Bharat Heavy Electricals Limited

Product Engineering / Fossil Boilers

Handling System

Annexure - I to Specification No. MHS-HEQ/077 - Rev. 03

(For Pneumatically Operated Furnace Maintenance Platform - 2 wall coverage.)

PROJECT	**: YADADRI 5x800MW**
CUSTOMER NO.	**: 1823-27**
REFERENCE DRAWING No.	**: 0-99-512-40356**

1.0 Supplier to supply Furnace maintenance platforms as per specification no. **MHS-HEQ/077 - Rev. 03**

2.0 Top of ceiling girder elevation : 98.444 M.

3.0 Access door elevation : 15.113 M.

4.0 SCOPE OF SUPPLY

4.1.0 PLATFORMS

4.1.1 Platform with 45° LH chamfer at one end and other with flat end for a length of 9.000M. - 1 Set.

4.1.2 Platform with 45° RH chamfer at one end and other with flat end for a length of 9.000M. - 1 Set.

4.1.3 Platform with both sides flat with length of 16.000 M. - 1 Set.

4.1.3 Platform wall roller assy. & bracket complete with connecting fasteners. The rollers shall be designed suitably to move on the spiral water walls.

4.1.4 Complete guard rails with connecting fasteners.

4.1.5 Connecting block and tubes with connecting fasteners.

4.1.6 Each module shall be capable of mounting STIRRUP arrangements such that any module can be used for traversing between any two cable openings.

4.2.0 STIRRUPS

4.2.1 Suitable Hot galvanised stirrups & stirrup retainer complete with fasteners.

4.3.0 HOIST (ROPE CLIMBING MACHINE)

4.3.1 Hoist for safe working load of minimum 800 Kgs.

4.3.2 Pneumatically operated rope climbing machine with top limit switch.

4.3.3 Common single power control for both hoists.

4.3.4 Air Supply hoses and corresponding fittings.

4.4.0 SAFETY DEVICES

4.4.1 Safety braking system

4.4.1 Fall arrest device

4.4.2 Anti tilting device

4.4.3 No power descent

4.4.4 Over speed safety device

4.4.5 Top limit switches

4.4.6 Overload/No load safety device assembly

4.5.0 WIRE ROPE

4.5.1 Suitable length and quantity of steel wire rope with suitable size and construction of 6 X 36 for pneumatically operated hoist. Supplier to specify the size of the rope offered. Minimum length of wire rope shall be 100 M.

4.5.2 Secondary wire rope with cable weight.

4.5.3 Rope shall be of galvanised steel wire.

4.5.4 Rope shall have tensile strength of 240 Kg/Sq.mm. minimum.

4.5.5 Rope end fittings,'D'shakles, thimbles, rope clamps and other required items.

4.6.0 PNEUMATIC SUPPLY

4.7.0 The supply pressure shall be 4-6 bar (g).

4.7.0 CONTROL SYSTEM: Centralised control box shall be provided for easy operation.

4.8.0 Vendor shall furnish other mechanical, electrical and control accessories required for safety, easy maintenance and easy operation.

5.0 DOCUMENTS NEEDED

5.1 Refer clause no 13.0 of specification.

6.0 All the points in specification & annexure - I to the specification should be strictly adhered to.

7.0 Offers without the required documents along with the offer shall not be considered.

BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI-620 014
Fuel Systems/PE(FB)

Title Sheet

Technical Specification for

PNEUMATICALLY OPERATED SUSPENDED SCAFFOLDING SYSTEM

Specification No.: MHS-HEQ/077 ***Revision No. : 03***

Rev. No.	*Rev. Date*	*Clause*	*Description*	*CHD. & APPD.*
03	*08-08-18*	*-various -*	*Revisit & update of specification.*	*SKS/NF*
02	*10-12-07*	*2.6*	*Special tools included in the scope of supply*	*DVK*
01	*12-10-07*	*1.2* *13.5.1*	*Scope clarity specified* *O&M- No. of copies was 25*	*SSR*

	Name	*Signature*	*Date*
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Approved	*A.Rajamohan*	*-Sd-*	

CONTENTS

1.0 *SCOPE*

1.1 This specification covers design, manufacture, inspection, testing and supply of air operated suspended powered scaffolding system. The specification is for ensuring a safe and trouble free operation of Powered suspended scaffolding system used during shutdowns and overhauls, for inspection and maintenance of furnace internals of steam generator.

This is a general specification dealing with the technical Requirements of Suspended Scaffolding System. The specific Contract requirements and special requirements, if any, are specified in the enclosed annexures-1. If the scope of the Specification differs from Annexure-1, the scope of supply exclusively dealt in the contract specific requirement of Annexure-1 will be binding.

1.2 The supplier shall be responsible for providing all material, equipment and service, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. It is not the intent to specify completely herein, all aspects of design and construction of equipment; nevertheless, the equipment shall conform in all aspects to high standards of engineering, design and workmanship.

2.0 SPECIAL REQUIREMENTS OF THE SYSTEM

2.1 The suspended power scaffolding system shall consist of independently suspended platforms for the front / rear walls and sidewalls of boiler furnace as specified.

2.2 The scaffold platforms shall be modular and interchangeable construction made out of light weight material, easy for assembly inside the furnace, possible for taking inside the furnace, through an access door whose **overall opening size is furnished in the Annexure-I**. The platforms shall be easily assembled inside the furnace.

2.3 The suspension wire ropes will be introduced into the furnace through the furnace cable openings provided at the top of boiler and will be fastened to roof girders of boiler.

2.4 The suspension wire rope shall be capable to withstand temperature up to **250 Deg. C** which would be prevailing for longer duration after boiler shutdown.

2.5 The suspended platforms shall be operated by air motor and climbing hoists .

2.6 The controls, safety devices, safety locks with necessary power supply cable, cable weight steel wire rope, secondary steel wire rope and special tools required for suspended platforms shall form part of the offer.

2.7 Vendor to provide suspension lugs (suitable to be welded at site) and other related items required for suspending the scaffolding at site. The lugs shall be capable of supporting four times the reaction forces imposed by the rated load on the scaffolding including scaffold self-weight.

3.0 GENERAL REQUIREMENTS

3.1 All materials, components and equipments used in the design, construction and installation of suspended powered scaffolds shall meet the requirements of its specified application in accordance with good engineering practice.

3.2 Scaffold platforms/ropes & other components of SAE shall be capable of supporting without failure under any scenario of usage.

3.3 The maximum rated speed at which the suspended powered scaffold moved in a vertical direction shall be in the range of 8.0 to 9.0 meters per minute.

3.4 An automatic overload/no load protection device shall be provided to cut power supply to the climbing machine for travel in the up/down direction when the load applied to the climbing machine exceeds 125% of its normal tension with rated load or no load.

3.5 Hoist shall never come down on its own.

3.6 Supplier shall provide suitable arrangement to prevent suspended power scaffolds from swaying. Suspended Scaffold platforms with rollers should always be engaged with water walls of boiler furnace. This should be ensured by providing extended wall rollers if necessary to prevent swaying of the platforms.

4.0 CODES & STANDARDS

4.1 The scaffolding system shall be designed to meet all the safety, design & sizing requirement defined by either of the codes - **EN-1808:2015 or ANSI A10.8-2011.**

4.2 Vendor shall follow either of the standards as mentioned above in total for designing the suspended scaffolding system.

4.3 Vendor should specify which code/standard is followed in their design of the offered system by **filling Sheet-A** of this specification.

5.0 PLATFORM OF SUSPENDED SCAFFOLD

5.1 The platform width shall not be less than 510 mm.

5.2 Platforms shall be provided with guard rails, mid rails and toe boards installed on all open sides and ends. The clear vertical distance between toe board, mid rails or guard rails shall be less that 500mm. The height of the guard rails shall be not less than 1000mm and not be more than 1100mm. All rails and posts shall be suitable for easy assembly & disassembly. Hoisting machines when located at not more than 450mm from ends of platforms hoist supporting stirrups, shall be considered as end guard rails. Else separate end guard rails shall be provided.

5.3 Toe boards shall extend to a minimum of **150mm** above the working surface.

5.4 Each platform shall bear a manufacturer's load rating plate stating the maximum rated load and stating the load rating when arranged in small modules. Load rating plates shall be made of non-corrosive material and shall have letters and figures that are legible.

5.5 Suspended Platforms shall be designed to carry the rated load. Considering **800 Kg per hoist** capacity, vendor to indicate the rated load of platforms in their drawings and technical data sheet for our review. This shall be never be less than 3 persons loading requirement. Per person loading = 120Kg.

5.6 The minimum load capacity of deck of platform shall be 200 Kg/m^2 at worst case loading zone.

5.7 Fabricated platforms and scaffold decks shall be designed to support, in addition to their own weight, at least four times the maximum intended load.

6.0 HOISTING MACHINES

6.1 Each pneumatically operated hoist of minimum safe working load of 800 Kgs, shall be complying with applicable international codes. Each air motor shall bear a nameplate, indicating the minimum operating pressure and required volume of air.

6.2 All gearing shall conform to the applicable standards with a service factor of not less than 1.0

6.3 The hoist – pneumatically operated rope climbing machine shall be supplied with top limit switch. There shall be common single power control for both hoists.

6.4 Lubrication wherever needed shall be provided to assure that all moving parts of hoists are lubricated at all times.

6.5 **Speed Reducers**

6.5.1 Each hoisting equipment shall be equipped with speed reducers or an equivalent to obtain mechanical advantage. Such speed reducers or other device shall contain positive type gearing such as worm gears, spur gears or bevel gears.

6.5.2 The speed reducers or other devices shall be directly connected to the drum of hoisting equipment.

6.6 **Primary Brakes**

6.6.1 Each pneumatically operated hoisting equipment shall be provided with a primary brake that automatically engages whenever air supply is interrupted.

6.6.2 The primary brake shall be rated to stop and hold 125% of its rated load of hoisting equipment.

6.6.3 Each primary brake shall be directly connected to the drive of the hoisting machine.

6.7 **Fall arrest device**

6.7.1 Each hoisting equipment shall be provided with an automatic emergency type fall arrest device that will stop and hold at least 125% of the rated load of the hoisting machine. If such a fall arrest device is of instantaneous stopping type, then it should stop and hold its total load before the hoist travels a vertical distance of 450mm maximum.

6.7.2 The fall arrest safety device shall act directly on a secondary safety wire rope in case of failure of the hoist or the suspensions rope. The traction hoist works on the primary suspension rope. The actuating mechanism of the fall arrest device shall be separate from the primary brake.

6.7.3 The fall arrest safety device shall not be used to stop and hold the hoist except under emergency situations. In normal operation, such a device shall not engage before the hoist is stopped by primary brake.

6.7.4 The design, installation and maintenance of every fall arrest safety device shall be such that the device is prevented from being made defective or in-operative by outside contamination.

6.8 **Hoisting Drum/Sheaves**

All hoisting drums shall be of proven design through tests to have no deleterious serious effect on the suspension wire rope.

6.8.1 **Traction Drum / sheaves**

6.8.1.1 The traction drum/sheaves shall be designed in a manner to maintain correct wire rope reeving at all times to prevent scrubbing and cross overs. They shall have a means of applying pressure on the hoist rope against the drum/sheave to ensure constant tractive force to develop the rating of the hoist.

6.8.1.2 The diameter of any traction drum/sheave shall not be less than 20 times the diameter of the wire rope used. If lesser diameter be used, tests shall be performed by the wire rope manufacturer or a qualified testing laboratory to determine that no deleterious effect is caused on hoist wire for the usage intended.

6.8.2 **Winding Drum (If Applicable)**

Each winding drum hoist shall be provided with a positive means of attachment of the suspension rope. Such attachment should develop a minimum of 80% of the rated breaking strength of the suspension rope.

6.8.2.1 **Single Wrap Winding Drum**

a) Every single wrap winding drum hoisting machine shall be provided with a means of level winding of the suspension rope.
b) Every single wrap winding drum shall be so designed that the drum will contain a minimum of four wire ropes of the suspension rope at all times.
c) The minimum diameter of every single wrap winding drum shall not be less than 25 times of the diameter of the suspension rope used.

6.8.2.2 **Multiple wrap Winding Drum**

a) Every multiple wrap winding drum hoisting machine shall be provided with a means for level winding of the suspension rope.
b) Every multiple wrap winding drum shall contain not less than four wraps of suspension rope at all times.
c) The minimum diameter of every multiple wrap winding drum shall not be less than 10 times the diameter of the suspension rope used.

6.9 **Pneumatic Circuit and Equipment**

6.9.1 The pneumatic circuit and controls shall comply with the governing codes, ordinances and regulations.

6.9.2 The air supply pressure shall be 4 to 6 bar (g).

6.9.3 Necessary provision shall be made with the airlock / other suitable arrangements for maintaining the stay put condition.

6.9.4 Strain relief devices shall be provided for hoses supplying air to hoisting machines. Such devices shall be located at the suitable places where the hoses are connected with hoists.

6.10 **Hoisting Machine Controls**

6.10.1 Hoisting machines shall have common control for each platform. If the control is of push button type, it shall be of the constant pressure. If it is fixed position type, it must have the provision for automatic locking when in the "OFF" position, or by means of guards against accidental actuation. The lever type control can be of the constant pressure type or of the fixed position type.

6.10.2 All hoist shall have a manually operated system that allows controlled descent of the scaffold in case of power failure. This **no-power decent** system shall be such that the controlled speed is lower than the tripping speed of the fall arrest device.

6.10.3 For a multi-point suspension, all the hoisting machines shall be synchronized and control shall be centralized with safety switch.

6.10.4 An **Anti-tilt device** shall be provided for the suspended platform with multi point suspensions.

7.0 SAFETY BELTS AND ANCHOR POINTS

7.1 Each workman on a suspended powered scaffold shall be provided with an approved safety belt with a lanyard of not more than 1.5 meters in length. The lanyard shall be attached to the safety belt with a self-closing safety hook. The scaffold needs to have anchor points for eventually attaching the other end of the lanyard.

7.2 The suspended powered scaffold shall be equipped with Overload Protection system and overload indicator.

8.0 ROPES

8.1 Suspended powered scaffolds shall be suspended by wire ropes. The minimum grade of the wire rope shall be of improved plough steel. (galvanized)

8.2 The suspension wire rope shall be covered with insulating material at least 1.2 Mtr. above the hoist to prevent possibility of the welding current arcing through the suspension wire rope during the course of welding, scarfing, etc.

8.3 Reverse bends in rope arrangement shall be avoided.

8.4 The minimum factor of safety of the wire rope shall be 6. Each wire rope used for scaffold suspension shall be capable of supporting at least six times the rated capacity of the hoist.

8.5 **Fastening:**

8.5.1 Babbitted and zinc sockets for wire ropes are prohibited.

8.5.2 Swaged attachments or spliced eyes are acceptable for fastening of wires.

8.5.3 Wire rope clips with twin base type shall be used and shall be installed as per the wire rope clip manufacture's recommendation.

8.5.4 All fasteners shall have anti-corrosion protection and develop at least 80% of the wire rope rated breaking strength.

8.6 **Ropes in Traction Drum /sheave Type**

8.6.1 On traction drum /sheave applications, provisions shall be made to prevent the machine from running off the wire rope.

8.6.2 The wire rope shall be of such length that the operator can lower to the lowest point of travel without end of the wire rope passing through the traction drum/sheave hoist.

8.7 **Winding Drum Type (If applicable)**

8.7.1 Winding drums shall have at least four turns of rope remaining when the platform has landed at the lowest possible point of its travel.

9.0 MULTI POINT SUSPENDED POWERED PLATFORM

9.1 The scaffold shall be suspended by more than two (2) independent wire ropes.

9.2 The scaffold shall be provided with hoisting machines complying with clause 5.0
9.3 The stages shall be supported by galvanized steel stirrups.
9.4 Hoisting machine wire ropes shall conform to clause 8.0
9.5 Guard rails, mid rails and toe boards shall conform to clause 4.0
9.6 Anti-tilt device shall be included.
9.7 Both hoisting machines shall be operated from the center of platform in a centralized fashion.

10.0 INSPECTION

10.1 All test certificates shall be furnished for buyer's reference and records.
10.2 All suspended power scaffold installations shall, on their completion and before being placed in service, be subjected to inspection by BHEL inspector or BHEL nominated inspection authority during manufacture/testing stages, to determine that the assembly conforms to applicable requirements. Hoist machines shall be inspected and tested in accordance with the manufacturer's recommendation.
10.3 Scaffolds (platform) & hoist machine shall be inspected and tested as per approved quality plan. The certificates and documents generated during inspection of above shall be furnished.

11.0 SPECIAL NOTES SUPPLEMENTED TO TECHNICAL SPECIFICATION

11.1 Supplier shall quote for recommended spares for three years trouble free operation separately.
11.2 Supplier shall furnish motor specification.
11.3 Sufficient number of packages of portable sizes to carry the components in fields shall be offered.
11.4 The size and locations of cable opening will be furnished for individual project by BHEL. Offer shall include the cable support details envisaged by supplier.
11.5 The procedure and support details of the false platform to be laid down before the assembly of suspended powered scaffolds shall be included in the offer with sketches.
11.6 The maximum temperature to which the rope shall be exposed for longer duration shall be specified.
11.7 Necessary provision shall be provided to keep the suspension ropes separate without twist.
11.8 Cable weights shall be provided suitably for secondary wire ropes.

12.0 GUARANTEE

12.1 The offered system shall be guaranteed for 18 months from the date on which the equipment / system is put into use (by the end user) or 24 months from the date of

supply whichever is earlier against defective design, defective material usage, defective workmanship, defective packaging and forwarding.

13.0 DOCUMENTS TO BE SUBMITTED BY VENDOR

13.1 DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

13.1.1 Product literature and drawings in support of the offer shall be submitted with the quotation to evaluate the offer.

13.1.2 Weight of individual major components as per the scope of supply shall be indicated in the drawing as bill of material (BOM).

13.1.3 The quality plan for the product under supply shall be furnished along with the offer.

13.1.4 General arrangement drawing with plan, elevation, and end view along with major dimensions and weight particulars.

13.1.5 Pneumatic circuit diagram as per clause 6.9 of this specification.

13.1.6 Filled in sheet-A of this Specification indicating the standards followed.

13.1.7 List of Initial spares (if any) to be supplied along with SAE.

13.1.8 Vendor to explain the effect of drop of air pressure below the design value.

13.1.9 Vendor shall furnish the following details along with the offer.

a) Quality and quantity of air
b) End connection details (vendor to include the counter mating component in his offer)
c) Effect of air quality deterioration on the pneumatic drive
d) Material of construction of pneumatic hose
e) Air connection distribution circuit
f) Size of the pneumatic line
g) Air drive specification

13.1.10 Design calculations

13.1.10.1 Vendor to provide calculations to justify the following:

a) Minimum load capacity of each offered suspended platform.
b) Selection of Rated Load for each offered suspended platform.
c) No. of person loading.
d) Suspended platform structural calculation
e) Calculation of suspension lugs.

13.2 DOCUMENTS TO BE FURNISHED AFTER AWARD OF CONTRACT

13.2.1 Packaging procedure detailing the list of components shall be dispatched individually with identification and with preservation and storage.

13.2.2 SAE - Data sheet including drawings and design information shall be submitted to get approval from End user/owner of the boiler.

13.2.3 SAE – CERTIFICATES

13.2.3.1 Test certificates shall be furnished before dispatch of components.

13.2.3.2 A certificate for the components' safety from Safety Steward of the country of make shall be provided.

13.2.3.3 Test certificate for the following shall be furnished.

a) Material test certificate for all the major components.
b) Shop test certificates for safety devices.
c) Performance TC for the intended duty conditions.
d) Quality Control/Inspection documents generated during the stages of inspection, performance inspection, and final inspection.

13.2.3.4 Guarantee certificate shall be furnished by the vendor.

13.2.4 Operation & Maintenance (O & M) Manual

13.2.4.1 No of copies of manual:3Sets + 3 CD ROMS / USB drives.

13.2.4.2 The size of manuals should be in correct A4 size with drawings in A3 size. Large size drawings (greater than A3 size) shall be reduced to A3 size and inserted.

13.2.4.3 Drawings shall be of printed or laser prints only.

13.2.4.4 Spiral of comb bound copies should be totally avoided.

13.2.4.5 If manuals are supplied in folders, the folder should have 3 hole punching system.

13.2.4.6 O & M manuals, should be submitted to BHEL/Tiruchirappalli prior to dispatch of the equipment.

13.2.4.7 **Manual, generally should contain the following:**

13.2.4.8 Data sheet

13.2.4.9 Brief description

13.2.4.10 Operation

13.2.4.11 Maintenance (including lubrication, where necessary) & service, recommended spares for 2/3 years trouble free service.

13.2.4.12 Bill of Materials

13.2.4.13 Assembly drawings with part list, dimensional drawings and other applicable drawings.

13.2.4.14 Manual should pertain only to the type or model supplied for this contract.

13.2.4.15 Drawings and catalogues

13.2.4.16 Sequence of erection and dismantling

13.2.4.17 Erection instruction

13.2.4.18 List of tools and tackles

13.2.4.19 Critical checks and permissible deviations/tolerances

13.2.4.20 Procedure/checklist for commissioning the system

13.2.4.21 Procedure for initial checking after erection

13.2.4.22 Trouble Shooting

14.0 GENERAL:

14.1 The language used shall be "English only" in offer, O & M manual, Labels, Drawings etc.

14.2 For equipment and other special requirements refer Annexure-I to this specification.

2.0 SHEET-A: STANDARD / CODE CHECKLIST

DESCRIPTION	CODE FOLLOWED (Vendor to fill and submit)
PLATFORM OF SUSPENDED SCAFFOLD	
RATED LOAD OF SUSPENDED PLATFORM	
HOISTING MACHINES	
POWER SYSTEM FOR HOISTS	
CONTROL SYSTEM FOR HOISTS	
SAFETY AND CONTROL OF SUSPENDED PLATFORM	
PNEUMATIC CIRCUIT AND EQUIPMENT	
SUSPENSION ROPES	