ACTIVITY: PAINTING/ COPPER SLAG BLASTING JOBS

**Objective**                     :-    Safe working procedure for painting/copper slag blasting.

**Scope**                          :-    Blast Furnace 1, 2, 3 & accessories

**Ref.**                              :- WIMAINT103, WIMAINT12, WIMAINT70, SPP44G

**Responsibility**              :-  Engineer In charge and workmen on job

**PPEs to be used:**

* Helmet, Safety shoes, Hand gloves, Dust mask, safety harness, safety goggle and ear plugs (In high noise areas). Additionally eye and face protection, gloves that give full protection upto forearms and apron are required for carrying out Copper slag blasting.

**Aspect & Impact**

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| --- | --- |
| Scrap generation | Resource Depletion |
| Hazardous waste | Health |
| Oil Spillage | Land contamination |
| Oil traced waste generation | Land contamination & Resource Depletion |
| Empty paint drums, brushes | Land contamination |

Hazards identified

Mechanical Hazard

1. Fall of person from height below 10 mtrs
2. Fall of person from height above 10 mtrs.
3. Fall of Grinders from height.
4. Fall of Paint containers,
5. Fall of painting brush
6. Fall of scaffold arrangement.
7. Fall of particle in eyes while chipping
8. Pressure hazard due to failure of compressed air line hose
9. Failure of compressor
10. Slipping in the water of cooling tower cell
11. Failure of partition
12. Drowning of person in cooling tower cell.
13. Recoil from water jet cleaning gun.

**Chemical Hazard -**

1. Toxic chemicals,
2. Co gas poisoning while painting on gas line,
3. Slashing of paint drops in eyes.
4. Fire & Explosion while painting inside poorly ventilated area.
5. Fire due to cutting/ welding spatter in open tin at store yard
6. Fire due to cutting/ welding spatter in open tin during transit
7. Hazardous dust generation during abrasive blasting

Physical Hazard -

1. Burns while painting hot surfaces.
2. Pressure due to failure of air /hydraulic system
3. Excessive noise while abrasive blasting.
4. Excessive dust generation during abrasive blasting.
5. Rebounding grit during abrasive blasting
6. Rebounding dirt or scales while water jet cleaning
7. May come in line of fire of rotatory/movable equipment without Electrical/Mechanical LOTO

**Electric hazard**

1. Electric shock on equipment
2. Fire due to electrical short circuit in paint store yard
3. Electrocution due to scaffolding pipe/material in contact with HT/LT power line.
4. Electrocution of person coming in contact with live wire.
5. Electric shock while handing paint stirrer, hand grinder or high pressure pump.

**Human behavior:-**

1. Alcoholism,
2. casual approach, & horseplay
3. Non usage of correct tools & PPE.

**Work No 1 : Painting**

1. Take clearance from production department for painting activity in the concerned area. Obtain a Work Permit from the shift Superintendent / in charge if the work is related to production after complying with all the related safety conditions.
2. If the job is near gas-affected area take co monitor and confirm CO concentration is below 35 ppm.
3. If the painting is to be done at height, make the proper scaffolding arrangement from certified scaffolders as per work instructions **WIMAINT103**.
4. In case painting job to carried around any equipment vicinity then respective equipment should be isolated Electrically & if applicable Mechanically from all form of energy source.
5. One Man One Lock to be followed by putting LOTO lock on LOTO box arrangement by individual persons who are going to perform painting job.
6. Scaffolding should be made with pipe (48.3mm nominal outside diameter), alternately cuplock scaffolding, modular or frame and brace type scaffolding can also be used.
7. Make sure that pipes used for scaffolding are not protruding in work area of other workmen or not in danger position (to hit someone).
8. Each supporting member for scaffolding, stair, and runway shall be placed on firm, rigid smooth foundation that prevents lateral displacement.
9. Before using the scaffolding ensure that it has been certified for use and tagged with Green tag by competent authorized person.
10. Barricade below area where painting is to be done.
11. While painting at height follow work at height procedure as per **SP44G.**
12. Study the environment, which will affect the parent material, accessibility of structure and select the painting scheme accordingly.
13. Before painting, all the dirt, oil traces etc, has to be removed from surface as per the surface preparation standard mentioned in painting scheme.
14. While doing surface preparation activity on BF gas line use only wire brush or water jet cleaning. **(chipping and grinding is strictly prohibited)**
15. Ensure proper locking of the grinder supply cable using cable hitch to avoid falling from height.
16. Take care for recoil from pressure gun while cleaning surface using water jet.
17. Also ensure usage of completely sealed safety goggles to avoid dust/rust scales going in the eyes.
18. Follow color coding mentioned in the table below for pipelines, equipment and structures.
19. Apply paint on the cleaned surface using paint brush/ paint roller or spray gun. Ensure proper locking of the tin (4 litre capacity only) on the structure to avoid falling from height.
20. Avoid paint from falling on ground. & direct contact by hand. Use hand gloves for the same
21. If the job is to be carried out is in closed compartment, ensure proper ventilation and illumination in the area. Use external blowers if required.
22. While carrying paint tins for painting ensure that the paint tins are closed.
23. Empty paint tins should be stored under proper canopy so as to avoid fire
24. Storage of paint container should be properly examined by the concerned Engineer.
25. Empty paint tins are classified as hazardous waste and to be disposed of through stores as per the decided frequency.
26. If cutting and welding is to be done near paint storage area prior permission of the same has to be obtained from concerned department. Shift the paint containers before starting any gas cutting / welding activity.
27. While working on or near electrical appliance ensure the shutdown of the same. Also do not work near live cables.
28. In case of painting for cooling tower cell, follow these safety precautions
29. Follow all precautions of painting and working at height
30. Close the water inlet to cooling tower hot water chamber and display and mechanically isolate the valve.
31. Isolate the other sumps by closing slide gate valve / vertical planks.
32. Use full body harness while working at height. Tie safety net below the working area where ever required.
33. Maintain water level in the sump to 500mm.
34. Make scaffolding to work inside and make proper access to scaffolding.
35. Remove inside panels one by one
36. Start painting after surface preparation.
37. Fix back the inside panels
38. Clean the sump thoroughly and revert back all valves to normal on completion of job
39. Nobody should go inside the sump without close supervision
40. Additional identification markers like colour bands (its size and location), arrow marks (size) and lettering to be done as per the table given below. (as per IS 2379: 1990 standard )

**Work No 2 : Copper slag blasting**

1. Take clearance from production department and Work Permit from the shift Superintendent / in charge if the work is related to production after following all the related safety conditions indicated in the work instruction.
2. If the job is near gas-affected area take co monitor and confirm CO concentration is less than 35 ppm.
3. If the blasting is to be done at height, make the proper scaffolding arrangement from certified scaffolders as per work instructions **WIMAINT103**.
4. Cordon the area coming under copper slag blasting area.
5. Scaffolding should be made with pipes (48.3mm nominal outside diameter). Alternately cuplock scaffolding, modular or frame and brace type scaffolding can also be used.
6. Make sure that pipes used for scaffolding are not protruding in workable area of other workmen or not in danger position (to hit someone).
7. Each supporting member for scaffolding, stair, and runway shall be placed on firm, rigid smooth foundation that prevents lateral displacement.
8. Before using the scaffolding ensure that it has been certified for use and tagged with Green tag by competent authorized person.
9. Suitable enclosure to be made while copper slag blasting to protect the environment from dust.
10. In case of in situ blasting proper barriers and curtain walls to be used to isolate the blasting operation from other workers.
11. Keep coworkers away from blasters.
12. Use exhaust ventilation systems in containment structures to capture dust.
13. Avoid blasting in windy conditions to prevent spread of hazardous material.
14. Use hearing protection, eye and face protection, helmet, gloves that give full protection upto forearms and apron while carrying out slag blasting.
15. Ensure the condition of the air hose is good before starting the job.
16. Screen the copper slag using suitable mesh to remove the external impurities before using same for blasting.
17. Before starting the sand blasting ensure the proper functioning of the compressor and availability of safety shutoff.
18. Sand Blast the structure with copper slag which must be free from chloride with the pressure of approximately 4.5-5 bar and 300CFM.
19. Copper blasting to be carried out by specialized/trained skilled workmen with the usage of all necessary required PPE.
20. One workman should stand at the Compressor for stopping the machine during emergency.
21. Preferably sand/slag to be stored in gunny bags or polythene lined inside to prevent ingress of moisture and contamination.
22. Paint the structure as per the instruction of the engineer. Sandblasted surface to be painted within 2 hours of sandblasting as site atmosphere is saline.
23. Follow the Painting scheme as required.
24. While sand blasting Heat area adequate care must be taken to avoid heat hazard.
25. While working on or near electrical appliance ensures the shutdown of the same. Also do not work near live cables.
26. Refer **WI/MAINT/12** and standard procedure SP44-H while handling material inside sand blasting shed

**DOs**

* Use goggles while chipping the surface.
* Use only certified grinder for surface finishing.
* Use Safety belt/Full body hardness while working at height.
* Inspect scaffolding at periodic interval.
* Follow grinding procedure **WI/MAINT/70** while using grinder
* Follow isolation procedure for all forms of energy

**DONTs**

* Use Barrels, Boxes, loose tile blocks or other unsuitable objects to support for working platform.
* Do not gas cut empty paint barrels as it may explode
* Do not carry out chipping and grinding on BF gas line and other fuel containers.
* Do scaffold/painting on electrical drive without equipment LOTO

# Safety Information:

As per the safety measures, inhalation of solvent vapor or paint mist and contact of liquid paint with skin and eyes should be avoided. Forced ventilation should be provided when applying paint in confirmed space or stagnant air. Even when ventilation is provided, respiratory, skin and eye protection is always recommended while spraying Paint.

While carrying out abrasive blasting take extreme care to minimize dust generation and containment.

Working near the electric line to be done under complete close supervision and only after suitable authorization for the job by area engineer both Electrical and mechanical.

PLEASE REFER MATERIAL SAFETY DATA SHEET PRIOR TO USING THE PRODUCT.

# PAINT CODE

|  |  |  |  |
| --- | --- | --- | --- |
| SR. NO. | CONTENT | GROUND COLOR | FIRST COLOR BAND |
| 1 | BOILER FEED WATER | SEA GREEN (NO. 217) |  |
| 2 | COOLING WATER | SEA GREEN (NO. 217) |  |
| 3 | FIRE WATER | FIRE RED (NO. 536) |  |
| 4 | DRINKING WATER | SEA GREEN (NO. 217) |  |
| 5 | STEAM | ALUMINIUM TO IS 2339 |  |
| 6 | COMPRESSED AIR UPTO 15 KG/CM2 | SKY BLUE (NO. 101) |  |
| 7 | INSTRUMENT AIR | SKY BLUE (NO. 101) |  |
| 8 | PLANT AIR | SKY BLUE (NO. 101) |  |
| 9 | LUBRICATING OIL | LIGHT BROWN (NO. 410) |  |
| 10 | HYDRAULIC POWER | LIGHT BROWN (NO. 410) |  |
| 11 | TRANSFORMER OIL | LIGHT BROWN (NO. 410) |  |
| 12 | NITROGEN | CANARY YELLOW (No.309) | BLACK |
| 13 | Oxygen | CANARY YELLOW (No.309) | WHITE |
| 15 | BLAST FURNACE GAS | CANARY YELLOW (No.309) |  |
| 16 | COKE OVEN GAS | CANARY YELLOW (No.309) |  |
| 17 | LIME | SMOKE GREY (No. 692) |  |

|  |  |  |
| --- | --- | --- |
| **COLOR CODES FOR STRUCTURE AND EQUIPMENT** | | |
| SR. NO. | CONTENT | GROUND COLOR |
| 1 | STRUCTURES (GENERAL) | SMOKE GREY (No. 692) |
| 2 | TURBINES & HIGH TEMPERATURE PUMPS | HEAT RESITANT ALUMINIUM |
| 3 | MOTORS | BUS GREEN (NO. 299) |
| 4 | HAND RAILING | YELLOW AND BLACK |

\* Numbers in the bracket indicate ISC (Indian Standard Color) number.

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| --- | --- | --- | --- | --- |
| **COLOR REFERENCE** | | | | |
| SKY BLUE (NO. 101) |  |  | SMOKE GREY (No. 692) |  |
| FRENCH BLUE (NO. 166) |  |  | CANARY YELLOW (No.309) |  |
| SEA GREEN (NO. 217) |  |  | LIGHT BROWN (NO. 410) |  |
| BUS GREEN (NO. 299) |  |  | FIRE RED (NO. 536) |  |

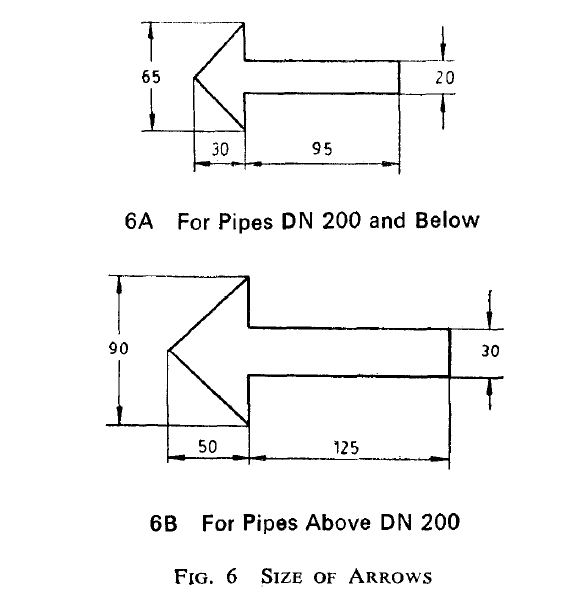
As per IS2379 standard minimum width of the color band shall confirm to the following table:

|  |  |
| --- | --- |
| Nominal pipe size | Width L (mm) |
| 80 NB and below | 25 |
| Over 100 NB up to 150 NB | 50 |
| Over 200 NB up to 300 NB | 75 |
| Over 300 NB | 100 |

Where it is required to indicate the direction of flow, arrows or letters may be painted near valves, junctions, walls etc. and at suitable intervals along the pipe, in a manner best suited for local conditions.

These shall be black or white in color and in contrast to the color on which they are super imposed.

Size of the arrow shall be as below



The recommended size of lettering for pipes of different diameters should be maintained as per below table.

|  |  |
| --- | --- |
| **Outside Diameter of pipe or Covering** | **Size of legend** |
| **mm.** | **mm.** |
| 20 to 30 | 10 |
| Above 30 to 50 | 20 |
| Above 50 to 80 | 30 |
| Above 80 to 150 | 40 |
| Above 150 to 250 | 63 |
| Over 250 | 90 |

**Painting Schemes**

|  |  |  |  |
| --- | --- | --- | --- |
| **Painting Scheme** | **Surface preparation** | **Scheme** | **Total DFT** |
| COAL TAR EPOXY PAINT | SURFACE PREPARATION BY HAND CLEANING/HAND SCRAPPING/HAND WIRE BRUSHING UP TO ST2/ST3 STANDARD | Application of coal tar epoxy paint (Base + Hardener ), 2 Coats of 100 DFT each | 200 microns |
| SYNTHETIC ENAMEL PAINT | SURFACE PREPARATION BY HAND CLEANING/HAND SCRAPPING/HAND WIRE BRUSHING UP TO ST2/ST3 STANDARD | Application of zinc phosphate primer 2 coats with DFT 50 micron followed by application of synthetic enamel paint 2 coats with DFT 30 micron / coat | 160 micron |
| SYNTHETIC ENAMEL PAINT | SURFACE PREPARATION BY HAND CLEANING/HAND SCRAPPING/HAND WIRE BRUSHING UP TO ST2/ST3 STANDARD | Application of zinc phosphate primer 1 coats with DFT 60 micron followed by application of synthetic enamel paint 2 coats with DFT 30 micron / coat | 120 micron |
| SYNTHETIC ENAMEL PAINT | SURFACE PREPARATION BY HAND CLEANING/HAND SCRAPPING/HAND WIRE BRUSHING UP TO ST2/ST3 STANDARD | Application of zinc phosphate primer 1 coats with DFT 60 micron followed by application of synthetic enamel paint 1 coat with DFT 30 micron | 90 micron |
| HEAT RESISTANT ALUMINIUM PAINT | SURFACE PREPARATION BY HAND CLEANING/HAND SCRAPPING/HAND WIRE BRUSHING UP TO ST2 STANDARD | Application of heat resistant (250 deg ) aluminium paint 2 coats | 40 micron |
| Sigma scheme ( PU paint) | SURFACE PREPARATION BY HAND CLEANING/SCRAPPING / WIRE BRUSHING/CHIPPING/SANDING ETC. CONFORMING TO SSPC SP2 STANDARDS OR SURFACE PREPARATION BY WATER JET CLEANING ( PRESSURE 200 -340 BAR) CONFORMING TO NACE WJ4 / SPWJ4 STANDARD SURFACE PREPARATION BY WATER JET CLEANING ( PRESSURE 200 - 340 BAR) CONFORMING TO NACE WJ4 / SPWJ4 STANDARD | Application of two component polyamide cured epoxy primer (Sigmacover 620) with base to hardener mixing ratio of 80:20 ( 2coats), followed by application of aliphatic acrylic polyurethane paint (SigmaDur 550)(1 coat). | more than 250 micron |
| Asian Paints PPG Scheme | SURFACE PREPARATION BY HAND CLEANING/SCRAPPING / WIRE BRUSHING/CHIPPING/SANDING ETC. CONFORMING TO SSPC SP2 STANDARDS OR SURFACE PREPARATION BY WATER JET CLEANING ( PRESSURE 200 -340 BAR) CONFORMING TO NACE WJ4 / SPWJ4 STANDARD SURFACE PREPARATION BY WATER JET CLEANING ( PRESSURE 200 - 340 BAR) CONFORMING TO NACE WJ4 / SPWJ4 STANDARD | Application of two component aliphatic polyurathane primer (Asian Paints PPG Apcothane CF 675) with base to hardener mixing ratio of 14:1 (3 coats), followed by application of modified epoxy paint (Asian Paints PPG Rust O CAP) with base to hardener mixing ratio of 4:1 (2 coats). | more than 350 micron |

**Amendement Record**

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| --- | --- | --- | --- |
| **Date** | **Manual Section Ref. & Para** | **Brief details of Revision** | **New Rev.** |
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| --- | --- | --- |
| **Prepared By:**  Area Engineer | **Reviewed & Issued By:**  Management Representative | **Approved By:**  Mechanical Head |
| **Signature** | **Signature:** | **Signature:** |
| **Review Date: 12.12.22** | **Review Date: 12.12.22** | **Review Date: 12.12.22** |