

Painting Specification 涂料规范				Responsible unit 负责单位		CTE	
				Responsible person 负责人		Chen Xindong	
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1. Purpose 用途

This specification described the requirements for painting engineering and construction.

本规范叙述了涂料工程设计和施工的要求。

2. Scope 范围

This specification covers the general requirements for selection of painting for new pipeline, equipment and steel structure for BYC. This specification is also suitable for painting maintenance work later for existing pipeline, equipment and steel structure of BASF-YPC Company Ltd. It is based on the requirements of BASF Works Standards, International Standards (ISO), Steel Structures Painting Council (SSPC), and Chinese National Codes.

该规范涵盖了对扬子石化—巴斯夫有限责任公司新管道、设备和钢结构涂料(方案)选择的总体要求。该规范也适用于对扬子石化—巴斯夫有限责任公司现有管道、设备和钢结构的油漆维护工作。它是基于巴斯夫工作标准、国际标准(ISO)、钢结构油漆协会(SSPC)标准以及中国国家标准而制定的。

This specification is not suitable for outside surface painting of equipment and piping having surface temperature exceeding 500°C.

该规范不适用于表面温度超过 500°C 的设备及管道外表面涂装。

This specification is not suitable for the painting of the surface of under-ground piping, required to be coated and wrapped with special material such as polyethylene, vinyl, etc.

该规范不适用于需要包覆聚乙烯、乙烯基树脂等特殊材料的地下管道表面的涂装。

3. Definitions 定义

Owner -the Owner is BASF-YPC.

业主 -业主是扬子石化—巴斯夫有限责任公司

Contractor -the Engineering, Procurement Contractor (EPC) 工程设计、采购承包商

承包商 -工程设计、采购承包商(EPC)

MS -Manufacturer's Standard 制造商标准.

DFT -Dry Film Thickness 干膜厚度

WFT -Wet Film Thickness; the thickness of the uncured or wet paint.
-湿膜厚度；未固化或未干涂料的厚度

TDFT -Total Dry Film Thickness 干膜总厚度

um -Micron meter 微米

4. CODES AND STANDARDS 规范和标准

4.1 Chinese Codes 中国规范

GB 8923 ---Rust Grade and Rust-Removing Grade of Steel Surface Before Coating.

GB 8923 ---涂装前钢表面锈蚀等级和除锈等级

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4.2 Steel Structures Painting Council (SSPC) 钢结构油漆协会(SSPC)

- SP 2 ---Hand Tool Cleaning
- SP 2 ---手动工具处理
- SP 3 ---Power Tool Cleaning
- SP 3 ---动力工具处理
- SP 10 ---Near-White Blast Cleaning
- SP 10 ---喷砂近白处理
- SP 11 ---Power Tool Cleaning to Bare Metal
- SP 11 ---动力工具处理到裸金属的程度

4.3 International Standards 国际标准

ISO 4624 Paints and Varnishes—Cross-cut test for adhesion

涂料和清漆——附着力交叉切割试验

ISO 8501-1 Preparation of steel substrates before application of paints and related products—Visual assessment of surface cleanliness—Part 1: Rust grades and preparation grades of un-coated steel substrates and steel substrates after overall removal of previous coatings

涂料和相关产品施工之前钢表面的预处理——表面清洁度的目视评定——第 1 部分：未涂装的钢材和全面清除原有防腐层后的钢材的锈蚀等级和除锈等级。

ISO 8503-2 Preparation of steel substrates before application of paints and related products—Surface roughness characteristics of blast-cleaned steel substrates. Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel—Compactor procedure

涂料和相关产品施工前钢表面的预处理——喷砂处理过的钢表面的表面粗糙度特性。第 2 部分：喷砂处理过的钢表面的等级判定方法——比较原则。

ISO 8504-2 Preparation of steel substrates before application of paints and related products—Surface preparation methods—Part 2: Abrasive blast-cleaning

涂料和相关产品施工前钢表面的预处理——表面预处理方法——第 2 部分：喷砂处理。

ISO 8504-3 Preparation of steel substrates before application of paints and related products—Surface preparation methods—Part 3: Hand and power tool cleaning

涂料和相关产品施工前钢表面的预处理——表面预处理方法——第 3 部分：手动和动力工具处理。

ISO 12944-7 Paints and varnishes—Determination of film thickness

涂料和清漆——膜厚度的测定

5. GENERAL 概述

Painting work includes surface preparation, application of painting, protection and clean-up, touch-up painting and marking of identification symbols and painting color code.

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涂漆工作包括表面处理、涂料施工、保护和清理、补漆以及标识符号和涂料颜色代码的标记。

During construction of painting work for equipment, piping and steel structure, it requires that professional technical staff should be in charge of technique, quality management.

在对设备、管道和钢结构进行涂料施工期间，要有专业技术人员负责技术、质量方面的管理。

Before construction, scheme establishment and technical explain should be finished. Applicators should be familiar with construction method and technical requirements.

施工之前，应确定施工方案和进行技术交底。施工人员应熟悉施工方法和技术要求。

Tools for construction of painting should have safe reliability and meet process requirements.

涂料施工的工具应安全可靠并满足工艺要求。

Before painting, surface to be coated should be treated according to the requirement, painting can be done only after passing inspection of surface preparation.

涂料施工之前，要涂刷的表面应根据要求进行处理，只有当表面处理通过检查之后才能进行涂刷。

Hydraulic and pneumatic testing should be carried out before equipment, pipe and pipe accessories being painted. If paints were coated before testing, the weld joint should be remained. After the testing is eligible, the weld joint should be coated as requirements.

在对设备、管线和管配件涂刷之前应进行水压、气密测试。若要在测试之前就涂刷，那么应保留焊缝，测试合格后，焊缝应按要求的涂刷。

The surface shall be free from weld spatter, rust, loose mill scale, dirt, dust, grease, oil and other foreign matter.

要涂刷的表面不应有焊渣、锈迹、疏松的氧化皮、污垢、灰尘、油脂、油污及其它杂质。

Requirements to steel substrate: 对钢表面的要求:

- Scar, air-hole and inclusion shall not exist on the substrate surface of equipment, pipe and steel structure, the surface shall be smooth and the highness of knaggy part is not greater than 2mm.

设备、管线和钢结构的表面不应存在疤痕、气孔和夹杂物，表面应光滑，凸起部位的高度不超过 2 毫米。

- Weld joint shall be smooth, free from air hole, burrs and weld spatter. The highness of weld joint is not greater than 2mm, the crack shall not exist in weld joint.

焊缝应光滑，没有气孔、毛刺和焊渣。焊缝的高度不超过 2 毫米，焊缝不应有裂纹。

The painting work Contractor shall be responsible for: 涂料施工承包商应负责:

- The quality of workmanship, which shall be performed in accordance with this specification and all other relevant documents such as site regulations, safety rules, referred standards and codes, etc.

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按照本规范和所有其它相关文件要求保证施工质量，相关文件包括现场规定、安全条例、引用的标准和规范等等。

- The protection of all equipment, structures and any other areas from mechanical damage, environmental damage, damage caused by abrasives during blast cleaning, paint droppings, or over spray.

对所有设备、结构和其它区域采取保护措施，以避免由于喷砂过程中的磨料所引起的机械损伤，油漆的滴落、过喷涂所造成的环境破坏。

- The characteristics of the paints and paint materials shall be obtained from the paint Manufacturer. The characteristics shall be obtained via the provision of separate technical, and health and safety data sheets.

从涂料制造商那里获取涂料和相关材料的特性资料。这些特性资料应包括技术、健康和安全教育清单。

- Control waste resulting from the Contractor's painting and coating activities, in accordance with site regulations and specific contract requirements.

根据现场规定和合同的特定要求来控制承包商在刷涂过程中的浪费。

- Maintaining workshop facilities, tools and equipment in a good and clean condition. Spray guns, brushes, rollers, paint pots and the like shall be regularly cleaned and shall be suitable for their purpose.

确保加工车间设施、工具及设备处于良好、清洁状态。喷枪、刷子、滚筒、油漆罐等定期清理并适用它们的用途。

6. PAINT SYSTEMS 涂料系统

Complete workshop application of paints is preferred. Where complete paint system application before transport to the site is not possible, primer and intermediate coat application in the workshop followed by touch up and topcoat painting on site is preferred over complete site application.

最好全部在加工车间完成涂刷。如果在运往现场之前完成全部的涂刷施工是不可能的，最好在加工车间先上底漆和中间漆然后在现场补漆和上面漆。

For each equipment tag and line number, a paint system number shall be assigned based on APPENDIX 2 of this specification.

对每个设备号和管线号，都应根据本规范附录 2 确定一个涂料系统号。

Paint system number shall be indicated on the drawing for equipment, and in the piping line list.

涂料系统号应在设备图和管线清单中指出。

6.1 Structural steel 钢结构

Paint system (APPENDIX 2) for structural steel is applicable to all steel structures, including supports for piping, **equipment**, instruments and electrical work. Steel structures to be fire proofed will have only the primer coat **and inter-coat** of the specified structural steel paint system.

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钢结构涂料系统（附录 2）适用于所有的钢结构，包括管线、设备、仪表和电气装置的支架或支撑结构。需要做防火的钢结构只需做指定的钢结构涂料系统的底漆和中间漆。

Floor plates and grating made of carbon steel shall be hot dip galvanized.

碳钢材质的波纹板和钢格栅应进行热镀锌。

Except special requirements of design (such as high strength bolts, etc), all structural steel bolts, nuts and washers shall be hot dip galvanized. Further painting of galvanized bolting is not required.

设计有特别要求的（如高强螺栓等）除外，否则所有用于钢结构上的螺栓、螺母和垫片都应进行热镀锌。不需要对镀锌螺栓进行涂刷涂料。

6.2 Piping 管线

Stainless Steel piping shall not be painted unless specified by Owner or Designer.

除非业主或设计特别规定，否则不锈钢管线不必涂刷涂料。

Piping includes all pipes, fittings and other inline or online appurtenances.

管线包括所有管子、配件及其它内嵌或外联的附件。

Hot dip galvanized piping will not require painting, except for the touch-up of damaged galvanizing or if color identification is required.

热镀锌过的管线不需要涂刷涂料，镀锌（层）损伤后的补漆或者需要颜色识别的例外。

Piping will be prefab coated with complete coating system in the workshop, only touch-up, including weld areas, shall be done in the field.

管线在预制厂应按完整的涂层系统进行预先涂刷，只有补漆（包括焊接区域）在现场进行。

Color and/or safety signs see APPENDIX 1A and 1B.

颜色和/或安全标识参见附录 1A 和 1B。

6.3 Equipment 设备

Stainless Steel equipment shall not be painted unless specified by Owner or Designer.

除非业主或设计特别指定，否则不锈钢设备不必涂刷涂料。

All steel equipment shall be provided with a paint system as per APPENDIX 2 including rotating equipment such as pumps, motors, and compressors.

所有钢质设备包括动设备如泵、马达和压缩机等都要根据附录 2 确定相应的涂料系统。

Standard off-the shelf equipment shall be painted with Manufacturers standard paint system. For color see APENDIX 1.

标准的现成设备应以制造商的标准涂料系统进行涂装。关于颜色参见附录 1。

Equipment and vessels resting on concrete supports and having carbon steel bottom or base plate, and not being grouted, shall be fully be painted.

静置在混凝土基础上的设备和容器，采用碳钢底板或垫板的且未用水泥浇注的部分应完全涂刷涂料。

Inside surface of vessel skirts shall be painted with the same paint system as the outside.

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容器裙座的内表面应使用与外部一样的涂料系统来涂刷。

All equipment shall be prefab coated with complete coating system in the workshop, only touch-up shall be done in the field.

所有设备要在预制厂按完整的涂层系统进行预先涂刷，只有补漆在现场进行。

6.4 Instrument and electrical 仪表和电气装置

Exposed threads of hot dip galvanized electrical conduit, small damaged areas on conduit, and damaged portions of hot dip galvanized cable trays, including cuts and welds, shall be hand cleaned and be touched up.

暴露的热镀锌的穿线管螺纹、穿线管上损坏的小区域以及热镀锌电缆桥架的损伤部分，包括切割处和焊接处，都要进行手工清理并补漆。

6.5 Total thickness of painting film 漆膜总厚度

For site maintenance, total thickness of painting film should be adapted to the following table:

对于现场维修，漆膜总厚度应与下表一致：

Corrosion degree 腐蚀程度	Total thickness of coat dry film 涂层干膜总厚度		Important or hard to repairing location 重要部位或难于修补的部位
	Inside 室内	Outside 室外	
Deep corrosion 重度腐蚀	≥200µm	≥250µm	Increasing 1-2 coating courses 增加 1 至 2 道涂层
Medium corrosion 中度腐蚀	≥150µm	≥200µm	
Weak corrosion 轻度腐蚀	≥100µm	≥120µm	

7. SURFACE PREPARATION 表面处理

7.1 Rust grades and Rust-Removing grades 锈蚀等级和除锈等级

Rust grade of steel surface should be determined by contrast with typical model photograph in GB 8923 "Rust Grade and Rust-Removing Grade of Steel Surface Before Coating".

钢材表面的锈蚀等级的确定应参照 GB 8923 中提供的“涂装前钢材表面锈蚀等级和除锈等级”的典型样板照片为标准。

Rust grade of steel surface are divided into four grades, they are:

钢材表面锈蚀等级分为四等，它们是：

- Grade A — surface of steel material completely covered with oxide skin without any rust;
等级 A — 钢材表面完全被氧化皮覆盖，没有任何锈蚀；
- Grade B — surface of steel material, on which rust and flake-off of part of oxide skin happened;

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等级 B — 钢材表面出现局部锈蚀及氧化皮剥落现象；

- Grade C — surface of steel material, on which oxide skin partly flaking off or being able to scraped out caused by rusting, and a small amount of corrosive pitting happened;

等级 C — 钢材表面出现部分氧化皮剥落或由于锈蚀的原因能够刮除氧化皮，且出现少量的点蚀现象；

- Grade D — surface of steel material, on which oxide skin completely flaking off caused by rusting, and an overall corrosive pitting happened.

等级 D — 钢材表面出现由于锈蚀引起的氧化皮完全剥落现象，并出现全面的点蚀现象。

Rust-removing grades of steel material are divided into six grades, they are:

钢材除锈等级分为六等，它们是：

- Sa3----Blast cleaning to visually clean steel 喷砂处理至视觉上的纯净钢；；

SSPC-SP5----White Metal Blast Cleaning 喷砂处理至露出白色金属；

There is no any visible residue on the substrate surface, and the surface shows homogeneous metallic shine and a certain roughness.

钢表面没有可见残留物，且表面呈现均匀的金属光泽和一定的粗糙度。

- Sa2.5----Very thorough blast cleaning 十分彻底的喷砂处理；

SSPC-SP10----Near White Metal Blast Cleaning 近白金属喷砂处理；

95% of the substrate surface is white metal, and slight stripe and color changing result from rust and mill scale, which do not exceed 5% on any 100*100 mm² surface, is allowance.

钢表面 95%为白色金属，允许由于锈蚀和氧化皮引起的细微斑纹及颜色变化，但这种轻微的斑纹及颜色变化的面积在任意 100*100 平方毫米的范围内不超过 5%。

- Sa2----Thorough blast cleaning 完全喷砂处理；

SSPC-PS6----Commercial Blast Cleaning 常规喷砂处理；

Allow spots and residue result from adhered tightly mill scale and corrosion hole, which is not exceed 1/3 on any 100*100mm² surface.

允许有来自于紧附的氧化皮和腐蚀孔的斑点和残留物，但这种斑点和残留物的面积在任意 100*100 平方毫米的范围内不超过 1/3。

- Sa1----Light blast cleaning 轻度喷砂处理；

SSPC-SP7----Brush Off Blast Cleaning 扫射喷砂处理；

Allow adhered tightly mill scale, rust and old paint existing.

允许有紧附的氧化皮、锈蚀和原有涂料的存在。

- St 3----Extreme thorough hand and power tool rust-removing 非常彻底地由手动和动力工具除锈；

SSPC-PS11---- Power Tool Cleaning to Bare Metal 动力工具处理到裸金属的程度；

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No visible grease and dirt or no adhered loose mill scale, rust, paint skin, and etc. on the surface of steel material. This kind of rust-removing should be done more thoroughly than St 2, surface of ought to have metal brightness.

钢材表面无可见油脂及污垢或者脱落的氧化皮、锈蚀、油漆皮等。这种除锈应比 St 2 级的更彻底，表面应有金属光泽。

- St 2---Thorough hand and power tool rust-removing 完全由手动和动力工具除锈。

No visible grease and dirt or no adhered loose mill scale, rust, paint skin, and etc. on the surface of steel material.

钢材表面无可见油脂及污垢或者脱落的氧化皮、锈蚀、油漆皮等。

7.2 Surface pre-cleaning 表面预清理

For optimum paint performance surfaces to be painted or coated shall be completely dry and free from rust, loose mill scale, dirt, dust, grease, oil and other foreign matter before any paint is applied.

为了获得涂料的最佳性能，需要涂刷或做防腐层的表面在涂刷前应完全干燥且没有锈迹、脱落的氧化皮、污垢、灰尘、油脂、油污以及其它杂质。

Surface pre-cleaning shall be carried out according to type and extent of contamination, form and size of equipment before surface preparation.

表面预清理应根据表面处理前污染物的类型和污染程度，设备的形状和尺寸来进行。

- Any grease, oil on the substrate surface shall be removed by means of a suitable nonflammable solvent or heat alkaline cleaning agent. The method is listed in Table 1, after that, use water or steam to wash it.

钢表面的任何油脂、油污应用合适的可燃溶剂或者热碱清洗剂来清除。表 1 中列出了这些方法。然后用水或蒸汽进行清洗。

- Organism, oxide or previous coat on substrate surface shall be removed by means of steam cleaning, roasting or shoveling.

钢表面的有机物、氧化物或以前的涂层应以蒸汽、烘烤或铲除的方式清除。

- If the surface has been exposed to a polluted, e.g. salt-laden, atmosphere, it shall be washed down with clean, fresh water prior to blasting or power tools cleaning.

如果表面已暴露在受污染的空气，如含盐量很高，那么在喷砂或电动工具处理之前应用清洁的淡水来清洗。

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Table 1 Greasy dirt-removing method of surface

表 1 钢表面油脂性污垢的去除方法

Method 方法	Cleaning solution (mass%) 清洗溶液 (质量百分数)	Cleaning temperature(°C) 清洗温度(°C)	Cleaning time (min.) 清洗时间 (分)	Applicability 应用于
Solvent method 溶剂法	200# solvent oil kerosene 200# 溶剂油 煤油	Normal temperature 常温	Unit washing out 单位清洗时间	Ordinary greasy dirt 普通油脂性污垢
Alkali washing method 碱洗法	Sodium hydroxide 3 氢氧化钠 Tertiary sodium phosphate 5 磷酸钠 Sodium silicate 3 硅酸钠 Water 89 水	90	40	Containing small amount of greasy dirt 含少量油脂性污垢
	Sodium hydroxide 5 氢氧化钠 Sodium carbonate 10 碳酸钠 Sodium silicate 10 硅酸钠 Water 75 水	90	40	Containing large amount of greasy dirt 含大量油脂性污垢

7.3 Surface preparation by blast cleaning 表面喷砂处理

7.3.1 General requirements 总体要求

Blast cleaning on site is not allowed, except with written approval of Owner.

除非得到业主的书面同意，否则不允许在现场进行喷砂处理。

Drying blast cleaning is the preferred method. The surface preparation grades shall be as specified in item 7.6 or the paint Manufacturer's instructions for the various paint systems.

干法喷砂处理是首选方法。表面处理等级应是条款 7.6 指定的等级或者是涂料制造商对各种涂料系统的用法说明中指定的等级。

Abrasives and compressed air shall completely dry and clean, free from grease, oil and moisture.

磨料和压缩空气应完全干燥、清洁，不含油脂、油污和湿气。

The substrate surface shall be kept from moisture. The blasting cleaning shall be stopped when the air temperature is less than 30C above the dew point.

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表面应干燥。当空气温度高出露点不足 30C 时应停止喷砂处理。

7.3.2 Abrasives 磨料

Abrasives for use in blast cleaning carbon steels and low alloy steels are specified in ISO 8504-2, suitable abrasives are:

用于对碳钢和低合金钢进行喷砂处理的磨料在 ISO 8504-2 中作了规定。合适的磨料有:

Quartz sand 石英砂

Chilled iron grit or shot 冷铁砂或铁丸

Steel and malleable iron grit or shot 钢和铸铁材质的砂或丸

Non-metallic abrasive (aluminium oxide, copper slag, garnet, etc.) 非金属磨料 (氧化铝、铜矿砂、石榴石等)。

The abrasives and compressed air shall be completely dry and clean, free from grease, oil and moisture. Re-used abrasives shall be clean, sharp and free from contaminants.

磨料和压缩空气应完全干燥、清洁，不含油脂、油污和湿气。回收再用的磨料应清洁、锐利且不含污染物。

Silica abrasives shall not be used for open blast cleaning operations, unless otherwise approved by the Owner. The silica river sand and sea sand is not allowed to use.

除非业主同意，否则硅石磨料不应用于开放式喷砂处理操作。不允许使用河沙或海沙。

7.3.3 Degree of roughness 粗糙度

The blast profile shall be that recommended by the paint Manufacturer. Roughness measurement shall be carried out by the Contractor using instruments in accordance with ISO 8503-2.

喷砂面外形应按涂料制造商推荐的为标准。粗糙度测量应由承包商使用 ISO 8503-2 中规定的仪器进行。

The following guideline may be used: 45~70 µm for painting work.

常用范围为：涂刷工作以 45~70 微米为佳。

7.3.4 Surface treatment after blast cleaning 喷砂处理后的表面处理

The substrate surface shall be cleaned with a vacuum cleaner, clean dry compressed air or clean dry brush after preparation.

喷砂处理后表面应该用真空吸尘器、清洁干燥的压缩空气或清洁干燥的刷子来清理表面灰尘。

After preparation of the substrate surface, any grit, dust etc. shall be removed and a layer of primer shall be applied before any corrosion or recontamination occurs, normally within 8 hours after blasting.

表面处理，任何砂粒、灰尘等都要去除，且在任何腐蚀或污染再次出现之前应涂上底漆，通常在喷砂处理后 8 小时之内就要做。

The cleaned surface shall never be left unprotected overnight.

经处理过的表面决不能不加保护地放在那里一整夜。

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7.3.5 Technique parameter of blasting as following table 喷砂处理的技术参数如下表

Type of abrasives 磨料类型	Component of abrasives granularity Standard griddle number (mm) 磨料粒径标准筛号组 (mm)	Minimum air pressure of nozzle 喷嘴的最小 气压(MPa)	Minimum diameter of nozzle 喷嘴的最 小直径 (mm)	Spraying angle (degree) 喷射角 (°)	Distance of spraying 喷射距离 (mm)
Quartz sand 石英砂	All pass No7 griddle, not pass No45 griddle, No20 griddle minimum remains is no less than 40%. 全部通过 7 号筛而不通过 45 号筛, 通过 20 号筛的最少留存量不少于 40%。	0.55	8	30~75	80~200
Garnet 石榴石	All pass No10 griddle, not pass No45 griddle, No30 griddle minimum remains is no less than 40%. 全部通过 10 号筛而不通过 45 号筛, 通过 30 号筛的最少留存量不少于 40%。	0.4	6	30~75	80~200
Chilled iron grit or shot 冷铁砂或铁丸	All pass No18 griddle, not pass No45 griddle, No30 griddle minimum remains is no less than 85%. 全部通过 18 号筛而不通过 45 号筛, 通过 30 号筛的最少留存量不少于 85%。	0.6	5	30~75	80~200
Steel and malleable iron grit or shot 钢和铸铁材质的砂或丸	All pass No7 griddle, not pass No45 griddle, No20 griddle minimum remains is no less than 40%. 全部通过 7 号筛而不通过 45 号筛, 通过 20 号筛的最少留存量不少于 40%。	0.6	5	30~75	80~200

7.3.6 The following selection list of shot for steel plate blasting may be referred to:

不同厚度的钢板在选择钢丸时可参考下表:

Steel plate thickness 钢板厚度(mm)	2~2.5	3~4	4~6	7~12
Shot diameter (mm) 钢丸直径 (mm)	0.5	0.8	1.0	1.5

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7.4 Surface preparation by hand and power tool 用手动和动力工具进行表面处理

This method shall be used for touch-up and/or repair of new construction painting or painting maintenance of aged steel structure, not be used for new construction painting in the workshop.

该方法适用于新涂层施工的补漆和/或修复，或者是旧钢结构的涂层维护，不适用于加工车间里的新涂层施工。

Manual cleaning using mechanical cleaning tools to remove mill scale and rust shall accord to ISO 8504-3, SSPC-SP2 and SSPC-11 grade St3 or Manufacture's specification.

用机械处理工具进行人工去除氧化皮和锈层应符合 ISO 8504-3, SSPC-SP2 以及 SSPC-11 St3 等级或者根据制造商的使用说明来进行。

When using impact tool to remove rust, do not damage metal surface; when using rotary tool to remove rust, too smooth scraping metal surface is unsuitable.

当使用敲击工具去除锈层时，不要损伤金属表面；当使用打磨工具去除锈层时，不可以过于抛光金属表面。

The substrate surface shall also be cleaned with a vacuum cleaner, clean dry compressed air or clean dry brush after preparation.

表面处理后也应该用真空吸尘器、清洁干燥的压缩空气或清洁干燥的刷子清理。

7.5 Surface preparation of stainless steel, hot dip galvanized and non-ferrous metal 不锈钢、热镀锌金属及有色金属的表面处理

Stainless steel shall not be painted unless specified by Owner or Designer.

除非业主或设计特别指定，不锈钢不应涂刷涂料。

If stainless steel, galvanized or non-ferrous metal surface were to be painted, a suitable pre-treatment in the form of a light blast cleaning with an appropriate abrasive shall be given to ensure proper adhesion of the subsequently applied paint system.

若不锈钢、镀锌金属或有色金属需要涂刷涂料，那么，用一种合适的磨料以轻微喷砂的处理方式作为预处理来确保后续涂料系统在施工时获得合适的附着力。

Aluminum oxide or other abrasives (free from any chloride or iron contamination) shall be used for blasting stainless steel.

应该用氧化铝或其它磨料（没有受到氯化物或铁的污染）来对不锈钢进行喷砂处理。

If blast cleaning is impossible in the shop, then solvent or steam cleaning with an alkaline detergent agent may be used for surface preparation.

如果无法在预制厂内进行喷砂处理，那么可用溶剂或者带碱性清洁剂的蒸汽进行表面处理。

If galvanized surfaces are contaminated with zinc salts and/or oil grease, etc., they shall first be cleaned by a fresh water wash and/or a suitable non-toxic and non-flammable detergent.

如果镀锌表面受到锌盐和/或油脂等的污染，那么首先应用淡水和/或合适的无毒且不燃的清洁剂洗掉它们。

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Below mentioned materials do NOT require painting:

下面所列的材料不需要涂刷涂料:

Bronze 青铜	Chrome Moly 铬钼
Monel 蒙乃尔铜-镍合金	Aluminum 铝
Inconel 铬镍合金	Copper 铜
Incoloy 耐热镍铬铁合金	Duplex stainless steel e.g. alloy 225/2205 双相不锈钢如合金 225/2205

7.6 Requirements of surface rust-removing grade for paints 各种涂料表面除锈等级要求

Generally, requirements of surface rust-moving grade of priming coat for steel material should agree to the following table:

一般来说, 涂刷底漆的钢材表面除锈等级应参照下表:

Primer sort 底漆种类	Rust-Removing Grade 除锈等级		
	Deep corrosion 深度腐蚀	Medium corrosion 中度腐蚀	Weak corrosion 轻度腐蚀
Bituminous epoxy 环氧沥青	Sa2.5	Sa2.5	-
Epoxy resin 环氧树脂	Sa2.5	Sa2.5	St3
Polyurethane 聚氨酯	Sa2.5	Sa2.5	-
Organic silicon heat-resistance 耐热有机硅类	-	Sa2.5	Sa2.5
Organic zinc-rich 有机富锌类	Sa2.5	Sa2.5	-
Inorganic zinc-rich 无机富锌类	Sa2.5	Sa2.5	-

7.7 Inspection after surface preparation 表面处理后的检查

After finishing surface preparation, should carry out gross inspection and local sampling inspection:

完成表面处理后, 应进行总体检查和局部抽样检查:

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Gross inspection means mainly inspecting surface have been rust-removed whether having missing removing part (rust, greasy dirty) or not, and caring about rust-removing quality at corner part as well as cleaning of surface greasy dirt and dust.

总体检查主要指检查除锈后的表面是否有漏涂部分（锈、油脂性污垢）并重点检查角落处的除锈质量以及油脂性污垢和灰尘的处理状况。

Local sampling inspection means contrasting rust-removed surface with typical sample photograph stipulated by GB 8923, and meeting the following requirements:

局部抽样检查指将除锈表面与 GB 8923 中的典型样本照片作比较，且满足下列要求：

- Inspect equipment one by one including five places for each, and the inspected area not be less than 100cm².

逐一检查每台设备，每台分别包括五个地方，且检查区域不少于 100 平方厘米。

- Inspect piping according to total extension meter of identical pipe diameter and rust-removing grade. For length less than or equal to 500m, sample five points; for more than 500m, increase one sampling point per 100m, each inspected area shall not be less than 100cm².

根据相同管径和除锈等级的总延长米来检查管线。对长度小于等于 500 米的，取五个检查点；对长度大于 500 米的，每 100 米就增加一个点。每个检查点的面积不应小于 100 平方厘米。

- Inspect steel structure: Spot inspection of 10% as per quantity of element and not less than 3 pieces for element of same kind.

检查钢结构：现场检查每批构件数量的 10%，同种构件不少于 3 个。

During inspection of surface preparation, if find points not conforming to rust-removing grade requirements, should retreat them again until being acceptable.

在对表面处理的检查期间，如发现不符合除锈等级要求的地方应重新处理直至合格为止。

After finishing surface preparation, ought to fill in inspection result form, as a format presented in the following table:

完成表面处理后应按照下面的格式填写检查结果表：

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Check list of surface preparation (format)
表面处理检查表 (格式)

Contractor name 承包商名称				Work name 工作名称			
Work time 工作时间		From 从		To 到			
Construction conditions 施工条件		Ambient temperature 环境温度					
		Relative humidity 相对湿度					
Rust grade 锈蚀等级		A, B, C, D					
Rust-removing grade 除锈等级		Sa3, Sa2.5, Sa2, St3, St2					
Inspection item 检查项目				Inspection result 检查结果		Inspection suggestion 检查建议	
Gross inspection 总体检查		Missing rust removing 除锈遗漏					
		Corner or local rust removing 角落或局部除锈					
		Greasy oil and dust cleaning 油脂及灰尘的清除					
Local sampling 局部抽样							
Complex quality evaluation 质量综合评价							
Quality inspector 质检员		Technical responsible person 技术负责人				Inspection date 检查日期	

8. PAINT PERFORMING 涂料施工

Paints and other coating materials shall be applied in accordance with the paint Manufacturer's instructions. The surface preparation shall be as described in section 7 of this specification.

涂料和其它涂层材料应按照涂料制造商的使用说明来使用。表面处理应按本规范第7节所描述的那样进行。

All surfaces shall receive an appropriate paint system as specified in APPENDIX 2 with the following exceptions:

所有表面均应采用附录2中所规定的合适的涂料系统，但下列情况例外：

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- Hot-dip galvanized steel, weathering steel and non-ferrous metals, unless specified by the Owner.

热镀锌钢、耐候钢和有色金属，业主特别指定的除外。

- Nameplates, code stampings and push buttons.

铭牌、钢印编码和按钮。

- Concrete brickwork, tile, glass and plastics, unless specified by the Owner.

混凝土砌砖、瓷砖、玻璃和塑料，业主特别指定的除外。

- Insulation weather proofing material or sheet.

保温耐候材料或保护层

- Any surface specified by the Owner not to be painted.

业主特别指定无需涂刷涂料的表面

8.1 Paint application requirements 涂料施工要求

The Contractor shall submit the painting procedure which includes the paint (Manufacturer's product name) to be used, surface preparation, safety device, test and inspection, etc., and obtain Owner's approval before performing the painting work.

承包商应提交涂料施工方案，包括要使用的油漆（制造商的产品名称）、表面处理、安全措施、测试和检查等，并在进行涂料施工前征得业主的同意。

Painting shall be done within 8 hours after surface preparation to prevent the surface from rusting prior to painting.

应在表面处理后的 8 小时之内就要进行涂刷，以免在涂刷前表面再次生锈。

The suitable temperature of construction environment is between 15°C and 30°C.

合适的施工环境温度是在 15°C 到 30°C 之间。

Paints shall not be applied when the surface temperature is higher than 40°C, unless the paint is suitable for application at this temperature.

除非涂料在 40°C 的温度下适合施工，否则在表面温度高于 40°C 时不应进行涂刷工作。

Painting shall not be performed when the temperature of the surface is less than 3°C above the dew point of surrounding air or when the relative humidity of the air is higher than 85% (unless otherwise specified by the paint Manufacturer).

当表面温度高出周围空气露点不足 3°C 或者空气相对湿度高于 85% 时，不应进行涂刷工作（除非涂料制造商另有说明）。

Painting shall not be performed when the air temperature is less than 5°C.

当空气温度低于 5°C 时不应进行涂刷工作。

Paints shall not be applied when there is a deposition of moisture in the form of rain, condensation, frost on the surface.

当表面沉积雾水、冷凝液、霜时，不应进行涂刷工作。

Paints shall not be performed out of doors when the weather is windy and sandy.

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风沙天气条件下，不应在室外进行涂刷工作。

Trial coating shall be made before coat performing. The purpose of trail coating is to obtain the technique of construction and performance of process in construction. Trail coating is one of important means to examine its property.

在正式涂刷之前应进行试涂刷。试涂刷的目的是为了掌握施工手法和施工工艺特点。试涂刷是检查涂刷效果的重要方法之一。

Paints shall not be applied on the within 50mm of edges, which later have to be welded. Such weld areas shall be taped off with a suitable removable tape, for a distance of 50mm either side of the weld line.

随后需要焊接的地方，其边缘 50 毫米以内不应进行涂刷。象这样的焊接区域，应该用合适的可撕胶带将焊缝两边各 50 毫米的区域贴起来。

When zinc rich primers are used, care shall be taken to avoid any possibility of over spraying onto duplex or austenitic stainless steel, nickel or 9% nickel steel component. If this happens, the inorganic zinc shall be removed by abrasive blast cleaning, followed by pickling with 10% nitric acid.

当采用富锌底漆时，应注意避免底漆过喷涂到双相或奥氏体不锈钢、镍钢或含 9% 镍的钢材上。如果这种情况发生了，应该先用喷砂处理的方法将无机锌清除，然后用 10% 的硝酸溶液酸洗。

NOTE to CONTRACTOR: Zinc rich primers shall not be applied on equipment located above equipment made from the above mentioned materials unless such equipment is located in a shielded position which will minimize the risk of molten zinc falling onto the equipment in the event of a fire.

承包商注意：位于由上述提到的材料所制的设备上方的设备，不应采用富锌底漆，除非上下两设备处于被隔开的状态，且当发生火灾时能够最大程度地降低熔化了了的锌落在下面的设备上。

If welding is to be performed on inorganic zinc coated surface, zinc should be removed thoroughly at least one inch from welding line.

如在涂过无机锌的表面进行焊接操作，锌涂层至少要被清除至距离焊缝一英寸的地方。

Paints shall be applied in accordance with the paint Manufacture's instructions, including the mix ratio, the method of application, the use of thinner and over coating times.

涂料应按制造商的使用说明来施工，包括混合配比、施工方法、稀释剂的使用以及涂刷间隔时间。

The paints of different Manufactures and different brands shall not be mixed for using. If using by mixing, test and confirmation shall be required.

不同制造商和品牌的涂料不能混合使用。如果要混合使用，应进行测试、确认。

Transport and installation of painted structures shall be carried out only after the drying time specified by the paint Manufacturer has elapsed. Damage to the paint system shall be avoided by taking appropriate measures, such as the use of non-metallic slings, etc. for handling and by minimizing handling as far as possible after painting.

只有在涂料制造商规定的干燥时间过去后，才能对涂刷过的构件进行运输和安装。应采取适当措施避免涂料系统的损伤，如采用非金属吊绳，涂刷后尽量减少倒运。

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If the painted surfaces are exposed to rain while painting is in progress, the affected paint shall be entirely removed and repainted after making the surface clean.

如果在涂刷过程中刚涂刷的表面受到了雨水浸湿，那么受影响的涂料应全部去除并在表面进行清理之后重新涂刷。

8.2 Spraying application 喷涂

High pressure airless or air spraying application is the preferred method of application.

高压无气喷涂或空气喷涂是首选的施工方法。

For air spraying, the distance from nozzle to the surface to be coated shall be 250~350mm, with an angle of 70~80 degree. The pressure of compressed air shall be 0.3~0.55MPa.

对于空气喷涂来说，喷嘴到要喷涂的表面之间的距离应在 250 毫米到 350 毫米之间，成 70 到 80 度的角度。压缩空气压力应在 0.3 到 0.55MPa 之间。

For high pressure airless spraying, the distance from nozzle to the surface to be coated shall not be less than 400mm, the pressure shall be 11.8~16.7MPa.

对于高压无气喷涂来说，喷嘴到要喷涂的表面之间的距离不应小于 400 毫米，压力应在 11.8 到 16.7MPa 之间。

Spraying paint on site may cause interference with other works and so approval from the Contractor or Owner shall be obtained.

现场喷涂可能会导致与其它工作相冲突，所以应征得承包商或业主的同意方可进行。

Each coat shall be applied uniformly and completely over the entire surface. All runs and sags shall be brushed out immediately or the paint shall be removed and the surface re-sprayed.

每一层涂层都应均匀、彻底地覆盖整个表面。所有流挂部分应立即刷掉，或者将涂料去除后重新喷涂。

Very complex structures should be painted by brush instead of spray gun to avoid over spraying, dry spray and unacceptable paint losses.

复杂的结构应该用刷子刷涂而不是用喷枪，以避免过喷涂、干喷和不必要的涂料损耗。

8.3 Brush application 刷涂

Brush application should be used at the following circumstances:

刷涂应在下列情形之下使用：

- For field touch-up and /or repairs or maintenance.

现场补漆和/或修补或者维护。

- When areas can not be properly coated by spraying for any reason, such as material or environmental consideration.

由于某种原因如出于材料或环境考虑，一些不适合用喷涂方式进行的区域。

- For the initial coat of paint to corners, edges, crevices, holes and welds or irregular surfaces prior to spray application.

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在喷涂之前，对一些角落、边缘、裂缝、孔洞和焊缝或者不规则表面事先进行涂刷。

- For “touch up” or repairs in shop and field, to localize damaged paint or areas of incorrectly applied paint.

在预制厂和现场补漆或修补，局部受损的油漆或者刷错油漆的区域。

- Where the paint Manufacturer considers the coating material suitable for brush application.

涂料制造商认为涂料材料只适合刷涂的地方。

- Brushes shall be of a style and quality that will permit the proper application of paint.

只有用刷子才能将某种涂料在施工中刷出能被许可的样式和质量。

Brush applications should be done in two passes that are perpendicular to each other so that a smooth coat, as near uniform in thickness as possible, is obtained. There should be no deep or detrimental brush marks.

刷涂施工应采用垂直交错两个方向进行，从而得到一个尽可能平滑、厚度均匀的涂层。不应有深的或有害的刷痕。

Paint shall be worked into all crevices and corners. Runs and sags shall be brushed out immediately, and interstices shall receive additional paint to ensure that these areas have at least the minimum specified dry film thickness and to ensure continuity of coating.

涂料应进入到所有的裂缝和角落。流挂部分应立即刷掉，缝隙处应多些涂料以确保这些区域至少能达到规定干膜厚度的最小值并确保涂料的连续性。

8.4 Roller application 辊涂

Roller application shall only be used on relatively large surface areas and only if spraying is not an option. Roller application shall only be used if the first or priming coat of paint has been applied by brush. Roller application shall be in accordance with the paint Manufacturer’s instruction.

辊涂只用于涂刷面积相对较大和不宜采用喷涂的时候。只有在第一层或底漆已采用刷子刷涂之后方可采用辊涂。辊涂应按制造商的使用说明来施工。

8.5 Touch up 补漆

Damages and/or surfaces with coat thickness out of tolerance shall be ground to bare steel in accordance with SSPC-SP-11 or ISO 8504-3 and recoated by brush or airless spray, within 8 hours after grinding, up to specified thickness.

受损的或漆膜厚度超过允许范围的表面应根据 SSPC-SP-11 或 ISO 8504-3 将它们打磨至裸金属的程度，并在打磨后 8 小时以内用刷涂或高压无气喷涂的方式重涂至规定的厚度。

On site touch-up painting shall be carried out to all damaged coating areas, including damages from transportation, bumping during handling or welding, cutting, correcting during the erection.

所有的涂层受损部位都应进行现场修补，包括由于运输、吊装或焊接、切割、安装校正中的引起的损伤。

Touch-up to the coating film should be carried out starting with the right damaged coat. As to the minor damages where the primer is not damaged, the areas shall be sanded smooth with sandpaper of 80~100 mesh size. The edges of these touch-up areas shall be sanded

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to obtain smooth transition slopes, so as to ensure the uniform anti-corrosive performance and appearance.

补漆施工应从油漆受损部位开始。对于底漆并没有破坏的受损较轻区域应该先用 80 到 100 目的砂纸打磨平。这些补漆区域边缘应磨出平滑的斜坡，以确保均一的防腐性能和外观。

The areas where the primer is damaged shall be power tooled to St3, in other words, the rust, mill scale and loose existing coatings should be thoroughly removed.

底漆受损区域应该用动力工具处理至 St3 的标准，也就是说，锈迹、氧化皮及现有的松的涂层应完全被去除。

The power tools for grinding can be powered rotary grinders, grinding wheels, sand-paper grinding discs or needle guns. While care must be taken that, the steel surfaces shall not be "polished" especially by using powered wire brush, otherwise the surface anchor pattern, and of cause the adhesion of primer with substrate will be harmed.

打磨用的动力工具可以是电动打磨机、砂轮机、砂轮片或针枪。必须注意，钢材表面尤其不能用电动钢丝刷进行抛光，否则表面粗糙度不够，势必影响到底漆的附着力。

During the grinding to the welds, all weld residues, splatters and burned old coatings shall be eliminated, and the weld joints shall be ground smooth.

在对焊缝的打磨过程中，所有焊渣和飞溅物及烧焦的旧油漆应去除掉，并且将焊缝打磨光滑。

The prepared areas shall be larger than the damaged areas, and edges of these prepared areas shall have smooth transition slopes to ensure the united even finish appearance and proper adhesion as expected.

处理过的区域应比受损区域大，处理过的区域边缘应保持平滑的斜坡以确保得到预期的均匀一致的面漆外观和适合的附着力。

Where the area is so extensive that blasting work is possible, touch up painting shall be done by spray method after the surface preparation by re-blasting.

当区域大到可以采用喷砂方法进行处理时，应在表面重新喷砂处理后以喷涂的方式来进行补漆。

Recoated the cleaned damaged areas. The thickness of each coat shall follow the specification, additional application shall be carried out once the thickness is insufficient.

重新涂刷清理过的受损区域。每层涂料的厚度应按本规范执行，厚度不够的应再次进行涂刷。

8.6 Finish colors 面漆颜色

Except as noted, all surfaces to be paint shall be according to APPENDIX 1.

除非特别注明，所有表面的涂层（颜色）应按附录 1 执行。

9. QUALITY CONTROLLING OF PAINTING 涂装质量控制

During the course of painting, the prior coat shall be inspected before next coat being performed.

在涂刷的过程中，每一层油漆必须经过检查后才可进行后道工序的施工。

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Extra coats of paint shall be applied on the areas where the shape result in thinly applied coatings, e.g. at edges, welds, corners etc. To compensate for these effects, stripe coats of paints shall be applied before the next full coat.

在边缘、焊缝、拐角等处由于形状导致漆膜较薄的地方应进行额外涂刷。为弥补这方面缺陷，在这些区域进行下一步全面涂刷之前应预先以带状形式涂刷一层涂料。

The color of every coating layer shall be different from each other when more layers are applied. The dry film thickness shall be as specified.

多层涂刷时每一层的颜色应互不相同。干膜厚度应符合规定。

10. TESTING AND INSPECTING 测试和检查

Before painting activities commence, the Contractor shall submit an inspection procedure and reports indicating inspections and tests with the used testing equipment to be conducted during preparation and application of the paint system for approval by Owner.

在涂刷工作开始前，承包商应提交检查程序和检查报告以及表面处理和涂刷过程中所用的测试设备的检测报告，以取得业主的认可。

Prior to, during and after completion of the painting work, the following coating inspections and tests shall be applied:

在涂刷之前、过程中以及完工之后，应进行下列检查和测试。

10.1 Prior to painting 涂装之前

10.1.1 Material 材料

Prior to application, painting materials shall be confirmed as the same one by the material certificate issued by paint Manufacturer. The condition of painting material shall be visually checked by the Construction Contractor.

施工前，应确认涂料与涂料制造商所发放的材料证书一致。施工承包商应对涂料的状况进行目视检查。

10.1.2 Dilution 稀释剂

Dilution for each paint shall be checked to meet the requirements specified by the paint Manufacturer's standard.

对每种涂料稀释剂应按照涂料制造商规定的要求进行检查。

10.1.3 Surface preparation 表面处理

Prepared surface shall be checked to meet the requirement of this specification.

检查表面处理以满足本规范的要求。

10.1.4 Weather condition 天气条件

Refer to paragraph 8.1, and weather condition shall be recorded.

参见 8.1 节，且应对天气条件作记录。

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10.1.5 Trial painting and adhesion testing 试涂刷和附着力测试

Trial painting shall be made before paint performing. The adhesion of the primer to the steel substrate and the inter-coat adhesion of the subsequent coats after curing shall be determined by the application of either a cross-cut test or a pull-off test.

涂刷施工前应进行试涂刷。底漆与钢表面和中间漆的附着力，干燥后的后续油漆层的附着力应通过十字切割或剥离测试的方法来确定。

10.2 During painting 涂装过程中

10.2.1 Weather condition 天气条件

Refer to paragraph 8.1, and weather condition shall be recorded.

参见 8.1 节，并对天气条件作记录。

10.2.2 DFT (Dry film thickness) measurement DFT (干膜厚度) 的测量

DFT shall be measured at each step of coating to meet the specified film thickness. Spot checks shall be carried out during the course of the painting operation to ensure that film thickness is being maintained. These shall be performed according to the procedure described in ISO 12944-7.

应对每一步涂刷的干膜厚度进行测量以使膜厚达到规定的要求。在涂刷施工过程中应进行现场检查以保证厚度。这些应按照 ISO 12944-7 中描述的检查程序来进行。

10.2.3 Coating quality 涂刷质量

During construction of painting, should inspect coating courses and coating quality at any time. Coating quality shall meet requirement in Table 2.

在涂刷施工过程中，应随时检查涂刷过程和涂刷质量。涂刷质量应达到表 2 中所述的要求。

10.3 After completion of painting 涂装完成之后

10.3.1 Total DFT (Dry film thickness) measurement 总 DFT (干膜厚度) 的测量

Total DFT shall be measured with electromagnetic type film meter to meet the specified DFT and shall be checked and confirmed according to the procedure specified in ISO 12944-7.

总干膜厚度应该用磁力膜厚计进行测量以达到规定的干膜厚度，并应按照 ISO 12944-7 中规定的程序进行核对并确认。

10.3.2 Color of final coat 面漆颜色

The final topcoat shall be visually checked in accordance with APPENDIX 1.

最终的面漆应按照附录 1 进行目视检查。

10.3.3 Appearance 外观

It shall be visually checked that the coated surface are free from any detrimental film irregularities, such as lifting peeling, crack and non-adherent. The completed painting is subjected to the Owner's visual inspection. Any painting not compatible with the

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requirements of this specification shall be repaired or re-performed by the Construction Contractor at his own cost.

目视检查油漆表面应无任何不规则的膜面，如起皮、裂缝和不附着。完工的涂层要由业主目视检查确认。任何不符合规范要求的涂层应由施工承包商修复或重新涂刷并自行承担相应的费用。

After finishing painting, give an appearance test. Coating quality shall meet requirement in Table 2, fill in related content in form of Table 3.

涂刷结束后，要进行外观测试。涂刷质量应达到表 2 中的要求，并将相关内容填在表 3 中。

Table 2 Coating quality requirement
表 2 涂层质量要求

Inspection item 检查事项	Quality requirement 质量要求	Inspection method 检查方法
missing-coating, rusting, air-bladder, uncoated place 漏刷，生锈，气泡，未涂部位	not permissible 不允许	eye measurement 目测
needle hole 针孔	not permissible 不允许	5~10 times magnifying glass 5 到 10 倍的放大镜
flow drop trace, flow mark 滴落和流挂现象	not permissible 不允许	eye measurement 目测
bright and smooth 明亮且平滑	bright, completely uniform 明亮，完全均匀	eye measurement 目测
color, brush stripe 颜色，刷痕	uniform color, clear and coherent 颜色均匀，清晰且连续	eye measurement 目测
thickness of dry coating film 干膜厚度	not less than design thickness 不小于设计厚度	magnetic thickness-tester 磁力测厚仪

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Table 3 Quality check list of painting work (format)
表 3 涂刷质量检查表(格式)

Contractor name 承包商名称				Work name 工作名称			
Work time 工作时间		From 从		To 到			
Construction conditions 施工条件		Ambient temperature 环境温度					
		Relative humidity 相对湿度					
Paint name 涂料名称							
Inspection item 检查事项			Quality state 质量状况				
missing-coating, rusting, air-bladder, uncoated place 漏刷, 生锈, 气泡, 未涂部位							
needle hole 针孔							
flow drop trace, flow mark 滴落和流挂现象							
bright and smooth 明亮且平滑							
brush stripe 刷痕							
thickness of dry coating film 干膜厚度							
Complex quality evaluation 质量综合评价							
Quality inspector 质检员				Technical responsible person 技术负责人			
						Inspection date 检查日期	

10.4 Inspection records and reports 检查记录和检查报告

Prior to final acceptance of the paintwork an inspection shall be made. The Applicator and the Contractor shall both be present and they shall sign an agreed inspection report.

在涂料工程交工之前应进行最终检查。实施单位和承包商均要到场并在检查报告上签名。

These reports shall include:

这些报告应包括:

1. General 概要:

Names of the Applicator and the responsible personnel.

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实施单位及负责人员姓名。

Dates when work was carried out.

工作起止日期。

2. Materials preparation 材料准备:

Equipment and techniques used.

所用设备及技术

Materials receipt condition.

材料收受情况

Type and calibration of instruments used.

所用仪器的型号及测量口径

3. Environmental conditions 环境条件:

Weather and ambient conditions.

天气及周围环境条件

Tools and methods used to prepare surface.

表面处理的工具及处理方法

Condition after preparation.

处理后的状况

4. Paints and painting 涂料和涂刷:

Information on systems being applied.

采用的涂料系统信息

Mixing and testing prior to application.

使用前的混合和测试

Paint application techniques.

涂料施工技术

5. Testing 测试:

Type of quality control checks carried out, and results.

所作质量控制检查的类型及其检查结果

Compliance or otherwise with specification.

与规范的一致性

11. STORAGE AND MIXING 储存和混合

11.1 Storage 储存

Painting materials should be stocked in sufficient quantities at the site of operation to ensure continuity of operations.

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施工现场应储存足够数量的涂装材料以确保施工的连续性。

Materials shall be stored in a well ventilated room, free from excessive heat or direct sun rays, and maintained at a temperature recommended by the Manufacturer. Open-air storage shall be considered unfit for use.

材料应储存在通风良好的房间里，避免温度过高或阳光直射，维持在制造商推荐的温度环境下。不适合户外存放。

Materials, which have shown pigment separation and can not be mixed to smooth, shall be considered unfit for use.

已出现颜料分离且不能混匀的材料应视为不适合使用。

Contractor shall know the MSDS of material to be used in construction, and shall get the MSDS information from materials supplier.

承包商应了解施工中所用的材料安全技术说明并应从材料供应商那里获得材料的安全技术说明资料。

There shall have flammable mark, fire precaution mark and no smoking mark in storage house.

储藏室里应有易燃、防火以及禁止吸烟的标记。

Storage area of painting materials shall be away at least 15 meters from hot work area.

涂装材料储藏区应离开动火工作区至少 15 米。

11.2 Mixing 混合

Two component materials shall not be mixed together immediately before reading Manufacturer's mixing requirements. Only a minimum amount to complete the job at hand should be mixed.

在未阅读制造商的混合要求之前，两种组分不应混在一起。只有为了完成手边的工作需要少量的材料时才应进行混合。

Whenever inorganic zinc is specified, it shall be carefully mixed and shall be constantly agitated during application to insure uniform consistency.

无论什么时候使用无机锌，都应小心混合并在使用过程中不断搅动以确保浓度均匀一致。

12. SAFETY RULES 安全规定

Safety training of operators and managers for painting must be required prior to painting.

涂刷工作开始前对油漆工和施工管理人员进行安全培训。

Paints and solvents shall be stored in special storage house and be supervised by special man, and there shall be fire-proof facilities. Working board "Burning is strictly prohibited" shall be established, and living in stock house is strictly prohibited.

涂料和溶剂应贮存在专门的贮藏室里且由专人监管，并配有防火设施。工作板应注明“严禁烟火”的字样，并严禁在贮藏室里居住。

Do not extinguish with water, as paint solvents float on water and this helps to spread fire. Dry chemical, foam or CO2 extinguisher shall be used for fire extinguishing.

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不要用水灭火，因为涂料溶剂会漂浮在水面上反而使火势蔓延。应该用化学干粉、泡沫或二氧化碳灭火器灭火。

When perform painting, strictly forbid to do possibly produce naked flame or electric spark simultaneously jobs.

涂刷施工时，严禁与可能产生明火或电火花的工作交叉作业。

The operator shall wear safety hat, gloves and eye protection, and do not touch mouth or eye with gloves.

施工人员应佩带安全帽、手套及护目镜，不许用手套接触嘴巴或眼睛。

Eyes are particularly sensitive, so if splashed in the eyes by paint of thinners, wash them immediately with fresh water for at least 15 minutes and seek medical advice.

眼睛特别敏感，所以如果稀释剂飞溅到眼睛里时，立即用清水冲洗至少 15 分钟并看医生。

The operator shall wear full body safety harness while operating on height above 2.0m with falling risk.

在 2 米以上的高度施工时，施工人员应佩带全身式安全带，以防坠落。

Ought to keep painting job site clean and tidy. When finishing job, ought to clean up remaining combustible, explosive, toxic, and other foreign substance.

应保持涂刷工作场所整洁。工作结束后，应将残留的易燃、易爆、有毒物及其它异物清理干净。

If working people touch toxic, harmful substance fell nauseated, vomiting or dizzy, ought to send them to well airing places or let them be treated.

如果工人接触了有毒有害物质感到恶心、呕吐或晕眩，应将他们送到通风良好的地方或者送去医治。

Ought to give people doing painting job twice physical examination per year. If finding any people unsuitable to do painting job, should make them leave from job position under order.

应给油漆工每年进行两次体检。如发现有人不适合做油漆工作，应责令他们离开这样的工作岗位。

It is necessary to give sand-blasting drum used for blasting job hydraulic test, and give manometer and safety valve, etc. regular inspection.

有必要对用于喷砂施工的砂罐进行水压试验，并对压力计、安全阀等进行定期检查。

Not only written approval but also being approved by Safety Department shall be required while using fire on flammable and explosible area.

在易燃易爆区域动火时，不但需要有书面认可还要征得安全部门的同意。

13. INSPECTION AND ACCEPTANCE 检查验收

Inspection and acceptance shall be carried out only after all work are completely finished.

所有工作全部完成以后方可进行检查验收。

Paint kinds, name, brand, coating courses and coating thickness shall meet design requirement.

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涂料种类、名称、品牌、涂层层数和涂层厚度都应达到设计要求。

Coating thickness shall be inspected with magnetic thickness-tester.

涂层厚度应用磁力测厚仪进行检测。

For equipment, inspection shall be done one by one. Each tester samples three points. If two of the three points can not pass the inspection, means off- specification; if one of them does not pass the inspection, shall sample another two points to be tested, if there is one point not able to pass, then consider all off-specification.

设备的检查应逐一进行。每次检测取三个点。如三个当中有两个没有通过检查就表示不合规范；如三个当中有一个没有通过检查应另取两个点进行测试，如这两个当中有一个没有通过检查就表示全部不合规范。

For piping, inspection shall be by total extended meter. Check three points per 300m (if short of 300m, still considering as 300m). If two of the three points can not pass the inspection, means off-specification; if one of them does not pass the inspection, another two points shall be sampled, if there is one point not able to pass, then consider all off-specification.

管线的检查是对整个延长米。每 300 米（如不足 300 米也以 300 米计）检查三个点。如三个当中有两个没有通过检查就表示不合规范；如三个当中有一个没有通过检查应另取两个点进行测试，如这两个当中有一个没有通过检查就表示全部不合规范。

For steel structure, spot inspection of 10% as per quantity of element and not less than 3 pieces for element of same kind. Inspect 5 places for each element, the value shall be the average of thickness of dry paint film at three measuring points with distance of 50mm.

钢结构的现场检查是抽检每批构件的 10%，同种构件不少于三个。每个构件检查五处，每处的测量值为间隔 50 毫米的三个检测点的干膜厚度的平均值。

When handing over and acceptance the complete Painting Work, the following document and information shall be completely prepared:

当全部涂刷工作交工验收后，应具备下面的全部文件及资料：

1. Certificate, test report or recheck report of paints and other materials.

涂料和其它材料的合格证，测试报告或复测报告。

2. Record of concealed work.隐蔽工程记录。

3. Relative record of technical treatment during constructing.

施工期间技术处理的相关记录。

4. Record of back repairing 返修记录。

The work and acceptance records for painting shall referred to the format of Table 4.

涂料施工检查和验收记录应参照表 4 的格式。

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Table 4 Inspecting and Acceptance Record for concealed work ---- Painting (format)
表 4 涂料隐蔽工程的检查和验收记录 (格式)

Work name: <i>工作名称:</i>				Unit name: <i>单位名称:</i>			
Work time <i>工作时间</i>	From <i>从</i>		to <i>到</i>				
Rust grades and de-rust grades of substrate surface of metal 金属表面锈蚀等级和除锈等级	Rust grade 锈蚀等级 (A, B, C, D)						
	De-rust grade 除锈等级 (Sa3, Sa2.5, Sa2, St3, St2)						
Construction conditions <i>施工条件</i>	Ambient temperature 环境温度:						
	Relative humidity 相对湿度:						
Painting methods <i>涂刷方法</i>	Primer <i>底漆</i>	Intercoat <i>中间漆</i>	Topcoat <i>面漆</i>	Touch-up <i>补漆</i>			
Appearance checking <i>外观检查</i>	Standards <i>标准</i>				Evaluation <i>评价</i>		
	Qualified: coating shall be homogeneous, and no visible wrinkling, sagging, blistering. <i>合格:</i> 涂层应是均匀的, 无可见起皱、流挂、起泡现象。						
	Excellent: coating shall be uniform color, homogeneous, and no wrinkling, sagging, blistering. <i>优良:</i> 涂层应是无色差、均匀的, 无起皱、流挂、起泡现象。						
Painting name and Dry film thickness of coating (um) <i>涂料名称和干膜厚度 (um)</i>	Name <i>名称</i>	Layers <i>层数</i>	Actual Thick-ness <i>实际厚度</i>	Design Thick-ness <i>设计厚度</i>			
	primer <i>底漆</i>						
	Intercoat <i>中间漆</i>						
	Top coat <i>面漆</i>						
	Total thickness 总厚度						
Quality description <i>质量描述</i>							
Quality inspector of contractor <i>承包商质检员:</i>	Principal of contractor: <i>承包商负责人:</i>			BYC's Acceptor: <i>BYC 验收人:</i>			
Date	Date			Date			

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14. Attachment 附件

APPENDIX 附录 1A Color table 颜色表

General 一般		
ITEM TO BE PAINTED 涂装项目	COLOR 颜色	RAL CODE 劳尔色码
Structural steel, Excluding gratings 钢结构, 钢格栅除外	Light Grey 浅灰色	7035
Floor plates 波纹板	Black 黑色	9017
Columns, drums, vessels, tanks, pumps, heat exchangers, rotating machinery with T ≤ 120°C 操作温度小于等于 120 摄氏度的塔、圆筒、容器、罐槽、泵、热交换器、转动机器。	Light Grey 浅灰色	7035
Columns, drums, vessels, tanks, pumps, heat exchangers, rotating machinery with T > 120°C 操作温度高于 120 摄氏度的塔, 圆筒, 容器, 罐槽, 泵, 热交换器, 转动机器	Aluminum 铝色	9006
Barricades, handrails, vertical ladder, safety door (including galvanized) 路障, 栏杆扶手, 直爬梯, 安全弹簧门 (包括镀锌材质的)	Yellow 黄色	1021
Fire fighting piping systems (above ground) 消防管线系统 (地面上的)	Shell Red 红色	3000
Spheres and storage tanks 球罐和储罐	White 白色	9010
Lube oil storage tanks 润滑油储罐	Green 绿色	6016
Rotating equipment 转动设备	Light Grey 浅灰色	7035
Instrument, panels consoles, panel boards and cabinets 仪表控制盘, 仪表柜	MS 厂商指定	Manufacturer's standard
Conduits 排污管、沟渠	Black 黑色	9005
Rotating Equipment Base plates/Frames 转动设备的底盘和支架	Black 黑色	9005
Piping NOT INSULATED ≤ 120°C; see footnote 操作温度小于等于 120 摄氏度的不保温管线; 见脚注	Light Grey 浅灰色	7035
Piping NOT INSULATED > 120°C; see footnote 操作温度大于 120 摄氏度的不保温管线; 见脚注	Aluminum 铝色	9006
Valve hand wheels 阀上的手动转轮	Black 黑色	9005

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SAFETY IDENTIFICATION COLORS 安全辨别色		
ITEM TO BE PAINTED 涂装项目	COLOR 颜色	RAL CODE 劳尔色码
Dangerous obstructions 危险障碍物	Black/Yellow Lines sloped at 45° minimum 50% of surface yellow 黑色和黄色 45 度斜线交替, 黄色和黑色个 50%	9005/1021
Dangerous or exposed parts of machinery 机械的危险或暴露部位	Alert Orange 橙色	2003
Fire fighting equipment and services 消防设备及设施	Shell Red 红色	3000
First aid equipment 急救设备	Dark Green 墨绿色	6028
Rigging/Lifting items: Davits, Lifting beams, overhead traveling cranes and portal cranes 吊装/起重: 吊柱, 起重梁, 行车和门座式起重机	Static parts Yellow/Black Lines sloped at 45° minimum 50% of surface yellow 静设备为黑色和黄色 45 度斜线交替	1021/9005
	Moving parts Alert orange 动设备为橙色	2003
Top & Bottom of handrails for ladders and stairways, where indicated 梯子和楼梯的上下两端扶手处需标注的	Yellow/Black stripes 黑色和黄色条纹	1021/9005
Road Marking 路标	White 白色	9010
Identification for "Stop" and "Danger", e.g. flammable liquid containers, emergency stop switches, fire protection equipment and apparatus 停止和危险的标志, 如易燃液体容器, 紧急制动开关, 消防设备和仪器	Red 红色	3002
Identification for marking hazardous parts of machines which may cut, crush, or other wise injure 有可能发生割伤, 挤伤或其它形式伤害的机械危险部位的标志	Alert Orange 橙色	2003
Identification for "Safety" and location of "First Aid", and "Safety Equipment" 安全, 急救点和安全设备的标志	Dark Green, White lettering 墨绿色底白色文字	6028 9010

Footnote: for all piping not covered by Appendix 1B

脚注: 适用于附录 1B 中没有涵盖的所有管道

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APPENDIX 1B 附录 1B

Standard for Labeling of Pipeline Based on Medium 基于介质的管道标识标准

1.0 General 概述

- This standard is applicable for labeling in industry e.g. refinery, chemical plants, laboratory and buildings. Piping in this standard includes all valves, flanges, appendages and connections with or without insulation.

本标准适用于工业标识，如炼厂、化工厂、实验室、建筑物等所用到的标识。本标准中的管道包括所有阀门、法兰、配件和连接件，不管它们有没有保温。

- Identification of the contents of a pipeline system shall be lettered by legend giving the name of the contents in full or abbreviated form using appropriate color.

管线系统内的介质应通过合适的颜色将其全称或缩写以图案的形式标注出来。

- All pipeline will be painted with a surface color according to the 5.0 Color Table as described in Appendix 1B of this standard, or a neutral color e.g. gray or aluminum color as required in Appendix 1A not included in the 5.0 Color Table as described in Appendix 1B.

所有管线都要根据本标准附录 1B 中 5.0 颜色表刷涂相应颜色的面漆，或是按附录 1A 中所要求的如灰色或铝色那样的中性颜色，这种中性颜色在附录 1B 中 5.0 颜色表中没有。

For carbon steel pipeline that is un-galvanized or un-insulated, the surface color shall be painted on the entire pipe per the 5.0 Color Table as described in Appendix 1B and Appendix 1A Color Table.

对于没有镀锌或没有保温的碳钢管线来说，应根据附录 1B 中的 5.0 颜色表及附录 1A 中的颜色表给整个管线表面涂色。

For pipeline that is galvanized or insulated or made of stainless steel, the surface color shall be painted in certain locations with Color Band per the Color Table. But for the galvanized fire-fighting pipe along the tank wall, the surface color shall be painted on the entire pipe per Appendix 1A Color Table.

对于镀锌的或保温的或不锈钢的管线来说，应根据颜色表的要求在某个部位给管线表面涂上色环。但对于围绕罐壁的镀锌消防管线来说，应根据附录 1A 中的颜色表给整个管线表面涂色。

- Pipeline shall be labeling with shields. The signs shall be labeling with the name of the medium in English and Chinese.

管线标识应为覆盖膜。标签中应该用中文及英文标明介质的名称。

- The signs shall be applied or painted on a good visible place on important parts of the pipeline e.g. beginning and end of the pipeline, on valves, flanges, appendages or connections or next to this point.

标签应置于或涂于管线重要部位的醒目位置，如管线起止端、阀门、法兰、配件或连接件处或旁边。

- Color and format of pipeline labeling out of BYC' pipe rack shall be in accordance with the standard adopted by local area.

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BYC 管廊以外管线标识颜色及格式应符合当地区域所采用的标准。

2.0 Location 位置

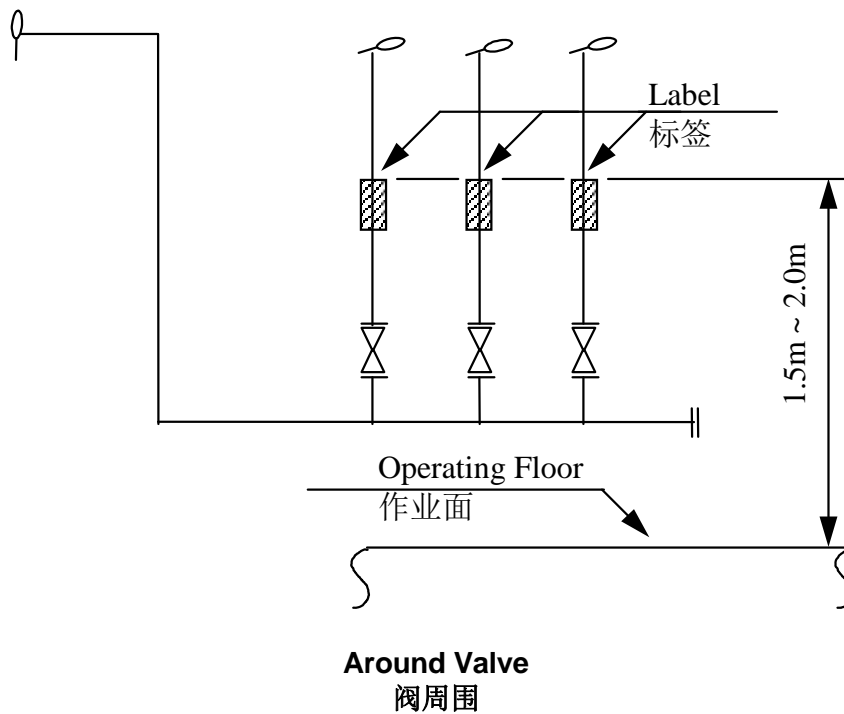
In general, identification marks (includes label and color band) shall be applied to the following location of piping system.

总的来说，识别标记（包括标签和色环）应位于管线系列的下列位置。

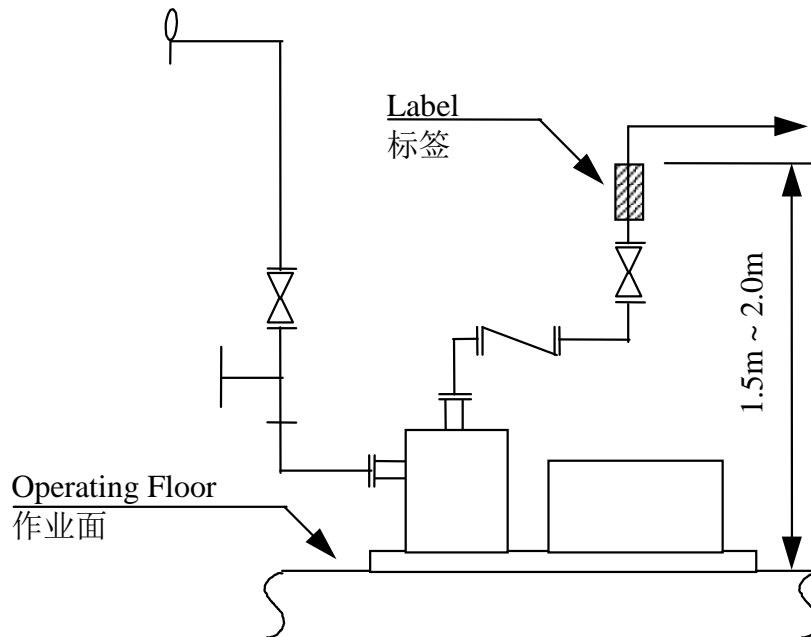
- Tank area limit of plant 装置的罐区边界。
- Changing points of direction 方向改变点。
- Intersection points for long stretch and yard piping 管线延伸段和原管线的交接处。
- At start and terminating points 起止端。
- Important location such as valves, pump, junction joints of service appliances, penetration points through wall or floor, on either side of pipe culverts.

重要位置，如阀、泵、服务设施集合处、穿墙穿楼板处、管道涵洞两边。

TYPICAL INTERVAL AND LOCATION OF LABEL FOR PIPING 管线标识的典型间距及位置



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Around Pump
泵周围

- Location of approach, exit and midway of pipe rack. For pipeline in pipe rack, two labels shall be applied at the same location around the pipeline.

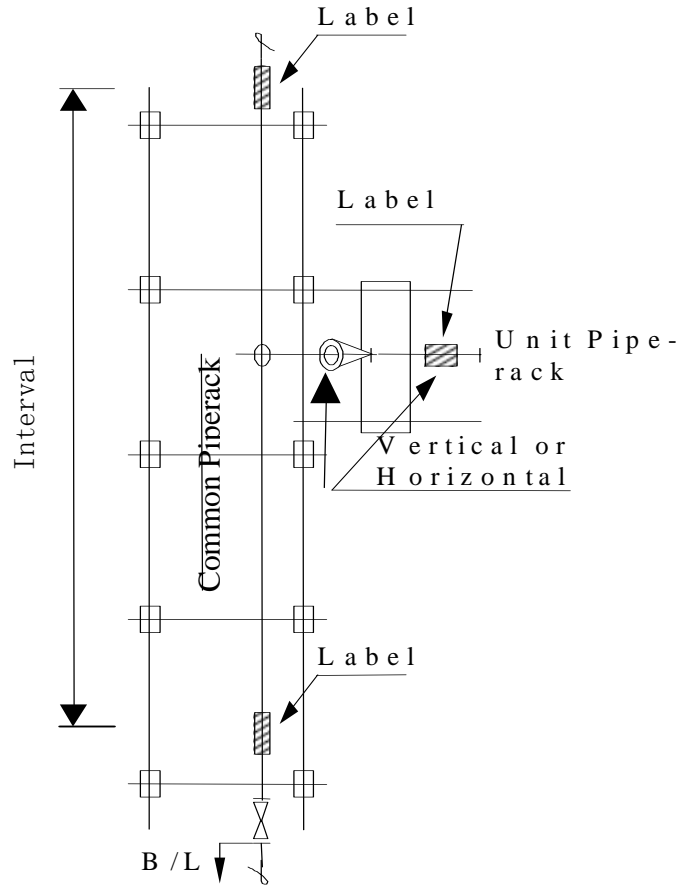
管廊的进、出口及中间位置。对管廊上的管线来说，同一位置处绕管道一圈应做两个标签。

- Other points as required by the Owner, such as midway of each pipeline way, below sheet could be referred.

业主要求的其它点，如在每条管线的中间，间距可参考下表：

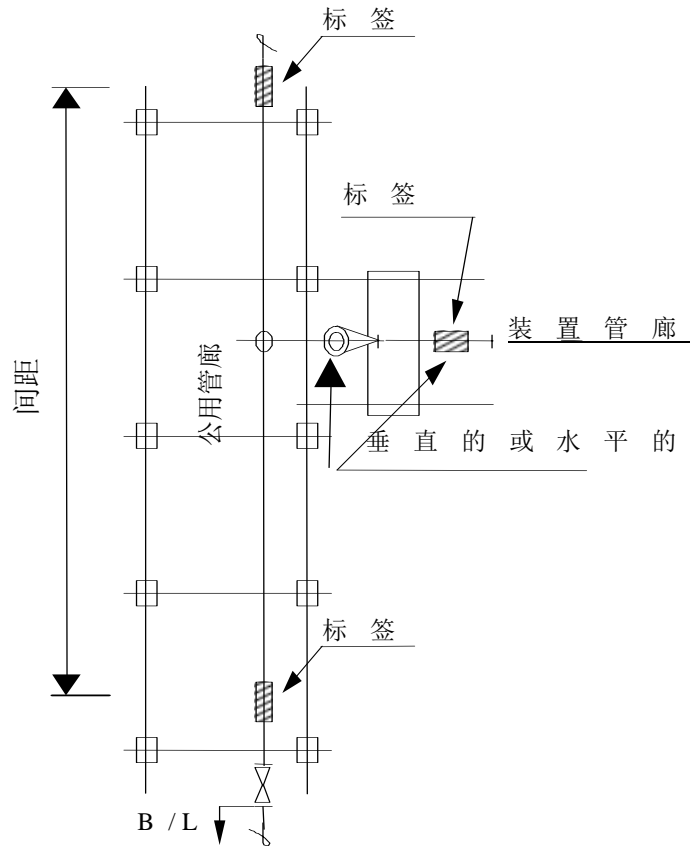
Pipe rack in the limit of Plant 装置界区内管廊	$\leq 100\text{m}$
Pipe rack out the limit of Plant (Utility) 装置界区外管廊（公用工程）	$\leq 200\text{m}$

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Around Pipe-Rack

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管廊周围

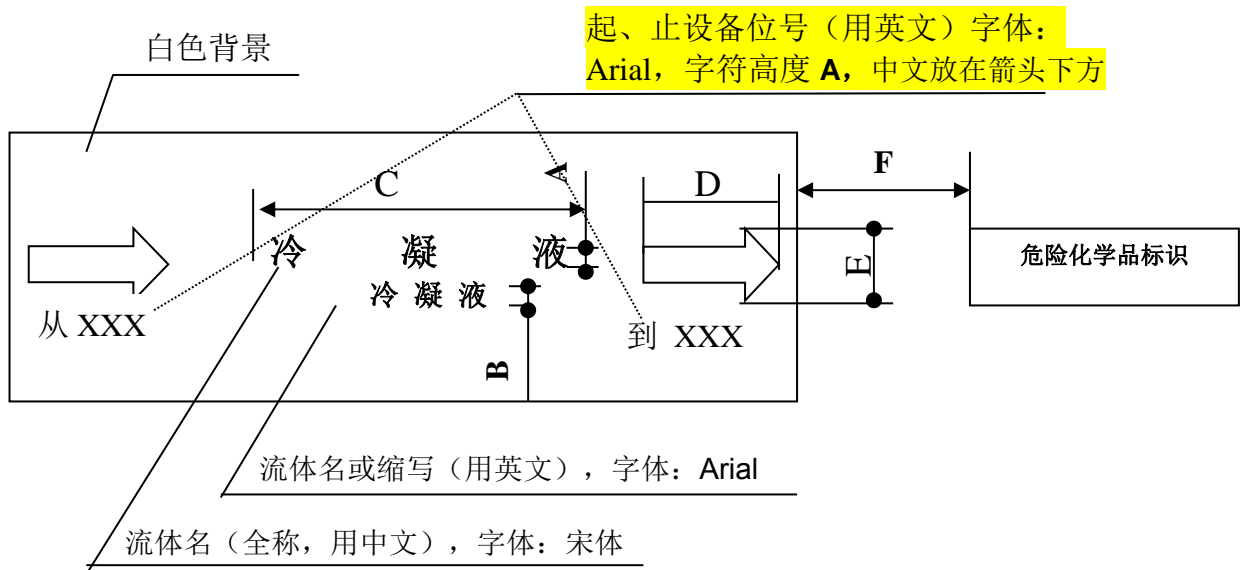
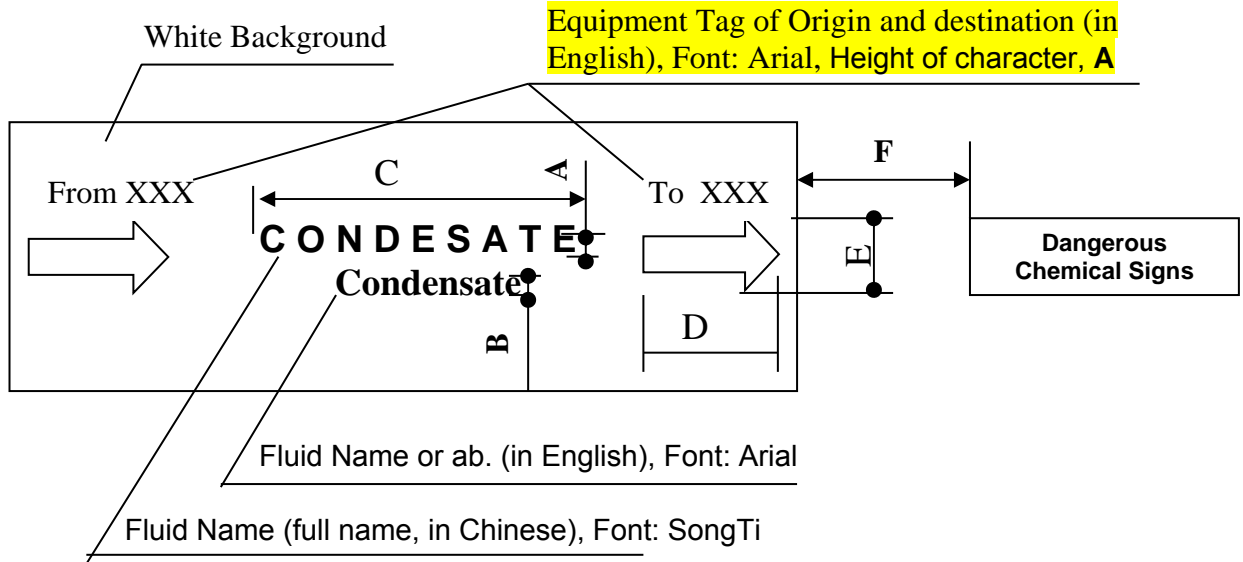
3.0 Format and Size of Label 标识的格式和尺寸

3.1 Format 格式

Format of the signs shall be as described in the following figure:

标识的格式应按下图描述的一样。

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3.2 Direction 方向

The direction of the arrow shall be in the direction of the flow. If the flow can be in the both directions, then the arrows shall be in the both sides of the sign.

箭头方向应是流体流动方向。如流体可双向流动，那么标签上应为双箭头。

The signs shall be painted directly on the pipe surface or made of weather resistance material e.g. Plastic.

标签应直接涂刷在管线表面上或用耐候材料制作的如塑料。

3.3 Color and Size of Characters 字符颜色和尺寸

Painting Specification 涂料规范				Responsible unit 负责单位		CTE	
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Arrow and Characters shall be on a white background. The color of arrow and characters is black. Size of the Characters shall be:

箭头和字符应于白色背景下。箭头和字符的颜色为黑色。字符的尺寸应为：

Diameter including insulation (mm) 含保温层的直径 (mm)	32	51	80	130	160	240	>240
Height of character, A (in Ch.) (mm) 字符高度 A (中文) (mm)	12.5	20	25	40	50	64	80/100
Height of character, B (in Eh.) (mm) 字符高度 B (英文) (mm)	6	10	12.5	20	25	32	40/50
Length of character, C (mm) 字符长度 C (mm)	Depend on the fluid name 取决于流体名称						
Length of arrow, D (mm) 箭头长度 D (mm)	75		100		150		200
Width of arrow, E (mm) 箭头宽度 E (mm)	15	25	40	60		100	125
Clearance, F (mm) 间距 F (mm)	50						

3.4 Dangerous Chemical Signs 危险化学品标识

The location of the dangerous chemical signs shall be described as the above figure. Regardless of arrow direction, the location of dangerous chemical signs should be on the downstream of the pipe label name all the time.

危险化学品标识的位置应如上图所示。不管箭头方向如何，危险化学品标识的位置应始终在管线标签名的下游。

Type and size of dangerous chemical signs refer to BYC Safety Signs standard.

危险化学品标识的类型和尺寸参见扬子石化—巴斯夫有限责任公司安全标识标准。

Safety Signs standard number is 01-010-00-0-0-00-021

安全标识标准号为 01-010-00-0-0-00-021。

4.0 Format and Size of Color Band 色环的格式和尺寸

The width of a each color band shall be the same size as the pipe diameter, up to a maximum band width of 300mm. If two bands are required, each band shall be the same width as pipe diameter, up to a maximum width of 300mm per band. The gap between the bands shall also be the same width as the pipe diameter, up to a maximum width of 300mm.

每条色环的宽度应与管径尺寸一样，最大环宽为 300 毫米。如需两条色环，每条色环的宽度应与管径尺寸一样，每条色环最大环宽度为 300 毫米。色环之间的间距也应与管径尺寸一样，最大宽度为 300 毫米

Examples:

例如：

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1. Entire Pipe is Painted per Color Table

根据颜色表对整个管子涂装

Painting Acid & Caustic Pipe (single color)

涂装酸性和碱性介质的管线 (单色)

Any size pipe

任何尺寸的管线

Entire Pipe is painted Purple
整个管线被涂成紫色

Painting Oxygen Pipe (one band, two colors):

涂装氧气管线 (一条色环, 两种颜色):

For D=50mm pipe, pipe is painted yellow, blue band of width 50mm

直径为 50 毫米的管线, 管线被涂成黄色、50 毫米宽的蓝色色环

Yellow 黄色	Blue 蓝色	Yellow 黄色
--------------	------------	--------------

Painting Toxic or Flammable Gas Pipe (two bands, two colors):

涂装有 毒或可燃气体的管线 (两条色环, 两种颜色):

For D=350mm pipe, pipe is painted yellow, brown band of width 300mm

直径为 350 毫米的管线, 管线被涂成黄色、300 毫米宽的褐色色环

Yellow 黄色	Brown 褐色	Yellow 黄色	Brown 褐色	Yellow 黄色
--------------	-------------	--------------	-------------	--------------

2. Pipe is Painted with Color Band

管线涂刷色环

Painting Acid & Caustic Pipe (single color)

涂装酸性和碱性介质的管线 (单色)

For D=150mm pipe, one purple band of width 150mm

直径为 150 毫米的管线, 一条 150 毫米宽的紫色色环

*	Purple 紫色	*
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Painting Oxygen Pipe (three bands, two colors):

涂装氧气管线 (三条色环, 两种颜色):

For D=50mm pipe, 3 bands of width 50mm each.

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直径为 50 毫米的管线，三条色环，每条 50 毫米宽。

*	Yellow 黄色	Blue 蓝色	Yellow 黄色	*
---	--------------	------------	--------------	---

Painting Toxic or Flammable Gas Pipe (five bands, two colors):

涂装有毒或可燃气体的管线 (五条色环，两种颜色):

For D=350mm pipe, 5 bands of width 300mm each.

直径为 350 毫米的管线，五条色环，每条 300 毫米宽。

*	Yellow 黄色	Brown 褐色	Yellow 黄色	Brown 褐色	Yellow 黄色	*
---	--------------	-------------	--------------	-------------	--------------	---

* Pipe base color (galvanizing or stainless steel) or insulation cladding background
 管线底色（镀锌或不锈钢）或保温保护层

For sensitive medium to sun light, and the pipe need not be insulated, the labeling shall be done as per the method of No.2, the pipe base color shall be light grey (RAL Code 7035).

对于对阳光敏感的介质，且管线不需保温，其标识可按第二种方法，管线底色为浅灰色（RAL 色号为 7035）。

5.0 Color Table 颜色表

MEDIUM 介质	COLOR MARKING 色标	RAL Number pipe 管线劳尔号	RAL Number Bands 色环劳尔号	Number of Bands 色环数量	Remarks 备注
Acid and Caustic 酸和碱	Purple 紫色	4001			
Ammonia 氨	Yellow with purple band 黄 色管线外贴紫 色色环	1012	4001	1	
Breath Air 呼吸空 气	Blue with white band 蓝色管线 外贴白色色环	5009	9010	1	
Emergency vent (mouth of pipe) 紧 急放空阀（管 口）	Yellow 黄色	1012			

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MEDIUM 介质	COLOR MARKING 色标	RAL Number pipe 管线劳尔号	RAL Number Bands 色环劳尔号	Number of Bands 色环数量	Remarks 备注
Hydrogen 氢气	Yellow with brown band 黄色管线外贴褐色色环	1012	8001	1	
Identification labels 鉴别标识	White with black lettering 白底黑字				Enough space shall be provided for hazard symbols added by Owner 要有足够的空间供业主添加危险标识符
Instrument Air 仪表风	Blue 蓝色	5009			
Nitrogen 氮气	Yellow 黄色	1012			
Oxygen 氧气	Yellow with blue band 黄色管线贴蓝色色环	1012	5009	1	
Plant Air 工厂风	Blue 蓝色	5009			
Sewage 下水道	Black 黑色	9005			
Steam 蒸汽	Aluminum 铝色	9006			
Toxic or flammable fluid 有毒或易燃液体	Brown 褐色	8001			
Toxic or flammable gas 有毒或易燃气体	Yellow with brown bands 黄色管线贴褐色色环	1012	8001	2	
Water 水	Green 绿色	6010			

Note: For insulated pipeline, the color bands shall be applied on parts of the cover sheet.
注：对于保温的管线，色环应固定在外护层上。

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APPENDIX 附录 2

1. System Selection Sheet 系统选择表

Commodity 常见类型	Material 材质	Temperature 温度 ¹	Insulated 保温与否	Surface Preparation 表面处理	System No. 系统号	Repair Surface Preparation 修补处表面处理	System No. Repair 修补系统号	Remarks 备注
Structural steel 钢结构	Galvanized 镀锌	<120°C	NO		Galvanized 镀锌	St3	5TU	Only damages 仅限受损部位
Structural steel 钢结构	CS	<120°C	NO	Sa2½	1	St3	1 TU	
Piping, Vessels, Tank, Silos, Exchangers 管线, 容器, 储罐, 料仓, 交换器	CS	<120°C	NO	Sa2½	1	St3	1 TU	
		<120°C	YES	Sa2½	4	St3	4 TU	
		120~200°C	NO	Sa2½	2	St3	2 TU	
		120~200°C	YES	Sa2½	6	St3	6 TU	
		200~500°C	NO	Sa2½	3	St3	3 TU	
		200~500°C	YES	Sa2½	3	St3	3 TU	
Piping, Vessels, Tank, Silos, Exchangers 管线, 容器, 储罐, 料 仓, 交换器	SS	60~150°C	YES	Sweep blast 扫射喷砂	7	St2	7TU	If chloride exist 如有氯离子存在
Fired Heater, Furnaces and Air Preheater Surface 火焰加热器, 燃烧炉和空气预热器 表面	CS	<120°C	NO	Sa2½	1	St3	1 TU	
		120~200°C	NO	Sa2½	2	St3	2 TU	
		200~500°C	NO	Sa2½	3	St3	3 TU	Color as per table 颜色参照 各表格



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Commodity 常见类型	Material 材质	Temperature 温度*	Insulated 保温与否	Surface Preparation 表面处理	System No. 系统号	Repair Surface Preparation 修补处表面处理	System No. Repair 修补系统号	Remarks 备注
Rotating equipment, Electrical motor, Pumps, Compressors 转动设备, 电动马达, 泵, 压缩机	CS or Alloy 碳钢 或合金				Manufacturer Standard 制 造商标准			Preferable Grey 7035 or vendor standard color 最好选用灰色 7035 或供应商 标准色
Galvanized piping 镀锌管线	Galvanized 镀锌	Normal 常温	NO	Sweep blast 扫射喷砂	10	Light grinding 轻轻打磨	10TU	For surface I.D. color 适用于表 面识别色
Potable water tanks 饮用水储罐	CS	<80°C	NO	Sa3	8	Spot blasting or St3 局部喷砂	8TU	Inner 内壁
Condensate water tanks 冷凝水储罐	CS	<80°C	NO	Sa3	9	Spot blasting or St3 局部喷砂	9TU	Inner 内壁
Bumper Steel Pile, Under Water 防撞钢 桩, 水下部分	CS	<120°C	NO	Sa2½	11	St3	11TU	
Bumper Steel Pile, On Water 防撞钢桩, 水 上部分	CS	<120°C	NO	Sa2½	12	St3	12TU	

Note 注: 1, temperature is the highest operation temperature 温度是指最高操作温度;



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APPENDIX 附录 2 2. Paint System 油漆系统

System number 系统号	Surface preparation 表面处理	Paint system 涂层系统			
		Primer 底漆	Inter-coat 中间漆	Top coat 面漆	Total DFT 总干膜厚度
1	Sa2.5	Epoxy zinc rich 环氧富锌底漆 DFT 75 um	High build epoxy polyamide 厚浆型聚酰胺环氧漆 DFT 105um	High build aliphatic polyurethane 厚浆型脂肪族聚氨酯 DFT 70um	250um
1TU (修补)	St3	(Surface tolerant) Epoxy aluminum primer (低表面处理) 环氧铝粉底漆 DFT 180um		High build aliphatic polyurethane 厚浆型脂肪族聚氨酯 DFT 70um	250um
2	Sa2.5	Alkyl zinc silicate 烷基硅酸锌底漆 DFT 75um	Silicone Acrylic 硅酮丙烯酸硅树脂漆 DFT 40um	Silicone Acrylic 硅酮丙烯酸硅树脂漆 DFT 40um	155um
2TU (修补)	St3		Silicone Acrylic 硅酮丙烯酸树脂漆 DFT 40um	Silicone Acrylic 硅酮丙烯酸树脂漆 DFT 40um	80um
3	Sa2.5	Alkyl zinc silicate 烷基硅酸锌底漆 DFT 75um	Heat resistant aluminum silicon 耐高温硅酮铝漆 DFT 30um	Heat resistant aluminum silicon 耐高温硅酮铝漆 DFT 30um	135um
3TU (修补)	St3		Heat resistant aluminum silicon 耐高温硅酮铝漆 DFT 30um	Heat resistant aluminum silicon 耐高温硅酮铝漆 DFT 30um	60um
4	Sa2.5	(Surface tolerant) Epoxy aluminum primer (低表面处理) 环氧铝粉底漆 DFT 100 um		(Surface tolerant) Epoxy aluminum primer (低表面处理) 环氧铝粉底漆 DFT 100 um	200um
4TU (修补)	St3	(Surface tolerant) Epoxy aluminum primer (低表面处理) 环氧铝粉底漆 DFT 100 um		(Surface tolerant) Epoxy aluminum primer (低表面处理) 环氧铝粉底漆 DFT 100 um	200um
5TU (修补)	St3	Special Zinc rich paint 特殊富锌漆 DFT100um			100um

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System number 系统号	Surface preparation 表面处理	Paint system 涂层系统			
		Primer 底漆	Inter-coat 中间漆	Top coat 面漆	Total DFT 总干膜厚度
6	Sa2.5	High build epoxy phenolic 厚浆型环氧酚醛漆 DFT 100um		High build epoxy phenolic 厚浆型环氧酚醛漆 DFT 100um	200um
6TU (修补)	St3	High build epoxy phenolic 厚浆型环氧酚醛漆 DFT 100um		High build epoxy phenolic 厚浆型环氧酚醛漆 DFT 100um	200um
7	Sa1	High build epoxy polyamide 厚浆型聚酰胺环氧漆 DFT 100um		High build epoxy polyamide 厚浆型聚酰胺环氧漆 DFT 100um	200um
7TU (修补)	St2	High build epoxy polyamide 厚浆型聚酰胺环氧漆 DFT 100um		High build epoxy polyamide 厚浆型聚酰胺环氧漆 DFT 100um	200um
8	Sa2.5	Coating shall be approved for potable water by authorities 饮用水设施的涂层需由权威部门批准			300um
8TU (修补)	St3	Coating shall be approved for potable water by authorities 饮用水设施的涂层需由权威部门批准			300um
9	Sa2.5	High build epoxy polyamide 厚浆型聚酰胺环氧漆 DFT 150um		High build epoxy polyamide 厚浆型聚酰胺环氧漆 DFT 150um	300um
9TU (修补)	St3	High build epoxy polyamide 厚浆型聚酰胺环氧漆 DFT 150um		High build epoxy polyamide 厚浆型聚酰胺环氧漆 DFT 150um	300um
10	Sweep blasting 扫射喷砂	epoxy polyamide or special primer 聚酰胺环氧漆或特殊底漆 DFT50um		High build aliphatic polyurethane 厚浆型脂肪族聚氨酯 DFT 50um	100um
10TU (修补)	Light grinding 轻度打磨	epoxy polyamide or special primer 聚酰胺环氧漆或特殊底漆 DFT50um		High build aliphatic polyurethane 厚浆型脂肪族聚氨酯 DFT 50um	100um

Painting Specification 涂料规范				Responsible unit 负责单位		CTE	
				Responsible person 负责人		Chen Xindong	
No. 编号	40-010-00-0-0-00-004			Revision 修订	7	Revision date 修订日期	2017.08.09
Category 类别	BYC Standard	Status 状态	Current 当前	Application area 使用范围	BYC	Page/Total pages 页/总页	48 / 49

System number 系统号	Surface preparation 表面处理	Paint system 涂层系统			
		Primer 底漆	Inter-coat 中间漆	Top coat 面漆	Total DFT 总干膜厚度
11	Sa2.5	Modified Epoxy 改性环氧树脂漆 DFT200um	Modified Epoxy 改性环氧树脂漆 DFT250um		450um
11TU	St3	Modified Epoxy 改性环氧树脂漆 DFT200um	Modified Epoxy 改性环氧树脂漆 DFT250um		450um
12	Sa2.5	Modified Epoxy 改性环氧树脂漆 DFT200um	Modified Epoxy 改性环氧树脂漆 DFT200um	High build aliphatic polyurethane 厚浆型 脂肪族聚氨酯 DFT 50um	450um
12TU	St3	Modified Epoxy 改性环氧树脂漆 DFT200um	Modified Epoxy 改性环氧树脂漆 DFT200um	High build aliphatic polyurethane 厚浆型 脂肪族聚氨酯 DFT 50um	450um

Notes: for heavy corrosion environment, such as there is much acid gas, other top coat with better anticorrosion performance shall be adopted.

注：对于重度腐蚀环境，如有较多的酸性气体，应采用防腐性能更好的面漆。

15. Revision Background and Next Revision Date 修订背景和下次修订日期

Previous Paint system cannot meet the environment condition.

原油漆系统已不能满足对应的环境了。

Next revision date of this procedure should be August, 08, 2020.

本程序的下次修订日期为 2020 年 08 月 08 日。

Painting Specification 涂料规范				Responsible unit 负责单位		CTE	
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Record of Revisions
修订记录

7	2017-08-09	Zhang Dinghua 张定华	Chen Xindong 陈兴东 2017.8.16	Pan Qingsheng 潘庆生 2017.8.17	6,7,34,35, 36,39,44, 46,47,48	Issued for Design, Construction and Maintenance 用于设计、施工和维修	
6	2011-08-05	Zhang Dinghua	Li Linggang	Dr. Alexander Wiesel	Page7,14, 32,42,45, 47,48	Issued for Design, Construction and Maintenance 用于设计、施工和维修	
5	2008-08-05	Zhang Dinghua	Li Linggang	Dr.Ulrich Schuenemann	Page6,8, 11,15,21, 45,47	Issued for Design, Construction and Maintenance 用于设计、施工和维修	
4	2006-06-27	Zhang Dinghua	Li Linggang	Dr.Ulrich Schuenemann	All 全部	Issued for Design and Construction 用于设计和施工	
3	2004-9-22	Zhang Dinghua	Li Linggang	Kurt Raschka	All 全部	Issued for Design and Construction 用于设计和施工	
2	2002-4-20	P.J. van Dijk	D. Mayadas	Jim Davis M. Schulz	All 全部	Issued for Design. All pages revised 用于设计, 所有页均修改过	
1	2001-10-2	P.J. van Dijk	D. Mayadas	Jim Davis M. Schulz	All 全部	Issued for Design 用于设计	
A	2001-4-23	P.J. van Dijk	J.Poort	Jim Davis M. Schulz	All 全部	Issued for Design 用于设计	

Revision No 修订序号	Date 日期	Originator 修订人	Reviewed by 审核人	Approved by 批准人	Pages 页数	Description 描述
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