**ACTIVITY :** **Major Activities for Relining Bf**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Objective : - Safe work procedure for fabrication dismantling & erection
* Scope : - Blast furnace & Accessories
* Ref. : -
* Responsibility : - Engineer In Charge & workmen at job

**PPE –s to be used:**

* Helmet, Safety shoes, Dust masks, Hand gloves safety belt and goggles

**Aspect – Impact**

|  |  |
| --- | --- |
| Scrap generation | Resource Depletion |
| Dust/Fumes generation | Air pollution |

Hazards identified

**Mechanical hazard -**

1. Trapping between two objects,
2. Fall of material, hammer, tools, slinged items, bolts, etc.
3. Fall of person from platform,
4. Entanglement
5. Impact of moving / slinged items.
6. Fall of material from height such as angles, channels, beams, plates ,bolts ,nuts etc. due to poor housekeeping.
7. Failure of sling, D shackle, chain pulley block
8. Failure of full body harness due to improper clamping, damaged rope, hooking on weak structure
9. Skidding of person due to poor housekeeping, oil spillage, uneven surfaces, broken bricks etc
10. Back pain while handling heavy load and improper posture
11. Cut injuries from sharp edges of items
12. Getting trapped / skid material stacked
13. Hitting of moving vehicles, and machinery in the plant
14. Slipping/Rolling of trolley while loading/unloading
15. Falling of cylinders due to improper fixing of protective M.S.chain
16. Fall of cylinder trolley due to failure of wheels
17. Explosion due to impact on the knob
18. Failure of the clutch / brake of hydra / material handling vehicles
19. Sliding/rolling of the material from vehicle.
20. Impact of moving / slung items, overturning / slipping of steel items.
21. Failure of rope
22. Bursting of tyre while moving / during erection
23. Jamming of the hand while locking the tempo/truck gates.
24. Getting trapped below Hydra because of failure of brakes or sudden jerks
25. Getting trapped between the swing portion & the body of Hydra
26. Getting hurt because of poor visibility
27. Impact of other vehicles
28. Non usage of PPE like shoes, helmet & safety harness, goggles
29. Alcoholism
30. Skidding of wheel stoppers
31. Human error
32. Overturning of vehicles due to uneven surfaces
33. Overturning due to loosing the centre of gravity.
34. Hitting of person while reversing
35. Incidents due to poor illumination
36. Failure of the workmen basket structure, temporary platform
37. Fall of person from height due to unbalance from workmen basket, temporary platform
38. Trapping of the person between basket and structure
39. Fall of workmen basket, temporary platforms due to failure of the clamping
40. Lifting of the truck due to unstable loading
41. Hitting on surrounding structures, while negotiating a turn
42. Fall of the Pal finger crane from the truck due to failure of mounting bolt
43. Failure of hydraulic system
44. Failure of hook of the crane
45. Fall of “falka” of truck during movement.
46. Fall of the extended boom from top.
47. Damage of overhead structure during marching of crane / hydra
48. Hitting / trapping of crane due to improper / non sequential operation
49. Bending of chassis due to non levelling of stabilizers
50. Failure of stabilizers
51. Failure of crane / chassis due to non levelling of crane platform with water level
52. Hitting of the boom due to fast operation.
53. Improper operation due to improper signalling.
54. Scaffold collapse caused by instability or over loading
55. Incident due to usage of mobile while driving / operation of crane / hydra / Palfinger/ Hiab basket
56. Trapping due to Improper jacking during crane maintenance
57. Fire due to fall of sparks welding / gas cutting
58. Back fire during gas cutting
59. Failure of welding hook due to improper / inadequate welding
60. Failure of welding hook due to welding on hard faced plates / unknown plates

**Human behavior**

1. Alcoholism,
2. Casual approach
3. No usage of PPE's.

**Physical hazard**

1. Vehicle emission
2. Pressure due to failure of air /hydraulic system
3. Burns

**Electrical hazard**

1. Electric shock from overhead lines or welding
2. Short circuit due to failure of electrical system
3. Electric shock from battery terminal

**Chemical hazard** –

1. Fire & Explosion
2. Co Gas poisoning

**General Guidelines**

1. Take clearance from the concerned department if the job is related to the other department.
2. Cordon the area where job is to be carried out.

**Major Activities for BF1 Relining**

**(To be read in addition to WI MAINT 94, HIMAINT 94 & RA MAINT 94)**

**A. Technical Specification For Works Package Relining (MECHANICAL)**

**B. Procedure For Grinding Machine Operation / Maintenance**

**C. Working On Rolling Machine**

**D. Rolled plate fit up as per drawing on the fabrication platform**

**E. Format for Hazard identification**

**A. TECHNICAL SPECIFICATION FOR WORKS PACKAGE RELINING (MECHANICAL)**

**1.0 FABRICATION, ERECTION, TESTING AND PAINTING FOR STRUCTURAL AND STEEL WORKS**

1.1.0 **Material**

1.1.1 Structural Steel

The Contractor shall submit the test certificates confirming to appropriate standards of all steel materials used for fabrication. All structural steel shall be free from rust, scales, lamination, cracks, fissures and other surface defects.

1.1.2 Bolts and Nuts

All bolts and nuts used by the Contractor shall confirm to IS: 1363-1992 and IS 1364-1992 as applicable and unless specified otherwise shall be hexagonal. All nuts shall confirm to IS:1363-1992 and IS: 1364-1992 having property class compatible to the property class of the bolt used.

1.1.3 Washers

Plain washers shall be made of mild steel conforming to IS:5369-1975 unless otherwise specified. One washer shall be supplied with each bolt and in case of special types of bolts more than one washer as needed for the purpose shall be supplied. An additional double coil helical spring washer conforming to IS 6755-1972 shall be provided for bolts carrying dynamic or fluctuating loads and those in direct tension. Tapered washers conforming to IS : 5372-1975 and IS 5374- 1975 shall be used for channels and beams respectively.

1.1.5 Electrodes

The welding work shall be done using low hydrogen electrodes. The electrodes used for fabrication and erection work shall conform to IS:814-1991.Electordes required for hard facing, SS to MS,SS to SS shall be of reputable make ( Advani/L&T)

**1.2** **Fabrication**

1.2.0 Standard

All fabrication of structural steel work shall be in accordance with IS:800-1984 and as per the approved drawings unless otherwise specified. The tolerances of fabrication of steel structures shall be in accordance with IS:7215-1974 unless otherwise specified.

1.2.1 Type of Construction

The steel structures shall generally be of shop welded construction. Site connections shall generally be provided by

i) Welding with erection bolts.

ii) Bolting with black bolts.

1.2.2 Storing Materials

All materials shall be stored properly on skids, above the ground. It shall be kept clean and properly drained. Structural steel shall be so stored and handled that members are not subjected to excessive stresses and damage. Girders and beams shall be placed upright and stored. Long members, such as columns and chords shall be supported on closely spaced skids to prevent injury from deflection.

1.2.3 Workmanship

i) General:

All workmanship shall be equal to the best practice in modern structural shops. Greatest accuracy shall be observed in the manufacture of every part of the work and all similar parts shall be strictly interchangeable.

ii) Templates

Templates used throughout the work shall be of steel or steel bushed in such cases as may be considered necessary by the Company. In case where actual materials have been used as templates for drilling similar pieces, the Company shall decide whether they are fit to be used as parts of the finished structure.

iii) Straightening:

All materials shall be straight and if necessary before being worked shall be straightened and/or flattened by pressure unless required to be of curvilinear form and shall be free from twists.

iv) Clearance

The erection clearance for cleated ends of members connecting steel to steel should not be greater than 2mm at each end. The erection clearance at ends of beams without web cleats should not be more than 3mm at each end, but where for practical reasons the greater clearance is necessary, suitably designed seatings or connections shall be provided.

v) Shearing, flame cutting and planning

Shearing or flame cutting may be used at the Contractor's option provided that a mechanically controlled cutting torch shall be used for the flame cutting and that the resulting edge shall be reasonably clean and straight. Sheared members shall be free from distortion at sheared edges. Special care shall be taken to remove the burnt edges of high tensile steel when flame cutting method is employed. When gas cutting is adopted, the flame cut edges shall be machined to a depth of 3 to 5mm depending on the thickness of the member.

Chipping of angle flanges and edges of plates wherever necessary shall be done without damaging the parent metal. Chipped edges shall be ground to a neat finish and sharp corners and hammered rough faces shall be rounded off.

The edges and ends of all flange plates and web plates of plate girders and built-up columns, of plates forming chords or web members of lattice girders, and all cover plates, the ends of all angles, tees, channels and other sections forming the flanges of plate girders and columns, and chords and web members of lattice girders shall be planned. Edge preparation for welding may be done by machine controlled flame cutting with edges free of burrs, clean and straight. In welded crane girder the top edges of all intermediate stiffener shall be prepared and butt welded to the top flange plates unless otherwise shown in the design drawings.

The butting surfaces at all joints of girders or columns shall be planed so as to butt in close contact throughout the finished joint.

The ends of all built-up girders and of all columns shall be faced in an end milling machine after the members have been completely assembled.

Bearing edges for crane girder bearing stiffeners, column caps, bases and roof structure connections shall be machined as shown in drawing.

Unless clean, square and true to shape, all flame-cut edges shall be planed.

Cold sawn ends if reasonably clean and flame-cut ends of sections not inferior to sawn ends in appearance need not be planed except for butting ends.

vii) Holing:

Holes for bolts shall be drilled to conform to clause 10 of IS:7215-1974. All holes, except as stated hereunder, shall be drilled to the required size or sub-punched 3mm less in diameter and reamed thereafter to the required size Thickness of the material for sub-punching shall not be greater than I6mm. All matching holes for bolts shall register with each other so that a gauge of 0.8mm less in diameter than the hole can pass freely through the members assembled for bolting in the direction at right angle to such members. All holes for turned and fitted bolts shall be drilled undersize by one mm and after assembly reamed, to a tolerance of +0. 13mm, -0mm unless otherwise specified.

Holes in purlins, side sheeting runners, packing plates and lacing bars may be punched full size, provided the thickness of the material does not exceed 13 mm.

All punching and sub-punching shall be clean and accurate and all drilling shall be free from burrs.

No holes shall be made by gas cutting process.

viii) Assembly:

All parts assembled for bolting shall be in close contact over the whole surface and all bearing stiffeners shall bear tightly at both top and bottom without being drawn or caulked.

The component parts shall be so assembled that they are neither twisted nor otherwise damaged. Specified cambers, if any, shall be provided.

All parts of bolted and welded members shall be held firmly in position by means of jigs or clamps while bolting or welding. No drilling of holes shall be permitted except to draw the parts together and no drift used shall be larger than the nominal diameter of bolt. Drifting done during assembling shall not distort the metal or enlarge the holes.

Trial assemblies shall be carried out at the fabrication stage to ensure accuracy of workmanship and these checks shall be witnessed by the Company.

ix) Bolting

All turned and fitted bolts shall be carefully turned and shall be parallel through out the barrel. The following limits of tolerance shall be permitted upon the diameter of the barrels of turned bolts and holes which they are to fit.

a) Barrel of Bolt hole

Limit of tolerance (High ... 0.00m +0.13mm)

(Low ... -0.13mm 0.00mm)

The barrel of each turned bolt shall be of such a length that it is in full contact with the work throughout, the screwed portion being made at least 1.6mm less in diameter than the barrel or to suit the next smaller size of metric screw thread. The barrel portion shall be jointed to the thread portion by a 45 degree chamfer within the thickness of washer. Unless otherwise specified, faces of heads and nuts bearing on steel work shall be machined. All such bolts shall be provided with washers having a hole of 1.5mm larger in diameter than the barrel of bolt and thickness of not less than 6mm so that the nut, when tightened, shall not bear on the unthreaded body of the bolt. In all cases, where the full bearing area of the bolt is to be developed, the threaded portion of the bolt shall not be within the thickness of the parts bolted together. The threaded portion of each bolt shall project through the nut by at least one thread. Tapered washers shall be provided for all heads and nuts bearing on bevelled surface.

x) Field Bolts:

Requirements stipulated under bolting shall apply for field bolts Field bolts, nuts and washers shall be furnished by the Contractor in excess of the nominal numbers required. Where erection at site is not carried out by the Contractor, he shall supply the full number of bolts, nuts and washers and other necessary fittings required to complete the work together with the following allowances in addition to the required numbers:

All types of bolts, nuts & washers (including MFG bolts) 10% but not less than 10 Nos.

1.2.4 Welding

i) General:

The welding and the welded work shall generally confirm to IS:816-1969 and 9595-1980 unless otherwise specified. As much work as possible shall be welded in shops and the layout and sequence of operations shall be so arranged as to eliminate distortion and shrinkage stresses.

ii) Electrodes:

All electrodes shall be kept under dry conditions. Any electrodes damaged by moisture shall not be used unless it is guaranteed by the manufacturer that when it is properly dried, there will be no detrimental effect. Any electrode which has part of its flux coating broken away or is otherwise damaged, shall be rejected. Any electrode older than six (6) months from the date of manufacture shall not be used. Batch certificate for electrode shall be submitted by Contractor.

iii) Preparation of Joints:

The edges shall be prepared with an automatically controlled flame cutting torch correctly to the shape, size and dimensions of the groove, prescribed in the design and fabrication drawings. In case of U-groove joint, the edges shall be prepared with an automatic flame cutting torch in two phases following a bevel out with a gouging pass or by machining.

The welding surfaces shall be smooth, uniform and free from fins, tears, notches or any other defect which may adversely affect welding and shall be free of loose scale, slag, rust, grease, paint, moisture or any other foreign material.

iv) Welding Procedure:

The welding procedure shall be worked out by the Contractor to suit the details of the joints as indicated on the drawings and the position at which welding has to be carried out. Welding procedure shall cover the following:

a) Type and size of electrodes

b) Current and (for automatic welding) arc voltage,

c) Length of run per electrode; or (for automatic welding) speed of travel;

d) Number and arrangement of runs in multi run welds;

e) Position of welding,

f) Preparation and set up of parts;

g) Welding sequence

h) Pre or post heating

i) Any other relevant information.

The welding procedure shall be such that the distortion and shrinkage stresses are reduced to a minimum and that the welds meet the requirement of quality specified hereunder.

Any weld found defective shall be cut by using either chipping hammer or gouging torch in such a manner that adjacent material is not injured in any way.

Peening of the welds involving deformation of the weld surface either during de-slagging operation or thereafter, shall not be allowed.

v) Fusion Faces and Surrounding Surfaces

Fusion faces and the surrounding surfaces within 50mm of welds shall be free from all mill scale and free from oil, paint or any substance which might affect the quality of the welds or impede the quality/progress of welding. They shall be free from irregularities which would interfere with the deposition of the specified size of weld or be the cause of defects.

All mill scale within 50mm of welds shall be removed prior to welding either by pickling followed by thorough power wire brushing or by other approved methods.

Preparation or cutting of the fusion faces is necessary the same shall be carried out by shearing, chipping, gas-cutting or flame gouging.

Where hand gas-cutting or hand-gouging is employed, the blowpipe or gouging blow pipe shall be properly guided.

vi) Assembly for welding

Parts to be welded shall be properly assembled and held firmly in position by means of jigs and clamps prior to and during welding.

vii) Welded Crane Girders and Other Plate Construction

Automatic submerged arc welding shall be employed for fabrication of welded crane girders and other plate construction wherever specified,

viii) Accuracy of Fit-up

Parts to be fillet welded shall be brought into as close contact as practicable and the gap due to faulty workmanship or incorrect fit-up shall not exceed 1.5mm. If greater separation occurs at any position, the size of fillet weld shall be increased at such positions by the amount of the gap.

ix) Jigs and Manipulators

Jigs and manipulators shall be used where practicable and shall be designed to facilitate welding and to ensure that all welds are easily accessible to the operators.

x) Ends of Butt Welded Joints

The ends of butt joint shall be welded so as to provide full throat thickness. This may be done by the use of extension piece, cross-runs or other approved means.

xi) Weld Face and Reinforcement of Butt Welds

The weld face shall at all places be deposited projecting of the surface of the parent metal. Where a flush surface is required the surplus metal shall be dressed off.

xii) Testing of Butt Welds

Butt welded joints are to be ultrasonically and radio graphically tested by the Contractor. If such tests indicate the joints to be defective, cost of test and rectification of defective welds shall also be borne by the Contractor.

xiii) Minimum Leg Length & Throat Thickness in Fillet Welds

The minimum leg length of a fillet weld as deposited shall be not less than the specified size. In no case shall a concave weld be deposited unless specifically permitted. Where permitted, the leg length shall be increased above that specified length, so that the resultant throat thickness is as great as would have been obtained by the deposition of a flat-faced weld of the specified leg length.

xiv) De - slagging

After making each run of welding all slag shall be thoroughly removed and the surface cleaned.

xv) Quality of Welds

The weld metal, as deposited (including tack welds is to be incorporated) shall be free from cracks, slag inclusions, porosity, cavities and other deposition faults. The weld metal shall be properly fused with the parent metal without under cutting or overlapping at the toes of the weld. The surface of the weld shall have a uniform consistent contour and regular appearance.

xvi) Weather Conditions

Welding shall not be done under weather conditions which might adversely affect the efficiency of the welding.

xvii) Qualification and Testing of Welders

The Contractor shall satisfy the Company that the welders are suitable fax the work for which they will be employed and shall produce evidence to the effect that welders have satisfactorily completed appropriate tests as described in IS:817 Part 1-1992. The Company may at his own discretion order periodic tests of the welders and/or of the welds produced by them. Such tests shall be at the expense of the Contractor.

Each welder certified fit for welding shall be given a code number by the Company, which shall be recorded in welder's register. Each welded joint or part welded joint of shell and pipe shall bear welder's code number to be written by welder by electrode.

xviii) Supervision

The Contractor shall employ a competent welding supervisor to ensure that the standard of workmanship and the quality of the materials comply with the requirements laid down in this specification.

1.2.5 Machining of Butts -Caps and Bases

Column splices and butt joints of struts and compression members depending on contact for stress transmission shall be accurately machined and close butt over the whole section. In column caps and bases the ends of shafts together with the attached gussets, angles, channels etc. after bolting and/or welding together as the case may be, should be accurately machined so that the parts connect butt over the entire surface of contact. Care shall be taken that connecting angles or channels are fixed with such accuracy that they are not reduced in thickness by machining by more than 0.8mm.

1.2.6 Slab Bases and-Caps

Slab bases and caps, if applicable, shall be in one solid piece, and except when cut from plates with true surfaces, shall be accurately machined over the bearing surfaces and shall be in effective contact over the whole area of the machined end of the stanchions. A bearing face need not be machined if it is to be grouted directly to a foundation provided it is true and parallel to the machine face. To facilitate grouting, holes shall be provided where necessary in stanchion bases for escape of air.

1.2.7 Crane Rail Joints

i) Crane rail joints & the joints of the gantry girder shall be separated by a minimum distance of 600 mm.

ii) Unless otherwise specified, crane rail joints shall be butt-jointed either by thermit or fusion welding as directed by the Company.

iii) The method of edge preparation, welding procedure and sequence shall have the prior approval of the Company. Edge preparation may be done by oxy-LPG flame and shall be neatly finished by chipping and grinding.

iv) All position low hydrogen electrode conforming to IS:814-1991, shall be used for welding. The rail ends shall be preheated to 250 degree centigrade before welding. The electrode shall be allowed to cool slowly. It is recommended that initial and intermediate layers of deposits may be built by using. Ferron V. Superchord or equivalent. Top 3mm layer shall be deposited with Duroid 2A or equivalent to obtain good wearing surface.

1.2.8 Requirement of welded joints

i) Besides the requirements of welding specified under sections above, the Contractor shall ensure the following requirements in the welded joints.

a) Strength-quality with parent metal.

b) Absence of defects.

c) Welded joints of tanks, pipe lines and containers subjected to pressure should be hermetically sealed in working condition under specified pressure and temperature.

d) Corrosion resistance of the weld shall not be less than that of parent material in aggressive environment.

ii) Methods of control

In order to exercise proper control of the quality of the welding, Contractor shall enforce methods of control as tabulated below :

| **Sl. No.** | **Purpose** | **Control Subject** | **Method of Control** |
| --- | --- | --- | --- |
| 1.0 | Control of welding materials and basic metal quality | Quality control of electrodes, welding wire, flux and protective gases | Weld ability test to determine the technological properties of materials |
|  | Checking of quality and Weld ability of the basic metal and welded members | Mechanical test of weld metal | Metallographic investigations of welds macro structure and microstructure |
|  | Checking of weld metal resistance for inter crystalline corrosion. Study of weld metal solidity by physical control methods |  |  |
| 2.0 | Checking of welders qualifications. | Welding of specimens for quality determination | Mechanical tests, metallographic investigations & checking of welded joints by physical control methods. |
| 3.0 | Control of welded joints quality | Control of assembly accuracy & technological welding process | Checking of assembly quality & centering of welded member checking of welding equipment conditions. Checking correctness of welding procedure. Visual examination of welds. |
|  |  | Selective of 100% checking of weld metal homogeneity | ultra-sonic control method, magnettographic method of control. |
|  |  | Selective mech., test and metallographical investigation of the joints (metal, strips, units) | Test of joint samples (strips, unit) for tensile strength, bending, torsion, varying loads etc. |
|  |  | Checking of welded joints for corrosion resistance | Welded joints corrosion test. Determination of weld resistance to the inter crystalline corrosion of welded area. |
|  |  | Checking of temper of weld area (only for welding of low alloy & alloy steels) liable to be hardened. | Determination of the hardness of weld metal & area close to weld. |
| 4.0 | Weld joints density control | Determination of soundness of weld to be used under highly adverse condition | Weld homogeneity test with kerosene, determination of weld homogeneity by means of vacuum chamber, ammonia & homogeneity test indicator (nitric acid, silver or mercury) |
|  |  |  | Pneumatic or hydraulic test of the welded tanks, pipelines, containers etc. Test for leakage by means of haloid. |

1.2.9 Shop Assembly

The steel work shall be temporarily shop assembled as necessary so that accuracy of fit may be checked before despatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place.

Since parts drilled or punched, with templates having steel bushes should be similar and so interchangeable, such steel work may be shop erected in part only as agreed by the Company.

1.2.10 Erection Marking

Each fabricated member whether assembled prior to despatch or not so assembled, shall bear an erection mark, which will help to identify the member and its position in respect of the whole structure, to facilitate re-erection at site.

These erection marks shall be suitably incorporated in the shop detail and erection drawings.

1.2.11 Controls in the fabrication and assembly of various structures

The Contractor shall in a routine check execution of established technological processes or general technological instructions. All welds shall be visually examined and measured for external dimensions by appropriate gauges. The welding of plates shall be done with current source, electrodes or wires of the same grade and diameter identical to those used in the structural welding. He shall also conduct selective examination of welds by ultrasonic or drilling methods. The number and procedure of such tests are specified elsewhere in this section. In addition, he shall conduct other tests of welds as directed by Engineer-In-Charge. The welded joints of doubtful quality as proved by ultrasonic test shall be examined by X-ray although this may be beyond the number of such tests specified without any extra cost.

To ensure good quality of workmanship the Contractor shall control the fabrication and assembly of structures as per the procedure outlined below.

i) Steel Structures of Industrial & Civil Buildings :

Criteria For Test

a) Visual examination - Hundred percent (100%) of the welded joints.

b) Ultrasonic testing - 100% for all butt welds.

ii) Steel structures of Blast furnace & other technological pipes & structures

Criteria for Test

a) Visual examination - Hundred percent (100%) of the welded joints

b) Ultrasonic testing - Hundred per cent (100%) for all butt welds..

1.2.12 Tests

i) Visual Examination

The Contractor shall conduct visual examination and measurement of the external dimensions of the weld for all joints. Before examining the welded joints, areas close to it on both sides of the weld for a width not less than 20 turn shall be cleaned of stag and other impurities. Examination shall be done by a magnifying glass which has a magnification power of tell (10) and measuring instrument which has an accuracy of -/+0.1 mm or by weld gauges. Welded joints shall be examined from both sides. The Contractor shall examine the following during the visual checks.

a) Correctness and shape of the welded joints

b) Incomplete penetration of weld metal

c) Influx

d) Burns

e) Unwelded craters

f) Under cuts

g) Cracks in welded spots and heat affected zones

h) Porosity in welds and spot welds

i) Compression in welded joints as a result of electrode

impact while carrying out contact welding

j) Displacement of welded element

The Contractor shall document all data as per sound laboratory practices.

ii) Mechanical Test:

The Contractor shall carry out various mechanical tests to determine weldability, metal alloyability, nature of break, correct size and type of electrodes, degree of pre-heat and post-heat treatment etc. The type, scope and sample of various mechanical tests shall be determined in agreement with the Company. The number of tests conducted shall depend on the results obtained to satisfy the Company that the correct type and size of electrode, degree of pre-heating and post-heating and weldability of different metal are being followed.

iv) Ultrasonic Test:

Ultrasonic test shall be conducted by the Contractor to detect gas inclusion (pores), slag inclusion, shallow welds, cracks, lamination and friability etc. Prior to starting of ultrasonic test the welded joint shall be thoroughly cleaned of slag and other material. Surface of the basic metal adjacent to welded joint on both sides shall be mechanically cleaned by a grinder or a metal brush to provide the contact of the whole ultrasonic probe surface with surface of basic metal. The width of the clean surface shall be as directed by the Company. The welded joint then shall be covered with a thin coat of transformer oil, turbine or machine oil to ensure acoustic contact. The joints so treated shall be market and the marks shall be entered into the documentation, subsequent to this, ultrasonic to this, ultrasonic test shall be carried out as directed by Company.

1.2.13 Tolerance in Workmanship

The permissible tolerance in workmanship shall be as per Tables 3.3.1.1, 3.3.1-2, 3.1-3, indicated in the following pages.

**PERMISSIBLE DEVIATIONS IN PITCH AND GAUGE OF HOLES FOR BOLTS OF THE NORMAL ACCURACY**

**Table - 3.3.1.1**

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | **Hole Dia. (mm)** | **Permissible deviations in spacing ( mm)** | **Permisible deviation in each group of holes** |
| Deviations in the hole diameter | Upto 17.0  above 17.0 | + 0.8  +1.0 | No limits |
| Quality (difference between the biggest and the smallest diameter ) | Upto 17.0  above 17.0 | + 0.8  +1.0 | No limits |
| Curves, exceeding 1 mm & cracks on the hole edges. | -- | -- | Not permissible |
| Non-coincidence of holds in separate details of an assembled unit, upto 1 mm | -- | -- | Upto 50 % |
| As above 1 mm upto 1.5 mm | -- | -- | Upto 10% |
| Slope of axis | -- | -- | No limits |

**PERMISSIBLE DEVIATIONS FOR ASSEMBLY OF WELDED JOINTS**

**Table 3.3.1-2**

|  |  |  |
| --- | --- | --- |
| **Sl. #** | **Type of welded joint** | **Permissible deviation** |
| a) | Square butt – joints  a) Gap between the ends of plates  b) Stepping of one plate over the other | +1.0 mm  1.0 mm |
| b) | B. Single Vee-Groove Joint  a) Bevel angle  b) Gap between two plates  c) Stepping of one plate over the other  d) Root thickness | +5 ºC  +1.0 mm  2.0 mm  1.0 mm |
| c) | Lap joints  a) Overlap  b) Gap between the surface | 5.0 mm  1.0 mm |
| d) | Tee fillet joints  Gap between the edge of the web and the surface of the flange | 2.0 mm |
| e) | Double V-Groove Joint  a) Stepping of one plate over the other  b) Deviation in value of root thickness  c) Deviation in bevel angle  d) Deviation in value of gap | 2.0 mm  1.0 mm  +5 ºC  +1.0 mm |

**TOLERANCE OF ASSEMBLED COMPONENTS OF STRUCTURES**

**TABLE - 3.3.1-3**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sl.No. | Description of component of structures | Deviation (+) in mm for the elements of structure length in meters | | | | | | |
| Upto 1 | 1 to 5 | 5 to 10 | 10 to 15 | 15 to 20 | 20 to 25 | Over 25 |
| I. | (i) Deviations from the dimensions assembled. Length and width of the details cut :  a) With oxygen by hand with a gauge  b) With shears or with a saw according to a gauge  c) With shears or with a saw with a stop  d) Machine gas cutting | 3.0  2.0  1.5  2.0 | 3.5  2.5  2.0  2.5 | 4.0  3.0  2.5  3.0 | 4.5  3.5  3.0  3.5 | 5.0  4.0  3.5  4.0 | -  -  -  - | -  -  -  - |
|  | (ii) Length & width of a planed detail milling processed on an edge planning machine | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | - | - |
| II. | (i) Distance between the centre of the ends holes  a) drilled according to marking  b) Drilled according to a gauge with bushing | 2.0  1.0 | 2.5  1.5 | 3.0  2.0 | 3.5  2.5 | 4.0  3.0 | -  - | -  - |
|  | (ii) Distance between the centre of adjacent holes  a) Drilled according to marking or to a gauge  b) Drilled according to a gauge with bushings | 1.5  0.5 | -  - | -  - | -  - | -  - | -  - | -  - |
|  | (iii) Deviations from the size of the components structures after complete fabrication.  Assembly in positional or in other devices with clamps with fixed positioners and also  a) According to guide blocks with pins  b) Sizes (length & width between milled surface (for all cases of assembly)  c) The same made in separate detailed during machining and fixed during assembling work with clamps  d) The same drilled according to positioners in finished structures.  e) The same, drilled according to positioners in finished structures | 2.0  3.0  1.0  2.0  1.0 | 3.0  5.0  1.5  3.0  1.5 | 5.0  8.0  2.0  5.0  2.0 | 7.0  11.0  2.5  7.0  2.5 | 8.0  12.0  3.0  8.0  3.0 | 9.0  14.0  3.5  9.0  3.5 | 10.0  15.0  4.0  10.0  4.0 |

1.2.14 Inspection and Testing of Fabrication

The Company shall have free access at reasonable times to the Contractor's Works where the fabrication of steel work is carried out and shall be afforded all reasonable facilities by the Contractor for satisfying himself that the fabrication is being undertaken in accordance with the provisions of the drawings and specification.

The Contractor shall continually inform Company of the progress in fabrication and as to when individual pieces shall be ready for inspection. The Contractor shall give a minimum of three (3) working days notice to the Company for inspection of the individual pieces.

Unless directed otherwise, inspection shall made at the place of manufacture prior to dispatch. Should any structure found not to comply with any of the provisions of this specification, it shall be liable for rejection. No structure or part of the structure, once rejected shall be re-submitted for inspection/test, except in cases where the Company considers the defect as rectifiable.

Defects which may appear during fabrication shall be made good with the consent of and according to the procedure laid down by the Company. All gauges and templates necessary to satisfy the Company shall be supplied by the Contractor. The Company, may, at his discretion, check the test results obtained at the Contractor's Works by independent tests at the Government Test House or elsewhere and should the material so tested be found to be unsatisfactory, the costs of such tests shall be borne by the Contractor.

1.2.15 Marking, Packing and Dispatching

Each piece shall be distinctly marked before delivery, in accordance with the approved marking diagram and shall bear such other marks as will facilitate erection. For easy identification at site a small distinguishing mark for each building shall be painted on each end of every member before dispatch from fabrication shop. The fabricated steel work shall be dispatched by the Contractor in such portions as may be found convenient for erection or as ordered by the Company to meet the time schedule.

All projecting plates or bars and all ends of members at joints shall be stiffened, all straight bars and plates shall be bundled, all screwed ends and machined surfaces shall be suitably packed and all bolts, nuts, washers and small loose parts shall be packed separately in boxes so as to prevent damage or distortion during transit.

1.3 **Erection**

1.3.0 General

Erection of structural steel work shall be carried out in accordance with IS:800­1984 and in an expeditious manner in conformity with drawings and specifications.

The suitability and capacity of all plant, equipment etc. used for erection shall be to the satisfaction of the Company.

1.3.1 Storing and Handling of Material

The fabricated materials on receipt at site shall be carefully unloaded, examined for defects, checked, sorted out for each building and stacked securely on skids above level ground. The ground shall be kept clean and properly drained. Girders and beams shall be placed upright and stored. Long members, such as columns and chords, shall be supported on skids, placed near enough to prevent injury from deflection.

The Contractor shall unload the fabricated materials promptly on arrival. Otherwise, he shall be responsible for demurrage charges, if any.

The fabricated material shall be verified with respect to markings on the marking plan or shipping lists supplied by the fabricator. Any material found damaged or defective shall be stacked separately and the damaged or defective portions shall be identified by painting in distinct colour. Such materials shall be dealt with as ordered by the Company.

The handling and storing of the component parts of a structure shall involve the use of method and appliances not likely to produce injury by twisting, bending or otherwise deforming the metal. No member slightly bent or twisted shall be put in place until the defects are corrected and members seriously damaged in handling shall be rejected.

All small bends or twists received by members shall be rectified before such members are put in place, any serious bends or damage shall be reported at once to the engineer by the Contractor for instructions. The straightening of bent edges of plates, angles and other shapes shall be done by methods not likely to produce fracture or other injury. Following the completion of the straightening of a bend or buckle, the surface of the metal shall be carefully inspected by the Contractor for evidence of incipient or other fractures. The Contractor shall immediately report to the Company present of such evidence and act according to his instructions

1.3.2 Setting Out

The Contractor shall be responsible for checking the alignment and levels of foundations, correctness of foundation bolt centres, their projected height above the foundation tops, the length of threading provided and the provision and fitment of nuts for the foundation bolts. These shall be checked well in advance of starting erection work and the Contractor shall be responsible for any consequences for non-compliance thereof. Discrepancies, if any, shall immediately be brought to the notice of the Company for his advice.

One set of reference axes and one bench mark level will be furnished to the Contractor. These shall be used for setting out of structures.

The Contractor shall assume full responsibility for the correct setting out of all steel work and erecting it correctly as per alignment and levels shown on the drawings and plumbing of vertical members. Notwithstanding any assistance rendered to the Contractor by the Company, if at any time during the progress of the work any error should appear or a rise therein, on being required to do so, the Contractor at his own cost shall remove and amend the work to the satisfaction of -'the Company.

1.3.3 Assembly and Erection

Before starting erection, the Contractor shall submit to the Company for his approval the method he proposes to follow and the number and type of equipment and temporary work he proposes to use for the erection. The approval of the Company shall not be considered as relieving the Contractor from his responsibility for the loads which the erection equipment & temporary work will be called upon to carry or support. Adequate allowance and provision shall be made for lateral forces and wind loads. Drawings for such temporary work shall be submitted to the Company for prior approval, if so desired by him.

The Contractor shall plumb and level all steel work and shall thoroughly brace and guy the structures during erection to keep them plumb and rigid till completion. Erected parts of the structure shall be stable during all stages of erection and the structural elements to be erected shall be strong enough to hear erection loads. The stability of structures subject to the action of wind, dead weight and erection forces shall be obtained by observing specified sequence of erection of vertical & horizontal structural members by installing permanent and temporary bracing. As the work progresses, the steel members shall be securely bolted up to take care of all dead loads, wind and erection stresses, including those due to erection equipment or its operation. No riveting, permanent bolting, welding or grouting shall be done until proper alignment has been obtained and approved by the Company.

The Contractor shall provide adequate supervision at all stages of the work and examine each portion of the work fix accuracy before fabrication or erection is commenced. He shall also provide facilities such as, adequate temporary access ladders, gangways, tools and tackles, instruments [etc. to](http://etc.to/) the satisfaction of the Company, for his inspection at any stage during erection. Irrespective of any inspection and tests made by the Company, Contractor shall be entirely responsible for the proper execution of the work, notwithstanding any approval which may have been given by the Company of the work or of tests carried out either by the Company or by the Contractor

1.3.4 i) Erection Tolerances for building structure

|  |  |  |
| --- | --- | --- |
| **Component** | **Description** | **Allowed variation** |
| **Main columns & Roof Posts** | a) Shifting of column axes at foundation level w.r.t building line |  |
|  | i) Line long direction | +3 mm |
|  | ii) In lateral direction | + 3 mm |
|  | B) Deviation of both major column axes from the vertical between foundation and the connection level with another member |  |
|  | i) For a col. Upto & including 10 m height | + 3 mm from true vertical |
|  | ii) For a Col. Greater than 10 M but less than 40 m height | + 3 mm from true vertical for 10 M length measured between connection level but not more that + 7 mm for 30 M length. |
|  | c) For adjacent pair of close. Across the width of the bldg. prior to placing of truss. | + 9 mm on true span. |
|  | d) For any individual column, deviation of any bearing or resting level from levels shown on drawings | + 3 mm |
|  | e) For adjacent pair of cols. Wither across the width of building or longitudinally level difference allowed between and seating levels which are supported to be at the same level. | + 3 mm |
| **Truss** | a) Deviation at centre of span of upper chord member from vertical plane running through centre of support | 1/1500 of the span or 10 mm whichever is less |
|  | b) Lateral deployment of top chord at centre of span from vertical plane running through centre of support. | 1/250 of depth of truss or 20 mm whichever is less. |
| **Crane Girder & tracks** | a) Difference in level of crane rails measured between the adjacent levels. | + 2 mm |
|  | b) Deviation to crane rail gauge | + 3 mm |
|  | c) Relative shifting of ends of adjacent to crane rails in plan and elevation after joining. | +1 mm |
|  | d) Deviation of rail axes from centre line of web. | + 3 mm |

ii) Assembly and Erection Tolerances for furnace and associated structures

|  |  |  |
| --- | --- | --- |
| **SR No.** | **Description** | **Tolerance** |
| **1)** | **Blast Furnace Shell** |  |
|  | i) Out of roundness ( largest difference in dia) of the cylinder | 0.003 times the designed dia. of cylinder. |
|  | ii) Displacement of the centre of the shaft cylinder with respect to mantle ring or lower level of bosh. | 0.002(H-h), not exceeding 30 mm, where h=ht. of mantle ring or lower level of bosh (for BF without mantle ring) & H= Height from bottom upto the regulated height. |
|  | iii) Displacement of top throat flange with respect to the centre of mantle ring or lower level of bosh. | 30 mm |
|  | iv) Level difference at anuy point of top level of the ring flange. | 3 mm |
|  | v) Edge level of notch in shaft shell for horizontal coolers. | +/22 mm |
| **2)** | Bustle main |  |
|  | i) Deviation in the elevations of the bottom level of bustle pipe, measured at the centre line of the tuyere, from the specified level shown in the drawing. | +/- 10 mm |
|  | ii) Deviation in the horizontal distance of the centre of the cross section of the bustle pipe from Blast Furnace shell, measured above the centre line of the tuyere from the specified level shown in the drawing. | +/- 20 mm |
|  | iii) Maximum difference in the diameters of the bustle pipe cross-section at any point. | 0.003 of design diameter |

1.3.5 Field Connections

Field connections in the trusses, portals, columns, roof girders, floor girders, crane, surge and auxiliary girders, column bracing etc. shall be welded with erection bolts as shown in the drawing. Connection of purlin, girt, roof bracing, wind girders, catwalk ways, staircases, ladders, handrails and all other secondary members may be bolted with black bolts, except where welded connections are required. The above connections shall be applicable in general unless otherwise shown in design drawings. All nuts for securing runways and gantries shall be locked against turning after tightening.

Holes in erection joints to be riveted or bolted (with machined bolts), shall be fitted with temporary bolts and plugs, after mounting the structures. The number of temporary bolts and plugs shall not be less than 50% of the total number of holes. In joints where the number of holes is equal to 5 or less, not less than 3 holes shall be temporarily bolted.

The number of washers on permanent bolts shall not be more than two (and not less than one) for the nut and one for the bolt head.

Field Welding:

All field assembly and welding shall be executed in accordance with the requirements for shop fabrication excepting such as manifestly apply to shop conditions only. Where the steel has been delivered painted, the paint shall be removed before field welding, for a distance of at least 50 min on either side of the joints.

1.4 **MECHANICAL**

1.4.0 General

1.4.1 Welding & Bolting

All required welding & bolting for various mechanical items shall be carried out as per details described in this TS.

1.4.2 Alignment & Leveling

The levels and alignment of all installed equipment shall be ensured to be within allowable tolerances as recommended in the respective manufacturer's instructions or as specified in the manufacture’s / Company's drawings. The levels, alignment of all equipment shall be carefully re-checked jointly with the Company after trial operation. All required adjustments shall be made by the Contractor as directed by the Company. Necessary alignment of important equipment shall be re checked to confirm to the specified tolerances and if necessary, adjustment shall be made by the Contractor.

All motors and driven equipment shall be accurately levelled and aligned to specified tolerances. For equipment shipped with motor mounted, aligned and coupled, the coupling shall be disassembled and alignment shall be re­checked.

1.4.3 Alignment will be done by Sesa workman whereas tendere shall provide the manpower

1.4.4 Flexible couplings, variable speed drives and guards shall be installed as per recommendation of supplier / manufacturer

1.4.5 All equipment shall be checked for free movement by hand after correct installation and alignment.

1.4.6 After the equipment has been installed, levelled and aligned, the foundation bolts shall be tightened and the equipment shall be grouted. When the grout has thoroughly cured, the alignment shall be rechecked.

1.4.7 Packing / Gaskets

Stuffing boxes & valves glands shall be checked for sufficient rings or packing and tightness of packing gland.

Connections requiring gaskets shall be tightened evenly all around to ensure equal stress over the entire gasket area. Wherever require, the torque wrench shall be used for tightening of bolts properly.

All packing, glands and flanged joints shall be checked and tightened as necessary during trial run and commissioning. Should any packing or gaskets of glands require replacement during this period, same shall be carried out by the Contractor.

1.4.8 Clean up and Painting

The Contractor shall do cleaning and painting of all equipment which shall include all connection materials and devices such as piping, exposed conduits etc. Items which have been supplied with finish coat before delivery but surfaces have damaged then these surfaces shall be cleaned, primed and finish coated to match to original colour. The painting shall be inclusive of the cost of paint. For details of paints & painting refer Clause No.3.3.9.

1.4.9 Erection Drawing

Erection Drawings and general arrangement drawings, specifications or instructions accompanying them shall be followed in erecting fabricated items and bought out equipment items throughout the project.

Erection marks as shown in erection drawings shall appear on the fabricated items and these shall be erected with marks in the same relative positions as shown on the plan or elevation.

If any dimensions figured upon a drawing or plan differ from those obtained by scaling the drawing or plan, the dimension as figured upon the drawing or plan shall be taken as correct. In case of discrepancy between large-scale details and small-scale drawing, the former will be followed, However, in such cases of discrepancy, the Contractor shall get the same clarified by the Company.

1.4.10 Tolerance and surface finish in workmanship

Relevant tolerances and surface finish in the fabrication work shall be followed as per relevant Indian Standard unless otherwise shown in approved detail drawings Great care shall be taken during bending of plates for making hot blast main Bustle pipe pieces. The deviation for these items shall be within 0.25% D (absolute).

**B. PROCEDURE FOR GRINDING MACHINE OPERATION / MAINTENANCE**

Objective : - Safe operation/maintenance of grinding machine for Proper and safe is grinding operation.

Scope : - Blast Furnace & Accessories Relining

Ref. : - OEM

Responsibility : - Engineer In charge & Maintenance Mason on job

PPE –s to be used :

 Helmet, Safety shoes tight cloth, goggles and hand gloves depending upon the Job

 Work No 1 : Procedure for Inspection of Grinding wheels

 Work No 2 : Procedure for Fixing of wheel to the machine

 Work No 3 : Usage of Grinding machine for grinding operation

 Work No 4 : Usage of straight grinder

**Aspect – impact**

|  |  |
| --- | --- |
| Scrap generation | Resource Depletion |
| Dust Generation | Air Pollution |

**Hazards identified**

Mechanical hazard:

1. Entanglement in between cable, moving wheels, etc

2. Fall / slip / overturning of Grinder during maintenance/operation

3. Rolling of Grinder in sloppy area and hitting on structure and nearby person

4. Fall of Grind particles in eye of operator and nearby persons

5. Failure of grinding wheel

6. Failure of grinder shaft

7. Breakage of wheel

8. Fall of grinding machine while grinding

9. Starting of grinding machine in rest position due to fall of material in starter switch

10. Human behavior – Operator nature, alcoholism, casual approach & non usage of PPE’ s

11. Breakage of grinding bits.

12. Grind particles getting stuck to the body.

Physical hazard:

1. Fire.

2. Dust inhalation while grinding

Electrical hazard: Electrical Shock

**Work No 1 : Procedure for Inspection & issue of grinding wheels**

Note: Inspection of the grinding wheels: to be carried out at receiving section of the store based on following guidelines**:**

1. Check the printed expiry date on the wheel. Expiry date must be at least 9 month due at the time of inspection.
2. Only the wheels of Grind well Norton, Carborandom Universal or BOSCH shall be accepted. (Item code : For AG 5 2801020027 &, For AG 7 2801020028 )
3. Check the printed speed on the wheels as per below given chart
4. Check the physical condition of the wheel for any cracks & condition of holding portion of the wheel.

**Work No 2 : Procedure for Fixing of wheel to the machine**

Note :

1. Only authorized person of contractor can replace the worn out wheel.
2. Contractor has to collect the worn out wheel and have store the removed wheel in the locked bin.
3. Grinding wheel to be used maximum up to the paper ring provided on the wheel.
4. New stock brought by the contractor to site shall be show to company engineer and company engineer will check the wheel for expiry date, rpm as well as make of the wheel. Company Engineer will write SIL on the wheel if it is OK.

Guidelines to follow for grinding wheel replacement:

1. Inspect the grinding machine for validity of certification, protection guard for wheel, handle, cable damage, lock nut condition and threads on the grinding wheel-mounting shaft.
2. If any discrepancy noticed in the machine like high vibration, breaking of handles, guard loose, etc then the authorize contractor grinder shall immediately report the problem to company engineer/ supervisor.
3. The contractor grinder will remove the worn out wheel and deposit it to storekeeper of the contractor. The wheel shall be removed with proper spanners and locking the rotor shaft properly. The contractor will issue him the wheel only after receiving the old wheel.
4. The old wheel will be stored in the locked Bin.
5. Based on the machine size and speed as per below given table, Authorized contractor grinder will replace the old wheel with new one

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Sr No*** | ***Description of wheel*** | ***Maximum operating speed of wheel in rpm*** | ***Grinding machine*** | ***Maximum operating speed of machine in rpm (idle speed)*** |
| *1* | *350X3x25.4mm A24 R5 BFW* | *4365* | *Drill Bit cutting machine* | *3780* |
| *2* | *180 X 7 X 22.23 HI cut AG 7* | *8520* | *AG 7* | *8500* |
| *3* | *125 X 7 X 22.23 HI cut AG 5* | *12220* | *AG 5* | *12000* |

1. Contractor Supervisor/ Store keeper will ensure that the wheel fixed on machine should have at least 6 months validity form date of Fixing and check for SIL mark.
2. Contractor supervisor/ Store Engineer will take care to avoid the authorized contractor grinder to over tightening the grinding nut since while running, the wheel will tent to tighten on the spindle. This can distort the flange.
3. Do not force the wheel on to the spindle if the bore is tight.
4. Never mount a wet or damaged wheel.
5. Contractor authorised Grinder will take a no load trial to ensure good condition of machine. Stop the machine and remount the wheel if there is excessive noise or vibration.

**Work No 3 : Usage of Grinding machine**

1. The operator should check the condition of the wheel, switch, the expiry date of wheel, guard & general condition of the grinder before using the machine for any operation.
2. It is the responsibility of the operator to use only certified grinding machines and ensure that no alterations is being carried out in grinding machine
3. Only trained persons are authorized to carry out grinding job
4. While using the machine first start the machine and wait till the machine takes its speed.
5. If the job to be ground is very small, hold the work piece in a vice with proper jig and fixture
6. Operator should ensure that the wheel guard covers at least half of the wheel to protect the user in the unlikely event of wheel breakage.
7. Perform the grinding operation with goggles. If gloves are used, it should not be loose to avoid entanglement with wheel
8. Grinding operation should be carried out below the chest level and with the usage of safety goggles only as the grind particle can flew and fall in eyes.
9. Do not allow any other person to operate in the area coming under the influence of grinding without proper PPE’s.
10. To ensure optimum performance, the machine should be held at on angle of 20 degree.
11. To avoid over loading of electric grinder, do not press the machine excessively on work piece.
12. For obtaining maximum wheel out put, operate the wheel at a speed close to the Maximum operating speed indicated on the wheel.
13. Select the smooth or rough grinding wheels for grinding as per requirement of the job.
14. Do ensure proper shutdown while grinding gas lines/highly inflammable material containers/Pressurizes vessels as spark generated can lead to the explosion.
15. Stop the machine after completion of the job and place on designated places (grind rest)

**Work No 4 : Procedure for operating straight grinder**

1. The operator should check the condition of the grinding bit, switch, grinding stone bit, certification of grinder & general condition of the grinder before using the machine for any operation.
2. Only trained persons are authorized to carry out grinding job.
3. Insert the grinding bit or stone grinding bit as per requirement in grinder chuck.
4. Lock the chuck with locking pin and tighten the chuck nut with spanner provided with grinder. Then remove the locking pin after tightening the nut.
5. Use certified extension cable if required to plug IN the grinder. While using the machine first start the machine and wait till the machine takes its speed.
6. If the job to be ground is very small, hold the work piece in a vice with proper jig and fixture
7. Perform the grinding operation with goggles and transparent face shield. Use hand gloves with long arm cover & apron with long sleeves to protect chips falling on body. Use painter’s brush to clean the chips from job.
8. Grinding operation should be carried out below the chest level and with the usage of safety goggles and transparent face shield only as the grind particle can flew and fall in eyes. Apron to be used to protect chips from falling on body clothes. Apron and hand gloves to be cleaned using painters brush or with slight air pressure.
9. Do not allow any other person to operate in the area coming under the influence of grinding without proper PPE’s.
10. To avoid over loading of electric grinder, do not press the machine excessively on work piece.
11. Select the smooth or rough grinding bits or stone bits for grinding as per requirement of the job.
12. Do ensure proper shutdown while grinding gas lines/highly inflammable material containers/Pressurizes vessels as spark generated can lead to the explosion.
13. Stop the machine after completion of the job and remove the plug out from socket.
14. Then remove the grinding bits.

**NOTE :**

1. Speed of wheel should be more than speed of grinder.
2. Usage of hand gloves depends upon the type of job being carried out. Loose gloves can lead to accident by entanglement of the hand while operation, where as gloves in Metallic handle save from electrical shock.
3. Use long arm hand gloves, body apron and transparent face shield when using straight grinder.
4. Return the used grinning wheel back to contractor engg/ storekeeper to give it to stores.
5. Use painters brush to clean the chips.

**DO NOT**

 Use grinding machine with out guard.

 Attempt to grind small items, with out holding the work piece in vice.

 Grind above chest level

 Grind restricted areas.

 Hold the grinding bit in hand while operating

**C. WORKING ON ROLLING MACHINE**

This activity is identified for BF shell, Bustles, goose neck, dust catcher, saturator, ducts, water seals, steel sections, etc which is required for relining.

 Objective : - Safe working on electrical operated rolling machine.

 Scope : - Blast Furnace Accessories

 Ref. : -

 Responsibility : - Concerned Mech. Engineer / In charge

PPE –s to be used:

* Safety shoes, helmet, cotton cloth, ear plugs, goggles and hand gloves.

**Aspect :** Noise generation, Fire, Fume generation, Waste generation,

**Hazards Identified:**

**Physical:** Pressure, Temperature, Electric shock during machine operations.

**Chemical**: Fumes

**Mechanical**:

1. Trapping of hand , cloth, between rollers / plate ,
2. Falling of material and person while handling the plates,
3. Fall of material like roller, plate
4. Grinding hazards like fall breakage of wheel, electrical shock, injury
5. Material handling hazards in WI/MAINT/12
6. Fall due to improper house keeping
7. Injury from sharp ends of plate/ cut pieces
8. Filure of tools, slings
9. Injury due to hydra hitting

**Do not:**

i) Stand on the opposite side while rolling

**Do;**

i) Always hold the plate by hand and maintaining a safe distance from the rolling machines.

**Procedure**:

**Rolling of plate on rolling machine:**

1. Gas cut the plate as per required size/drawing .Keep extra length for pre-punching
2. Do edge preparation by grinding / gas cutting.
3. Switch ON the Electrical isolator and release the push button.
4. Check electrical safety validity and healthiness before starting the job

**Operation of Machine:**

1. Certify the Rolling machine before operation for safely.
2. Trained personnel should operate the rolling machine and during the rolling operation only one person shall operate the machine.
3. Skilled personnel’s are to be allowed to handle the plates during the rolling operations.
4. For safe handling of plates, a monorail beam may be required to be fitted above the rolling machine with proper handling facilities like chain pulley block, slings, etc. It is essential to build the structure with the approved drawing and get certified tools and tackles considering the maximum capacity being handled. The max capacity being handle should be displayed on chain block and duly certified by a competent person approved by factory Inspectorate.

5. If handing facility is not made, hydra can be used with adequate care and following guideline must be followed.

**5.1** The Hydra operation to be carried out as per the work instructions mentioned in **“Operation Of Hydra and Cranes ” & WI/MAINT/12 .**Procedure for using the hydra during rolling operation to be followed as mentioned below:

i) Use Hydra to lift the plate by using proper plate hooks and slings. Edge of the plate to be manually prepared to ensure complete circle.

ii) Place the plate on the movable rollers with the help of Hydra. No person shall stand near the operating switch while placing the plate on the rollers.

iii) All care must be taken to avoid trapping of person while hydra is moving forward as well as reverse.

6. The Pre-Bending operation is performed at the leading and trailing edge of the sheet which is normally 1.5 times to 3 times of the thickness of the plate. This operation is very critical and care must be taken that the welding does not break while performing the rolling operation.

7. Mark on the plate as per the drawing and weld the Pre- bending plate to it of considerable length.

8. Prepare the edges for smooth feeding of the plate.

9. Align the plate properly so that the line of feeding matches with the rollers.

10. Tighten the top roller to required tightness and give instruction to start the rolling machine.

11. Roll the plate through the machine to required diameter and then loosen the top roller. Check the rolled section with the temp plate.

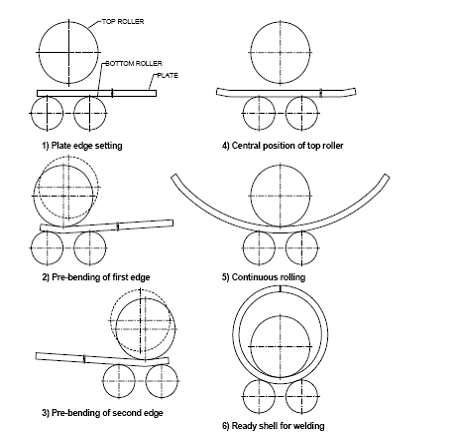
12. In order to reroll the plate, slide it back to original position and clamp it again with the help to top roller.

13. While tightening the top roller care must be taken that it is tighten uniformly on both sides and the rod for tightening is removed from that machine while in operation.

14. Once the rolling operation is complete, switch off the machine and press the emergency push button. The person operating the machine should move away from the switch and give clearance for removing the rolled section.

15. Remove the rolled part with the help of hydra and keep it in secured location.

16. When the rolling operation is over for the day the main isolator should be put off so that nobody start the machine.

****

**Fig 1:Rolling plate sequence for fixed bottom roller**

**D. ROLLED PLATE FIT UP AS PER DRAWING ON THE FABRICATION PLATFORM**

Objective : - Safe operation/maintenance of set up rolled plates on the fabrication platform

Scope : - Blast Furnace & Accessories Relining

Ref. : - OEM

Responsibility : - Engineer In charge & Maintenance Mason on job

PPE –s to be used :

 Helmet, Safety shoes, goggles and hand gloves depending upon the Job

**Aspect – impact**

|  |  |
| --- | --- |
| Scrap generation |  |

**Hazards identified**

Mechanical hazard:

1. Trapping between two objects,

2. Fall of person from platform,

**3.** Failure of sling, D shackle, chain pulley block

**4.** Cut injuries from sharp edges of items

**5.** Getting trapped / skid material stacked

**6.** Entanglement due to welding cables, cutting hoses, grinding etc on the platform.

**7.** Impact of moving / slung items, overturning / slipping of steel items.

**8.** Getting trapped below Hydra because of failure of brakes or sudden jerks

**9.** Getting trapped between the swing portion & the body of Hydra

**10.** Non usage of PPE like shoes, helmet & safety harness, goggles

**11.** Alcoholism

**12.** Hitting of person while reversing

**13.** Incidents due to poor illumination

**14.** Failure of the workmen basket structure, temporary platform

**15.** Fall of person from height due to unbalance from workmen basket, temporary platform.

Physical hazard:

**1.** Vehicle emission

**2.** Burns

Electrical hazard:

**1.** Electric shock from overhead lines or welding

**2.** Short circuit due to failure of electrical system

**3.** Electric shock from battery terminal

**Procedure**:

1) Water level of the platform is to be checked properly by the contractor fitter and Supervisor.

2) The marking (punching) of the Dia. of the segment which is too kept on the platform is to marked.

3) After that the stopper to be welded to the platform on the outer circumference of the rolled plate which is to be placed on the platform.

4) The rolled plate is then lifted by the hydra .(Hydra operation to be carried out as per the work instructions mentioned in **“Operation Of Hydra and Cranes ” & WI/MAINT/12)**

5) No person should stand near the plate, while moving and keeping the plate on the platform. All care must be taken to avoid trapping of person while hydra is moving forward as well as reverse.

6) After placing the plate on the platform, it should be given support (like angle, rod etc) from the outer side if the plate is tappered or if it is a straight portion then the support is to put on both the side.

7) Then the additional stoppers are to be placed from the inner as well as outer dia. to hold it.

8) Only after complete securing the support provided to the plate the sling must be removed from the hydra.

9) Same procedure is to be followed for all the plates while placing on the platform.

10) After fixing all the plates on the platform with proper dimensions the spider on the top portion of the segment is to be welded.

11) Once the plates are arranged the setting of the shell segment shall be carried out with the help of chain block, wedges, keys etc to bring the proper shape.

12) The contractor supervisor shall check the dimension & give clearance for inspection of the assembled portion.

13) All critical dimensions shall be checked.

14) The template shall be kept ready to check the curvature at different portions.

15) The top & bottom circle concentricity is to be checked with the Plum.

16) Welding should be done only after clearance from the company engineer.

17) All the welding should be checked as per the approved procedure.

18) After making ready, the segment will be lifted with Hydra/crane & kept at secure location.

19) After lifting the segment from the platform the water level of the platform is to be taken and the same procedure should be followed for all the segments.

**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** |