

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. : 02

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
Rev. No.	Rev. Date	Clause	Description	CHD. & APPD.

	Name	Signature	Date
Prepared	M.Alagiri	-Sd-	
Reviewed	J.V.V.Aruna Kumar	-Sd-	
Checked	S.Dhanabal	-Sd-	
Approved	A.Rajamohan	-Sd-	



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077
Rev. 02

CONTENTS

CLAUSE	DESCRIPTION
1.0	Intent of specification
2.0	Special Requirements Of The System
3.0	General Requirements
4.0	Platforms
5.0	Hoisting Machines
6.0	Safety Belts And Lines
7.0	Ropes
8.0	Multi Point Suspended Powered Platform
9.0	Single Point Suspended Powered Scaffolds
10.0	Inspection
11.0	Special Notes Supplemented To Technical Specification
12.0	Guarantee
13.0	Documents To Be Submitted By Vendor
14.0	General



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

1.0 INTENT OF SPECIFICATION

1.1 *SCOPE:*

This specification covers design, manufacture, inspection, testing and supply of air operated suspended powered scaffolding system. The technical requirements to ensure 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 are specified.

1.2 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.

1.3 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.

1.4 The supplier may also make alternate offers provided, such offers are superior in his opinion, to the requirements of these specifications in which case, adequate technical information, operating feedback etc. are to be enclosed with the offer, to enable the Purchaser to assess the superiority and reliability of the alternatives offered.



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

2.0 SPECIAL REQUIRMENTS OF THE SYSTEM

- 2.1 The suspended pneumatically operated scaffolding system shall consist 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 lightweight material, easy for assembly inside the furnace, possible for taking inside the furnace through an access door on the furnace hopper wall. **For size of access opening on the furnace hopper wall, refer annexure-I to this specification.**
- 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 ropes shall be designed to work in normal ambient temperature and normal atmospheric conditions but with excessive dust prevalent within the furnace. However the suspension wire ropes shall pass through the pent house whose temperature will be about 300-430° C upto 15-20 hrs after the steam generator is tripped.
- 2.5 The suspended platforms shall be operated by air motor and climbing hoists.
- 2.6 The controls, safety devices, safety locks with necessary air supply hoses and tee-off, distributor hoses, male/female couplers, pressure gauges for air supply pressure air motor mechanical top limit switch, steel wire rope, secondary steel wire rope and special tools required for suspended platforms shall form part of the offer.

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 The maximum rated speed at which the suspended powered scaffold moved in a vertical direction shall be in the range of 7.0 to 8.0 meters per minute.



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

- 3.3 An automatic overload/under load protection device shall be provided to cut air 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 under load.
- 3.4 Scaffold platforms/ropes & other components shall be capable of supporting without failure at least five times the static load.
- 3.5 Platforms shall be capable of supporting without failure at least four times their rated load.
- 3.6 For the scaffold platforms designated for a rated load of 800 kgs., supplier shall specify the concentrated load on one sq. meter area.
- 3.7 Hoist shall never come down on its own.
- 3.8 Supplier shall provide suitable arrangement to prevent suspended powered scaffolds from swaying.

4.0 PLATFORMS

- 4.1 Platforms shall be provided with guard rails, mid rails and toe boards installed on all open sides and ends. The vertical posts shall be installed with pitches not more than 900mm and guard rails shall be not less than 900mm and shall not be more than 1000mm with mid-rails and shall be of dismountable type. 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 guardrails, else separate end guardrails shall be provided.
- 4.2 Toe boards shall extend to a minimum of 150mm above the working surface.
- 4.3 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.



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

5.0 HOISTING MACHINES

5.1 Each pneumatically operated hoist shall be complying with applicable international codes. Each air motor shall bear a nameplate, indicating the minimum operating pressure and required volume of air.

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

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

5.4 Speed Reducers

5.4.1 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.

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

5.5 Primary Brakes

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

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

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

5.6 Secondary Brake

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



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

5.6.2 The secondary brake shall act directly on the suspension wire rope on a traction type hoist. On a winding drum type hoist the secondary brake shall act either on the suspension wire rope or on the drum or on the drum extension. Secondary brakes shall be independent of the drive trains on all type of hoists. The actuating mechanism of a secondary brake shall be separate from the brake.

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

5.6.4 The design, installation and maintenance of every secondary brake shall be such that the brake is prevented from being made defective or in-operative by outside contamination.

5.7 Hoisting Drum

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

5.8 Traction Drum

5.8.1 The traction drum 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 to ensure constant tractive force to develop the rating of the hoist.

5.8.2 The diameter of any traction drum 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.

5.9 Winding Drum

5.9.1 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.



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

5.10 Single Wrap Winding Drum

- 5.10.1 Every single wrap-winding drum hoisting machine shall be provided with a means of level winding of the suspension rope.
- 5.10.2 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.
- 5.10.3 The minimum diameter of every single wrap winding drum shall not be less than 25 times of the diameter of the suspension rope used.

5.11 Multiple Drum

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

5.12 Pneumatic Circuit And Equipment

- 5.12.1 The pneumatic circuit and controls shall comply with the governing codes, ordinances and regulations.
- 5.12.2 The air supply pressure shall be 4 to 6 bar (g).
- 5.12.3 Necessary provision shall be made with the airlock / other suitable arrangements for maintaining the stay put condition.
- 5.12.4 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.
- 5.12.5 Vendor shall furnish the following details along with the offer.
 - Quality and quantity of air
 - End connection details (vendor to include the counter mating component in his offer)
 - Effect of air quality deterioration on the pneumatic drive



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

- Material of construction of pneumatic hose
- Air connection distribution circuit
- Size of the pneumatic line
- Air drive specification

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

5.13 Hoisting Machine Controls

5.13.1 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 “CLOSE” 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.

5.13.2 Emergency operation of the main drive machine may be provided to allow manual cranking. This provision for manual operation shall be designed so that not more than one man per hoist will be required to perform this. The access to this provision shall include a means of to make the prime mover inoperative while under emergency manual operation. Other-wise suitable arrangement shall be provided to disconnect the power source before using the manual crank. The design shall be such that the emergency brake is operative at or below governor tripping speed during normal operation.

5.13.3 For a multi point suspension, both the hoisting machines shall be synchronised and control shall be centralized with safety switch.

5.13.4 Anti tilt device shall be provided for platform with multi point suspensions.

6.0 SAFETY BELTS AND LINES

6.1 Each workman on a suspended powered scaffold with single point or two point suspension 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 belt with a self closing safety hook and the other end attached by means of a full arresting device to a life line, drop line or fixed anchorage.



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

6.2 On a suspended pneumatically operated scaffold with two suspension ropes and without overhead protection canopy over the stage, the lanyard attached to the safety belt shall be secured to a separate hanging drop line (vertical line) with a self activating adjustable locking device. The upper part of the drop line shall fastened to a fixed anchorage other than the scaffold support rigging and independent of work surface. The drop line and its anchorage shall be capable of supporting a minimum dead weight of 4 times the rated load.

7.0 ROPES

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

7.2 Reverse bends in rope arrangement shall be avoided.

7.3 The minimum factor of safety of the wire rope shall be 6.

7.4 Fastening:

7.4.1 Babbitted and zinc sockets for wire ropes are prohibited.

7.4.2 Swagged attachments or spliced eyes are acceptable for fastening of wires.

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

7.4.4 All fasteners shall be of GI/Cadmium coated and develop at least 80% of the wire rope rated breaking strength.

7.5 Traction Drum Type

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

7.5.2 The wire rope shall be of such length that the operator can lower to the lowest point of travel with out end of the wire rope passing through the traction drum hoist.

7.6 Winding Drum Type

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



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

8.0 MULTI POINT SUSPENDED POWERED PLATFORM

- 8.1 The scaffold shall be suspended by more than two (2) independent wire ropes.
- 8.2 The scaffold shall be provided with hoisting machines complying with clause 5.0
- 8.3 The stages shall be supported by galvanized steel stirrups.
- 8.4 Hoisting machine wire ropes shall conform to clause 7.0
- 8.5 Guard rails, mid rails and toe boards shall conform to clause 4.0
- 8.6 Anti-tilt device shall be included.
- 8.7 Both hoisting machines shall be operated from the center of platform in a centralised fashion.

9.0 SINGLE POINT SUSPENDED POWERED SCAFFOLDS:

- 9.1 The scaffold shall be provided with hoisting machines conforming with clause 5.0
- 9.2 In case of non-straight supporting arrangements, the induced stress in suspension support system must be within the design limits.
- 9.3 A life line shall be provided to each work man as per clause 6.0

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.



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

- 11.2 Sufficient number of packages of portable sizes to carry the components in fields shall be offered.
- 11.3 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.
- 11.4 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.
- 11.5 The maximum temperature to which the rope can be exposed for longer duration shall be specified.
- 11.6 Spacer shall be provided to keep the suspension ropes separate without twist.
- 11.7 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 of commissioning or 24 months from the date of supply.

13.0 DOCUMENTS TO BE SUBMITTED BY VENDOR

13.1 Documents/Details to be furnished along with the offer:

- 13.1.1 Product literature and drawings in support of the offer shall be submitted in three copies 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.
- 13.1.3 The quality plan for the product under supply shall be furnished along with the offer.
- 13.1.4 Scheme / circuit for the system shall be furnished.
- 13.1.5 Details as listed under Cl.5.12.5 and Cl.5.12.6
- 13.1.6 List of spares for 3 years trouble free operation



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

13.2 Documents to be furnished after award of contract

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

13.3 Test certificates shall be furnished before despatch of components.

13.3.1 A certificate for the components from Safety Steward of the country of make shall be provided.

13.3.2 Test certificate for the following shall be furnished.

13.3.2.1 Material test certificate for all the major components.

13.3.2.2 Shop test certificates for safety devices.

13.3.2.3 Performance TC for the intended duty conditions.

13.3.2.4 Quality Control/Inspection documents generated during the stages of inspection, performance inspection, and final inspection.

13.4 Guarantee certificate shall be furnished by the vendor.

13.5 Operation & Maintenance (O & M) Manual

13.5.1 Number of copies required is "6". The soft copy of the full O&M manual in the form of CD shall be submitted to the Purchaser.

13.5.2 The hard copies of the Manuals should be in printed form only.

13.5.3 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.

13.5.4 Drawings shall be of printed or laser prints only.

13.5.5 Spiral or comb bound copies should be totally avoided.

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

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

13.5.8 Manual, generally should contain the following :

13.5.8.1 Data sheet

13.5.8.2 Brief description

13.5.8.3 Operation



*General Specification for
Pneumatically Operated
Suspended Scaffolding System*

MHS-
HEQ/077

Rev. 02

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

13.5.8.5 Trouble shooting

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

13.5.9 Manuals should pertain only to the type or model supplied for a particular order.

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.