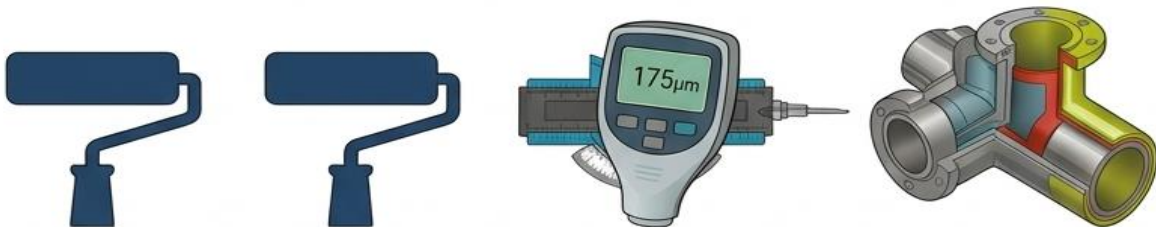


# PAINTING & COATING QC INSPECTOR

## CHAPTER 1: Advanced QC Inspection and Standards



## EXAM PREPARATION



# EXAM PREPARATION GUIDE

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## PAINTING & COATING QC INSPECTOR — ARAMCO APPROVAL EXAM PREPARATION GUIDE

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<b>Series</b>	Saudi Aramco Painting & Coating QC Inspector Exam Preparation
<b>Document</b>	Complete Study Guide — Coating QCI Principles, Standards & 200 Questions
<b>Reference Standard</b>	SAES-H-001 / SSPC-PA2 / NACE SP0188 / ISO 8501 / ISO 8503 / SAES-H-002
<b>Level</b>	Painting QC Inspector / Coating Inspector / NACE Level 1 / BGAS Grade 2
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### HOW TO USE THIS GUIDE

This guide is for inspectors and engineers preparing for the Saudi Aramco QC Inspector Approval exam. Study Parts 1–6, then answer all 200 questions. Check answers on the last page only.

Section	Content
<b>Part 1 — Surface Preparation</b>	Blast cleaning grades, profile, cleanliness — ISO 8501 / SSPC / NACE
<b>Part 2 — Coating Application</b>	Primer, intermediate, topcoat — application inspection step by step
<b>Part 3 — DFT Measurement — SSPC-PA2</b>	Dry film thickness procedures — SSPC-PA2 compliance requirements
<b>Part 4 — Holiday Detection</b>	Pinhole and discontinuity testing — buried and immersed coatings
<b>Part 5 — Ambient Conditions &amp; Defects</b>	Temperature, humidity, dew point — defect identification and causes
<b>Part 6 — Standards, Formulas &amp; Key Rules</b>	SAES-H-001, SSPC-PA2 — all coating formulas with worked examples
<b>Part 7 — 200 Exam Questions</b>	8 sections × 25 questions, A/B/C options, answer key last page

**Passing Score: Aim for 180+/200 (90%) before sitting the real exam.**

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## PART 1 — SURFACE PREPARATION

### 1.1 BLAST CLEANING GRADES

**EXAM:** Surface preparation grades are 25–30% of coating QCI questions. Memorise ISO Sa grades and SSPC equivalents.

ISO Grade	SSPC	NACE	Description	Application
Sa 1	SSPC-SP 7	NACE 4	Light blast — loosely adhering material removed	Overcoating — non-critical
Sa 2	SSPC-SP 6	NACE 3	Commercial — 2/3 mill scale removed	General structural — less critical
Sa 2½	SSPC-SP 10	NACE 2	Near-white metal — 95%+ free of contaminants	Aramco standard for process equipment
Sa 3	SSPC-SP 5	NACE 1	White metal — 100% clean	Immersed, buried, submerged service

**Sa 2½ (SSPC-SP 10) is the Aramco standard per SAES-H-001. Sa 3 required for buried and submerged service.**

### 1.2 SURFACE PROFILE

Surface profile provides the mechanical key for coating adhesion. Measured before each coat application.

Aramco Profile Range	Coating System	Standard
40–75 µm Rz	Epoxy primer — most coating systems	SAES-H-001 Table 1
50–100 µm Rz	Heavy-duty — immersed service	SAES-H-001 Table 2
25–50 µm Rz	Inorganic zinc silicate primer	SAES-H-001 Sec. 7

### 1.3 CLEANLINESS VERIFICATION

Contaminant	Test Method	Acceptance Criteria
Salt / chloride	Bresle patch — conductivity reading	Maximum 30 mg/m <sup>2</sup> — SAES-H-001
Dust	Tape test — ISO 8502-3	Grade 1 or 2 maximum
Oil and grease	UV lamp or solvent wipe	No visible contamination
Moisture	RH and surface temperature check	Steel ≥3°C above dew point

## PART 2 — COATING APPLICATION

### 2.1 COATING SYSTEM COMPONENTS

Coat	Function	Typical Product	QCI Check
Primer	Adhesion + corrosion inhibition	Inorganic zinc silicate (IZS) or epoxy zinc	DFT, cure, no contamination before next coat
Intermediate	Build film thickness — barrier	Epoxy — solvent-free for immersed	DFT, cure test, intercoat interval
Topcoat	UV resistance — colour — chemical	Polyurethane, acrylic, silicone	DFT, colour, gloss, cure
Stripe coat	Edges, welds, bolts — thin areas	Same as primer — brush applied	Verify stripe coat applied before full coat

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## 2.2 APPLICATION INSPECTION — STEP BY STEP

Step	Check Item	Acceptance Criteria
1	Blast grade confirmed — profile record on file	Sa 2½ confirmed — profile in range — salt <30 mg/m <sup>2</sup>
2	Ambient conditions — temp, RH, dew point	Steel ≥3°C above dew point — RH ≤85%
3	Paint batch number — mixing ratio — pot life	Correct batch — ratio per TDS — within pot life
4	Stripe coat applied — edges, welds, bolts	Brush stripe visible on all edges
5	WFT during application	WFT within range to achieve specified DFT
6	DFT after cure — SSPC-PA2 compliance	90%+ readings in spec — no single below 80% minimum

## PART 3 — DFT MEASUREMENT — SSPC-PA2

### 3.1 SSPC-PA2 DFT REQUIREMENTS

**EXAM:** SSPC-PA2 DFT rules appear in 30–35% of coating QCI exam questions. Most important topic.

Requirement	Rule	Consequence if Failed
Gauge type	Type 2 magnetic pull-off or electronic — calibrated	Invalid readings — NCR
Gauge calibration	Daily — certified shims on representative substrate	Invalid readings — re-calibrate
Measurement frequency	5 readings per 10m <sup>2</sup> (per 100 sq ft)	Insufficient data — take more
Area average	Average of 5 readings must meet minimum DFT	Additional coat required
Individual reading minimum	No single reading below 80% of minimum DFT	Spot repair required
Maximum DFT	No single reading above specified maximum	Risk of mud cracking — NCR
Overall compliance	90%+ of all readings must meet minimum DFT	Additional coat required — re-inspect

**EXAM TRAP:** 90% of readings must meet minimum DFT AND no single reading below 80% of minimum. BOTH conditions must be satisfied simultaneously.

## PART 4 — HOLIDAY DETECTION

### 4.1 HOLIDAY TESTING — NACE SP0188

Holiday = discontinuity (pinhole) in coating exposing substrate. Mandatory for all buried, submerged, and immersed coatings per SAES-H-001.

Type	Application	Test Voltage	QCI Check
Wet sponge (LV)	Coatings < 500µm — above grade	67.5V DC	Wet sponge — no sparks — full coverage
DC high voltage spark	All thicknesses — critical service	Per DFT x voltage factor	Correct voltage — electrode speed <0.3m/s
AC pulse	All thicknesses	Manufacturer specified	Complete coverage — no area skipped

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**DC High Voltage Formula: Test voltage (V) = 3294 × √(DFT in mils). Convert μm to mils by dividing by 25.4.**

**Holiday found = mark, allow to cure, repair, re-test repaired area PLUS 150mm surrounding area. Document all holidays and repairs.**

## PART 5 — AMBIENT CONDITIONS & DEFECTS

### 5.1 AMBIENT LIMITS FOR COATING APPLICATION

Condition	Limit	Tool	Action if Outside Limit
Relative humidity	Maximum 85%	Digital hygrometer	Stop — wait for conditions to improve
Steel surface temp	Min 3°C above dew point	Contact thermometer	Stop — condensation risk
Air temperature	5°C to 40°C (most epoxies)	Calibrated thermometer	Stop — cure rate affected
Wind speed	< 15 m/s typical	Anemometer	Stop — overspray and contamination

### 5.2 COATING DEFECT IDENTIFICATION

Defect	Appearance	Cause	Action
Pinholing	Small holes through coating	Solvent entrapment — too thick	Sand, clean, re-coat
Blistering	Raised bubbles	Moisture under coat	Blast to metal — re-coat
Runs and sags	Thick drips down surface	Too thick — too close	Sand, clean, re-apply
Mud cracking	Map cracking pattern	Too thick — zinc silicate	Blast to metal — re-coat
Fish eyes	Circular craters	Contamination — oil or silicone	Clean surface — recoat
Delamination	Layers separating	Intercoat interval exceeded	Blast to metal — re-coat

## PART 6 — STANDARDS, FORMULAS & KEY RULES

### 6.1 KEY COATING FORMULAS

Formula	Expression	Example
DFT Coverage (%)	$(\text{In-spec readings} / \text{Total}) \times 100$	$85/100 \times 100 = 85\%$ — FAILS (< 90%)
WFT to achieve DFT	$\text{WFT} = \text{DFT} / \text{Volume Solids}$	DFT=200μm, VS=60% → WFT=333μm
DFT from WFT	$\text{DFT} = \text{WFT} \times \text{Volume Solids}$	WFT=300μm, VS=65% → DFT=195μm
Holiday voltage (DC)	$3294 \times \sqrt{\text{DFT(mils)}}$	DFT=16mils → $3294 \times 4 = 13,176\text{V}$
Salt contamination	Bresle reading × conversion factor	Per ISO 8502-9 — max 30 mg/m <sup>2</sup>

### 6.2 COATING STANDARDS REFERENCE

Standard	Coverage
SAES-H-001	Aramco coating — system selection, surface prep, application — process equipment
SAES-H-002	Aramco coating — above-grade piping and equipment
SSPC-PA2	DFT measurement — frequency, area averages, acceptance criteria
ISO 8501-1	Surface cleanliness grades — Sa 1, Sa 2, Sa 2½, Sa 3

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<b>ISO 8502-3</b>	Dust assessment — tape test — grades 0–5
<b>ISO 8502-9</b>	Bresle salt test — soluble salt contamination measurement
<b>ISO 8503</b>	Surface profile — Ra and Rz roughness measurement
<b>NACE SP0188</b>	Holiday testing — DC and AC methods — procedures
<b>SSPC-SP 10</b>	Near-white blast cleaning — equivalent to Sa 2½

## PART 7 — EXAM QUESTION BANK — 200 QUESTIONS

Total: 200 questions | 3 options A/B/C | Passing score 180+/200

**Answer all 200 questions BEFORE checking the answer key on the last page.**

### SECTION 1 (Q1–25)

1	SSPC-PA2 requires what % of DFT readings to meet minimum?	A 70%	B 90% — AND no single reading below 80% of minimum	C 100%
2	Sa 2½ blast grade SSPC equivalent?	A SSPC-SP 5	B SSPC-SP 10 — near-white metal blast	C SSPC-SP 6
3	SSPC-SP 5 (white metal) is ISO grade?	A Sa 2½	B Sa 3 — 100% clean — most demanding blast grade	C Sa 2
4	Aramco max salt contamination before coating (SAES-H-001)?	A 50 mg/m <sup>2</sup>	B 30 mg/m <sup>2</sup> — Bresle patch test	C 100 mg/m <sup>2</sup>
5	Min steel temperature above dew point before coating?	A 1°C	B 3°C minimum — below this moisture condensation risk	C 10°C
6	Max relative humidity for most coating application?	A 70%	B 85% maximum — check TDS for product-specific limit	C 95%
7	Holiday in coating means?	A Scheduled break	B Discontinuity — pinhole in coating exposing substrate	C Thick spot in film
8	NACE SP0188 governs?	A DFT measurement	B Holiday testing of protective coatings — DC and AC methods	C Blast cleaning grades
9	DFT Coverage formula?	A Total / In-spec × 100	B (In-spec readings / Total readings) × 100	C In-spec × Total
10	WFT to achieve DFT=200µm with 60% volume solids?	A 200µm	B 333µm — DFT / Volume Solids = 200/0.6	C 120µm
11	Blistering in coating is caused by?	A Too thin application	B Moisture trapped under coating — osmotic pressure forms bubbles	C Wrong solvent
12	Mud cracking is caused by?	A Too thin application	B Coating too thick — excessive shrinkage on curing — especially zinc silicate	C Wrong temperature
13	Purpose of stripe coat?	A Decoration only	B Extra protection on edges, welds, bolts — areas prone to thin film and early failure	C Adhesion test
14	IZS primer requires minimum blast grade?	A Sa 1	B Sa 2½ minimum — rough profile required for mechanical bond	C Sa 2
15	Fish eyes in coating are caused by?	A Too thin application	B Oil or silicone contamination on steel before application	C Wrong nozzle
16	Intercoat interval maximum (epoxy)?	A No limit	B Per TDS — typically 30 days — exceeding reduces inter-coat adhesion	C 1 year

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17	ISO 8501-1 defines?	A Profile grades	B Visual surface cleanliness grades — Sa 1, Sa 2, Sa 2½, Sa 3	C DFT measurement
18	ISO 8502-9 governs?	A DFT measurement	B Bresle method — soluble salts on steel surfaces	C Profile measurement
19	Testex replica tape measures?	A DFT	B Surface profile — pressed onto blasted surface — read with micrometer	C Salt contamination
20	SSPC-PA2 minimum readings per 10m <sup>2</sup> ?	A 3	B 5 gauge readings per 10m <sup>2</sup>	C 10
21	Pot life of two-component coating means?	A Container shelf life	B Time from mixing until too viscous for proper application	C Shelf life before mixing
22	Sa 1 blast removes?	A Everything	B Only loosely adhering material — minimal blast	C 95% of contamination
23	Low voltage wet sponge holiday test voltage?	A 500V	B 67.5V DC — for coatings below 500µm above grade	C 12V DC
24	Holiday found during testing. Must?	A Continue testing area	B Mark location — repair after curing — re-test repair plus 150mm surrounding area	C Accept small holiday
25	Application temperature below 5°C. Must?	A Apply slower	B Stop — cure impaired — coating may not achieve specified properties	C Apply thicker

## SECTION 2 (Q26–50)

26	Volume solids affect?	A Drying time only	B DFT achieved from WFT — higher VS% = thicker dry film from same wet coat	C Adhesion only
27	Pinholing is caused by?	A Over-application	B Solvent entrapment — applied too thick — solvent boils out leaving pinholes	C Under-application
28	Runs and sags are caused by?	A Too thin application	B Too thick application — gravity causes paint to flow before curing	C Wrong primer used
29	Delamination between coats is caused by?	A Over-application	B Intercoat interval exceeded — contamination — inadequate cure of previous coat	C Correct application
30	Blast-cleaned surface must be coated within?	A 24 hours	B 4 hours maximum — 2 hours in humid conditions per SAES-H-001	C 48 hours
31	DFT single reading = 75% of minimum. Per SSPC-PA2?	A Accept — within 80%	B FAIL — no single reading below 80% minimum — spot repair required	C Average across area
32	SAES-H-001 governs?	A Tank coating	B Aramco coating — system selection, surface prep, application — process equipment	C Underground pipe
33	DC high voltage holiday test voltage formula?	A 100 × DFT (mils)	B 3294 × √DFT (mils) — NACE SP0188	C 1000 × DFT (mm)
34	Pull-off adhesion test measures?	A DFT	B Bond strength between coating and substrate — minimum per specification	C Hardness of coating

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35	QCI ambient condition record must include?	A Time only	B Air temperature, steel temperature, RH, dew point, and weather conditions	C Temperature only
36	Cathodic disbondment is?	A UV degradation	B Coating adhesion loss from cathodic protection current — can lift coating from metal	C Thermal peeling
37	Coating Hold Points in ITP include?	A Final coat only	B Surface prep, primer, each intermediate coat, final coat, holiday test — each is a hold	C Holiday test only
38	Sa 2 blast grade (commercial blast) removes?	A 100% of mill scale	B Approximately 2/3 of mill scale and rust — SSPC-SP 6	C Loosely adhering only
39	Anchor profile purpose?	A Appearance	B Provides mechanical key for coating adhesion — blasted roughness	C Increases DFT
40	Flash rust on blasted steel before coating means?	A Minor — ignore	B Surface must be coated quickly — flash rust indicates time limit exceeded — assess per spec	C Acceptable always
41	Wet blasting acceptable if?	A Never acceptable	B Flash rust inhibitor used — surface profile maintained — for enclosed or confined spaces	C Always acceptable
42	Coating ambient monitoring must be done?	A Once per day	B Before and during each application session — conditions can change rapidly	C Weekly
43	Low VOC coating preferred in?	A Open air only	B Enclosed spaces and ATEX areas — reduces explosion and health risk from solvent vapour	C All outdoor locations
44	Coat applied over uncured primer. Effect?	A No effect	B Solvent entrapment — blistering — lifting — NCR required	C Faster total cure
45	Purpose of pre-application meeting with contractor?	A Collect materials list	B Align on ITP, hold points, ambient limits, documentation requirements before work starts	C Issue work permit
46	Thermally sprayed zinc inspection includes?	A DFT only	B Adhesion test, DFT, visual — per SSPC-CS 23.00	C Holiday test only
47	Maximum temperature for polyurethane topcoat application?	A No limit	B Per TDS — typically 40°C maximum — above this causes blistering and skinning	C 60°C
48	Coating system C5-M per ISO 12944 is?	A Mild corrosion	B Very high corrosion — offshore marine environment — most demanding system	C Interior standard
49	QCI rejects a coat — contractor disputes. Correct process?	A Remove NCR	B NCR stands — formal dispute process — Aramco QA reviews — engineering decision	C Stop all work
50	In exam — DFT below minimum in critical area. Answer is always?	A Ignore if one reading	B NCR — additional coat required — re-inspect per SSPC-PA2	C Average readings across area

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## ANSWER KEY

**STOP — Do not look until all 200 questions answered.**

Q1–20	Ans	Q21–40	Ans	Q41–60	Ans	Q61–80	Ans	Q81–100	Ans
1	B	21	B	41	B				
2	B	22	B	42	B				
3	B	23	B	43	B				
4	B	24	B	44	B				
5	B	25	B	45	B				
6	B	26	B	46	B				
7	B	27	B	47	B				
8	B	28	B	48	B				
9	B	29	B	49	B				
10	B	30	B	50	B				
11	B	31	B						
12	B	32	B						
13	B	33	B						
14	B	34	B						
15	B	35	B						
16	B	36	B						
17	B	37	B						
18	B	38	B						
19	B	39	B						
20	B	40	B						

Your Score	Result	Action
180–200	Excellent	Ready for Aramco exam. Review any weak areas.
160–179	Good	Review weak sections before sitting real exam.
140–159	Needs Work	Re-study sections below 70% before reattempting.
Below 140	Not Ready	Complete full re-study of all parts.

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## ABBREVIATIONS

### SURFACE PREPARATION

Short Form	Full Form
Sa	Blast Cleaning Grade (ISO 8501)
SP	Surface Preparation (SSPC)
SSPC	Society for Protective Coatings
NACE	National Association of Corrosion Engineers
RH	Relative Humidity
DP	Dew Point
TDS	Technical Data Sheet

### COATING TERMS

Short Form	Full Form
DFT	Dry Film Thickness
WFT	Wet Film Thickness
NDFT	Nominal Dry Film Thickness
VS	Volume Solids
IZS	Inorganic Zinc Silicate
VOC	Volatile Organic Compound
SDS	Safety Data Sheet

### MEASUREMENT UNITS

Short Form	Full Form
$\mu\text{m}$	Micrometre (0.001mm)
mils	Thousandths of an inch (1 mil = 25.4 $\mu\text{m}$ )
Ra	Arithmetic mean surface roughness
Rz	Mean peak-to-valley roughness depth