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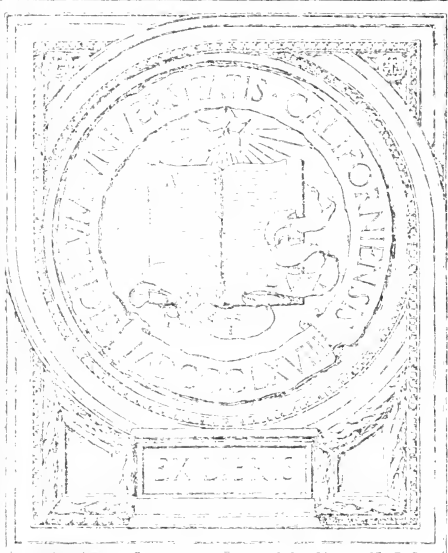
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General Specifications

for

Electric Overhead Traveling Cranes Heavy Duty Steel Mill Service

Association of Iron and Steel
Electrical Engineers

1007 Empire Building,
Pittsburgh, Pa.



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Presented at the
Fifteenth Annual Convention
September 19-24, 1921

GENERAL SPECIFICATIONS FOR ELECTRIC
OVERHEAD TRAVELING CRANES
HEAVY DUTY STEEL MILL SERVICE

AS RECOMMENDED BY

THE CRANE STANDARDIZATION COMMITTEE OF 1921

F. W. CRAMER,* Chairman

1. *Title.*

These specifications shall be known as the "Association of Iron and Steel Electrical Engineers Specifications" and if included in a contract as such, shall form a part of that contract, whether attached to it or not.

2. *Scope and Application.*

It is intended these specifications shall apply to heavy duty steel mill cranes, and as far as practical to cranes for special service such as stripping ingots, charging ingots into and drawing them out of soaking pits, ore handling, charging open hearth furnaces, etc. It is not intended they shall take precedence entirely over specifications for special cranes or over ordinary or light duty cranes for general purposes.

3. *Proposals.*

When inviting proposals, purchaser shall submit supplementary specifications containing principal dimensions, capacity, electric current available, and any unusual requirements.

Builder shall submit with proposal full description covering the design and construction of the crane.

*Engineer of Tests, Cambria Steel Company, Johnstown, Pa.

4. *Drawings and Specifications.*

On acceptance of proposal, two copies of specifications shall be furnished to the purchaser and on completion of the crane two sets of working drawings shall be supplied. Such specifications and drawings shall be treated by the purchaser as confidential information and shall be used only for the purpose of insuring the fulfillment of the contract or as a guide in maintaining the crane in proper condition.

5. *Superintendence and Acceptance.*

If stipulated in the specifications, builder shall furnish superintendence for erecting and operating the crane for a fixed period to demonstrate that it complies with all requirements. Compliance with the specifications shall be determined by inspection after delivery and proper tests made under maximum working load.

6. *Material, Workmanship and Inspection.*

Material and workmanship shall be of best quality and shall be subject to the inspection by the purchaser at any time. On request builder shall furnish purchaser or his representative full information concerning the material entering into the construction.

7. *Strength of Material.*

(a) Proper provision shall be made for all parts subject to impact and rough usage. Journals and shafts shall be of sufficient size to bring bearing pressures and deflections within safe and practicable limits.

(b) Fibre stress in cast iron shall in no case exceed 2,000 pounds in tension, or 8,000 pounds in compression. Fibre stress in cast steel shall in no case exceed 8,000 pounds in tension or 10,000 in compression.

(c) Wrought iron and structural steel as regards physical properties, shall conform with "The Manufacturer's Standard Specifications."

8. *Kind and Quality of Material.*

(a) All castings shall be of steel unless otherwise specified, except brake shoes and drums, which may be of cast iron.

(b) If purchaser desires a special type of collector shoe he shall supply builder with drawings of same.

(c) All castings shall be of best material, free from blow-holes or other injurious defects.

9. *Factor of Safety at Rated Capacity.*

(a) Load hook not less than 10.

(b) Hoist shafting and all gears not less than 6.

(c) All other parts not less than 5.

10. *Accessibility.*

(a) All parts which may require occasional removal or replacement shall be readily accessible.

(b) All lubricating devices shall be conveniently located.

11. *Interchangeability.*

As far as practical, corresponding parts of a crane shall be alike and interchangeable.

12. *Gears and Covers.*

(a) All gears and pinions shall be cut to diametrical pitch, Brown and Sharpe standard involute teeth.

(b) All pinions shall be made of open hearth steel unless otherwise specified.

(c) No split gears shall be allowed.

(d) Overhung gears shall be used only with purchaser's approval.

(e) All gears shall be protected by gear covers arranged so that top part can be removed for inspection and repairs without disturbing lower part.

(f) The builder shall use the motor manufacturers' standard gear ratios.

13. *Shafting.*

(a) All shafting shall be increased at least $\frac{1}{8}$ -inch in diameter for the hub fits of gears, pinions, track wheels or drums, except when these are located at the end of the shaft.

(b) All shafting 6 inches or less in diameter not having increased diameter for hub bearings may be cold rolled or drawn. All shafting having increased diameters for hub bearings, and all shafting above 6 inches in diameter, shall be forged and turned to size.

(c) The minimum diameter of bridge line shafting shall be $3\frac{3}{8}$ inches. Starting with $3\frac{1}{2}$ inches, the standard diameters shall run in even $\frac{1}{4}$ -inch sizes.

(d) End sections of bridge drive shaft shall be 4 feet long and interchangeable.

(e) Middle section shall be 8 feet long.

14. *Press Fits.*

All parts subject to torsion are to be pressed or shrunk on to the shaft and keyed in place.

15. *Brackets.*

(a) Bearing brackets, if not cast integral with frame, must be kept in alignment by male and female joints or other equally effective method. Holding bolts shall not be depended on for this purpose.

(b) Duplicate brackets shall have holding bolt holes drilled to template so as to be interchangeable.

(c) Tie brackets, made in a single piece, shall be provided to tie all driving and driven shafts, and shall be located as close as possible to pinion and gear.

(d) Where brackets or other supporting parts requiring accurate alignment, are attached to structural material, unless such structural material is of sufficient thickness to allow for finishing, heavy planing strips shall be riveted to structure; these strips and parts that are attached to them must be assembled with their contact faces machined.

16. *Bearings.*

(a) All track wheels unless otherwise specified shall be provided with type of bearings known as Master Car Builders or "M. C. B." type. The bearing linings shall be flanged at each end. Construction of bearings shall be such as to permit "lining up" to compensate for wear.

(b) All bearings except on motors, sheaves and track wheel pins, shall be fitted with caps, finished male and female. They shall be accurately bored and lined with split bushings having flanges on each end to hold them in place, and proper provision shall be made to keep the bushings from turning.

(c) Bottom half of bearing lining shall be so designed as to permit of removal and replacement without removing shaft.

17. *Lubrication.*

Grease cups shall be provided for all bearings except those for wheels or motors. They shall have standard pipe threads

and as far as possible, be located at points accessible from foot walks. Type of grease cups to be specified by purchaser if there is a preference.

18. *Shaft Couplings.*

(a) The standard A. I. & S. E. E. coupling shall be so designed that the same coupling can be used on all sizes of line shafting from $3\frac{3}{8}$ inches to $4\frac{1}{2}$ inches diameter inclusive.

(b) It shall have a straight face, a 10-inch bolt circle and six 1-inch holes for body bound bolts.

(c) This coupling for safety reasons must be covered by a guard.

19. *Bolts, Nuts and Rivets.*

(a) Bolts not otherwise specified, shall be rough machine bolts, U. S. Standard threads, with cold punched hexagon nuts.

(b) Bolts shall be provided with lock nuts. Inaccessible bolt heads shall be held in some way to prevent bolts from turning.

(c) Studs or cap screws are not to be used.

(d) Bolts are to be so located if possible as not to require the use of socket wrench or other special wrench.

(e) In fabricating and assembling structural work such as gusset plates, brackets supporting foot-walks and bridge line shaft, angles supporting operator's cab, and all other parts rivets shall be used instead of bolts wherever practicable.

20. *Stairs and Ladders.*

(a) Stairs shall be provided in preference to ladders. Stair treads shall be of material designed to prevent slipping, and shall not be less than 18 inches in length. Where stairs are not constructed with risers, a plate shield shall be attached to the under side, extending the entire length.

(b) Where ladders must be provided they shall be of steel and constructed with square rungs to prevent turning. The rails shall extend 42 inches above landing place at top, for safety in getting on or off the ladder.

(c) Where the slope of stairs exceeds an angle of 55 degrees from the horizontal, ladders shall be used in preference to stairs.

21. *Footwalks.*

(a) Unless otherwise specified steel footwalks with rough tread, not less than $\frac{1}{4}$ -inch thick and 24 inches wide shall be provided on outside of both girders, extending to web of the girders and full length of crane and where practical over end carriages and cab making it continuous around top of crane. Where only one such footwalk is installed on the crane, it shall be on the side carrying the bridge motor. When motor is not located entirely below floor of walk, the walk shall be widened at the motor to give a clearance of not less than 15 inches between railing and motor. Where motor is located partly or entirely below footwalk it must be surrounded by a plate corresponding to the footwalk.

(b) When practicable, a footwalk with railing of same material and same general construction as walks and railings on bridge girders, or just a railing, shall be provided across ends of trolley.

22. *Railings.*

All railings shall be made of structural steel; shall be of standard construction, not less than 42 inches high, with toe boards not less than 4 inches high with intermediate member 21 inches high.

Railings shall be provided on girder footwalks and ends of bridge, landing on cab, and on stairs leading to bridge girder from landing on cab.

23. *Box for Supplies.*

A steel box for storing oil, grease and waste, made of steel plate and provided with hinged lid, shall be fastened to girder side of footwalk.

24. *Bridge End Carriages.*

(a) Carriages shall be made either of cast or structural steel.

(b) They shall, where practicable, have bearings on both sides of driving pinions cast integral with carriage. Flanges shall be on outside to afford easy access for bolting or riveting.

(c) Heavy lugs shall extend across the bottom of each carriage near each track wheel and one-inch above the rail to prevent excessive drop of crane in case of breakage of track wheel pin or carriage.

(d) No part of carriage or track wheel gears shall project below the flange of track wheels.

(e) Pads shall be provided for use of jacks or wedges when changing track wheels. Carriage and track wheels shall be so designed as to permit of changing the wheels by raising the carriage just enough to free the bearings.

(f) Bumpers shall be provided on each end of the carriages for protection of crane in case of collision or one crane being required to push another. Location and type of bumpers to be specified by purchaser.

(g) Where necessary, steps or ladders must be provided to give access to compensating trucks from track girders.

(h) Guards which will shove forward or off the track any object placed across it, like a person's foot or arm, shall be attached to each end of the carriages.

25. *Track Wheels.*

(a) Track wheels shall preferably be of rolled or forged steel. Cast steel wheels may be used if specified.

(b) The standard tread diameter of bridge track wheels shall be 18-inch, 24-inch, 27-inch and 30-inch, and tread shall be made to suit a standard rail not smaller than 85 pounds section. Treads for heavier rails to be made to suit.

(c) The standard bores of these wheels shall be as follows:

18-inch diameter	4 $\frac{5}{8}$ -inch bore
24-inch diameter	5 $\frac{5}{8}$ -inch bore
27-inch diameter	6 $\frac{5}{8}$ -inch bore
30-inch diameter	7 $\frac{5}{8}$ -inch bore

(d) A standard increase in diameter of $\frac{1}{8}$ -inch for all bridge track wheel axles in the wheel hubs is recommended.

(e) All bridge track wheels on same crane to be interchangeable.

(f) The A. I. & S. E. E. standard for bridge runway rails shall be an 85-pound open hearth rail for ordinary cranes, and for special cranes requiring over an 85-pound rail, purchaser shall specify type and size of rail.

(g) The standard tread diameters of trolley track wheels shall be 12, 15, 18, 21 and 24 inches.

(h) The standard bores of these wheels shall be as follows:

12-inch diameter	$3\frac{1}{8}$ -inch bore
15-inch diameter	$3\frac{5}{8}$ -inch bore
18-inch diameter	$4\frac{5}{8}$ -inch bore
21-inch diameter	$5\frac{1}{8}$ -inch bore
24-inch diameter	$5\frac{5}{8}$ -inch bore

(i) With maximum load on crane track wheel bearing pressures must not exceed 750 pounds per square inch projected area.

26. *Bridge Girders.*

Top and bottom cover plates and angles of box section girders shall be in one piece throughout the girder length, but splicing of approved design will be allowed in web plates. Web plates shall be not less than $5/16$ -inch thick. The top cover plate of box girders carrying rails, shall be supported at frequent intervals by structural steel distance pieces which shall bear against it and be riveted to both web plates. Girders shall be rigidly fastened to end trucks and shall be tied together at top and bottom by plates which shall be as broad as possible without interfering with the trolley travel. To further assist in keeping crane "square" and stiff, a heavy angle shall be riveted across top of girders at extreme ends, and the entire end covered by a plate riveted to this angle, to angles on end of all web plates, and riveted or bolted to end carriages. Box girders shall be drained to prevent accumulation of oil and water, holes to be not less than $3/4$ -inch diameter.

27. *Rails for Trolley.*

Rails for trolley cross travel shall be of only open hearth steel. Joints shall be made by means of standard splice bars, and provision shall be made to prevent creeping of rails on girders. Rails shall be fastened in place by steel clamps and through bolts spaced not more than 36 inches on centers, and those on one side shall have a lead of about three inches over those on the other side.

The standard trolley rails shall be 60 and 85 pound sections.

28. *Bridge Drive.*

The line shaft pinion shall drive directly into the track wheel gears.

29. *Operator's Cab.*

(a) Cab shall be made of structural steel and be of fire-proof construction. It shall be of weather-proof construction if crane is to be operated on outdoor runways. It shall be made substantial and rigid by proper gusset plates and bracing, but such bracing shall not interfere with access to cab or vision of the operator. Particular attention to be given these features in case cab is located at center of bridge.

(b) Such slope as the roof may have shall be toward the rear of the cab. Floor shall be extended to form a landing platform outside the door, which platform shall be equipped with standard railing.

(c) A suitable warning signal appliance shall be provided.

30. *Trolley.*

(a) Side frames of trolley shall be of cast or structural steel. The requirements for bridge end carriages shall apply as far as possible to side frames. Frames shall be connected with structural steel cross girts. Drum bearings and supports for sheaves shall be located so as to equalize the load on track wheels as nearly as possible.

(b) Wheel fenders as described in specifications for bridge end carriages shall be attached to the trolley frame at each end of each side frame.

(c) Trolley to have floor plate under motors, shafts, drums, etc., forming a working platform with provision made for reaching footwalk on either side of frame.

31. *Drums.*

(a) Drums shall be keyed to their shafts on driving gear end. They shall have turned grooves of depth equal to one-half the diameter of the rope, and pitch at least $\frac{1}{8}$ inch greater than this diameter. They shall be designed so as to leave not less than two complete wraps of the rope on drum when hook is in the lowest position. They shall have flanged ends of depth and thickness as required for size of cable.

(b) Pitch diameter of drums shall be not less than 30 times diameter of hoisting rope.

(c) Where a drum for lifting magnet cable is specified it must be so located that cable will not interfere with hoist ropes.

Weather protection shall be provided for magnet cable drum on cranes for outdoor service.

(d) The crane builders shall use the motor manufacturers standard gear ratios.

32. *Brakes.*

(a) Unless otherwise specified, and where direct current is used, lowering shall be by electro-dynamic control with one magnetic brake on armature shaft of hoist motor.

(b) Magnetic brakes shall be capable of retarding the full load at double speed and holding same when stopped, unaided by other brakes.

(c) Brake wheels shall be accurately balanced.

(d) Brake coils shall be so designed that the temperature rise shall not exceed that of motor and shall be protected by metal casing.

(e) Brakes for same size motor shall be alike and interchangeable.

(f) Mechanical retaining brakes, if specified shall be of sufficient capacity to absolutely prevent load from descending unless motor is revolved by power in the lowering direction.

(g) Foot brake shall be provided for bridge movement, capable to stop crane under any load condition with 100 pounds pressure on foot lever in a distance not exceeding 10 per cent of the speed in feet per minute at which the crane is traveling when the brake is applied.

(h) Means shall be provided to prevent any parts of brake from falling to the ground in case they become detached or broken.

33. *Sanders.*

Track sanders operated from the cab by the crane operator, shall be provided for sanding the runway rails when the rails are too slippery at any time for operating.

34. *Ropes.*

(a) Ropes shall be suitable for the service they are employed for.

(b) Where double ropes are provided for safety or for double drive, each rope shall have the same capacity that would be required if only one rope was provided.

35. *Sheaves and Blocks.*

(a) Sheaves shall be bronze bushed and have finished grooves not less than $1\frac{1}{2}$ times the diameter of the rope.

(b) Sheaves shall have a pitch diameter not less than 30 times the diameter of the rope and shall be protected by guards which fit close to the flanges so as to prevent rope coming off.

(c) Bottom block shall be of structural steel and plates, and hook shall swivel on ball bearings so constructed as to exclude dirt. All parts of block shall be so arranged as to be readily lubricated, grease cups being so located as to be protected from injury as far as practical.

(d) All sheaves to have guards, to keep rope in grooves.

36. *Conductors.*

Conductors across the bridge shall be of rigid type.

37. *Motors and Controllers.*

Purchaser shall specify make, type and sizes of motors and controllers to be used.

38. *Wiring.*

(a) Purchaser shall submit detail wiring specifications or install his own wiring.

(b) An enclosed double pole safety switch shall be mounted on the foot walk adjacent to the cab and be so connected, that it will disconnect the main circuit between the collectors and the switchboard.

39. *Switchboard.*

A protective switchboard panel shall be provided. Location and type to be specified by the purchaser.

40. *Limits.*

Overtravel limits shall be provided. They shall open main motor circuit at any predetermined point, and where limited space for travel may require it, dynamic braking shall be applied to prevent drifting of load.

41. *Painting.*

All structural work and parts usually painted shall be thoroughly cleaned and painted with two coats of paint. Parts that

are inaccessible after they are assembled shall be cleaned and painted before assembling.

42. *Safety Devices.*

In addition to the safety appliances specified in these General Specifications the builder shall supply and install all appliances necessary for compliance with the Factory Laws of the State in which the crane is to be operated.

APPENDIX A

HOT METAL CRANES

1. For cranes handling hot metal the following additional specifications shall apply:

2. *Operator's Cab.*

(a) Operators' Cabs shall be so constructed as to enable the operator to completely enclose himself by means of doors and windows.

(b) When crane is handling molten metal and no provision is made for the quick escape of operator, by runway or other means, in case molten metal gets spilled, there shall be provided a compartment for operator to get into that will resist unbearable heat for at least 10 minutes. The door to such compartment shall be at least 18 inches wide and it must be so attached that it can be tightly closed.

(c) Cab that will be subject to heat from below, shall have a shield plate not less than 3/16 inches thick, six inches below floor of cab. It shall be attached with bolts having spacing sleeves on them.

3. *Trolley.*

On cranes for handling molten metal, where the main hoist drums carrying two sets of ropes are driven by two motors, each through its own train of gears, each motor and set of gears must be capable of handling the full load independently of the other.

4. *Brakes.*

(a) Each main hoist on a hot metal crane shall be equipped with two magnetically operated brakes, one mounted on end of

armature shaft, the other on intermediate shaft as near the drum as is practicable.

(b) Each brake shall be capable of stopping the full load, lowered at twice the hoisting speed, and holding the load when stopped unassisted by other brakes.

(c) Each brake to comply with paragraph 32 General Specifications as to construction.

5. *Ladle Hooks.*

(a) Ladle hooks for hot metal ladle shall be either built up of laminated plates or made of heat treated forgings.

(b) Ladle hooks shall be provided with wearing slippers of suitable material (if specified).

(c) Locks to hold the ladle in vertical position shall be attached to the hook so that they can be seen from the operator's cab. Means shall be provided for holding the lock out when tipping the ladle.

6. *Separators.*

Separators for hot metal ladle hooks shall be of structural steel, and shall be protected from heat by plate guard, separated from beam by spacing sleeves.

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