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Construction Mechanical and Electrical Engineering Coordination Management Technology and Its Application in Tibet

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Abstract

The construction coordination management of mechanical and electrical projects runs through the construction preparation stage, construction process stage, completion acceptance and service warranty stage. In order to promote the smooth development of construction tasks, construction is difficult, professional construction teams and cross operations are many, and construction coordination management is more important. The coordination and management technology of construction mechanical and electrical engineering is developed from five aspects: mechanical and electrical general contract management, coordination management with construction general contracting units, coordination management with various professional subcontractors, coordination management of on-site cross-operation, and coordination management with related units Research, and apply the research results to multiple projects in Tibet. The results of the study show that: the management methods of mechanical and electrical general contracting mainly include target management, tracking management, coordination management, pre-control management and system management. In the coordination and cooperation with the construction general contractor, the mechanical and electrical general contractor will focus on the handover of the mechanical and electrical working surface, and assist the general construction contractor to establish the working principles of "machine room priority" and "mechanical and electrical working surface priority" in the project. For projects that adopt the responsibility system of mechanical and electrical general contracting, except for the implementation of projects by the general mechanical and electrical contracting contractor, other professional contracting of mechanical and electrical services are mainly elevators, floodlighting, independent equipment suppliers, municipal supporting contractors, etc. and corresponding coordination and cooperation are required Work. The pipelines and equipment of various mechanical and electrical specialties should be well coordinated in construction, so as to achieve coordination in plane positioning, layered layout and collision and bending.

Keywords

Mechanical and electrical engineering; Coordination management; Construction project; Tibet area.

1. INTRODUCTION

In recent years, with the development of the national economy and the construction industry, compared with traditional ordinary buildings, there are more and more professional systems for modern urban construction projects, and the functional layout is becoming more and more complex and diversified. More and more, such as the coordination between mechanical and electrical general contracting and construction general contracting, refined decoration units,

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supervision, design institutes, owners and government departments, and coordination between various mechanical and electrical units, such as building equipment monitoring systems and air conditioning , heating and ventilation system, water supply and drainage system, strong current and lighting system, weak current system, elevator monitoring interface coordination, fire alarm and linkage system and smoke prevention system, water fire extinguishing system, air conditioning system, electrical system, elevator, etc. Switching, monitoring, interface cooperation of opening and closing control, etc. [1-3]. It is necessary to establish a good coordination and cooperation mechanism among various units and disciplines, so as to avoid rework caused by mismatching construction procedures and construction interfaces, and achieve various construction goals of the project [4,5].

The construction coordination management of electromechanical projects runs through the construction preparation stage, construction process stage, completion acceptance and service warranty stage. In order to promote the smooth progress of construction tasks, construction is difficult, professional construction teams and cross operations are many, and construction coordination management is more important. The coordination and management technology of construction mechanical and electrical engineering includes five aspects: mechanical and electrical general contract management, coordination management with construction general contracting units, coordination management with various professional subcontractors, coordination management of cross-site operations, and coordination management with related units do your research.

Through the analysis of the construction content, construction procedures, construction interface, construction interface and other aspects of the relevant units of the electromechanical general contracting construction, the factors that are restricted and affected by each other are identified, and corresponding organizational and management measures are taken to establish a coordinated communication Mechanism to eliminate various factors that restrict the smooth development of construction, satisfy various functions, and meet the target management requirements of project safety, quality, and progress.

2. MECHANICAL AND ELECTRICAL GENERAL CONTRACT MANAGEMENT TECHNOLOGY

2.1. Mechanical and electrical general contract management method

The management methods of mechanical and electrical general contracting mainly include target management, tracking management, coordination management, pre-control management and system management. Among them, the management system includes quality management system, technical management system, safe and civilized construction management system, progress management system, material equipment management system, document transmission management system, and deepening design management system.

2.2. Mechanical and electrical general contract management plan。

(1) Progress control

According to the total construction period of the project, formulate the mechanical and electrical general contracting construction period plan and phased control node plan, take the general mechanical and electrical engineering progress plan as the main line, and incorporate all professional subcontracting construction schedules into the unified planning system of mechanical and electrical general contracting, and establish a three-dimensional guarantee plan Management system, implement hierarchical plan control system, formulate coordination and management measures for mechanical and electrical general contracting progress plans, including regular engineering meetings, regular inspections, special meetings, construction progress inspections, progress reports and other management methods.

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(2) Technical control

Mainly include: joint review of drawings, design disclosure; technical disclosure; construction organization design and special program preparation and review; technical review; standard specification, procedure management; engineering technical data management, etc.

(3) Quality Control

The main things to be done are: total quality management; electromechanical general contract responsibility system for electromechanical engineering quality; quality disclosure; quality inspection and testing; model quality guidance; quality veto system; Whole-process quality tracking and monitoring; finished product protection; quality assurance deposit.

(4) Safety, environmental protection and civilized construction control

In addition to effective safety and civilized construction management for self-construction projects, mechanical and electrical general contracting. In addition, effective safety management and coordination must be carried out for designated subcontractors and independent construction units. Combined with the actual situation of the project, a series of safe and civilized construction management systems, safety, environmental protection and civilized construction management systems will be formulated, including the responsibility system for safe, environmentally friendly and civilized construction, the special program compilation review system, the special fund guarantee system for safety and civilization, the safety education system, Special operation certification system, safety technology disclosure system, safety activity system, regular inspection and rectification system, safety and civilized reward and punishment and accident reporting system, crisis shutdown system, important process stand-by system, etc.

3. COORDINATED MANAGEMENT TECHNOLOGY WITH CONSTRUCTION GENERAL CONTRACTOR

In the coordination and cooperation with the construction general contractor, the electromechanical general contractor will take the handover of the electromechanical working face as the key coordination content. Assist the general construction contractor to establish the working principle of "machine room priority" and "mechanical and electrical work surface priority" in the project, and actively provide work surfaces for the mechanical and electrical units according to the plan, so as to ensure the timely, orderly and high-quality implementation of the mechanical and electrical construction of the project.

3.1. Participate in the coordination and cooperation of the construction general contractor

The main items that need to be coordinated include layout and site occupancy, temporary water and electricity, vertical transportation of equipment and materials, reserved and pre-embedded structure construction, equipment foundation construction, handover of construction work surface, use of temporary facilities, axis and elevation Provision of control lines, coordination of on-site transportation roads, safe and civilized construction management, preparation and collection of technical archives and data, scheduling of construction progress, entry and exit of equipment and materials, entry and exit of on-site personnel, on-site fire protection, coordination of green building certification Cooperation, equipment joint commissioning, project completion acceptance.

Participate in various coordination meetings organized by the construction general contractor, mainly including regular meetings for deepening design, construction schedule scheduling, comprehensive engineering meetings, safe and civilized construction regular meetings, regular engineering quality meetings, regular construction coordination meetings, joint commissioning

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special meetings, file management special meetings, Engineering technology regular meeting, intermediate handover and acceptance meeting.

4. COORDINATED MANAGEMENT TECHNOLOGY WITH VARIOUS PROFESSIONAL SUBCONTRACTORS

4.1. Coordination and cooperation plan with fine decoration contractors。

The cooperation, coordination and communication measures between the electromechanical general contractor and the decoration unit are as follows:

1 Professional coordinators shall be set up in the organizational structure of the electromechanical general contract, and they shall participate in the necessary coordination meetings of the decoration project in accordance with the requirements of the general construction contract.

2 In the process of deepening the design, the mechanical and electrical general contractor provides the approximate location of the mechanical and electrical terminals and inspection ports. The layout position, the size of the ceiling opening, and the decoration unit will carry out the opening of the ceiling plate to ensure the accuracy of the installation size of this part of the equipment.

3 During the construction process, when the mechanical and electrical general contractor cooperates with the decoration unit, the process arrangement should be done well, and the delivery should be delivered to the decoration unit on the basis of concealed acceptance according to the design, and the elevation and size should be carefully reviewed during construction, and timely reported to the supervisor and the contract developer.

4 During the decoration construction process, the mechanical and electrical general contractor shall do a good job of protecting the decoration products. After the decoration panels are completed, timely measures shall be taken to ensure that no pollution and damage to the decoration surface will be caused.

5 The electromechanical general contractor coordinates the decoration unit to reserve maintenance for the air duct valves, water pipe manual valves, electric valves, pipeline compensation devices, terminal water testing devices, and pipeline inspection ports set up in the electromechanical engineering in the ceiling or decorative panels, port for future property management and maintenance.

4.2. Coordination with curtain wall contractors

The cooperation, coordination and communication measures between the electromechanical general contractor and the curtain wall unit are as follows:

1 Preparatory stage

1) The electromechanical general contractor is responsible for coordinating relevant electromechanical subcontractors to deepen the drawings of floodlighting.

2) A full-time coordinator shall be set up in the organizational structure of the electromechanical general contractor to participate in the necessary coordination meetings for professional subcontracting of curtain walls in accordance with the requirements of the general construction contract. Coordinate matters such as reserved equipment for external walls, material access and exit channels, and perfect connection of curtain wall lightning protection systems.

2 Construction stage

l) Responsible for the pre-embedding of the floodlighting threading pipes related to the curtain wall.

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2) During the construction process, the mechanical and electrical general contractor should do a good job in protection and product protection to prevent the curtain wall project from being damaged by falling objects from high altitudes by itself and the mechanical and electrical subcontractors.

3 Completion acceptance stage

Participate in and guide the collation and filing of lightning protection and grounding materials in curtain wall engineering materials.

4.3. Coordination with the elevator unit。

The cooperation, coordination and communication measures between the electromechanical general contractor and the elevator unit are as follows:

1 Preparatory stage

2 construction stage

Coordinate with relevant mechanical and electrical majors to complete the elevator control and monitoring pipelines according to the schedule, complete the installation of the elevator anti-piston vent muffler, and complete the ventilation and lighting installation of the elevator machine room.

3 Completion acceptance stage

l) Participate in and cooperate with the collation and filing of elevator engineering data.

2) Coordinate and cooperate with the elevator unit testing and completion acceptance, and cooperate with the elevator unit to obtain evidence.

4.4. Coordination and cooperation scheme with other professional subcontractors of electromechanical

For projects that adopt the general contract responsibility system of electromechanical, except that the general contractor of electromechanical implements the project itself, other professional contractors of electromechanical are mainly elevators, floodlighting, independent equipment suppliers (such as window cleaners, hotel kitchen equipment, hotel laundry room equipment, etc.), municipal supporting contractors, etc. , need to do a good job in coordination and cooperation.

5. COORDINATION AND MANAGEMENT TECHNOLOGY FOR ON-SITE CROSS-OPERATION

The cross-construction of mechanical and electrical engineering and other specialties mainly includes: the coordination and cooperation of walkways and large-space pipelines and equipment with the cross-construction of private construction, decoration and decoration, the coordination and cooperation of cross-construction of walkways and large spaces with other mechanical and electrical professional subcontracting and other engineering pipeline installations , the coordination and cooperation between the installation of pipeline wells and ventilation shafts and the cross-construction of civil engineering, decoration and decoration, the coordination and cooperation between the installation of equipment and pipelines in the machine room and the cross-construction of civil engineering, decoration and decoration, the coordination of toilet pipelines and the cross-construction of civil engineering, decoration and decoration Cooperate.

5.1. Coordinate and manage with civil engineering and decoration professional

The focus of the work in the aisle and the large space ceiling is the timely insertion and mutual coordination of each construction process. Before the fine decoration construction, the

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mechanical and electrical majors determine the positioning size and space of the end devices on the ceiling and wall according to their respective construction drawings. Dimensions, together with the fine decoration construction unit, draw the comprehensive arrangement diagram of the terminal appliances, coordinate the reasonable construction process between the electromechanical specialty and the fine decoration construction unit, and the decoration unit is responsible for reserving the holes and inspection ports of the terminal facilities such as air vents.

Before construction, mechanical and electrical majors should concentrate on organizing comprehensive pipeline balance and deepening design, rationally arrange the installation position of pipelines, and reasonably arrange construction procedures. When the mechanical and electrical majors install the air ducts and water pipes, the construction majors should reserve the partition wall of the tube well according to the specific requirements of the mechanical and electrical majors. After the mechanical and electrical installation is completed, the civil engineering major should promptly repair and block the hole and install the door, and at the same time should do a good job in the protection of the finished product.

What needs to be emphasized is that the civil decoration should be completed in advance such as sealing the upper part of the shaft, plastering and scraping the wall, so as to avoid increasing the difficulty of the decoration after the pipeline is installed or not being able to carry out the wall decoration behind the pipeline.

In addition to the temporary holes reserved in the wall for equipment transportation or post-build walls, the masonry, dust and paint construction in the machine room should be completed before the mechanical and electrical construction. During the coating work, the protection of the finished mechanical and electrical engineering products should be done well to prevent the completed heat preservation and paint finishes from being polluted and reduce rework.

Complete the comprehensive layout of the pipelines in the machine room in advance, and complete the installation of large-diameter pipelines above the equipment before the equipment is in place. Mechanical and electrical majors should promptly submit the equipment foundation dimensions and technical data that have been submitted for review and approval to the construction unit for construction; at the same time, review and accept the equipment foundation before the installation of mechanical and electrical equipment to ensure the quality of equipment installation. The hoisting and transportation of electromechanical equipment should fully consider the bearing capacity of the structural floor and the position of the beam and slab.

During the construction of the leveling layer on the civil engineering professional ground, the slope should point to the position of the floor drain, and the slope should be correct, so as not to affect the normal use of the floor drain in the future. During the construction of the civil partition wall, the water supply and drainage professional should be inserted in time, and the pipeline laying in the partition wall should be done well. For the water supply pipes that need to be installed on the floor and shear walls, pipe grooves should be reserved during the structural construction process to avoid artificial drilling.

The gaps in the pipe grooves inside the toilet wall and the floor after the installation of pipes, as well as the gaps around the sleeve pipes, shall be sealed by the civil construction unit. When the bathroom is waterproofed, it is necessary to formulate key operating procedures for the floor drain and casing parts of the water supply and drainage profession to ensure no leakage; at the same time, the water supply and drainage profession should do a good job in the sealing of the casing.

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5.2. Coordinating management with other electromechanical subcontracting projects

The public walkway on each floor has basically become a path pipe gallery where various mechanical and electrical professional pipelines are concentrated. The space is small, the professional pipelines are relatively large, there are many cross operations, and the construction is relatively difficult. Therefore, it must be carefully organized in terms of construction coordination and cooperation. strive to install all professional pipelines in a limited space, layered and side-by-side layout is reasonable, beautiful and straight, and meets the requirements of the code. This is the responsibility of construction coordination and cooperation. In addition to other large space areas in the public walkway, there are also more pipelines and equipment for electromechanical majors, and the space is relatively larger than that of the walkway. However, it also requires good construction coordination and cooperation to create favorable and good construction conditions for the construction of various specialties.

Plane positioning coordination: the plane positioning of the pipeline should pay attention to the direction of the non-pressure pipe; take into account the outer wall and bracket size of the water pipe, the thickness of the insulation layer required for the air-conditioning water pipe and air-conditioning air duct; pay attention to the distance between the electrical bridge, the outer wall of the water pipe, and the air duct of the straight pipe section According to the actual situation, determine the distance from the wall column; pay attention to the spacing required by the specifications between professional pipelines, the construction operation space, and other factors such as the reserved pipeline position and maintenance space.

6. COORDINATION AND MANAGEMENT TECHNOLOGY WITH RELEVANT UNITS

6.1. Coordination with owners

Table 1. Coordination with the owner

Number	Coordination
1	After entering the site, according to the provisions of the construction contract, provide the owner with the required plans for drawings and obtain the drawings. Submit the detailed design drawing plan to the owner, communicate with the owner in detail on the in-depth design work, and actively participate in the design disclosure and joint review of drawings organized by the owner, so as to carry out the deepening design and the timely approval of drawings, and reduce the design in the construction process Changes are beneficial to the owner's investment control.
2	When necessary, communicate with the owner in detail about the adjustment of the construction schedule or construction plan, and obtain the understanding and support of the owner, so as to guide the smooth development of the construction.
3	After entering the site, timely compile the "Equipment and Material Entry Plan", "Equipment and Material Brand Application Form" and submit material samples to the owner for approval, so as to sign the "Equipment and Material Supply and Marketing Contract" with the supplier. The factory manufactures and produces according to Plan to organize equipment and materials to enter the site. When necessary, invite the owner's representative to assess equipment and material suppliers.
4	According to the actual situation of the site and past successful experience, put forward reasonable suggestions to the owner to meet the various requirements of the owner and solve the difficulties existing in the construction.
5	Communicate with the owner in a timely and effective manner regarding the on-site visa and the payment of the project progress payment, and strive to receive the project payment on time, which is conducive to the turnover of project funds and the payment of equipment and materials and workers' wages.
6	In order to ensure the normal operation and maintenance of the equipment system and a high sense of responsibility for after-sales service after the completion acceptance and handover, actively communicate with the owner about the equipment operation training before operation and maintenance during operation.

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Layered layout coordination: first arrange large pipes and non-pressure pipes (such as air pipes, large-diameter chilled water pipes, drain pipes, etc.), and try to avoid or bend other small pipes and pressure pipes. The air pipe is arranged at the top, and the bridge frame and the water pipe are arranged horizontally and separately when they are at the same height. When they are in the same vertical direction, the bridge frame is arranged above and the water pipe is arranged below.

Collision and winding coordination: the cross-bending of pipelines generally follows the principles of "small pipes to large pipes", "pressure pipes to non-pressure pipes", "cold water pipes to hot water pipes", etc., also taking into account the technical requirements of compliance with specifications and convenient construction Principle and cost saving, let the low-cost pipeline bend around the economical principle of the high-cost pipeline.

6.2. Coordination with supervision relationship。

Table 2. Coordination with supervision

Number	Coordination
1	Accept the supervisor's confession and obey the supervision of the supervisory unit.
2	Regularly communicate with the supervisory engineer on the construction progress plan, approval of the construction plan, acceptance of equipment and materials, acceptance of concealed works, and acceptance of sub-sections and subdivisions, so as to facilitate mutual promotion of construction progress, project acceptance, and improve Construction quality and ensuring construction safety and other work.
3	Submit the required programs, plans, reports, etc. to the supervisor in time.
4	During the whole process of construction, the construction and quality, safety and civilized construction management shall be carried out in strict accordance with the construction plan and construction organization design approved by the owner and the supervisor. On the basis of passing the self-inspection of each sub-project, the supervisory engineer is notified in advance to inspect and accept, and the existing problems or partial defects are rectified and re-inspected according to the requirements of the supervisory engineer.
5	All finished products, semi-finished products, equipment, materials, and utensils that enter the site are actively notified to the supervisory engineer for acceptance, timely fill in the material admission and acceptance records, and promptly submit to the supervisory engineer to complete the signing procedures, and actively cooperate with the supervisory engineer to witness and take samples. Materials that need to be re-tested before use according to the regulations, and actively submit the test result report.
6	For the quality of sub-item or process inspection, strictly implement the criterion of "the previous process is unqualified, and the next process will not be constructed". For the possible disagreement of work opinions, follow the "first implement the guidance of the supervisory engineer, and then negotiate and unify In the on-site quality management work, maintaining the authority of the supervision engineer is conducive to the development of the next step.
7	Participate in the regular meeting of supervisory engineers on time, and actively carry out construction work in accordance with the requirements of the regular meeting of supervisory engineers.
8	Communicate with the chief supervisory engineer in a timely and effective manner regarding the on-site visa and the payment of the project progress payment, and strive for the support of the chief supervisory engineer, and receive the project payment on time, which is conducive to the turnover of project funds, as well as the payment of equipment materials and workers' wages pay.

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6.3. Coordination with design units and consultants

Table 3. Coordination with Design Units and Consultants

Number	Coordination
1	Set up a special coordination department to coordinate with design and consultants to solve relevant technical problems in construction.
2	Draw the comprehensive pipeline diagram in time and provide it to the general contractor, and follow up the approval progress of the drawing in time to ensure the on-site construction schedule.
3	Actively participate in the design disclosure, and carry out engineering technical coordination in design and construction.
4	Regularly organize discussions on relevant technical issues, and contact designers and consultants in time to negotiate and resolve them.
5	According to the contract documents, the general contractor shall provide the materials and equipment manufacturers to the consultant in time for approval by the consultant.
6	Actively report the project implementation status to the design and consultants, solicit their opinions and suggestions on the construction process, and effectively implement optimized plans and measures.
7	Ensure the accuracy of materials submitted to design and consulting companies, provide effective basic data for design, consulting company decision-making, and management in a timely manner, and submit various daily, monthly, and quarterly reports on time.
8	On-site measurement data, project monitoring result feedback, working condition calculation data, etc. are submitted to the workers in a timely manner for inspection by professional consulting companies at any time.

7. CONCLUSION

The key technology of coordination and management of construction mechanical and electrical engineering has been successfully applied in many projects in Tibet, and achieved good results, which has been unanimously recognized by supervisors and owners. The technical summary can provide reference for the implementation of subsequent similar projects. The main conclusions are as follows:

(1) The management methods of mechanical and electrical general contracting mainly include target management, tracking management, coordination management, pre-control management and system management.

(2) In the coordination and cooperation with the construction general contractor, the mechanical and electrical general contractor will focus on the handover of the mechanical and electrical working surface, and assist the general construction contractor to establish the working principles of "machine room priority" and "mechanical and electrical working surface priority" in the project.

(3) For projects adopting the responsibility system of mechanical and electrical general contracting, in addition to the implementation of the project by the mechanical and electrical general contractor, other professional contracting of mechanical and electrical services are mainly elevators, floodlighting, independent equipment suppliers, municipal supporting contractors, etc., and corresponding coordination and cooperation work is required.

(4) The pipelines and equipment of various mechanical and electrical specialties should be coordinated and coordinated in construction, so as to achieve coordination in plane positioning, layered layout, and collision and bending.

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