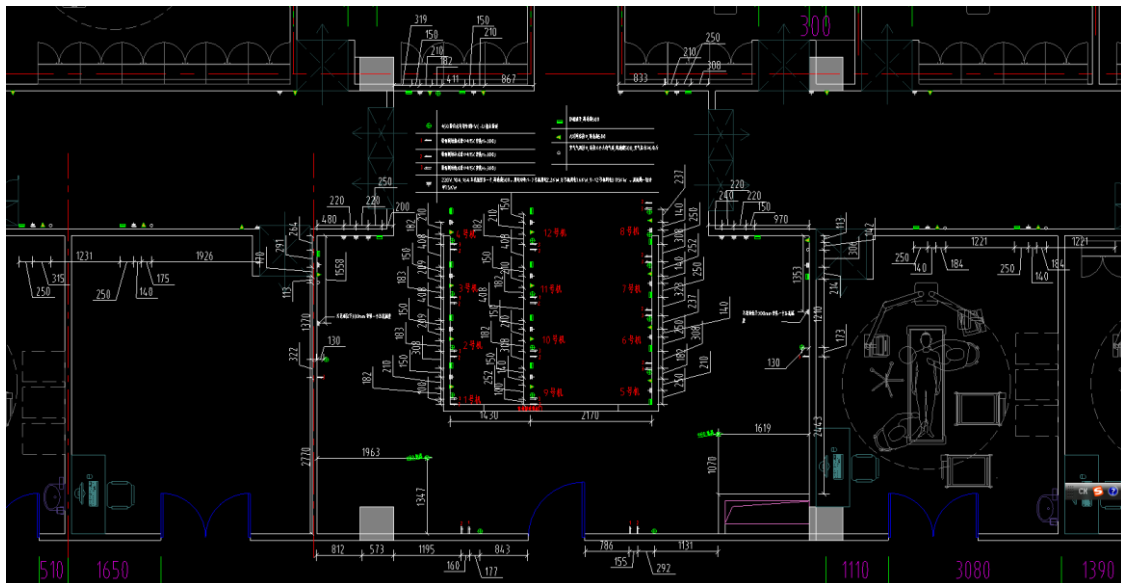


Figure 2:Location Diagram of Installation Requirements of Cleaning and Disinfection Room

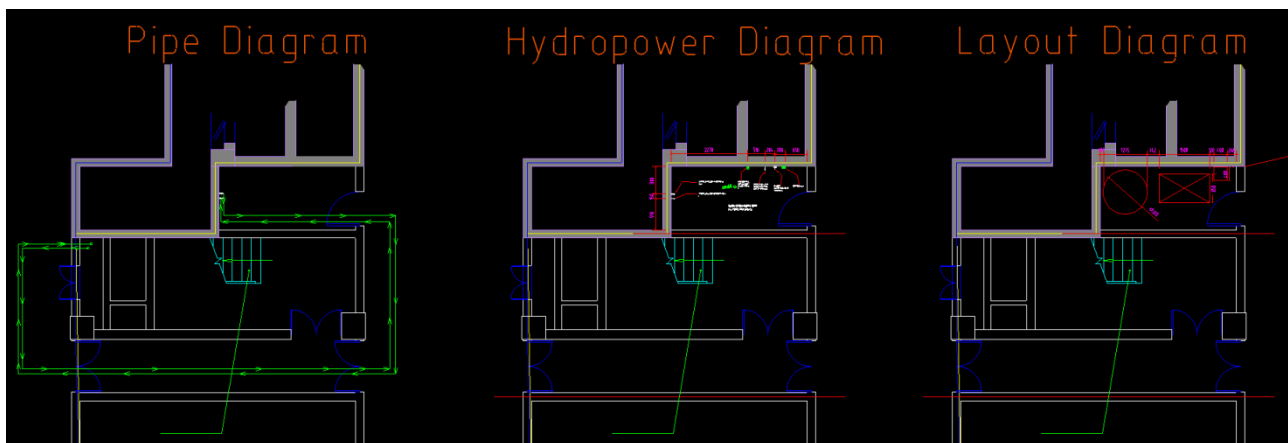


Figure 3:Diagram of Installation Requirements for Water Treatment System

The tower layout of the endoscope center is shown in Figure 4. Due to the late bidding of C-arm machine for ERCP and X-ray machine for ERCP, after comprehensive consideration of the mainstream products on the market and in combination with the actual situation of the site, two groups of floor crossing holes are designed in the two ERCP rooms, which are crossed from the two machine rooms to the control room, as shown in Figure 5.

After the procurement of ERCP C-arm machine and ERCP X-ray machine [8-9] is completed, since the ERCP X-ray machine is fixed on the floor of the machine room and is heavy (about 2000 Kg), there are high requirements for the distribution box, ground bearing, ground levelness and cable routing, so it is necessary to further deepen the construction drawings and check the site conditions to ensure that the equipment can be installed smoothly. Figure 6 shows the layout and site requirements of the X-ray machine for ERCP.

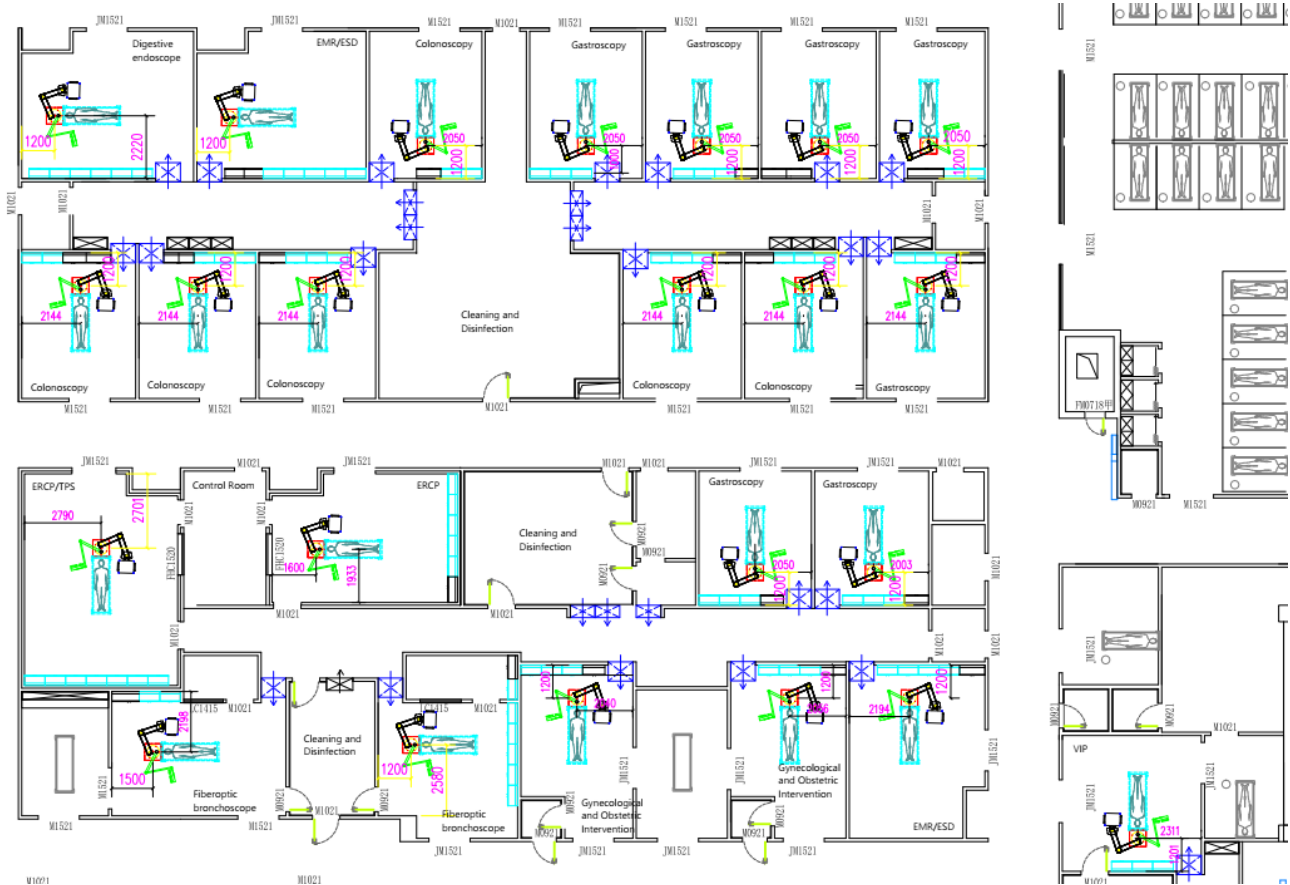


Figure 4:Layout of Endoscope Center Tower

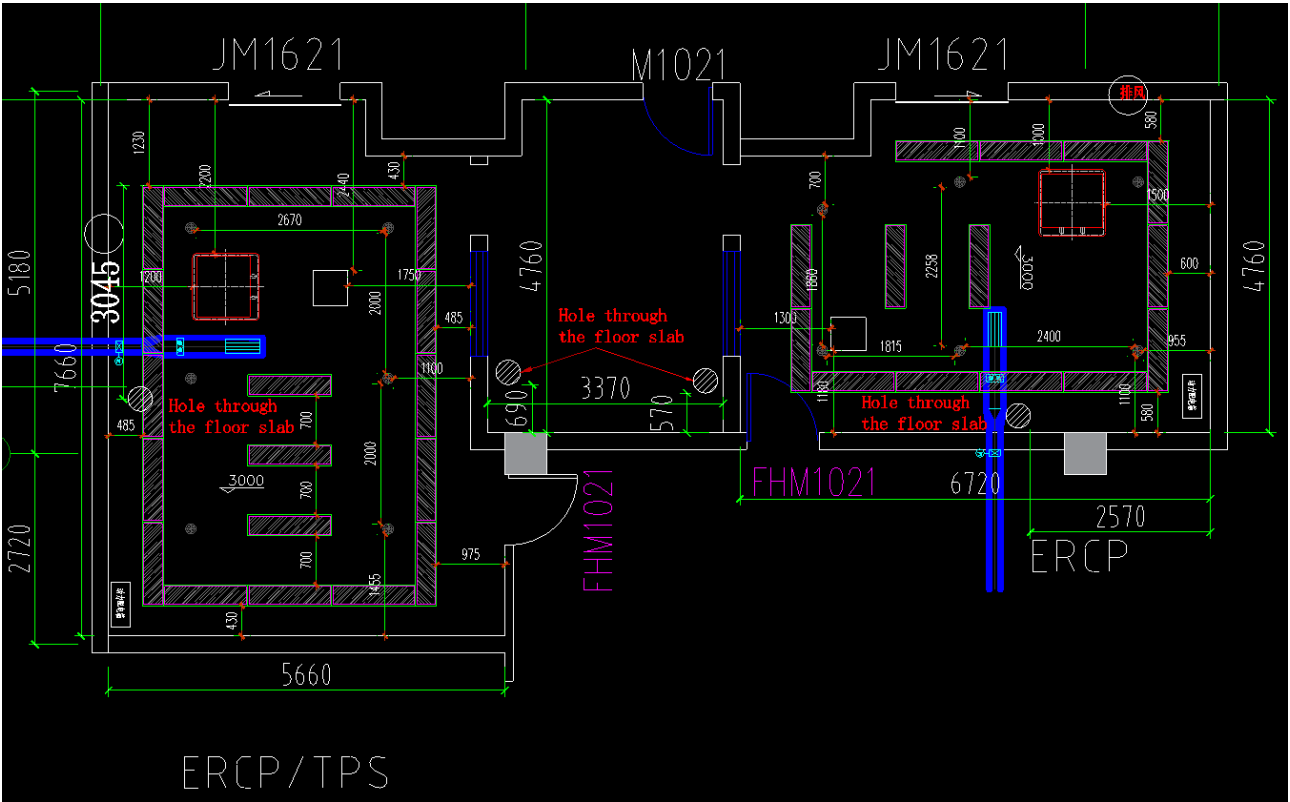


Figure 5: Scheme of floor penetration in ERCP room

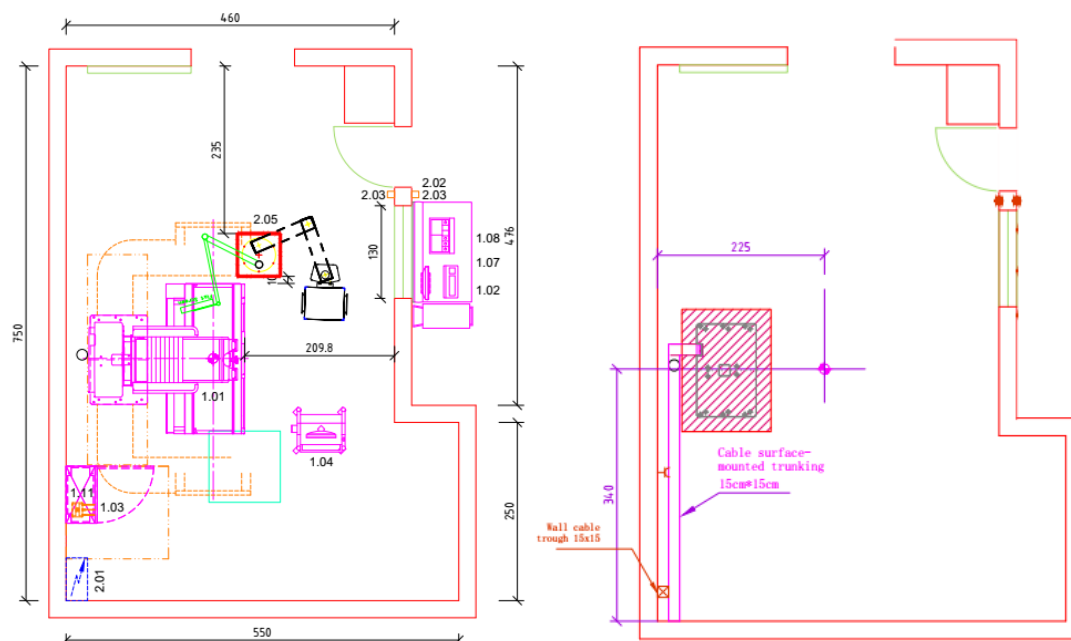


Figure 6: Layout and Site Requirements of X-ray Machine for ERCP

### 3. Construction stage

The construction part shall be completed by the construction party under the guidance of the construction management department. As the medical engineering department, regularly survey the site to understand the progress, compare the current situation of the machine room with the design drawings, ensure that the construction is carried out in accordance with the design drawings, if the construction cannot be carried out in accordance with the drawings due to objective factors, communicate with the equipment manufacturers in time, actively coordinate the solution and continue to follow up, and promote the use of departments (endoscopy center), equipment manufacturers, construction management department.

### 4. Arrival and installation

Due to the different weight and installation requirements of each equipment, the mobilization time of each equipment is also different. Considering the decoration construction, the embedded parts of the crane tower need to enter the site before the ceiling construction. In addition, the mobilization time also needs to consider the demand for other equipment, such as the water treatment system, from the construction point of view, it can be mobilized after the construction is basically completed, but the automatic endoscope cleaning machine and the endoscope cleaning workstation need pure water, so it needs to be arranged to enter the site earlier. Other equipment can enter the site after the completion of construction and cleaning.

In addition, for the X-ray machine for ERCP, the approach channel shall also be considered. After investigation by engineers of mainstream brands, it is confirmed that it can be carried by elevator.

In the process of equipment installation and commissioning, it is inevitable to encounter various unexpected details. At this time, as the medical engineering department, it should coordinate with the manufacturer, the construction management department and the construction party to solve the problems together with the approval of the user department.

## 5. Conclusion

In the construction of the new hospital, as there are a large number of medical equipment to be installed, and many of them have certain requirements for the installation site, as an engineer of the medical engineering and equipment department, we should intervene in advance and complete the equipment layout design and the summary of equipment installation requirements before the decoration construction [10]. In the construction stage, follow up in time, and feed back and solve in time when it is found to be inconsistent with the drawings. In the construction stage, it is necessary to negotiate with the equipment manufacturer and the construction management department about the time of equipment entering the site, so as to ensure that the construction and entry are not delayed, and to ensure the smooth opening of the hospital.

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