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CONSTRUCTION STRATEGY OF DIESEL GENERATOR SYSTEM FOR LARGE-SCALE CLOUD COMPUTING CENTER

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Abstract: With the rapid development of cloud computing business, cloud computing centers have gradually shifted from small and medium-sized to large-scale centralized deployment. This article uses the diesel generator system engineering practice of a cloud computing center in Guangdong as a reference to discuss the diesel generator set in large -scale cloud computing center projects.
Keywords: Medium voltage distribution cabinet; Diesel generator; Cloud computing

1 PROJECT NEEDS ANALYSIS

A cloud computing center project in Guangdong covers an area of 11,000 square meters and deploys 1,216 cabinets, 512 with average power of 5.5kW and 704 with 6kW. The total power of the 1,216 cabinets is 7,040kW. According to PUE=1.35, the total power is 9,504 kW. The construction standard is as follows: National standard "GB50174-2017 Data Center Design Specification" Level A standard. According to Class A standard requirements, a diesel generator set must be configured as a backup power supply, and the diesel generator set must be in an N+X (X=1~N) redundant configuration [1].

2 DIESEL GENERATOR SYSTEM DESIGN

Class A engine room requires the oil machine to operate continuously and without time limit, that is, COP power. The calculated load of the oil engine in this plan is 9504 kW, and the Italian Mercedes-Benz 10kV medium-voltage diesel generator set GSW2520P is selected. The engine specification of the oil engine is Perkins 4016-61TRG3, and the generator specification is Leroy Somer's LSA53.1 UL85, the automatic control panel uses PRAMAC AC03 parallel controller. The main power (PRP) of the generator set is 1804 kW/2255kVA, the standby power (LTP) is 2004kW/2505kVA, and the continuous power (COP) is 1603 kW/2004kVA. A total of 7 oil generators, 6 main and 1 backup, are used in parallel [2-3]. The total COP power is 9618 kW, which meets the load demand.

Under normal circumstances, two lines of 10kV mains power operate at the same time, each carrying half of the load; when one line of mains power fails or fails, the bus tie is automatically switched on, and the other line of mains power takes up all the load; when both lines of mains power are equally When power is lost, the oil generator automatically starts within 15 seconds and completes parallel operation within 60 seconds. It is controlled by the automatic control system, opens the 10kV mains power circuit breaker, closes the oil machine power circuit breaker, and supplies power to the load; when the mains power returns to normal Afterwards, the system continues to be powered by the diesel generator system and needs to be manually switched back to the mains power supply; the diesel generator system will not run in parallel with the mains power supply under any circumstances[4].

After the oil engine detects the start signal, the six units start the parallel output at the same time. After running for 5 minutes, the engine is reduced according to the actual load rate of the back end. This can ensure that the oil engine has sufficient resistance to load impact in the early stage of startup. If one of the 6 oil generators fails to start normally during the startup process, it will automatically switch to the backup engine to start[5] .

This oil machine system includes a total of 7 oil machine inlet cabinets, 1 PT cabinet, 2 parallel output cabinets, 1 parallel control cabinet, 1 dummy load wiring cabinet, 1 dummy load test control cabinet, 1 One set of grounding resistance cabinet, one set of DC operating power supply cabinet, and one dummy load.

The maximum rated current of a single unit is 137.74A, the circuit breaker current is 630A, and the complete set of medium-voltage distribution cabinets for the oil machine control system uses Schneider's original PIX-12 medium-voltage distribution cabinet [6].

The circuit breaker in the oil machine inlet cabinet is Schneider HVX-12-25-06 vacuum circuit breaker, equipped with two CTs, ground knife, zero sequence CT, lightning arrester, microcomputer protection P127, and multi-function meter PM2125C. The PT cabinet adopts PTT-12, PT & arrester sharing solution, with PT, arrester and harmonic elimination resistor. The parallel control cabinet adopts the IG-NT-MINT system. In addition to collecting the AC-03 controller signals on the control unit, all control signals related to the grounding resistance cabinet, parallel output cabinet, parallel input cabinet and other equipment are all collected from this cabinet.

The circuit breaker in the dummy load wiring cabinet is HVX-12-25-06, with two CTs, lower PT, arrester, fuse, zero sequence transformer, microcomputer protection P343, and multi-function meter PM2125C.
The false load test control cabinet mainly contains a control host and a display screen, and is operated and controlled through the load cabinet control system software.
The grounding resistance cabinet is a 10kV generator neutral point grounding resistance cabinet from Baoding Tianwei. Seven oil generators share one grounding resistance cabinet. When the oil machine is started, the grounding resistance cabinet mainly includes supporting equipment such as resistors, vacuum contactors, and current transformers. Among them, the resistor THT-FZG-10/58 has a rated resistance value of 58Ω, a short-term current flow capacity of 100A, a rated current flow time of 10s, an allowable deviation of the resistance value at 25℃ ≤ ±3%, and a resistivity of 1.09μΩm. The vacuum contactor is single-pole JZC1-12/400, with a rated voltage of 12kV and a rated current of 400A. The operating voltage of the DC operating power supply is 110V and the capacity is 80AH.
The dummy load is Hebei Kaixiang AC10.5kV-2000kW high-voltage intelligent AC load cabinet. The rated voltage of the load cabinet is AC10.5kV, the rated power is 2000kW, the working power supply is AC380V/50HZ, and the cooling method is forced air cooling. It should be noted here that in the design of the external mains power distribution system, it is necessary to provide power for the forced air cooling fan of the dummy load. This is a point that is particularly easy to miss.
According to the specification requirements, the oil engine system must be configured with 12 hours of fuel. The full-load fuel consumption of the oil engine is 482L/h. Calculated based on 12 hours, the total full-load fuel consumption of the six oil engines is 34704L, which is about 34.7m3. Due to fire protection regulations, a single indoor daily fuel tank cannot exceed 1 m3. Seven units are equipped with a total of 7 daily fuel tanks of 1 m3. The bottoms of the daily fuel tanks are interconnected by balanced oil pipes, and a 30 m3 horizontal diesel storage tank is installed outdoors. installed on the ground. The outdoor oil tank is surrounded by fences for protection and isolation, and is equipped with surveillance cameras and searchlights.
Gear oil pumps are used to deliver oil, and the oil pumps are configured in a 1+1 redundant manner. After the diesel is transported by tanker, it is stored in an outdoor diesel storage tank and pressurized by the filter and oil pump. The daily tank is controlled by an automatic level transfer control system. At low fluid level, the solenoid valve opens and starts the oil transfer pump. At high level the solenoid valve closes. When a fire breaks out between the daily fuel tanks, turn on the emergency oil drain pump and drain the diesel in the daily fuel tanks into the underground oil tank.
The cable input from a single unit to the medium voltage cabinet is ZR-YJV22-8.7/15kV-3*120 cable, and the cable output from the medium voltage cabinet to the 10KV medium voltage busbar is ZR-YJV22-8.7/15kV-3*400 cable.
The operating data of the entire oil engine system is connected to the dynamic environment monitoring system of the cloud computing center through the RS485 intelligent interface. Through the dynamic environment monitoring system, the operating status of the oil engine can be viewed remotely.

3 DESIGN OF OIL ENGINE ROOM

In accordance with environmental protection requirements, noise reduction measures are installed at the air inlet and outlet, and the noise is controlled within 65dB.
Microporous sound-absorbing panels are installed on the walls and sheds around the entire oil machine room and are lined with 50mm thick sound-absorbing cotton.
The weight of a single oil engine is 18.5 tons. A concrete load-bearing foundation was built on the floor of the oil engine room. The load-bearing foundation and all floors are treated with green epoxy polyurethane anti-static floor paint, which can not only prevent static electricity, but also prevent the impact of dust on the ground. The unit is running.
As an independent fire protection zone, the oil engine room uses smoke and temperature sensors for fire detection, and is equipped with a heptafluoropropane gas fire extinguishing system. At the same time, the oil machine is equipped with a handheld carbon dioxide fire extinguisher and a gas mask.

4 CONCLUSION

After the installation and commissioning of the diesel generator system was completed, it underwent strict third-party full-load testing and simulated switching operations in various scenarios. All indicators met relevant specifications and design requirements, and can operate safely and stably. This article combines theory with practice and combines some problems that occurred during the deployment of multiple diesel generator sets. It is hoped that it can provide a reference for the majority of cloud computing center construction practitioners to avoid similar problems from recurring.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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