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ENGINEERING SPECIFICATION FOR INTERNAL & EXTERNAL COATING OF AVIATION FUEL PIPING

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ENGINEERING SPEC. FOR INTERNAL AND EXTERNAL COATING OF ATF PIPING

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ENGINEERING SPEC. FOR INTERNAL AND EXTERNAL COATING OF ATF PIPING

1. General

- 1.1 This specification covers the requirements and general guidelines for both shop and field application of surface preparation and internal and external coating on aviation fuel oil piping.
- 1.2 Field application for surface preparation and coating shall not take place under adverse conditions, in particular rain, fog, sandstorm or when such conditions are likely to occur. No surface preparation or coating shall take place at temperatures below 5°C, or when the relative humidity is greater than 85% or when the metal surface temperature is less than 3°C above the dew point. No work shall take place when the wind speed exceeds 35 km/h.
- 1.3 In this project, aviation fuel oil piping (process piping) are divided into aboveground part and underground part, the detail requirements for internal and external coating on aboveground and underground piping are according to follow table:

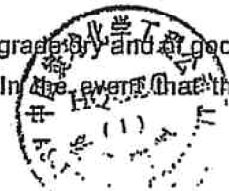
	SURFACE PREPARATION	PAINTING REQUIREMENT
INTERNAL SURFACE OF ABOVEGROUND PIPING	SA - 2 1/2	AMINE - CURED EPIKOTE COATING
EXTERNAL SURFACE OF ABOVEGROUND PIPING	SA - 2 1/2	PRIMER PAINTNG INTERMEDIATE TOP
INTERNAL SURFACE OF UNDERGROUND PIPING	SA - 2 1/2	AMINE-CURED EPIKOTE COATING
EXTERNAL SURFACE OF UNDERGROUND PIPING	SA - 2 1/2	HDPE COATING

2. Procedure**2.1 Surface Preparation for Internal and External Surfaces**

2.1.1 Blast cleaning will not be conducted when the relatively humidity of the air is greater than 85% and the substrate surface temperature is less than 3°C above the dew point.

2.1.2 Only dry abrasive blast-cleaning techniques shall be employed.

2.1.3 Preferred abrasive shall be copper slag or chilled iron grit properly graded and of good quality. The size range shall be 20-40 mesh US standard sieve. In the event that the



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material manufacturer recommends abrasive in sieve sizes other than indicated herein, then the manufacturers' recommendation shall be followed, after approval from Employer's representative

2.1.4 Solvent cleaning shall be carried out whenever deposits of oil & grease are present on the surface before carrying out the specified surface preparation.

2.1.5 Minimum standard for blast cleaning shall be in accordance with USA SSPC-SP5-63 near white finish and to a visual standard in accordance with Swedish IS 5900-1967 standard Sa - 2 1/2.

2.1.6 If during surface preparation flash rusting of the blast cleaned surface occurs prior to coating, then re-blasting of the affected areas should be carried out to the standard laid down.

2.1.7 Preparation and painting applications shall be arranged to ensure that freshly applied paint shall not be contaminated by the cleaning of adjacent surfaces. Surfaces that are not cleaned within the stated time limit shall be re-cleaned to the required standard before priming.

2.1.8 Prepared surfaces shall be cleaned free from any residual abrasive dust particles or any other loose products of the cleaning operations by means of compressed air.

2.1.9 The compressed air supply used for blast cleaning shall be free of water and oil. Adequate separators and traps shall be provided and these shall be kept emptied of water and oil.

2.1.10 Spent abrasive shall be removed from cleaned external surfaces by dry brushing and blowing down with clean, dry compressed air. Internal surfaces shall be dry brushed and vacuum cleaned.

2.2.11 Any laminations occurring in steel surfaces to be painted shall be removed.

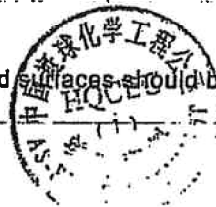
2.1.12 After fabrication, all weld spatters will be removed and where necessary, the welds will be ground smooth. All welded areas will be blasted to SA-2 1/2.

2.2 Epoxy Coating on Internal Surface of Piping**2.2.1 Proposed System**

Application of two coats Copon EA 4 2217 at 65 microns dry film thickness per coat unless otherwise specified.

2.2.2 Application of First Coat Copon EA4 2217

Copon EA4 2217 should be applied by airless spray. Prepared surfaces should be clean, .



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dry and free from contamination.

Copon EA4 2217 is a two component material comprising a Base and Activator component which must be mixed together prior to use. The Base should be stirred and whilst Activator should be added and mixing until a thoroughly homogeneous product is obtained.

Copon EA4 2217 should not be applied when the relative humidity is above 85% or when the surface to be coated is less than 3°C above the dew point. The minimum temperature for application is 10°C .

Copon EA4 2217 should be a nominal 120 microns wet to produce 65 microns DFT.

During application regular checks shall be carried out using wet coating thickness gauges.

Once the coating has dried, the surface should be inspected and any visible areas of bare steel be coated to the correct film thickness.

2.2.3 Application of Second Coat Copon EA4 2217

The first coat of Copon EA4 2217 should be dry and free from contamination.

The second overall coat of Copon EA4 2217 mixed in accordance with section 2.2.2 should be applied.

2.2.4 Final Drying Time

Copon EA4 2217 achieves full cure after 7 days at 20°C. This time will be extended at low temperatures and shortened at high temperature.

2.2.5 Precautions After Coating

The internal coating can be applied either before or after other treatment to the pipe, however the following precautions should be taken when the internal coating is carried out before other treatment.

Care should be taken in handling and shoring the coated pipe to ensure that the coating is kept clean and undamaged.

Any dirt or contamination of the cured coating shall be removed by careful cleaning /degreasing and the surface dried before the final replacement of end caps.

The internal coating must be thoroughly dry before any process involving heat is carried out to avoid solvent blistering or other damage to the coating.

2.2.6 Quality Control

Proper quality control include following items:



ENGINEERING SPEC. FOR INTERNAL AND EXTERNAL COATING OF ATF PIPING**A. Surface preparation Stage**

- Comparison with BS 7079 Part A1:1989 standard for surface preparation
- Check on blast profiles and comparison with BS 7079 Part C3
- Check on cleanliness of blast surface prior to coating
- Regular check on humidity, dew point and surface temperature during blast cleaning

B. Application Stage

- Regular checks on wet film thickness
- Regular visual checks for coating integrity, uniformly, freedom from runs, sags and imperfections
- Regular checks on humidity, dew point and surface temperature during coating

C. Minimum 24 Hours After Application

- Checks on dry coating thickness

D. Test for Cure

- Mek test for full cure prior to commissioning

2.3 Painting on External Surface of Aboveground Piping

According to "Engineering Specification for Surface Preparation & Painting"

2.4 HDPE Coating on External Surface of Underground Piping

Underground aviation fuel oil piping shall be coated with high-density polyethylene in accordance with "DIN 30670 - Polyethylene Coating for Steel Pipes and Fittings" (latest revision) or equivalent standard

The minimum coating thickness shall be as specified in following table:

Nominal Size of Pipe	Minimum Thickness of normal coating, mm
Up to 4"	1.8
4" to 10"	2.0
10" to 20"	2.2

3. Inspection and Testing**3.1 Inspection of Pipeline Coating**

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A 100% Holiday examination of the entire pipeline coating shall be carried out whilst the pipeline is strung along the edge of the pipe trench, prior to lowering the pipeline into the trench.

All defects registered by the Holiday detector shall be clearly marked and reported to the Engineer. When the Engineer has carried out his inspection. The Contractor shall unless otherwise directed by the Engineer repair the damages/defective portions of the pipeline coating in accordance with this Specification. When the repair is completed the Contractor will repeat the Holiday inspection of the satisfaction of the Engineer. Only when the sector to the pipeline under examination has been finally approved by the Engineer shall it be laid in position of the supports at the bottom of the trench.

3.2 Peel Test

The Contractor shall perform a Peel Test of 2% of all sleeves and wrappings. The precise joints and tapes to be tested shall be at the discretion of the Engineer.

The peel test shall be carried out by making two parallel cut 75 mm apart and 150 mm long over the weld bead, in the case of a through welded joint, and over the coat/pipe interface in the case of tape wrapped fittings. The adhesive and/or surface irregularities and tear in a cohesive manner. The Contractor shall allow for repair of all sleeves and wrappings thus tested. Material shall be supplied for this purpose. No more than one peel test and repair shall be allowed per joint.

3.3 Final Examination of Coating

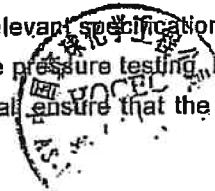
The Contractor shall carry out a final visual check of the pipeline coating once this is in place on the pipeline supports and all welding work has been completed. The Engineer will be in attendance during this verification and any burns, holes or tears in the pipeline coating shall be made good by the Contractor in accordance with this Specification and to the satisfaction of the Engineer.

3.4 Protection of Welded Joints and Damaged Coating

All butt-welds on coated pipelines and butt-welded fittings where possible shall be protected with wrap-around shrink-fit sleeves shrunk on to the pipe barrel fitting around the weld in accordance with the relevant specification. The sleeves shall not be applied before the line has been fully pressure tested.

Where it is not possible to protect a pipe joint or welded fitting with a shrink fit sleeve the weld area or fitting shall be protected by means of a butyl primer and pe protective tape. Application of the (t)ale shall be in strict compliance with the relevant specification. As noted above no tapes shall be applied prior to the completion of the pressure testing. In the case of joints which have to be welded in-situ, the Contractor shall ensure that the joint to be

Latter



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either sleeved or taped is well clear of the trench wall or supports before attempting this word.

3.5 DFT Inspection

DFT(Dry Film Thickness) should conform to the requirement in this specification.

4. Quality Inspection Procedure

Quality Inspection Procedure shall be executed manufacture's quality plan. See following attachments.

Attachment1 - Quality Inspection Procedure for Internal Coating

Attachment2 - Quality Inspection Procedure for Three Layer Polyethylene Coating

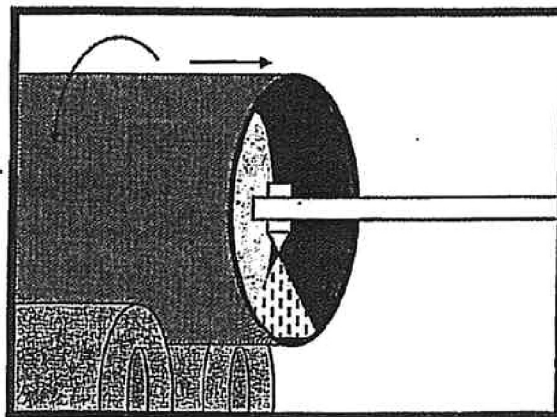




P.T. Bredero Price Indonesia

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Quality Plan




Internal Coating

DOCUMENT NUMBER

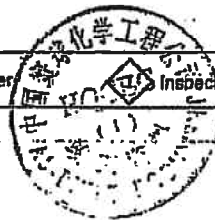
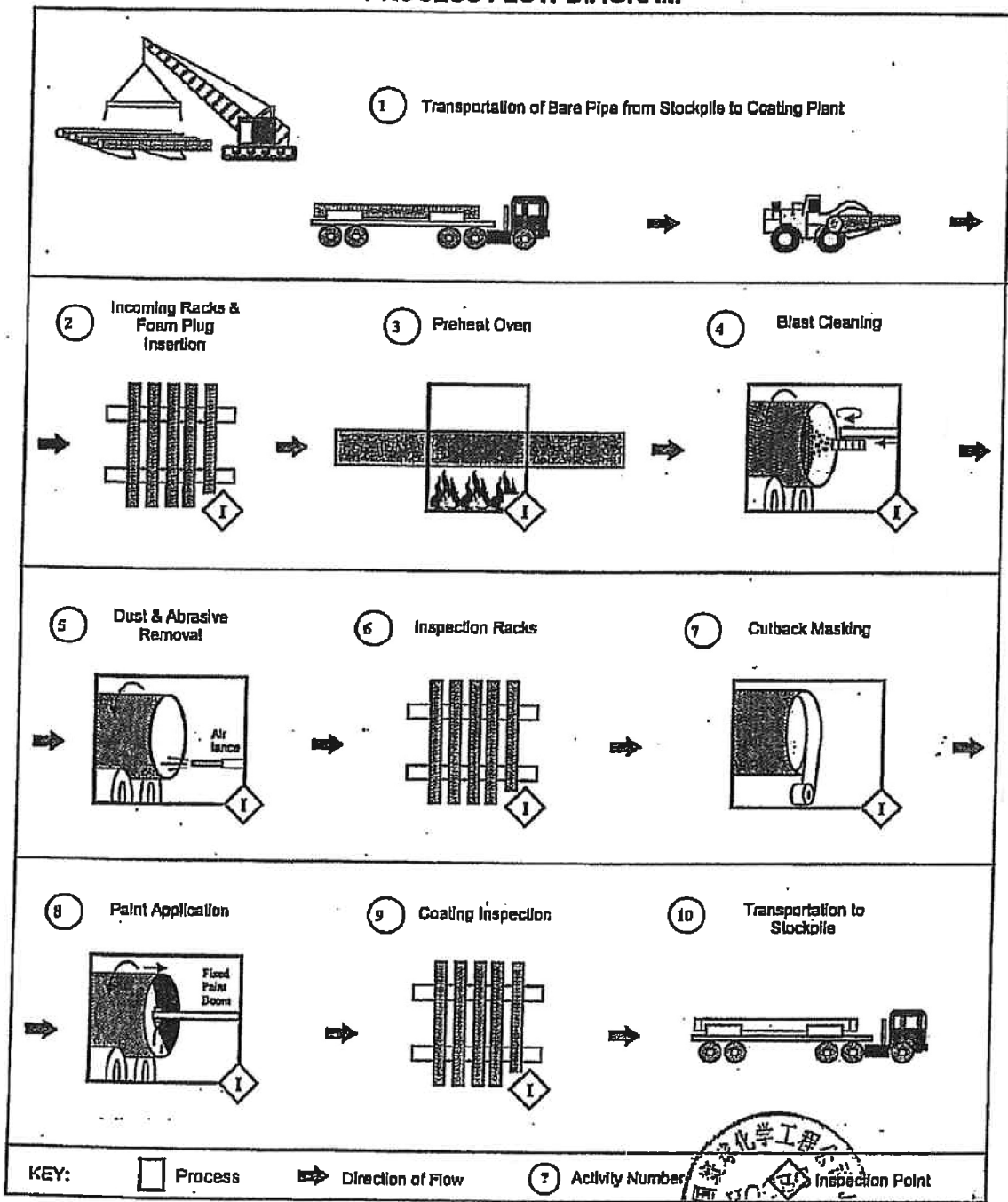
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Revision No.	Revision Date	Comments	Raised By	Approved By	Authorized By	Customer

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PROCESS FLOW DIAGRAM



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1.0 INTRODUCTION

1.1 SCOPE

This Quality Plan defines the application, inspection, repair, handling and storage requirements of factory applied internal epoxy coatings for flow improvement or anti-corrosion protection of steel line pipe. The coating system can be applied to longitudinal welded, spiral welded and to seamless pipe for the construction of buried or submerged pipelines.

This procedure is written with the intention of being a working instruction for PTBPI personnel by detailing the standard of workmanship and acceptance criteria throughout each phase of the process.

1.2 DEFINITIONS

Customer

PTBPI

Manufacturer

- Organization issuing Purchase Order to Bredero Price
- P.T. Bredero Price Indonesia
- Manufacturer or Supplier of raw materials associated with the coating process.

1.3 COATING SYSTEM DESCRIPTION

The coating system described in this document shall be manufactured using Liquid Epoxy as the main coating material, using suitable surface preparation and application techniques to obtain the coating properties required for its intended installation and operating conditions.

2.0 REFERENCES

The following references are relevant to this procedure:

2.1 Customer's Specifications

2.2 PTBPI Management Procedures

3.0 RESPONSIBILITIES

3.1 The Superintendent shall be responsible for all plant workforce and equipment necessary for the required operation. He shall also ensure that the operations are performed in a safe manner and that the product meets the requirements specified herein.

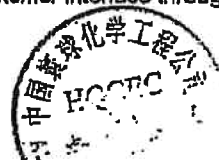
3.2 The QA/QC Manager is responsible for ensuring that the Customer's agreed quality requirements are satisfied. He shall also ensure that the Q.C. inspectors inspect and control the quality of the product in accordance with this document.


3.3 Project Coordinator shall ensure that all services and coating related materials are available for the successful and timely completion of the project. He shall also act as the Customer interface throughout the duration of the Project.

4.0 COATING SYSTEM REQUIREMENTS

4.1 INCOMING RACKS - PIPE RECEIPT

On entering the Plant, pipes shall be placed on incoming racks where they shall be inspected for damage and contamination. Any internal surface grease and oil shall be removed by solvent cleaning which does not leave residue, in compliance with SSPC-SP-1 or customer approved method. Pipe identity shall be verified and recorded on incoming racks, and transferred to the external surface of the pipe. Where excessive contamination is present, pipes shall be quarantined and brought to the attention of the Customer's Representative.



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4.2 PIPE PRE HEAT

Pipes shall be preheated where necessary to a temperature of minimum 3°C above dew point and to remove any condensation observed on the steel before blast cleaning work. Pipe temperature and ambient relative humidity shall be monitored using a pyrometer and hygrometer.

4.3 BLAST CLEANING

Pipes shall be cleaned by mechanical or air blasting, depending on pipe diameter, using abrasive. Condition of pipe profile and cleanliness shall be continuously monitored to ensure the quality of blast finish is achieved.

4.4 DUST AND ABRASIVE REMOVAL

On completion of blast cleaning, pipes are indexed to dust/abrasive removal station. The pipe is rotated as the residual abrasive is removed from the internal bore of the pipe cleaned by blowing dry compressed air. Depending on weight and size, the pipe may be raised on the Tilt Bridge to accelerate this process. Upon completion of cleaning and removal of residual abrasive, pipes are then indexed to inspection racks. Prepared surface shall be inspected/checked to ensure that project requirement is achieved.

4.5 END CUTBACK TAPING

Before coating, the required cutback length shall be taped internally to protect the ends from being coated. Such cutbacks shall be checked and measured to ensure that project requirement is met.

4.6 COATING APPLICATION

The coating material shall be prepared according to mix ratio and thinned, if required or as specified by the manufacturer. The freshly prepared material shall be agitated and transferred to the application nozzle. The pressure, spray tip and travel speed shall be adjusted to give the optimum performance and the required paint coverage.

Blast cleaned pipes shall be lowered on support rollers and rotated. The coating shall then be applied to the internal surface by airless spray using an internal lance.

Freshly coated pipe is then moved to a holding rack where inspection, repair works and curing are carried out. Missed/test area shall be brushed up using material of same mix, as per manufacturer's recommendation. Q.C. personnel shall check wet film coverage by using comb type wet film gauge. The coating is let to dry and cure at ambient temperature.

Tally Inspector shall reinstate the required pipe identification onto the internal cutback area prior to any pipe leaving the plant.

4.7 REPAIRS TO COATING

Small repair areas on fresh coating shall be attended to immediately, where possible, by using paint from the same mix and brushing over the area.

Where the coating has cured, the repair area shall be prepared by using wire brush, sandpaper or other suitable means. Coating shall be abraded over 25 mm to provide rough overlap surface between repairs and parent coating. Material of correct mix proportions shall be applied by using brush or roller. Care must be taken to ensure proper finish without sags, runs or other defects. Repair shall be cured at ambient condition.


4.8 OUT GOING RACKS & YARD COATING INSPECTION

Coated pipes shall be kept until touch dry before being transferred from the plant to other, station or storage. Once coating is cured, QC Inspector shall perform dry film thickness checks and other tests to requirement, as detailed in the Inspection and Test Plan below.

4.9 RETEST PROCEDURE

Any pipe tested that fails to meet the project requirements shall be rejected and reprocessed. Pipe coated before and after the test pipe shall be tested until acceptable results or extend of failure is identified. All pipes that failed shall be reprocessed.



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4.10 STRIPPING AND RE-COATING

Coating defects that cannot be repaired such as excessive runs, sags, etc. shall be caused for rejection. Coating shall be re-blasted or sweep blasted, or as per paint manufacturers' recommendations, and re-coated.

5.0 HANDLING, TRANSPORTATION & STORAGE

5.1 HANDLING

At outgoing racks pipes shall be rolled on bearing racks for final inspection. Where no further processing of the pipe is required, pipe shall be transferred from outgoing racks to trucks by means of overhead crane, fitted with suitably padded hooks, and transferred to storage. Front-end loaders may also be used providing the lifting cradle is lined with soft rubber or foam.

Rejected pipes shall be marked with single red circumferential band for identification and traceability. Such rejected pipes shall be stored separately for further process; e.g. re-blasting and re-coating work.

Quarantine pipes including test pipes shall be marked with Red/White hazard tapes. Where such quarantine is due to steel damage during process/handling, the pipe shall then be colour-coded white at bevel face. Such hazard tapes/markings shall be removed/cancelled by QC upon acceptance of repair work, rectification or Customer agreed action, as applicable.

Pipes with identity problem shall be marked with Yellow/Black hazard tapes, and shall be controlled and monitored by Tally personnel. Such hazard tapes/markings shall be removed cancelled by Tally personnel upon completion of Customer agreed action.

5.2 TRANSPORTATION

Pipe shall be transferred from outgoing racks to trucks by means of overhead crane, fitted with suitably padded hooks. Pipes shall be transported by flat bed trucks with suitable padded supports to prevent damage to the internal coating. Front-end fork loaders may also be used providing the lifting cradle is lined with soft rubber or foam.


5.3 STORAGE

Pipe shall be stored on sand berms comprising of two baulks of sand, 30cm high with a bearing surface 1m wide, each 6m apart, approximately. Sand berms shall be inspected for suitability prior to use. Sand berms shall be covered with polythene sheeting, to ensure no contact between pipe and berm.

All pipes shall be stored in stacks segregating the pipe by source, grade, and diameter and wall thickness, coating type and where applicable colour-codes. Pipes shall be positioned clear of the ground and at an angle sufficient to ensure adequate water drainage through the bore of each pipe. Pipe interiors shall be kept clean and free from mud splashing or dirt deposits during storage.

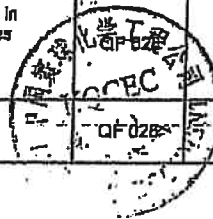
Pipe will be stacked with due consideration to impact effects, nested together up to a maximum of 4 metres high.




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INSPECTION & TEST PLAN

Process/ Location	Description	Frequency	Acceptance Criteria (As per Customer's Specification - Where Applicable)	Report Forms	Approval Inspection	
					PTBPI	Customer
Material Receipt	Paint - Base, Activator & Thinners	Every Batch	Test Certificate Values shall conform to Specification requirements	IRF033	VNC	ME
	Abrasive	Every Delivery	Packaging Secure, Marking Legible			
Incoming Racks	Visual Inspection	All pipes	Contamination & defect Free	-	V	M
	Verify pipe identity	All pipes	Transfer pipe identity to external surface	-	V	M
Surface Preparation	Check pipe temperature and relative humidity.	Startup and every 2 hrs.	3°C above dew point. Target range 10 - 55°C. Relative humidity 90% max.	QF 024	HNC	ME
	Inspected blast finish and for steel defects.	All pipes. Record every 2 hrs.	Sa 2.5 minimum	QF 024	HVC	ME
	Check surface profile using Testex Tape	Startup and every 2 hrs	40µm to 100µm. (1.5 - 4 mils)	QF 024	DC	ME
	Cutback Tape Application	Every Pipe	1 inch to 2 inch (25 mm to 50mm)	-	D	M
Coating Application	Paint mixing	Every Mix	Ratio and thinning in accordance with Manufacturer's recommendations	QF 025	VHC	ME
	Check Coating Finish and Coverage	Every Pipe	Defect free and full coverage	-	V	M
	Wet Film Thickness	Every 10 th Pipe	Wet film as required to produce a DFT of 38 microns	QF 025	NC	M
Out Going Racks	Repairs	Every Repair	Visually check all repairs - defect free	QF 030	VC	ME
	Marking	Every Pipe	Reinstate pipe identity on cutback area prior to leaving the plant. Full stencil to be applied following coating cure located 6 inch from pipe end.	-	M	M
Laboratory Testing Testing in accordance with API RP 5L2	Pin Hole Test (using glass slides)	3 per shift	No more than 15 pinholes in any inch sq. when viewed with 100 Watt bulb.	QF 028	VC	ME
	Bend Test	3 per shift	No cracking of the coating when bent over a 0.5" diameter mandrel.	QF 028	TVC	ME
	Adhesion Test	3 per shift	No lifting of the coating other than cuttings.	QF 028	TVC	ME
	Stripping Test	3 per shift	Coating shall not be removed in strips but shall flake off. Pieces should break into powder like particles.	QF 028	TC	ME
	Thickness Test (on glass slides)	3 per shift	43 microns minimum	QF 028	VC	ME



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Process/ Location	Description	Frequency	Acceptance Criteria (As per Customer's Specification - Where Applicable)	Report Forms	Approval Inspection	
					PTBPI	Customer
Laboratory Testing (cont.)	Cure Test- 4 hrs Immersion in solvent	Once Per Shift	No softening, wrinkling or blistering of the coating film.	QF 028	T V C	M E
	Water Soak Test - 4 hrs Immersion in water	Once per shift	No loss of adhesion, softening, wrinkling or blistering of the coating film.	QF 028	T V C	M E
Filed Inspection	Dry Film Thickness	5% of shift production	38 microns minimum.	QF 025	V T H C	M E
Calibration	Profile Gauge	Startup and Every 4hrs	Calibrate with Profile Shim	QF 024	Adjustable to $\pm 5\%$ of Target Value	
	Coating Thickness Gauge	Startup and Every 4hrs	Calibrate with Thickness Shim	QF 025	Adjustable to $\pm 5\%$ of Target Value	

Legend	C	Record & Raise Documents	H	Hold Point	N	Non-Destructive Testing	V	Visual Inspection
	D	Dimensional Inspection	I	Random Inspection	R	Review	W	Witness
	E	Examine / Endorse Documents	M	Monitor	T	Destructive Testing	WFO	Witness First Of