حديد الإمارات
emirates steel
a SENAAT company إحدى شركات صناعات

Integrated Management System

Engineering Standards

PAINTING & PROTECTION Engineering Standards

PRD-PP-GS-001

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1. PURPOSE

The purpose of the ES Engineering Standards is to provide information and guidelines for the design, erection, installation and commissioning of plant and equipment across ES Sites.

2. SCOPE

The standards referenced in this document are issued to all contractors and form an integral part of the contract documentation.

Compliance is mandatory by all Contractors, ES Departments and personnel, whilst designing, erecting, installing and commissioning plant and equipment within ES sites, and any deviations require the explicit written approval of ES.

3. DEFINITIONS / ABBREVIATIONS

ES - Emirates Steel

MOC - Management of Change

4. RESPONSIBILITIES

VP of Marketing & Strategy - Is responsible for approving the Standards, and delegating members of his department to review them on a periodical basis, and / or write new standards when deemed necessary.

Projects Construction Manager - Is responsible for ensuring that all projects undertaken within ES comply with these standards.

Engineering Manager Projects - Is responsible for revising the Standards as requested by the projects and operations departments.

5. DESCRIPTION

5.1 General Requirements

5.1.1 SCOPE

This standard defines requirements for protective coatings, including associated cleaning, preparation and general finish required of surfaces and items associated with all works including civil, structural, mechanical and electrical works, whether executed at the Contractor's works or at site.

5.1.2 STANDARDS

BS EN ISO 12944-1 Paints and varnishes - Corrosion protection of steel structures by protective paint systems:

- Part 1: General introduction;
- Part 2: Classification of environments;
- Part 3: Design considerations;

- Part 4: Types of surface and surface preparation;
- Part 5: Protective paint systems;
- Part 6: Laboratory performance test methods;
- Part 7: Execution and supervision of paint work;
- Part 8: Development of specifications for new work and maintenance.

BS 5493 1977 Code of practice for protective coating of iron and steel structures against corrosion.

EN ISO 14713 Protection against corrosion of iron and steel in structures - zinc and aluminium coatings - guidelines.

ISO 1461 Hot dip galvanized coatings on fabricated ferrous products - Specifications

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 uncoated steel substrates and of steel substrates after overall removal of previous coatings.

ISO 14713 Protection against corrosion of iron and steel in structures - Aluminium and zinc coatings - Guidelines.

5.1.3 BASIC FINISH REQUIREMENTS

1. GENERAL

All equipment and structures shall withstand environmental conditions where they will finally be located and those they will be exposed to during transportation to site, storage and erection.

Structures and equipment shall be designed to eliminate corrosion traps or dissimilar metals in contact that might encourage corrosion. Adequate access shall be provided for corrosion protection work.

The open ends of all steel hollow sections shall be sealed with a plate that is fully welded in place.

Wherever viable, the base material shall be resistant to the environment; otherwise separately applied means of protection shall be provided in the form of proven coatings and paint systems. A paint system shall typically consist of surface preparation, primer

coat, intermediate coat if required and finish coat, according to standard materials and methods.

Wherever possible, preparation and painting shall be performed at the manufacturer's works. Site painting work shall be kept to a minimum. Where site painting operations are necessary, the Contractor shall utilise paints that are readily available from local sources.

The locally obtained paints shall be compatible with any paint protection that has already been applied to the steelwork off site.

In selecting paint systems and other protective measures, attention must be paid to protection from corrosive industrial atmospheres, sea air and moisture. Erosion and contamination by airborne dust must also be considered.

Special care shall be taken to protect items installed below ground against corrosion, especially from saline groundwater. Cathodic protection shall be provided for all buried and submerged structures.

For the purposes of the buildings, plant and equipment design the ES site shall be classed as a “Polluted Coastal” area according to BS 5493 1977 Table 1 and the protection systems defined in Table 3 Part 3 shall apply for a “Long” first life to maintenance of 10 to 20 years. The CONTRACTOR shall provide the appropriate protection systems defined in BS 5493 1977.

The corrosivity of the atmosphere, water and soil shall be established as specified in EN ISO 12944 Part 2 and paint and protection systems shall be selected accordingly, but unless specifically agreed in advance with ES external surfaces shall suit no less than atmospheric corrosivity Category C4, with Categories Im2 and Im3 for water and soil respectively. The durability category shall be no less than Medium.

2. SURFACES EMBEDDED IN CONCRETE

Structural materials embedded in concrete including reinforcing bar and wire shall be protected by one coat of a suitable primer. The coating shall be applied at the manufacturer’s works using equipment and methods in accordance with the coating manufacturer's recommendations. Care shall be taken throughout handling,

transportation, storage and fabrication to prevent damage to the coating. Cut surfaces, damage to coatings and any other bare metal remaining before pouring concrete shall be retouched using the same paint system - materials, methods of preparation and application.

Coating grade and thickness shall be agreed in advance with ES.

Potential problem areas for corrosion arising from moisture such as plinths, bases of columns, and earthing and bonding points shall receive special attention regarding arrangement details, coating and cathodic protection. Solutions shall be agreed with ES.

3. MACHINED SURFACES

Machined surfaces which are left unpainted for assembly on site shall be protected against rusting by coating or covering with a suitable compound that will preserve the surface in good condition. Such coatings and coverings shall be easily removable prior to installation.

4. UNPAINTED SURFACES

The decision to leave any surfaces unpainted, for example the insides of bunkers or containers for bulk transportation or storage, shall be discussed and agreed in advance with ES.

5. STRUCTURAL STEEL

Steelwork delivered pre-assembled or intended for bolted assembly shall be finish painted, also any surfaces that will be inaccessible after works fabrication. In the case of steelwork fabricated or welded on site, the components shall be prepared and prime painted at the manufacturer's works prior to dispatch to site.

Steelwork including heavy components and structures shall be protected in accordance with BS 5493 1977 with attention to the special conditions such as corrosivity which may affect the choice of paint system, as identified in EN ISO 12944 Part 2.

The design shall ensure that there are no corrosion traps, also that dissimilar metals are insulated from each other to avoid galvanic corrosion and that adequate access is provided for corrosion protection work, as called for in EN ISO 12944 Part 3. Cathodic protection shall be provided for all buried and submerged structures.

Paint systems shall be selected as indicated in EN ISO 12944 Part 4, taking into consideration the surface preparation method, required durability and suitability for the environment as prescribed in Part 5 of the EN ISO standard. Should it be necessary to consider a surface/paint system for which limited long-term experience is available, laboratory testing shall be referenced as called for in EN ISO 12944 Part 6.

Surfaces shall be protected to avoid corrosion in storage or transit. All items to be shipped as deck cargo shall be capable of withstanding this condition for a period of up to 12 months without metal loss. This is to ensure that the surfaces will be protected sufficiently to allow them to be easily cleaned and prepared for finish painting or retouching as appropriate at site. At site, all surfaces shall be inspected, and their condition assessed as required by EN ISO 12944-4 and in the case of any corrosion, damage in transit, etc. the appropriate treatments shall be applied.

Paint systems and methods of application shall pose minimum risk to health and safety and the environment. Zinc chromate and lead compounds shall not be used.

Methods of application for paint systems shall be selected and the work planned in accordance with ISO 12944 Parts 8 and Part 9. Plans shall be agreed with ES in advance of the work. Adequate supervision including formal inspections shall be carried out during and after the work as recommended in the standard.

Paint colours, colour codes and methods of marking shall comply with ES Engineering Standard 08-020. All markings whether applied using paint, transfers, adhesive labels etc. shall be of the equal or better durability to that of the appropriate EN ISO 12944 paint system.

6. PIPEWORK AND TANKS

The painting of the exterior of pipework and tanks shall generally be as for structural steel, above. Interior finishes shall be in accordance with process requirements.

Where pipework is acid cleaned, internal surfaces shall be protected using an ES approved product compatible with the intended fluid. The pipework shall be further protected using plastic bungs or other sealing measures.

Colour coding and marking of pipes and tanks shall be in accordance with ES Engineering Standard 08-020. All markings, whether applied using paint, transfers,

adhesive labels etc. shall be of the equal or better durability to that of the appropriate EN ISO 12944 paint system.

All water-cooling systems where corrosion inhibitors are used shall be passivated by chemical cleaning and film deposition procedures before commissioning. The method shall be proposed by the Contractor and agreed with ES.

Pipework which generally requires chemical cleaning is listed below:

- Lubricating oil
- Hydraulic Systems
- Steam services, depending upon application where steam purity is important

7. PLANT EQUIPMENT

All plant equipment shall have appropriate paint systems applied and finished at the manufacturer's works. Sufficient quantities of the finish paint shall be supplied with the equipment to enable any damage to paintwork to be made good by the Contractor before handover.

Any plant equipment which is to be fabricated on site may be left for finish painting after fabrication but shall nevertheless be shipped suitably protected for transit, storage and installation.

Preferred paint systems are those as specified for structural steel, see above.

8. BUILDINGS

Certain items of buildings, such as cladding, and siding may be supplied in the finished state. Where cladding or siding is cut or drilled on site, the raw edges shall be touched up using a paint system compatible with those already applied to the cladding or siding. All other surfaces shall be finished at site using standard paint systems. All paint systems and finishes shall be agreed with ES.

Colours shall be in accordance with ES Engineering Standard 08-020.

5.1.4 MATERIALS AND APPLICATION

1. GENERAL

The Contractor shall obtain from the paint manufacturer and supply to ES suitable formulation data of the materials for approval. In all cases, paints and other materials

shall be delivered by the paint manufacturer direct to the contractor in sealed containers and stored in accordance with the manufacturer's instructions.

Application of paint systems shall be planned in accordance with EN ISO 12944 Part 9 and supervised throughout.

The paints and associated materials shall be applied in accordance with EN ISO 12944 Part 8 and strictly in accordance and manufacturer's instructions. Special attention shall be paid to requirements for temperature, humidity, dust, wet conditions, or any other adverse weather and application conditions. This also applies to the periods between application and while the paint is drying and curing. No dilution of any paints shall be carried out except by the manufacturer in his works.

Notwithstanding the cleaning operations given in the specified standards and recommendations, all moisture, grease or any other matter which may adversely affect the painting or coating processes must be removed by whatever means are necessary for the operation.

2. SAFETY REGULATIONS ON SITE

The Contractor's personnel shall familiarise themselves with and adhere to ES safety regulations and guidance given by the paint manufacturer.

3. INSPECTION

The various painting systems shall be inspected and tested using magnetic thickness gauges, wet paint film thickness gauges, Holiday detectors and other methods as called for in the standards.

The Contractor shall furnish all the required items of test equipment together with reagents and disposables required and operate them under appropriate conditions. Independent wet paint samples will be taken from pots progressively throughout the period of the painting and tested for viscosity and formulation.

Methods of application for paint systems shall be selected and the work planned in accordance with ISO 12944 Parts 8 and Part 9. Inspection and Test Plans (ITP) shall be agreed with ES in advance of the work. Adequate supervision including formal inspections shall be carried out during and after the work as recommended in the standard.

4. SAMPLES

The Contractor shall carry out as directed by ES the painting of sample panels. Sample panels may be required for any of the finishes or any variation of the finish on any of the colours required. Where a surface/paint system for which limited long-term experience is available, evidence of laboratory testing as called for in EN ISO 12944 Part 6 shall be provided.

Sample panels shall be of the size directed by ES and shall be preserved as examples and removed or obscured when directed by ES.

5. PREPARATION OF SURFACES

The requirements of EN ISO 12944 regarding preparation shall be followed for structures and general steelwork and the principles applied as appropriate to the preparation of all other work.

a. BLAST CLEANING

Shot blasting according to the appropriate Standard and as required for the paint system is preferred to other types of blast cleaning. For structural steel, the surface shall be prepared by shot blasting to SA:$2^1/_2$.

b. GALVANIZING

The guidelines of EN ISO 14713 shall be followed. Surfaces to be galvanized shall be prepared and hot-dipped in accordance with ISO 1461.

Galvanising alone is not considered to be suitable for protection purposes. Any galvanized items shall have damaged areas repaired using a zinc rich cold galvanising paint before the application of a suitable paint system.

c. HAND CLEANING

Hand cleaning shall be carried out using power driven tools and wire brushing in accordance with the appropriate Standard; hand wire brushing on its own is not acceptable. Finish shall be to the grade specified for the paint system.

d. PICKLING

Methods for pickling, with the appropriate procedures and safety provisions shall be agreed with ES in advance, in each case.

All treatments shall include the appropriate rinsing, neutralising and post treatment to eliminate any tendency to corrosion in the long term.

e. FLAME CLEANING

Where approved by ES, flame cleaning may be carried out according to an agreed standard procedure.

f. METAL SPRAYING

Metal spraying shall be carried out according to standards agreed with ES.

g. CLEANING PRIOR TO SITE PAINTING

Metal surfaces to be painted at site shall be shipped to site prime painted and have all superficial rust or other contaminating matter removed, then cleaned and washed down in accordance with EN ISO 12944.

h. GENERAL SITE PREPARATION

All concrete, brickwork, plaster lagging, woodwork or the like shall be cleaned of all traces of efflorescence, dirt, oil, grease or any other matter which may affect the painting process. Any bubble holes, cracks, or other surface defects shall be filled with an appropriate filler to obtain a smooth surface suitable to accept the application of the selected paint system to the satisfaction of ES.

In some areas, considerable deposits of dust, lagging, dropping, etc, may accumulate on surfaces caused by progressive erection of plant or equipment prior to the commencement of finished painting works. Such deposits shall be removed by the Contractor prior to commencement of the painting works in such areas.

6. SURFACE FINISH

Prime painting, undercoating and finish painting shall be carried out according to the appropriate requirements of this Standard.

For structural steel, the priming coat shall be applied to the steelwork within 4 hours of the steelwork being shot blasted.

The whole of the work shall be executed to give a uniform finish.

ES may require additional coats if the finish of any part of the work is not equivalent to its counterpart in previously accepted painted surfaces carried out by the Contractor elsewhere on site, or if the paint film thickness is less than the film thickness required in Specification or Standards. Special care shall be taken when painting the edges of flanges and the like to ensure that the specified film thickness is maintained.

Each coat of paint shall be to a slightly different shade to the preceding coat, such shades being to the approval of ES.

7. TOUCHING UP PAINTWORK

All paintwork shall be touched up and left clean and perfect on completion of the works.

Damaged paintwork shall first be scraped, wire brushed and lightly sanded, then washed down with fresh water and dried before touching up. Compatible solvents may be used if required but shall be thoroughly rinsed down with fresh water.

Primers and undercoating shall be used where necessary in addition to finish coats, depending on the degree of damage to the paintwork. The finish coat shall be made good using the existing types of paints the same number of coats as applied to surfaces, to give an equivalent finish.

5.1.5 CLEARING AND CLEANING OF SITE

During the progress of the Contract and at completion of the work on site, the Contractor shall clean up generally and remove his own rubbish and plant. All glazing, plant, fittings and floors shall be cleared of any paint and other droppings immediately after painting in the vicinity.

The Contractor shall take reasonable precautions to keep all road and access ways clear of any spillage or droppings from his paint works to the satisfaction of ES. All such spillage or droppings which accrue shall be cleared immediately.

All cleaning in the vicinity of machinery shall as far as possible be carried out with electrically operated tools with vacuum attachments for the collection of dust and scale.

Specific precautions shall always be taken to prevent the ingress of dust, scale or liquids into the working parts of ES machinery.

5.2 Color Codes

5.2.1 INTRODUCTION

This standard covers the colours to be adopted for painting and finishing buildings, structures, equipment, and specifies the colour coding of pipes and tanks to identify their contents.

5.2.2 REFERENCES

Reference for RAL colour definitions:

- http://www.ral.de/

Colour codes are based on:

- BS 1710 Specification for identification of pipelines and services
- BS 4800 Schedule of paint colours for building purposes

5.2.3 DECORATIVE COLOURS

1. GROUND AND EXPOSED STRUCTURES

a. Barriers	Signal Yellow	RAL 1003
	Signal Black	RAL 9004
b. Traffic signs, posts and barriers	Signal White	RAL 9003
	Signal Red	RAL 3001
c. Road and parking line marking	Signal White	RAL 9003
	Signal Yellow	RAL 1003
d. Curb stones and concrete barriers	Signal Yellow	RAL 1003
	Signal Black	RAL 9004
	Signal White	RAL 9003
e. Structures and frames	White Aluminium	RAL 9006
f. Pipes and tanks		
See Sections 4 and 5 below		

2. ADMINISTRATION AREAS

a. Exterior walls and cladding	Leaf Green	RAL 6002
b. Parapet	Clay Brown	RAL 8003
c. Door frames and window frames	Clay Brown	RAL 8003
d. Doors	Signal White	RAL 9003
e. Offices (emulsion)	Ivory	RAL 1014
f. Toilets	Signal White	RAL 9003
g. Concrete ceilings (emulsion)	Signal White	RAL 9003

3. PRODUCTION AREAS

a. Exterior walls/cladding	Leaf Green	RAL 6002
b. Door & window frames	Clay Brown	RAL 8003
c. Doors	Signal Grey	RAL 7004
d. Offices	Ivory	RAL 1014
e. Toilets	Pure White	RAL 9010
f. Concrete ceilings (emulsion)	Pure White	RAL 9010
g. Mosque Prayer Area	Pure White	RAL 9010

4. SUBSTATIONS

a.	Doors	Signal Yellow	RAL 1003
b.	Interior paint (emulsion)	Ivory	RAL 1014
c.	Offices	Ivory	RAL 1014
d.	Floor	Mouse Grey	RAL 7005
e.	Concrete ceilings (emulsion)	Pure White	RAL 9010
f.	Door and window frames	Clay Brown	RAL 8003
g.	Toilets	Pure White	RAL 9010
h.	Exterior	Pure White	RAL 9010
i.	Control room	Beige	RAL 1001

5. CONTROL ROOMS & PULPITS

a.	Interior	Night Blue	RAL 5022
b.	Doors	Signal Yellow	RAL 1003
c.	Door frames and window frames	Clay Brown	RAL 8003

6. A/C ROOMS

a.	Barriers	Signal Yellow	RAL 1003
		Signal Black	RAL 9004
b.	Traffic signs, posts and barriers	Signal White	RAL 9003
		Signal Red	RAL 3001
c.	Road and parking line marking	Signal White	RAL 9003
		Signal Yellow	RAL 1003
d.	Curb stones and concrete barriers	Signal Yellow	RAL 1003
		Signal Black	RAL 9004
		Signal White	RAL 9003
e.	Structures and frames	White Aluminium	RAL 9006
f.	Pipes and tanks		
	See Sections 4 and 5 below		
g.	All areas (enamel)	Ivory	RAL 1014

7. BUILDINGS

a. Structure

b. Cladding Roof

c. Side Walls

8. PLANT & EQUIPMENT

a.	All	Constructors standard colours

5.2.4 COLOUR CODES FOR IDENTIFYING PIPE AND TANK CONTENTS

1. DECORATIVE COLOURS

All pipes shall be painted throughout their length as follows:

Water	-	White aluminium	RAL 9006
All other media up to 80°C		Silver grey	RAL 7001
	over 80°C	White aluminium	RAL 9006

2. IDENTIFICATION BAND COLOURS

All pipes shall be painted with bands of colour to identify their contents as stated Table 1 below:

Table 1 Identification band colour codes

Pipe contents	Primary identification band colour		Secondary identification band colour	
	Name	BS4800 No.	Name	BS4800 No.
Sea water	Leaf Green	RAL 6002	Leaf Green	RAL 6002
Industrial water	Leaf Green	RAL 6002	Salmon Pink	RAL 3022
Potable water	Leaf Green	RAL 6002	Signal Blue	RAL 5005
Desalinated water	Leaf Green	RAL 6002	Light Blue	RAL 5012
Fire water	Flame Red	RAL 3000	Flame Red	RAL 3000
Steam	Purple Red	RAL 3004	Purple Red	RAL 3004
Compressed air	Light Blue	RAL 5012	Light Blue	RAL 5012
Instrument air	Light Blue	RAL 5012	Signal Yellow	RAL 1003
Oxygen gas	Ochre Yellow	RAL 1024	Signal White	RAL 9003
Nitrogen gas, inert gas or CO_2	Ochre Yellow	RAL 1024	Signal Blue	RAL 5005
Natural gas	Ochre Yellow	RAL 1024	Yellow Green	RAL 6018
Acids and alkalis	Blue Lilac	RAL 4005	Blue Lilac	RAL 4005
Diesel fuel oil	Signal Brown	RAL 8002	Signal White	RAL 9003
Heavy fuel oil	Signal Brown	RAL 8002	Signal Brown	RAL 8002
Lubricating oil	Signal Brown	RAL 8002	Emerald Green	RAL 6001
Hydraulic oil	Signal Brown	RAL 8002	Salmon Pink	RAL 3022
Drainage	Signal Black	RAL 9004	Signal Black	RAL 9004
Electrical	Signal Orange	RAL 2010	Signal Orange	RAL 2010

3. LOCATION

Identification shall be applied as indicated in Figure 1, in the following locations:

(a) On both sides of valves.

(b) On both sides of connections/flanges.

(c) At either side at locations where pipes pass through walls, floors and ceilings.

(d) In the case of long runs, at approximately 20 m intervals.

Where several pipes run together, the bands shall be aligned.

5.2.5 METHOD OF APPLICATION - PIPES

The name of the pipe contents, in both Arabic and English, shall be stenciled or applied using a durable labelling system agreed with ES, on colour bands together with arrows indicating the direction of flow and process pipe numbers, applied as shown in Figure 1 below.

Dimensions of the colour bands and size of lettering shall be as indicated in Table 2.

Black lettering and black flow arrow shall be used on orange, yellow, white, grey, aluminium, green, light blue and pink; white lettering and white flow arrow shall be used on red, blue, black and dark green fields.

Table 2 Identification Labelling Details

Pipe outside diameter, mm	Primary identification colour band width, mm	Secondary identification colour band width, mm	Text height, mm
19 to 32	200	50	13
33 to 51	200	50	19
54 to 190	300	75	32
200 to 250	600	150	64
> 250	800	200	89

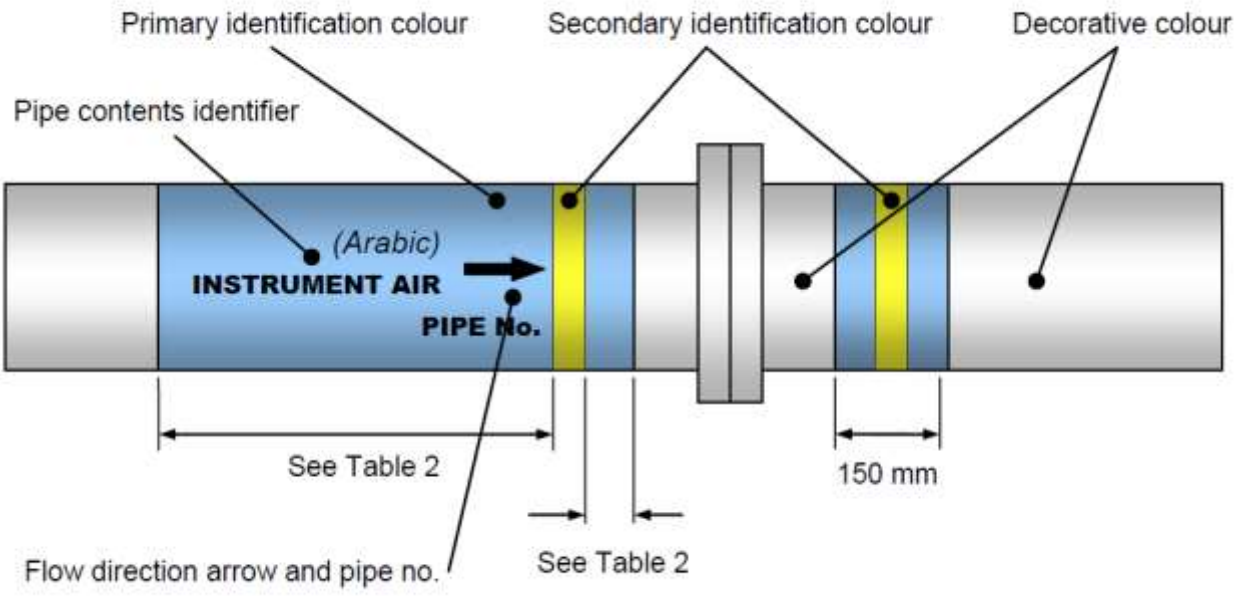

Figure 1 Application of colour codes to pipes

5.2.6 METHOD OF APPLICATION - TANKS

All tanks shall be painted with bands of colour. Colour coding for tanks shall be the same as specified for pipes.

Tanks shall be marked identifying their contents in both Arabic and English. The lettering shall be 300mm high for Arabic, 200mm high for English. The colour of the lettering shall be same as specified for pipes.

Four identifications shall be painted equally spaced around the tank and at inlet and outlet points.
Horizontal tanks shall have the identification on the sides or ends of the tank, whichever gives the best view.

A minimum of two identifiers are required in addition to identification at outlet and inlet points.

The identification markings shall be located as shown in Figure 2.

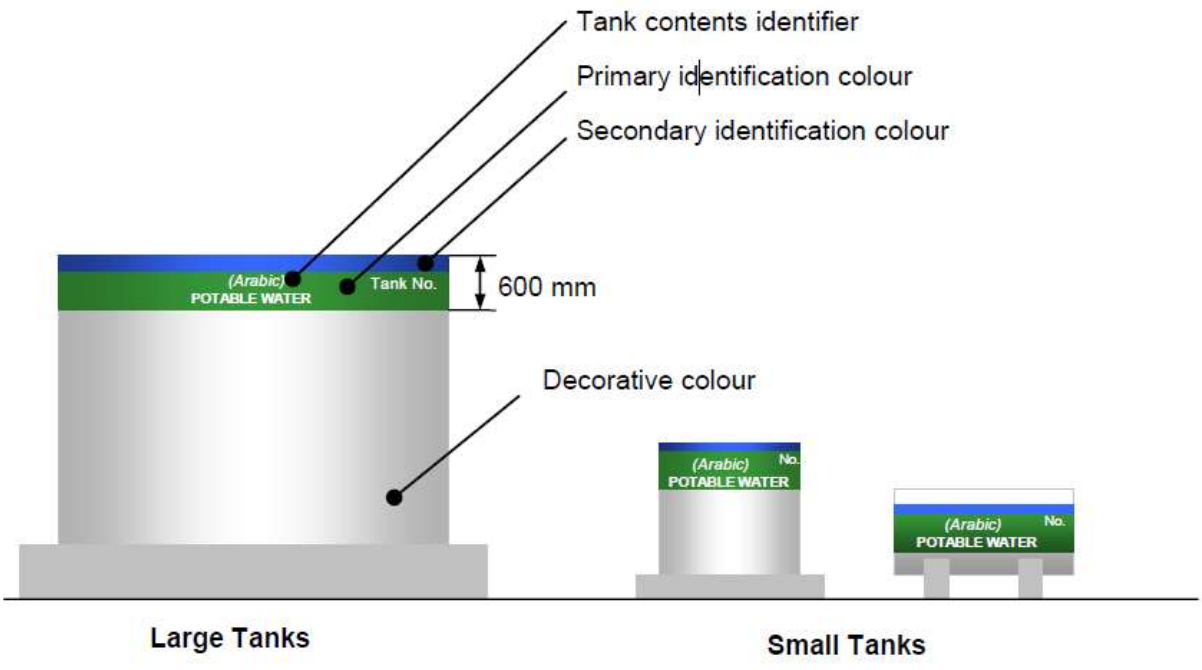

Figure 2 Application of colour codes to tanks

6. SUPPORTING DOCUMENTS

NA

7. REVISION HISTORY

Issue No.	Date	Page/s	Cause of Revision
0	17.11.2019	All	First Issue