SEMMPF365

Inspecting furnace and ladle linings and equipment

Overview

This standard identifies the competences you need to inspect furnace linings and, where appropriate, pouring vessels, used in the production and transportation of molten metal. Manual and fully or partially mechanised methods will be used, in accordance with approved procedures. You will be required to select the appropriate materials and equipment to use, based on the type of furnace and the metal to be melted for the inspection and any subsequent repairs and corrective actions. Furnaces that produce single, batch and continuous melts of metal are included in this standard, which also covers both ferrous and non-ferrous alloys. You will examine the furnace lining for damage and wear after each melt has taken place. You will be expected to be able to recognise sub-standard and defective linings and plan necessary repairs as appropriate. You will be able to recognise when a replacement furnace or ladle lining is required and be able to report this to the appropriate authority. Any sub-standard furnace lining material will be removed and new lining material added. Both manual and mechanical means will be used to remove the sub-standard linings. You will, where appropriate, dry/cure the repaired lining prior to starting the melting cycle. You will light/start up the furnace to pre-heat the lining before metal charging is carried out. Where the metal is to be melted, in either fixed or movable crucibles, you will also inspect these vessels for wear/damage and carry out routine servicing to maintain their life. Where appropriate, you will repair/replace discharge launders. You will, where appropriate, knock out, re-line and dry/cure pouring vessels to be used for the casting operation. Your activities will include the operating of any mechanical, electrical or electronic equipment used during inspection and repair of melting furnaces and associated equipment. You will understand when a furnace or ladle lining or equipment should be quarantined for repair or replacement and the procedures to carry out to achieve this. Your responsibilities will require you to comply with organisational policy and procedures for the preparation and repair of melting furnace linings and associated equipment. You will report any problems with materials, furnaces and equipment in use that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work to verbal or written instructions. You will also be expected to take responsibility for maintaining the melting furnaces and other associated equipment, in a safe and functional condition. Your underpinning knowledge will be sufficient to provide a sound approach to your work and will provide an informed approach to the inspection, preparation and maintenance of the melting furnaces and ladles you use. You will understand the different types of metal in use, and the associated furnaces and ladles used to melt and pour these metals. You will understand the different methods of melting metal, such as single, batch or continuous processes and the effects that each of these has on the furnace and ladle linings. You will understand the safety precautions required when carrying out the furnace and ladle inspection activities. You will be required to demonstrate safe working practices throughout. You will also understand your responsibilities for safety and the importance of taking the necessary safeguards to protect yourself and others in the workplace and towards the environment.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety legislation, regulations, directives and other relevant guidelines
2. obtain the required equipment and ensure that it is in safe and usable condition
3. prepare equipment in line with work requirements
4. inspect and check furnace,ladle linings and equipment
5. check that required safety arrangements are in place to protect other workers from activities likely to disrupt normal working
6. carry out repairs to furnace, ladle linings and equipment
7. check the inspection work is completed to the required standard and specifications
8. deal promptly and effectively with problems within your control and report those that cannot be solved
9. ensure that work records are completed, stored securely and available to others, as per organisational requirements
10. leave the work area in a safe condition on completion of the activities, as per organisational and legal requirements

Knowledge and understanding

You need to know and understand:

1. the specific safety precautions to be taken whilst carrying out the activities (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials) 2. the health and safety requirements of the work area and the activities, and the responsibility these requirements place on you 3. the hazards associated with the activities, and how to minimise them and reduce risks 4. the personal protective equipment and clothing (PPE) to be worn during the activities 5. how to obtain job instructions and how to interpret the information 6. the different materials that are used to line/repair furnaces and ladles (such as acid/base, wet/dry, gas/heat cured, sprayed materials, pre-formed liners) 7. why it is necessary to check amounts of materials prior to starting furnace/ladle repairs and actions to take if the amounts are incorrect 8. why checks should be made on the materials to be used 9. the effects on the repairs and the furnace operation, if the base products are past their `use by' date, are different in content from the company requirement/specification, or are applied incorrectly 10. the different fuels used to melt metal and the effects they have on the furnace linings 11. the different types of furnaces and equipment used to melt and transport metal (bale out, lift out crucible, tilting crucible, cupola, rotary, induction (high and low frequency), direct/indirect arc) 12. how to recognise when furnace and ladle linings need repairing and replacing (scoured areas, fused linings or damaged bricks, tuyere area damage, damaged lining rings, damaged or broken base block, burner box damage, thinning of refractory linings, contaminated crucibles, broken/cracked or damaged furnace surround, insulation breakdown, damage to pouring vessels, damage to power input cables or fuel supply lines and damage to burner nozzle) the consequences of using furnaces and ladles that are defective or have incorrectly installed linings 13. how to safely remove linings from the furnaces and ladles, and the tools and equipment that are used (hand and power tools) 14. how to mix, prepare and apply the various linings (refractory materials and pre-formed linings) 15. the reasons why the repaired furnace lining and, pouring vessels linings, should be dried or cured prior to the furnace/vessel being used to melt/carry metal 16. the organisational quality control checks for the furnaces/ladles 17. why it is important to keep the furnace and repair equipment clean and free from damage, to practise good housekeeping of tools and equipment, to maintain a clean and unobstructed working area and to carry out start-up and shut-down procedures 18. the extent of your responsibilities and whom you should report to if you have problems that you cannot solve when checking and inspecting melting furnace or pouring vessel/ladle linings 19. how to access, use and maintain information to comply with organisational requirements and legislation

Scope/range related to performance criteria

1. Prepare and repair for inspections, by carrying out all of the following activities: 1. confirm that the required equipment is available and is in a safe and usable condition 2. check and inspect the furnace and ladle linings for damage and wear 3. plan repair procedures on defective furnace and ladle linings using the appropriate procedures, equipment and materials 4. check and inspect associated furnace and ladle equipment and agree any corrective actions or quarantining defective equipment for repair or replacement 5. check that correct amounts of repairing/relining materials are available (refractory materials, pre-formed linings) 6. check the quality/specification of the materials that you use and ensure that the materials specification complies with repair procedures documentation 7. adhere to health and safety regulations, systems and procedures to realise a safe system of work 8. follow the defined repair procedures at all times 9. ensure that the completed furnaces and ladles meet the required specification for quality and accuracy 10. leave the work area in a safe condition on completion of the preparation activities 2. Inspect the equipment, checking for completeness and freedom from defects, to include five of the following: 1. power cables 2. fuel supply lines 3. furnaces 4. furnace linings 5. ladles 6. crucibles and associated pouring or molten metal transfer vessels 3. Use a range of hand and power tools during the repair/relining of the furnaces and ladles, to include two of the following: 1. hand tools 2. compacting tools 3. spraying equipment 4. pneumatic tools 5. mixing equipment 6. gassing equipment 7. other specific tools 4. Check, prepare and use one of the following repair/lining materials: 1. water based refractory 2. dry powder refractory 3. chemically bonded 4. pre-formed linings 5. Repair furnace and ladle linings, to include six of the following: 1. manually chipping out damaged areas 2. using mechanical assistance to remove damaged areas 3. mixing, preparing and applying new lining/repair material 4. inserting new pre-formed liner 5. dressing repaired areas 6. drying or curing lining 7. carrying out any required pre-heating of the lining, prior to production starting 8. reporting any problems you cannot resolve (such as with power or fuel supply) 6. Confirm the completion of the furnace/ladle inspection/preparation/repair, to include both of the following: 1. reporting that furnace/ladles are ready for use, in accordance with company procedures 2. quarantining furnaces/ladles that are not suitable for use, in accordance with company procedures 7. Carry out inspections, preparations and repairs to one of the following quality and accuracy standards: 1. company standards and procedures 2. current industry standards and codes of practice 3. other international standards 4. customer standards and requirements

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