3. MATERIAL SPECIFICATIONS

All products must comply with the Materials Specifications as referenced in this section, and the County's Standard Details. All references to ASTM, AWWA, and other standards shall include latest revisions.

3.1 Water Systems

3.1.1 Water Pipe

A. Ductile iron pipe shall meet the requirements of AWWA C151 and AWWA C150. 3" through 12" pipe shall be, at a minimum, pressure class 350. 14" through 20" pipe shall be, at a minimum, pressure class 250. 24" pipe shall be, at a minimum, pressure class 200. 30" and larger pipe shall be, at a minimum, pressure class 150. Pipe shall have cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA Standard C104. A minimum of 5% of the pipe furnished shall be gauged for roundness full length and so marked. Pressure class of pipe shall be increased if the specific installation warrants it.

Pipe fittings shall be ductile iron meeting the requirements of AWWA C110 or AWWA C153, pressure class 250. Fittings shall have a cement-mortar lining and a bituminous seal coating.

Buried pipe and fittings shall have either mechanical joint or push-on joint, both conforming to the requirements of AWWA C111. Bolts for mechanical joint fittings shall be high strength cast iron having an ultimate tensile strength of 75,000 psi and a minimum yield point of 45,000 psi.

Exposed pipe and fittings shall have flanged joints conforming to the requirements of AWWA C115. Pipe shall be minimum thickness of class 53. Bolts shall be high strength cast iron having an ultimate tensile strength of 75,000 psi and a minimum yield point of 45,000 psi.

B. Polyvinyl chloride pipe (PVC) 4" through 12" in size shall conform to the requirements of AWWA Specification C-900, with gasket joints, minimum DR-18 Class 150 with iron pipe O.D. Fittings shall be ductile iron, Pressure Class 250, with mechanical joints. Ductile iron pipe shall be utilized if the working pressure for PVC pipe will be exceeded in the specific installation. Pipe shall be certified by the National Sanitation Foundation.

Cell Classification for PVC water pipe shall be 12454-B.

C. Molecularly Oriented Polyvinyl Chloride (PVCO) 4" through 12" in size shall conform to the requirements of AWWA Specification C-909, with gasket joints, Class 150 with iron pipe O.D. Fittings shall be ductile iron, Pressure Class 250, with mechanical joints. Ductile iron pipe shall be

utilized if the working pressure for PVC pipe will be exceeded in the specific installation. Pipe shall be certified by the National Sanitation Foundation.

3.1.2 Gate Valves and Tapping Valves

A. Gate valves shall comply with AWWA Standard C500, latest revision and the following:

1. All valves shall be manually operated, inside screw and yoke, equipped with operating nut, for installation in a vertical position, unless otherwise specified. They shall be iron body, bronze mounted, double disc with one of the following wedging designs:

    a. Two-point side wedging as employed in the Metropolitan design.

    b. Four-point wedging as employed in the Mueller design.

    c. Two-point bottom wedging as employed in the Clow design.

    d. “Classic” wedging as employed in the American Darling design.

2. All wedges will be solid bronze.

3. All valves shall open left (counter clockwise). Buried valves shall have mechanical joints while exposed valves shall have flanged joints. All joint surfaces of mechanical joint end gate valves which will be in contact with the mechanical joint gasket shall be fully machined to the dimensions and tolerances set forth in ASA A21.11.

4. The bodies, bonnets and other cast iron parts shall conform in all respects to the American Society for Testing Materials’ Standard Specifications for Gray Iron Castings, ASTM Specification Designation A-126, Class B for valve sizes 4” through 24” and A-126, Class C for valve sizes 30” through 48”. The castings shall be clean and perfect without blow or sand holes or defects of any kind. No plugging or stopping of holes will be allowed.

5. All valves shall have either a bronze stem collar bushing with two O-rings above the stem collar or a stem collar with one O-ring below and one O-ring above the stem collar, with the stem collar being completely sealed in a permanent grease reservoir.

6. All other materials not specified shall meet AWWA C500, latest edition.

7. Valves 4” through 12” must have a 200 psi working and 400 psi test pressure. Valves 14” and larger must have 150 psi working and 300 psi test pressure.

8. All valves shall be manufactured to allow removal of seal plate under pressure in either an open or closed position.

9. If the standard valve provided by a manufacturer does not fully comply with these specifications, but compliance can be attained by providing optional features, then each valve must be permanently marked to indicate the option or options that have been provided. The method of marking valves indicating the options which are included must be approved by the County.

B. Resilient Seat Gate Valves

1. All resilient seat gate valves 2”-12” in size shall comply with AWWA C-509, latest revision.

2. All valves shall be manually operated non-rising stem, equipped with operating nut, for installation in a vertical position, unless otherwise specified, and the valve body shall be ductile iron or high strength cast iron with reinforced flanges.

3. All iron surfaces, internal and external must be coated with a minimum 8 mils thickness of hand applied epoxy or 3-5 mils thickness fusion bonded epoxy.

4. The valve stem shall have an independent stem nut (not rigidly attached to the gate) which allows the gate to flex without stressing the stem.

5. All valves shall have either a bronze stem collar bushing with two O-rings above the stem or a stem collar with one O-ring below and one O-ring above the stem collar.

6. Seating shall use compression closure. The gate shall be of a true bi-directional, mirror image design.

7. Valves shall have a smooth bottom design.

8. Valves shall have a port in the bottom of the gate to allow purging of the gate.

9. All valves shall open left (counter-clockwise). Buried valves shall have mechanical joints while exposed valves shall have flanged joints.

10. The bodies, bonnets and other cast iron parts shall conform in all respects to the American Society for Testing Materials' Standard Specifications of Gray Iron Castings, ASTM Specification Designation A-126, Class B for valve sizes 2" through 12". The castings shall be clean and perfect without blow or sand holes or defects of any kind. No plugging or stopping of holes will be allowed.

11. Valves must have a 250 psi working and 400 psi test pressure.

12. If the standard valve provided by a manufacturer does not fully comply with these specifications, but compliance can be attained by providing optional features, then each valve must be permanently marked to indicate the option or options that have been provided. The method of marking valves to indicate that options are included must be approved by the County.

C. Tapping Valves:

1. Tapping valves shall meet above specifications as referenced in A. and B. above except, the body seat rings shall have a clear inside opening sufficient to pass a cutter of full diameter and equal to the nominal size of the valve. The outlet end shall be suitable for use with the type of pipe being utilized.

2. Tapping valves will be suitable for use with all approved manufactured tapping sleeves without modification.

3.1.3 Butterfly Valves (16" - 72")

All butterfly valves shall conform to the latest revision of AWWA Standard C-504, Class 150-B unless otherwise indicated and meet the following:

A. Valve bodies shall be cast iron, ASTM A-126 Class B or ductile iron per ASTM A-536 grade 65-45-12. Body ends shall be flanged with facing and drilling in accordance with ANSI B16.1, Class 125 or mechanical joint in accordance with AWWA Standard C-111 or ANSI A21.11. All mechanical joint end valves shall be furnished complete with joint accessories (bolts, nuts, gaskets and glands), and is for underground use only. All valves shall conform with AWWA C-504, Table 3, Laying Lengths For Flanged Valves and Minimum Body Shell Thickness for all Body Types.

B. Valve disc shall be cast iron, ASTM A-126 Class B or ductile iron ASTM A-536, grade 65-45-12. Valve disc shall be of the offset or symmetrical design providing 360 degree uninterrupted seating. For sizes 30" and larger disc shall be of the flow through type, cored, or domed with ribs parallel to flow.

C. The resilient seat shall be BUNA-N located in the valve body mechanically retained by epoxy or 18-8, Type 304 stainless steel retaining ring secured by 18-8, Type 304 stainless steel screws. The seat shall be capable of mechanical adjustment in the field and field replaceable without the need for special tools on 24" and larger valves. Valve mating seat shall be 18-8, Type 316 Stainless Steel.

D. Valve shaft shall be 18-8, Type 304 stainless steel. Valves shall have either one piece (through shaft) or two piece (stub shaft). The shaft should be attached to the disc by means of O-ring sealed taper pins with lock nuts on 30" and larger valves. Taper pins should be either 304 stainless steel or 416 stainless steel heat treated for added strength.

E. The valve assembly shall be furnished with a factory set thrust bearing designed to center the valve disc at all times.

F. Shaft bearing shall be contained in the integral hubs of the valve body and shall be of non-cold flowing phenolic backed, PTFE or corrosion resistant self-lubricated sleeve type.

G. Valve shaft seal shall consist of Split-V ring. Where the valve shaft projects through the valve body for the actuator connection, the Split-V ring packing seal shall be field replaceable without valve disassembly.

H. Valves shall open counter-clockwise.

I. When required, manual actuators shall be amply sized for line conditions. All manual actuators should be traveling nut or wormgear type. All 16" through 72" butterfly valve manual actuators shall be capable of withstanding 450 foot pounds of input torque against the open or closed stops. All actuators shall have adjustable mechanical stop limits. The closed position stop may or may not be externally adjustable.

J. All valves shall be coated with AWWA Standard Epoxy Coatings or asphalt varnish equal, in conformance to AWWA Standard C-550 or C-450, latest revision. All interior ferrous surfaces, including disc, shall be coated a nominal 10 mils thick for long life; and body exterior shall have a minimum 8 mils thickness of hand applied epoxy or 3-5 mils thickness fusion bonded epoxy coating in order to provide protection in shipment and storage, and to afford a superior base for field-applied finish coats.

3.1.4 Tapping Sleeves (Fabricated Steel)

A. The body of the tapping sleeve shall be of 3/8" carbon steel, ASTM grade A285.

B. Flange to be AWWA C207 Class D ANSI, 150 lb. drilling.

C. The carbon steel body shall have a 12 mil thick coating of fusion-bonded epoxy. Bolts shall be 18-8, Type 304 stainless steel.

D. Gaskets shall be Grade 60 compounded for use with water, alkalis, mild acids and most hydro-carbon fluids, up to 212° F.

3.1.5 Tapping Sleeves (Stainless Steel)

A. The body of the tapping sleeve shall be of 18-8 type 304 stainless steel.

B. Flange to be ductile iron, carbon steel or 304 stainless steel, 150 lb. drilling.

C. Gaskets shall be Grade 60 compounded for use with water, alkalis, mild acids and most hydro-carbon fluids, up to 212° F.

D. Clamping hardware (nuts, bolts and washers) shall be 18-8 type 304 stainless steel, with plastic anti-gall washers. Drop-in bolts or welded-on studs are acceptable.

3.1.6 Tapping Sleeves (Fabricated Steel with Mechanical Joint Ends)

A. Sleeve body, valve flange, gaskets, hardware and coating to be the same as the fabricated steel tapping sleeve.

B. The mechanical joint glands to be ASTMA-36 iron or ductile iron.

C. The gland retaining hardware (nuts, bolts and washers) to be 18-8 type 304 stainless steel.

3.1.7 Tapping Sleeves (Cast Iron with Mechanical Joint Ends)

A. The body and glands of the tapping sleeve shall be of ASTM-126, Class B cast or ductile iron. Sleeve shall be furnished complete with all mechanical joint accessories (bolts, nuts, gaskets and glands), and shall have a bituminous seal coating.

B. Valve flange, body gaskets and clamping hardware (bolts, nuts and washers) shall be as specified for the fabricated steel tapping sleeve.

3.1.8 Tapping Sleeve Applications

A. The use of tapping sleeves and valves on the County water system will be considered where it can be shown that installation of a tee and line valve on the existing water main will not be beneficial to the County.

B. The stainless steel or fabricated steel with mechanical joint ends or cast/ductile iron with mechanical joint ends tapping sleeves may be used for any approved tap on PVC or ductile iron water main.

C. The stainless steel or fabricated steel with mechanical joint ends or cast/ductile iron with mechanical joint ends tapping sleeves may be used for all approved taps on asbestos-cement pipe (except 16" size) and for size-on-size or one size down taps on all other pipe material.

D. The fabricated steel tapping sleeve may be used for approved two (or more) size down taps on PVC, cast iron or ductile iron water main.

F. Certification, Testing and Installation:

1. The following testing and conditions relating to tapping sleeves apply to all manufacturers:

a) The tapping sleeve shall be tested in place to a minimum of 200 psi. It is the contractor's responsibility to order the correct pressure rated tapping sleeve.

b) If the sleeve fails the 200 psi pressure test, the original failed sleeve shall be replaced with an entirely new sleeve.

c) The concrete thrust block shall be poured to also support the tapping sleeve from beneath. The tapping sleeve, valve and tapping machine assembly is to be adequately supported during the tapping operation to prevent movement or rotation of the tapping sleeve.

d) Installation instructions must be followed in strict accordance with the latest County's procedures.

3.1.9 Double Detector Check Valve Assembly

A. Valve Pit:

1. Valve pits shall be of adequate size and readily accessible for inspection, testing, maintenance, and removal of equipment contained therein. They shall be constructed and arranged to properly protect the installed equipment from movement of earth, freezing, and accumulation of water. Poured-in-place or precast concrete, with or without reinforcement, are appropriate materials for construction of valve pits. Pits constructed of block material are not acceptable. Precast concrete vaults will be as reflected on the standard detail drawings as manufactured by CSR Virginia Precast, Elite Fire Protection, Concrete Pipe and Products or approved equal.

2. The vault shall be watertight. The vault shall be coated on the outside face with a mastic or bituminous coating to prevent infiltration.

3. The vault will contain positive drainage. A sump with gravity flow is required if water table problem does not exist. Where water table problem exists, a sump pump is required.

4. Pipe penetrations shall be sealed with "Link-seals", a waterproof mastic coating or equal. A clearance of 1"-3" shall be provided around the pipe where the fire line enters and exists the pit.

B. Valving:

1. Must be U.L. listed or F.M. approved. The double detector check valve assembly shall have a bypass meter with ¾" check valve assembly surrounded by an OS&Y gate valve on both the inlet and outlet side of the assembly. The double detector check assembly shall meet the requirements of the American Society of Sanitary Engineering and the International Plumbing Code Standards for backflow prevention devices.

2. The Fire Department connection may or may not be located in the vault. The use of post indicating valves, location of the Fire Department connection, and other fire related questions will be addressed by the Hanover Fire Administration.

3. Pipe stands, such as poured concrete or fabricated metal, shall be provided to support the entire assembly. Metal pipe stands shall be galvanized or be coated with an acceptable paint to prevent rust. Concrete block or brick are not acceptable support materials.

3.1.10 Fire Hydrants

A. Fire hydrants shall be manufactured in full compliance with this specification and shall also comply with the AWWA Fire Hydrant Specification C-502, latest revision and the following:

1. Type: Compression - Dry Standpipe: Valve shall open against and close with the pressure. The design shall be such that all internal operating parts can be removed through the standpipe and main valve rod extended without excavating.

2. Size: Internal valve diameter shall be a minimum 4½".

3. Inlet Size and Type: 6" mechanical joint end with accessories.

4. Hose Nozzles: Each hydrant shall be equipped with two 2½" I.D. hose nozzles with National Standard threads, one quarter turn bayonet lock or threaded in with O-ring seal and suitable locking arrangement.

5. Steamer Nozzle: Each hydrant shall be equipped with one 4½" Steamer Nozzle having National Standard Threads, one quarter turn bayonet lock, or threaded in with O-ring seal and suitable locking arrangement.

6. Direction of Open: Left, counter-clockwise.

7. Size and Shape of Operating Nut and Cap Nuts: to be 1½" point to flat pentagon. Each hydrant shall be equipped with a weather cap.

8. Seal Plate: The hydrant shall be so constructed that a moisture-proof lubricant chamber is provided which encloses the operating threads, thereby automatically lubricating the threads each time the hydrant is operated. The lubricant chamber shall be enclosed with at least three O-rings. The two lower O-rings will serve as pressure seals; the third O-ring will serve as a combined dirt and moisture seal to prevent foreign matter from entering the lubricant chamber. The hydrant shall be equipped with either an anti-friction washer or bronze bushing to reduce operating torque. The bonnet will be secured to the hydrant using bolts and nuts.

9. Standpipe - Groundline Safety Construction: The standpipe sections shall be connected at the groundline by a two part, bolted safety flange or breakable lugs. The main valve rod sections shall be connected at the groundline by a frangible coupling. The standpipe and groundline safety construction shall be such that the hydrant nozzles can be rotated to any desired position without disassembling and removing the top operating components and the top section of the standpipe. The minimum inside diameter of the standpipe shall be 6".

10. Main Valve, Rod Assembly: The main valve rod assembly shall be so constructed to allow removal of all operating parts through the standpipe regardless of depth of bury, using a removal wrench which does not extend below the groundline of the hydrant. The main valve seat ring shall be bronze and its assembly into the hydrant shall involve bronze to bronze thread engagement, and the valve assembly pressure seals shall be obtained without the employment of torque compressed gaskets. The design of the main valve rod shall be such that the operating threads at the top of the rod and the valve assembly threads at the bottom of the rod are isolated from contact with water in the standpipe or in the hydrant inlet shoe.

11. Drain Valve: The operation of the drain mechanism shall be correlated with the operation of the main valve and shall involve a momentary flushing of the drain ports each time the hydrant is

opened. The drain ports shall be fully closed when the hydrant valve is more than 2½ turns open and the drainage channel in the bronze valve seat ring shall connect to two or more outlet drain ports. No springs may be employed in the hydrant valve or drain valve mechanism.

12. Depth of Bury: Normally hydrants shall be suitable for installation in trenches 4-1/2' deep. Required parts and materials to adjust fire hydrants to different depth of bury shall be provided by the manufacturer to meet actual field conditions as required.

13. Painting Instruction: Two prime coats and one aluminum finish coat shall be used, unless otherwise specified. Exposed area of fire hydrant shall receive one field coat of "aluminum" color Rust-Oleum paint after installation. Final field coat shall be brush applied. The wetted surface of the hydrant shoe shall be epoxy coated to prevent corrosion of the waterway.

14. Pressure Rating: Test pressure 400 psi, working pressure 200 psi.

B. If the standard hydrant provided by a manufacturer does not fully comply with these specifications, but compliance can be attained by providing optional features, then each hydrant must be permanently marked to indicate the option or options that have been provided. The method of marking hydrants to indicate that options are included must be approved by the Product and Design Review Committee.

3.1.11 Check Valves

Check valves shall be of the horizontal swing type; iron body bronze mounted, equipped with weighted lever or spring as specified or shown on the plans.

3.1.12 Water Service Assembly for 5/8" Water Meters

All materials for the installation of water services shall be as follows or approved equal:

A. Water meter boxes shall be Brooks 2200 (18" depth), NDS D-2400 (18" Pit), Mid-States Plastics MS182418, or approved equal.

B. Meter box lids shall have a 1-3/4" diameter hole located in its center. The hole shall either be cast in place, at the foundry or, after casting, be retrofitted via a plasma arc torch. Holes shall be compatible with the County's touch read meter system.

C. Water meter boxes used in traveled areas shall be made of cast iron as manufactured by Capitol Foundry or approved equal. Material shall consist of gray iron per ASTM A-48 (latest revision) Class 30.

D. Meter yokes shall be 3/4" Ford 5020, AY McDonald 502, Mueller 502 or approved equal with angle valve. Expanders shall be Ford EC23 or approved equal.

E. Corporation stop with corporation cock thread inlet shall be as specified in the approved materials list.

F. Pipe shall be 1" or 3/4" type "K" copper domestic manufactured.

G. Tail piece on yoke shall be 1" or 3/4" type "K" copper, 36" long.

H. Service Saddles:

1. All saddle castings must be ductile iron and meet the requirements of ASTM A-536-80, protected with corrosion resistant paint or epoxy coating.

2. All saddles must have a minimum of two (2) 1 1/2" wide (including bolts) stainless steel straps type 304 (18-8) where welds are passivated for resistance to corrosion. Exception: Ford FS202 which has two (2) bolts and a single strap with a minimum width of 3 1/4".

3. Gaskets must be made of virgin NBR compound.

4. Service saddles are required for all service taps.

I. Backflow prevention devices at yokes are not to be used.

3.1.13 Water Service Assembly for 1" Water Meters

All materials for the installation of water services shall be as follows or approved equal:

A. Water meter boxes shall be Brooks 2200 (18" depth), NDS D-2400 (18" Pit), Mid-States Plastics MS182418, or approved equal.

B. Meter box lids shall have a 1-3/4" diameter hole located in its center. The hole shall either be cast in place, at the foundry or, after casting, be retrofitted via a plasma arc torch. Holes shall be compatible with the County's touch read meter system.

C. Water meter boxes used in traveled areas shall be made of cast iron as manufactured by Capitol Foundry or approved equal. Material shall consist of gray iron per ASTM A-48 (latest revision) Class 30.

D. Meter yokes shall be 1" Ford 504, AY McDonald 504, Mueller 504 or approved equal with angle valve. Expanders shall be Ford EC4 or approved equal.

E. Corporation stop with corporation cock thread inlet shall be as specified in the approved materials list.

F. Pipe shall be 1" or 1 ½" type "K" copper domestic manufactured.

G. Tail piece on yoke shall be 1" or 1 ½" type "K" copper, 36" long.

H. Service Saddles:

1. All saddle castings must be ductile iron and meet the requirements of ASTM A-536-80, protected with corrosion resistant paint or epoxy coating.

2. All saddles must have a minimum of two (2) 1 1/2" wide (including bolts) stainless steel straps type 304 (18-8) where welds are passivated for resistance to corrosion. Exception: Ford FS202 which has two (2) bolts and a single strap with a minimum width of 3 1/4".

3. Gaskets must be made of virgin NBR compound.

4. Service saddles are required for all service taps.

I. Backflow prevention devices at yokes are not to be used.

3.1.14 Water Service Setter for 1-1/2" and 2" Water Meters

All materials for the installation of water services shall be as follows or approved equal:

A. **General:** All 1-1/2" and 2" meter setters shall be constructed of seamless threaded red brass pipe, standard Type K hard copper tube (per ASTM B-88-62,) high quality brass (per AWWA C-800,) and leadless solder, and provide horizontal female pipe threads on both front and rear connections. Setters must include a valved bypass for meter maintenance, except for irrigation and residential meters.

B. **Bypass:** Meter setters shall have an appropriately sized bypass line with an inverted key or ball-type stop threaded directly into the inlet bypass tee fitting. This bypass valve shall have a solid tee head and be either lock wing type or provide a bracket or other device to lock this valve in the "off" position upon installation. If copper tube is used for the bypass line, the compression connection for the copper side of the bypass valve must be as produced by the following manufacturers:

Mueller Co., "110" compression connection for copper pipe; or

Ford Meter Box Co., "Pack Joint" connection for copper pipe; or

A.Y. McDonald, "T" compression connection for copper pipe.

Otherwise, a tee head inverted plug or ball type bypass valve is required with a threaded connection. Both of the bypass tee fittings, (inlet and outlet,) shall have brace pipe eyelets cast within them to stabilize setter upon installation.

C. **Angle Valves:** Flanged, inverted key or ball-type "tee head" angle valves are required on both meter connections, and will include lock wings and meter support bracket to aid in meter installation. Pack joint or compression connections are NOT allowed on the vertical riser pipe; these connections must be threaded or soldered copper. Valves shall be double drilled, (2" size only,) to accommodate both 1 1/2" and 2" meters. Angle or ball valves shall provide a stop or check to limit movement of tee head at 90° Maximum, (from fully open to completely off.) Arrows cast within the inlet valve shall indicate direction of flow while in service.

D. **Dimensions:** Meter setters shall accommodate the following meter dimensions:

1-1/2" flanged meter laying length: 13", plus gaskets

2" flanged meter laying length: 17", plus gaskets

The rise or height of meter setter, measured vertically from center line of inlet pipe thread to center line of meter flange bolt shall be:

1-1/2" meter setter, maximum height of 8 1/2"

2" meter setter, maximum height of 9 1/2"

The copper used on the bypass and vertical riser pipe, (if so equipped,) shall be Type K and comply with ASTM B-88-62, which states outside diameters as shown here:

3/4" nominal pipe size, .875" outside diameter, .065" wall

1" nominal pipe size, 1.13" outside diameter, .065" wall

1-1/2" nominal size pipe, 1.63" outside diameter, .072" wall

2" nominal size pipe, 2.13" outside diameter, .083" wall

The bypass assembly shall be sized as follows:

1-1/2" meter setter requires minimum 1" bypass pipe & valve

2" meter setter requires minimum 1" bypass pipe & valve

E. Meter boxes for 1-1/2" and 2" meters shall be as shown in the standard details.

F. Backflow prevention devices at yokes are not to be used.

3.1.15 Valve Boxes

All underground valves shall be installed in approved cast iron valve boxes, having suitable base and shaft sections and covers to protect the valve and permit easy access and operation. Box assemblies shall have screw adjustment.

3.1.16 Air Release Valves

All air release valves shall be designed in accordance with the following standard and/or by the engineer as required.

A. Type 1: Small orifice valves shall be either of the a) kinetic design type employing only one moving part, a stainless steel float ball or b) of the stainless steel float and lever type. It shall maintain the closed position to prevent the loss of water by positive seating of the float ball against a smoothly ground contact surface of the exhaust orifice.

It shall automatically provide for the escape of air to atmosphere without the loss of water when the float ball moves away from the orifice seat. The body of the valve shall be cast iron and shall be coated to withstand a moist environment.

Air release valves shall have a minimum of a 1” N.P.T. inlet for 6”, 8”, 12”, and 16” pipe sizes and a 2” N.P.T. inlet for pipes 20” and larger; and shall have a minimum of a 3/32” outlet orifice for 6”, 8”, 12” and 16” pipe sizes and a minimum 3/16” outlet orifice with 20” and larger pipes.

Air release valves shall be suitable for 150 psi working pressure at a minimum.

Air release valves for sewage force mains shall be specifically designed for sewage applications.

All flushing attachments shall be provided with air release valves.

B. Type 2: Shall be a combination, dual unit valve, combining one (1) small and one (1) large unit, both employing the kinetic operating principal or of the stainless steel and lever type. For the Kinetic type, the only moving parts shall be two (2) stainless steel balls (one for each unit) which will remain in the respective throat areas when discharging air without blowing shut or collapsing the float ball(s).

In the closed position, resulting from water filled line, the valve shall prevent leakage.

The large orifice seat shall be of composition material and replaceable.

The body of the valve shall be cast iron and shall be coated to withstand moist environment.

Air release valve size shall be 6" with a 3/8" orifice for the small unit and shall be suitable for 150 psi working pressure. Large unit shall be sized based on the specific application.

3.1.17 Valve Manholes

Valve manholes shall be concrete meeting the requirements of ASTM C-478. Diameters shall be as shown on plans but in no case shall they be less than 4 feet in inside diameter except for manholes for butterfly valves which shall have a minimum inside diameter of 6 feet. Manhole frame and covers meeting the requirements for sanitary manhole frame and covers shall be utilized except that the covers shall have the word "WATER" cast on them.

3.1.18 Joint Restraint Systems

When gray cast or ductile iron fittings are used with AWWA C900 PVC pipe in sizes up to 12" or ductile iron pipe in sizes up to 48" and the engineer has determined thrust blocking will not provide adequate thrust restraint, an approved joint restraint system shall be installed.

Under normal conditions, the approved method of restraint shall be concrete thrust blocking per County standard details for dead-ends (cul-de-sacs, etc.); and horizontal bends, reducers, tees and crosses; and a joint restraint system for vertical bends, all valves, and carrier pipe through casings.

All valves should be as close to a tee as possible and restrained to that tee, using approved joint restrainers. Where the valve cannot be installed and restrained at a tee, the valve must be restrained using an approved joint restraint system.

When joint restraint systems are required due to the specific application(s), special design considerations, or poor soil conditions the engineer shall provide the calculations used in determining the required length of pipe on either side of the fitting to be restrained. Also, the engineer shall provide special plan details for each necessary joint restraint system.

Joint restraint systems require that sufficient lengths of pipe be restrained, in addition to the fittings. The standard length of pipe requiring restraint varies from application to application and is designed based on variables such as soil bearing capacity, soil condition, pipe size, pipe material, pressure and fittings.

Where conditions are encountered in the field during construction in which thrust blocks do not provide the required thrust protection, the Developer's and/or County's Contractor shall be responsible for ensuring that the engineer and those individuals on the County staff responsible for plan review prior to plan approval are contacted to evaluate and/or adjust the design appropriately.

All restraint devices must be U.L. listed and F.M. approved. Restraints are acceptable for

PVC and ductile iron pipe under the following conditions:

A. For PVC Pipe

Where PVC pipe is connected to fittings, mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility and minimal deflection of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. There shall be no dissimilar metals allowed. Dimensions of the gland shall be such that it can be used with all AWWA approved standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153.53/A21.53 of latest revision. The mechanical joint restraint device shall have a working pressure of at least twice the working pressure of the pipe with a minimum of 150 psi. Twist-off nuts shall be used to ensure proper actuating of the restraining devices.

All bell and spigot end joints within this length shall be restrained with a clamping ring and an additional ring designed to fit behind the bell end of the PVC pipe. The rings shall be connected with T-head bolts or rods.

All clamping rings shall incorporate serrations on the inside surface to provide positive restraint on the outside surface of the pipe and shall provide full support around the circumference of the pipe to maintain roundness.

Restraining devices shall have a pressure rating equal to or greater than the PVC pipe, and shall be capable of withstanding a minimum test pressure of 2 times the pressure rating of the device.

Restraining devices and T-bolts shall be manufactured from high strength ductile iron, ASTM A536, Grade 65-45-12. Clamping bolts and nuts shall be manufactured from completely corrosion resistant COR-TEN STEEL or equal.

Restraining devices shall be as approved by the Department of Public Utilities.

B. For Ductile Iron Pipe

Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility and minimal deflection of the joint shall be maintained after burial. Glands shall be manufactured of

ductile iron conforming to ASTM A536-80. Twist-off nuts shall be used to ensure proper actuating of the restraining devices.

Restraining devices shall be of ductile iron, heat-treated to a minimum hardness of 370 BHN. There shall be no dissimilar metals allowed. Dimensions of the gland shall be such that it can be used with all AWWA approved standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153.53/A21.53 of latest revision. The mechanical joint restraint device shall have a working pressure of at least twice the working pressure of the pipe.

All bell and spigot end joints within this length shall be restrained with a clamping ring and an additional ring designed to fit behind the bell end of the ductile iron pipe. The rings shall be connected with T-head bolts or rods. Rods must be protected from corrosion either by rod material or coating.

3.1.19 Flushing Hydrants

Flushing hydrants shall be manufactured in full compliance with the following specifications and shall also comply with AWWA's latest specifications on flushing hydrants:

A. The flushing hydrant shall be capable of being locked and shall be freeze-proof. It shall be equipped with National Standard fire thread connections and a breakaway union for high traffic areas.

B. It shall be of size 2".

C. The hydrant barrel shall be 2" iron pipe. The exterior shall be painted with approved coating for durability. The overall length of hydrants can vary according to the depth of water systems.

D. The barrel and the standpipe shall be joined with a breakable malleable union. A brass hose connection, 2-1/2" NSFT with attached cap and chain, shall be provided for convenience in flushing.

E. The body valve shall have bronze body with automatic weep, such that when the valve is in OFF position the hydrant barrel shall automatically drain. The valve stem shall be above ground and shall be lockable to prevent tampering. Its operating device shall be of key-type design, with permanent attachment to the valve stem.

F. Installation shall be in accordance with Hanover County's Flushing Hydrant detail found in these standards.

3.1.20 Cast Couplings

Center Sleeve: Made of ductile iron, Spec ASTM-A536, and coated with an enamel shop coat, sized to accommodate all AWWA pipes of the same nominal size.

End Ring: Made of ductile iron Spec ASTM-A536, and color coded with an enamel shop coat to easily identify its use on various types of pipe.

Gaskets: SBR rubber compound, Grade 30 per Spec ASTM D-2000 for normal water service and an extended shelf life.

Bolts: High strength low alloy steel bolts with heavy hex nuts, per AWWA C-111.

3.1.21 Casing Spacers

Casing Spacers shall be bolt on style with a shell made in two sections of heavy T-304 stainless steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner .090" thick with 85-90 durometer or neoprene rubber. All nuts and bolts are to be 18-8 stainless steel. Runners shall be made of ultra high molecular weight polymer (UHMW) or glass reinforced plaster. Runners shall be supported by risers made of heavy T-304 stainless steel or 10 gauge welded steel. The supports shall be mig welded to the shell and all welds shall be passivated or 3/8" diameter stud welded to band and locked with a locking fastener. The height of the supports and runners combined shall be sufficient to keep the carrier pipe at least .75" from the casing pipe wall at all times.

3.2 Sanitary Sewer Systems

3.2.1 Sewer Pipe and Fittings

A. Polyvinyl chloride (PVC) nonpressure pipe (6”-15”) and fittings shall meet requirements of ASTM D3034, Type PSM, SDR-35 with elastometric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the County for plastic pipe as shown in the County’s Standard Details.

B. Polyvinyl Chloride (PVC) non-pressure pipe (18” - 48”) and fittings shall meet requirements of ASTM F679, Table I Type SDR-35 for large diameter solid wall PVC pipe with elastometric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the County for plastic pipes as shown in the County’s Standard Details.

Cell Classification for Sewer Pipe shall be 12454-B or 12364-C.

C. Polyvinyl Chloride (PVC) non-pressure pipe (21” and larger) shall meet requirements of ASTM F794 and fittings shall meet the requirements of ASTM 3034-35 PVC sewer pipe with elastometric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the County for plastic pipes as shown in the County’s Standard Details.

D. Ductile iron pipe shall meet requirements of AWWA C151. Pipe shall be thickness Class 52.

Mechanical joints and jointing materials shall meet requirements of AWWA/ANSI C111/A21.11.

Push-on joint and rubber gasket shall meet requirements of AWWA C111.

Where exposure to high levels of hydrogen sulfide is not anticipated, pipe may have cement-mortar lining and a bituminous seal coat. Thickness classes shall meet requirement of AWWA C150.Cement mortar lining with bituminous seal coat for ductile iron pipe and fittings shall meet requirements of AWWA/ANSI C104/A21.4. Cement mortar lining shall be standard thickness.

Where exposure to high levels of hydrogen sulfide are anticipated, pipe shall have corrosion resistant coating such as epoxy, Griffin H_2Sewer Safe sewer pipe, Protecto 401 lining, or other coating approved by the County.

Exterior, bituminous coating for cast iron fittings and ductile iron pipe shall meet requirements of AWWA/ANSI C106/A21.6 or AWWA/ANSI C151/A21.51 as applicable.

3.2.2 Sanitary Sewer Manholes:

A. Manholes shall be constructed of precast reinforced concrete manhole sections in accordance with requirements of ASTM C478 and as shown on the Standard Details.

B. A maximum of two lift holes per manhole section may be provided.

C. Provide tongue and groove joints in manhole sections with a preformed groove in the tongue for placement of an O-ring type round, rubber gasket or Press Seal, Inc.'s Profile RS gasket.

Gasket shall comply with requirements of ASTM C361.

Gasket shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure.

D. Provide flexible pipe connections to manholes for pipes 21" in diameter and smaller in size. Materials shall consist of EPDM and elastomers designed to be resistant to water, sewage, acids, ozone, weathering and aging. Use neoprene conforming to ASTM C443 and ASTM C923 and all stainless steel elements of the connector shall be totally non-magnetic Series 304 Stainless, excluding the worm screw for tightening the steel band around the pipe which shall be Series 305 Stainless. The worm screw for tightening the steel band shall be torqued by a break-away torque wrench available from the precast manhole supplier, and set for 60 - 70 inch/lbs.

Cast or core drill openings in manholes to receive connectors. Connectors shall be suitable for field repair or replacements. Connectors not suitable for field replacement are unacceptable.

The assembled connectors shall allow at least an 11° angular deflection of the pipe and at least one inch of lateral misalignment in any direction and be suitable for a normal variation in diameter or roundness for the pipe material used.

E. Manhole steps shall be corrosion-resistant and shall be one-half inch grade 60 steel reinforcing rod encapsulated in a copolymer polypropylene. The steps shall conform with ASTM C478 paragraph 11 and to the dimensions shown on the Standard Details.

F. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, but not tacky or brittle. Seating surfaces between frame and cover shall be machined. The dimensions and weights

shall conform to the requirements shown on the Standard Details. The word “SEWER” shall be cast into the cover.

G. Sealant for manhole frames shall be a one-component polyurethane sealant similar to Sika “Sikaflex” type 430 or bitumastic material.

H. Sealant for flexible pipe connections shall be a two-component polysulfide sealant similar to Sika “Sikaflex” type 412 with primer type 419.

I. All manholes shall be watertight.

J. Coal tar coating are allowed on the exterior of manholes, but not required. Coal tar coatings are not allowed in the interior of manholes.

3.2.3 Corrosion Resistant Manholes

In addition to the requirements above, corrosion resistant manholes shall have a lining system meeting one of the following additional requirements:

A. All concrete utilized in manhole shall have ConShield admixture added in accordance with the manufacturer's recommendations. The precast supplier shall provide written certification that ConShield was added per manufacturer's recommendation to all acid resistant manholes delivered. This certification shall be given to the Inspector prior to delivery. All sections of manhole with ConShield shall be clearly marked by the supplier at the plant so that the Inspector and contractor can identify those manholes with ConShield admixture. The certification provided by the supplier shall indicate the method utilized for marking manholes with ConShield admixture at the plant.

B. Raven 405 epoxy coating as manufactured by Raven Lining Systems, Inc. applied at a thickness of 80 to 100 mils. Coating shall be applied in accordance with all requirements of the manufacturer. All defects shall be repaired in accordance with the manufacturers’ recommendations.

C. PermaCast or PermaForm lining with ConShield admixture applied in accordance with manufacturer’s recommendations.

D. Other coating systems as specifically approved by the department of Public Utilities.

HDPE and PVC lined manholes are not acceptable.

3.2.4 Sewage Air/Vacuum Valves

All sewage air/vacuum valves shall be designed in accordance with the following standard and/or by the engineer as required:

A. The sewage air/vacuum valve shall be designed to automatically exhaust large quantities of air during filling of a system. It shall also allow air to

enter the pipe system when the line is being emptied. All this shall be accomplished through the functioning of a compound lever system in conjunction with a large and small orifice in one integral body casting.

B. This device shall have only orifices and no mechanical leverage, other than the weight of a stainless steel float ball.

C. It shall automatically provide for the escape of the air to the atmosphere without the loss of water when the float ball moves away from the orifice seal.

D. The body of the valve shall be cast iron and shall be coated with fusion bonded epoxy or teflon or other approved coating to withstand moist abrasion and corrosive conditions.

E. Float with Buna-N seal shall be provided for positive seating.

F. Rigid stainless steel valve plug shall be provided to seal off the outlet orifice.

G. Wherever possible, valve shall have elongated bodies to minimize the problem of clogging by permitting the use of a long float stem. However, where height restrictions do not permit the use of the standard height valve, a short body valve can be applied.

H. Sizes 1” through 3” shall have N.P.T. inlets and outlets. Larger sizes shall have flanged inlets conforming to ANSI class 125 or 250 and shall have N.P.T. outlet as standard. Flanged outlet or protective hood shall be optional. It shall have a minimum of 3/32” outlet orifice for an operating pressure of 0-150 psi and 1/8” outlet orifice for an operating pressure range of 0-300 psi.

I. Valve shall be suitable for 300 psi working pressure at a minimum.

J. All flushing attachments shall be provided with each valve.

3.2.5 Sewage Combination Air Release Valves

All sewage combination air release valves shall be designed in accordance with the following standard and/or by the engineer as required:

A. Combination valve shall be designed to have the operating features of both air and vacuum valves and air release valves. It shall purge air from the system at start-up, vent small pockets of air while the system is pressurized and running, and prevent critical vacuum conditions during draining. They shall be installed at all the high points in the pipe line where air would naturally tend to rise during filling and collect during operation and/or where vacuum would tend to form when the system is drained.

B. The device shall have only orifices and no mechanical leverage, other than the weight of a stainless steel float ball.

C. The body of the valve shall be cast iron and shall be coated with fusion bonded epoxy, teflon or approved coating to withstand moist, abrasion and corrosive conditions.

D. Float with Buna-N seal shall be provided for positive seating.

E. Rigid stainless steel valve plug shall be provided to seal off the outlet orifice.

F. Wherever required, a combination of the sewer air and vacuum valve and sewer pressure air release valve shall be made with appropriate piping arrangement to accommodate the specific application.

G. Sizes up to 3" shall have N.P.T. inlets and outlets. Larger sizes shall have flanged inlets conforming to ANSI class 125 or 250 and shall have N.P.T. outlet as standard. It shall have a minimum of 3/32" outlet orifice for an operating pressure of 0-150 psi and 1/8" or 1/16" outlet orifice for an operating pressure range of 151-300 psi.

H. Valve shall be suitable for 300 psi working pressure.

I. All flushing attachments shall be provided with each valve.

3.2.6 Sewage Air Release Valves

All sewage air release valves shall be designed in accordance with the following standard and/or by engineer as required:

A. The sewage air release valve shall be designed to automatically exhaust small amounts of air accumulated at a system's high point. This shall be accomplished while the system is in service and under pressure. They shall be installed at high points in the system where air naturally tends to collect.

B. The device shall have only orifices and no mechanical leverage, other than the weight of a stainless steel float ball.

C. The body of the valve shall be cast iron with stainless steel trim and shall be coated with fusion bonded epoxy, teflon or approved coating to withstand moist, abrasion and corrosive conditions.

D. Stainless steel float with Buna-N seal shall be provided for positive seating.

E. Sizes up to 3" shall have NPT inlets and outlets as per ANSI B2.1. Larger sizes shall have flanged inlet conforming to ANSI B16.1 class 125 as

standard. It shall have a minimum of 3/16" orifice for an operating pressure of 0-150 psi and 1/8" outlet orifice for an operating pressure range of 151-300 psi.

F. Valve shall be suitable for a working pressure of 300 psi.

3.2.7 Sewage Plug Valves

A. All sewage plug valves shall be of the non-lubricated, eccentric type with resilient faced plug and round ports of no less than 90%, or rectangular ports of no less than 80%, of the connecting pipe area, except valves of 24" or larger size shall have port areas of no less than 70% of the connecting pipe area.

B. Valves shall be for buried underground service as well as plant service and shall be rated for 175 psi up to 12" and 150 psi for sizes 14" and larger. Drop-tight shut off shall be provided at full rated working pressure in the standard flow direction and 50 psi in the reverse direction, except when full-rated sealing is required in both directions.

C. Valves 6" and larger shall be equipped with geared actuators with a 2" square operating nut. Handwheel and power actuated valves shall also include a 2" square operating nut for emergency operation.

D. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be zinc plated.

E. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel.

F. Valves shall open left (counterclockwise) and shall have mechanical joint end connections, or as specified by the County.

G. Valve bodies and all other cast iron parts shall conform in all respects to the American Society for Testing Materials' Standard Specifications of Gray Iron Castings, ASTM Specification Designation A-126, Class B. The castings shall be clean and perfect without blow or sand holes or defects of any kind. No plugging or stopping of holes will be allowed.

H. Body ends shall be flanged with facing and drilling in accordance with ANSI B16.1, Class 125 or mechanical joint in accordance with AWWA Standard C-111 or ANSI A21.11. All mechanical joint end valves shall be furnished complete with joint accessories (bolts, nuts, gaskets and glands).

I. Valve bodies shall be furnished with a raised seat surface completely covered with 90% pure nickel to ensure that the resilient plug face contacts only nickel, or a one-piece 304 stainless steel seat ring threaded to the body. The nickel seat must be welded to the valve body or the body seat ring to produce a metallurgical bond with interpenetration to the base metal with a bond strength equal to or greater than the valve body or seat ring material. The nickel or stainless steel seat must be machined to a finish of not more than 16 micro-inches to achieve minimal friction and wear to the resilient plug face during valve operation. Whether welded or screwed, the valve seat shall be designed to provide uniform contact with the resilient plug face and to prevent the plug face from contacting any cast iron surface. Resilient seats or seats attached to the body by screws or any other method not specified herein are not acceptable. Plated or sprayed nickel seats or epoxy seats are not acceptable.

J. Valve bodies shall be furnished with an adjustable closed position stop. The seat end and standard flow direction shall be cast onto the valve body.

K. Resilient faced plug/operating shaft shall be of a one piece design of ASTM A126 Class B cast iron with a seating surface eccentrically offset from the center of the plug shaft, and shall have a precision molded resilient facing of chloroprene (Neoprene), Buna-N (nitrile) or nitrile-butadiene (Hycar). With the valve in the open position, all surfaces of the plug/shaft shall be substantially out of the fluid flow path.

L. Valve shaft journal bearings shall be sleeve type, sintered, oil impregnated, permanently lubricated, type 316 ASTM A743 grade CF-8M or AISI type 317 L stainless steel, or phenolic backed Teflon. Thrust bearings shall be located in the upper and lower journal areas and shall consist of stainless steel, Teflon, or a combination of those materials. Grit seals shall be provided in the upper and lower journals to prevent abrasive material from entering the bearing and seal areas.

M. Valve shaft seals shall conform to AWWA Standard C504-87, Section 3.7 and shall be of the bronze cartridge type utilizing O-rings, or the adjustable multiple V-ring type and shall be replaceable without disassembling the valve, while the valve is under system pressure.

N. Valve interiors and exteriors shall be coated according to AWWA Standard C550-90 with a two-component high build epoxy suitable for potable water service, with interior surfaces receiving 8 - 10 mils (dry film thickness) and exterior surfaces receiving 3 - 5 mils (dft) or 8 - 10 mils

(dft) hand-applied epoxy coating. For buried or submerged service, 8 - 10 mils (dft) of asphalt varnish may be substituted for the exterior coating.

O. Valve testing shall be conducted per AWWA C504-87 Section 5, covering rubber seated butterfly valves. Each valve shall be performance tested per paragraph 5.2 assuring valve operation.

P. Body seat and shell leakage testing is to be conducted on each valve as per paragraphs 5.3 and 5.4.

Q. Proof of design testing shall be conducted per paragraph 5.5 and witnessed by a third party inspection agency. Certified copies of this report shall be available upon request.

R. Eccentric plug valves for wastewater service shall be as approved by the County.

3.3 General

3.3.1 Tracing Wire System

A. Wire shall be #12, stranded, type THHN, thermoplastic insulated and nylon jacketed. Wire shall be color coded blue for water and green for sewer.

B. Acceptable Wire Connectors:

1. Set screw pressure type for use with No. 12 stranded wire size. Holub Industries MA-2, Ideal Industries Model 30-222, or equal.

2. C-Tap for two way splicing of tracer wire, for use with No. 12 stranded wire size. T&B #54705 or equal.

3. Split bolts, three wire type for splicing of tracer wire, for use with No. 12 stranded wire size. ILSCO Catalog #SEL-2S or equal.

C. Test Station Box – Test station boxed shall be a minimum of 18” tall with cast iron lid and collar and plastic body tube. Cast iron collar shall be a minimum of 2” deep. Lid shall be bolted to collar with brass bolt. Lid shall be imprinted with the wording “TEST”. Test Station Box shall be Bingham & Taylor Figure Number 375, 2 ½” size.

D. Electric Tape - Vinyl electric tape.

E. Electrical Coating – Scotchkote 3M electrical coating Part No. 054007 or equal.

F. Wire nut - non-conductive for No. 12 stranded wire size.

3.3.2 Marking Tape

A. Tape shall be polyethylene tape with a metallic core, 2” in width, with appropriate continuous printed message. Tape shall be Catalog No. 2 WAT as manufactured by the Seton Name Plate Corp. or approved equal.