

AN VIET MECHANICAL COMPANY LIMITED

KM3 – PHAN TRONG TUE STREET – THANH TRI – HANOI



PRODUCTION CAPACITY

HANOI

PRODUCTION CAPACITY PROFILE

AN VIET MECHANICAL COMPANY LIMITED

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PART I

GENERAL INTRODUCTION

Established in 2004, An Viet Mechanical Company Limited has grown rapidly, affirming its name in the field of hot-dip galvanizing of steel structures in Vietnam. An Viet has focused on investing in infrastructure, improving equipment, technology and human resources. An Viet has great development opportunities in the future thanks to the Company's available strengths, bringing outstanding values and benefits to customers, which not all manufacturing and trading companies can do.

The main business aspect:

- Hot-dip galvanizing of steel structures

An Viet plating will be one of the leading companies in Vietnam trusted by customers in the field of manufacturing hot-dip galvanizing of steel structures.

PART II

POWER OF AN VIET MECHANICAL CO., LTD

- *Two modern lines apply advanced technology of the developed countries with designed capacity as follows:*

+ *Line 1: Capacity of 15,000 tons/year*

+ *Line 2: Capacity of 25,000 tons/year*

- **Human resources**

Human resources with high labor discipline and qualification are well trained by leading experts in hot-dip galvanizing industry of Vietnam: Minimize quality risk, constantly increase labor productivity and increasingly reduce production costs.

- **Effective production and management:** according to the criteria of quality management standards of ISO1461:2009/TCVN 5408:1991. ASTM A123 / A123 M-09

- **Diverse products:** An Viet plating products can be applied to all steel structures for construction industry, building structure, traffic equipment, electricity, telecommunications and many other fields: Electrical equipment (poles, power station beams, and details): Bridge, road and traffic equipment (pipelines, bridges and floor drainage floor surface, bridge beams, bridge columns and separators, signs, lighting poles, etc.), construction equipment (columns of workshops and offices; columns and arches of stadium, etc.); columns of radio, television and telecommunications; outdoor advertising equipment (Advertising columns and banners).

- **Steel structure equipment is hot-dip galvanized according to international quality standards:** American Standard ASTM ASH 40; British Standard BS 1387 - 1985; Australian Standard AS 1074. All requirements for the quality of hot-dip galvanized steel structures are met. Customers will enhance their reputation with the works.

- **Affordable price** (According to the survey results on the market, the price of An Viet Company is the lowest in the market). Customers will save costs and operating costs of production and business.

PART III

HOT-DIP GALVANIZING PRODUCTION CAPACITY

With two modern production lines, line 1: capacity of 15,000 tons/year, line 2: capacity of 25,000 tons/year of parallel production, our Company can meet the hot-dip galvanizing output of 40,000 tons/year. With a convenient geographical location for transportation of customers, our plant is located in the Metal Depot No. 1 – Km3 – Phan Trong Tue Street – Thanh Tri district – Hanoi. The plant is close to NH1 which is the arterial road to transport goods and steel structures into infrastructure projects in the inner and suburban areas as well as neighboring provinces in the Northern and Central regions.

3.1. SPECIFICATIONS OF HOT-DIP GALVANIZING LINE

The specifications of the line will determine product quality standards, product cost and management-related factors such as the effect of the equipment line on the environment, the longevity and reliability of the equipment system, the consumption norms of raw materials and fuels. The basic equipment for hot-dip galvanizing includes: Galvanizing tank, furnace for heating the galvanizing tank, mechanisms for dipping, pushing components into molten zinc and drawing them out of the molten mass.

Galvanizing tank:

Capacity, equipment and quality of the coating depend heavily on the structure of the tank, its size, its longevity (shelf life). The galvanizing tank of An Viet Me. Co., Ltd is made of Muk 3 low carbon steel, country of origin: Germany, with components of steel: C 0,04%; Mn 0,15%; P < 0,02%; S <0,03%.

Galvanizing furnace and method of operation:

Currently, the design of the heating system and operation of the galvanizing furnace are used in the form of heating by oil burning. This is a fairly common method used in developed countries. This method has the advantage of fast melting time, suitable for large capacity lines, automatic heating and temperature control system. In addition, operating costs are less than heating costs using electricity or gas systems in Vietnam. The tank is guaranteed a uniform heat distribution because it is heated by the method of heating the tank by forced

circulation (with ventilation fan). The heat used in this method is several times larger than normal heating. The rate of gas generated is from 15 – 20m/sec. The temperature of the product heating the air around the tank is 550 - 1000°C and after consumption, uses 440 - 460°C. The weight of galvanized item is tightly controlled with the weight of the component determined in a unit of time, so the tank is kept at a stable temperature. This amount depends on the weight of the component and the volume of zinc in the tank. For example: When the tank contains 100 – 150 tons of zinc in one hour, it is necessary to put 5 – 6 tons of components, when the tank contains 150 - 200 tons of zinc, it is necessary of 6 – 8 tons of components.

Transportation equipment:

Components in molten zinc include large load-bearing cranes with a system of multiple speeds to ensure the dipping time of each type of component.

Equipment for operating hot-dip galvanizing process

Equipment used for hot-dip galvanizing technology are listed below

No.	Name of equipment	Specifications	Qty.
1	Steel tank for dip zinc Muk 3, made in Germany. Reinforced around.	Inner size (LxWxH) 12,000 x1,400x 2,200 (mm) Thickness =50mm Weight: 36 tons/tank	02
2	Furnace	Built of fire bricks and heat-resistant mortar with red brick insulation for chimney, heat transfer ribs, floor support pipes, nozzle pipes, surrounded by red bricks.	02
3	Oil burner	Ecoflam S.P.A (Italy)	04

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4	Temperature sensor (Germany)	0 –1 000oC in the furnace chamber 0 –600oC in the plating tank	08 04
5	Molten zinc pump	10 m3 /h – High heat resistance	04
6	FO oil tank	20 m3 made of stainless steel with heater and automatic pump controller	04
7	Intermediate FO oil tank	10 m3 made of stainless steel with heater and automatic pump controller	02
8	Acid detergent tank	Inner size: L x W x H 12 500 x 1 500 x 2 500 (mm) Built of waterproof brick, and lining of acid-resistant and temperature-resistant Composite up to 70oC	08
9	Wash tank	Inner size:12 500 x 1 500 x 2 500 Built of waterproof brick and acid-resistant cement finishing	04
10	Flux tank	Inner size: 12 500 x 1 500 x 2 500 Stainless steel is heated by the residual heat of the plating furnace	02
11	Passive tank	Steel tank lined with Composite inside	04
12	Acid pump	Stainless steel pump and plastic pump	04

13	Thickness check machine Positector 6000 Test	Made in USA for checking coating thickness	03
14	Crane 5 tons - 7.5 tons	Span: 15m. Lifting speed 8m/min Horizontal running speed: 20m/min Vertical running speed: 17m/min Lifting height: 9m Electric hoist	14

3.2. HOT-DIP GALVANIZING CAPACITY AND PROCESS

Galvanizing equipment capacity: With two production lines, line 1: capacity of 15,000 tons/year, line 2: capacity of 25,000 tons/year of parallel production, An Viet can meet all customers' progress requests.

Technology

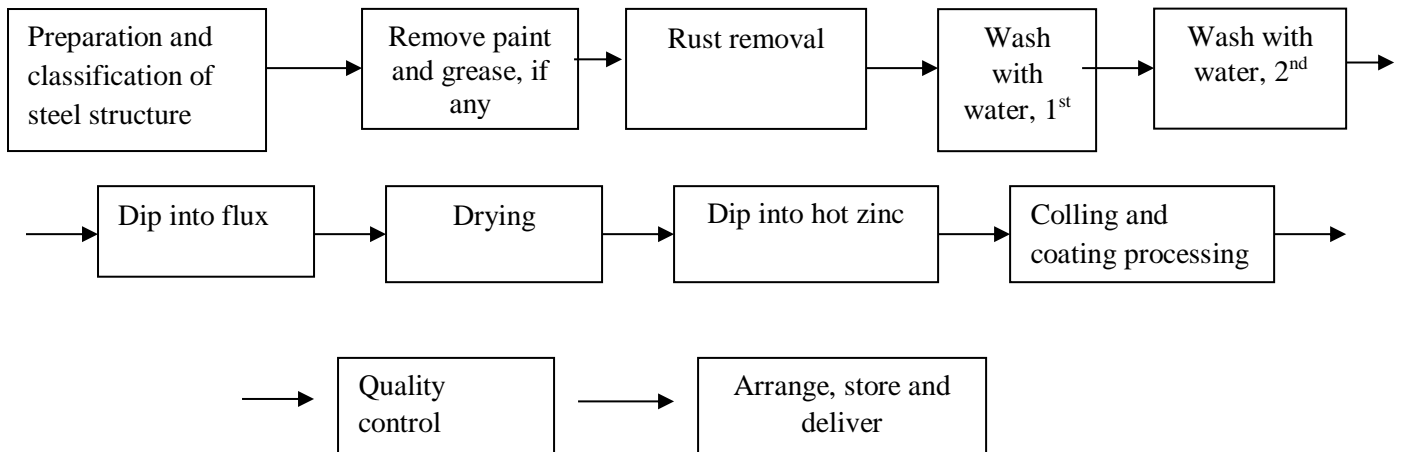
- Galvanizing furnace technology: Ensuring steel structures galvanized at stable standard temperatures from 440°C – 460°C, ensuring the thickness and adhesion of the coating.
- Quality of input materials: Korean zinc with the purity of 99.995%. Japanese dispensed zinc with a minimum purity of 98.5%. These are highest quality input materials that the world is using, ensuring the output quality.
- The preparation of cleaning solutions, fluxes and other solutions is according to the standards.
- Production staff's manipulation and operation: Ensuring the time for cleaning, soaking products in molten zinc environment.

Important principles of the dipping process to ensure the best quality of the product:

- Minimize the volume of devices dipped in molten zinc to minimize heat loss and reduction of the quality of dip.
- The molten zinc surface must be free of oxides, ash and impurities
- Products must dip quickly and not float;

- The dipping time must be fast to keep the coating thickness within the required limit as well as achieve the homogeneity and enough temperature to begin to rise again.

3.3. DIAGRAM OF HOT-DIP GALVANIZING PROCESS



3.4. Description of technological process

1. Preparation and classification of steel structure.

- Materials must be proper and suitable for hot-dip galvanizing technology
- The surface must be clean, free from paint, grease and not grainy.
- Steel is not warped, rusted or cracked.

Structures with grease and paint must be cleaned with hot caustic soda solution (NaOH) at 60°C.

2. Rust removal by chemical:

- Hydrochloric acid.
- Solution concentration: 5 -25% and is distributed from the lowest concentration tank to the highest concentration tank.
- Temperature 25 -35°C.
- Period of time: 20 - 90 minutes, depending on the quality of the surface of the embryo before soaking and cleaning to ensure the product no longer rust. Remove rust on the steel surface. Plating quality depends on steel quality and surface cleaning quality.

Before each plating shift and during the production process, technicians check the concentrations so that they reach the prescribed concentrations of each tank, then put the products into soaking baskets in each suitable types, then transfer to the bleaching tanks in an orderly manner for easy removal.

- Check the quality of rust removal before moving on to the next stage.
3. **Wash with water:** Tank 1: Use pressure water to wash away the iron salt dust generated during acid soaking.
 4. **Tank 2:** Rinse with clean running water, wash and inspect at the same time. If not clean, soak again, then clean and rinse to remove the rust before moving on to the next stage.
 5. **Dip into flux:** Clean steel is quickly dipped into hot flux tank ($ZnCl_2$ and NH_4Cl mixture) at $60^\circ - 75^\circ C$ for 2 – 5 minutes depending on the dipped components.
 6. **Drying:** The drying is carried out on the mouth of the galvanizing tank for 1 – 3 minutes depending on the structure and the size so that the steel can be dry and hot up to $70^\circ - 90^\circ C$.
 7. **Galvanizing:** The galvanizing tank is always controlled within the temperature range of $440^\circ - 450^\circ C$ depending on each product category.
 - Before dipping and especially before taking the product out of the galvanizing tank, it is necessary to clear the slag on the surface of the galvanizing tank so that the coating does not have any slag. The dipping speed is 1m – 1.5 m/min, when the component is removed from the molten zinc surface, shake or vibrate slightly or use a knife to remove all the drops and zinc stains into the tank.
 - The dipping time depends on the temperature and each dipped product. Visually check that the zinc layer is tightly sealed with no drops or slag, then moving on to the next stage.
 8. **Cooling and zinc layer processing:** After being removed from the molten zinc tank, the product must be immediately dipped into Chromate solution to prevent the process of continuous interaction between iron and zinc at high temperature of the dipped product to ensure labor safety and form a durable zinc Chromate array, keep the zinc shiny for long, not be gray due to oxidation, maintain the tank temperature at 30 - $45^\circ C$.
 9. **Quality control:** Inspect the coating thickness, surface zinc adhesion, gloss, appearance of the coating according to prescribed standards. Satisfactory

products are classified, packaged and warehoused for finished products. If unsatisfactory, return to the first step to process again.

10. All products that pass quality control are classified into lots, packaged and tied into bundles for delivery or storage.

3.5. Organization of production:

Line 1 has an average galvanizing capacity of 40 – 45 tons/day.

Line 1 has an average galvanizing capacity of 65 – 70 tons/day.

The production is divided into 04 shifts/workshop/day of continuous production, every shift lasts 6 hours. There are 15 days in each shift, allocated as follows.

- 5 cleaning workers (1 person in charge)
- 5 plating workers (1 person in charge of crane)
- 5 workers who bale and deliver goods.

3.6. Other conditions

. Environment

The environmental issue is a global issue, not a specific issue of An Viet Me. Co., Ltd, so the Company has installed gas, dust and wastewater treatment systems designed by Vietnam Academy of Science and Technology to ensure sufficient conditions to discharge gas and water to the outside environment.

The production lines do not use toxic chemicals. This hot-dip galvanizing plant was built and organized according to the environmental regulations in Vietnam to ensure the surrounding environment is free from toxic chemicals (acid solution); workers can work in a clean and safe environment.

. Fire protection

The products of An Viet Me. Co., Ltd are mostly iron and steel, so the occurrence of fires is very rare, but in the production process, An Viet Me. Co., Ltd still arranges fire extinguishers at the prescribed places to handle when a fire occurs. An Viet Me. Co., Ltd has also organized workers, especially the officials and security guards to take part in professional training on fire prevention and fighting taught by functional agencies.

PART IV

PRODUCTION ORGANIZATION AND HUMAN

An Viet Me. Co., Ltd is under the strategic establishment and management of the Chairman of the Board of Directors. Regarding management and administration activities, in the past time, the Company has arranged its organization in order to improve the capacity of organization, administration and business direction. Currently, the Company has five functional departments organized according to the online structure:

- **Sales and Marketing Department:** Manage sales and marketing activities for hot-dip galvanization.
- **Accounting and Financial Department:** Manage financial activities, capital sources, labor costs, selling expenses and administrative costs.
- **Supplies Department:** Manage raw materials, tools, machines, equipment, warehouse; receive and deliver goods to customers, production shifts.
- **Human Resource and Administration Department:** Manage personnel of the entire Company. Ensure that departments perform the functions and tasks effectively, ensure the recruitment and development of staff and employees according to the Company's strategic requirements.
- **Production Management Department:** Manage the exploitation and operation of the Company's technological line system, with the important goal that product quality always meets customer requirements.
- **Human resource:** Human resource is also a strength of An Viet Me. Co., Ltd. Through recruiting by a method of methodical input testing, the Company has selected a team of officials and employees with good working capacity, basic knowledge and strong specialization. This is the source of the Company's rapid development.

PERSONNEL'S QUALIFICATIONS OF AN VIET ME. CO., LTD PERSONNEL

Qualifications	Number of people	Ratio (%)
Number of people without professional qualifications	63	40.127
Number of people with technical intermediate degree	40	25.47
Number of people with college degree, technical engineer	35	22.293
Number of people with bachelor's degree in economics	19	12.10
Total	157	100

The ratio of 40.127% of people without professional qualifications is concentrated in the general department: Security guards, cooking staff, support team, packaging, loading and unloading, and some production workers. The ratio of people with intermediate degree and college and above accounts 59.873%, moreover, the key positions in the Company held by experienced and qualified people have proved by firm human resource base of the Company.

Staff training activities are taking place in three basic forms:

- Long-term specialized training: accounting, chemistry, mechanics.
- Short-term specialized training: supplies management, marketing and sales.
- Direct training in the working process: Effective production process and labor safety issues.

These training activities have gradually brought practical benefits to the Company in the operation process. In the future, the Company needs to continue investing in professional training for officials in the field of finance and information management; strategic management training for the Company leaders. Improve knowledge on galvanizing technology through cooperation with foreign experts.

APPENDIX I

- **CERTIFICATE OF BUSINESS REGISTRATION**

- **STANDARD CERTIFICATES**

APPENDIX II

PRODUCTS OF HOT-DIP GALVANIZING PROCESS

CONCEPT OF HOT-DIP GALVANIZING METHOD

Dipping metal needs to create a protective layer on molten metal which requires only the following conditions:

- Base metal must have molten temperature higher than that of coating metal.
- The surface of base metal must be clean of rust and grease.
- Easy to create a closed flux film to increase the wetting of molten metal.

Dipping metal products in molten zinc will create a corrosion protection layer. They are usually alloy with the outermost pure zinc layer.

PRODUCTS AND ADVANTAGES FROM HOT-DIP GALVANIZING METHOD

The concept of hot-dip galvanizing method shows that the products created from the process are layers of iron-zinc bonding and pure zinc covering the outside of steel structures. Products of hot-dip galvanizing process bring huge advantages for steel structures serving infrastructure projects and civil equipment for socio-economic life. These advantages are manifested through the following characteristics:

- Initial cost to protect the durability of steel is low: With most methods of protecting the durability of steel structure, hot-dip galvanizing method produces steel products with low initial cost because hot-dip galvanization focuses on high mechanical production process, which is strictly controlled while other methods focus on labor resources. As society grows, labor cost will be much higher than the cost of mechanization solutions.
- Cost to protect the durability of steel during the use is the lowest: The low initial cost and long service life make hot-dip galvanization a most economical and comprehensive method to protect steel for a long time. Currently, Vietnam is using popular coating method because of its low initial cost. But because the protective ability of the coating is poor, it is very easy to be destroyed, especially outdoor works that are heavily affected by the climate: radiation, monsoon, heat and humidity, heavy rain, etc., so it is easy for steel to be rusty and quickly broken. The coating method requires regular maintenance, about once or twice a year, so in the long run, the cost of coating is much higher than hot-dip galvanizing method that only requires to plate once while maintaining the steel durability for many years, depending on each climate region, no annual maintenance is needed. Moreover, with the coating method, many works in remote areas are difficult to carry out regular maintenance, so it is difficult to keep it for long run or

the coating method cannot guarantee the safety in dangerous areas such as: High voltage electricity, high and difficult terrain areas. It is clear that hot-dip galvanization is proving to have superior advantages over the advantages of coating.

- The steel structure protection period is long and can be estimated: Currently, there is no better steel protection method than hot-dip galvanizing method. Hot-dip galvanization can protect steel structure from rusting for 20 - 40 years in industrial and marine environments, and 50 - 100 years for less harsh environments. In addition, the outer zinc layer is corroded at a very slow speed, at the same time, hot-dip galvanization has certain quality standards that govern it, so it is possible to proactively estimate the longevity of steel structures.
- Easy to inspect: It is easy to inspect the thickness of the coating through a number of electronic measuring devices. From that, it is possible to quickly determine the longevity of steel structure with high reliability.
- Steel products are quickly applied: Hot-dip galvanized steel products are easy to use, without any additional preparation activities for coating, repair and inspection. When it has just galvanized, steel product is ready to serve the projects. Therefore, hot-dip galvanization helps speed up the progress of construction works.
- Durability of the protective layer: The hot-dip galvanizing process creates a solid zinc-iron alloy protective layer that no other method has. As a result, hot-dip galvanized steel products have the best resistance for opportunistic disadvantages during storage, transportation and assembly, or highly corrosive environments.
- Comprehensive steel protection: With hot-dip galvanization, the entire surface of the steel is covered with zinc, from inside to outside, from angles to hidden parts of steel structure that no other method can do.

APPLICATIONS OF PRODUCTS CREATED FROM HOT-DIP GALVANIZING METHOD

With the preeminent advantages of hot-dip galvanization, especially the economic benefit, long-term steel structure protection and convenience, hot-dip galvanization is currently used with hundreds of diverse application areas. All over the world, including Vietnam, they gradually have been applying the benefits of this method for infrastructure construction projects. Almost any steel structure product that needs these properties is subject to hot-dip galvanization. The following are some typical applications of the products created from hot-dip galvanizing method in Vietnam today.

Electrical equipment: Poles, poles, power station beams, grounding wire, manipulation cage.

Road, bridge and traffic equipment: Pipelines, drainage floor surface for roads and bridges, bridge girders, support panels and pillars, signpost, lighting poles, etc.

Infrastructure for chemical and petrochemical industry.

Construction of works: Beams and columns of workshops, offices, columns, stadium arches, barriers.

Radio, television and telecommunication poles.

In addition, there are some items of industries such as:

Outdoor advertising equipment: Poles, panels.

Automobile: Car floor.

In summary, hot-dip galvanization can apply to all steel structures for construction, building structures, traffic equipment, electricity, telecommunications and many other fields.

TYPICAL PROJECTS

Viet Tri - Son La 220 KV transmission line

500KV transmission line

O Mon 110 KV transmission line

220KV transformer station of Huoi Quang Hydropower Plant - Muong La - Son La

Lighting columns system in Hai Phong

National Convention Center Project

Hai Phong Metro supermarket

Lighting columns system Project in Hanoi

Ho Chi Minh Highway

National Highway 1A

Hanoi – Hai Phong National Highway 5A

Hanoi – Hai Phong National Highway 5B

National Highway 2, National Highway 6, National Highway 3

Handrail of Nga Tu So Overpass

Handrail of Thanh Tri Bridge

Handrail of Vinh Thinh Bridge

Handrail of Nhat Tan Bridge

Viettel Microwave Antenna columns

Parts of Cai Lan Port

Rach Mieu Bridge Works

The path of the Hai Van Pass tunnel

Bridge works of Road 18

Handrail system to protect railway traffic safety of section from Hanoi to Thanh Hoa

Anti-glare fence of Ring Road 3 - Hanoi City

Soft guardrail project in Lang Hoa Lac street

National Highway 32 Nghia Lo - Vach Kim - Yen Bai

Cau Gie - Ninh Binh Expressway

Hanoi – Lang Son Expressway

Hanoi – Lao Cai Expressway

Yen Bai – Phu Tho Expressway

Fence and calf barn of TH True Milk Joint Stock Company

Works of National Assembly Building, Noi Bai Airport, Ministry of Foreign Affairs Building

Upgrading corrugated iron of National Highway 1A guardrail

Cancer Hospital of Nghe An province

Power grid works in Co To district - Quang Ninh

Mong Duong Thermal Power Plant - Quang Ninh

Viettel Executive Headquarters

Formosa Ha Tinh Iron and Steel Plant

Nghi Son Refinery & Petrochemical Plant