HOW TO MANAGE PAINTING or COATING PROJECTS?

Basics that you need to know

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WHAT IS A PAINTING OR A COATING PROJECT?

*"A Painting or Coating Project"***,** in its simplest but comprehensive description, is a project in which paint and coatings materials are applied successfully to a variety of substrates i.e. steel, concrete, wood, plastics, composites, etc. within a specified beginning and end times, and with defined scope and resources. Likewise, *"a Painting or Coating Project Management"*, is the application of knowledge, skills, tools, and techniques to project activities to meet this paint or coating project requirements.

A successful painting or coating should have these goals in mind:

- Operations and project delivery time on time
- Economically feasible in terms of raw material and operational costs
- Should meet all safety, health and environmental requirements i.e. regulations, directives and standards

Like other disciplines in the industrial market, there are some terminology i.e. abbreviations that should be known to fully grasp this subject.

Terminology

ASTM: American Standart Testing Materials
CPCA: Canadian Paint and Coatings Association
HSWA: Health and Safety at Work Association
ISO: International Organization for Standardization
ITP: Inspection Test Plan
NORSOK: Norsk Sokkels Konkuranseposisjon (Norwegian Shelf's Competitive Position)
NACE: National Association of Corrosion Engineers
OSHA: Occupational Safety and Health Administration
QA: Quality Assurance
QC: Quality Control
PCP: Process Control Procedures
SDS: Safety Data Sheets
SSPC: Society for Protective Coatings
SWA: Stop Work Authority
TDS: Technical Data Sheet
VOC: Volatile Organic Content
CAPA: Corrective Action Preventive Action
NCR: Non-conformance Report

PLANNING THE PROJECT

Work Plan

A successful project must have a comprehensive Work Plan shall include the following items:

1. Purpose
2. Introduction
3. Scope of Work
4. Project general information including where the work will take place, geographical & weather conditions, who the contractor is (if awarded) and its case histories,
5. Project management procedure with a flowchart including documents
6. Materials used
7. Material application methods
8. References to all applicable standards, e.g. ASTM, NACE International, SSPC, ISO, NORSOK with copies
9. Competent application personnel with certification
10. Safety, fire, environment and health information
11. Material storage and handling details (İncluding materials to be painted and coatings)
12. Pre-application test panel validation
13. Timeline (in a Gantt chart)
14. Daily contractor log
15. Manufacturer's support with their documentation
16. Containment information
17. Surface Preparation details
18. Inspection Test Plan and Hold Points
19. Instruments and test kits with their methodology on using
20. Coating repair procedure
21. Documents and Document control i.e. Quality Control and Quality Assurance Systems
22. Warranties in writing, signed by the responsible parties i.e. engineering company, subcontractor and coating manufacturers' reps. (and Insurance if any)

Along with the Work Plan, all SDS and TDS documents of the materials used in the project should also be attached to data file for future usage during or after the project. Of course, these items should be in parallel with the Projects Specification or the owner's written contract.

PCPs

Following the Work Plan, the procedures for each specific processes i.e. surface preparation, paint/coating application should be written in detail, so that one can easily understand how to perform this operation in a step-by-step fashion. In these procedures, all details of the operations such as methods, tools, equipments, material to be used should be specified in accordance with project specification and other legal project documents. To avoid any dispute or conflict, each operational step and its details should be referenced to an industrial or international standard so that these PCPs can be understood and agree upon mutually.

Figure 1: Process Control Procedures (PCPs) are vital guidelines of the paint&coating projects.

SELECTION OF SURFACE PREPARATION METHODOLOGY AND TECHNIQUES

The primary factor that influences how long a coating will last in service is Surface Preparation. Also, It has been estimated that 60 to 80% of all premature coating failures are caused either completely or partially *by inadequate* or *improper surface preparation*[1]. Therefore selecting the suitable and correct technique and tools for Surface Preparation of substrates i.e. carbon steel, crucial.

There are 4 main categories that surface preparation of substrates can be performed before paint or coating applications:

i. By hand tools
ii. By power-tools
iii. By abrasive blasting
iv. By pressurized water only or water-abrasive mix

Unless not stated in the project specification or in the product data sheet of the selected paint or coating in the project, , one can use the following standards and guidelines as a starting point in order to select the proper method and tool:

- NACE/SSPC Joint Surface Preparation Standards (for steel and concrete)
- ISO, 8501,8502, 8503 and 8504 International Standards (for steel)
- ICRI (for concrete)

As a guide, you can find the correspondence of each standard in the following table:

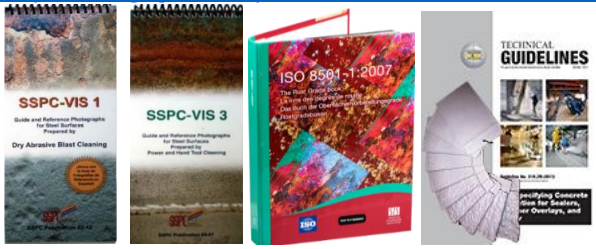
Cleaning Grade (abrasive) NACE, SSPC	Cleaning Grade (water alone) ISO, NACE	NACE abrasive	NACE SSPC	SSPC abrasive	ISO Abrasive Water
White metal	Bare metal	1	WJ-1	SP-5	Sa 3
Near-White	Very Thorough	2	WJ-2	SP-10	Sa 2 ½ Wa 2 1/2
Commercial	Thorough	3	WJ-3	SP-6	Sa 2 Wa 2
Industrial	Thorough	8	WJ-3	SP-14	
Brush Off	Light	4	WJ-4	SP-7	Sa 1 Wa 1

Figure 2: International Surface Preparation Standards – Comparison of Different Terminology

Additionally, you can follow PCPs when preparing a surface, but prior to surface preparation, ensure:

- All grease and oil from all surfaces are removed
- Scales, debris, and residues are removed
- All hot work(such as welding and heat treatments must be complete
- Burst all blisters present and blister caps must be removed from the surface

These guidelines, standards and visual photographs can be purchased via the links below:
http://www.sspc.org/PB-00212_4
http://www.sspc.org/PB-00407_3
https://icri.site-ym.com/store/ViewProduct.aspx?id=5569335
https://ktagage.com/product/iso-8501-1-the-rust-grade-book/



SELECTION OF PAINTING/COATING SYSTEMS

In order to select the best painting or coating system, the most important question to be answered are:

i. What are the exposure conditions to which the paint/coating requested to withstand?
ii. How long (i.e. months, years) is the service life the structure to be painted/coated
iii. What are the climatic conditions of the application area i.e. temperature, humidity, wind, etc.?
iv. Is the application area closed, sheltered or open?
v. When is the application time? Summer, Spring or Winter-time?

In addition, it is a good idea to base the selection of the paint/coating system on international standards such as ***AS/NSZ 2312:*** *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings,* ***ISO 12944-5 :*** *Corrosion protection of steel structures by protective paint systems -- Part 5: Protective paint systems* and ***NORSOK M-501 :*** *Surface preparation and protective coating.*

In these standards, the paint/coating system selection methodology is quite similar: Upon specifying the exposure/corrosion category, which is C1,C2,C3, C4 and C5-I/C5-M in ISO 12944-5, then you can find the tables including this exposure/corrosion category and select the paint/coating system based on service life expectancy, surface preparation method and generic type paint/coating.

Moreover, the selection criteria of the paints or coating can be performed based on the generic type of their chemical composition, such as Acrylic, Alkyd, Latex, Epoxy family (polyamide, polyamine, aminoamine adduct, phenolic or etc.), Aliphatic or Aromatic Polyurethanes, Polyurea, Silicone or Zinc-rich. Luckily, there are guidelines from SSPC for each of these generic paints/coatings:

http://www.paintsquare.com/standards/?fuseaction=subcat&catid=1&subcatid=6

Alternatively, there are industry-accepted systems and standards such as *SSPC Painting/Coating Systems* and *NACE coating standards* categorized by environmental zones i.e. *Chemical atmospheric exposure for various pH ranges between 0-14 a, Interior, Exterior and Immersion service (fresh water, salt water, etc.) and etc.* The detailed tables consisting these paint/coating systems can be reached from the following links:

http://www.sspc.org/site/images/standards/std-vol2intro.pdf
https://nace.org/uploadedFiles/Committees/NACEStandards_Detailed.pdf

These questions, standards and paint specifications are the essential ones but there may be other considerations depending on the owners' expectations and the project specification. These can be extra functionality expectations from the paint or the coating system i.e. smart features (e.g. color-changing, radio-signal blockage, anti-graffiti, self-healing or etc.) or safety limitations such as heavy toxic metal prohibition, or VOC limitations due to solvent emission directives in Europe or USA.

For more information, you can read the booklets on this topic published by paint/coating manufacturers worldwide. However, there are quite lot comprehensive and unbiased books published by paint/coating professionals worldwide:

- http://www.sspc.org/PB-00801_2
- https://www.crcpress.com/Paint-and-Coatings-Applications-and-CorrosionResistance/PE/p/book/9781574447026
- http://onlinelibrary.wiley.com/book/10.1002/9783527611867

SELECTION OF PAINTING OR COATING APPLICATION TECHNIQUES, TOOLS AND EQUIPMENTS

As in different industries like construction, fabrication or printing, different tools and equipment with using different techniques are used in the application of paint or coating materials. The main tools, equipments and methods are:

- Brush
- Paint Glove
- Roller
- Air (Conventional) Spray
- Airless Spray
- Electrostatic Spray
- Plural Component Spray
- Dipping in a Tank
- Other methods

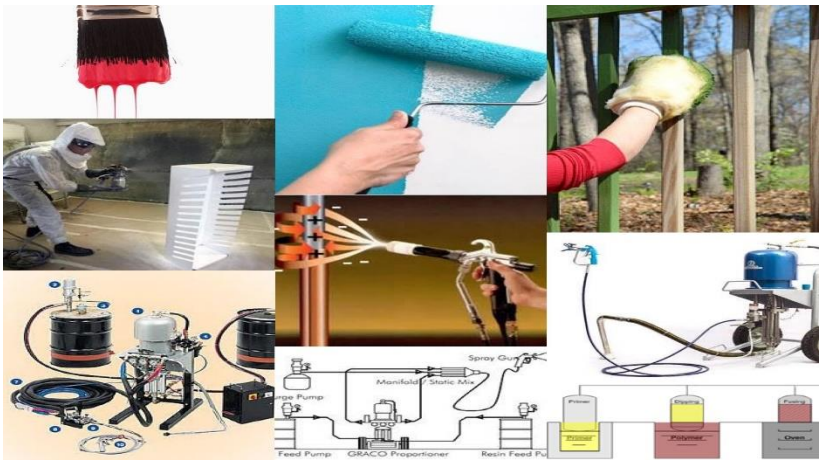


Figure 3: *Industrial Paint application equipments*

These application tools and equipments require intensive experience that can be gained via trainings and practice on-site. For example, you can get these spray application trainings with hands-on practicing from SSPC, National Painting and Decorative Institute, TrainthePainter, ICATS,

https://painters.edu.au/Training-Courses/Applying-Paint-by-Spray.htm
http://trainthepainter.com/
http://www.icats-training.org/
http://www.sspc.org/trn-crs-appc12-option1

Figure 4: Paint Application Trainings&Certification Programs Providers

As important as application process and selection are the material storage and material preparation steps like straining, mixing (and cooling or heating if needed) just prior to application. These information can be easily found in the technical data sheet (TDS) of the material to be applied.

COMMUNICATION/CREW MANAGEMENT

In a typical industrial project, there will be a group people assigned to perform management, application and inspection of painting/coating work that we call as the Painting/Coating Crew. These crew members may have

different experience and personality but the general attitudes below will guide you to be successful in your relations and outcomes:

- **Have no ego and stay calm:** While techniques for staying calm vary from person to person, there are frequent advices from Psychologists such as try counting to 10, go to your happy place., thinking about your loved ones or places, etc.
- **Whenever possible, know exactly and precisely what you want before you are engaged in the conflict—and remember to stay focused:** This is true for any type of conflict or negotiation. A boxer knows what he wants before getting into the ring, a child knows what she wants before asking a parent for dessert, and you should know what you want. Therefore, you need to know every detail of the project in a precise manner so that you can solve the problem in shorter and less problematic conversations.
- **Come up with a strategy for getting what you want:** Establish a personal connection and familiarity with the people you will be working with and, perhaps, conflicting with. Explain that you, like everyone there, have the same goals—to serve the client and to make a living. "Let's work together to get through this smoothly. After all, we want the same thing. I promise to be pleasant and professional at all times." Like a boxer studying his opponent, you are familiarizing yourself with your potential opponents so that if conflict should arise, you have some idea of their personality and needs to better get what you want.
- **Whenever possible, let the data do your talking:** Refer to test results, written specifications, or anything to support your position.
- **Be empathetic and sincere:** Putting yourself into someone place may see the situation with different perspectives. Also, there might be a possibility that the solution is in the hands of others and what your are thinking at the moment may not be a part of the solution. Therefore, making empathy and sincere talking may be a good ice-breaker and problem solving opportunity.
- **Ask questions:** In order to find a way out for the issue you are facing with, you need to collect as much information as you can. As a result, the solution may be the collection of all the answers you've collected so far.
- **Be tough as a last resort:** You can be kind and patient only for so long. If someone becomes overly belligerent, stay calm, but have some prepared lines at your disposal. "Can we please agree to stick to the issues and data, and stay away from personal remarks?" "Do you think we can agree to speak to each other calmly and professionally?"
- **If you're wrong, own it and own it big:** There is a global saying "Nobody is Perfect". In this manner, you may make mistakes or think wrongly during the painting/coating project. This is quite normal and if you are a humble and wise professional you accep that you are wrong in front of others. If they continue to rant, stay calm and listen. Remember, it's not personal.

Although we want to have a problem-free calm business life, in the real world we should expect potential technical and personal problem and we should be ready to solve in the manners described above.

QUALITY ISSUES

One of the important step for a successful project is Quality management via QC and QA methodology.

In QC step, the quality of the process (i.e. surface preparation, painting or coating) or the raw materials are checked via Inspection Test Plans (ITP), which contains in the control/inspection instruments, standards, procedures/techniques and the acceptance criteria.

Inspection Item	Technique/ Instrument	Frequency of Tests	Standard Test Method Reference	Spec. Reference	Acceptance Criteria
Verify pre-blast surface cleanliness	Visual	100% of surface	SSPC-SP 1	3.4.2	Removal of all visible grease, oil & debris
Verify correct type and cleanliness of abrasive media	Visual & conductivity meter	Each lot of abrasive	SSPC AB 1 ASTM D 7393 ASTM D 4940	2.3.1	Expendable, angular slag, no visible oil; < 1,000 µS/cm conductivity
Verify compressed air cleanliness	Blotter test	Twice per work shift	ASTM D 4285	3.4.7	Clean, dry air; no evidence of water or oil
Verify installation of protective coverings	Visual	Prior to surface preparation and painting	NA	3.4.1	Properly installed & maintained

Table 1 (The cells in yellow are optional in preparing an ITP**)**

A good comprehensive resource for creating a well-prepared ITP can be found in the link below:
http://www.sspcelearning.org/customcontent/QCS/SSPC%20inspectionplan.pdf

On the other hand, in QA step the quality is assured by means of checking the inspection reports, certificates or any other documents if they are in compliance with project specification, contact or any other approved documents of the project in concern.

Figure 4: Checlists to control if the documents are in compliance with the project specification

Finally, in order to carry out a successful QA and QC steps, one has to know these most commonly used international (i.e. ISO, EN, and etc.) or industry-accepted standards (API, ASTM, DNV, NACE, SSPC and etc.) listed below* :

http://www.corrosionclinic.com/corrosion_resources/list%20of%20Coatings%20standards%20for%20the%20oil%20and%20gas%20industry.html

* Since these standards and their contents are quite big, it is beyond the scope of this article to detail and may be the topic of other articles related with INSPECTION and STANDARDS İN PROTECTIVE COATING FIELD in the future. However, they can be learned from various occupational trainings and certification programs from FROSIO, NACE, SSPC, TWI and alike technical societies around the word.)

COATING DEFECTS IDENTIFICATION, REMEDIES AND REPAIRS

In a Paint/Coating project, you need to know that the *sources* and *reasons of failures* so that you can plan what will you do as a remedy and then repair. Since paints&coatings are much like humans, animals or machines, sooner or later FAILURE* occurs! (*Paint/Coating FAILURE may be defined as the deterioration of the paint or coating system, or corrosion of the coated structure, more rapidly than would be normally expected, under the service conditions.)

These failures may appear as a result of:

1. **Design-related Issues** (i.e. sharp edges, corners, weld splatters, water traps, overlapped joints, etc.)
2. **Surface preparation operations** (i.e. abrasive and dust contamination, insufficient surface profile and cleanliness, etc.)
3. **Paint or Coating Types and Formulations (**i.e. unsuitable paint/coating selection for project conditions, formulated-related issues involving improper resin, pigment, fillers and additives, incompatible paint/coating type for the substrate to be coated i.e. oil-based paints for zinc-rich surfaces like Galvanizing, Zinc-rich painted surfaces)
4. **Paint or Coating Application** (i.e. too much wet paint film thickness, incorrect equipment selection, incorrect application technique, etc.
5. **Paint or Coating Drying/Drying** (i.e. high humidity, too high/low temperature, uneven heating, etc.)
6. **Unexpected service conditions** (i.e. unexpected weather conditions, disasters like earthquakes and tornados, aggressive chemical spillage, etc.)

SAGGING, BLEEDING, CRACKING, CHECKING, DISCOLORIZATION, WRINKLING are some examples of the paint&coating failures frequently experienced in the protective coating field. To avoid these examples of paint/coating failures and more, the actions below are can be followed as a remedy:

- Proper selection of a high-performance paint/coating system appropriate for the particular environment and service
- Preparation of a job specification that includes all requirements necessary to achieve long-term paint/coating performance
- Appropriate surface preparation of the environment, service and paint/coating system, as recommended by the paint/coating manufacturer
- Appropriate application of the paint/coating system, as recommended by its manufacturer, thorough inspection of all phases of the work to ensure that all project specification requirements are met.
- Evaluate the defective areas using ASTM D714 or ISO 4628 standards to identify the level of failure.
- Rapid corrective actions to address any deviations from recommendations or early signs of paint/coating defects.

Figure 5: Examples of Paint/Coating Defects and Failures

For more information on this subject, there are books, technical data sheets or bulletins published by paint/coating societies, manufacturers and paint/coating professionals like Dr. Richard W. Drisko who is also ex-protective coating specialist and advisor for US Navy:

- http://ponderosapaintco.com/techdata/7.pdf
- http://www.sspc.org/Marketplace/Books/Paint-and-Coating-Failures
- http://onlinelibrary.wiley.com/doi/10.1002/9780470744673.ch10/summary
- https://www.naaa.com/standards/Identifying_and_Correcting_Paint_Defects.pdf

HEALTH&SAFETY&ENVIRONMENT (HSE)

Surface preparation and painting/coating applications for Paint/Coating project do contain risks and hazards inherently. However, there are precautions and protective equipments to cancel or minimize these inherent risks and hazards during the painting or coating phase of the project. Some of these inherent risks are:

- Fire&Explosion
- Solvent emissions
- Slip&Falls
- Working at heights
- Breathing hazardous dust and chemicals
- Confined spaces
- Noise/Hearing Loss
- Radioactivity
- Electric-related risks
- Static electric
- Etc.

If these inherent risks cannot be prevented or minimized, then protective measures like personal protective equipments (PPE) should be used at all times.

A good resource for obtaining HSE information is the SDS documents (formerly MSDS before GHS regulation) which should be presented along with each product used in the project. Here you can find the risks, hazards and necessary protective equipments associated with handling and using all the chemical materials including, surface preparation chemicals, painting or coatings products from manufacturers.

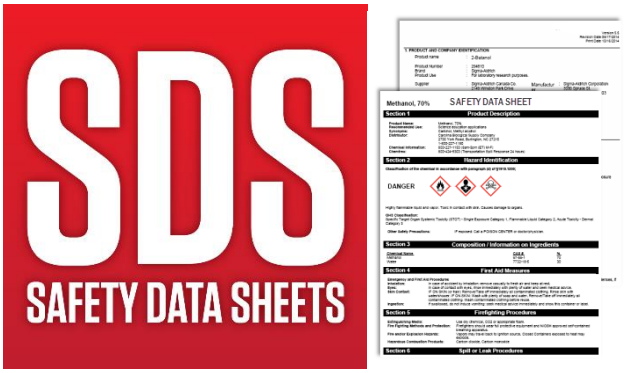


Figure 6: SDS or Safety Data Sheets of each chemicals are obligatory in all industrial projects.

Also, HSE issues can be discussed at the pre-construction meeting with site safety manager/supervisor and get a clear understanding of the safety rules of the project in concern. Moreover, safety and health organizations around world like CPCA, OSHA, NIOSH, SSPC, SWA and HSWA are organizing safety trainings publishing safety bulletins about painting and coatings application industry periodically. As a side note, local/national sources (i.e. Ministry of Labour in Turkey) may help you in creating Safety Checklists for Painting Works:

http://www.sspc.org/trn-crs-icsmc
https://www.osha.gov/Publications/OSHA3897.pdf
https://www.cdc.gov/niosh/docs/2004-101/chklists/n40spr~1.htm
https://www.csgb.gov.tr/media/3738/boya.docx

CONCLUSION

Managing PAINTING or COATING PROJECTS is a multi-discipline work and requires a great deal of technical knowledge & site experience in various fields i.e. substrates, surface preparation, paints/coatings, crew management, quality issues, health, safety, and environment issues. To wrap up; for a successful project management, these tips may help you manage your project in the most economical, safe and healthy way:

1.Plan the Painting/Coating project in detail: As discussed above, this is first and most crucial step of the project where nearly all the success comes from. This includes preparing Work Plan and PCPs in accordance with the Project specifications and standards involved.

2.Ensure proper surface prep before deployment : This is perhaps the most important step in any successful coating project because it separates the quality of one project from another.

3.Selecting the correct paint/coating materials : The success or failure of the project mainly depends on this step. However by asking the necessary questions mentioned above and using the industry-wide and international standards effectively, one can easily deal with issue successfully.

4.Select the correct painting or coating application techniques, tools and equipments : After selecting the correct paint/coating materials, the next step is to select the correct painting or coating application techniques, tools and equipments so as to apply these materials onto desired surface easily and efficiently. This decision can come from the hard way, site experience -trial-and-error process- or can be gained by industy-accepted training and certification programs mentioned above. As a side note, before heading to the job site, perform a thorough inspection of all the equipment you will be using to cut down on wasted time. Bring spare parts for any unexpected field repairs.

5. Establish correct communication and crew management

In any project, communication is key. Out in the field things can change very fast. They key is to keep everyone in the loop on the conditions at the job site, including the account manager and the end-client. There are also universal personal attitudes that should be followed mentioned in the above section so that creq management is smooth and successful

6. Document every step of the process and manage quality issues effectively

From start to finish, take photos of everything. Photos will serve you and your clients well for any reports and marketing material you create. Do not forget to fill in a proper Quality Assurance sheets .Also you need to know and use the essential quality arguments like ITP, CAPA, NCR and industrial/international paint/coatings standarts.

7. Identify the paint/coating defects&remedies and repairs in a correct fashion.

In every Paints/Coatings Project, sooner or later you will face with a failure eventually. Luckily, there are worldwide publications and websites you can use as an aid, which are mentioned above.

8. Health&Safety&Environment (HSE)

For all the operation in the paint/coating project, you need to think about HSE issues which may create an headache and lead inefficiencies & potential work loss even legal issues. To overcome these problems, you can use own site experience or take trainings from industry-accepted worldwide agencies to gain years of knowledge and experience. Alternative, you can get a variety of information thay you may benefit from SDS documents at no cost.

For more detailed information: +90 532 361 8031