



<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

## SPECIFICATIONS FOR CIVIL WORKS

Rev.	Date	Description	Prepared	Reviewed	Approved	Client Review
0	18-05-2022	Issued for Tender		SJ	SKJ	

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

## Contents

1.0	PURPOSE .....	3
2.0	CODES .....	3
3.0	EARTHWORK.....	4
4.0	PLAIN AND REINFORCED CONCRETE WORK.....	6
5.0	STEEL REINFORCEMENT .....	14
6.0	FORM WORK .....	15
7.0	CONCRETE BLOCK WORKS .....	16
8.0	FLOORING AND PAVING .....	18

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		



## 1.0 PURPOSE

This document specifies the technical specifications for civil & structural and other allied works. It also specifies the design philosophies, codes and standards to be followed in the design process.

## 2.0 CODES

The principal design codes and standards to be followed in this project are given below:



- I. Statutory requirement specified by IATA, JIG, DGCA, PESO and other agencies that have laid down basic parameters for handling of ATF at airports.
- II. Tank design - API 650.
- III. Vent for Atmospheric Tank (Vapor relieving system - API 2000).
- IV. Steel Pipe - API Specification 5B for petroleum.
- V. Line Pipe - API Specification 5L for Line pipe.
- VI. Pipe Flange - ASME B 16.5.
- VII. Fire Protection Facilities - IP-19 / NFPA 30.
- VIII. Sprinkler system - NFPA 13.
- IX. Fixed water spray system - NFPA-15.
- X. Foam System - NFPA 11.
- XI. Foam water spray system - NFPA 16.
- XII. Inter distances between facilities - NFPA 30.
- XIII. Fire water and Foam system - NFPA 11, 30 and IP Part 19.
- XIV. Product pump - API 610.
- XV. Aviation Micro Filter - EI 1590 (optional).
- XVI. Aviation / Filter separator - EI 1581.
- XVII. Aviation Fuel filter Monitor - EI 1583.
- XVIII. Airport storage & mobile Fueling equipment - EI 1542.
- XIX. Internal Protective coating system used in Aviation fueling systems - EI 1541.
- XX. Rubber hose & Hose assemblies for Aircraft fuel handling - API Standard 1529 / EN 1361.
- XXI. Product Pipe lines - ANSI B31.3, API.
- XXII. Valves - API, BS.
- XXIII. Hazard Area Classification - API RP 505 (Zone 1 & Zone 2).
- XXIV. Civil - BS.

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

### 3.0 EARTHWORK

#### 3.1 EXCAVATION



- I. Excavation shall be carried out in soil of any nature and consistency, in the presence of water or in the dry, met on the site to the lines, levels and contours shown on the detailed drawings and contractor shall remove all excavated materials to soil heaps on site or transport for use in filling on the site or stack them for reuse as directed by the Owner / Consultant.
- II. Surface dressing shall be carried out on the entire area occupied by the buildings including plinth protection as directed without any extra cost.
- III. The site around all buildings and structures to a width of 3 meters beyond the edge of plinth protection, ramps, steps, etc. shall be dressed and sloped away from the buildings.
- IV. Black cotton soil, and other expansive or unsuitable soils excavated shall not be used for filling in foundations, and plinths of buildings or in other structures including manholes, septic tanks etc. and shall be disposed of within the contract area marked on the drawings, as directed, levelled and neatly dressed.
- V. In case of trenches exceeding 2 meters depth or where soil is soft or slushy, the sides of trenches shall be protected by timbering and shoring. The Contractor shall be responsible to take all necessary steps to prevent the sides of trenches from caving in or collapsing. The extent and type of timbering and shoring shall be as directed by the Owner / Consultant.
- VI. Where the excavation is to be carried out below the foundation level of adjacent structure, the precautions to be taken such as under pinning, shoring and strutting etc. shall be determined by Owner / Consultant. No excavation shall be done unless such precautionary measures are carried out as per directions of Owner / Consultant.
- VII. Specification for Earth work shall also apply to excavation in rock/asphalt. The excavation in rock shall be done such that extra excavation beyond the required width and depth as shown in drawings is not made. If the excavation done in depth greater than required / ordered. The contractor shall fill the extra excavation with concrete of mix 1:5:10 as the foundation concrete at his own cost.

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

- VIII. Contractor shall make all necessary arrangements for dewatering / defiling as required to carry out proper excavation work by bailing or pumping out water, which may accumulate in the excavation pit from any cause / source whatsoever.
- IX. Contractor shall provide suitable draining arrangements at his own cost to prevent surface water entering the foundation pits from any source.
- X. The contractor is forbidden to commence the construction of structures or to carry out concreting before Owner / Consultant has inspected, accepted and permitted the excavation bottom.
- XI. Excavation in disintegrated rock means rock or Boulders including brickbats which may be quarried or split with crow bars. This will also include laterite arid hard conglomerate.
- XII. The measurements for excavations shall be restricted and limited to minimum excavation line as per drawing for payment purposes.

### 3.2 FILLING

- I. Back filling of excavations in trenches, foundations and elsewhere shall consist of one of the following materials approved by Owner / Consultant
  - i. Soil
  - ii. Sand
  - iii. Moorum
  - iv. Hard-core
  - v. Stone / gravel
  - vi. All back-filling material shall be approved by the Owner / Consultant
- II. Soil filling - Soil material shall be free from rubbish, roots, hard lumps and any other foreign organic material. Filling shall be done in regular horizontal layers each not exceeding 20 cm. depth.

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

- III. Back filling around completed foundations, structures, trenches and in plinth shall be done to the lines and levels shown on the drawings.
- IV. Back filling around pipes in the trench shall be done after hydrotesting is done.
- V. Back filling around liquid retaining structures shall be done only after leakage testing is completed and approval of Owner / Consultant is obtained.
- VI. Sand used for filling under foundation concrete, around foundation and in plinth etc. shall be fine / coarse, strong, clean, free from dust, organic and deleterious matter. The sand filling under foundation shall be rammed with Mech. compactor. Sand material shall be approved by Owner / Consultant.
- VII. Moorum for filling, where ordered, shall be obtained from approved pits and quarries which contain siliceous material and natural mixture of clay. Moorum shall not contain any admixture of ordinary earth. Size of moorum shall vary from dust to 10 mm.



#### 4.0 PLAIN AND REINFORCED CONCRETE WORK

These specifications deal with cement concrete, plain or reinforced, for general use, and covers the requirements for concrete materials, their storage, grading, mix design, strength & quality requirements, pouring at all levels, reinforcements, protection, curing, form work, finishing, painting, admixtures, inserts and other miscellaneous works.

#### 4.1 MATERIALS

- I. Cement: Any of the following cements may be used as required.

IS - 269	Ordinary Portland cement, 33-grade.
IS - 8041	Rapid hardening Portland cement.
IS - 455	Portland slag cement.
IS - 8112	43 Grade ordinary Portland cement.

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

IS - 12330	Sulphate resistant ordinary Portland cement.
IS - 12269	53 Grade ordinary port land cement.
IS - 6909	Specifications for super Sulphate cement.

- II. Water: Water used for mixing and curing concrete and mortar shall conform to the requirements as laid down in clause 5.4 of IS: 456.
- III. Aggregates: Coarse and fine aggregates for cement concrete plain and reinforced shall conform to the requirements of IS 383 and / or IS 515. Before using, the aggregates shall be tested as per IS: 2386.

Coarse aggregate: Coarse aggregate for all cement concrete work shall be broken or crushed hard stone, black trap stone obtained from approved Quarries or gravel.

Sand: Fine aggregate for concrete work shall be river bed coarse sand from approved sources. Grading of coarse sand shall be within grading zones I, II or III laid down in IS: 383, table 4. If required, the aggregates (both fine and coarse) shall have to be thoroughly washed and graded as per direction of Owner / Consultant.

#### 4.2 MIXING

All cement concrete plain or reinforced shall be machine mixed. Mixing by hand may be employed where quantity of concrete involved is small, with the specific prior permission of the Owner / Consultant. 10% extra cement shall be added in case of hand mixing as stipulated in IS-456.

#### 4.3 WATER CEMENT RATIO

Once a mix, including its water-cement ratio, has been determined and specified for use by the Owner / Consultant, that water cement ratio shall be maintained.

#### 4.4 LAYING

Concreting shall be commenced only after the Owner / Consultant has inspected and passed the sub-base / base or the centering, shuttering and reinforcement. Concrete in slab beams, columns, footings etc. shall be laid gently in layers not exceeding 15 cm and shall be properly consolidated by means of approved mechanical vibrators.

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

#### 4.5 CURING

- a. After the concrete has begun to harden, it shall be protected with moist gunny bags, sand or any other material approved by the Owner / Consultant against quick drying. After 24 hours of laying concrete, the surface shall be cured by flooding with water or by covering with wet absorbent materials for 7 days as per the direction of Owner / Consultant.
- b. Approved curing compounds may be used in lieu of moist curing with the permission of the Owner / Consultant. Such compounds shall be applied to all exposed surfaces of the concrete as soon as possible after the concrete has set. No extra payment shall be made for the same.

#### 4.6 GRADES OF CONCRETE

- I. Grades of cement concrete shall be as given below:

	Grade Specified	Characteristic compressive strength at 28 days (N/mm <sup>2</sup> )
i.	M 7.5	7.5 (75 Kg/cm <sup>2</sup> )
ii.	M 10	10 (100 Kg/cm <sup>2</sup> )
iii.	M 15	15 (150 Kg/cm <sup>2</sup> )
iv.	M 20	20 (200 Kg/cm <sup>2</sup> )
v.	M 25	25 (250 Kg/cm <sup>2</sup> )
vi.	M 30	30 (300 Kg/cm <sup>2</sup> )
vii.	M 35	35 (350 Kg/cm <sup>2</sup> )

- II. Grades lower than M 25 shall not be used in reinforced concrete.
- III. M 7.5 grades of concrete may be used for lean concrete bases & simple foundation for masonry walls.
- IV. A sieve analysis test of aggregates shall be carried out as and when the source of supply is changed without extra charge notwithstanding the mandatory test required to be carried out as per IS Code / specification.
- V. All test in support of mix design shall be maintained as a part of records of the contract. Test cubes for mix design shall be prepared by the contractor under his own arrangements and at his costs, but under the supervision of the Owner / Consultant.



	<b>Delhi Aviation Fuel Facility Private Limited</b>			
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm			
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0	

#### 4.7 NOMINAL MIX CONCRETE



- I. All concrete work (P.C.C / R.C.C) shall be with nominal mix concrete unless specified otherwise. The proportions of materials used for concrete of grades M5, M 7.5, M10, M15 and M20 shall be as per following Table.

#### PROPORTIONS FOR NOMINAL MIX OF CONCRETE

Grade of Concrete	Total Quantity of Dry Aggregate by Mass per 50 Kg of Cement (as sum of Fine and coarse aggregates), in Kg, Max.	Proportion of Fine Aggregate to coarse aggregate (by Mass)	Quantity of water per 50 Kg of cement Maximum in liters.
M 5	800	Generally, 1.2 subject to an upper limit of 1:1.5 and a lower limit of 1:2.5	60
M 7.5	625	-do-	45
M 10	480	-do-	34
M 15	350	-do-	25
M 20	250	-do-	30

#### Notes:

- a) The proportions of the fine aggregates should be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates become finer and the maximum size of coarse aggregate becomes larger. Graded coarse aggregate as per IS: 383 may be used.
  - b) This Table envisages batching by weight. Volume batching when done, the nominal mixes would roughly be 1:3:6, 1:2:4 and 1:1.5:3 for M10, M15 and M20 respectively.
  - c) For under water concreting the quantity of coarse aggregate, either by volume or mass, shall not be less than 1.5 times not more than twice that of fine aggregates.
- II. The cement content of the mix specified for any nominal mix shall be proportionately increased if the quantity of water in a mix has to be increased to overcome the difficulties of placement and compaction, so that water - cement ratio is not exceeded. In case of vibrated concrete, the limits specified, above may suitably be reduced to avoid segregation.



	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

III. If the nominal mix concrete made in accordance with the proportion given for a particular grade does not yield the specified strength, such concrete shall be classified as belonging to lower grade. However, if the strength results of test are higher than those specified for the grade in the nominal mix of concrete it shall not be placed in a higher grade.

#### 4.8 DESIGN MIX CONCRETE

- i. Design mix shall be allowed for major works where it is contemplated to be used by installing weigh batch mixing plant as per IS 4925.
- ii. At the time of tendering, the contractor, after taking into account the type of aggregates, plant and method of laying he intends to use, shall allow in his tender for the design mix i.e., aggregate / cement and water / cement ratios which he considers will achieve the strength requirements specified, and workability for concrete to be properly finished.
- iii. Soon after the contractor gets L.O.I. to commence the work, he shall carry out preliminary tests for design mix on trial mixes proposed by him in design of mix to satisfy the Owner / Consultant that the characteristic strength specified in clause 4.6.3 is obtained. Prior to this may ask the contractor has to get design mix done as per IS 10262 through govt. approved / reputed institute and contractor shall arrange the same at his own cost. The concrete mix to be actually used shall be approved by the Owner / Consultant.
- iv. Notwithstanding the above, the following shall be the maximum combined weight of coarse and fine aggregate per 50 kg of cement.

	Grade of Concrete	Maximum weight of fine & coarse aggregates together per 50 kg of cement
(For Nominal Mix only)		
i.	M - 10	480 kg
ii.	M - 15	350 kg
iii.	M - 20	250 kg

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

- v. The workability of concrete produced shall be adequate, so that the concrete can be properly placed and compacted. The slump shall be as follows, when vibrators are used.



i.	Mass concrete in RCC foundations & retaining walls	:	10 to 25 mm
ii.	Beams, slabs & columns simply reinforced	:	25 to 40 mm
iii.	Thin RCC sections or sections with congested reinforcement	:	40 to 50 mm

- vi. The minimum consumption of the cement irrespective of design mix shall not be less than the following:

M 20	300 kg/cu m
M 25	300 kg/cu m
M 30	320 kg/cu m
M 35	340 kg/cu m
M 40	360 kg/cu m

#### 4.9 TESTING OF CONCRETE

- i. Testing of concrete, sampling and acceptance criteria shall be in accordance with Clauses 15, 16 & 17 of IS 456.
- ii. A slump test shall be taken at each mixer at least once in every fifty batches mixed. Any batch for which a slump test is being made shall not be transferred to the place of laying until the slump test has been completed. Any batch which gives a slump in excess of that described at the time of preliminary tests shall be rejected and removed from the site.
- iii. At least six cubes shall be taken for every 30 cu. meters of concrete or part thereof deposited in the work on any day. Three cubes shall be tested for 28 days' strength.
- iv. If a test for particular work does not meet the specified requirements, the Owner / Consultant, in his absolute discretion may accept the work at a correspondingly reduced rate provided the average strength at 28 days is not less than 85% of the specified strength.
- v. If the results are poorer than 85% of the specified strength, the Owner / Consultant may order further testing of any kind as may be deemed necessary in his opinion, including load tests. The load tests shall be carried on the portion of the structure involving

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

concrete represented by the unsatisfactory works test and such other adjoining elements of a building as the Owner / Consultant may decide.

- vi. If the results of the load tests are not satisfactory, the contractor shall at his own cost undertake remedial measures including dismantling and reconstruction according to the directions and to the satisfaction of the Owner / Consultant. If the load test is successful, the Owner / Consultant may exercise his judgment before accepting or rejecting the work and shall still have the power to apply a reduction in rate as herein-stated before, in case the work in question is accepted.

#### 4.10 PROPORTIONING



Mixes of cement concrete shall be as ordered. Where the concrete is specified by grade, it shall be prepared by mixing cement, sand and coarse aggregate by weight as per mix design. In case the concrete is specified as volumetric mix, then dry volume batching shall be done, making proper allowances for dampness in aggregates and bulking in sand. Equivalent volume batching for concrete specified by grade may however be allowed by the Owner / Consultant at his discretion.

#### 4.11 PRE-CAST CONCRETE

The specifications for pre-cast concrete will be similar as for the cast in situ concrete. All pre-cast work shall be carried out in a yard made for the purpose This yard shall be dry, properly levelled and having a hard and even surface. If the ground is to be used as a soft former of the units, shall be paved with concrete or masonry and provided with a layer of plaster (1:2 proportion) with smooth neat cement finish or a layer of MS sheeting. The casting shall be over suitable vibrating tables or by using form vibrators as per directions of Owner / Consultant.

The yard, lifting equipment, curing tank, finished material storage space etc. shall be designed such that the units are not lifted from the mould before 7 (seven) days of curing and can be removed for erection after 28 (Twenty-Eight) days of curing. The moulds shall preferably be of steel or of timber lined with G.I. sheet metal. The yard shall preferably be fenced.

Lifting hooks, wherever necessary or as directed by Owner / Consultant shall be embedded in correct position of the units to facilitate erection, even though they may not be so on the drgs. and shall be burnt off and finished after erection.

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

Pre-cast concrete units, when ready shall be transported to site by suitable means approved by Owner / Consultant. Care shall be taken to ensure that no damage occurs during transportation. All adjustments, leveling and plumbing shall be done as per, the instructions of the Owner / Consultant. The contractor shall render all help with instruments, materials and staff to the Owner / Consultant for checking the proper erection of the pre-cast units.

After erection and alignment, the joints shall be filled with grout or concrete as directed by Owner / Consultant. If shuttering has to be used for supporting the pre-cast unit they shall not be removed until the joints has attained sufficient strength and in no case before 14 (fourteen) days.

#### 4.12 PROTECTION OF CONCRETE

All concrete shall be protected from damage by rain or by workmen, equipment, overload or any other causes. All edges, corners and projections of concrete members likely to be damaged, shall be protected by means of wooden cover fillets.

#### 4.13 CONSTRUCTION JOINTS



Construction joints shall be made only where shown on the drawings or as approved by the Owner / Consultant.

#### 4.14 SEPARATION JOINT

Separation Joint shall be obtained by using an approved alkathene sheet struck on the surface against which concrete shall be placed. Adequate care should be taken to cause no damage to the sheet.

#### 4.15 DAMP PROOF COURSES

Damp proof course shall consist of cement concrete or RCC of specified proportions and thickness. Surface of brick or stone masonry shall be levelled and prepared before laying the cement concrete.

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

#### 4.16 SAMPLING OF CONCRETE

Sampling & strength Test of concrete, Acceptance criteria and Inspection & Testing of Structure: This shall be as per the requirements laid down in clause Nos: 15, 16 & 17 of IS: 456.

#### 5.0 STEEL REINFORCEMENT

##### 5.1 STEEL REINFORCEMENT SHALL COMPRISE

- i. Mild steel bars conforming to IS: 432 Part-I
- ii. Hard drawn steel wire fabric conforming to IS: 1566
- iii. Cold twisted bars conforming to IS:1786.
- iv. TMT bars
- v. Fusion bonded Epoxy coated bars conforming to IS: 13620
- vi. All joints in reinforcement shall be lapped adequately to develop the full strength of the reinforcement, unless reinforcement are as per provision of IS: 456 or as per instruction of Owner / Consultant.

Following procedure shall be followed for welding of Tor steel reinforcement bars.

1. Welding of Tor steel reinforcement bars shall be taken up only after specific approval by Owner / Consultant.
2. Lap welding with longitudinal beads shall only be adopted.
3. The thickness of weld bead should be  $0.2 \times$  diameter of bar and the length of the longitudinal bead required shall be  $10 \times$  diameter of bar, however, the maximum length of continuous bead shall be limited to  $5 \times$  diameter of bar with intermediate gap. When welding is done on both sides bead length shall be  $5 \times$  diameter of bar on each side.
4. Stripper at closer spacing shall be provided in the lap welded joints as directed by Owner / Consultant.
- vii. M.S. round bars shall be hooked at ends as specified. Ribbed Tor-Steel shall be bent at right angles at ends as indicated or directed.



	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

## 6.0 FORM WORK

- I. The shuttering or form work shall conform to the shape, lines and dimensions as shown on the drawings and be so constructed as to remain sufficiently rigid during placing and compacting of the concrete and shall be sufficiently tight to prevent loss of liquid from the concrete. The surface that becomes exposed on the removal of forms shall be examined by Owner / Consultant or his authorised representative before any defects are made good. Work that has sagged or bulged out, or contains honey combing, shall be rejected. All shuttering shall be plywood or steel shuttering.
- II. The Contractor shall be responsible for sufficiency and adequacy of all form work. Centering and form work shall be approved by the Owner / Consultant, before placing of reinforcement and concreting.
- III. **STRIPPING TIME** - Forms shall not be struck until the concrete has reached a strength at least twice the stress to which the concrete may be subjected at the time of removal of form work. The strength referred to shall be that of concrete using the same cement and aggregates, with the same proportions and cured under conditions of temperature and moisture similar to those existing on the work. Where possible, the form work shall be left longer as it would assist the curing.

Note 1 - In normal circumstances and where ordinary Portland Cement is used forms may generally be removed after the expiry of the following periods:

a.	Walls, columns and vertical faces of all structural members	24 to 48 hours as may be decided by the Owner / Consultant
b.	Slabs (props left under)	3 days
c.	Beam soffits (Props left under)	7 days
d.	Removal of props under slabs	
	1.	Spanning upto 4.5 m
	2.	Spanning over 4.5 m
e.	Removal of props under beams and arches:	
	1.	Spanning up to 6 m
	2.	Spanning over 6 m

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

For other types of cements, the stripping time recommended for ordinary Portland Cement may be suitably modified.

Note 2 - The number of props left under, their sizes and disposition shall be such as to be able to safely carry the full dead load of the slab, beam or arch as the case may be together with any live load likely to occur during curing or further construction.

## 7.0 CONCRETE BLOCK WORKS

This specification covers the construction of brick masonry in foundations, arches, walls, etc. at all elevations. The provision of IS: 21 shall be complied with unless permitted otherwise.

### 7.1 BRICKS

All bricks shall conform to class 35 as designated in IS Code / Specifications unless specified otherwise.



### 7.2 MORTAR

- I. Cement and water shall conform to the requirements laid down for cement concrete work.
- II. Sand for masonry mortar shall be river bed coarse sand conforming to IS: 2116. Maximum quantities of clay, fine dust shall not be more than 5% by weight. Organic impurities shall not exceed the limits laid down in IS: 2116.
- III. Mix of mortar for building brick work shall be as specified in the item of work.
- IV. Mixing of mortar shall be done in a mechanical mixer. When quantity involved is small, hand mixing may be permitted by the Owner / Consultant. Any mortar remaining unused for more than 30 minutes after mixing shall be rejected.

### 7.3 BRICK MASONRY

Brick work shall be built in English bond, unless otherwise specified. The thickness of joints shall be 10 mm + 3 mm. Thickness of joints shall be kept uniform. In case of foundations and manholes etc. Joints up to 15 mm may be accepted.



	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

#### 7.4 HALF BRICK MASONRY

All courses shall be laid with stretchers. Reinforcement comprising 2 Nos. 6 mm dia MS bars shall be provided over the top of the first course and thereafter at every third course.

#### 7.5 LAYING

All iron fixtures, pipe spouts, hold fasts of doors and windows, which are required to be built into the wall shall be embedded in cement concrete blocks 1:2:4 mix (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) 150 mm x 100 mm x 100 mm size, unless otherwise indicated in the item.



#### 7.6 CURING

Brick work shall be protected from rain by suitable covering when the mortar is green. Masonry work shall be kept constantly moist on all faces for a minimum period of seven days.

#### 7.7 CEMENT CONCRETE BLOCK

Cement concrete block shall be machined made in the proportion of such that mix shall not be leaner than one cement to Twelve combined aggregates (by volume) but having minimum strength of M 7.5. Combined aggregate shall be graded as near as possible to IS: 383. The fineness modules of combined aggregate shall be between 3.6 and 4. The concrete block shall be properly cured as per IS-456. The surface of conc. block shall have even face without any honeycomb and free from cracks.

- I. Mortar - Cement and water shall conform to the requirements laid down for cement concrete work.
- II. Sand for concrete block masonry mortars shall be coarse sand generally conforming to IS:2116. Maximum quantities of clay, fine dust, shall not be more than 5% by weight. Organic impurities shall not exceed the limits laid down in IS:2116.
- III. Mix of mortar for building concrete block shall be as specified in the item of work.
- IV. Mixing of the mortar shall be done in a mechanical mixer. When quantity involved is small hand mixing may be permitted by Owner / Consultant. Any mortar remaining unused for more than 30 minutes after mixing shall be rejected.

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

## 7.8 CONCRETE BLOCK MASONRY

The thickness of joints shall be 10 mm +/- 3mm. Thickness of joints shall be kept uniform. In case of foundation and manholes etc. joints upto 15 mm may be accepted.

## 7.9 HALF CONCRETE BLOCK

All courses shall be laid with stretchers. Reinforcement comprising 2 nos. 6 mm dia MS bars shall be provided over the top of the first course and thereafter at every fourth course.

## 7.10 LAYING

All iron fixtures, pipes spouts, hold fasts of doors and windows which are required to be built into the wall shall be embedded in cement concrete blocks 1:2:4 mix (1 cement: 2 coarse sand: 4 graded stone aggregate. 20 mm nominal size) 150 mm X 100 mm size unless otherwise indicated in the item.



## 7.11 CURING

Concrete block masonry shall be protected from rain by suitable covering when mortar is green. Masonry work shall be kept constantly moist on all faces for a minimum period of seven days.

## 8.0 FLOORING AND PAVING

### 8.1 SUB BASE OF FLOOR

- I. The area to be paved shall be divided into suitable panels. Form work shall be provided. The boarding / battens shall be fixed in position with their toe at proper level, giving slope where required. Alternatively, base concrete may be deposited in the whole area at a stretch
- II. Before placing the base concrete, the sub-base shall be properly wetted and rammed. The concrete of the specified mix shall then be deposited between the forms where provided, thoroughly tamped and the surface, finished level with the top edge of the forms. The surface of base concrete shall be spreader uniformly. The surface shall be finished rough to provide adequate bond for the topping. Two or three hours after

	<b>Delhi Aviation Fuel Facility Private Limited</b>				
<b>Project Name</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL fuel Farm				
<b>Document No.</b>	DAFFPL-SPC-SGC-501	<b>Rev.</b>	0		

concrete has been laid the surface shall be brushed with wire brush to remove any scum or Latinate and swept clean so that coarse aggregate is exposed.

## 8.2 CEMENT CONCRETE FLOOR FINISH

- I. The surface of base concrete shall be thoroughly cleaned by scrubbing with coir or steel wire brush. Before laying the topping, the surface shall be soaked with water at least for 12 hours and surplus water mopped up immediately before the topping is laid.
- II. The forms shall be fixed over the base concrete dividing into suitable panels. Where glass dividing strips are provided, thickness of glass dividing strips shall be 4 or as indicated. Before placing the concrete topping, neat cement slurry at the rate of 2 kg/sq.m shall be then thoroughly brushed into the base concrete just ahead of the finish. The topping shall then be laid, thoroughly compacted by using screed board / plate vibrator. The surface floated with a wooden float to a fair and even surface shall be left for some time till moisture disappears from it. Junctions with skirting / dado or wall surfaces shall be rounded off using cement mortar 1:2 curing shall be carried out for a minimum of 7 days.



**Delhi Aviation Fuel Facility Private Limited**



**Project Name:**

Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm

**Document No.:**



DAFFPL-SGC-SPC-408

**Rev.:**

00

## SPECIFICATIONS FOR PAINTING OF PIPELINE



0	18-05-2022	Issued for Tender	DR	AP	SKJ	
<b>Rev</b>	<b>Date</b>	<b>Description</b>	<b>Prepared</b>	<b>Reviewed</b>	<b>Approved</b>	<b>Client Review</b>

	<b>Delhi Aviation Fuel Facility Private Limited</b>		
<b>Project Name:</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm		
<b>Document No.:</b>	DAFFPL-SGC-SPC-408	<b>Rev.:</b>	00

## Contents

1.1 Scope of specification .....	3
1.2 Extent of work .....	3
1.3 Codes and standards .....	3
1.4 General requirement .....	4
1.5 Tools, tackles and Measuring Instruments .....	4
1.6 Surface preparation .....	5
1.6.1 General .....	5
1.6.2 Procedure for surface preparation .....	5
1.7 Primer application .....	9
1.8 Type and application of paint .....	9
1.9 Storage .....	10
1.10.1 Lettering .....	11
1.11 Inspection and testing .....	11

### General specification for Painting

	<b>Delhi Aviation Fuel Facility Private Limited</b>		
<b>Project Name:</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm		
<b>Document No.:</b>	DAFFPL-SGC-SPC-408	<b>Rev.:</b>	00

## 1.1 Scope of specification

This specification defines the requirements for surface preparation, selection and application of primer and finish paints for Piping & Steel structures, Equipment. Notwithstanding whatsoever may or may not be indicated herein below, the contractor shall be bound to use the best available quality of materials, workmanship and methods of application, approved, and as per standard practice, it being understood that the specifications are largely indicative and not intended to be exhaustive.

## 1.2 Extent of work



The following surfaces and materials shall require painting.

- All structural steel work including steel supports etc. as provided by the contractor.
- All above ground carbon steel piping and fittings (Including painting of identification marks).
- Coloured identification bands on all piping, as required.

## 1.3 Codes and standards

Materials and workmanship for the work covered by this contract shall conform to the following codes and standards but not limited to:

- 1) IS: 5 Colour for ready mixed paints and materials
  - 2) IS: 101 Methods of tests for ready mixed Paints and enamels.
  - 3) IS: 2339 Aluminium paint for general purpose in dual containers.
  - 4) IS: 2379 Colour code for identification of pipeline.
  - 5) IS: 2932 Enamel, synthetic, exterior (a) undercoating (b) finishing.
  - 6) Paint manufacturer's instruction & safety data sheet.
  - 7) Technical data sheets for paints/touch - up paints system.
- 8) Surface preparation shall be carried out in accordance with project technical specification.
- a) ISO 12944
  - b) ISO 8501
  - c) ASTM-D-3359
  - d) SSPC PA-2
  - e) ISO 8504
  - f) ISO 8502

	<b>Delhi Aviation Fuel Facility Private Limited</b>			
<b>Project Name:</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm			
<b>Document No.:</b>	DAFFPL-SGC-SPC-408	<b>Rev.:</b>	00	

## 1.4 General requirement

The paint manufacturer's instructions shall be followed as far as practicable at all times. Particular attention shall be paid to the following.

- Expiry date of paints/primers, wherever the same is indicated on the sealed containers and where not indicated, six months from the indicated date of manufacture to be considered.
- Proper storage to avoid exposure as well as extremes of temperature.
- Surface preparation prior to painting.
- Mixing and thinning.
- Application of primer paint and the recommended limit on time intervals between coats.
- Absence of inclement weather conditions while applying primer and paint.
- Lapse of minimum time interval between opening of sealed containers and their being fully used up.



Any painting work (including surface preparation) on piping shall be commenced only after the system

tests have been completed and clearance for taking up painting work is given by the Engineer in Charge, who may, however, at his discretion authorize in writing, the taking up of surface preparation of painting work in any specific location, even prior to completion of system test.

## 1.5 Tools, tackles and Measuring Instruments

All tools, brushes, rollers, spray guns, blast materials, hand/power tools for cleaning and all equipment, scaffolding material, shot/sand blasting equipment, and air compressor etc. required to be used shall be suitable for the work and all in good order and shall be arranged by the contractor at site and in sufficient quantities.

All paints and primers shall be brought to the site in sealed containers which shall be opened in order of their manufacturing dates in the presence of the Engineer in Charge or his authorized representative. Time expired paints/primer shall not be used in the work.

	<b>Delhi Aviation Fuel Facility Private Limited</b>			
<b>Project Name:</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm			
<b>Document No.:</b>	DAFFPL-SGC-SPC-408	<b>Rev.:</b>	00	

## 1.6 Surface preparation

### 1.6.1 General

To achieve maximum durability, following methods of surface preparation shall be followed, depending on steel surface condition & instructed by Engineer-in-Charge/Specification. Adhesion of the paint film to surface depends largely on the degree of cleanliness of the metal surface. Proper surface preparation contributes more to the success of the paint protective system.

- Manual or hand tools cleaning
- Mechanical or power tools cleaning.
- Solvent cleaning
- Sand blasting

Mill scale, rust, scale and foreign matter shall be removed fully to ensure that a clean and dry surface is obtained. Remove all other contaminants, oil, grease etc. by use of an aromatic solvent prior to surface cleaning.

Irrespective of the method of surface preparation the first coat of primer must be applied by brush on dry surface. This should be done immediately and in any case within 4 hours of cleaning of the surface.

However, at times of unfavorable weather conditions, the Engineer-in-Charge shall have the liberty to control the time period, at his sole discretion and/or to insist on re-cleaning, as may be required before primer application of primer is taken up. In general, during unfavourable weather conditions, painting shall be avoided as far as practicable.



### 1.6.2 Procedure for surface preparation

Contractor shall submit detailed procedure for painting for its approval by Owner. Contractor shall be also arrange at their cost for the visits of the Paint manufacturer to inspect and certify of the quality of Surface Preparation, application of Painting System for full time during work of painting.

- Manual or hand cleaning  
Hand tool cleaning normally consists of the following.
- Hand de-scaling and/or hammering
- Hand scraping
- Hand wire brushing.

Rust, mill scale spatters, old coatings and other foreign matter, shall be removed by hammering, scraping tools or emery paper cleaning, wire brushing or combination of the above methods. On completion of cleaning, loose material shall be removed from the surface





	<b>Delhi Aviation Fuel Facility Private Limited</b>			
<b>Project Name:</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm			
<b>Document No.:</b>	DAFFPL-SGC-SPC-408	<b>Rev.:</b>	00	

by clean rags, and the surface shall be brushed, swept, de-dusted and blown off with compressed air to remove all loose matter.

- Mechanical or power tools cleaning
  - Power tools cleaning shall be done by mechanical striking tools chipping hammers, grinding wheels or rotating steel wire brushes. Excessive brushing of surface shall be avoided as it can reduce paint adhesion. On completion of cleaning, the detached rust, mill scale etc., shall be removed by clean rags and/or washed by air jet before application of the paint.
- Solvent cleaning
  - Solvent cleaning is a procedure for removing, detrimental foreign material like oils, grease, and other contaminants, which are soluble in solvents like white kerosene or mineral turpentine. Solvent cleaning is to be done, if warranted prior to surface preparation.
  - The following sequence of operations shall be followed for cleaning.
  - Soil, cement, spatter, drawing compounds, salts and other extraneous matter shall be removed by brushing with wire brushes, stiff fibre or by scraping. Fresh water cleaning may also be applied.
  - Oil, grease and other contaminants shall be wiped with rags or brushes dipped in solvent. The final wiping and scrubbing shall be done with clean rags and brushes to prevent spreading of loose oil, grease, etc. over the surface. After the cleaning it must be ensured that no residue is left on the surface.

Fire and explosion hazards are inherent in solvent cleaning operations. Recommended safety precautions of the solvent manufacturer shall be followed in the storage and handling of the solvent.

- Rub down and touch up of primer
  - The shop coated surface shall be rubbed down thoroughly with emery paper to remove all dust, rust and other foreign matters, washed with degreasing solvent (white spirit) to completely remove grease, etc. and then cleaned with warm fresh water or dry air. The portions wherefrom the shop coat has peeled off, shall be roughed up and allowed to dry before giving one coat of anti-corrosive primer. The compatibility between shop coat and primer should be ascertained from the paint manufacturer.
- Non compatible shop coat primer
  - The compatibility of the finishing coat with the earlier coat should be confirmed from the paint manufacturer. In the event of use of primer such as a Zinc rich epoxy, Inorganic Zinc Silicate, etc. as shop coat, the paint system shall depend on the condition of the shop coat. If the shop coat is in a satisfactory condition showing no major defects, the shop coat shall not be removed. The touch up primer and finishing coat (s) shall be identified for application by the Engineer in Charge.
- Sand blasting (To be considered only if carried out within controlled space and environment)

	<b>Delhi Aviation Fuel Facility Private Limited</b>		
<b>Project Name:</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm		
<b>Document No.:</b>	DAFFPL-SGC-SPC-408	<b>Rev.:</b>	00

- Blast cleaning is the ideal surface preparation method to achieve an ideal surface for painting. All the other forms of surface preparation have their limitations. In blast cleaning, an abrasive is directed at high velocity against the surface. The abrasives are generally chilled iron steel shots/ grits or coarse sand. There are three recognized specifications for blast cleaning standards and all give three equivalent grades.’



Table 1.3: Blasting Grade

Blasting Grade Specification			
Steel structures painting council (SSPC Spec.)	White metal(SP-5-63)	Near white(SP- 10-63)	Commercial(SP- 6-63)
Swedish standard organization	Sa- 3	Sa- 2 ½	Sa- 2

Table 1.4: Blasting Grade Recommendation Guide

Swedish Standard	Corrosive Environment	Application
Sa- 3	Extremely aggressive	When long terms protection is desired because of difficult access to the surface
Sa- 2 ½	Fairly Corrosive	When long term protection is desired, for chemically resistant systems such as polyurethane, epoxy and chlororubber resin paints
Sa- 2	Mildly Corrosive	For steel to be painted with an ordinary synthetic conventional system

The Swedish standard contains photographs of the various standards of three different degrees of blasted steel and is preferred for reference purpose by most individuals.

	<b>Delhi Aviation Fuel Facility Private Limited</b>		
<b>Project Name:</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm		
<b>Document No.:</b>	DAFFPL-SGC-SPC-408	<b>Rev.:</b>	00

While the Swedish standard is pictorial, the other two are descriptive, attempting to define the areas of residual scale, etc. allowable for each grade. The Swedish standards, which are the most universally accepted, illustrate steel in four conditions before blasting has been carried out, as this will obviously affect the visual appearance of the surface after the required preparation. These are

- A completely mill scale covered un-corroded surface.
- A surface that has begun to rust with mill scales present.
- A surface that is fully corroded but not visibly pitted.
- A surface which is severely corroded with obvious pitting.

The grades of cleaning by blasting are pre-fixed by the reference Sa number. Thus Sa3 is steel blasted to white metal with all rust, mill scale etc., being removed fully. This is quite difficult to achieve practically and is normally only specified for certain specialty coatings. Sa 2.5 second quality or near white is the more usually accepted standard and would be considered as a suitable base to realise the full expected service of most coating systems.

Anything less than specified shall be a compromise.



Brush off or sweep blasting is frequently used as a more rapid and probably cheaper method of removing firmly adhering, fouling and broken coating systems.

### Surface profile

Blast cleaning produces a roughened surface and the evenness of this profile is important. Most specifications call for peak to trough amplitudes of 100 microns maximum

Table 1.5: Surface profile

Abrasive		Max Abrasive particle size	Max height of Profile (mils)
Crushed Iron Grit			
G - 50		25	3.3
G - 40		18	3.6
G - 25		16	4.0
G - 16		12	8.0
Iron Shots			
S - 230		18	3.0
S - 330		16	3.3
S - 390		14	3.6

	<b>Delhi Aviation Fuel Facility Private Limited</b>			
<b>Project Name:</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm			
<b>Document No.:</b>	DAFFPL-SGC-SPC-408	<b>Rev.:</b>	00	



## 1.7 Primer application

- After surface preparation, the primer should be worked into by brush application, also to cover the corners, sharp edges, etc. in the presence of an inspector nominated by the Engineer in Charge. The shades of successive coats should be slightly different in colour in order to ensure application of individual coats. The thickness of each coat and complete coverage should be checked as per provisions of this specification. This should be approved by Engineer in Charge before application of successive coats. Airless spray gun method shall be used for painting.

## 1.8 Type and application of paint

- Prepared surfaces shall not be left exposed to weather over-night and also to moist atmosphere before applying primer coat.
- Do not apply paint when the temperature falls below 10 degrees Centigrade.
- Do not apply paint when the relative humidity is above 90% or during fog, rain or mist.
- Primed surface should be over coated after the re-coat ability time specified by paint manufacturer
- All the Primers and Finishes are supplied in brushing consistency. Thinner should be added, as per paint manufacturer's recommendation, only if viscosity increases during the application due to higher ambient temperature.
- Blast cleaned surfaces shall be coated with the primer within a maximum period of 3-4 hours. If relative humidity is over 75%, this period should be reduced to 1-2 hours, for better performance.
- All two pack primers and paints shall be used up within the pot life mentioned in the data sheets, given by the concerned manufacturer.
- Application of paints is recommended at ambient temperature. The substrata should also be at ambient temperature.
- Paint Material and Painting Systems shall be as per following table 4.5:

Sr no	Description	Opt temp deg C	Activity	Specification of Paint	No of Coats	Dry Film Thickness	Over Coating Interval (Hours)	DFT Required	Total DFT(μ)
1	External Surface-CS MOC Pipe with fitting	60	Surface Preparation	Sa 2 ½	-	-	-	-	300

	<b>Delhi Aviation Fuel Facility Private Limited</b>			
<b>Project Name:</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm			
<b>Document No.:</b>	DAFFPL-SGC-SPC-408	<b>Rev.:</b>	00	

	(Non Insulated)							
			Prime Coat	Inorganic base Ethyl Zinc silicate build (Min 60% Vol. solids)	1	75	12	75
			Intermediate coat	Epoxy high build MIO Coating (Min 60% Vol. solids)	1	150	24	150
			Final Coat	Aliphatic acrylic PU	2	35	12	75



Table 1.6: Paint material and painting systems

**Notes:**

- All primers and finish coats shall be cold cured and air-dried unless otherwise specified.
- Technical data sheets for all paints shall be supplied at the time of submission of quotation.
- All paints shall be applied in accordance with manufacturer's instruction for surface preparation and application.
- The paints and primers, when supplied by the contractor, shall conform to the specifications given above and be of Approved Make.

**1.9 Storage**

All paints and painting material shall be stored only in rooms to be provided by the contractor and approved by the Engineer in Charge for the purpose. All necessary precautions shall be taken to prevent fire. The main storage building shall preferably be separate from the adjacent buildings. A sign-board bearing the words "PAINT STORAGE NO

	<b>Delhi Aviation Fuel Facility Private Limited</b>		
<b>Project Name:</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm		
<b>Document No.:</b>	DAFFPL-SGC-SPC-408	<b>Rev.:</b>	00

NAKED LIGHT HIGHLY INFLAMMABLE" shall be clearly displayed outside. Fire extinguishers shall be installed in the paint store.

Colour bands to distinguish one fluid from another of the same group, shall be selected from tables of IS2379. Ground colours as given in the scheme shall be applied throughout the entire length for un-insulated pipes. For insulated pipes colour coating of 2 m. length shall be applied over the aluminium sheeting at places requiring colour bands. Colour band (S) shall be applied at the following locations.



- At battery limit points
- At intersections in pipe racks
- At other points, such as midway of each piping rack, near valves, junction joints at service appliances, wells, etc.
- For long stretches/yard piping at 50m. Intervals.
- At start and at terminating point

### 1.10.1 Lettering

The chemical, commercial or other commonly understood name of the flowing medium in the pipe or the contents in a tank or equipment shall be written on the ground color applied to the surface. The ground colour shall be applied in convenient lengths at selected places where personnel normally have to attend in the plant area.

### 1.11 Inspection and testing

- All painting materials including primers and thinners brought to the site by the contractor for application shall be procured from reputed manufacturers as per specifications and shall be accompanied by manufacturer's test certificates. In case such certificates are not available, Engineer in Charge may direct the contractor to have the materials tested in accordance with relevant specifications at owner's/outside laboratories, accepted by the Engineer in Charge, and all costs thereof shall be borne by the Contractor.
- The Engineer in Charge, at his discretion may call for additional tests of materials accompanied by manufacturers test certificates. The Contractor shall arrange to have such tests performed, including batch wise test of wet paints for physical and chemical analysis. All costs thereof shall be borne by the Contractor.
- The painting work shall be subjected to inspection by the Engineer in Charge at all times. In particular, following stage inspection will be performed and contractor shall offer the work for inspection and approval at every stage before proceeding with the next stage. The record of inspection shall be maintained and Full Time Inspection by Paint Manufacturer.
  - Stages of inspection are as follows:
  - Surface preparation

	<b>Delhi Aviation Fuel Facility Private Limited</b>		
<b>Project Name:</b>	Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm		
<b>Document No.:</b>	DAFFPL-SGC-SPC-408	<b>Rev.:</b>	00

- Primer application
- Each coat of paint.
- Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of the Engineer in Charge before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, contractor shall be responsible for making good any defects found during final inspection/guarantee period/defect liability period as defined in the General Conditions of Contract.
- Random salt contamination shall be checked before application of paint to ensure no salt deposition on surface. Frequency shall be decided by the paint manufacturer and Engineer-in-Charge. Adhesion Test XCUT & Dolly as per instructions of Engineer-in-Charge.
- Dry film thickness (DFT) and Wet Film Thickness (WFT) shall be checked and recorded after application of each coat.
- The contractor shall provide thickness-measuring instrument (ELKOMETER) with appropriate range(s) for measuring dry film thickness of each coat.
- At the discretion of the Engineer in Charge, the contractor shall ask the paint manufacturer to provide expert technical service at site as and when required. This service should be free of cost and without any obligation to the owner, as it would be in the interest of the manufacturers to ensure that both surface preparation and application are carried out to their recommendations.
- Final inspection shall include measurement of dry film thickness, check of finish and workmanship. The thickness should be measured at as many points/ locations as decided by Engineer in Charge and shall be within + 10% of the dry film thickness.