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**Office of Project Director**  
**Rajasthan Urban Infrastructure Development Project**  
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Dated: 18.09.2008

**Sub: Construction Management System - Circular No. - 18.**  
**Ref: Guidelines for execution of Water Supply Pipe Line works.**

1. The alignment of pipe line shall be kept as straight as possible with minimum bends in horizontal and vertical direction and far away from road carpet with minimum interference of underground utilities. If houses are only on one side of the road, then distribution pipe line shall be laid towards the houses, for ease of water connections. The alignment shall be marked on ground by using ranging rods and pegging. The levels shall then be taken along the fixed up alignment.
2. There is tendency to lay pipe line with minimum prescribed cover every where. Thus pipe line follows the ground profile and results in many bends in vertical plane. The bends in vertical plane not only increases pipe line losses and consequently more energy consumption but also entraps air which adversely affects performance of the pipe line. Therefore, while laying pipe line, the undulation in ground should be removed or dampened in pipe line by properly designing the 'L' Section. The pipe line should be laid at designed gradients and bend should be designed when it is essential.
3. For all type of pipes, the L section of the selected alignment shall be prepared in such a manner that at least 1.0 meter earth cover is provided over the socket or coupler or joint of the pipe line. In no case clear cover less than 1.0 meter should be accepted. However, if the alignment of the pipe line is likely to come under the widening of road/crossing important road, the clear cover over the socket portion shall not be less than 1.50 meter. In case of other roads minimum 1.0 meter clear cover shall be provided. It should be seen that there is minimum quantity of earth work and minimum bends in vertical direction.
4. The excavation of the trench shall be done according to the width and depth in accordance of the finally approved L-section. In case excavation is done by mechanical means, then last 15 cm depth shall be excavated manually. It shall be ensured that bed levels of the trench are as per L section and bed of trench is firm and compact. If bed is loose then it shall be compacted. The bed of the trench shall be made straight before laying of the pipe line so that the whole length of the pipe rests on it. It may be ensured by having some more excavation in the portion where socket of pipe will be placed.
5. The pipe and its socket portion shall be cleaned before placing in position. The rubber ring shall be kept in proper position in the socket only after cleaning of the socket. The pipe shall be lowered slowly in to the trench either mechanically or manually, but in no case it shall be throne in to the trench. Crane shall be used for lowering of heavy pipes. The new pipe placed in trench shall be inserted in previously laid pipe with lubricant soluble in water and it should be ensured that it goes inside the socket up to prefixed length. The level of the pipe shall be checked to match with level given in L-section.
6. The pipes shall be laid in about 50-100 m length. Then it shall be ensured that the pipes are straight by putting a rope over pipes in this length. The pipe sockets which are out from straight alignment should be rectified immediately. The specials / valves shall be laid and fixed along with laying pipe line and no gaps

shall be left in the pipe for this purpose. All pipe lines shall be sectional tested at given pressure and leakage shall not exceed the permissible limit.

7. The pipe shall be well packed at bottom with earth by hand before refilling the trench. The earth shall be then filled up to pipe level and compacted in layers of 15 cm each after watering to optimum moisture content. More care shall be taken for compaction up to top of pipe. The refilling of remaining trench shall than be done in layers after compaction.
8. In case of road crossing, minimum cover on pipe, proper and firm bedding, refilling with optimum compaction shall be ensured. The work of laying pipe line below road crossings should be supervised by officer not below the rank of AEn, PIU and ACM, DSC.
9. The fittings for DI pipes shall be only DI fittings with socket or flanged as the case may be. In PVC pipe, PVC specials such as bends, double sockets shall be used. Where PVC specials are not manufactured such as tees, reducers etc. flanged cast Iron fittings shall be used. Detachable joints should not be used for jointing
10. The standard quality of rubber ring (EPDM), rubber gaskets (EPDM) and nut bolts shall only be used.
11. In service line MDPE pipe shall only be allowed. The ferule connection shall be done with standard and heavy duty ferule & saddle piece and rubber packing of not less than 6 mm thickness.
12. **Testing of Water supply pipe lines.**

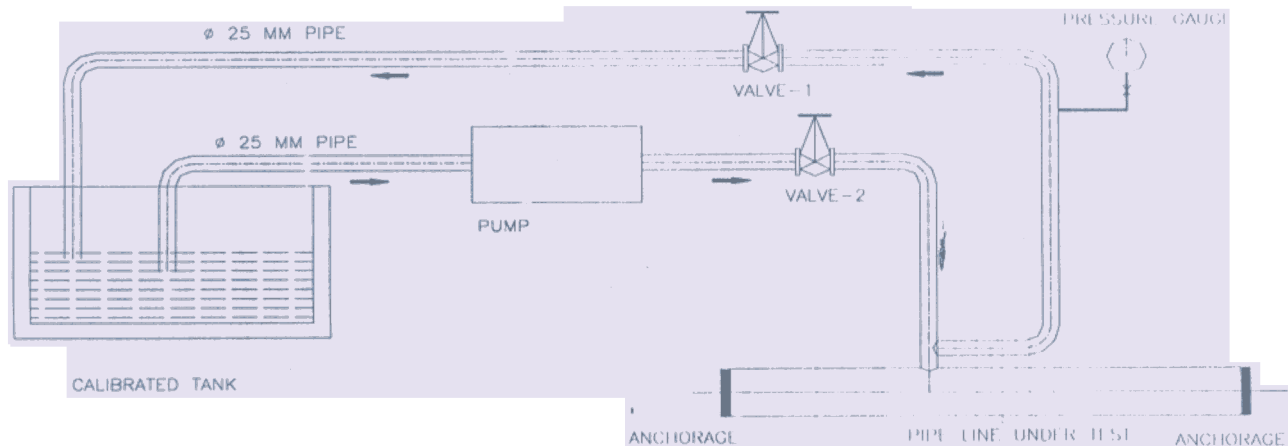
As you are aware, under various Water Supply Packages, Sectional field testing of laid pipe line is mandatory requirement and has been provided in all contracts under RUIDP. The procedure of sectional field testing is clarified below for guidance and strict compliance.

- (a) Pressure test and Leakage test during sectional testing of newly laid pipe lines should be done only after constructing thrust blocks wherever required. Even after construction of such blocks **at least 5 days time should pass** before testing the pipe line so that thrust blocks are well set.
- (b) At the dead ends of pipe line thrust develops. In case of permanent dead end, thrust block should be constructed before testing. In case of temporary dead end, temporary anchor should be provided to take complete thrust. The blind face of such end cap shall be properly braced during testing by screw jack and wooden planks or steel plate.
- (c) The length of pipe line to be tested may initially be kept as 500M which can be increased in subsequent tests by Engineer.
- (d) The water should be filled in from lowest point in network to be tested and air vents should be provided at higher points. During such filling of pipe line with water, air should be released from air vent pipes and care should be taken to close air vents only when complete air has been released from the pipe line and smooth flow of water starts.
- (e) **Field test pressure:** The field testing of the entire pipeline laid shall be done for pressure of 1.5 times working test pressure as per relevant IS code in general; however in case of DI pipe the field test pressure may be considered as 2 x maximum design pressure (with minimum design pressure as 6.0 Kg/sq cm). Some example of such field test pressures are:

| S.No. | Type of pipe      | Working Pressure | Field Test Pressure |
|-------|-------------------|------------------|---------------------|
| 1.    | uPVC Pipe class 3 | 6 Kg./sq cm      | 9 Kg./ sq cm        |

| S.No. | Type of pipe      | Working Pressure                       | Field Test Pressure   |
|-------|-------------------|--|---|
| 2.    | uPVC Pipe class 4 | 8 Kg./ sq cm                           | 12 Kg./ sq cm   |
| 3.    | DI Pipe K 7 / K 8 | As per pipe size & up to 45 kg / sq cm | 2 x maximum design pressure (with minimum design pressure as 6.0 Kg/ sq cm) |
| 4.    | MS Pipe           | Say 8 Kg./ sq cm                       | 12 Kg./ sq cm   |

(f) **Filling water:** Water should be filled in pipe line from the point in pipe line section having lowest RL. The air vents should be provided on high RL points. Air should be released simultaneous to water filling and once air is totally released and smooth flow of water starts the air vent can be closed. Reciprocating pump having pressure capacity more than pressure test requirement should be used. The pump should suck water from calibrated tank. The delivery of pump should be connected to pipe for filling the pipe. One more pipe should take off excess water from pipe line under test as shown in sketch below.



(g) **Procedure:** Pressure gauge of 150 mm diameter and pressure rating 1.5 to 2 times test pressure should be installed. The pressure gauge should be calibrated and certified from standard test house. Valve 1 & 2 should be controlled and pump should be kept running so that pressure in pipe line shown by pressure gauge remains constant and equal to required test pressure, readings should be taken of calibrated tank every 15 minutes. The leakage in pipe line is indicated by the volume reduced in calibrated tank and which has gone in the pipe line to maintain constant testing pressure. This reading should be carefully taken. If the tank is not calibrated then it should be kept full initially and any reduction in water level during testing in this tank should be replenished by adding carefully measured quantity of water (by Measuring Jars) from some other tank. Such additional quantity should be equal to leakage in the pipeline. Before starting testing, the pipe may be kept filled in with water for suitable time decided by the Engineer. Thrust of pipe during testing should not be transferred on next section of Pipe line. One Test pressure gauge duly calibrated & certified from standard test house should be kept by field Engineer for verifying the reading of pressure gauge installed by the contractor.

(h) **Time of Test:** The test should be done for three (3) hours.

- (i) **Maximum Permissible Leakage:** This is given in contracts. However where not given in contract document following should be adopted.

| Type of Pipe | Permissible limits  | Example  | Permissible values of leakages (litre) for 3 hours testing |
|--------------|---|--|--|
| uPVC         | Q=1.125 litre per Km length per 10 mm diameter of pipe per 30 mtr. test pressure per 24 hrs   | 90mm dia, 500m length for 3 hours testing at 9kg/sqcm  | 1.90   |
| AC           | Allowable Leakage<br>( $q_i$ ) = $\frac{ND\sqrt{p}}{10}$<br>Where $q_i$ = the allowable leakage in $\text{cm}^3/\text{hour}$<br>N= no. of joints in the length of the pipe line<br>D= Diameter in mm and<br>P= the average test pressure during the leakage test in MP <sub>a</sub> | 300mm dia, 2000m length for 3 hours testing at 1.125Mpa ( $\text{N}/\text{mm}^2$ ) taking length of each pipe as 5m. | 38.18  |
| PSC          | Q=30 litre per Km length per 10mm diameter of pipe per 30 mtr. test pressure per 24 hrs   | 800mm dia, 500m length for 3 hours testing at 12kg/sqcm  | 600  |
| MS           | Q=1 litre per Km length per 10 mm diameter of pipe per 30 mtr. test pressure per 24 hrs   | 800mm dia, 1500m length for 3 hours testing at 12kg/sqcm   | 60   |
| DI           | Q=1 litre per Km length per 10 mm diameter of pipe per 30 mtr. test pressure per 24 hrs   | 300mm dia, 2500m length for 3 hours testing at 18kg/sqcm   | 56.25  |

- (j) **Recording of Test Results:** One register for testing pipe line should be maintained. All tests including failure tests should be recorded. (Performa attached)
- (k) **Witnessing testing of pipe:** All sectional tests should be witnessed and signed in register, by concerned ACM and EE.
- (l) **Reference:** Handbook on Pipes and Fittings for Drinking Water Supply (SP-57: QAWSM) and relevant IS Codes (amended up to date) published by BIS may be referred for details. This Hand Book describes in Chapter of testing and disinfection in details.

### 13. Backfilling and compaction in trenches.

Restoration of road, in case of trenches excavated for laying of water supply lines etc. is a critical activity in the project. It is our responsibility that these excavated trenches are backfilled and compacted to required standards with in the shortest possible time to avoid public inconvenience. Backfilling in prescribed thickness of layers & compaction to required density is very important. Any sub standard work will result settlement in the trench in near future and will be liable for criticism from all circles. Proper care is therefore required to be taken at every level to ensure refilling of trench and restoration of road to desired standards. It has been observed that there is wide gap between the length of excavated trench and the refilling of trench in the works. This should be minimized and ensured that only minimum trench length is kept open with all safety measures. The following procedure should be adopted for backfilling and compaction:

- (a) Laboratory test should be conducted for different nature of soils to be backfilled in the trench by Standard Proctor Test and maximum dry density at Optimum Moisture Content should be worked out.
- (b) The trench should be refilled in the layers not more than 15 cm and should be compacted by mechanical means in top 1.5 m and rammed manually with

rammer below 1.5 m depth (portion in which timbering is there) so as to achieve the desired dry density.

- (c) The field density should be checked for every layer by sand replacement method or core cutter method. The sand replacement method is easier and requires less effort in comparison to core cutter method.
- (d) The water content ratio shall be gauged quickly by calcium carbide method. It is difficult to use oven drawing method in case of determination of field density in trenches located at several places and it takes time too.
- (e) It is therefore advised that required number of these equipments should be kept at site by the Contractors so that field density can be checked immediately and work is not held up due to this reason.
- (f) It is also desired that in each package where restoration of work is to be done, the backfilling and compaction to required standards should be carried out on one stretch of road in the presence of the person not below the rank of Executive Engineer for setting up an example and for enforcing the procedure in the remaining work of refilling of trenches. This effort should be repeated regularly.

#### 14. Separation of water supply lines from sewer lines and avoiding water pipe line from sewer manholes.

More care needs to be taken in maintaining adequate separation of water lines and sewer while laying new water lines/sewers. Pollution in water pipe line from sewers/drains can endanger human health. It is of utmost importance that all measures are taken to prevent it. Your attention is invited to the Water Supply and Treatment Manual (clause 10.11 page 389) which stipulates measures for protection against pollution near sewer and drains. These stipulations should be followed strictly.

The maximum possibility of pollution in water supply lines is when these lines pass through manholes of sewers. Therefore this condition should be totally avoided and during construction of manhole/ laying of water supply pipe line it should be ensured that no water pipe line passes through Manhole. The subsequent detection of any pipe line passing through manhole becomes extremely difficult. In these circumstances either location of manhole should be changed or pipe line should be shifted to lay it out side the manhole. This should be strictly followed.

**This circular should be abided by all the members of PMU, IPIU, IPMC and DSC.**

  
(Karni Singh Rathore)  
Project Director

Dated: .09.2008  
18.

F3 (106) (32)/RUSDIP/PMU/CMS/2007/1115-160

Copy to following for information and necessary action:

1. Addl. PD -I & II/ FA/ Dy. PD (T)/ Dy. PD.(Adm.)/ SE (WW)/ WS / PO (all)/ Sr. AO / All APOs / AAO/ PA to PD PMU, RUIDP, Jaipur.
2. Chief Engineer, PIU, Bisalpur, RUIDP, Jaipur.
3. SE Jodhpur, Executive Engineer/APO's, IPIU, RUSDIP (Concerned), Alwar, Baran-Chhabra, Barmer, Bharatpur, Bundi, Chittorgarh, Churu, Dhaulpur, Jaisalmer, Jhalawar-Jhalrapatan, Karauli, Nagaur, Rajsamand, Sawai Madhopur and Sikar.
4. Team Leader IPMC, DSC-I, Bharatpur, DSC-II, Nagaur, DSC-III, Jhalawar, RUSDIP.
5. DSC-I, Alwar/ Dholpur/ Karauli/ Sawai Madhopur, DSC-II, Churu/ Jaisalmer/ Barmer/ Sikar and DSC-III, Chittorgarh/ / Rajsamand/ Bundi/ Baran, RUSDIP.
6. ACP, RUIDP, Jaipur to send by e-mail and put up the Guidelines on the website.

  
Dy. Project Director (T)

**Performa for Recording of Test Results for testing of pipe lines**

**Name of Package:**

**Name of Contractor:**

**Date of Test:**

**Sketch of Loop under Test giving length, size, type of pipe, location of Air Valves, pressure relief valves, loop ends, Thrust Blocks,** (if space is less the diagram be prepared on back side)

**Permissible leakage in above loop: Calculation**

**Required Pressure for Testing:**

| S. No. | Time (fifteen minutes interval) | Reading of Tank(Level) | Leakages observed in 15 minutes (in ml) | Total Leakage (in ml) in 3 hours |
|--------|---------------------------------|------------------------|---|----------------------------------|
| 1.     |                                 |                        |   |                                  |
| 2.     |                                 |                        |   |                                  |
| 3.     |                                 |                        |   |                                  |
| 4.     |                                 |                        |   |                                  |
| 5.     |                                 |                        |   |                                  |
| 6.     |                                 |                        |   |                                  |
|        |                                 |                        |   |                                  |
|        |                                 |                        |   |                                  |

**Whether**

**Yes/No**

**Signature of Support Engineer:**

**Signature of ACM:**

**Signature of AEn/Jen PIU:**

**Signature of Executive Engineer:**

**Signature of Contractor's representative:**

**Signature of Other Authorities witnessing the Test:**

**Note:** - Reporting for each test results should be done on a separate page of Register.