

GOVERNO DO ESTADO



CEARÁ

AVANÇANDO NAS MUDANÇAS

GOVERNO DO ESTADO DO CEARÁ
SECRETARIA DOS RECURSOS HÍDRICOS
COMPANHIA DE GESTÃO DOS RECURSOS HÍDRICOS COGERH
PROJETO DE DESENVOLVIMENTO URBANO E GESTÃO DOS RECURSOS HÍDRICOS
PROURB CE

PROJETO EXECUTIVO DA ADUTORA DE ASSARÉ

RELATÓRIO GERAL

VOLUME 4.2 TECHNICAL SPECIFICATIONS

TALVEG

Engenharia

FORTALEZA
MAIO DE 1996

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VOLUME 4.2 - TECHNICAL SPECIFICATIONS

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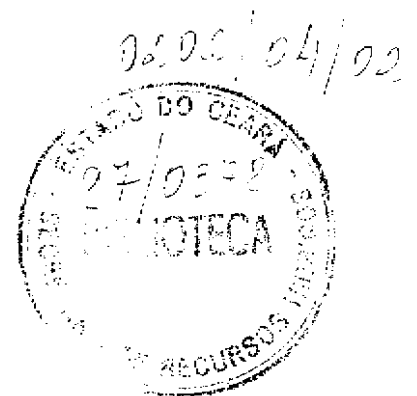
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SUMMARY

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1 - GENERAL CONSIDERATIONS

All equipment's used shall be new and accepted by the INSPECTOR ENGINEER, who will disapprove the one that are not in conformity with these specifications.

Every imperfect equipment refused by the INSPECTOR ENGINEER shall be immediately retreated from the jobsite with all expenses payed by the contractor.

The quality criterion's shall obey the specifications by ABNT - Associação Brasileira de Normas Técnicas (Brazilian Technical Standard Association). For equipment's that have not been included in ABNT, the following standards can be used:

- AWWA ⇒ American Water Works Association.
- ASA ⇒ American Standard Association.
- ASTM ⇒ American Society for Testing and Materials
- ANSI ⇒ American National Standard Institute.
- AISI ⇒ Association International of Standard Institute.
- ASME ⇒ American Society of Mechanical Engineers.
- ISO ⇒ International Organization of Standardization.

2 - DUCTILE IRON PIPE AND FITTINGS

Especing

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The PB pipes shall have been manufactured in conformity with the ABNT NBR-7663 e NBR-8318 standard, by a centrifugal spinning process and shall be class K-7, K-9 or 1 MPa as specified in the project.

The rubber rings used by mechanical joints shall be in compliance with ABNT NBR-7676 standard.

The joint with flanges shall be supplied with screws, nuts and gaskets the screws and nuts shall be galvanized by fire.

The pipes shall be internally coated with high oven and Sand Portland Cement Mortar, applied by a centrifugal spinning process in conformity with ABNT NBR-8688 standard.

The external coat shall be made by a bituminous paint in compliance with ANSI/AWWA C-151 e ANSI/AWWA a-104 standards.

The external and internal fittings coat shall be made with bituminous painting also in conformity with ANSI/AWWA C-104 e ANSI/AWWA C-151 standards.

The centrifugal pipes with threaded flange shall attend the NBR-7560 standard and shall be classes NP-10 or NP-16, as the project.

The fittings shall also be manufactured by ductile cast iron and can have push-on, mechanical or flanged joints, according to the project.

The push-on joints with rubber rings for ductile cast iron pipes and fitting shall attend the supply criterion's specified by ABNT NBR-7674 and rubber rings shall attend ABNT NBR-7676 standard.

The supplier shall include the costs of all accessories and fitting as rubber rings, washers, screws, nuts and others.

The setting shall include all costs of solder execution and pipes cutting at the jobsite constructor.

The mechanical joints for ductile cast iron shall be in conformity with ABNT NBR-7677 standard.

3 - GATE VALVES

000010

These shall be flat type with ductile cast iron flanges and drive wheel (as projected), body, cap and wedge, ASTM-B-62 bronze sesling rings, AISI-410 stainless steel rod and SBR elastameter joint.

The pressure class and diameters shall be in conformity with the project.

The flanges penetrations shall attend ABNT-PB-816 - Part 1 and NBR-7676 standard.

4 - BUTTERFLY VALVES

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- body with flanges and drive sheel -ductile iron;
- joint case-ductile iron;
- lid-ductile iron;
- clasp rings - 3Ni ductile iron;
- butterfly ductile iron;
- support axle -18.8 stainless steel;
- operating axle - 18.8 stainless steel;
- seal seat - CF-8 stainless steel (AISI-304);
- superior and inferior wad - reinforced Teflon;
- seal joint - synthetic rubber type Bruno-N.

The valves shall have diameters and pressure class in conformity with the project and with AWWA C-504 and NBR-7675 standards both for flanges penetrations.

5 - DUO CHECK VALVES

000014

The valves shall have one or two port-holes to be fixed between the flanges and shall be constructed of the following materials:

- body - ductile iron;
- support axle - 18.8 stainless steel;
- disc - ductile iron;
- limited axle - AISI-304- stainless steel;
- disc axle - AISI-304- stainless steel;
- spring - AISI-302 - stainless steel;
- seal - Bruno-N.

The valves shall have diameters and pressure class as indicated in the project and shall attend API-594 standard.

6 - AIR VALVES

000016

Especing

The air valves shall be triple function type with flanges and shall be constructed of the following materials:

- body -ductile iron;
- supports - ductile iron;
- discharge nipple -brass;
- lid - ductile iron;
- large float - special plastic for 50 mm ND and aluminum for 100 to 200 mm ND;
- short float - rubber;
- seal ring - natural rubber.

The valves shall have diameters and pressure class as indicated in the project and shall attend NBR-7675 standard for flanges penetration.

7 - RELIEF VALVES

000018

Especing

The valves shall be flanged extremity spring constructed of the following materials:

- Hood body and castle - ASTM-A-12668 cast iron;
- Rod - shaped stainless steel;
- Disc - shaped stainless steel;
- Disc support - AISI-304 - stainless steel;
- Support disc guide - AISI-304 - stainless steel;
- Seal ring - AISI-304 - stainless steel;
- Spring - cadmed carbonic steel;
- Regulator screw - AISI-304 - stainless steel;
- Nuts - carbonic steel.

The valves shall have diameters and pressure class as indicated in the project and shall attend NBR-7675 standard for flanges penetration.

8 - PIPES AND FITTINGS IN PVC

000020

These Technical Specifications are basically for the presentation of the criteria and the supply conditions and for the definition of parameters and quality standards of the material for pipes and fittings specified in PVC in the quantity stated in the projects and, eventually, for the items which though specified in another material may be offered in PVC as an option, according to an opening foreseen in this bidding though which alternative materials may be offered.

For the pipes, fittings and accessories offered, catalogues and trial certificates must be presented together with the proposal for the purpose of evaluation during the judgment of the proposals.

All the pipes, fittings and accessories specified here must at least support the required operating pressure, according to what is stated in the quantification charts.

All materials and equipment's must be delivered at the jobsite.

The mentioning of specifications of fittings and accessories of specific Suppliers and Manufacturers does not imply any preference, but is merely a reference to the desired characteristics, and any other similar parts may be offered.

The pipes must be of proven resistance to the operation pressure of the project and must last for at least 05 (five) years. All materials shall be delivered with an 18 - months guarantee or beguaranteed for 12 months after set in to operation.

The Manufacturer or Supplier will be responsible for completely substituting the components included in the project for other equipment's of similar performance and technical specifications.

All materials must be homogeneous, without flakes or fringes and should be flawless.

The Manufacturer or Supplier of the pipes, fittings and accessories is responsible for hiring a specialized technician to supervise the delivery of materials and the testing of the pipes afthen the network has been installed.

During the assembly phase the Supplier's or Manufacturer's technical representative should communicate with the INSPECTOR ENGINEER from the Secretary of Water Resources about any necessary changes for the carrying out of the services with perfection and according to the standards of the company.

The price stated in proposal of the supplier or Manufacturer with regard to pipes, fittings and accessories(steel washers, nuts, screws, etc) must include manufacturing costs, transportation, delivering and unloading of materials, social and fiscal fees, technical assistance and other expenses for which the Manufacturer or Supplier cannot claim any reimbursement.

Price proposals will refer to the month of bidding and will be in the currency stated in the public notice of the competition.

8.1 - Identification

Every pipe or part must show the following information on the external surface, either in paint, with a sticker or in relief:

- a) manufacturer's brand or identification;
- b) the nominal diameter (ND);
- c) the pressure class (NP).

8.2 - Transportation

The pipes, accessories and other components shall be transported by the Manufacturer or Supplier (with loading, unloading and conditioning) to the jobsite and placed in an area specified by the INSPECTOR ENGINEER.

8.3 - Reception And Storage

A representative of the INSPECTOR ENGINEER and the Manufacturer or Supplier shall be in charge of receiving all materials and will direct workers in the unloading area without any cost to the Employer.

The Secretary of Water Resources (SRH) will be solely responsible for safekeeping and conserving materials received.

The Manufacturer or Supplier should stack received materials correctly using their own wooden boards to create stacks of pipes. The stacks should contain pipes of same diameter only. The

rubber rings should be packed correctly and not be exposed to sunlight or high temperatures. The fittings and accessories packed in boxes will be checked one by one and then packed again and stored.

Once a defect is detected in more than one part of the same lot the case will be examined by the INSPECTOR ENGINEER and the representative of the Manufacturer or Supplier. After determining the origin of the defect a decision can be made whether to accept or refuse specific parts or the entire lot.

Defective parts should be listed on a special form and returned with a descriptive report signed by the INSPECTOR ENGINEER and the representative of the Manufacturer or Supplier. Such returns shall not imply any cost to the Employer.

No defective parts may be left in the storage area.

The material will be considered as properly received only when the storage list and the shipping invoice have been stamped and signed by representatives of the INSPECTOR ENGINEER and the representative of the Manufacturer or Supplier and when a competent authority has signed a quality certificate as regents by the INSPECTOR ENGINEER.

8.4 - Material

The pipes shall be made with a vinilic polycloreto resin without plastic and only compounds necessary to make the manufacture of the polymers to produce pipes with a fine superficial finishing and with mechanical resistance according to this norm.

The pipes and their fittings have push-on joints, soldable joints, flanges or scramble according to the project.

The pipes shall not take to the water amounts above the limits established of elements, such as Pb, Cr, As, Hg and Sn, that can change its quality.

The Manufacturer of the pipes shall give, when requested by the buyer, a certificate that those are proper for use, according to the demanding on the previous item.

The Manufacturer can use reprocessed material by him during the manufacture and or trials, as long as the final products follow the requirements of this Norm. Not any other reprocessed material can be used.

Each kind and diameter of pipe, mentioned in this Norm, shall have gone through trials of qualities established and done by the manufacturer.

The PBL pipes shall be manufactured on the nominal diameters : 100 mm - PN 80 (ABNT 12:008-034) and the PBA, on the nominal diameters : Class 12 - ND 50, 75 e 100 mm and Class 20 - ND 100 mm, according to the EB-183 (1977) ABNT.

The rigid and screwball PVC shall be manufactured according to the EB-892/77 (NBR 5648) with diameters 3" to 3/4" and the soldable with 75 mm and 32 mm diameters according to this Norm.

The push-on joint shall be proper to work interred under the minimum service pressure, according to the pipe's pressure class and show the minimum performance required by this Norm.

The Manufacturer shall supply and include in the expenses the rings and the steel washers, screws, nuts and the other fittings, enough to the assembly of the pipes, properly packed.

The lubricant used on the assembly of the elastic joints, shall be recommended by the Manufacturer and supplied in amounts according to the number of joints, having its costs included in the costs of the pipes.

The pipes shall have nominal length of 6,0 m, and assembly length (CM) not inferior to 6,0 m after the connection.

8.5 - Inspection Tests

The pipes shall be submitted to trials, and after that described and followed by the certificate of presentation supplied by the department in charge.

8.5.1 - Quality Trials

- effects on the water - according to the NBR 5684;

- resistance to lasting internal hydrostatic pressure of 1000 hours - according to the NBR 7228.

8.5.2 - Receiving Trials

- vicat's softening point - according to the NBR 7232;
- resistance to instant internal hydrostatic pressure - according to the NBR 5683;
- dimensional stability - according to the NBR 5687.
- elastic joint performance - the pipes and fittings submitted to performance inspection must follow these conditions:
 - a) the bags of the JE pipes with rubber rings according to the manufacture's specifications, properly enbricated shall allow assembly by slipping with rigid PVC pipes;
 - b) the rubber ring shall stage in the righth place after the assembly. It shall not be observed any kind of structural damage to the ring and fittings, due to the efforts necessary during the assembly of the joints.
 - c) the push-on joints and the weld, 24 hours after the assembly, shall be verified to check the watertightness according to the NBR 5685.

8.5.3 - Inspection

The pipe's inspection shall be done at the work's location. The Manufacturer or Supplier shall supply the Employer with the equipment, control papers and specialized personal to the tests of the tests of quality control.

The employer and his/her representative shall be told, 15 days beforehand, of the beginning of the delivery of the material ordered.

In case the employer or his/her representative do not show up on the arranged date, to supervise the tests, the Manufacturer shall not do them and shall try to set another date.

All the supplement will be divided into lots of 500 pipes with the same ND, by the Manufacturer or Supplier. Of each lot, a representative sample will be taken, according to the following table.

SAMPLE TABLE

SIZE OF LOT	SAMPLE'S SIZE	FIRST SAMPLE		SECOND SAMPLE	
		FIRST ACCEPTANCE NUMBER	FIRST REJECTION NUMBER	SECOND ACCEPTANCE NUMBER	SECOND REJECTION NUMBER
PIPES	PIPES	DEFECTIVES PIPES			
16 - 25	2	0	2	1	2
26 - 90	3	0	2	1	2
91 - 150	5	0	2	1	2
151 - 280	8	0	2	1	2
281 - 500	13	0	3	3	4

Each pipe in the sample will be submitted to dimension inspection following these standards:

- a) measure, using a micrometer, the thickness of the pipe's wall, at the end of it, without any barb and approximately 1 cm from the bevels. There shall be made from 3 to 8 measurements of the perimeter equally spaced. Consider as minimum thickness (t).
- b) the medium external diameter (med) shall be measured at the end of the pipe. It can be measured by using a string, getting the med from the relation between the perimeter and the

number 3,142 approximated to 0,1 mm or by using the paquimeter according to the measurements arithmetic average, approximated to 0,1 mm.

To determine the assembly length (AL), two pipe's shall be chosen from the sample. The AL will be got from the arithmetic average of the measurements done, with a difference of approximately 120 °.

The pipes accepted in the preliminary inspection will go through receiving tests to check their conditions.

One of the accepted sample's pipe will be used to get specimen tested to do the destructive tests, following these instructions:

- a) to check performance of the push-on or weld joints, two segments of 0,30 m of length, shall be cut one from each end. For the fittings a JE or JS shall be done according to the NBR 5685.
- b) to check the vicar softening point, two samples shall be taken according to the NBR 723
- c) to check the resistance to instant internal hydrostatic pressure, a segment of about 400 mm of length shall be cut according NBR 5683.
- d) to check the dimensional stability a segment of about 300 mm of length shall be cut .

When the material is accepted by the INSPECTOR ENGINEER, the inspection certificate shall be supplied as soon as the inspection tests finish and this shall be done at the place of the work.

The lots will be accepted or rejected, according to the number of defective pipes according to the SAMPLE TABLE and according to the INSPECTOR ENGINEER.

In case of getting as far as two negative results, the tests shall de repeated with two more pipes when all of then shall be approved.

The pipes from which the sample were taken can be accepted as they were with their total length, according to the INSPECTOR ENGINEER.

8.6 - Technical Assistance

The Manufacturer or Supplier is obliged to offer technical assistance free of charge to the Employer during the reception, assembly and start-up of the network, and until the completion of tests and their acceptance.

9 - PRFV PIPES AND FITTING

Especing

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These Technical Specifications are basically for the presentation of the criteria and the supply conditions and for the definition of parameters and quality standards of the material for pipes and fittings specified in PRFV in the quantity studded in the projects and, eventually, for the items which though specified in another material may be offered in PRFV as an option, according to an opening foreseen in this bidding though which alternative materials may be offered.

For the pipes, fittings and accessories offered, catalogues and trial certificates must be presented together with the proposal for the purpose of evaluation during the judgment of the proposals.

All the pipes, fittings and accessories specified here must at least support the required operating pressure, according to what is stated in the quantification charts.

All materials and equipment's must be delivered at the jobsite.

The mentioning of specifications of fittings and accessories of specific Suppliers and Manufacturers does not imply any preference, but is merely a reference to the desired characteristics, and any other similar parts may be offered.

The pipes must be of proven resistance to the operation pressure of the project and must last for at least 05 (five) years. All materials shall be delivered with an 18 - months guarantee or beguaranteed for 12 months after set in to operation.

The Manufacturer or Supplier will be responsible for completely substituting the components included in the project for other equipment's of similar performance and technical specifications.

All materials must be homogeneous, without flakes or fringes and should be flawless.

The Manufacturer or Supplier of the pipes, fittings and accessories is responsible for hiring a specialized technician to supervise the delivery of materials and the testing of the pipes after the network has been installed.

During the assembly phase the Supplier's or Manufacturer's technical representative should communicate with the INSPECTOR ENGINEER from the Secretary of Water Resources about any necessary changes for the carrying out of the services with perfection and according to the standards of the company.

The price studded in proposal of the supplier or Manufacturer with regard to pipes, fittings and accessories(steel washers, nuts, screws, etc) must include manufacturing costs, transportation, delivering and unloading of materials, social and fiscal fees, technical assistance and other expenses for which the Manufacturer or Supplier cannot claim any reimbursement.

Price proposals will refer to the month of bidding and will be in the currency studded in the public notice of the competition.

9.1 - Identification

Every pipe or part must show the following information on the external surface, either in paint, with a sticker or in relief:

- a) manufacturer's brand or identification;
- b) the nominal diameter (ND);
- c) norm's number.

9.2 - Transportation

The pipes, accessories and other components shall be transported by the Manufacturer or Supplier (with loading, unloading and conditioning) to the jobsite and should be placed according to the INSPECTOR ENGINEER.

9.3 - Reception And Storage

A representative of the INSPECTOR ENGINEER and the Manufacturer or Supplier shall be in charge of receiving all materials and will direct workers in the unloading area without any cost to the Employer.

The Secretary of Water Resources (SRH) will be solely responsible for safekeeping and conserving materials received.

The Manufacturer or Supplier should stack received materials correctly using their own wooden boards to create stacks of pipes. The stacks should contain pipes of same diameter only. The

rubber rings should be packed correctly and not be exposed to sunlight or high temperatures. The fittings and accessories packed in boxes will be checked one by one and then packed again and stored.

Once a defect is detected in more than one part of the same lot the case will be examined by the INSPECTOR ENGINEER and the representative of the Manufacturer or Supplier. After determining the origin of the defect a decision can be made whether to accept or refuse specific parts or the entire lot.

Defective parts should be listed on a special form and returned with a descriptive report signed by the INSPECTOR ENGINEER and the representative of the Manufacturer or Supplier. Such returns shall not imply any cost to the Employer.

No defective parts may be left in the storage area.

The material will be considered as properly received only when the storage list and the shipping invoice have been stamped and signed by representatives of the INSPECTOR ENGINEER and the representative of the Manufacturer or Supplier and when a competent authority has issued a quality certificate as required by the INSPECTOR ENGINEER.

9.4 - Material

The PVC pipes shall be made of polyvinylchloride resin, obtained by extension.

The reinforcement of the pipes shall be made, or not, of pigmented thermofixed resin polymerized and structured with filaments of borosilicate glass, E type.

The pipes shall be with couplings and spigots with push-on joints, and the push-on-joint or flanged fittings according to the project.

The pipes internal surfaces shall be uniform and shall not present glass filament protuberance on the external reinforcement surface.

The pipes shall be made with a vinyl polyurethane resin without plastic and only compounds necessary to make the manufacture of the polymers to produce pipes with a fine superficial finishing and with mechanical resistance according to this norm.

The pipes and their fittings have push-on joints, solderable joints, flanges or screws according to the project.

Especially

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The pipes shall not take to the water amounts above the limits established of elements, such as Pb, Cr, As, Hg and Sn, that can change its quality.

The Manufacturer of the pipes shall give, when requested by the buyer, a certificate that those are proper for use, according to the demanding on the previous item.

The Manufacturer can used reprocessed by him during the manufacture and or trials, as long as the final products follow the requirements of this Norm. Not any other reprocessed material can be used.

Each kind an diameter of pipe, mentioned in this Norm, shall have gone through trials of qualities established and done by the manufacturer.

The push-on joint shall be proper to work interred under the minimum service pressure, according to the pipe's pressure class an show the minimum performance required by this Norm.

The Manufacturer shall supply and include in the expenses the rings and the steel washers, screws, nuts and the other fittings, enough to the assembly of the pipes, properly packed.

The lubricant used on the assembly of the elastic joints, shall be recommended by the Manufacturer and supplied in amounts according to the number of joints, having its costs included in the costs of the pipes.

The pipes shall have nominal length of 6,0 m, and assembly length (CM) not inferior to 6,0 m after the connection.

9.5 - Inspection Tests

The pipes shall be submitted to trials, and after that described and followed by the certificate of presentation supplied by the department in charge.

9.5.1 - Quality Trials

- effects on the water - according to the NBR 5684;
- internal pressure rupture - according to the NBR 7365 9.5.2;

- trials of reception -9.5.2;
- verification of watertightness to internal pressure - NBR 7366;
- PVC pipes - bursting strength - NBR 6483;
- PRFV pipes - diametral crushing strenght - NBR 7972;
- elastic joint performance - the pipes and fittings submitted to performance inspection must follow these conditions:
 - a) the bags of the JE pipes with rubber rings according to the manufacture's specifications, properly enbricated shall allow assembly by slipping with rigid PVC pipes;
 - b) the rubber ring shall stage in the right place after the assembly. It shall not be observed any kind of structural damage to the ring and fittings, due to the efforts necessary during the assembly of the joints.
 - c) the push-on joints and the weld, 24 hours after the assembly, shall be verified to check the watertightness according to the NBR 5685.

9.5.2 - Inspection

The pipe's inspection shall be done at the work's location. The Manufacturer or Supplier shall supply the Employer with the equipment, control papers and specialized personal to the tests of the tests of quality control.

The employer and his/her representative shall be told, 15 days beforehand, of the beginning of the delivery of the material ordered.

In case the employer or his/her representative do not show up on the arranged date, to supervise the tests, the Manufacturer shall not do them and shall try to set another date.

All the supplement will be divided into lots of 500 pipes with the same ND, by the Manufacturer or Supplier. Of each lot, a representative sample will be taken, according to the following table.

SAMPLE TABLE

SIZE OF LOT	SAMPLE'S SIZE	FIRST SAMPLE		SECOND SAMPLE	
		FIRST ACCEPTANCE NUMBER	FIRST REJECTION NUMBER	SECOND ACCEPTANCE NUMBER	SECOND REJECTION NUMBER
PIPES	PIPES	DEFECTIVES PIPES			
16 - 25	2	0	2	1	2
26 - 90	3	0	2	1	2
91 - 150	5	0	2	1	2
151 - 280	8	0	2	1	2
281 - 500	13	0	3	3	4

Each pipe in the sample will be submitted to dimension inspection following these standards:

- a) measure, using a micrometer, the thickness of the pipe's wall, at the end of it, without any barb and approximately 1 cm from the bevel. There shall be made from 3 to 8 measurements of the perimeter equally spaced. Consider as minimum thickness (t).
- b) the medium external diameter (med) shall be measured at the end of the pipe. It can be measured by using a string, getting the med from the relation between the perimeter and the number 3,142 approximated to 0,1 mm or by using the paquimeter according to the measurements arithmetic average, approximated to 0,1 mm.

To determine the assembly length (AL), two pipe's shall be chosen from the sample. The AL will be got from the arithmetic average of the measurements done, with a difference of approximately 120°.

The pipes accepted in the preliminary inspection will go through receiving tests to check their conditions.

One of the accepted sample's pipe will be used to get specimen tested to do the destructive tests, following these instructions:

- a) to check performance of the push-on or weld joints, two segments of 0,30 m of length, shall be cut one from each end. For the fittings a JE or JS shall be done according to the NBR 5685.
- b) to check the vicar softening point, two samples shall be taken according to the NBR 723
- c) to check the resistance to instant internal hydrostatic pressure, a segment of about 400 mm of length shall be cut according NBR 5683.
- d) to check the dimensional stability a segment of about 300 mm of length shall be cut .

When the material is accepted by the INSPECTOR ENGINEER, the inspection certificate shall be supplied as soon as the inspection tests finish and this shall be done at the place of the work.

The lots will be accepted or rejected, according to the number of defective pipes according to the SAMPLE TABLE and according to the INSPECTOR ENGINEER.

In case of getting as far as two negative results, the tests shall de repeated with two more pipes when all of then shall be approved.

The pipes from which the specimen tested were taken can be accepted as they were with their total length, according to the INSPECTOR ENGINEER.

9.6 - Technical Assistance

The Manufacture or Supplier is obliged to offer technical assistance free of charge to the Employer during the reception, assembly and start-up of the network, and until the completion of tests and their acceptance.

10 - PIPES AND FITTING IN CARBON STEEL

These Technical Specifications are basically for the presentation of the criteria and the supply conditions and for the definition of parameters and quality standards of the material for pipes and fittings specified in carbon steel in the quantity studded in the projects and, eventually, for the items which though specified in another material may be offered in PROVE as an option, according to an opening foreseen in this bidding though which alternative materials may be offered.

For the pipes, fittings and accessories offered, catalogues and trial certificates must be presented together with the proposal for the purpose of evaluation during the judgment of the proposals.

All the pipes, fittings and accessories specified here must at least support the required operating pressure, according to what is stated in the quantification charts.

All materials and equipment's must be delivered at the jobsite.

The mentioning of specifications of fittings and accessories of specific Suppliers and Manufacturers does not imply any preference, but is merely a reference to the desired characteristics, and any other similar parts may be offered.

The pipes must be of proven resistance to the operation pressure of the project and must last for at least 05 (five) years. All materials shall be delivered with an 18 - months guarantee or beguaranteed for 12 months after set in to operation.

The Manufacturer or Supplier will be responsible for completely substituting the components included in the project for other equipment's of similar performance and technical specifications.

All materials must be homogeneous, without flakes or fringes and should be flawless.

The Manufacturer or Supplier of the pipes, fittings and accessories is responsible for hiring a specialized technician to supervise the delivery of materials and the testing of the pipes after the network has been installed.

During the assembly phase the Supplier's or Manufacturer's technical representative should communicate with the INSPECTOR ENGINEER from the Secretary of Water Resources about any necessary changes for the carrying out of the services with perfection and according to the standards of the company.

The price studded in proposal of the Supplier or Manufacturer with regard to pipes, fittings and accessories (steel washers, nuts, screws, etc) must include manufacturing costs, transportation, delivering and unloading of materials, social and fiscal fees, technical assistance and other expenses for which the Manufacturer or Supplier cannot claim any reimbursement.

Price proposals will refer to the month of bidding and will be in the currency studded in the public notice of the competition.

10.1 - Identification

Every pipe or part must show the following information on the external surface, either in paint, with a sticker or in relief:

- a) manufacturer's brand or identification;
- b) the nominal diameter (ND);
- c) norm's number.

10.2 - Transportation

The pipes, accessories and other components shall be transported by the Manufacturer or Supplier (with loading, unloading and conditioning) to the jobsite and should be placed according to the INSPECTOR ENGINEER.

10.3 - Reception And Storage

A representative of the INSPECTOR ENGINEER and the Manufacturer or Supplier shall be in charge of receiving all materials and will direct workers in the unloading area without any cost to the Employer.

The Secretary of Water Resources (SRH) will be solely responsible for safekeeping and conserving materials received.

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The Manufacturer or Supplier should stack received materials correctly using their own wooden boards to create stacks of pipes. The stacks should contain pipes of same diameter only. The rubber rings should be packed correctly and not be exposed to sunlight or high temperatures. The fittings and accessories packed in boxes will be checked one by one and then packed again and stored.

Once a defect is detected in more than one part of the same lot the case will be examined by the INSPECTOR ENGINEER and the representative of the Manufacturer or Supplier. After determining the origin of the defect a decision can be made whether to accept or refuse specific parts or the entire lot.

Defective parts should be listed on a special form and returned with a descriptive report signed by the INSPECTOR ENGINEER and the representative of the Manufacturer or Supplier. Such returns shall not imply any cost to the Employer.

No defective parts may be left in the storage area.

The material will be considered as properly received only when the storage list and the shipping invoice have been stamped and signed by representatives of the INSPECTOR ENGINEER and the representative of the Manufacturer or Supplier and when a competent authority has issued a quality certificate as regents by the INSPECTOR ENGINEER.

10.4 - Material

The pipes shall be made of carbon steel sheets with a low to medium traction resistance (minimum 34 kgf/mm^2), a minimum flow limit of 21 kgf/mm^2 and a minimum stretching capacity of 28% at 50 mm and 22% at 200 mm.

Standard sheets should be according to the ANBT NBR -6648 CG 21 norm (over 5 mm thick) and the ANBT NBR -6650 CG 21 norm (less than 5 mm thick), equivalent to ASTM A 283 grade C. The sheets used for the connections shall follow the same norms.

10.5 - Manufacture Of The Pipes And Part

The edges of steel plates, which are to be joined by automatic welding, should be cut mechanically in the desired shapes - Sec. 3.1 - AWWA - C. 201.

The longitudinal welding may only be done after the rolling of the sheets Sec. 3.2 - AWWA - C. 201.

When assembling the sections and with regard to the adjustment of the parts in welding position the specifications of Sec. 3.4 - AWWA - C. 201 should be observed.

The welding of the sheets for making of sections should also follow the specifications of Sec.3.6 - AWWA - C-201.

The correction of welding defects and use of automatic or manual welding will likewise be in accordance with Sec. 3.7,3.8 and 3.9 - AWWA - C. 201.

Welders must meet the requirements of ASMR "Boiler and Pressure Vessel Code ", Sec. ix, Part A and of AWS "American Welding Society", as specified in Sec. 3.1 - AWWA - C. 201.

Finally, all surfaces and edges to be welded must be free of oil, grease and dirt.

The manufacture of pipes, fittings and accessories must be strictly in accordance with the specifications of norms ABNT EB 554, ASTM A134, ASTM A139 and AWWA C200.

The clamps will be made according to the ABNT EB 585 Fe 4212 norm (equivalent to DIN 1693 GGG 42 and ASTM A 536 GR G5-45-12).

The screws will be made of steel SAE 1036, forged ASTM A 307. The rubber rings (will be manufactured according to norm ASTM-D-200-2bc 710 B 14.

The Manufacturer of the pipes and fittings shall, if requested by the purchaser, supply a control based certificate to prove that the parts are suitable and meet the requirements of the aforementioned items.

10.6 - Ranges Of Tolerance

The accepted tolerance, in the dimensions of the manufacture of the pipe sections, shall follow the specifications in the AWWA - C 201, witch are:

- external diameter, as calculated from the circumference : $\pm 0,5 \%$;
- validation difference between largest and smallest diameter : $1,0 \%$;

- length variation in relation to specifications:
 - ⇒ normal section : 50,8 mm (2 inches)
 - ⇒ special section : 3,17 mm (1/8 inches).

10.7 - Tests

The test will belong to two categories : welding tests and hydrostatic tests. These tests will be carried out at the factory and will aim at the sections of the manufactured pipes.

The welding tests will be carried out according to Sec. 5 - AWWA - C-201, which determines at least one test sample for every 91,5 mm (300 feet) of manufactured pipe. The types and quantities of the sheets for samples and welding must follow the recommendations of sec. 5.1.4. of AWWA - C 201.

The required welding tests are:

- Etch test (attack with HCl);
- Reduced-section tensile test;
- Free bend test;
- Root bend test;
- Nick break test.

Test results should be in accordance with the limits of tolerance stated in Sec. 5.2 - AWWA - C 201, and the acceptance, in case the section is reconditioned, should be as determined in Sec. 5.3 - AWWA - C 201.

The hydrostatic tests should be carried out in the factory and must be appropriate and the pressures tested should be those indicated in the order.

10.8 - Costing Of Pipes And Special Fitting At The Factory

10.8.1 - Scope

This specification refers to the execution conditions of the internal and external coating of the steel pipes welded at the factory.

The coatings will be made in strict accordance with the AWWA - C-203 norm: "Standard for Coal Tar Enamel Procreative Coatings for Steel Water Pipe".

This item does not apply to the coating of field weldments and repairs of damage caused by transportation and/or installment.

10.8.2 - Complementary Information

The coatings specified here are made to protect against corrosion of the steel pipes, whether they are buried or not, and under normal installation conditions. For aggressive conditions the coatings will have to be special and will be described separately.

The internal coating will consist of a first coat of paint with surface mordant. When dry this coat will be coal tar enamel, or epoxy. The coats may be applied manually or automatically.

The external coating for buried pipes will consist of a primary coat of paint with surface mordant which, once dry, will be followed by a coat of bituminous enameled covered by a layer of asbestos felt impregnated by enamel, then followed by a protective coat of whitewash or Kraft paper.

The external coating for non-buried pipes will consist of two primary coats of red lead based paint followed by a coat of paint with aluminum pigments. The second of the primary coats may be substituted by synthetic white enamel.

The supplier should be offered the line project with diameters, location and extension of underground and surface intervals and the types of protective coating, the temperature to which the pipe will be submitted before and after installment, the coating consumption rates for each area of application as well as the AWWA - C- 203 norm and list of required tests.

10.8.3 - Execution of Coatings

The INSPECTOR ENGINEER must be present during the coating work and will watch the work procedure, coating quality and acceptance tests, making sure the AWWA-C-203 norm is obeyed.

All pipe surfaces must be thoroughly cleaned by washing and sandblasting, so that no oil, rust or other encrustation's remain and the surface becomes gray. The necessary care is specified in Sec. 3.2 of AWWA-C-203.

The primary paint may be applied manually with brushes or mechanically with a spraying device, but it is not permitted to use any thinner in the paint which should be applied immediately after clearing the dry surface.

The primary paint application conditions, regarding drying time, application temperature limits and correction of defects in the painting, will be as specified in Sec. 3.3 and 3.4 AWWA - C -203.

The bituminous coal tar enamel should be heated in appropriate kettles with temperature control and there should be a protection against dust and humidity before and heating process, according to Sec. 3.5 - AWWA - C- 203.

The application of enamel on the external surface shall be done by rotating the pipe and spiraled bands of even thickness, firmly adherent to the primer. The successive bands should have a withdrawal of 12,7 mm (at least 1/2 inch). The application conditions are specified in Sec. 3.9 - AWWA - C- 203.

The pipe sections which will almost all have their joints welded on the site of installment must not have any coating on the butt ends so as to avoid damage.

. Primary Painting

- ◇ The primary paint for the internal and external coating of the buried pipes must be "type A " Coal Tar Primer specified by the AWWA - C- 203 norm and must guarantee a perfect adherence of the bituminous enamel. The painting should meet the requirements of the Sec. 12 - AWWA - C - 203.
- ◇ The primary paint for the external coating of the non-buried pipes will be the red lead type in synthetic resin and must be as specified in Sec. 8 - AWWA - C- 203.
- ◇ In cases when the second coat is synthetic white enamel, a titanium oxide in alkaline resin will be used, according to Sec. 9 - AWWA - C- 203.

. Coating

- ◇ The bituminous enamel should be produced by a special treatment of coal tar pitch with filler of inert material and without any kind of asphalt.

- ◇ The enamel must meet the requirements of "Table I" for test of the AWWA - C- 203 norm.
- ◇ The sampling tests for the determination of consumption rates, drying time, heating temperatures and application are specified in Sec. 3 - AWWA - C - 203 together with the procedure to be followed.
- ◇ The making of sample sheets, laboratory tests and parameters are specified in the following norms: ASTM-M-D.26;D.271; D.71 and D.5, and AWWA -C-203 - Sec. 4.4 and Sec. 5. These norms are for the determination of filling point rates, specific weight, penetration rate, high temperature outflow, low temperature clefting, deflation, enamel at operation temperature.

. Protective Covering

- ◇ The asbestos felt must not contain less than 85 % asbestos of the total amount of unsaturated felt and may be applied once it's been saturated with coal tar enamel.
- ◇ The physical characteristics of the asbestos felt should correspond to Sec. 6.2 to 6.6 - AWWA - C- 203 and the procedures of ASTM - D - 146.
- ◇ The tar paint should be made of water, linseed oil, limestone and salt in the proportions stated in Sec. 7 - AWWA - C- 203.
- ◇ The aluminum paint should have the composition, pigmentation and physical characteristics specified in the Sec. 10 and 11- AWWA - C - 203.

10.9 - Inspection

Apart from the visual inspection of the coating quality, the external surface must undergo inspection of electric insulation so that areas with low electrical resistance, i.e. openings in the coating, may be detected.

The internal surface, especially where there are parts to be reconditioned or where the personnel moves, may be submitted to similar test if the INSPECTOR ENGINEER wishes so.

The electrical resistance test, called "Holiday Test" , will be carried out with a portable, voltage-adjustable "Electrical Holiday Detector", operated as described in Sec. 3.13 - AWWA - C - 203.

10.10 - Technical Assistance

The Manufacture or Supplier is obliged to offer technical assistance free of charge to the Employer during the reception, assembly and start-up of the network, and until the completion of tests and their acceptance.

11 - HIGH DENSITY POLYETHYLENE PIPES AND FITTINGT

11.1 - Generalities

These Technical Specifications prescribe the minimum requirements for the acceptance and reception of high density black polyethylene pipes containing vinyl acetate (VA), with high resistance to fracture by tension, to ultraviolet radiation and to thermal oxidation and which are to be used for transporting and distributing water either underground or over ground.

The pipes should be made of high density black polyethylene in such a way that the end product meet the requirements of these technical specifications.

For the pipes, fittings and accessories offered the proposal must come with catalogues and trial certificates for evaluation during the judgment of the proposals.

All the pipes, fittings and accessories specified here must at least support the operating pressure required for class, according to the quantification charts.

All equipment's and materials must be delivered at the jobsite.

The mentioning of specifications of fittings and accessories of specific Suppliers and Manufacturers does not imply any preference, but is merely a reference to the desired characteristics, and any other similar parts may be offered.

The pipes must be of proven resistance to the operation pressure of the project and must last for at least 05 (five) years. All materials shall be delivered with an 18 - months guarantee or be guaranteed for 12 months after set in to operation.

The Manufacturer or Supplier will be responsible for completely substituting the components included in the project for other equipment's of similar performance and technical specifications.

The materials should contain an adequately dispersed content of vinyl acetate and soot and should be stabilized with appropriate antioxidant in order to make the product resistant to fracture by tension, absorbent of ultraviolet radiation, resistant to thermal oxidation and flawless.

The Manufacturer or Supplier of the pipes, fittings and accessories should hire a specialized technician to work at the jobsite supervising the reception of the material and the pipe tests after assembly of the network.

During the assembly phase the Supplier's or Manufacturer's technical representative should communicate with the INSPECTOR ENGINEER from the Secretary of Water Resources about any necessary changes for the carrying out of the services with perfection and according to the standards of the company.

The price stated in the proposal of the supplier or Manufacturer with regard to pipes, fittings and accessories must include manufacturing costs, transportation, delivering and unloading of materials, insurance, social and fiscal fees, technical assistance and other expenses for which the Manufacturer or Supplier cannot claim any reimbursement.

Price proposals will refer to the month of bidding and will be in the currency stated in the public notice of the competition.

11.2 - Identification

The pipes should be marked with easily readable characters, using a pyrograph every 2 meters at the most. The markings should be:

- a) identification or brand of manufacturer;
- b) number norm;
- c) the abbreviation for high density black polyethylene;
- d) number indicating nominal diameter;
- e) nominal pressure "NP".

And at least once in every bobbin there should be a code for tracing back the product to the Manufacturer's Quality Program.

11.3 - Transportation

The pipes, accessories and all other components should be transported by the Manufacturer or Supplier (including loading, unloading and conditioning) to the jobsite and should be placed according to the INSPECTOR ENGINEER'S instructions.

11.4 - Reception And Storage

A representative of the INSPECTOR ENGINEER and the Manufacturer or Supplier shall be in charge of receiving all materials and will direct workers in the unloading area without any cost to the Employer.

The Secretary of Water Resources (SRH) will be solely responsible for safekeeping and conserving materials received.

The Manufacturer or Supplier should stack received in bobbins or rods in an appropriate fashion on top of wooden platforms. The fittings and accessories packed in boxes will be checked one by one and then packed again and stored.

Once a defect is detected in more than one part of the same lot the case will be examined by the INSPECTOR ENGINEER and the representative of the Manufacturer or Supplier. After determining the origin of the defect a decision can be made whether to accept or refuse specific parts or the entire lot.

Defective parts should be listed on a special form and returned with a descriptive report signed by the INSPECTOR ENGINEER and he representative of the Manufacturer or Supplier. Such returns shall not imply any cost to the Employer.

No defective parts may be left in the storage area.

The material will be considered as properly received only when the storage list and the shipping invoice have been stamped and signed by representatives of the INSPECTOR ENGINEER and he representative of the Manufacturer or Supplier and when a competent authority has issued a quality certificate as regents by the INSPECTOR ENGINEER.

11.5 - Materials

The pipes should be made of high density black polyethylene in such a way that the end product meet the requirements of this Norm.

The basic polymer should be enriched with the products which are strictly necessary for its transformation and for the pipes according to this Norm.

The material should contain an adequately dispersed content of vinyl acetate and soot and should be stabilized with appropriate antioxidant in order to make the product resistant to fracture by tension, absorbent of ultraviolet radiation, resistant to thermal oxidation.

The pipes must be made with the dimensions and tolerance listed Table 1.

TABLE 1 - DIMENSIONS AND TOLERANCE FOR HIGH DENSITY BLACK POLYETHYLENE

DIAMETER OF PIPE (mm)	EXTERNAL DIAMETER (mm)		THICKNESS OF WALL (mm)			
			SRD 11		SDR 17,6	
	MIN	MAX	MIN	MAX	MIN	MAX
90	90	90,6	8,2	9,2	5,1	5,8
125	125	125,6	11,4	12,7	7,1	8,0
140	140	141,0	12,8	14,2	8,0	8,9
180	180	181,2	16,4	18,2	10,2	11,4

The pipes should be supplied in bobbins with multiple lengths of 50 m and a tolerance of + 1,0 % - 0,5 %. The unit of purchase of the pipes will be meters and the requested quantities should be whole multiples of bobbins.

11.6 - Inspection Trials

The pipes must be submitted to trials, then discriminated and accompanied by a certificate issued by a competent authority.

a) Raw material quality trials

- Ultraviolet absorption coefficient submitted to 12:008 - 039;
- Oxidant induction time submitted to 12:008 - 040;
- Qualitative analysis of ultraviolet presence;

- Soot contents submitted to MB 1123 or MB 9058;
- Density submitted to MB 1123 or MB 1160;
- Traction resistance and stretching capacity submitted to NBR 9622;
- Resistance to fracture by tension submitted to project of norm 12:008 - 041.

b) Raw material reception trials

- Dispersion of soot according to ABNT, project 2: 009.22001/88;
- Fluidity rate submitted to MB 1122;
- Pipe acceptance trials;
- Dimensions and tolerances.

The pipes samples, measured as specified in Table 2, must meet the requirements stated in Table 1 as far as the average external diameter and the wall thickness are concerned.

In each composed lot the sample (bobbins) for dimensional inspection is taken as specified in Table 2.

TABLE 2 - SAMPLING PLAN FOR DIMENSIONAL INSPECTION

SIZE OF LOT	NUMBER OF SAMPLES	FIRST SAMPLING		SECOND SAMPLING	
		FIRST NUMBER ACCEPTANCE	FIRST NUMBER REFUSAL	SECOND NUMBER ACCEPTANCE	SECOND NUMBER REFUSAL
50 - 90	8	0	2	1	2
91 - 150	13	0	3	3	4
151 - 280	20	1	4	4	5
281 - 500	32	2	5	6	7

- Traction resistance and stretching capacity - samples obtained from pipes and submitted to NBR 9622 at a speed of 500 mm/min and at $(23 \pm 2) ^\circ \text{C}$, according to 6.9.5.2;
- Accelerated thermic aging - samples obtained from pipes and submitted to 12: 0 08 - 042 during 48 hours at $(100 \pm 5) ^\circ \text{C}$, according to 6.9.5.2;
- Increase in fluidity - samples obtained from pipes and submitted to MB 1122, as established in 6.9.5.2;
- Resistance to short time hydrostatic pressure - samples obtained from pipes according to 6.9.5.4, should not burst when submitted to 2: 06.07 -003;
- Resistance to prolonged internal hydrostatic pressure - samples obtained from pipes according to 6.9.5.4, should not burst when submitted to 2: 06.07 -004;
- Dimensional stability - samples obtained from pipes and submitted to 2: 06.07 - 005 during 1 hour and at $(100 \pm 3) ^\circ \text{C}$, as established in 6.9.5.

d) Inspection

The pipes should be inspected at the jobsite. The Manufactures or Supplier should leave equipment, control models and trial technicians at the purchaser's disposal, in accordance with their quality control routine.

The purchaser or his representative should be informed about the starting date of the reception of ordered material at least 15 days in advance.

If the purchaser or his representative does not show up on the scheduled date to watch the reception trials, the Manufacturer should not start trials but settle a new date with the purchaser.

The manufacturer or Supplier should present a Quality Guarantee Handbook specifying the organization and the procedures of the system of his Quality Program with respect to :

- I. performance guarantee for the high density black polyethylene used in the making of the pipes and based on quality trials;

- II. inspection planning;
- III. control of documents;
- IV. measuring and control devices;
- V. inspection and trials for the reception of raw material;
- VI. inspection and trials for the acceptance of pipes;
- VII. final inspection;
- VIII. corrective action;
- IX. handling, packing and shipping;
- X. quality records;
- XI. quality checking.

The total supply of pipes will be subdivided in lots from 500 m to 25.000 m which will then be submitted to a dimensional check through the following steps:

- a) The wall thickness should be measured with a micrometer at the butt end of the pipes being controlled, free of fringes and about 1 cm from the edge;
- b) Three to eight equally interspaced measurements should be taken on the perimeter, and minimum thickness found shall be considered the lowest value obtained with a precision down to 0,1 mm;
- c) The external diameter of the butt end of the pipe should be measured with a thickness compass and the measurements should be taken orthogonal to obtain the arithmetic average with a precision down to 0,1 mm.

The pipes samples obtained as specified in Table 2 and which have passed the dimensional check shall compose lots, as shown in Table 3, for destruction trials.

TABLE 3 - SAMPLING PLAN FOR DESTRUCTION TRIALS

SIZE OF LOT	NUMBER OF SAMPLE	FIRST SAMPLE		SECOND SAMPLE	
		FIRST NUMBER ACCEPTANCE	FIRST NUMBER REJECTION	SECOND NUMBER ACCEPTANCE	SECOND NUMBER REJECTION
BOBBINS	BOBBINS	NEGATIVE RESULTS OBSERVED			
50-90	2	0	2	1	2
91-150	3	0	2	1	2
151-280	5	0	3	3	4
281-500	8	1	4	4	5

The samples for destruction trials should be obtained as follows:

- For the trials of resistance to fracture by tension the sample should be about 250 mm long;
- For the trial of traction resistance and stretching capacity and for the trial of accelerated thermic aging the sample should have the shape and size described in NBR 9622, type 2;
- For the trial of increase in fluidity rate the sample should be a fragmented pipe segment weighing about 10 g;
- For the trial of internal short-time hydrostatic pressure and for the trial of internal prolonged hydrostatic pressure with temperature the samples should be about 400 mm;

- For the trial the dimensional stability the sample should be about 150 mm long.

As soon as the INSPECTOR ENGINEER has finished the inspection trials he should complete an inspection certificate on the site of inspection.

The lots will be accepted or rejected, according to number of defective pipes, as shown in Table 3, and depending on evaluation of the INSPECTOR ENGINEER.

If two negative results occur, trials should be repeated in two more pipes, that is with twice as many samples, in order to approve all pipes.

The bobbins from where the testing samples were taken may be accepted as having the original full length, if authorized by the INSPECTOR ENGINEER.

11.7 - Technical Assistance

The Manufacturer or Supplier is obliged to offer technical assistance free of charge to the Employer during the reception, assembly and start-up of the network, and until the completion of tests and their acceptance.

When a line is in need of fittings and special parts along its extension, the interchangeability at these points and in the interconnections with other materials should be taken care of.

At least ten assembly joints per diameter should be supplied for a quick coupling in case of accident. These joints must permit interchangeability with other materials.

The Manufacturer or Supplier will supply an example of each equipment and material used for the perfect union of high density black polyethylene pipes by welding. This will imply no cost to the Employer who will be responsible for the safekeeping of this equipment and material.