SPECIFICATION FOR STEEL PIPES & FITTINGS

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STEEL PIPES AND FITTINGS

1. Standards

Steel Pipes and Fittings shall be supplied in accordance with:-

(a) The American Petroleum Institute Specification for Line Pipe, A.P.I. Standard 51 (25th Edition, April 1970) together with the additional clauses or amendments set out in this Specification or,

(b) The American Petroleum Institute Specification for Spiral Weld Line Pipe, A.P.I. Standard 5 L S (5th Edition, April 1970) together with the additional clauses or amendments set out in this Specification, or,

(c) Any other National Standard or Specification acceptable to the Engineer as providing Equivalent or better quality of materials and workmanship together with additional clauses set out in this Specification.

2. Grade of Steel used in Pipes and Fittings

2.1 The Grade of steel used in the pipes and fittings shall be Grade A for welded pipe in accordance with Table 3.1 of the A.P.I. Standard.

2.2 The Contractor shall submit to the Engineer ladle and check analyses in accordance with Section 3 Clauses3.2 and 3.3 of the relevant A.P.I. Standard.

3. Welding

3.1 Pipes may be manufactured by either an electric resistance welding process or by a submerged are welding process. Pipes less than 200 mm nominal diameter may be manufactured by seamless process at the option of the Tenderer.

3.2 Fittings shall be manufactured by an electric resistance welding process unless an alternative method is approved by the Engineer.

3.3 Skelp end joints shall not be permitted within any pipe or fitting. Section 2.2 of A.P.I. Standard 5 LS shall be deleted.

4. Manufacturing Process

4.1 The Tenderer shall at the time of tendering submit full details of the manufacturing processes he intends to use.

4.2 The Contractor shall advice the Engineer of all details of fabrication, welding, cleaning and coating procedures prior to the commencement of fabrication. Such details shall include but not be confined to:

(1) Type or brand of steel
(2) Welding process
(3) Type and size of electrodes, number of bends and rate of deposition of weld metal.
(4) Electrical characteristics
(5) Weld position and direction of welding
(6) Time lapse between passes
(7) Cleaning process and preparation of surface of steel before application of coating.
(8) Specifications of all lining and sheathing materials, their thickness and application procedures.

4.3 The Contractor shall not change any details of manufacture procedure without the approval of the Engineer.

5. Fittings

5.1 Fittings shall be fabricated from pipe conforming with the requirements of this Specification. In addition between 5% and 10% of all welds shall be radiographed and the exposed film made available for inspection by the Engineer. Where considered necessary the Engineer may require additional radiographic tests and hydraulic tests may also be required on all flanged fittings or fittings on which doubtful weld inspection results are revealed.

5.2 Prior to the commencement of fabrication of fittings the Contractor shall submit detailed drawings of the fittings and shall obtain the approval of the Engineer to his proposals. Overall dimensions of the fittings shall be as indicated on the Drawings attached to the Bills of Quantities or otherwise as given in British Standard 534.

6. Pipe Ends

6.1 Unless stated otherwise in the Bills of Quantities the pipes shall be supplied with unbevelled plain ends in accordance with Section 7 Clause 7.4 of A.P.I. Standard 5 LS or the relevant clause of the adopted Standard suitable for use with Dresser Viking Johnson or similar couplings and shall be sufficiently free from indentations, projections or roll marks for a minimum distance of 150 mm from all plain ends to permit a tight joint make-up with the rubber gasket type of coupling.

6.2 If so stated in the Bills of Quantities but not otherwise the ends of pipes to be coupled with mechanical couplings shall have a steel plate 75 mm x 50 mm x 10 mm thick welded to them before the application of the internal lining. These plates shall be supplied a clear 150 mm from the pipe ends to ensure

that no interference is caused to the jointing operation. The plates shall be welded to the pipes so that they lay on the same longitudinal line on the pipe.

6.3 If required the Contractor shall provide in accordance with the Provisional items included in the Bills of Quantities similar 75 mm x 50 mm x 10 mm thick steel plates for site welding to the plain ends of pipes and fittings.

7. Flanges

7.1 Flanges shall be suitable for the nominal pressure stated in the Bills of Quantities as follows.

NP 10 for a nominal hydraulic working pressure of up to 10 kgf/cm^2
NP 16 for a nominal hydraulic working pressure of up to 16 kgf/cm^2
Dimensions of flanges shall be in accordance with BS 4504 : 1969

7.2 All bolts to be supplied with flanges shall be of ductile iron or high tensile steel to the approval of the Engineer.

7.3 All gaskets shall be of the "inside bolt circle" type manufactured from Class `A' natural rubber in accordance with the requirement of British Standard Specification BS 2494.

7.4 Two washers shall be supplied with each bolt and nut.

8. Tolerances

8.1 Paragraphs headed "Pipe Ends" and "Out of Roundness" in Table 6.3 of the A.P.I. Standard shall be deleted and replaced by the following paragraph:

8.2 **Pipe Ends**

Pipe 250 mm and smaller shall not be more than 0.40 mm smaller than the specified outside diameter for a distance of 100 mm from the end of the pipe and shall permit the passage over the ends for a distance of 100 mm of a ring gauge which has a bore 1.6 mm larger than the specified out side diameter of the pipe. Pipe 300 mm to 500 mm inclusive shall not be more than 1.6 mm smaller than the specified outside diameter for a distance of 150 mm from the end of the pipe and shall permit passage over the ends for a distance of 150 mm of a ring gauge which has a bore 1.6 mm larger than the specified outside diameter of the pipe. At the option of the Contractor the minimum outside diameter of pipes 500 mm and smaller may be measured with a diameter tape. Pipe 550 mm and larger shall not be more than 1.6 mm larger than the specified outside diameter for a distance of 150 mm from the end of the pipe as measured with a diameter tape.

8.3 **Out-of-Roundness**

For a distance of 150 mm from the ends of the pipe the maximum outside diameter shall not be more than 1 per cent larger than specified and the minimum outside diameter shall not be more than 1 per cent smaller than specified.

8.4 Pipes supplied sized over their entire length within the above tolerance shall be suitably marked for identification purposes.

9. Pipe Lengths As specified in the bill of quantity ± 50mm

9.1 The average length of pipe in 90% of the entire consignment shall be 8 metres and none of these pipes shall be shorter than 6 metres or longer than 10 meters.

9.2 The average length of pipe in 10% of the entire consignment shall be 4 metres and none of these pipes shall be shorter than 3.5 metres or longer than 4.5 metres.

9.3 Pipes for crossings shall be of the exact lengths stated in the Bills of Quantities $\pm$ 50 mm.

10. Inspection and Testing

10.1 The Contractor shall obtain such facilities for inspection by the Engineer as would be his as purchaser under the relevant A.P.I. Standard and he shall arrange for the Engineer to be supplied with a copy of the reports called for in the relevant Standard. The Contractor shall dispatch to the Engineer all films or records of inspection immediately after processing and in no case more than 24 hours after the inspection.

10.2 The Bill Inspection Hydrostatic Test Pressures shall be not less than those stated in the Bills of Quantities.

11. Bitumen (Asphalt) Lining, Coating and Sheathing

11.1 All pipes shall be protected internally and externally in accordance with this Specification. The term "lining": describes the coating of the internal surfaces. The term "coating" is used to denote an unreinforced coating applied to external surfaces and the term "sheathing" is used to denote a reinforced coating applied to external surfaces.

11.2 Tenderers shall use bitumen (asphalt) lining and sheathing.

11.3 The enamel shall be the same for lining and coating or sheathing.

11.4 All kettles shall be equipped with an efficient thermometer and adequate screens to prevent particles of foreign matter or other deleterious materials from appearing on the finished lining.

11.5 All materials rejected by the Engineer by reason of prolonged heating, over heating charring, contamination etc. shall be dumped and on no circumstances reheated for re-use.

11.6 At all times during cold weather when the pipe temperature is below $8^{o}C$ or during rainy or foggy weather when moisture tends to collect on cold pipe enamelling shall be preceded by warming the pipe. Warming shall be done by any method which will heat the pipe uniformly to the recommended temperature without injury to the primer. Steel temperature of the pipes shall not exceed $70^{o}C$.

12. Preparation of Steel Surfaces

12.1 Immediately prior to the application of coating materials the surface of the steel, shall be completely dry and free from contamination by oil, grease, dirt or other deleterious matter.

12.2 The method used by the Contractor to prepare the surface of the steel and the degree of cleanliness and roughness of the surface shall be subject to the approval of the Engineer.

12.3 If necessary, the pipes shall be cleaned of oil, grease or wax by means of immersion in a bath of 10% by wt. solution of sodium hydroxide at a temperature at least $50^{o}C$ or other method approved by the Engineer.

12.4 Steel surfaces shall preferably be blast cleaned. The quality of surface finish or blasted cleaned surfaces shall be not less than "Second quality" as defined in British Standard Specification BS 4232 : 1967, equivalent to Swedish Standard SA 2.5.

13. Priming

13.1 Immediately following the preparation of the steel surfaces, primers shall be applied to the pipes and fittings in accordance with the requirements of AWWA Standard 0203-66.

13.2 All primers shall have good spraying and brushing properties and a minimum tendency to produce bubbles during application. The primer shall dry hard to the touch when applied as recommended.

13.3 Primers shall produce an effective bond between the metal the subsequent coating of enamel. They shall contain no benzol or other toxic or highly volatile solvents and no added pigments or inert fillers, or other substances and shall show no tendency to settle out in the container.

13.4 The primer shall be thoroughly agitated in the drums before use and care shall be taken to ensure that loss of the volatile portions of the primer has not

caused thickening and that the primer is not contaminated by water, dirt or any other substances. Any primer so deteriorated or contaminated shall not be used.

13.5 Primers shall be cold applied in accordance with Clause 9.14 or may be hot applied.

13.6 Other methods of obtaining an effective bond between the metal and coating of enamel without the use of a primer, including pre-heating the pipe, shall be subject to the approval of the Engineer.

14. Primer under Bitumen (Asphalt) Enamel Coating and Sheathing

14.1 Primer to be used under bitumen (asphalt) enamel pipe coating and sheathing shall be composed of a petroleum bitumen (asphalt) base and petroleum solvents suitably blended to produce a liquid coating which may be applied cold by brushing or spraying and shall be that recommended by the suppliers of the bitumen (asphalt) enamel specified in Clause 9.16.

15. Enamels

15.1 Bitumen (asphalt) enamel shall be specified in Clause 9.16. Alternatively for the lining only an unfilled bitumen enamel to the approval of the Engineer may be used.

15.2 The enamel shall be such that it does not impart either taste or toxic substances to chlorinated drinking water.

16. Bitumen (Asphalt) Enamel

16.1 Bitumen (asphalt) enamel shall consist of either bitumen derived from petroleum or naturally occurring asphalt or a uniform blend of the two materials combined with an inert mineral filler which shall have a minimum tendency to settle in a fluid state. The enamel shall be uniform in character free from water and shall not foam when heated to 205^{o}C,. The filler used shall be ground slate flour or talc. Limestone or asbestos filler shall not be used except with the prior approval of the Engineer. The enamel shall conform with the physical specification given in Table 1.

Table 1

Physical Specification of Bitumen (Asphalt) Enamel

Properties	Test Method	Requirements Min.	Max.
Softening Point (ring and ball)	ASTM D36	115°C	130°C
Filler (ash)	ASTM D271	25%	35%
Filler fineness, through 200 mesh	ASTM D546	90%	-
Specific gravity at 25°C	ASTM D71	1.20	1.40
Penetration:25°C 100 g. 5 Sec.	ASTM D5	8	15
Flash Point (Cleveland open cup)	ASTM D92	200°C	-
Loss on heating at, 163° : 5hrs.	ASTM D6	-	0.5%
Settlement (ratio of ash in bottom half to ash in top half after 5 hours at 200°C)	-	-	2.1
Water content, by weight	BS 3235	-	0.05%
Sag after 24 hours at 75°C	BS 4147 or AWWA C.203		1.6 mm
Cracking after 6 hours at -18°C	AWWA C. 203	-	None
Peel test	AWWA C. 203	No peeling	

17. Testing Primers and Enamels

i. The test procedure for primers and enamels shall be as set out in Table 1. If required by the Engineer the Contractor shall submit samples (not less than 20 kgs. of enamel and 2.5 litres of primer) for testing and approval before use.

18. Bitumen (Asphalt) Internal Lining

18.1 Except as otherwise provided herein the inside lining enamel shall be bitumen (asphalt) enamel.

18.2 The Contractor shall ensure that the internal surfaces of the pipe are clean, dry and free of dust before the application of the lining.

18.3 The application of the enamel to the inside surface of all pipes other than fittings shall be by centrifugal casting by either the Trough Method or by the Retracting Weir of Food line Method.

18.4 The temperature of the enamel on application shall be as recommended by the Supplier of the enamel and the Contractor shall provide the Engineer with a copy of the Supplier's instructions and recommendations for the application of the enamel. Care shall be taken to ensure that it is at no time heated above the maximum temperature recommended. In the event of the enamel being subjected to a temperature above that recommended it shall not be used but shall be discarded.

18.5 During application of enamel the pipe shall be revolved at the speed best suited to produce a smooth glossy lining of uniform thickness. Finished enamel lining shall be free from wrinkles, sags, blisters or blow holes.

18.6 The thickness of the lining shall be 2.4 mm and allowable variations in thickness shall not be out side the range 2 to 4 mm except within, 25 mm of the longitudinal weld where the allowable maximum thickness will be 5 mm.

18.7 All pieces of lined pipe in which excessive rough areas appear or other irregularities exist which the Engineer considered unsatisfactory shall be stripped of the entire lining and relined.

18.8 The lining shall be carried up to the end of the pipe where a cut off of approximately 45^{o} shall be cleanly made while the enamel is plastic.

19. Bitumen (Asphalt) Sheathing

19.1 The Contractor shall ensure that the pipe is clean, dry and free of dust before the application of the first flood coat of bitumen (asphalt) enamel. This shall be applied as soon as possible after the priming coat is dry and in any case before the primer has gone `dead'. In the event of the primer having gone `dead' the Contractor shall strip the dead primer and then re-prime the pipe.

The Contractor shall apply the first flood coat of enamel and while the enamel is still hot the pipe shall be wrapped with fibre glass inner wrap. This shall be wound on with enough tension to ensure that it is fully saturated but care shall be taken to avoid pulling it through the enamel to the metal. The overlap of the inner wrap shall not be less than 25 mm and the thickness of the first coat shall be 2.4 mm with an allowable tolerance of $\pm$ 0.8 mm.

19.2 The pipe shall then receive a second flood coat of enamel and whilst this is still hot shall be wound with outer wrap. Alternatively, the second coat of enamel may be applied simultaneously with the outer wrap. The overlap of the outer wrap shall be 25 mm and the thickness of the second coat shall be not less than 0.8 mm.

19.3 The total thickness of the sheathing shall in no place be less than 2.4 mm.

19.4 The sheathing shall be terminated cleanly at a distance of 150 mm from the ends of the pipes and fittings or such other distance as required to be compatible with the dimensions of the couplings and moulding boxes.

19.5 After sheathing the outer surface shall be given a coat of water resistant whitewash as specified in Clause 9.22.

20. Sheathing Reinforcement

20.1 Inner Wrap

20.1.1 The inner wrap shall be a glass fibre tissue which shall consist of a uniformly porous mat of chemically resistant bore-silicate glass containing not less than 5% B 203 as defined by ASTM definition C162-52.

20.1.2 The glass fibre monofilaments making up the mat shall be in a random arrangement bonded with a phenolic type resin compatible with bitumen (asphalt) Enamel. Continuous filament glass yarn to provide longitudinal reinforcement shall be embedded in the mat at 20 mm centres.

20.1.3 The glass fibre base shall have the physical characteristics shown in Table3.

Table 3 - Physical Characteristics of Glass Fibre Base

Nominal Thickness	0.5 mm
Tensile Strength (per 150 mm wide strip)	45 kg minimum
Porosity	1.3 mm W.G.
Temperature Resistance	Unaffected under load in hot bitumen at 288^{o}C for 1 minute
Phenolic Type Binder Content	12% + 2%

20.1.3.1 Alternatively a woven glass fibre mat to the approval of the Engineer may be used for the inner wrap. The composition of the fibre monofilaments and physical and chemical characteristics of the woven mat shall be similar to those specified for the glass fibre tissue and be in accordance with Section A.2.2 of AWWA Standard 0203-66.

20.2 **Outer Wrap**

20.2.1 The outer wrap shall consist of a glass tissue or mat as specified in clause 23.1 saturated with plasticised bitumen (asphalt) enamel. The resultant outer wrap shall be uniform flexible and with random pin holes to facilitate the release of hot gases.

20.2.2 The finished outer wrap shall have the physical properties shown in Table 4.

Table 4 - Physical Characteristics of Outer Wrap

Thickness (nominal) Weight per 10 sq.m Tensile strength (per 150 mm wide strip) Tear strength (transverse)	0.75 mm 4.5 kg 54.5 kg minimum 4.5 kg minimum

20.2.3 The glass fibre base shall be saturated with bitumen (asphalt) compound having the physical characteristics as given in Table 5 and which shall be fully compatible with the bitumen (asphalt) enamel specified for the pipe line coating.

Table 5 - Physical Characteristics of Bitumen Saturant

Test	Min	Max
Softening Point-Ring & **Ball, ASTM D36-26**	80^{o}C	85^{o}C
Penetration - 25^{o}C -100 g per 5 Sec. -ASTM D5-52	15	25

20.2.4 Subject to the approval of the Engineer the Contractor may draw the glass fibre tissue or woven mat through a bath of bitumen (asphalt) saturant, immediately prior to the application of the outer wrap to the pipe.

20.2.5 The Contractor may if he wishes and with the prior approval of the Engineer use an outer wrap consisting of an asbestos felt base conforming to AWWA standard 0203-66 Section A2.1 saturated with bitumen (asphalt) as specified in sub-clause 20.2.3 hereof.

21. Coating Of Fittings

21.1 Fittings shall be cleaned, primed and coated to give results which are equivalent to similar work on straight pipe sections. If the shape precludes spinning internal surfaces shall be double coated by application of enamel

with hand daubers. The brush strokes of enamel shall be made in the direction of flow. All brush strokes shall overlap to form a continuous coating.

22. Whitewash

22.1 The whitewash finish applied to the sheathing shall be of the following composition.

Water	200 litres
Boiled Linseed oil	4 litres
Processed quicklime	72 kg
Salt (sodium chloride)	4.8 kg

22.2 Lime and oil shall be slowly added simultaneously to the water and mixed thoroughly. The mixture shall be allowed to stand for not less than 3 days before it is used.

22.3 For the purpose of distinguishing between pipe type coloured pigment shall be added to the whitewash as follows.

Pipes sizes overall - light green

In the case of unsheathed pipes a light green band shall be painted longitudinally for the full length of pipes supplied sized overall.

23. Pipes to be laid above ground

23.1 Pipes for river over crossings and fittings to be laid above ground shall be supplied lined as specified in Clause 9.18 hereof and with an external shop coat of type B (fast drying) primer as specified in Clause 9.14.1 or other primer approved by the Engineer which is compatible with the material to be subsequently used for painting.

24. Inspection and acceptance

24.1 The Contractor shall provide facilities and equipment as required by the Engineer to test the interior and exterior coating of all pipes for holidays and any defects so revealed shall be made good in a manner approved by the Engineer. Voltages applied shall be not less than 8000 V in the case of the lining and 12000 V in the case of the sheathing.

24.2 Should the coating of any pipes exhibit six or more faults as revealed in holiday detection the coating is to be stripped and the pipe recoated.

24.3 Repairs to the satisfaction of the Engineer will be allowed on these coatings having between one and five faults.

24.4 Where up to four holidays occur within a single area of 400 sq.mm these four holidays are to be taken as a single fault.

24.5 The Contractor shall provide facilities for the Engineer to carry out an adhesion test on the coating of up to 5% of the pipes. The adhesion test on the pipes shall follow the procedure for carrying out a peel test on test plates as described under Section 244 (5) in AWWA Std. C 203-66. The adhesion of the enamel coating shall be such that no peeling of the coating results from such tests. The coating shall be made good to the satisfaction of the Engineer after completion of adhesion tests. The adhesion test will be carried out over a temperature range consistent with the temperature of service conditions.

24.6 The Engineer shall have full access to all those parts of the plant that are concerned with the testing, furnishing or preparation of materials or the performance and testing of work under this specification.

24.7 The Contractor shall furnish the Engineer with reasonable facilities and space (without charge) for the inspection, testing and obtaining of such information as he desires respecting the character of material in use and the progress and manner of the work.

25. Mechanical Couplings and Flanged Adaptors

25.1 Mechanical couplings for jointing plain-ended pipes shall be of the Dresser Viking Johnson or similar type approved by the Engineer.

25.2 The thickness of the steel in both the middle ring (sleeve) and the follower rings (flanges) shall be not less than 1.6 mm thicker than the thickness of the walls of the adjoining pipes. The middle ring (sleeve) and the follower rings (flanges) shall be of such materials and dimensions that they are not stressed beyond half the yield stress of the material when the pipes connected by them are subjected to the hydrostatic test pressure stated in the Bills of Quantities.

25.3 Except where otherwise stated the middle ring (sleeve) of the coupling shall be provided with a suitable pipe stop (centre register).

25.4 The joint rings used shall be of Class `A' natural rubber in accordance with the requirements of British Standard Specification EN 681-1:1996 or other Specifications approved by the Engineer.

25.5 Flanged adaptors for jointing flanged fittings to plain ended pipes shall conform to the foregoing contents of this Clause.

25.6 Prior to the commencement of fabrication the Contractor shall submit to the Engineer for approval detailed drawings of all mechanical couplings and flanged adaptors.

25.7 All mechanical couplings and flanged adaptors shall be supplied with a shop coat of Type B (fast drying) primer as specified in Clause 9.14.1 or other primer approved by the Engineer which is compatible with the material to be subsequently used for moulding or painting.

25.8 Moulding boxes for moulding mechanical couplings shall be of cast aluminium alloy to the approval of the Engineer. They shall be of economical design sized so that the minimum clearance over any part of the coupling shall be 6 mm and also make a close fit over the external surface of the pipe sheathing and steel pad specified in Clause 9.6.2

26. Marking

26.1 The contractor shall label and clearly mark all pipes, fittings crates and boxes in indelible paint specified in the notes forming a part of this Specification.

26.2 All lettering and numbering shall be at least 50 mm high.

26.3 In addition all fittings shall be marked with the corresponding item number in the Bills of Quantities or other number specified by the Engineer.

27. Protection of Ends

27.1 The Contractor shall provide protection to the approval of the Engineer for the ends of all pipes and fittings prior to the pipes and fittings leaving the manufacturers works in order to guard effectively against damage during transit and storage and the ingress of foreign matter inside the pipes and fittings. Suitable ventilation openings shall be incorporated in all end caps.

27.2 All details of the proposed methods of providing such protection shall be submitted at the time of tendering.

28. Storing Handling and Hauling of Pipes and Fittings

28.1 Every precaution shall be taken to avoid damage to pipes and fittings. The pipes shall not be stacked more than three tiers high.

28.2 In handling pipes and fittings every care should be taken to avoid distortion, flattening denting scoring or other damage. Pipes and fittings shall not be allowed to drop or strike objects and shall be lifted or lowered from one level to another by means of approved equipment only.

28.3 When lifting pipes and fittings special lifting hooks with a curved plate to fit the curvature of the pipes or fittings shall be used. Alternatively, Webbing slings not less than 300 mm wide or other approved means shall be used. Pillows shall also be provided between securing chains or lashings when loads are being transported.

28.4 Lined and sheathed pipes and fittings shall not be handled or transported when the ambient temperature is below $5^{o}C$ unless the manufacturer of the enamel indicates otherwise.

29. Protection and Moulding of Couplings

29.1 All couplings will be protected externally after assembling with bituminous composition poured into moulds. The ends of each pipe and the inside of each coupling will be protected by coating with bituminous paste before assembly.

29.2 The Contractor shall supply all the necessary bituminous composition and paste required for this work and he shall include the details in the appropriate items of the Bills of Quantities.

29.3 All buried joint made with Johnson Flange Adaptors of flanges will be protected externally after assembly with `Denso' paste, mastic and tape wrap manufactured by Messrs. Winn & Coales or equally suitable materials to the approval of the Engineer. The paste mastic and wrapping materials shall be suitable for application in wet conditions.

The contractor shall supply all the necessary materials and shall give details of those proposed in the appropriate items in the Schedule of Particulars and Bills of Quantities.

30. Packing of Bolts, Joint Rings and Gaskets

30.1 Bolts of the same length and size (and their accompanying nuts and washers) shall be packed together in boxes not exceeding 100 kg gross weight.

30.2 Joint rings and gaskets shall be packed in boxes and separate packages shall be provided for each size and description of ring or gasket.

30.3 Each box and package therein shall be clearly labelled stating the number, size and description of the contents.

31. Couplings Stools and Pipe Saddles

31.1 The Contractor shall supply coupling stools and pipe saddles for the support of pipe above ground. The coupling shall be manufactured generally in accordance with the drawings shows in the appendices and shall where appropriate conform with the Specification Clauses relating to mechanical couplings and flanged adaptors.

31.2 Prior to the commencement of fabrication the contractor shall submit to the Engineer for approval detailed drawings of the coupling stools and pipe saddles required.

31.3 All couplings and saddles shall be supplied with a shop coat of Type B (fast drying) primes as specified in Clause 9.14.1 or other primer approved by the Engineer which is compatible with the material to be subsequently used for painting.

32. Pipes Restraining Bar

32.1 The Contractor shall supply pipe restraining bars for side welding or otherwise to pipes laid at steep gradients over ground as indicated in Appendix.

32.2 The method of fixing the bars shall be such that the internal lining of the pipe shall not be damaged. Where greater thickness of pipe wall is required to prevent damage to the lining by welding heat, the number of pipes requiring restraining bars shall have pads welded on at the time of fabrication for later fixing of the bars on site.

32.3 Prior to commencement of fabrication of the bars the Contractor shall submit detailed drawings to the Engineer for approval.

32.4 All bars shall be supplied with a shop coat of Type B (fast drying) primer as specified in Clause 9.14.1 or other primer approved by the Engineer which is compatible with the material to be subsequently used for painting.

33. Cement-Mortar Lining and Coating of Steel Pipes

33.1 As an alternative, the tenderers are requested to quote for cement-mortar lined and coated steel pipes.

33.2 Cement-Mortar lining and coating of steel pipes shall be according to AWWA Standard C 205 - 71 for Cement - Mortar protective lining and coating for steel Water Pipes - 4 in and Larger Shop applied or any other equivalent standards acceptable to the Engineer as providing equivalent or better quality of materials and workmanship.

33.3 The length of lining and coating hold back are the same as those specified for Bitumen (asphalt) lining, coating and sheathing in this section.

33.4 Wire fabric reinforcement shall be used for lining specials.

33.5 Thicknesses of lining and coating and the respective tolerances shall be those given in Table 1 and 2 of AWWA Standard C 205 - 71.

33.6 Spiral Wire reinforcement shall be used for mortar coating of pipes.

33.7 Dielectric under coat will not be necessary for coating of the pipes.

33.8 The Bidder shall state the type of curing he proposes to adopt.