HAND OPERATED HANDLING EQUIPMENTS

1.0 GENERAL:

1.1 This purchase specification specifies the requirements for design,manufacture, inspection and testing at supplier's works and supply erection &commission of manually (Hand) operated Trolley With Hoist (TWH), Under Hung crane (UHC) and male & female interlock mechanism. For scope of supply, refer to Annexure II.

1.2 The trolley with hoist, under hung crane and interlock mechanism will be operating in normal ambient temperature range of 0-50°c.The atmosphere will be with excessive dust, heat, moisture and corrosive fumes.

1.3 The equipment shall be designed for operation suitable for OUTDOOR DUTY Without any roofing above the equipment. The trolley with hoist / under hung crane shall be operated on monorail /runway beams of rolled or fabricated beam.

1.4 Technical parameters for equipment design are furnished in Annexure I. For scope of supply and special requirements refer to Annexure II. Annexure III comprises data sheets which are to be duly filled in by the vendor and shall be submitted along with the offer.

This is a general specification dealing with technical reqirements of various handling equipment as mentioned adove. Contract requirements and special requirements (if any)for a particular project are specified in the enclosed annexures.

2.0 CODES AND STANDARDS:

2.1.0 The equipment shall comply with the latest revisions of the following standards.
2.1.1 IS 3832 Specification for hand operated chain pulley block.
2.1.2 IS 6216 Specification for short link chain grade T (8) calibrated for pulley blocks and other lifting appliances.
2.1.3 IS 8610 Specification for point hook with shank upto 25 tonnes trapezoidal section
2.1.4 IS 807 Design, manufacture. erection and testing (Stuctural portion) of cranes and hoists.
2.1.5 IS 3681 General plan for spur gear and helical gears.
2.1.6 IS 2062 Weldable structural steel.
2.1.7 IS 3815 point hooks with shanks for general engineering purpose
2.1.8 IS 2429 (PART 2) Round steel short link chain (Electric butt welded), Grade 30
2.1.9 IS 1024- code of practice for use of welding in bridges and structures subjected to dynamic loading.

2.1.10 IS 2004- Carbon steel forgings for general engineering purposes
2.1.11 IS 4368- Alloy steel billets,blooms and slabs for forging for general engineering purposes.

3.0 TECHNICAL REQUIREMENTS

3.1.0 Design and manufacture of under hung crane and chain pulley block with trolley and male and female interlock mechanism shall be of consistent capacity, lift, headroom, span, overhang and other parameters as specified in the annexure-1.
3.1.1 While designing the under hung crane, chain pulley block with trolley and male & female interlock mechanism, care shall be taken for the following features.

3.1.1.1 Minimum effort to lift and move the under hung crane & chain pulley block with rated safe working load.

3.1.1.2 Self Braking systems for holding the load and stop the crane in any position.

3.1.1.3 Compact design and even loading of bearings.

3.1.1.4 Ease of installation and maintenance.

3.1.1.5 Interlock mechanism shall be capable of taking the axial load due to the movement of equipment with rated safe working load.

3.1.2 All materials used for construction of different components shall individually conform to standards mentioned in clause 2.0

3.2.0 HAND OPERATED CHAIN PULLEY BLOCK, RACHET LEVER& UNDER HUNG CRANE.

3.2.1 FRAME: The Frame, crane girder and end carriage shall be designed for proper strength built from steel plates with bolted/welded construction (recommended-material: IS2062).

3.2.2 GEAR & PINIONS: Hand operated under hung crane and chain pulley block with trolley shall be supplied with helical/spur/worm gear.The gear shall be designed for surface durability. In case of enclosed gearing, means shall be provided for ample lubrication,Such lubrication points are to be indicated along with specification of lubricant, market trade names, quantity of lubricant requirement and frequency of lubrication. Material of construction shall be conforming to relevant Indian standard or equivalent and hardened. Hardness shall be min. 250BHN for pinions & minimum 200BHN for gears. However vendor shall maintain and ensure that gear hardness is always less than pinion hardness by atleast 35BHN. Helical gears only shall be used for hoists. For CT/LT helical or spur gears shall be used. All gears & pinions shall be examined by LPI/MPIfor surface cracks,after case hardening.

3.2.3 GEAR HOUSING : Gear housing assembly consists of a fabricated housing in which gears are assembled (worm-worm wheel in case of worm wheel type and spur gear in case of spur gear type)

3.2.4 LOAD BRAKES: Hand operated under hung crane and chain pulley block with trolley shall be provided with an automatic mechanical load brake, Ratchet & pawl type, which will prevent self lowering of the load and arrest and sustain load in all working positions. The load brake shall also allow smooth lowering of the load without serious overheating which may impair efficient working of the block. The pawl and ratchet shall be made of steel and hardened and tempered to provide satisfactory degree of wear resistance. Hardness shall be minimum 375BHN for Pawl & minimum 300BHN for Ratchet. However vendor shall maintain and ensure that ratchet hardness is always less than pawl hardness by atleast 50BHN. Material shall be of 45C8 - IS2004 & IS 4368 or equivalent. Supplier to indicate material specification and provide material test certificates for compliance.

3.2.5 BEARING : Only antifriction bearings of reputed make shall be used. Supplier shall specify the make of the bearings used in the offer (make shall be of-TIMKEN, SKF, NSK. FAG, TORRINGTON).

3.2.6 HOOKS : Hooks shall meet the dimensional, material,testing & inspection requirement of IS 3815 /8610. The hook shall be provided with standard depress type safety latch and swivel thrust bearings with hardened race. Lugs for fixing safety latch shall be either forged along with the hook or clamp type latch with lugs shall be provided. Welding of lug is not permitted. Locking arrangement shall be provided to avoid unscrewing of the hook in service. Material of hook shall be conforming to IS 2004 - 35C8 or equivalent. (Tensile strength shall be in the range of 50 to 62 kg/sqmm) and made by controlled grain forging and normalised. All the hooks shall be tested for twice the safe working load. After the proof load all hooks shall be examined by LPI / MPI & UT (UT required for hooks>5.0T capacity) for cracks. The hook shall not distort or fracture. Ball & roller bearings shall not be used in these hooks. The bottom hook block shall be provided with thrust bearing to enable its free swivelling in the loaded condition without twisting the load chain.

3.2.6.1 Suspension fittings other than hook block shall be of sufficient strength to afford a static factor of safety of not less than 4(four).

3.2.7 LOAD CHAIN : The link chain shall be of minimum GRADE 80 conforming to IS:6216. The chain shall be pitched and polished. The chain shall be coated with rust preventive oil. All chains shall be tested for 2 times of SWL and other testing shall be as per IS 6216.

3.2.8 HAND CHAIN : The hand chain shall be of GRADE 30 and conform to IS: 2429 (part2). The chains shall be pitched and polished. The chain link dimensions shall be 6.0mm. conforming to IS 2429 (part 2). The length of chain shall be such that the lowest point of loop will be 0.4 meter above the operating level. The chain shall be coated with rust preventive oil.

3,2,9 LOAD CHAIN WHEEL: Wheel for load chain shall be made of material suitable for use with load chain employed and be of adequate strength and shall be designed to ensure effective operation.

3.2.9.1 HAND CHAIN WHEEL : Wheel for hand chain shall be of malleable cast iron/ plate with suitable thickness to ensure effective operation and shall be provided with flange.

3,2.9.2 The chain guide shall be so designed that the chain will neither come out of the wheel during use nor get caught between guide & the wheel.

3.2.10 IDLER WHEELS : The chain pulley blocks shall be provided with idler wheels so shaped as to avoid twisting of the chain when passing around.

3.2.11 WHEELS : Wheels for under hung crane and trolley wheels for chain pulley block shall be spur geared type, cast/forged, 4 wheeled driven by hand chain.

3.2.11.1 Trolley/ under hung crane wheels shall be designed to suit the monorail / runway beam size and profile decided by purchaser (which will be furnished during drawing approval stage).

3.2.11.2 Shall be made out of forged or low carbon steel/cast steel with heat treated to minimum 200BHN hardness. Cast iron grade 20 with hardness of 200BHN is also acceptable. The drive gears, if any, integral with the wheel shall be of the same material and hardness. Wheels for under hung crane and trolley wheels for hoists shall be spur geared type, cast/forged 4 wheeled.

3.2.12 TROLLEY : The trolley for chain pulley block shall be of spur geared type fabricated construction, 4 wheeled, driven by hand chain and shall have provision for mounting the chain pulley block.

3.2.13 END CARRIAGE: Shall be of 4 wheeled spur geared type and fabricated construction. Suitable wheel base shall be provided. End carriages shall be designed to suit the runway beam size. (Which will be furnished by purchaser during drawing approval.) End carriages shall be connected with crane girder by welding or by fasteners (For ease of transportation, if welding required, the same shall be done at site by purchaser).

3.2.14 RATCHET LEVER: consist of toothed wheel, pawl, catch etc.,The pawls shall be of strength to arrest the full load from lowering due to gravity. The relative width & positioning of the rachet wheel & the pawl shall be such that it will ensure full engagement irrespective of wear of the friction faces. the pawl & the rachet shall be made of steel, hardened & tempered or given an equivalent treatment to provide satisfactory degree of wear resistance together with toughness.The hardness of the pawl tip shall not be less than 40 HRC & that of rachet not less than 30 HRC. The pawl shall engage with the rachet wheel either by means of a spring other than a tension spring or by some other equally effective meams. The pawl shall be so positioned that it engages the rachet wheel under gravity when its operating mechanism fail. Adequate arrangment shall be made to ensure that the pawl does not seize on the pawl pin.

3.2.15 CRANE GIRDER: Crane girder shall be of rolled section. Fabricated beam and welded beam shall not be used for this purpose unless otherwise specified by the purchaser for special cases. For such cases, refer annexure-II to this specification for details. Camber / deflection shall be within span/1000. Allowable bend (straightness) shall be 1mm/metre and maximum bend shall not exceed 6mm of total span.

3.2.16 Suitable anti tilt/topple or roller arrangment shall be provided between runway beam and crane girder to avoid toppling of crane while the hoist is at overhang side.

3.3.0 MALE & FEMALE INTERLOCK MECHANISM

3.3.1 Male & Female interlock mechanism shall be designed to transfer the trolley with hoist with rated safe working load from master crane to slave crane or master crane to fixed monorails and vice versa. The interlock mechanism shall be capable of withstanding the forces even when one of the cranes is being operated by mistake. The cross travel stoppers should give way to the hoist when interlock mechanism is coupled. Dimensional tolerance for the male & female component of the interlock mechanism shall be very close which will ensure proper locking (without play) and smooth transfer of trolley from one crane to the other.

3.3.2 Hand wheel with chain of suitable length shall be provided to operate the male & female mechanism manually from the operating floor.

3.3.3 Male and female interlock mechanism shall be designed suitable to take the axial load and safe working load.

3.4 Grease nipples shall be provided at all lubrication points & shall be easily accessible. Frequency of lubrication shall be minimum.

3.5 Fasteners shall be made of precision grade high tensile steel (Grade 8.8-class) and galvanised. Load bearing fasteners shall be suitably designed & machined.Vendor shall furnish material / tensile strength for special fasteners in the arrangement drawing.

3.6 WELDING :

All welding shall conform to IS 1024 and welders shall be qualified to AWSD1.1/ASME -Section IX

3.7 NAME PLATES:

3.7.1 Name plates shall be provided with non-corrosive material.
3.7.2 Name plates shall have details of the equipment,model no. type capacity, lift, span and motor & brake details.
3.7.3 All lubrication points shall be provided with name plates.

4.0 INSPECTION AND TESTING

4.1 Purchaser's (BHEL) and end user's (BHEL's customer) representative shall have the access to the works of vendor at all reasonable times for the purpose of witnessing the purchased equipment being tested.

4.1.1 Vendor shall provide a Quality plan along with the offer for review and approval by Purchaser or end user.

4.2.0 Each chain pulley block with trolley shall be subjected to 1.5 times the safe working load for a lift of minimum one metre, which shall ensure that every part of the block mechanism and each tooth of the gears come under load. The trolley with load shall be tested for smooth operation for cross travel without any problems.

4.2.1 All visual examination after operational proof test for deformation, cracks etc, shall be checked by Purchser or its appointed representative for all 100% cases.

4.2.2 Type test (static loading) shall be conducted at 200% safe working load. Static tensile loading shall be done once in a year or if there is a design change which ever is earlier. Records shall be maintained by the supplier for this and a copy of the same shall be furnished.

4.2.3 All under hung cranes shall be tested for 125% of safe working load. All visual examination afer operational proof test for deformation, cracks etc, shall be checked by Purchser or its appointed representative for all 100% cases.

4.2.4 Each under hung crane shall be subjected to 1.25 times the safe working load at the middle of the crane girder. The trolley and chain pulley block with load shall be tested for smooth operation for cross travel on the crane girder without any problems. Wheel matching of the crane with runway beam shall be checked with 125% safe working load. Allowable deflection is span / 1000 at SWL.

4.3 Certificate of test and examination shall be issued for the hooks and chain pulley blocks with trolley and under hung crane individually giving the followibg information.

4.3.1 Safe Working Load
4.3.2 Range of Lift
4.3.3 Load chain & hand chain size and grade
4.3.4 Span of the crane
4.3.5 Over hang on either side
4.3.6 Proof load applied.

4.4 HOOKS :

4.4.1 Raw material test certificate shall be submitted from manufacturer.

4.4.2 Proofload at 200% of safe working load on each hook irrespective of capacities

4.4.3. Chemical composition and destruction test shall be carried out on one sample per batch.

4.4.4 After proof load test, hook shall be examined for cracks,deformation, flaws and other defects with LPI / MPI. Hooks above 5T capacity shall be examined with UT. Acceptance norms for LPI / MPI: No linear indications or crack are acceptable while carrying-out LPI / MPI. For UT, it shall be as per ASME-Sec. VIII - AM203.2

4.5 LOAD CHAIN :

4.5.1 BREAKING TEST : First few links of the lot (Refer IS 5616) shall be tested for minimum breaking load (400% SWL) after manufacture, heat treatment and calibration.The sample shall first be subjected to proof loading and then shall be tested to destruction and breaking load.

4.5.2 ROLLING OVER WHEEL TEST : Full length of chain after proof loading shall be passed over actual load chain wheel.

4.6 All structural welds, gears, castings/forging shall be examined by MPI /LPI for cracks, surface defects. Acceptance norms for LPI / MPI: No linear indications or crack are acceptable while carrying-out LPI /MPI. All butt welds shall be tested radiography and acceptance norms shall be as per AWS D1.1/ ASME - SECTION IX.

4.7 PERFORMANCE TEST FOR CHAIN PULLEY BLOCKS, RACHET LEVER and UNDER HUNG CRANES,

4.7.1 Under hung crane shall be checked for smooth running of chain pulley block with trolley on crane girder and crane movement shall be checked with 125% safe working load on runway beam at site by purchaser / end user under vendor's supervision and if found defective, the same shall be replaced at free of cost by vendor.

4.7.2 Chain pulley block with trolley and under hung crane shall be checked for brake system to arrest the movement and sustain the load at any working position.

4.7.3 Chain pulley block with trolley shall be checked for smooth running on monorail with load above 2 meters, from ground.

4.7.4 Wheels shall be checked for matching with monorail / runway beam.

4.7.5 Rachet lever shall be checked for its smooth operation to the rated capacity

4.7.6 Equipment shall be provided with name plates consisting of:

A. Description B.Serial No C. Manufacturer

D. Type E.Capacity & size. F. Year of manufacture.

5.0 PROTECTION AND PAINTING

5.1 SURFACE PREPARATION : The surfaces to be coated shall be free from contamination, weld slag and spatter shall be removed. Surface defects shall be removed by suitable methods.Sharp edges shall be smoothened by grinding. Prior to surface preparation oil, grease ,drilling emulsions, cutting emulsions and preservative agents shall be carefully removed by suitable solvents, The surface shall be carefully dried with clean cloth to prevent the dissolved impurities from spreading over the entire surface. The surface shall be cleaned by wire brush and shot blasting, if required. Proper adhesion of paint to the surface shall be ensured.

5.2 PAINTING

5.2.1 PRIMER : 2 coats of red oxide with 40 microns DF thick minimum.

5.2.2 FINISH COAT : 2 Coats of enamel paint with each 40 microns DF thick minimum.

5.23 Finish paint colour shall be of Black for HOOK and Golden yellow for CHAIN PULLEY BLOCKS and UNDER HUNG CRANES.

5.2.4 Non ferrous material, austenitic stainless steels, plastic or plastic coated materials, insulated surface of equipment and pre painted items need no painting.

5.3 All the rotary parts inside shall be thoroughly greased.

5.4 All the machined parts shall be covered with water proof packing material and packed in wooden boxes to avoid any damage during transit.

5.5 Machined and bearing surfaces shall be protected with varnish or thick coat of grease.

5.6 For special painting if any, refer annexure -II to this specification.

6.0 PACKING AND IDENTIFICATION

6.1 All packaging shall be done in such a manner as to reduce the volume. The equipment shall be dismantled into major components suitable for shipment and shall be properly packed to provide adequate protection during shipment. All assemblies shall be properly match marked for site erection.

6.2 Attachments, spare parts of the equipment and small items are to be packed separately in small cases. Each item shall be tagged with identification of the main equipment number, item denomination, and reference number of the respective assembly.

6.3 Detailed packing list in water proof envelope shall be inserted in the package together with equipment.

6.4 Each equipment shall have a name plate giving the salient equipment data, make, year of manufacture, equipment number followed by the firm, manufacturer's name plate. Each hoist will have a name plate fixed on both faces in such a manner that the safe working load can be cleary seen from the operating floor.

7.0 SPARE PARTS

7.1 Mandatory spares: The offer shall include list of recommended spares with itemised price, for 2/3 years operation of the equipment. Proper coding and referencing of spare parts shall be done so that later identification with appropriate equipment will be easier.

7.2 Commissioning spares: The offer shall include the required commissioning spares as part of the main package. The cost of such spares included may be separately indicated in the offer.

8.0 DRAWINGS AND O & M MANUALS :

8.1 The drawings furnished with the offer shall clearly indicate the items (bill of materials) that go to make the trolley with hoist and / or under hung crane. The drawings shall clearly indicate the weight particulars of such items /sub assembly that will be despatched as loose items in the packing cases. The bill of material shown in the drawing shall match with that of the despachable unit as indicated in the packing slip. The drawing shall be prepared in AUTOCAD and vendor shall forward both hard copies (3 numbers each) and floppy (copied with drawing files) to the purchaser.

8.2 Performance and load test certificate shall be submitted along with the supply.

8.3 Catalogues and other details of the product shall be submitted along with the offer.

8.4 The vendor check list shall be filled up at the manufacturers works and shall be duly signed by inspection engineer and manufacturer's representative.

8.5 O & M MANUALS

8.5.1 Number of copies required is 5.

8.5.2 Manuals should be in printed form only (Xerox copies are not acceptable),

8.5.3 The size of manuals should be in correct A4 size with drawings not bigger than A3 size. Large size drawings, greater than A3 size, should be reduced to A3 size and inserted (Drawings shall be of laser prints or printed. Blue prints are totally not acceptable)

8.5.4 Spiral or comb bound copies should be totally avoided.

8.5.5 If manuals are supplied in folders. the folder should have punching,

8.5.6 O & M manuals, should be submitted to BHEL / Hyderabad prior to despach of the equipment.

8.5.7 Manual, generally, should contain the following :

8.5.7.1 Data sheet

8.5.7.2 Brief description

8.5.7.3 Operation

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

8.5.7.5 Trouble shooting

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

8.5.8 Manuals should pertain only to the type or model of the equipment supplied for a particular order.

8.5.9 The O & M manuals are to be prepared in electronic media and co-pied on a floppy and submitted along with hard copies.

9.0 DOCUMENTS BY VENDOR

9.1 Along with the offer (in three sets)

9.1.1 Data sheets for Trolley With Hoist & Under Hung Crane (Annexure III)

9.1.2 Technical specification for equipment

9.1.3 Quality plan & typical arrangement drawing

9.1.4 Deviation: Any deviation to specification shall be clearly spelt out in the offer itself. During Contract / Delivery / Installation Stages, no deviation will be entertained.

9.1.5 Exclusion: Any exclusion from scope of supply shall be clearly spelt out in the offer itself. Exclusion of major /critical items shall make the offer liable for rejection.

9.2 After placement of order

9.2.1 Quality plan is to be submitted by vendor for Purchaser's and End user's approval.

9.2.2 Dimensional drawing for approval.

9.2.3 Data sheet for hoists and cranes for Purchaser's / End user's approval.

9.2.4 Five copies of O & M instruction manuals shall be provided with details for storage, installation, erection procedures, drawings, operation & trouble shooting, lubrication schedule, spares requirement, spares identification. All copies to be sent to BHEL /Hyderabad.

9.2.5 Softcopy with as build drawing files & O & M manual details for equipments under supply to be provided to Purchaser.

9.3 DURING SUPPLY

9.3.1 Performance test certificates for TWH, UHC, Safety devices and Chain.

9.3.2 Physical, Chemical, hardness and NDE test certificates shall be provided, wherever applicable, for trolly/crane wheels,load chain, hand chain,pulleys,hook,gears,pinions,shafts and other materials.

9.3.3 Other certificates either for sub-vendors manufacturing or boughtout items shall also be furnished, if applicable.

10.0 GUARANTEE REQUIRED :

18 months from the date of commissioning or 24 months from the date of supply.

11.0 ERECTION, COMMISSIONING & HANDING OVER TO CUSTOMER :

The supplier will depute experienced engineer to supervise erection of the handling system. Supplier will commission the system to the satisfaction of the customer.Customer certificate to this effect is to be submitted to BHEL after comlpetion of the work.

VAR NO.	DESCIRPTION	MATL. CODE	WEIGHT
00	HAND OPREATED HANDLING EQUIPMENTS	BA9755035001	1000 KGS.
01	RATCHET LEVEL TYPE MANUAL HOIST - 10 T CAPACITY	BA9755035010	200 KGS.

RECORD OF REVISIONS

REV.NO	DATE	REVISION DETAILS	REVISED	APPROVED
01	5.5.2005	UPDATED THE SPEC BASED ON INPUTS RECEIVED FROM PE-FB TRICHY.	MVRM	J G K

COMP.FILE NAME 989-8.DWG

Ref. Doc.