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Research on Construction and Corrosion Prevention Characteristics of Aviation Fuel Storage Tank

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Abstract

Civil aviation airport is on the high speed development period in China, as the airport project for the construction of the airport terminal with the construction of the airport is in the midst of rapid expansion, the aviation oil tank continues to large-scale development direction, in this paper, the aviation kerosene tank and pipeline installation in the process of construction, welding, NDT, and anticorrosion technology has carried on the comprehensive discussion.

Keywords

Jet Fuel; Aviation Kerosene Storage Tank; Storage Tank Corrosion Protection; Piping Installation.

1. Introduction

With the thorough implementation of the policy of the development of the western region, there are frequent contacts between the western region and the eastern region, people's living standards are improving year by year, air transport business volume is growing rapidly, and a large number of airport facilities need to be expanded and transformed. In order to carry out the construction synchronously with the main project of the airport according to the plan and in order to ensure the safe supply of aviation fuel, large capacity aviation fuel tank fuel supply facilities and equipment need to be built to provide safe and high quality fuel supply service for the development of the airport. At the same time, due to the special characteristics of aviation kerosene storage tank itself, it will inevitably bring higher construction difficulty. It is necessary to analyze and grasp the corresponding construction and anti-corrosion characteristics in the node in detail, and do a good job of processing and optimization, and finally improve the reliability of aviation kerosene storage tank.

2. Classification and nature of aviation fuel

There are two main types of aviation fuel, depending on the power of the aircraft. One is the fuel for piston engines, mainly gasoline. The other type is for Jet (turbojet, turbofan, turboprop, turboshaft and other gas turbines) aero-engine, scientific name Jet fuel, English name Jet fuel, generally known as aviation kerosene, is a petroleum product. There are many types of jet fuel, generally classified as 1, 2, 3, and 4, of which 3 is the most commonly used. No. 3 jet fuel has the advantages of suitable density, high calorific value, good combustion performance, rapid, stable, continuous and complete combustion, small combustion area, less carbon deposit, and not easy to coking; The low temperature fluidity is good, can meet the cold and low temperature area and high altitude flight to the oil fluidity requirements; It has good thermal stability and anti-oxidation stability, which can meet the needs of supersonic high altitude flight. High cleanliness, no mechanical impurities and water and other harmful substances, sulfur content, especially mercaptan sulfur content is low, little corrosion to the machine parts [1].

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3. Characteristics of aviation fuel storage tanks

The nature of jet fuel and its use occasions determine that its storage containers are different from the general crude oil and finished oil tanks. According to the technical specification of civil airport fuel supply engineering construction, the aviation fuel storage tank should adopt vertical inner floating top cone bottom tank or horizontal tank. Horizontal oil tank has a relatively small capacity. It is often used as a zero-position tank in the oil depot of civil aviation system, that is, to store dirty oil in the oil depot area. When the volume is greater than 100 m3, vertical tank can be used. Conical tank bottom Conical tank bottom is the main characteristic of aviation fuel storage tank. To control the water content of jet fuel, remove mechanical impurities. The jet fuel storage tank is designed with a cone bottom, and the slope of the cone bottom should not be less than 4%. In order to timely discharge the water and impurities precipitated in the tank bottom and prevent the corrosion of the tank bottom wall by water, inorganic salts and microorganisms in oil products, sewage outlets should be set in the center of the tank bottom [2]. The use of conical tank bottom can not only ensure the oil clean, but also prolong the service life of the tank.

4. Construction characteristics and construction technical requirements of aviation fuel storage tank

4.1 Construction of aviation fuel storage tanks

In China, the volume specifications of oil tanks used in the petrochemical industry are 10,000 m3, 20,000 m3, 50,000 m3 and 100,000 m3, etc. According to the structure, there are vault oil tanks and floating roof oil tanks, etc. The existing aviation fuel storage tanks are designed and manufactured according to the "Design Code for Vertical Cylindrical Steel Welded Oil Tanks" (GB50341-2014) and "Construction Code for Vertical Cylindrical Steel Welded Oil Tanks" (GB50128-2014). Generally, 10000m³ vertical cylindrical steel welded storage tanks are made of Q345R and Q235B steel. The 10,000m ³ aviation fuel storage tank is provided with independent inlet and outlet pipelines, and a floating oil outlet device is installed on the outlet pipeline line. The oil tank is also provided with oil measuring hole, light hole, vent hole, manhole, manhole with core, level gauge mouth, sampling device and other accessories. The aviation fuel storage tank is provided with a winding ladder and a railing around the top of the tank. A steel platform is set where the oil gage hole is set on the top of the tank, and the places leading to other accessories on the top of the tank are provided with anti-sliding steps [3,4].

Vertical oil tanks shall be processed and manufactured in accordance with the construction drawings of oil tanks, and the construction technical requirements and acceptance standards shall be implemented in accordance with the Code for Construction and Acceptance of Vertical Cylumn Steel Welded Storage Tanks and the Code for Construction and Acceptance of Civil Transportation Airport Oil Supply Engineering. The 10m³ buried horizontal oil tank adopts double layer tanks. The purchase of finished products shall be designed and manufactured in accordance with "Steel-Glass Fiber Reinforced Plastic Double Layer Burying Oil Storage Tank". The inner layer steel tanks and openings shall meet the requirements of this design.

4.2 Construction of process pipeline

4.2.1 Piping installation

The construction and acceptance standards of process pipelines shall be implemented in accordance with the relevant provisions of the Code for Construction and Acceptance of Oil Supply Projects in Civil Transportation Airports, the Code for Construction of Industrial Metal Pipeline Projects and the Code for Acceptance of Construction Quality of Industrial Metal Pipeline Projects. In case of any inconsistency between the specifications, the more stringent one shall prevail. Before the construction of the oil pipe must be cleaned up inside the pipe, and take measures to prevent any debris into the pipe.

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4.2.2 Pipe welding

The welding process is argon electric joint welding. Before the pipeline welding, the welding process should be evaluated for the welded materials according to the requirements of the Construction Specifications for Field Equipment and Industrial Pipeline Welding Engineering. The welding materials between ferritic steel and austenitic stainless steel shall be of type Cr-Ni content of 25%Cr-13%Ni, and shall be carried out in accordance with the relevant provisions of Welding Specification for Dissimilar Steels in Petrochemical Industry.

4.2.3 Non-damage detection of process pipelines

The current national standards "Code for Construction and Acceptance of Civil Transportation Airport Oil Supply Project", "Standard for Acceptance of Construction Quality of Industrial Metal Pipeline Project" and "Nondestructive Testing of Pressure Equipment" shall be implemented. In case of inconsistency between the standard requirements, the more strict standard shall prevail. The welded joint of stainless steel pipe adopts 100% radiographic inspection, and the qualified level is II; The welding joint of carbon steel pipeline is first tested by 100% ultrasonic, and the qualified level is II, and then the spot inspection is carried out by X-ray inspection, and the detection percentage is 20%, and the qualified level is the normal level.

4.2.4 Pipeline pressure test

The design pressure of the general process pipeline is 1.0MPa, and the pressure test medium is clean water. For the stainless steel pipeline, the content of chloride ion in the pressure test water should not be greater than 25ppm. The strength test pressure is 1.5MPa, the leakage test pressure is the design pressure, and the test medium is compressed air.

4.2.5 Pipeline purging

Purge with "air purge" according to the requirements of "Industrial Metal Pipeline Engineering Construction Code", the purge pressure should not be greater than 1.0MPa, the air flow rate should not be less than 20m/s; The acceptance shall be carried out in accordance with the provisions of "air purging" in the Code for Acceptance of Construction Quality of Industrial Metal Pipeline Engineering.

5. Anti-corrosion engineering of aviation fuel storage tank

The anti-corrosion of aviation fuel storage tanks shall not only meet the provisions of "Code for Design of Civil Transport Airport Fuel Supply Engineering" and "Code for Construction and Acceptance of Civil Transport Airport Fuel Supply Engineering", but also meet the following requirements. In case of inconsistency between the standard requirements, the more strict one shall prevail.

5.1 Anti-corrosion of aviation fuel storage tanks

5.1.1 Surface treatment

After cleaning the anticorrosive surface of the storage tank, sandblasting shall be carried out to meet the requirements of Grade SA2.5 in the "Visual Evaluation of Surface Cleanliness of Steel Surface Treatment Before Coating -- Part 1: Rust Grade and Treatment Grade of Steel Surface Uncoated and After Full Removal of the Original Coating" (GB/T8923.1-2011). Can not be sandblasted derusting areas can be used mechanical derusting, grade ST3.0.

5.1.2 Corrosion protection of the inner wall of aviation fuel storage tank

Large aviation fuel storage tank 10000m 3 storage tank, 20000m 3 recovery tank top board, wall board (above 0.2m) and the pipeline in the tank, pipe fittings using white epoxy and non-conductive electrostatic oil resistant anticorrosive coating anticorrosive, the oil tank inner wall of the bottom 1 ring above the wall of the paint film thickness is not less than 200μm, The thickness of paint film on the upper surface of oil tank bottom plate and the bottom 1 ring wall of oil tank shall not be less than 300μm. The construction and acceptance standards shall comply with the provisions of the Technical Code for Corrosion Prevention Engineering of Steel Petroleum Tanks. The inner wall of the dirt oil

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tank, the internal and external walls of the pipeline and pipe fittings shall be anticorrosive with white epoxy oil resistant anticorrosive coating, and the thickness of the dry film shall be no less than 200μm. The construction and acceptance standards shall be in accordance with the Technical Standard for Internal Anticorrosive Coatings of Liquid Epoxy Coatings in Steel Storage Tank (SY/T 0319-2012).

5.1.3 Anti-corrosion of the outer wall of aviation fuel storage tank

The tank body of 10,000m 3 tank and 200m 3 recovery tank of large aviation fuel storage tank (including accessories such as winding ladder, handrails and railings), the exterior wall primer and intermediate paint of the above-ground storage tank shall be epoxy type, and the topcoat shall be acrylic polyurethane type composite paint. The dry film thickness of the coating shall be determined according to the supporting system of the coating, and shall not be less than 200μm. The outer wall of the floor of the aboveground storage tank shall be coated with inorganic zinc-rich primer and epoxy coal pitch anticorrosion. The total dry film thickness shall be no less than 300μm. The construction and acceptance standards shall comply with the provisions of the technical specifications for anti-corrosion engineering of steel petroleum storage tanks. The outer wall of the overground part of the 2.3m half-buried recycling tank is made of composite paint with epoxy type primer, epoxy type intermediate paint and acrylic polyurethane type top paint. The total thickness of the dry film is not less than 200μm. The structure design of the coating is arranged according to the requirements of the product. Construction technical requirements and acceptance standards shall be implemented in accordance with the provisions of the Technical Specifications for Construction of Anti-corrosion Engineering of Petrochemical Coatings (SH/T3606-2011) and the Acceptance Specifications for Construction Quality of Anti-corrosion Engineering of Petrochemical Coatings (SH/T3548-2011) [5,6].

5.2 Pipe anticorrosion

The material is carbon steel or low alloy steel process pipeline for internal and external anti-corrosion treatment; The aboveground process pipes made of stainless steel shall not be treated with anti-corrosion. The surface of process pipes and fittings shall be removed by spraying (casting). The rust protection level shall not be lower than the "Visual evaluation of surface cleanliness of steel surface treatment before coating - Part 1: GB/T8923.1-2011 Rust Grades and Treatment Grades for Uncoated Steel Surfaces and Steel Surfaces after Full Removal of Original Coating (GB/T8923.1-2011), Sa2.5. After qualified surface treatment, the coating construction should be carried out within 4h. After surface treatment, there should be no floating rust before painting. When floating rust or surface pollution occurs, the surface treatment must be carried out again. The inner wall of the process pipeline and pipe fittings shall be coated by high-pressure airless spraying process. It is strictly prohibited to use manual painting or paint by rolling the ball inside the pipe. Before spraying, test spraying should be carried out to determine the form speed of the spraying machine; The inner wall of the pipeline shall be anticorrosive with oil resistant anticorrosive coating of common grade conforming to the requirements of jet fuel, and the dry film thickness of the coating shall be no less than 200μm. The technical requirements and acceptance standards for construction shall be in accordance with the Technical Standard for Internal Anticorrosive Coating of Liquid Epoxy Coatings for Steel Pipes (SY/T0457-2010). Coating surface should be smooth, smooth, no bubbles, no scratches and other appearance defects wet film should not flow phenomenon; After the anticorrosive layer is dried, the thickness of the anticorrosive layer shall be measured at any 4 points which are more than 150mm away from the pipe Orient and evenly distributed along the circumference with a nondestructive detector. The two ends of each pipe shall be measured separately, and 10% of each batch shall be randomly checked, no less than 2, and the thickness of the anticorrosive layer shall be no less than 200μm. After curing, the coating shall be inspected root by root according to the resistance method stipulated in "Leak Test Method of Pipeline Anti-corrosion Layer" (SY/T0063-1999). No leakage point shall be considered as qualified. If the pipe diameter is small and inconvenient for detection, the number of measured thickness points can be increased (as far as possible to measure the middle position of the pipeline) instead. Coating adhesion inspection: the tool

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tip is used to parallel cut two cutting marks in the direction of the length of the coating tube body, the spacing is 3mm, each length is 2 ~ 3mm, cutting should make the tool tip and the coating vertical, cutting marks should penetrate the coating to the metal base, use the tool tip to pick the coating between two marks, higher than grade B (including grade B) is qualified. The outer wall of buried process pipeline is specially reinforced anti-corrosion with epoxy coal pitch, and the coating thickness is no less than 0.8mm.

The outer wall of the aboveground process pipeline shall be anticorrosive with water-resistant and weather-resistant anticorrosive coating such as acrylic acid. The dry film thickness shall not be less than 200μm according to the medium corrosion strength. The thickness of primer and top coat of pipeline anticorrosive coating shall be according to the thickness of anticorrosive coating of tank inner and outer walls. The construction technical requirements and acceptance standards shall be in accordance with the provisions of the Code for Corrosion Prevention Design of Paint for Petrochemical Equipment and Pipeline (SH/T3022-2011).

6. Summary

Because of the difference of jet fuel and other refined products, aviation fuel tank in the design and construction with crude oil storage tank is in essence the difference, especially in the steel sheet splicing fixed, steel plate lifting, welding quality control and so on stage, the strict control and control, to effectively control the emphasis and difficulty in construction, to ensure the high quality to complete the construction work. In the aspect of anticorrosion, effective anticorrosive measures and anticorrosive materials are adopted to achieve the ideal anticorrosive effect and produce good economic benefits. Due to the limited space, this paper briefly discusses the key points in the construction process of aviation fuel storage tank and the anti-corrosion construction technology and acceptance standards in the construction process.

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