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## Specification for Steel Plate Girders.

Imperial Government Railways of Japan, May, 1904.

The girders must be built strictly in accordance with this specification and the annexed standard drawings.

### Materials.

The whole of the steel used throughout the work must be made by the Siemens-Martin or Open-Hearth process, by the approved makers and subject to the approval of the Inspector or Consulting Engineer.

The steel must be uniform in character for each specified kind.

The finished bars, plates and shapes must be free from cracks on the faces or corners, and have a clean, smooth finish.

No work shall be put upon any steel at or near the blue temperature or between that of boiling water and ignition of hard wood sawdust.

All tests shall be made on samples cut from the finished material after rolling, the samples to be at least 12 inches long, and to have a uniform sectional area not less than  $\frac{1}{8}$  square inch.

Material which is to be used without annealing or further treatment is to be tested in the condition in which it comes from the rolls. When material is to be annealed or otherwise treated before use, the specimen representing such material is to be similarly treated before testing.

The elongation shall be measured on an original length of 8 inches. Two test pieces shall be taken from each melt or blow of finished material, one for tension and one for bending.

All samples or full-sized pieces must show uniform fine grained fractures of a blue steel-gray color, entirely free from fiery luster or blackish cast.

The steel shall have an ultimate strength, when tested in samples of the dimensions above stated, of 60,000 to 68,000 pounds per square inch, an elastic limit of not less than one-half of the ultimate strength, and a minimum elongation of 22 per cent. in 8 inches. Before or after heating to a low cherry red and cooling in water at 82 degrees Fah., this steel must stand bending to a curve whose inner radius is one and a half times the thickness of the sample, without cracking.

Rivet steel shall have an ultimate strength of 50,000 to 58,000 pounds per square inch and an elongation of 26 per cent.

Before or after heating to light yellow heat and quenching in cold water, this steel must stand closing solidly together without any sign of fracture.

### Workmanship.

All workmanship shall be first class in every particular.

The plate shall be planed on all edges by machine.

All joints shall fit perfectly close together.

For punching, the diameter of the die shall in no case exceed the diameter of the punch by more than  $\frac{1}{16}$  of an inch, and all holes must be clean cut without torn or ragged edges.

All rivet holes must be so accurately spaced and punched that when the several parts forming one member are assembled together, a rivet  $\frac{1}{16}$  inch less in diameter than the hole can generally be entered, hot, into any hole, without reaming or straining the metal by "drifts;" occasional variations must be corrected by reaming.

All holes for field rivets, shall be accurately drilled or reamed to an iron template, so that as far as possible all like pieces may be interchangeable.

The rivets when driven must completely fill the holes. The rivet-heads must be round and of a uniform size for the same sized rivets throughout the work. They must be full and neatly made, and be concentric to the rivet-hole, and thoroughly pinch the connected pieces together.

Wherever possible, all rivets must be machine driven.

The machines must be capable of retaining the applied pressure after the upsetting is completed.

Riveted work will be subject to the following conditions:

All sheared edges of plates and angles will be planed off to a depth of  $\frac{1}{4}$  of an inch and all punched holes will be reamed to a diameter  $\frac{1}{8}$  of an inch larger so as to remove all the sheared surface of the metal; unless the material is such that any rivet holes punched as in ordinary practice will stand drifting to diameter one-third greater than the original holes, without cracking either in the periphery of the holes or on external edges of the pieces, whether they be sheared or rolled.

No reliance will be placed upon the welding of steel.

No sharp or unfilleted angles or corners will be allowed in any piece of metal.

The whole of the girders when put together must fit closely and when riveted shall be free from twist, bend or open joints.

All forging shall be sound, and neat and true.

### Provision for Erection and Transportation.

The girders for 60 foot span will be received in two sections, and girders for 70 foot and 80 foot spans in three sections, separated at the web joints as shown; sufficient rivets shall be supplied with each girder for riveting these joints, and also for riveting bracings, stiffeners, and all at other parts that will have to be riveted up in the spot with 25 per cent. to spare.

### Marking and Name Plates.

All parts separated shall be carefully and distinctly marked with letters and numbers corresponding with their position in each span, for the purpose of facilitating their putting together; but to provide against the possibility of the identification of any of the parts being lost, the several parts must be exactly similar, so that the various parts will go together when interchanged,

Each span must also be marked with the letters I. R. J.

The marks shall be made by punches or painting, and the contractor shall furnish to the Imperial Government Railways tracings in duplicate showing the divisions and marks as arranged.

A name plate of neat design and finish, giving the year of manufacture, the name of the steel maker and the workshop, shall be firmly attached to outside of the web plate of every girder.

### Painting.

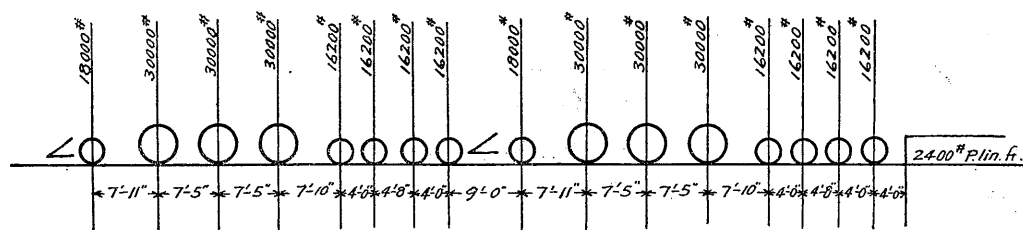
The whole of the work shall receive two coats of good oil paints, after having been previously thoroughly cleaned and coated with boiled linseed oil, the first coat to be of red lead, and the second oxide of iron paint.

All the surfaces coming in contact after riveting shall be painted with one coat of red lead and pure linseed oil, before being riveted together.

No painting shall be done before Inspection.

### Final Test.

Before the final acceptance a thorough test shall be made by loading on one or all of the girders being completely built up with the weights which are equivalent to that of the following diagram.



After such test the girders must return to their original positions without showing any permanent change in all their parts.

N. B.—The Inspector or Consulting Engineer is to be appointed by the Japanese Government.

### List of Approved Makers for Steel Bridge Materials.

Consett Iron Co., Durham, England (For Steel Plate only)

Dorman Long & Co., Middlesbrough, England.

Edgemoor Bridge Works of American Bridge Co., Wilmington, Del., U. S. A.

Fried. Krupp, Essen, Germany.

Gutehoffnungshütte Aktien Gesellschaft für Bergbau, Oberhausen, Germany.

John Cockerill & Co., Seraing, near Liege, Belgium.

Keystone Bridge Works of American Bridge Co., Pittsburg, Pa., U. S. A.

Luxemburger Bergwerks-und-Saarbrücker Eisenhütten-Aktien-Gesellschaft, "Burbacher Hütte" near Saarbrücken, Germany.

Patent Shaft & Axletree Co., Staffordshire, England.

Pencoyd Iron Works of American Bridge Co., Phila., U. S. A.

Shelton Steel, Iron & Coal Co., Staffordshire, England.

Steel Co. of Scotland, Glasgow, Scotland.

Steel Peech & Tozer, Yorkshire, England.

Imperial Japanese Government Steel Works. (製鐵所)

N. B.—If Rivets can not be obtained from any of the above named makers, they may be supplied by the Rivet, Bolt and Nut Co., England.

