

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

I : VALVES

1.0 General

1.1 *Approved makes and brand of valves*

The Contractor shall only use approved makes and brand of valves. He shall submit the list of proposed valve(s) **within two (2) weeks** of the issuance of the Letter of Award, complete with the detailed Schedule of Particulars. He shall be responsible to test and commission all valves, fittings, etc. supplied and installed by them.

1.2 *Drawings*

Typical Drawings are presented in the Schedule of Particulars.

Detailed engineering shop drawings **MUST BE** issued by the Contractor before manufacture/fabrication. The Contractor shall prepare any additional drawings, which the Contractor requires to interpret the Drawings for the use of his employee.

The Contractor shall be responsible for any discrepancies, errors or omissions in the Drawings or other particulars supplied by him, whether such Drawings or particulars have been approved by the S.O. or not.

1.2.1 Drawings to be provided by the Contractor.

1.2.1.1 Tender Drawings

The Contractor shall submit with his tender two (2) copies of typical cross-section drawings showing the salient features of the valves and fittings offered together with sufficient details to enable the general arrangement of the valves to be determined.

All drawings submitted by the Contractor with his tender shall be listed in the **Schedule C of the Schedule of Particulars**.

1.2.1.2 Approved Drawings

Within four (4) weeks of the Contract being awarded, the Contractor shall submit for approval to the S.O. the following shop drawings with the manufacturer's endorsement in triplicate:

- (i) Dimensioned drawings of each valve, which shall include details of each component, and shall show the grade and materials of construction of each component;
- (ii) Diagrams of connections for each type of electrical equipment together with a comprehensive wiring diagram showing all connections between the various items of equipment. The terminal lettering on the diagrams shall correspond to the terminal makings to be used on the equipment;
- (iii) All details drawings necessary to enable the S.O. to provide to other Contractor with details such as interconnecting cables, cable terminations, foundations and bolt holes.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

- (iv) All detail drawings showing the installation of the valves and actuators where the installation works is being carried out the Contractor.

The Contractor shall make such changes to the drawings as the S.O. may require and shall resubmit the amended drawings to the S.O. for approval. These drawings and any additional detailed drawing as the S.O. may require from time to time shall become the **Approved Drawings** to be used for the manufacture and supply of the Goods. The Contractor shall provide additional set(s) of the Approved Drawings as the S.O. may require, without additional charge.

Unless specific instructions are given by the S.O. in writing, no drawings other than Approved Drawings or drawings issued by the S.O. shall be used for the performance of the Contractor's obligations under the Contract.

Within 1 month of the despatch of any item of the Goods, the Contractor shall supply for record purposes **six (6) bound complete sets of the Manufactured Drawings** amended as necessary to show the Goods as manufactured.

After completion of installation, **As-Built Drawings** for installation works shall be submitted **within one (1) month** of the completion of the Works.

Drawing format:

All drawings at each stage shall be submitted in the following formats:-

- **Approved Drawings:** Five (5) sets in paper prints (A3 size);
- **Manufactured Drawings:** Six (6) sets in paper prints (A3 size);
- **As-Built Drawings:** Six (6) sets in paper prints (A3 size); and three (3) sets in CD-ROM.
- All drawings must be signed and duly endorsed.

1.3 Manufacturing Report and Instruction Manuals

The Contractor shall supply **six (6) bound copies of the Manufacturing Report and Instruction Manuals** to the S.O. on or before delivery of the Goods.

The **Manufacturing Report** shall provide a detailed description of the manufacturing process, the raw materials used, test on raw materials, the standard and method of manufacture, the tests employed at every stage of the manufacturing process in particular ISO Quality Assurance, Internal Quality Control, type of paint, test on completed paintwork, etc. The quality of the product shall not be less than the minimum quality as approved by the S.O. In case of non-compliance, the Goods shall be rejected without payment and the S.O. will not entertain any further requests.

The **Instruction Manuals** shall include the full description of the Goods supplied, state requirements for the handling and storage of the Goods from the date of acceptance to installation and give step by step procedures to assemble and erect the Goods and the S.O. to carry out any operations likely to be required during the life of the Goods, including installation, commissioning, testing, operation, maintenance, dismantling and repairs. The Instruction Manuals shall be approved in draft form by the S.O. before printed in its final form.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

Maintenance instructions shall include charts showing lubrication, checking, testing and replacement procedures to be carried out weekly, monthly and at longer intervals to ensure trouble-free operations. Where applicable, fault location charts shall be included to facilitate finding the cause of imperfect operation or breakdown.

The manuals shall contain detailed descriptions of the construction and operation of the Goods with enlarged diagrams, lists of parts and procedures for ordering spares.

If in the opinion of the S.O. the information supplied is insufficient, the Contractor shall supply further information as required. The manuals shall be printed in A4 size sheets and suitably indexed and bound. A collection of manufacturer's descriptive leaflets alone **will not** be acceptable.

1.4 Quality Assurance

Within **fourteen (14) days** of the Letter of Acceptance, the Contractor shall produce and submit to the S.O. for comment an outline Quality Assurance Plan. Within **fourteen (14) days** thereafter, the Contractor shall submit to the S.O. for approval a detailed Quality Assurance Plan that shall take proper account of the S.O.'s comments on the outline Quality Assurance Plan.

The approval by the S.O. of such Plan shall not relieve the Contractor of any of his duties or responsibilities under the Contract. The Contractor shall implement the quality assurance procedures in the **Approved Quality Assurance Plan**. The Quality Assurance Plan shall set out the specific quality procedures, practices, resources and sequence of activities to meet the requirements of the Conditions of Contract and Specifications and shall include but not limited to:

- i. Contractor's quality statement
- ii. Contractor's organisation structures including quality control organisation
- iii. Contractor's quality procedures
- iv. Principal staff
- v. Contractor's plant
- vi. Manufacturing and delivery programme
- vii. Progress reports
- viii. Contractor's design procedures
- ix. Contractor's method statement, including transportation and handling of materials
- x. Contractor's method statement during installation
- xi. Verification, testing, and reporting procedures for design, equipment, materials and workmanship in the office, factory or on site
- xii. Document Control
- xiii. Health, safety and security
- xiv. Internal quality control
- xv. Interim measurements and payment
- xvi. Final measurement

The Plan shall include organisation charts illustrating the main tasks and their sub-division, the reporting structure and;

- i. Interface between the Contractor and the S.O.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

- ii. interface within the Contractor's internal project team
- iii. Contractor's internal quality management arrangement including quality assurance and auditing personnel.

The Contractor shall submit and receive approval of the Quality Assurance Plan before starting manufacture of the Goods. The S.O. shall audit the Contractor's quality plan and its implementation. The Contractor shall submit a partial Quality Assurance Plan to the S.O. to cover any work the Contractor will carry out **within fourteen (14) days** from the date of the Letter of Acceptance. The Contractor shall not be entitled to commence the manufacturing of the Goods prior to receipt of the S.O. approval of the Quality Assurance Plan for that part. The S.O. may at his sole discretion, reject any of the works which in his opinion have not been executed in accordance with the Quality Assurance Plan and the Contractor shall re-execute at his own cost and without any entitlement to any extension of time all such parts of the Works so rejected.

The Contractor shall adhere to the principles and procedures contained in the Approved Quality Assurance Plan and any amendment or supplement thereof.

The Contractor shall deliver the goods by the dates and in the order of priority as he shall have ascertained from the S.O. and included in the programme of delivery.

1.5 Notice of Deliveries

The Contractor shall notify the S.O. of the delivery date of each consignment **at least two (2) weeks in advance**, and seek his instruction as to the point(s) of unloading. Every consignment shall be accompanied by a detailed delivery note including the numbers of each valve, fitting and/or actuator itemised as in the Bill of Quantities.

1.6 Marking

All valves shall bear the following marks on the outside of the valves:

- (a) The Manufacturer's distinguishing mark, manufacturing standard
- (b) The diameter (mm) and weight (kg).
- (c) The serial number and/on item number associated with the Bill of Quantities.
- (d) The pressure rating (PN)
- (e) Loading and duty at, which the valve has been designed to operate

Apart from all these markings, a bronze plate engraved with the word "SYABAS" (50mm high) shall also be tied to each valve.

1.7 Inspection

All Goods to be supplied under the Contract shall be inspected by the S.O., the Engineer or their appointed representative at the Contractor's premises or at the places of manufacture, if manufactured at other premises.

The Contractor shall provide such office facilities, assistance, labour, materials, electricity supply, fuel, stores, apparatus and instruments including X-ray or gamma ray equipment, as may be necessary to allow a thorough and extensive inspection to be carried out.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

The S.O., the Engineer or their appointed representative shall be entitled at all times during manufacture to inspect, examine and test on the Contractor's premises or at the places of manufacture if manufactured at other premises, the materials and workmanship

of the Goods. Such inspection, examination or testing shall not relieve the Contractor from any of his obligations under the Contract.

1.8 Delivery, Install and Commission

The Contractor shall deliver to and unload all the Goods at the site or at a designated storage yard as instructed by the S.O., where the Goods will be examined, inspected and re-tested by the S.O., the Engineer or their appointed representative. Any endorsement by the S.O.'s Representative on any delivery order issued by the Contractor's transporting agent shall not be taken to mean acceptance of the Goods.

The Contractor shall provide and be responsible for all labour, plant and equipment and packing necessary including the provision of padded timber support, wedges, hessians or straw for off loading the goods from the transport lorries and stacking them in an orderly and safe manner along with sufficient protection of the Goods from the time of storage up to the time of the installation to the satisfaction of the S.O. and/or the Engineer.

Any of the Goods found on delivery at the Site to be faulty or damaged will not be taken over and shall be repaired or replaced by the Contractor at his own cost, as directed by the S.O.. In this respect, the Contractor, or his authorised representative shall be present on Site and storage yard during the deliveries and subsequent inspection, if necessary.

The Contractor shall plan, make all necessary arrangement(s), provide manpower, specials and fittings, lighting for night work, barricades and blinking lights for work along busy roads, apply for work permits with the Local Authorities, pay for such permits, remove and dismantle the old valve, make preparations of pipe ends and join with the new valve, commission the works to the satisfaction of the S.O.. The rates quoted shall include the Contractor's profit, derived from the sale of the damaged or old valve.

The acceptance and/or taking over the Goods by the S.O. shall be subject to the testing and commissioning specified in the Specification.

1.9 Site Conditions

The climatic conditions in Malaysia are generally hot, humid and tropical with maximum air temperature in the shade exceeding 35°C and relative humidity frequently reaching 98%. The Contractor shall take due considerations of the climatic conditions in the design, transportation and storage of the Goods during the entire course of the works and working life of the Goods.

1.10 Valve Agent

The Contractor shall assign a competent Valve Agent and such assistants as may be necessary who must be capable of receiving instructions in Bahasa Malaysia and English.

The Valve Agent shall co-ordinate all submission until approval; co-ordinate the whole stage of design, manufacture, shipping, delivery, installation, testing, commissioning,

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

prepare payment claims, settle any claims with regards to the Work, until issuance of the Certificate of Making Good Defects and Final Accounts.

Any directions, explanations or instructions given to such Valve Agent by the S.O. shall be deemed to have been given to the Contractor. Should the Contractor fail to provide such Valve Agent, the S.O. shall appoint others as Valve Agent and all wages and other expenses in connection with such employment shall be deducted from any monies due to the Contractor.

2.0 Material and workmanship

2.1 Standards and Codes of Practice

The following Standards and Codes of Practice are referred to in this Specification. The Standards or Codes shall be the latest edition current at the time of the preparation unless otherwise specified for particular application.

JKR Specification

- (1) 20200-0043-99 JKR Standard Specification for Ductile Iron Air Valves
- (2) 20200-0050-99 JKR Standard Specification for Butterfly Valves
- (3) 20200-0083-00 JKR Standard Specification for Ductile Iron Type B Gate (Sluice) Valves for Waterworks Purposes (DN 50 to DN 600)
- (4) BS 5163:1986 Predominantly key-operated cast iron gate valves for water works purposes (part superseded by JKR specification)
- (5) BS 5150:1990 Cast iron gate valves (part superseded by JKR specification)
- (6) BS 4504:1989 Circular flanges for pipes, valves and fittings (PN designated)
- (7) BS5155:1984 (1991) Specification for butterfly valves (part superseded by JKR specification)
- (8) BS 5840:Part 1 Valve mating details for actuator operation.
Specification for flange dimensions and characteristics testing of valves
- (9) BS 6755:Part 1:1986 Specification for production pressure testing requirements
- (10) BS 1452:1990 Specification for flake graphite cast iron
- (11) BS 2789:1985 Specification for spheroidal graphite or nodular graphite cast iron
- (12) BS 970 Specification for wrought steels for mechanical and allied employering purposes
BS970:Part 1(1991) General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels
- (13) BS 1504:1984 Specification for steel castings for pressure purposes
- (14) BS 3100:1991 Specification for steel castings for general employering purposes
- (15) BS 1400:1985 Specification for copper alloy ingots and copper alloy and high conductivity copper castings

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

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| (16) BS 2872:1989 | Specification for copper and copper alloy forging stock and forgings |
| (17) BS 2874:1986 | Specification for copper and copper alloy rods and sections (other than forging stock) |
| (18) BS 4164:1967 | Specification for coal tar based hot applied coating materials for protecting iron and steel including suitable primers where required |
| (19) BS 2494:1990 | Specification for elastomeric joint rings for pipe work and pipelines |
| (20) BS 6920:1988 | Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of water; |
| Part 1 | Specification |
| Part 2 | Method of test |
| (21) MS 672 : 1999 | Specification of Rubber Seals in Water Supply, Drainage and Sewerage Pipelines (1 st revision) |

2.2 **Materials**

The term 'materials' shall mean all materials and articles of every kind whether raw, processed or manufactured to be supplied by the Contractor for the manufacture of the Goods. Except as may be otherwise specified for particular parts of the Goods, the provisions in this section of the Specification shall apply to materials and workmanship for any part of the Goods.

All materials other than natural or pre-treated materials shall be new and of the kinds and qualities described in the Contract and shall at least be equal to approved samples.

As soon as practicable after receiving the order to commence the manufacture of the Goods, the Contractor shall inform the S.O. of the names of the suppliers from whom he proposes to obtain any materials, but he shall not place any order, without the approval of the S.O. which may be withheld until samples have been submitted and satisfactorily tested. The Contractor shall thereafter keep the S.O. informed of orders for and delivery dates of all materials.

Materials shall be transported, handled and stored in such a manner as to prevent deterioration, distortion, damage or contamination.

2.3 **Samples and Test on Samples**

Pursuant to the Conditions of Contract, the Contractor shall submit samples of such Goods as may be required by the S.O. and shall carry out the specified tests directed by the S.O. at the place of manufacture of the Goods or at a laboratory approved by the S.O..

Samples shall be submitted and test be carried out sufficiently early to enable further samples to be submitted and tested if required by the S.O.. The Contractor shall prepare the necessary test pieces and supply all labour, appliance, testing apparatus and everything necessary for the carrying out of all the specified tests.

The cost of the samples and of conducting all specified tests on the samples shall be included in the Contract Rates.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

Approval by the S.O. as to the placing of orders for materials, Goods or as to samples or tests shall not prejudice any of the S.O.'s power under the Contract nor relieve the Contractor of any of his obligations under the Contract.

The S.O., the Engineer or their representatives will inspect and examine the Goods and witness the test on the Goods at the Contractor's premises in accordance with the requirements of the Specification and the relevant standards.

2.4 Test Certificates

Certificates in duplicate shall be provided by the Contractor giving the process of manufacture and the results of the specified tests as and when requested by the S.O.

Similar certificates in duplicate shall be provided by the Contractor in respect of materials to be used in the manufacture of the Goods giving the process of manufacture, chemical analysis (where relevant) and the results of the specified tests. The material shall be suitably marked to enable it to be identified from reference on the certificates.

No materials subject to test shall be incorporated in the manufacture of the Goods until a satisfactory test certificate has been received and approved by the S.O.

In case of any items which have not been inspected at the manufacturer's works, the Contractor shall obtain from the Manufacturer and supply to the S.O. certificates signed by the Manufacturer giving the results of the tests as carried out and certifying that the items have been manufactured in accordance with this Specification.

2.5 Independent and Local Tests

The S.O. reserves the right to carry out any independent tests he may deem fit on the completed goods or any material supplied under the Contract, at any state of manufacture or delivery.

Any samples of materials which may be required for such tests shall be provided by the Contractor at no extra cost to the Contract.

Inspection may be undertaken at the manufacturer's works or at such other locations as specified/required by the S.O.

All facilities and test equipment, which may be required by the S.O., shall be provided at the Contractor's expense.

Any materials, workmanship or completed Goods, which are shown to be not in accordance with the Specification by such independent test shall be rejected, notwithstanding any previous certificate which may have been provided in accordance with Clause 2.5 of the Specifications.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

2.6 *Testing Facilities*

The Contractor shall at his own expense arrange with the suppliers or manufacturers to supply the necessary gauges and prepare all test pieces and supply all labour and apparatus for testing which may be required by the S.O., the Engineer or their representatives for carrying out the tests to requirements of this Specification at the Contractor's premises or at the place of manufacture, and shall also provide all test pieces required.

If the Contractor shall fail to perform any of the foregoing obligations, the S.O. shall be at liberty to perform the said obligations or any of them, which the Contractor has failed to perform, either at the Contractor's premises, places of manufacture or elsewhere and charge the costs and expenses thereof to the Contractor.

2.7 *Certificate of Quality and Warranty*

With every consignment of Goods delivered under this Contract, the Contractor shall furnish a signed certificate in each case and worded as follows.

The manufacturer shall provide a **10-years written warranty** in a form to be acceptable by the S.O.

"This is to certify that the quality of the Goods delivered in the consignment is not inferior to the quality laid down in the Specification. It is warranted that all Goods supplied are new and unused."

The installing Contractor shall provide a **5-years written warranty** as follows:-

"We warranty that we have taken the utmost care in installing the valve, fittings, etc. equivalent to or higher than the standard required in this Specification. We shall provide FREE inspection, advise, maintenance and repairs should the installed Goods fail in any way."

No payment will be made in respect of any consignment not accompanied by such certificate.

2.8 *Rejected Materials*

Any materials delivered to the Site, which have been rejected by the S.O., the Engineer or their representatives shall **IMMEDIATELY** be removed from the Site.

Any Goods or materials, which have been rejected shall be marked in a distinctive manner which will preclude any possibility of their use for the purposes of the Contract.

Such Goods may be submitted for re-test following the correction of any defects, where such correction is permitted, subject to the approval of the S.O.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

3.0 REQUIREMENT

3.1 GENERAL REQUIREMENTS

3.1.1 Materials

The valves, fittings and actuators ('Goods') shall be manufactured from materials specified in the clauses appropriate to the particular item. Where the material to be used has not been laid down in this Specification, the Contractor shall use only those materials in such compositions as have been proved in actual service to be the most suitable for the particular purpose.

All castings shall be reasonably smooth and free from flaws and defects. The valve trims including pins, spindles and face rings, etc, shall be of corrosion resistant metals and such parts that may show signs of corrosion or wear at the end of the Defects Liability Period shall be replaced at no extra cost to the Contract or where allowed by the S.O., replaced by non-corrodible material of special quality at the Contractor's expense. Care shall be exercised in the selection of various types of metals for use in the valves to reduce the effects of bi-metallic corrosion to the minimum.

Clauses on materials, standards, samples, tests and testing facilities under **Section 3.2** of the Specification shall be applicable where appropriate.

3.1.2 Grade of Materials

Materials used shall be of a quality not inferior to the following :-

Ductile Iron	-	BS 2789/BS EN1563 (Grade 500/7)
Stainless	-	BS 970 Grade 316S16 and Grade 304S31 (in some cases only)
Cast Steel	-	Plain carbon steel to BS 1504-161; Grade 430 BS 3100 Steel A1
Gunmetal	-	BS 1400 Designation LG2
High Tensile Brass-		BS 2872 CP114; Grade CZ114/CZ116
Phosphor Bronze	-	BS 2870

3.1.3 Design

The Contractor shall design the valves to the S.O.'s satisfaction and in accordance with the Specification. The design shall be in accordance with the best modern practice and shall be such as will facilitate inspection, cleaning, lubrication and repair to ensure satisfactory operation under all service conditions.

The Goods may be of the Contractor's standard design provided that such design is generally in accordance with the Specification.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

Approval by the S.O. of the Contractor's design or drawings shall not relieve the Contractor or any of his obligations or liabilities under the Contract except in so far as is provided for by the Conditions of Contract.

3.1.4 Castings

The structure of castings shall be homogeneous and free from non-metallic inclusions and other injurious defects. All castings shall be close-grained, sound, smooth, symmetrical and shall be carefully cleaned and dressed off. No stopping or plugging will be permitted in the case of holes or flaws appearing therein, and casting shall be made from first running.

If any casting should prove defective, the S.O. shall have the power to reject it and the Contractor shall replace it at no extra expense to the Contract.

3.1.5 Forgings

All major stress bearing forgings shall be made to a standard specification, which shall be submitted if required to the S.O. for approval before work is commenced. Forgings shall be subjected to non-destructive tests to detect flaws if any. Forgings shall be heat treated for the relief of residual stresses. The name of the maker and particulars of the heat treatment proposed for each such forging shall be submitted to the S.O.. The S.O., the Engineer or their representatives may inspect such forgings at the place of manufacture with a representative of the Contractor.

3.1.6 Workmanship and finish

Workmanship and general finish shall be of first class commercial quality and in accordance with best workshop practice.

All parts, which can be worn or damaged by dust shall be totally enclosed in dust proof housings.

3.1.7 Lubrication

The Contractor shall submit full details of the method of lubrication to be employed for Goods to be supplied under the Contract. The Contractor shall supply all necessary lubricating equipment, including sufficient grease and other lubricants of each required grade for setting valves to work and the cost of this shall be deemed to have been included by the Contractor in the Contract rates.

3.1.8 Protection against climatic conditions

The valves supplied shall be of the appropriate grade and quality and shall be adequately protected against the climatic conditions at the Site. The Contractor shall take these conditions into account in deciding what grade, quality and protection is required. Any valves which are found to be unsuitable for use under these conditions shall be removed and replaced by a suitable one by the Contractor at no extra expense to the S.O..

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

Valve bodies, surface boxes and all other castings shall be coated in accordance with **Section 3.2.4** for tropical conditions. Machined surfaces shall be covered by a suitable rust inhibitor, such as a high melting point grease of approved quality.

All submerged moving parts, or the pins, spindles and faces, etc in contact with them, shall be of non-corrodible materials. Any parts that show signs of corrosion or wear during the Period of Defects Liability shall be replaced by non-corrodible material of special quality for the purpose at no extra expense to the S.O.. Care shall be exercised in the choice of metals for use in the Goods to reduce the effects of bi-metallic corrosion to a minimum. The foregoing shall apply also to the moving parts exposed to the weather.

3.1.9 Inspection

All Goods shall be inspected by the S.O., the Engineer or their representatives at the Contractor's premises or at the place of manufacture. The Contractor shall provide such office facilities, assistance, labour, materials, apparatus and instruments as may be necessary to allow a thorough and extensive inspection to be carried out.

The S.O. shall have free access to the Contractor's plant or the manufacturer's works at all reasonable times, and shall be at liberty to inspect the manufacture of the Goods and component parts at all stages. The charging of cupolas, melting, drawing off, conveying and pouring of all metals shall be carried out in such a manner and at such time or times that the S.O. desire to see that the work is carried out in accordance with this Specifications, particularly but not limiting the following requirements/ conditions:

- (a) The manufacture of the Goods and component parts at all stages shall be inspected and if found defective or inferior in quality to, or differing in form or material, from the requirements of the Contract, may be rejected. The whole of any consignment may be rejected if any of the Goods, or component part is found not to conform in every respect to the requirements of the Contract.
- (b) The Contractor shall, if called upon to do so, obtain the S.O.'s approval of the manner in which the Contractor proposes to supply the Goods shall furnish such drawings and information as the S.O. may require.
- (c) The Contractor shall notify the S.O. in advance of the date on which any of the component parts, or Goods are ready for inspection.
- (d) The S.O. shall not be required to sign any form of waiver or indemnity concerning his presence or actions at the place of inspection.
- (e) If any of the items, whether completed or in course of production, are rejected by the S.O., they shall be marked or segregated in such manner satisfactory to the S.O. as to ensure their subsequent identification as rejected work.
- (f) When independent tests and analyses, in addition to those made by the S.O. at the Contractor's or manufacturer's premises, are considered necessary by the S.O., such tests, or analyses will be made by persons appointed by the S.O.. The Contractor shall bear the cost of supply and carriage of samples and in addition where the results of such tests or analyses show that the items are not in accordance with the Specification, the cost of such tests or analyses.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

- (g) The Contractor shall not deliver any of the Goods or report them as ready for delivery until the S.O. shall have given his consent.
- (h) The inspection, examination or testing including the approval of the Goods by the S.O. shall not release the Contractor from any of his obligations and liabilities under the Contract.

The Contractor shall allow in his rates, where applicable and related expenses for inspection of valves by the S.O..

3.1.10 Protection against damage during transit

All Goods shall be securely packed in crates or boxes for protection against damage during transit. Valves of 450mm diameter and above shall be individually crated, battened and bound with steel strip.

Flanges of valves shall be protected by wooden discs temporarily bolted on or secured by steel strapping. Spindle caps of sluice valves shall be removed and secured to the inner side of one of the wooden discs by means of a steel strip. Otherwise they shall be packed in a case. The projecting end of the spindle shall be well wrapped with straw rope covered by hessian cloth and secured in place by binding wire, which shall be carried under the flange of the gland.

All plain ends shall be adequately protected by straw rope secured in place by binding wire or strap. None of the packing will be returnable. The cost of packing shall be included in the Contract rates.

3.1.11 Identification plates and labels

Each main and auxiliary item of the Goods shall, unless otherwise, specified, have permanently attached to it in a conspicuous position an identification plate of weather-resistant material on which are engraved or stamped the Manufacturer's name, service rating, loading and duty at which the item of valves has been designed to operate, serial number, weight and reference number as specified.

Additionally, each item shall have marked upon its body in raised letters the manufacturer's name, service rating, year of manufacturer and size of the Goods.

Details of proposed inscriptions shall be submitted to S.O. for approval before any labels are manufactured.

3.2 Valves, Fitting and Actuators

3.2.1 General

All valves shall be designed to avoid cavitation and vibration in all positions, to minimize head loss in the open position and to seal the water passage completely when shut. All operating spindles and gears shall be provided with adequate points for lubrication. Unless otherwise specified, all valves shall be closed in a clockwise direction. Lifting lugs shall be provided for valves of sizes 600mm and above.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

Head loss curves through the valves for throttled flow conditions shall be provided for all valve sizes.

All protective coatings shall be non-toxic and shall not foster microbiological growth nor impart any odour, taste, cloudiness or discoloration to the water.

After installation, the external surfaces shall be painted with two coats of cold applied high solid liquid epoxy to AWWA C210-84. **The minimum dry finished thickness shall not be less than 350 micron.**

The Contractor shall take note that all valves will normally be installed with one end fixed and the other end to a flexible joints either a flange adaptor or mechanical coupling joint. **Unless otherwise stated, all valves shall be double flanged.**

Unless otherwise specified, the bodies and discs of sluice valves, butterfly valves, and non-return valves shall be manufactured from **ductile iron to BS 2789/BS EN 1563 Grade 500/7.**

3.2.2 Flanges

All valves are to be installed on steel pipes with flange details as per BS 4504. All flanges shall be cast integral with the valve, add-on flanges by other means is not acceptable.

All valve flanges shall be designed to withstand the stresses of the valve ratings. They shall be at right angles to and concentric with the bore axes. They shall be of the raised face type, truly faced over their whole width and drilled in accordance with BS 4504 to match with the flanges for the steel pipes. Bolthole shall be drilled off centre lines and shall be truly in line end to end with the longitudinal axis.

3.2.3 Works Test

After completion of assembly each valve shall be shop operated from the fully open position to the fully closed position and return to fully open under no flow condition to demonstrate that the assembly is working smoothly. The torque required on each valve shall be ascertained. Where electric motor actuators are provided, the complete assembly of valve and actuator shall be tested.

All valves shall be hydrostatically tested at the place of manufacture to the pressures specified and shall satisfactorily pass the specified tests before they are packed for delivery.

All valves shall be body tested to one and a half (1 ½) times the valve rating pressure. Seat tests to 1.1 times the valve rating pressure and shall be carried out on all valves.

All valves shall be subjected to "open end" test in accordance with B.S. 5163 and each valve shall be subjected to separate hydrostatic tests as follows:-

(a) **Seat tests**

The tightness of seats shall be tested as follows:-

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

- (i) with the wedge or disc closed and with the valve fixed at one end only and the other end free, the test pressure shall be applied to that face of the wedge or disc, the other face being at atmospheric pressure. There shall be no visible leakage past the wedge or disc at the hydrostatic test pressure (gauge) specified;
- (ii) The above procedure shall be repeated but with the valve fixed at the other end and with the pressure applied to that end of the valve.

(b) **Body test**

With the wedge or disc open the test pressure (gauge) specified shall be applied to the whole body of the valve. There shall be no visible leakage through the body, the flanged joint or the valve packing gland nor shall any part be permanently deformed.

The test durations for all tests shall be as in the table below:-

Nominal Diameter (mm)	Minimum test duration (minutes) for	
	Body	Seat
Up to and including 150	1	1
200 to 300	3	2
350 and above	5	3

- (c) The S.O. requires the Contractor to comply with the following additional tests, as per JKR Standard Specification (JKR 20200-0083-00):-

- **Strength Test (Type B gate valve)**

The valve shall be arranged that one end is pressurised to produce a differential pressure on the disc equivalent to the maximum permissible working pressure of the valve. The minimum strength test torque as specified in Table 8 JKR 20200-0083-00 shall then be applied gradually to the top end of the valve stem in the fully closed position, in order to test the strength of the valve component.

The test shall be repeated with the valve in the open position. During the strength test, the test pressure shall be maintained.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

- **Functional Test**

The valve shall be fully opened and then closed, using the same number of turns, as specified in the Schedule of Particulars, with a torque not exceeding the maximum functional test torque during any time in its travel.

Then the test shall be repeated in the closed position.

- **Durability test** (for elastomer on the wedge or for resilient seated valve)

The valve shall be fully closed and subjected to the working pressure of the valve. Then, it is opened to 1/3 of the fully open position and fully closed again. Each closure is considered as one cycle.

Each valve shall be subjected to 50 cycles whilst the working pressure of the valve is maintained.

After the durability test, the elastomer shall be inspected to ensure no visual cracks, tear or chipping off.

- (d) A test certificate must be supplied with each valve. It shall contain a statement by the manufacturer confirming that the valve has been tested, the test results, the standard adopted, pressures used, test medium and duly signed by an authorized personnel. The serial number on the certificate shall be the same as on the valve.

The cost of these additional tests shall be included in the Contract rates for factory testing.

3.2.4 Surface Preparation/Protective Coating

All protective coatings shall be non-toxic, potable water compatible and shall not foster micro biological growth nor impart any odour taste, cloudiness or discoloration to the water.

All internal and external parts of the ductile iron valves shall undergo the necessary surface preparation for polymeric coating purposes. Bituminous coating is not allowed. Either one of the following polymeric coatings is acceptable:

- for coating using either fusion-bonded epoxy powder or polyamide 11 (RISLAN) materials, the coating thickness shall not be less than 250 μ m for fusion bonded polyamide 11 or not less than 350 μ m for fusion bonded epoxy as specified in AS/NZ 4158.1 Part 1.
- for coating using cold applied high solid liquid epoxy (solvent or solventless) which meet the requirement of AWWA C210-84, the coating thickness shall not less than 350 μ m.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

3.2.5 Sluice Valves (Gate Valves) Type B

3.2.5.1 General Description

- (a) All gate valves shall be of **resilient seat (50mm to 300mm); metal seat (350mm to 600mm), Type B**, PN 16(bar) rating (unless otherwise specified), cap operation with non-rising spindle/stem, conforming to JKR Specification 20200-0083-00: JKR Standard Specification for Double Flanged Ductile Iron Type B Gate Valve for Waterworks Purposes and BS 5163:1986 or better. The range of valve sizes covered is DN50 to DN600.
- (b) All gate valves of 300mm dia. and up to 600mm dia. shall be supplied complete with spur gearing. Where gear box is specified, the status of the valve open/close position shall be provided.
- (c) It shall be closed by turning the key or hand wheel in a "clockwise" direction when facing the top of the valve.
- (d) All flanges and boltings shall comply with BS4504 or BS EN 1092-2: 1997.
- (e) A schedule of component and material are attached in **Table 1**.

3.2.5.2 Materials and Designs

- (a) **Ductile iron** conforming to BS 2789/BS EN 1563 with **Grade 500/7** for the following:
 - (i) Body
 - (ii) Bonnet
 - (iii) Stuffing Box
 - (iv) Grand/Seal housing
 - (v) Wedge
 - (vi) Cap/Handwheel/ torque limiting/stem cap
- (b) Spindle shall be of stainless steel 431S29 conforming to BS 970. The spindle shall be of the inside screw non-rising type and shall have machined square or ACME threads. It shall be truly circular throughout and be of such length that when the valve is closed, the bottom end of the spindle engages fully in the spindle nut. The spindle collar or thrust plate shall be concentric and machined, suitable for the specified test pressure to provide stem guidance and low friction bearing on opening and closing torque.
- (c) Stem nut and wedge ring/body (not applicable for resilient seat) shall be of gunmetal LG2 conforming to BS 1400 or stainless steel 431S29 or 304S31 conforming to BS 970.
- (d) **Dust seal/excluder and spindle seal** shall be of rubber O-ring made of EPDM or Nitrile conforming to MS 672:99 or AS1646:92. **Stuffing box and bonnet gasket** shall be not less 3mm thick gasket made of EPDM or Nitrile conforming to MS 672:99 or AS1646:92 with 66-75 IRHD. **Gland Packing** shall be of asbestos free teflon braided packing or rubber O-ring made of EPDM or Nitrile conforming to MS 672:99 or AS 1646.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

- (e) The wedge for resilient seat shall be vulcanised with rubber made of EPDM or Nitrile conforming to MS 672:99 or AS 1646:92. The entire wedge gate shall form an axial and butt seal against the valve body, giving a tight shut-off at all pressures up to the full rating or the required test pressure. The method of butt sealing at the bottom of the wedge shall give smooth straight-through bore in the body without seating recess.

The valve shall be designed so that the gate may be removed without removing the body from the connecting pipe work. The gate guides shall be cast integrally with the valve body and be of adequate strength and of sufficient length to guide the gate throughout their full travel. In the fully open position, the gate shall be withdrawn well clear of the flow stream and the spindle shall not protrude into the bore of the valve.

- (f) Seal cartridge shall be of gunmetal LG2 of BS 2872 or acetal resin.
- (g) Bolts, nuts, washers and setscrews shall be of stainless steel 316S16 for corrosion resistance for the following:
- | | |
|----------------------------------|---------------------------|
| (i) Hand wheel setscrew & washer | (ii) spindle cap setscrew |
| (iii) Gland bolts & nuts | (iv) Bonnet bolts & nuts |
- (h) The valves will normally be installed in concrete chambers approximately 3 to 4 metres below the ground level and as such the gears and bearings shall be protected by suitable water-tight enclosures permanently packed with grease. The gearing assemblies shall be enclosed in boxes of corrosion resistant material.
- (i) Ductile iron caps shall be supplied to fit the spindles or operating gears for all the valves and these shall be secured by brass set screws with the direction of closing indicated on the caps.
- (j) Opening closing indicators shall be provided and mounted on all valves.
- (k) An identification plate marking the serial no. of the valve, dimension, type of valve, etc. shall be permanently attached to the valve body.

SYABAS' STANDARD SPECIFICATION FOR PIPE LAYING WOKS

First Edition : May 2007

ITEM	COMPONENTS	MATERIAL	GRADE	STANDARD
1	Handwheel setscrew & washer	Stainless steel	304S31	BS 970
2	(Stem cap setscrew)	Stainless steel	304S31	BS 970
3	Handwheel	Ductile iron	500/7	BS 2789 or BS EN1563
4	(Stem cap)	Ductile iron	500/7	BS 2789 or BS EN1563
5	Gland	Ductile iron	500/7	BS 2789 or BS EN1563
6	Gland bolts & nuts	Stainless steel	304S31	BS 970
7	Gland packing	Asbestos free teflon braided packing Or Rubber O-Ring	- Nitrile or EPDM	- MS 672 : 1999 or AS 1646 : 1992
8	Stuffing box	Ductile iron	500/7	BS 2789
9	Stuffing box gasket (3mm thick) (min)	Rubber	Nitrile or EPDM (66-75 IRHD hardness)	MS 672
10	Stem/Spindle	High tensile brass Or Stainless steel	CZ116, CZ114 431S29	BS 2872/BS 2874 BS 970
11	Bonnet	Ductile iron	500/7	BS 2789
12	Bonnet bolts & nuts	Stainless steel	304S31	BS 970 : Part 4
13	Bonnet gasket (3mm thick) (min)	Rubber	Nitrile or EPDM (66-75 IRHD hardness)	MS 672
14	Stem nut/Spindle nut	Gunmetal Or Stainless steel	LG2 431S29 or 304S31	BS 1400 BS 970
15	Wedge ring/Body ring (not applicable for resilient seating)	Gunmetal Or Stainless steel	LG2 316	BS 1400 BS 970 : Part 4
16	Wedge	Ductile iron (400mm dia. only) Or Ductile iron vulcanized with rubber	500/7 Nitrile or EPDM	BS 2789 MS 672 : 1999 or AS 1646 : 1992
17	Body	Ductile iron	500/7	BS 2789
18	Dust seal/excluder	Rubber O-ring	Nitrile or EPDM	MS 672 : 1999
19	Seal cartridge	Gunmetal/acetal resin	LG2	BS 2872
20	Stem seal/Spindle seal	Rubber O-ring	Nitrile or EPDM	MS 672 : 1999

Table 1 : Components and materials for sluice valve

3.2.5.3 Test and Inspection

- (a) All sluice valves shall be Works Tested in accordance to **Clause 3.2.3** and site tested where deemed necessary.
- (b) Durability test for elastomer on the wedge of the resilient seated valves shall be tested in accordance to **JKR Specification 20200-0083-00**.
- (c) A test certificate shall be issued for each valve tested with details of the standard, pressures used, type of tests conducted, medium used, duration of tests, serial number of valve, date of tests, certified by a qualified tester, etc.

3.2.5.4 Mandatory Marking

Each valve shall be clearly marked on the body (this marking shall be integral with the body of the valve) with the following information:-

- (a) Nominal diameter (i.e. DN.....)
- (b) Pressure rating (i.e. PN.....).
- (c) Manufacturer's name or trade mark.
- (d) The relevant Standard (i.e. Specification JKR/20200-0083-00 or BS 5163)
- (e) Body material designation (i.e. DI for Ductile Iron)
- (f) Designation of the valve type (i.e. Type `B').
- (g) Year of manufacture.
- (h) Direction of valve closing (i.e. arrow indicating clockwise).
- (i) Seat material identification (i.e. RES for Resilient Seated).

Apart from all these markings, a bronze plate engraved with the word "SYABAS" (50mm high) shall also be tied to each valve.

3.2.6 Butterfly Valves

3.2.6.1 General

- (a) The butterfly valves shall conform generally to JKR Specification 20200-0050-99 or BS 5155 or better. The valve shall be selected as follow:-
 - **CONCENTRIC DISC DESIGN** is suitable for dual flow operation;
 - **SINGLE or DOUBLE ECCENTRIC DISC DESIGN WITH RESILIENT SEAT, TIGHT SHUT-OFF TYPE** is suitable for single way operation.

All valves shall be suitable for waterworks purposes in a tropical country. All butterfly valve shall be rated at PN16 (bar) unless otherwise specified. The range of valve sizes covered is DN50 to DN2000.

- (b) It shall be closed by turning the lever or hand-wheel in a "clockwise" direction when facing the top of the valve. Opening/closing indicators shall be provided and mounted on all valves. These indicators shall be visible from the top of deep chambers (especially when the valve is installed in a chamber).
- (c) All flanges (and boltings when required) shall comply to BS 4504:1989 or BS EN1092-2:1997.

A schedule of components and materials are attached in **Table 2**.

3.2.6.2 Materials

- (a) **Ductile Iron** conforming to BS 2789/BS EN1563; minimum **Grade of 500/7** shall be used for:
 - (i) Body
 - (ii) Disc

The disc shall be concentric for hydrodynamic flow, reduced turbulence, to minimize pressure drop across the valve and to ensure stable hydraulic flow characteristics.

For the internal body resilient lining type, the lining may be of the replaceable or non-replaceable type. The body lining shall isolate the complete body interior surface from the water conveyed by ensuring leak tightness around the pipe flanges and at the shaft.

Liner shall be EPDM, foodstuff approved conforming to MS 672:1999 or AS1646:1992.

Disc shall be polyurethane coated; foodstuff compatible.

For the eccentric disc design resilient seated type, the seat facing shall be of full peripheral seating with one face of a resilient material [EPDM to MS 672:1999] and the other face of stainless steel ring secured to the body or disc by stainless steel screws. The seat shall be fully adjustable and replaceable without removing the valve from the line [applicable for valves larger than 700mm dia. only].

- (b) Shaft shall be in 13% Cr Stainless Steel to EN 10088-3 A35-574 with a minimum thickness of 250 microns, if it is fully isolated from the fluid, or 18-12 type stainless steel to BS 1504 315L16 if the shaft is in contact with the fluid.

The shaft and the disc shall be on the same axis and the valve shall be fully bi-directional i.e. capable of being completely tight shut off under the full differential pressure (valve rating) in both directions.

The shaft shall be of solid, one-piece construction and secured to the valve disc by stainless steel pins or spline key of adequate strength. All shafts shall have

phosphor-bronze graphite-filled self-lubricating or similar approved bushes with approved seals designed to allow valve placement with the shaft horizontal or vertical. The shaft seal of the gland packing type shall be fully adjustable to eliminate line leakage and shall be accessible and replaceable without removing the valve actuator.

- (c) Valves will be installed with the disc shafts horizontal. Valves of 450mm diameter and above shall be provided with suitable reducing gears. Quadrant worm reducing gear totally enclosed in a ductile iron gear box and secured to the valve body shall be provided for the smooth operation of the valves.

The worm shaft shall be vertical and square at the top for operation with a mild steel/stainless steel key held in a vertical position. The gearing shall be suitable for operation of the respectively valves by a mild steel/stainless steel tee key and bar with a force of 270 Newtons applied on each side simultaneously from a distance 750mm from the centre of the key against the full unbalanced pressure of the valve rating. Suitable means shall be provided to prevent overstressing of the valve seat in the close position.

The gearing and bearings shall be protected by suitable water-tight enclosures permanently packed with grease. The Contractor shall provide details of the type of gearings in the Schedule of Particulars and shall state in his Tender the type of test to be carried out to demonstrate the water tightness of the assembly under a head of 3.5 metres of water column.

- (d) Ductile iron caps shall be supplied to fit the spindles or operating gears of all the valves and these shall be secured by brass set screws with the direction of closing indicated on the caps.
- (e) Opening/closing indicators shall be provided and mounted on all valves.

3.2.6.3 Tests and Inspection

- (a) All butterfly valves shall be Works tested in accordance to **Clause 3.2.3** and site tested where deemed necessary.
- (b) Durability test for elastomer on the wedge of the resilient seated valves shall be tested in accordance to JKR Specification 20200-0050-99.
- (c) A test certificate shall be issued for each valve tested with details of the standard, pressures used, type of tests conducted, medium used, duration of tests, serial number of valve, date of tests, certified by a qualified tester, etc.

3.2.6.4 Mandatory Markings

Each valve shall be clearly marked on the body (this marking shall be integral with the body of the valve with the following information :-

- (a) Nominal diameter (i.e. DN.....)
- (b) Pressure rating (i.e. PN10)

- (c) Manufacturer's make or trade mark
- (d) The relevant Standard (i.e. JKR/20 2000-0050-99 or BS 5155)
- (e) Body material designation (i.e. DI for Ductile Iron)
- (f) Designation of the valve type (i.e. Type : rubber-lined)
- (g) Year of manufacture
- (h) Direction of valve opening (i.e. arrow indicating clockwise)
- (j) Seat materials identification (i.e. EPDM)

Apart from all these markings, a bronze plate engraved with the word "SYABAS" (50mm high) shall also be tied to each valve.

Table 2 : Components and materials for butterfly valve

Component	Material	BS Reference	Grade or designation
Body Body with integral seat Disk	Ductile Iron	BS 2789 BS EN 1563	500/7
Handwheel	Ductile Iron	BS 2789 BS EN 1563	420/12
Shaft/Spindle	Stainless steel	BS 970	431S29
Internal fastenings	Carbon steel	Specific grades are outside the scope of this standard	
	Stainless steel		
	Phosphor bronze	BS 2870, BS 2873	PB102
	Aluminium bronze	BS 2872, BS 2874, BS 2875	CA103, CA104, CA106
	Nickel copper alloy	BS 3076	NA13

3.2.7 Non-return Valves

Non-return valves shall be of an approved **non-slamming, tilted disc or recoil type to PN 16** (unless otherwise specified), capable of withstanding severe transient surge shall be mechanically and hydraulically designed to ensure rapid closure before reversal of flow under high velocities and surge conditions especially when an air surge vessel is incorporated and/or when two or more pumps are running in parallel. The valves shall be adequately sized so that under normal flow conditions the velocity shall not exceed 2.0m per second and the friction losses not greater than 0.5m. Valves of diameter greater than 460mm shall be of the multi-door type. **Friction curves and dynamic performance test for non-slam features MUST be submitted with the tender. These curves must be endorsed and signed by both the manufacturer and agent/sole**

distributor, without which their tender will not be accepted. In this instance, an endorsement means that the manufacturer and agent/sole distributor warrants the results of the tests and that each of the valves manufactured will meet these minimum standard.

The body, door and cover shall be of spheroidal graphite iron to BS 2789/BS EN1563; minimum Grade of 500/7.

The door shall be hinged on an aluminium bronze or stainless steel pin and supported in gun metal bearing blocks. The body seat and door facing rings shall be gun metal or aluminium bronze. For horizontal valve, the seating shall be inclined at an angle of not greater than 50 degrees from the flow axis. All internal parts shall be renewable. All non-return valves exceeding 450 mm diameter shall incorporate a by-pass complete with isolating valves.

The flow are through the valve body, inlet and outlet, shall be equal to the pipe size and gradually increased to as area 40% greater that pipe size through the valve seat.

Non-return valves for installation in vertical pipes delivering upward flows shall be suitably modified where necessary to achieve the above design criteria.

Conventional check-valves are unsuitable for the above duties and will not be acceptable for use in delivery mains of the pumps.

During normally open position, headloss must be at the minimum possible and in the close position, there shall be NO LEAK. Certified test reports must be submitted.

The Contractor shall guarantee that the valve supplied complies with the NON-SLAM Characteristics. This feature shall be specified in the test certificate and verified on site. Should the valve fail to prove this, the Contractor shall provide a replacement and/or alternative, at no additional cost to the Contract.

All check valve shall be provided with a position indicator of the disc, visible from all positions. All check valve shall be surface prepared in accordance to **Clause 3.2.4** and BS 6920.

Air Valves

3.2.8.1 General

All air valves shall generally conform to JKR Specification 20200-0043-99 (or better) for ductile iron air valves.

Double orifice air valves shall be of the `Aerokinetic' type incorporating hydrodynamic principles suitable for air exhausting during charging or venting when emptying of the main. The ball-sealed orifice shall always remain open while air is discharged and shall be immediately closed when the water rises in the valve to lift the ball and seal the orifice.

The escaping turbulent air or a mixture of air and water spray (even at the critical velocity of 300 m/sec) shall not cause the ball to be thrown into the discharging air stream and be blown shut prematurely during the filling of the water main at a high rate. Under no circumstances shall the large orifice ball blow shut prematurely.

Standard double orifice air valves shall have a minimum pressure rating of 16 bars (unless otherwise specified) and in all cases shall be supplied with PN 16 flanges to BS 4504:1989.

The ball of the large orifice shall bear a calculated mathematical relation with the inlet diameter of the valve i.e. average cross-sectional area of escaping air stream, so that the ball will be blown shut by a stream of water but held down by a stream of air. The buoyancy of the ball shall be such that it will ensure effective sealing of the large orifice even at low pressure. The weights of each ball of the same size and type shall be not differ by more than 2%.

Single small orifice air valves shall be reliable in action and shall operate such that the ball cannot be held against orifice by air pressure alone.

The design of the valve shall be such as to allow maximum free air discharge and inflow at pressure differentials of plus 0.5 bar and minus 0.2 bar respectively. **The Contractor MUST submit with his tender, curves for free air discharges and inflow against various air pressures at valve inlet. These curves must be endorsed and signed by both the manufacturer and agent/sole distributor, without which their tender will not be accepted. In this instance, an endorsement means that the manufacturer and agent/sole distributor warranties the results of the tests and that each of the valves manufactured will meet these minimum standard.**

Each air valve shall be supplied with horizontally positioned isolating sluice valve of the same size with bevel gearing arrangement for vertical operation and a set of flange jointing materials including nuts, bolts, washers and joint gaskets for insertion between the air valve and sluice valve. The gear box shall be greased pack, concealed permanently and water-tight. The isolating sluice valve is specified in **Clause 3.2.5**. The bevel gear pinion shall be of corrosion resistant steel. A pressure tapping insertion into a suitably designed short piece as shown in the Drawings shall be supplied with each air valve tee. The flange diameter of the insertion short piece shall be the same to suit the air valve.

All air valves shall be made insect proof by providing stainless steel screens at the vents leading into the atmosphere. The floats shall be ABS plastic balls or stainless steel Grade 316.

The orifice shall be either gunmetal or stainless steel, not less than 3mm and tapering to 10mm suitable to release accumulated air within the pipe. The profile of the orifice shall be such as to avoid damage to the ball surface. The orifice shall be protected by a suitable plug of stainless steel.

The low pressure cover shall be massive and designed to withstand full operating thrust in working condition. The neoprene seat ring shall be held securely in place under the low pressure cover by a joint support ring to prevent it from sagging when the ball is not sealing the orifice.

After completion of machining but before assembly the valve body shall be hydraulically tested to one and a half (1.5) times the valve rating pressure for a period a 5 minutes and thereafter compressed air at a slightly higher pressure shall be released through the valve inlet to check the function of the ball.

Subsequently, the hydraulic pressure shall be reduced to 0.5 bar and there shall be no leakage through any of the orifices.

Materials used shall not be inferior to the following:

- | | | | |
|-----|---------------------------------------|---|---|
| (a) | Ductile Iron | : | BS 2789/BS EN 1563:1997; Grade 500/7 |
| (b) | Gunmetal for valve seats | : | BS 1400 LG2 |
| (c) | Brass/Gunmetal for plugs and spindles | : | BS 2872/2874 CZ114, CZ116/BS 1400 LG2 |
| (d) | Rubber for Gasket or seal ring | : | MS 672:99/AS (Grade 66-75 IRHD) |
| (e) | ABS Plastic * | : | ISO 2580 |
| (f) | Stainless Steel | : | BS 970 Grade 316S16 |

Note : ABS plastic float shall be counter weighed such that the seam/joint of the ABS ball will always remain horizontal, it will seal against the seat of the air valve in one position only.*

3.2.8.2 Test and Inspection

- (a) All air valves shall be tested in accordance to JKR Specification 20200-0043-99 : Section 3.
- (b) A test certificate shall be issued for each valve tested as follows:-
 - Type tests
 - Performance test

The certificate shall be complete with details on pressure used, type of test conducted, medium used, serial number of valves, date of test, certified by a qualified tester.

3.2.8.3 Mandatory Marking

All air valves shall have the following cast on the body:

- a) Manufacturer's name or distinguished trade mark;
- b) The designation of size.
- c) Nominal pressure designation
- d) Year of manufacture
- e) Air valve type

Apart from all these markings, a bronze plate engraved with the word "SYABAS" (50mm high) shall also be tied to each valve.

3.2.9 Control Valves

3.2.9.1 Altitude Control Valves

The altitude valve supplied shall be of the **full bore, one way flow, pilot controlled, diaphragm or piston actuated, hydraulically operated Globe type valve**, which closes to prevent overflow when top water level is reached and opens for refilling when the tank or reservoir water level lowers to a present limit. Wherever specified, the altitude valve shall be equipped with "stop-starter" switch to stop the pump(s) at top water level and restart the pump(s) when the water level lowers to a present level. Throttling action is required for gradual closure of the valve as the top water level is approached.

All altitude valves supplied shall also function as a check valve designed to close anytime the upstream or supply pressure drops below the reservoir head regardless of the elevation of water in the reservoir.

The valve body shall be of the **cast on double-flanged type, fabricated from cast iron of grade not inferior to BS 1452 Gr 250 or ASTM A-126**. Flanges shall be dimensioned and drilled in accordance with BS 4504 to PN 16 (unless otherwise specified). The valve shall be of extra heavy construction throughout with an interior trim of bronze to ASTM B-62.

The valve seats and seals shall be easily serviceable/renewable. All controls and piping shall be of non-corrosive material.

The main valve shall be external pilot operated, with free floating piston operated without springs, diaphragms or levers. The piston shall be guided on its outside diameter by long stroke stationary cage.

The pilot shall be direct acting, 3-way, spring and diaphragm operated valves. The sensing control line shall be 25mm nominal outer diameter PE or copper pipe with compatible and suitable fittings for connection to the pilot and the reservoir. The sensing tubing through the reservoir wall shall be **stainless steel SS316**.

A visual valve position indicator shall be provided to indicate the valve piston position.

The visual shall be capable of operating in any position and shall incorporate a single flanged cover at the top of the valve. All parts shall be accessible and serviceable without removing the valve from the pipeline.

3.2.9.2 Float Control Valves

The float/level controlled valve supplied shall be of the **full bore, one way flow, pilot controlled, diaphragm or piston actuated, hydraulically operated globe type valve**. The main valve modulates to maintain a constant tank level.

The valve supplied shall be suitable for side mounting and/or at ground level. It may or may not operate together with another external float, plunger, level, etc.

The control shall be a modulating, remote mounted type of simple but sensitive design, requiring minimum head to open the valve and responsive to water level variation.

The construction material of this valve is similar to the Altitude Control valve in **Section 3.2.9.1**.

3.2.10 Fittings

Extension spindles of galvanised mild steel/stainless steel shall be provided for operating of valves. The bottom end of the spindle shall be in the form of a socket to fit the cast iron cap and the top end squared to suit the valve key.

Extension spindles shall be of suitable cross section to prevent buckling or permanent distortion under all operating conditions and shall be capable of withstanding at least twice the rated output torque of the electric motor actuator or at least twice the torque developed at the stem created by a maximum force of 340 N at the rim of the hand wheel.

The length of the spindle required between the top of the valve and the horizontal axis of the hand wheel, both in the case of hand wheel operated valves and electric motor actuated valves, shall be as shown on the Drawings. The spindle shall be supported such that the L/R (L = length or span between supports, R = radius of gyration) for the unsupported part of the spindle shall not exceed 200.

Where spindles are furnished in more than one piece, the different sections shall be joined together by rigid couplings. The couplings shall be threaded and keyed or threaded and bolted, and shall be of greater strength than the spindle.

The threads of the spindle shall be machine cut and of the square or ACME type. The number of threads per decimetre shall be such as to work most effectively with the actuator.

Rising spindles shall be provided with adjustable limit nuts or stop collars above and below the pedestal lift nut to prevent over-travel of the sluice or disc gate in either direction.

Bracket-mounted and floor-mounted spindle guides, including both the guide housing and the bracket, shall be constructed so that when properly spaced they will hold the stem in alignment and yet allow it enough play to permit easy operation. The inside diameter of the guide shall not be more than 3mm larger than the outside diameter of the spindle. The guides shall be spaced in accordance with the manufacturer's recommendations for each spindle size.

The guide shall be adjustable with regard to the bracket to provide concentric alignment with the spindles and shall be lined, and provisions shall be made to hold the lining rigidly in place so as to prevent loosening while in service.

Brackets shall be fixed to the concrete walls with sufficient anchor bolts to prevent twisting or sagging under load. Valve keys shall be of galvanized mild steel/stainless steel suitable to operate the extension spindles.

Cast iron surface boxes shall have square openings with top supporting flanges and be 100mm deep suitable for heavy traffic. The covers shall be of the chained type.

The Contractor shall obtain from the S.O. confirmation of the exact length of extension spindles required before manufacturing them.

3.2.11 Electric Actuators

Electrically operated actuators for valves shall be sized to guarantee closure at the maximum possible differential pressure across the disc. The safety margin of motor power available for unseating the door shall be at least 50 percent in excess of maximum closing torque at the nominal supply voltage. For valve sizes 300mm or greater, the closing and opening shall take approximately 2 minutes for each operation unless otherwise specified. For valve sizes less than 300mm, the operating speed for closing and opening shall be 300mm per minute.

The electric motors shall be Class F insulated and tropicalised and with a time rating of 15 minutes or twice the valve stroking time, whichever is longer. Duty rating shall be S2 or S4.

Motor burn-out protection shall be provided by direct sensing of motor temperature by a thermostat embedded in the motor winding. A changeover volt-free contact (monitor relay) for remote indication of motor tripped shall be provided.

A space heater shall be provided in the electric actuator. The heater shall be suitable for use on a single phase A.C. supply and wired to the terminals compartment. The heater shall be sufficiently rated to maintain the temperature above dew point when the actuator motor is stationary.

The actuators gearbox shall be of totally enclosed grease lubricated type, suitable for operation at any angle. The gearbox shall be designed to be leak proof and without further re-greasing throughout its operating life. The drive shall incorporate a lost motion hammer blow feature. The output shaft shall be hollow to accept a rising stem. Thrust bearings of the ball or roller type shall be provided in such a way that the gear case can be opened for inspection or disassembled without releasing the stem thrust or taking the valve out of service.

A hand wheel shall be provided for emergency operation and shall be arranged such that when engaged the motor shall be automatically disconnected mechanically and electrically and the drive being restores to power only after disengaging the hand wheel and by starting the motor. The hand wheel and any gearing shall be such as to permit emergency manual operation in a reasonable time and in any case shall not exceed one hour. Clockwise operation of the hand wheel shall give closing movement of the valve unless otherwise stated.

The actuator shall be furnished with a drive bushing easily detachable for machining to suit the spindle or gearbox input shaft. The drive bushing shall preferably be positioned to enable standard length stems to be used. The valve manufacturer shall furnish stem details so that the actuator manufacturer can machine the drive bushings to suit the valve extended spindles. Unless otherwise specified, extended spindles, wherever required, shall be of hot dipped galvanised mild steel construction coated with coal tar epoxy paint. Where the length of the extended spindle exceeds 1.5m length, universal couplings shall be incorporated.

Electric actuators shall be provided with open and close torque and position limit switches with separate changeover volt-free contacts at each end of travel for remote indication and inter-locking. Means shall be provided to prevent the open torque switch tripping while the initial unseating hammer blow effect is applies. Two extra sets of limit switches shall be provided, as required, with at least three switches per set, each set independently adjustable to any valve opening or closing position.

A mechanical dial indicator (indicating 0-100 percent marking) shall be provided to show continuous valve movement. In addition, a 4 – 20 mA analogue signal output shall be provided for continuos remote position transmission.

The reversing contactor starter and local controls shall be integral with the actuator, suitably housed to prevent breathing and condensation build-up.

Static or solid state controls will not be accepted.

The starter shall be suitable for 60 starts per hour, and shall comprise mechanically and electrically interlocked reversing contactors of appropriate rating to the motor size with coils fed from a 110 volt control transformer of 40 VA minimum rating. The common connection of the contactor coils at the transformer shall be earthed so that the contactors drop out in the event of leakage to earth. The primary winding shall be separated from the secondary by an earthed screen and the secondary output shall be protected by an easily replaceable cartridge type fuse.

When the distance between the actuator and the remote control point exceeds 500 metres, the remote control voltage shall be 24V DC, derived from a rectified supply from the remote control point. The required DC interposing relays shall be incorporated in the actuator and shall be suitable for satisfactory operation within 80-110% of the nominal DC voltage.

A phase discriminator shall be incorporated to ensure correct rotations.

Local controls shall comprise pushbutton switches to Open, Close and Stop and a Local/Off/Remote selector switch pad lockable in any one of three positions:-

- Local control only.

- Off-On electrical operation.
- Remote control plus local stop only.

Padlocks shall be provided.

A monitoring relay with a normally open contact to indicate that the actuator is available for remote operation shall be provided with the relay being energised from the control transformer only when :-

- Local/Off/Remote selector switch is in Remote position
- 3 phase power supply available
- Control supply available
- Phase rotation correct
- Thermostat not tripped
- Local stop button not locked off

Internal wiring shall be of tropical grade PVC insulated stranded cable of 5A minimum rating for control circuits and of appropriate size for the control and 3-phase power.

Each wire shall be clearly numbered and identified at each end. The terminals shall be of the stud type. Cable entries shall be suitable for PVC/SWA/PVC cables and armoured screened signal cables.

The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal and the compartment shall be provided with a minimum of three threaded cable entries. All wiring supplies as part of the actuator shall be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable. A durable terminal identification card showing plan of terminals shall be provided attached to the inside of the terminal box cover indicating serial number, external voltage values, wiring diagram number and terminal layout.

The actuator enclosure shall be weatherproof, hose-proof and water-tight to IP 68 (3 metre water head) of BS 5490 with sealing O-rings. The terminal compartment shall be separately sealed from the rest of the enclosure so that wiring and integral controls are not adversely affected by water, while the cover is removed for site cabling or maintenance.

Each actuator shall be supplied complete with installation instructions and wiring diagram and sufficient spare cover screws and seals to make good site losses.

Where power supply is not available at site, a socket and plug arrangement shall be provided to receive power supply from a portable/mobile generator set. The sockets shall be bulk head mounted on to the actuator and shall be provided with a hood. The protection afforded by the socket shall be IP 67 even with the plugs disconnected.

The sockets mounted on the actuators shall be provided with male pins (8 pins rated at 35 Amps to suit 415V power supply). Plugs complete with hood cover to match the sockets fitted on the actuators shall be provided. Plug/socket connectors fitted on the end of flying leads will not be accepted.

3.2.12 Head Stocks

Headstocks for valves shall be the non-rising spindle and direct manual type with open and shut indicator. The headstock supplied shall be suitable for mounting of actuators for valves. The components used shall be cast iron which comprises of a handwheel, a yoke cap housing gunmetal and a headstock.

After completion of installation and site tests, all headstocks shall be painted with two coats of cold applied polyurethane topcoat minimum 100 micron dry film thickness and to a colour approved by the S.O. and these costs are deemed included in the Contract rates.

3.2.13 Spares

All spare parts shall be new, unused and strictly interchangeable with the parts for which they are intended to be replaced and shall be treated and packed for long storage under the climatic conditions prevailing at the Site. Each spare part shall be clearly marked or labelled on the outside of its packing with its description, number and purpose and, when more than one spare is packed in a single case or other container, a general description of its contents shall be shown on the outside of such case or container and a detailed list enclosed. All cases, containers and other packages shall be marked and numbered in an approved manner for purposes of identification.

All cases, containers or other packages are liable to be opened for such examination as the S.O. may require and the packing shall be designed to facilitate opening and thereafter repacking.

3.2.14 Measurement and Payment

The Goods and all work in connection therewith as specified shall be valued by **re-measurement**. Items in the Bills of Quantities are provisional and only such items as are installed in the system shall be paid, unless otherwise specified.

The Goods supplied under this Contract shall include design, manufacture, shipping, tax and duties, etc. transport, temporary storage at store yard, haul, guard, handle and place in position ready for jointing and painting of valve, etc. after installations.

The Contractor shall take note that valves shall be installed under the supervision and/or direction of the valve manufacturer/supplier and the Contractor shall accord all necessary assistance and coordination for the successful and complete installation. The cost of such provision shall be deemed to be included in Contract rates.

All the Goods other than spares shall only be measured for payment after they have been installed, incorporated and accepted in the Works.

All Goods shall only be measured for payment after they have been delivered to the site and accepted by the S.O.. Notwithstanding what is provided elsewhere, the terms and conditions of payment of the Goods shall be as follows:

- 75% on delivery and successful testing of the valves at Site
- 15% on successful installation and commissioning
- 10% on satisfactory completion of Defects Liability Period

3.2.15 Site Testing and Commissioning

After the valves have been delivered to the Site, the Contractor will repeat the hydrostatic pressure tests as specified for the works tests. The Contractor will give the S.O. in writing (2) weeks notice of the date on which the valves will be tested and the S.O. or his representatives will attend the tests. Whether the S.O. or his representatives witness the tests or not, the Contractor will provide a copy of the test results to the S.O..

Should any leakage occur in the valves during these tests, the Contractor shall remedy the defects at his own expense failing which the S.O. will remedy the said defects and charge all expenses incurred to the Contractor. Notwithstanding what are stated elsewhere no valve shall be considered accepted for installation until the valve has passed the specified tests at the manufacturer's works and at the site.

Upon completion of the installation works (whether by the Contractor or by others), the operation of all the valves in particular those that are electrically actuated shall be tested. When all the valves have been successfully tested, the Contractor shall apply in writing to the S.O. to install and to commission the Works.

The commissioning of the Works shall be carried out over a period of one (1) week wherein all the valves shall be checked for operation. The frequency of checks during the one (1) week commissioning shall be at the direction of the S.O.